SESSIONAL PAPERS

VOLUME 15

SECOND SESSION OF THE ELEVENTH PARLIAMENT

OF THE

DOMINION OF CANADA

SESSION 1910

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TO THE

SESSIONAL PAPERS

OF THE

PARLIAMENT OF CANADA

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LIST OF SESSIONAL PAPERS

Arranged in Numerical Order, with their titles at full length; the dates when Ordered and when Presented to the Houses of Parliament; the Names of the Senator or Member who moved for each Sessional Paper, and whether it is ordered to be Printed or Not Printed.

CONTENTS OF VOLUME 1.

(This volume is bound in two parts.)

1. Report of the Auditor General for the year ended 31st March, 1909. Volume I, Parts A, C to J (inclusive) L, M, N; Volume III, Parts V, W, X, Y. Presented 12th November, 1909, by Hon. W. S. Fielding. Volume II, Ports B, K and O to U, (inclusive), presented 12th January, 1910, by Hon. W. S. Fielding.
Printed for both distribution and sessional papers.

CONTENTS OF VOLUME 2.

2. Public Accounts of Canada, for the fiscal year ended 31st March, 1909. Presented 12th November, 1909, by Hon. W. S. Fielding.
Printed for both distribution and sessional papers.

3. Estimates of the sums required for the services of Canada for the year ending on the 31st March, 1911. Presented 18th November, 1909, by Hon. W. S. Fielding.
Printed for both distribution and sessional papers.

4. Supplementary Estimates of sums required for the service of Canada, for the fiscal year ending 31st March, 1910. Presented 24th November, 1909, by Hon. W. S. Fielding.
Printed for both distribution and sessional papers.

5. Further Supplementary Estimates of sums required for the service of Canada, for the fiscal year ending 31st March, 1910. Presented 14th March, 1910, by Hon W. S. Fielding.
Printed for both distribution and sessional papers.

5a. Supplementary Estimates of sums required for the service of Canada for the fiscal year ending 31st March, 1911. Presented 3rd February, 1910, by Hon. W. S. Fielding.
Printed for both distribution and sessional papers.

5b. Further Supplementary Estimates of the sums required for the service of Canada, for the fiscal year ending 31st March, 1911. Presented 30th April, 1910, by Hon. W. S. Fielding.
Printed for both distribution and sessional papers.

5c. Further Supplementary Estimates of the sums required for the service of Canada, for the fiscal year ending 31st March, 1910. Presented 20th April, 1910, by Hon. W. S. Fielding.
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19. Report of the Minister of Public Works, for the fiscal year ended 31st March, 1909. Presented 12th November, 1909, by Hon. W. Pugsley.
Printed for both distribution and sessional papers.

19*a*. (No issue.)

19*b*. (No issue.)

19*c*. Supplementary Report of the International Waterways Commission, 1909. Presented 19th November, 1909, by Hon. W. Pugsley.
Printed for both distribution and sessional papers.

19*d*. Report of the International Waterways Commission on proposed dam and regulation work at foot of Lake Erie, and appendices accompanying said report. Presented 17th February, 1910, by Hon. W. Pugsley.. .. ..*Not printed.*

19*e*. Additional correspondence, International Waterways Treaty, and Report on division of Waters of St. Mary and Milk River. Presented 4th April, 1910, by Sir Wilfrid Laurier.
Printed for both distribution and sessional papers.

20. Report of the Department of Railways and Canals, for the fiscal year ended 31st March, 1909. Presented 12th November, 1909, by Hon. G. P. Graham.
Printed for both distribution and sessional papers.

CONTENTS OF VOLUME 11.

20*a*. Canal Statistics for the season of navigation, 1909. Presented 21st March, 1910, by Hon. G. P. Graham.. .. ..*Printed for both distribution and sessional papers.*

20*b*. Railway Statistics of Canada, for the year ended 30th June, 1909. Presented 12th January, 1010, by Hon. G. P. Graham.
Printed for both distribution and sessional papers.

20*c*. Fourth Report of the Board of Railway Commissioners for Canada, to 31st March, 1908, for the year ending 31st March, 1909. Presented 12th November, 1909, by Hon. G. P. Graham.. .. ..*Printed for both distribution and sessional papers.*

20*d*. Report of the Hudson Bay Railway Surveys. Presented 13th December, 1909, by Hon. G. P. Graham.. .. ..*Printed for both distribution and sessional papers.*

21. Report of the Department of Marine and Fisheries (Marine) for 1908. Presented 15th November, 1909, by Hon. L. P. Brodeur.
Printed for both distribution and sessional papers.

CONTENTS OF VOLUME 12.

21*a*. Eighth Report of the Geographic Board of Canada, containing all decisions to June 30, 1909. Presented 25th November, 1909, by Hon. L. P. Brodeur.
Printed for both distribution and sessional papers.

21*b*. List of Shipping issued by the Department of Marine and Fisheries, being a list of vessels on the registry books of Canada on the 31st December, 1909.
Printed for both distribution and sessional papers.

22. Report of the Department of Marine and Fisheries (Fisheries) for 1909. Presented 12th November, 1909, by Hon. S. A. Fisher.
Printed for both distribution and sessional papers.

CONTENTS OF VOLUME 13.

22*a*. Lobster Fishery. Evidence taken before Commander William Wakeham, M.D., (Officer in charge of the Gulf Fisheries Division) in Quebec and the Maritime Provinces. Two volumes. Presented 11th March, 1910, by Hon. W. Templeman. Also copy of the Report of Commander Wakeham in relation thereto.
Printed for both distribution and sessional papers.

CONTENTS OF VOLUME 14.

23. Report of the Harbour Commissioners, &c., to 31st December, 1908. Presented 13th January, 1910, by Hon. R. Lemieux..*Printed for both distribution and sessional papers.*

23*a*. Report of the Chairman of the Board of Steamboat Inspection, for the fiscal year ended 31st March, 1909. Presented 12th November, 1909, by Hon. S. A. Fisher.
Printed for both distribution and sessional papers.

24. Report of the Postmaster General, for the fiscal year ended 31st March, 1909. Presented 12th November, 1909, by Sir Wilfrid Laurier.
Printed for both distribution and sessional papers.

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25. Report of the Department of the Interior, for the fiscal year ended 31st March, 1909. Presented 12th November, 1909, by Hon. F. Oliver.
Printed for both distribution and sessional papers.

25*a*. Report of the Chief Astronomer.
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25*b*. Annual Report of the Topographical Surveys Branch.
Printed for both distribution and sessional papers.

25*c*. Report of the High Commissioner for Canada, for the year ended 31st March, 1909. Presented 12th November, 1909, by. Hon. F. Oliver.
Printed for both distribution and sessional papers.

26. Summary Report of the Geological Survey Branch of the Department of Mines, for the calendar year 1909.
Printed for both distribution and sessional papers.

26*a*. Summary Report of the Mines Branch of the Department of Mines.
Printed for both distribution and sessional papers.

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27. Report of the Department of Indian Affairs, for the fiscal year ended 31st March, 1909. Presented 12th November, 1909, by Hon. F. Oliver.
Printed for both distribution and sessional papers.

28. Report of the Royal Northwest Mounted Police, 1909. Presented 12th January, 1910, by Sir Wilfrid Laurier.. .. ..*Printed for both distribution and sessional papers.*

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estimated quantities of work yet to be done, and the estimated sums yet to be paid under these headings in respect of each contract. Also as to all contracts other than the twenty-one covered by the Return brought down on the 26th of April, 1909, No. 46h: a copy of (*a*) engineer's itemized estimate of quantities as to each contract of each class of work and material, as set out in the schedules and itemized, and total estimated expenditure based upon rates of accepted tender, and (*d*) a copy of all tenders received; (c) itemized quantities of work and material under the various headings actually done or furnished to date, and itemized, and total expenditure therefor; itemized statement of estimated quantities of work yet to be done and material, &c., yet to be furnished and itemized, and total estimated cost of the same based on contract prices. Presented 17th February, 1910.—*Mr. Lennox.* *Not printed.*

42*j*. Return to an address of the House of Commons, dated 14th February, 1910, for a copy of all correspondence, submissions, references, reports, returns and orders in council, in reference to the adjustment of the disputed item of 581 cubic yards of excavation, claimed at 10 instead of $2.50 a cubic yard, referred to in a letter of the Auditor General to the Secretary of the Transcontinental Commission, dated the 18th August, 1909. Presented 24th February, 1910.—*Mr. Lennox*.. .. ..*Not printed.*

43. Report of Robert M. Coulter, Deputy Postmaster General, on his mission to Australia and New Zealand to discuss with the governments of those countries the possibility of taking steps that would lead to the inauguration of a steamship service between England, Australia and New Zealand, via Canada, on the Atlantic and Pacific oceans. Presented 22nd November, 1909, by Sir Wilfrid Laurier.. ..*Printed for sessional papers.*

44. Return to an order of the House of Commons, dated 16th November, 1909, for a copy of all correspondence, documents and papers of every description not already brought down touching the recent treaty with the French Republic, or any modification therein. Presented 24th November, 1909.—*Mr. Borden*.. .. ..*Not printed.*

45. Minutes of proceedings of the Board of Internal Economy of the House of Commons for the past year, pursuant to Rule of the House No. 9. Presented 24th November, 1909, by the Hon. The Speaker.. .. ..*Not printed.*

46. Detailed statement of all bonds or securities registered in the Department of the Secretary of State of Canada, since last return (2nd February, 1909), submitted to the parliament of Canada under section 32 of chapter 19, of the Revised Statutes of Canada, 1906. Presented 25th November, 1909, by Hon. C. Murphy.. .. ..*Not printed.*

47. Return under chapter 125 (R.S.C), 1906, intituled: 'An Act respecting Trade Unions,' submitted to parliament in accordance with section 33 of the said Act. Presented 25th November, 1909, by Hon. C. Murphy.. .. ..*Not printed.*

48. Return of orders in council passed between the 1st of December, 1908 and the 31st October, 1909, in accordance with the provisions of section 5 of the Dominion Land Survey Act, chapter 21, 7-8 Edward VII. Presented 29th November, 1909, by Hon. F. Oliver.. .. ..*Not printed.*

49. Return of orders in council which have been published in the *Canada Gazette* and in the *British Columbia Gazette*, between 1st December, 1908, and 31st October, 1909, in accordance with provisions of subsection (*d*) of section 38 of the regulations for the survey, administration, disposal and management of Dominion lands within the 40-mile railway belt in the province of British Columbia. Presented 29th November, 1909, by Hon. F. Oliver.. .. ..*Not printed.*

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67. Return to an order of the House of Commons, dated 29th November, 1909, for a copy of all reports and correspondence in connection with section 29, township 9, range 22, west of the 4th meridian, as well as applications for railway right of way and station grounds within such land. Presented 12th January, 1910.—*Mr. McGrath..Not printed.*

68. Return to an order of the House of Commons, dated 6th December, 1909, for a copy of all papers, reports, correspondence, &c., between the Department of the Interior and its officers and agencies and any other persons, relative to the s.w. ¼ section 24-38-10 w. 3rd m., and the respective claims of Allan R. Mudie and Thos. G. Warwick. Presented 12th January, 1910.—*Mr. Lake.. .. ..Not printed.*

69. Return to an order of the House of Commons, dated 15th December, 1909, showing the names of the two hundred and twenty-one members of the House of Commons, as provided for in 6-7 Edward VII., Dominion Statutes, 1907, chapter 41, section 1, excepting only such seat or seats as have fallen vacant. Presented 12th January, 1910.—*Mr. White (Renfrew).. .. ..Not printed.*

70. Return to an order of the House of Commons, dated 24th November, 1909, showing the total number of incubators and brooders, respectively, imported into Canada from the United States during the fiscal year ending March 31st, 1909, and the total cost of each. Presented 13th January, 1910.—*Mr. White (Renfrew).. .. ..Not printed.*

71. Return to an order of the House of Commons, dated 22nd November, 1909, for a copy of all letters, telegrams, applications, contracts and correspondence with regard to the taking of spawn for the fish hatchery at Snake Island, Winnipegosis, for the years 1907, 1908 and 1909. Presented 13th January, 1910.—*Mr. Campbell.. .. ..Not printed.*

72. Return to an order of the House of Commons, dated 15th December, 1909, showing a list of all exports, technical advisers, and special officers generally, engaged by the government in connection with the naval defence programme and its execution, giving names, special qualifications, duration of engagement and rate of remuneration, as well as the total amount expended to date under the above; also amounts expended to date for articles, books, instruments and objects of all kinds in connection with said naval defence programme. Presented 13th January, 1910.—*Mr. Monk.*
Printed for sessional papers.

73. Return to an order of the House of Commons, dated 29th November, 1909, showing the number of lighthouses in British Columbia, the salaries of the lightkeepers at the end of the financial year 1907-1908; what the salaries are to-day; why some salaries have been reduced and when such reduction took place. Presented 13th January, 1910.—*Mr. Smith (Nanaimo).. .. ..Not printed.*

74. Return to an address of the House of Commons, dated 18th November, 1909, for a copy of all orders in council, correspondence, documents and papers of every description relating to the proposed sale or disposal of any part of the Peigan Indian Reserve in the province of Alberta, including any advertisement of such sale and record of the proceedings, whether by vote or otherwise, under which any of the Indians on said reserve purported to give their consent thereto. Also a return showing the actual number of Indians on said reserve entitled to vote or elect in respect of such proposed sale, and all other information in the possession of the department or its officials relating to or in any way referring to the proceedings in connection with such proposed sale. Presented 13th January, 1910.—*Mr. Herron.. .. ..Not printed.*

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78f. Return to an order of the House of Commons, dated 14th February, 1910, for a copy of all papers and instructions given to A. S. Williams, Law Clerk of the Department of Indian Affairs, and to S. Swinford, Inspector of Indians, Winnipeg, in connection with their work among the St. Peter's Indians in Manitoba; also a copy of the report of these gentlemen in connection with the work they have been engaged in during the last few weeks among the St. Peter's Indians. Presented 4th April, 1910.—*Mr. Bradbury.* *Not printed.*

79. Return to an order of the Senate, dated 26th November, 1909, for a copy of the several complaints which in 1908 and 1909 have been made by different parties to the Minister of the Interior or to the Superintendent of Immigration of the manner in which immigrants are treated at Quebec. Presented 13th January, 1910—*Hon. Mr. Landry.* *Not printed.*

80. Return to an order of the Senate, dated 2nd December, 1909, for a copy of all accounts filed during the fiscal year 1907-8 in the Department of the Interior by Sosthène Morisset, one of the clerks of the Immigration office at Quebec. Presented 13th January, 1910.—*Hon. Mr. Landry.* . . . . . . *Not printed.*

80a. Return to an order of the Senate, dated 3rd December, 1909, for a copy (1) of the medical certificate given by Doctors Pagé and Nadeau to justify the order for the sending back of the immigrant Otta Nittenen, in November, 1908; (2) of the correspondence on this subject exchanged between the agent of the Canadian Pacific Railway, Mr. Jules Hone, and Messrs. Lavoie and Stein of the Immigration Office at Quebec, and the Superintendent General of Immigration at Ottawa, Mr. W. D. Scott, in November and December, 1908. Presented 13th January, 1910.—*Hon. Mr. Landry.* *Not printed.*

80b. Return to an order of the Senate, dated 3rd December, 1909, for a copy of the attendance and pay-lists of the employees in the Immigration Office at Quebec, for the first four months of the present year. Presented 13th January, 1910.—*Hon. Mr. Landry.* *Not printed.*

80c. Return to an order of the Senate, dated 2nd December, 1909, for the Report of Detentions and Deportations at the port of Quebec for the month of November, 1908. Presented 13th January, 1910.—*Hon. Mr. Landry* . . . . . . *Not printed.*

80d. Return to an address of the Senate, dated 25th January, 1910, for a copy of the attendance and pay-lists of the employees of the Immigration Office at Quebec, for the months of January, February, March and April of 1909. Presented 10th February, 1910.—*Hon. Mr. Landry* . . . . . . *Not printed.*

80e. Return to an order of the Senate, dated 12th January, 1910, for a copy of the report made in 1906 to the Department of the Interior by Mr. Blair, upon the inquiry held by him at Quebec, at the Immigration Office, on the subject of certain complaints concerning the administration of the said office. Presented 22nd February, 1910.—*Hon. Mr. Landry* . . . . . . *Not printed.*

80f. Return to an order of the House of Commons, dated 15th December, 1909, for a copy of the correspondence exchanged since the 1st of January, 1908, between the medical examiners of immigrants and the Superintendent of Immigration, respecting the inspection of immigrants. Presented 23rd March, 1910—*Mr. Paquet* . . *Not printed.*

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103. Return to an order of the House of Commons, dated 3rd February, 1910, for a copy of the report of Commander Wm. Wakeham, Special Commissioner and Inspector of Fisheries for the Gulf of St. Lawrence, on the Lobster Industry of the Maritime Provinces and the province of Quebec. Presented 3rd February, 1910, by Sir Wilfrid Laurier.. .. ..*See Sessional Paper No. 22a.*

104. Return to an order of the House of Commons, dated 17th January, 1910, for a copy of all correspondence, reports, despatches, documents and other papers relating in any way to the claim for a homestead, by the members of the family of Angus Sauve, who was in the African campaign, aud who died a short time after his arrival in the country. Presented 4th February, 1910.—*Mr. Boyer*.. .. ..*Not printed.*

104a. (1909). 1. International Boundary Waters Treaty, signed at Washington, 11th January, 1909. 2. Rider attached by the United States Senate.
Printed for both distribution and sessional papers.

105. Report of a system of uniform and common international regulations for the protection and preservation of the food fishes in international boundary waters of Canada and the United States. Prepared by the International Fisheries Commission pursuant to and under the authority of the Convention of April 11, 1908, between Great Britain and the United States. Presented 4th February, 1910, by Sir Wilfrid Laurier.. .. ..*Printed for distribution.*

106. Return to an order of the House of Commons, dated 19th January, 1910, for a copy of all papers, letters, telegrams, documents and correspondence, occurring during the first six months of 1908, in connection with suggested amendments to the Northwest Irrigation Act. Presented 7th February, 1910.—*Mr. Magrath*.. .. ..*Not printed.*

107. Return to an address of the House of Commons, dated 16th November, 1909, for a copy of all petitions addressed to His Excellency the Governor General of Canada, or to the government, or any department thereof; also of all letters, correspondence of all kinds, and all reports had by the government in reference to the navigation, cleaning and deepening of the river known as River des Prairies, following along the northern boundary of the island of Montreal. Presented 7th February, 1910.—*Mr. Monk.*
Not printed.

107a. Report of Mr. G. de G. Languedoc, assistant engineer, in respect of work required to be done along Rivière des Prairies, to give a five-foot channel at low water for navigation. Presented 15th February, 1910, by Hon. W. Pugsley.. .. ..*Not printed.*

108. Return to an order of the House of Commons, dated 24th January, 1910, showing what interest or control the Canadian Northern Railway Company has in any of the following railway companies: The Ontario and Rainy River Railway Company, the Port Arthur, Duluth & Western Railway Company, the Manitoba & Southeastern Railway Company, the Minnesota & Manitoba Railway Company, the Minnesota & Ontario Bridge Company, the Saskatchewan Northwestern Railway Company, the Qu'Appelle, Long Lake & Saskatchewan Railway Company, the Alberta Midland Railway Company, the Edmonton, Yukon and Pacific Railway Company. 2. What subsidies either in land, money or by way of guarantee of securities have been granted to any of the railway companies mentioned on account of the main or branch lines or both, of the said companies, either by the Dominion government, or the provincial governments of Ontario, Manitoba, Saskatchewan and Alberta, or any muncipality through which their lines run. 3. What portion of these subsidies have been earned to date. 4. How many miles west of Edmonton a line of railway is constructed and in operation

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128. Return to an order of the House of Commons, dated 7th February, 1910, showing the number of chartered banks that have gone into liquidation since 1888, the date of the charters of each, the date of suspension, the capital stock, assets and liabilities, respectively, at date of supension, and the per cent of dividends paid to both holders and depositors respectively. Also what other banks have disappeared by amalgamation or otherwise, with similar information as above in respect to them. Presented 4th March, 1910.—*Mr. Foster*.. .. ..*Not printed.*

129. Return to an order of the House of Commons, dated 7th February, 1910, for a copy of all memorials, reports, correspondence and documents not already brought down, including report of the survey made during the past summer and autumn of the harbour at Cape John and Tatamagouche Bay, in the counties of Pictou and Colchester, in the province of Nova Scotia, relating to the route of the winter steamers between Prince Edward Island and the mainland of Canada, and suggesting and recommending a change or changes in the said route, and an increase in the number of trips daily of such winter steamers; and also a copy of all memorials, reports, correspondence and documents relating to the route of the summer mail steamers between Charlottetown and the mainland of Canada, and suggesting a change or changes in that route, and an increase in the number of trips daily of such summer mail steamers; and also with regard to connecting such suggested new summer route or routes with a point or points on the Intercolonial Railway; and also for a copy of all memorials, and correspondence, asking for additional and improved aids to navigation of the harbour of Charlottetown and in Tatamagouche Bay and harbour. Presented 4th March, 1910.—*Mr. Warburton*.. .. ..*Not printed.*

130. Return to an order of the House of Commons, dated 7th February, 1910, for a copy of all reports of surveys of any projected railway lines or routes in the province of Prince Edward Island during the years 1908 and 1909, and particularly reports of the surveys of any such line from Royal Junction, or thereabouts, to Kensington or thereabouts; also of all correspondence, recommendations, documents and papers of every kind, nature and description relating to or concerning the said projected railway lines or routes or the surveys therefor. Presented 6th March, 1910.—*Mr. Borden*..*Not printed.*

130*a*. Return to an order of the House of Commons, dated 14th March, 1910, for a copy of all memorials, reports of surveys, engineers' reports, estimates, correspondence and documents in the possession of the Department of Railways and Canals, and of the Intercolonial Railway Commission, relating to the survey and construction of a proposed branch of the Prince Edward Island Railway through New London and along the north shore of Queens County, in that island. Presented 8th April, 1910.—*Mr. Warburton.* *Not printed.*

131. Return to an order of the Senate, dated 22nd February, 1910, for a comparative statement for the years 1907, 1908 and 1909, of crude petroleum oil imported into Canada, and values. Presented 4th March, 1910.—*Hon. Mr. Domville*.. .. ..*Not printed.*

132. Return to an order of the House of Commons, dated 28th February, 1910, for a copy of reports of the following Quarantine Frontier Inspectors:—Dr. Bradford, Dr. Carter, Dr. Duncan, Dr. Thornton, Dr. Wallace, Dr. May, Dr. McKenty, Dr. Little, Dr. Henderson and Dr. Scott. Presented 9th March, 1910.—*Mr. Sharpe (Lisgar)*..*Not printed.*

133. Report of the Hydrographic Survey, in connection with Irrigation, for the season of 1909. Pesented 10th March, 1910, by Hon. F. Oliver.
Printed for both distribution and sessional papers.

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134. Return to an order of the House of Commons, dated 17th February, 1909, showing particulars of the places where the expenditures mentioned in column 365, unrevised *Hansard*, for wharfs in Nova Scotia, New Brunswick and British Columbia, where made, together with amounts expended in each instance for construction and repairs, respectively. Presented 10th March, 1910. *Mr. Barnard.. .. ..Not printed.*

135. Return to an address of the House of Commons, dated 16th November, 1909, for a copy of all petitions addressed to the government or any member thereof, as well as of all letters, correspondence and reports in the possession of the government, and having reference to repairs required at two wharfs built by the government and situated at Ste. Genevieve and Isle Bizard, in Jacques Cartier County, P.Q., and also all the correspondence concerning the construction of those wharfs, and of their use as piers for a bridge. Presented 11th March, 1910.—*Mr. Monk.. .. ..Not printed.*

136. Return to an order of the House of Commons, dated 17th January, 1910, showing the foreign exhibitions in which Canada has taken part since July, 1896, the time and place where such was held, the expenditure thereon by the government of Canada, the persons, not common labourers, who had charge of the same or were employed thereat, the sums paid to such severally under the heads of (*a*) salary, (*b*) expenses, and the total cost to the country of each such exhibition; also the amounts received as revenue from the sale of articles or commodities, lumber, buildings and other materials, respectively. The whole statement to be made up in tabular form and the additions of money columns to be made. Presented 11th March, 1910.—*Mr. Foster.*
Printed for sessional papers.

137. Return to an order of the Senate, dated 18th February, 1910, for a statement showing the number of homestead entries, pre-emptions, scrip locations and military warrant locations in townships 35, 36, 37, 38 and 39, in ranges 1 to 19, inclusive, of 4th meridian, and in townships 32, 33 and 34, in ranges 1 to 8 inclusive, west of 4th meridian. Presented 16th March, 1910.—*Hon. Mr. Talbot.. .. ..Not printed.*

138. Return to an order of the House of Commons, dated 19th January, 1910, for a copy of all correspondence between the government, or any member thereof, and the Imperial South African Service Association, or any of its officers, in reference to a proposed military reserve to be formed by the members of the Imperial South African Veterans' Association. Presented 17th March, 1910.—*Mr. Macdonald.. ..Not printed.*

139. Return to an address of the House of Commons, dated 14th February, 1910, for a copy of all orders in council, correspondence, reports, documents and papers, relating to the right or privilege to raise the waters of Clear Lake, province of Manitoba, application for which was made by a company to develop power on the Little Saskatchewan river. Presented 21st March, 1910.—*Mr. Roche.. .. ..Not printed.*

140. Return to an order of the House of Commons, dated 7th February, 1910, for a copy of all correspondence, advertisements, tenders and other documents, in connection with a proposal or proposals to lease a part or the whole of the Black Foot Reserve. Presented 21st March, 1910.—*Mr. Magrath.. .. ..Not printed.*

141. Return to an order of the House of Commons, dated 14th March, 1910, for a copy of all correspondence, reports, documents and papers relating to the strike of the employees of the Dominion Coal Company and the Cumberland Coal and Railway Company, in the counties of Cape Breton and Cumberland, Nova Scotia. Presented 23rd March, 1910.—*Mr. Rhodes.. .. ..Not printed.*

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178. Return to an order of the House of Commons, dated 28th February, 1910, for a copy of all representations made by business or commercial men or citizens of Winnipeg to the department or government since the contemplated action of the government in reference to closing or keeping open the post office to box holders on Sundays, and who made them; and of all orders given by the Postmaster General or his department to the postmasters in reference to this Sunday closing. Presented 2nd May, 1910.—*Mr. Haggart (Winnipeg)*.. .. ..*Not printed.*

178a. Supplementary Return to No. 178. Presented 2nd May, 1910.. .. ..*Not printed.*

179. Return to an order of the House of Commons, dated 17th November, 1909, for a copy of all accounts, vouchers, correspondence, reports and other papers, not already brought down in connection with the survey of the St. John River channel between Fredericton and Woodstock, N.B. Presented 2nd May, 1910.—*Mr. Crocket..Not printed.*

180. Return to an address of the Senate, dated 17th March, 1910, for all documents, letters, returns, &c., concerning the damming of the river La DéCharge, near Lake St. John, in the district of Chicoutimi; which returns are to the effect of showing whether it would be possible to maintain the level of Lake St. John at a reasonable height in order to ensure serviceable navigation on that lake and its tributaries. Presented 2nd May, 1910.—*Hon. Mr. Choquette*.. .. ..*Not printed.*

181. Return to an address of the House of Commons, dated 14th February, 1910, for a copy of all orders in council, reports, correspondence, documents and papers not already brought down relating to the construction of the Georgian Bay canal, or any portion thereof, relating to the surveys thereof, and all offers, proposals and written negotiations not already brought down, with respect to the construction of the said canal or any portion thereof by any company, corporation or syndicate, or with respect to the guarantee by the government of bonds or debentures for the purpose of raising the necessary capital for the construction of the said canal. Presented 3rd May, 1910.—*Mr. White (Renfrew)*.. .. ..*Not printed.*

182. Return to an address of the House of Commons, dated 17th January, 1910, showing the various commissions appointed for all purposes by the government since July 1896, the person or persons composing the commission and the date of appointment, the purpose for which appointed, the date of completion of the work in each case, and the cost of each under the head (*a*) salary, (*b*) travelling expenses, and (*c*) printing report, if any; the word 'commissions' to include the missions of ministers, single or associated, going on public account to the countries outside of Canada. Presented 3rd May, 1910.—*Mr. Foster*.. .. ..*Not printed.*

182a. Supplementary Return to No. 182. Presented 3rd May, 1910.. .. ..*Not printed.*

183. Return to an order of the House of Commons, dated 28th February, 1910, showing the number of persons in the employ of each department of the government during the year 1909 under the following heads: (*a*) civil service employees at Ottawa; (*b*) civil service employees outside of Ottawa; (*c*) in stated and regular employ, but not under the Civil Service Act, giving the distinctive service of each group; (*d*) those in temporary or casual employment, giving the distinctive work of each group, and also showing the total amount paid under each head. Presented 3rd May, 1910.—*Hon. Mr. Foster*.. .. ..*Not printed.*

184. Return to an order of the Senate, dated 2nd May, 1910, showing for each of the last ten years the date of the prorogation of parliament and the date on which the bound statutes of the session were distributed. Presented 4th May, 1910.—*Hon. Mr. Power.* *Not printed.*

ANNUAL REPORT

OF THE

DEPARTMENT OF THE INTERIOR

FOR THE

Fiscal Year ending March 31, 1909

PRINTED BY ORDER OF PARLIAMENT

OTTAWA
PRINTED BY C. H. PARMELEE, PRINTER TO THE KING'S MOST
EXCELLENT MAJESTY
1909

[No. 25—1909.]

To His Excellency the Right Honourable Sir Albert Henry George, Earl Grey, G.C.M.G., &c., &c., Governor General of Canada.

MAY IT PLEASE YOUR EXCELLENCY:

The undersigned has the honour to lay before Your Excellency the report of the transactions of the Department of the Interior for the fiscal year ending March 31, 1909.

Respectfully submitted,

FRANK OLIVER,
Minister of the Interior.

OTTAWA, AUGUST 2, 1909.

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REPORT

OF THE

DEPUTY MINISTER OF THE INTERIOR

1908-9

DEPARTMENT OF THE INTERIOR,
OTTAWA, July 15, 1909.

The Honourable FRANK OLIVER,
Minister of the Interior.

SIR,—I have the honour to submit the thirty-sixth Annual Report of the Department of the Interior, for the twelve months ending March 31, 1909.

As evidenced by the statements submitted by the chief officers in charge of the various services of the department, the general results obtained have been highly satisfactory. The net revenue derived on account of Dominion lands has been the largest in the history of the department, and while there has been a falling off in the total emigration to Canada, there has been a substantial increase in the number of free homestead entries granted to agriculturists, as compared with the previous year. The work in consequence has been unusually heavy, especially as a result of the opening up to pre-emption and homestead entry of all the available odd numbered sections in the provinces of Manitoba, Saskatchewan and Alberta on September 1, last. However, I am glad to be in a position to state that the recent amendments made to the Dominion Lands Act, coupled with the framing, under your immediate supervision, of rulings and regulations for the guidance of agents and the general information of the public, have contributed largely to simplifying the land administration of the department; and to these factors chiefly must be attributed the success attending the efforts of the officers in charge of the land agencies in the west in properly dealing with the tremendous increase in work in most of the offices.

It is to be hoped that it may be possible at an early date to similarly consolidate the Immigration Act and to bring about such changes and amendments to the present law as may facilitate the administration of this important branch of the department.

DEATHS.

I regret to have to report that there were ten deaths in the department during the past year, namely four at headquarters and six in the outside service. The following is a list of the persons who have died:—

Head Office—

Mrs. J. Ricard, Secretary's Branch, died November 20, 1908.

Mederic Marin, Registration Branch, died November 24, 1908.

Wm. F. Ratz, D.L.S., Surveys Branch, died February 6, 1909.

C. G. Wood, Geographer's Branch, died February 24, 1909.

Outside Service—

Miss Ella Carr, Immigration Office, Winnipeg, died April 16, 1908.

R. S. Cook, agent Dominion Lands, Prince Albert, died October 27, 1908.

Mrs. Julia Marquette, matron Immigration Hospital, Quebec, died November 1, 1908.

T. H. Ritchie, guardian, Detention Hospital, St. John, N.B., died December 31, 1908.

Alexander Bailey, Immigration Office, Halifax, N.S., died January 5, 1909.

Geo. Noot, Immigration Boundary Inspector, White Horse Pass, died January 25, 1909.

STATEMENT showing Gross Cash Revenue received from all Sources during the Fiscal Year ended March 31, 1909, compared with Receipts for the previous Fiscal Year.

Source of Revenue.	Fiscal Year 1908-9.	Fiscal Year 1907-8.	Increase.	Decrease.	Net Increase.
	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
Dominion Lands	2,254,283 98	1,998,219 92	256,064 06		
School Lands	687,422 74	708,045 83		20,623 09	
Ordnance Lands	205,749 96	8,674 95	197,075 01		
Seed Grain	53,590 86	12,899 84	40,691 02		
Casual Revenue	26,224 29	20,069 03	6,155 26		
Registration Fees (Yukon)	1,352 13	2,256 65		904 52	
Fines under the Immigration Act	40 00	1,650 00		1,610 00	
Fines and Forfeitures, N.W.T.	241 00		241 00		
Total	3,228,904 96	2,751,816 22	500,226 35	23,137 61	477,088 74

STATEMENT of Receipts on account of Dominion Lands Revenue for the Fiscal Year ended March 31, 1909, as compared with the Receipts for the previous year. (Net Cash Revenue.)

Particulars.	1908-1909.	1907-1908.	Increase.	Decrease.	Net Increase.
	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
Homestead fees	389,039 00	301,693 73	87,345 27		
Pre-emption fees	141,550 15		141,550 15		
Purchased homestead fees	8,245 00		8,245 00		
Improvements	70,928 86	71,139 47		210 61	
Sales of lands	951,442 28	656,303 03	295,139 25		
Map sales, office fees, &c	7,296 55	7,727 29		430 74	
Rentals of lands	9,986 86	5,309 01	4,677 85		
Survey fees	42,388 31	141,255 35		98,867 04	
Timber dues	269,837 52	473,608 94		203,771 42	
Grazing lands	53,312 79	43,211 78	10,101 01		
Coal lands	55,535 89	29,697 64	25,838 25		
Hay permits	5,921 80	4,976 45	945 35		
Mining fees	92,637 60	130,703 55		38,065 95	
Hydraulic leases	4,488 81	6,248 97		1,760 16	
Dredging leases	11,188 34	19,616 84		8,428 50	
Export tax on gold	81,585 07	70,504 65	11,080 42		
Free certificates for export of gold	166 00	162 50	3 50		
Stone quarries	906 38	1,270 93		364 55	
Irrigation fees	367 00	516 75		149 75	
Rent of water power	542 28	2,640 78		2,098 50	
Fees *re* Board of Examiners, D.L.S.	1,040 00	690 00	350 00		
Patent and interchange fees	1,334 50	1,283 50	51 00		
Rocky Mountains Park	31,321 20	27,232 87	4,088 33		
Free miners' certificates		76 25		76 25	
Suspense account	4,333 16	1,385 35	2,947 81		
Refunds of refunds	18,105 26	692 77	17,412 49		
Miscellaneous	783 37	271 52	511 85		
	2,254,283 98	1,998,219 92	610,287 53	354,223 47	
Refunds	101,029 37	114,600 04		13,570 67	
	2,153,254 61	1,883,619 88	610,287 53	340,652 80	269,634 73

STATEMENT showing yearly the Gross Revenue (in cash only) received from all sources from July 1, 1886, to March 31, 1909.

Fiscal Year.	Dominion Lands (Cash.)	School Lands.	Seed Grain.	Ordnance Lands.	Fines and Forfeitures.	Registration Fees.	Casual Revenue.	Total.
	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
1886-1887	183,114 78	35,707 41	....	21,676 57	3,249 25	3,317 16	90 15	247,155 32
1887-1888	223,360 73	42,045 11	....	36,239 88	1,267 05	7,212 02	372 79	310,497 58
1888-1889	243,046 84	52,354 94	26,146 13	42,072 07	739 25	6,543 53	1,075 36	371,978 12
1889-1890	224,770 16	45,188 57	5,017 44	29,921 61	958 75	8,866 39	261 63	314,984 55
1890-1891	268,751 35	38,826 33	3,385 60	54,229 69	1,595 02	10,866 65	627 81	380,282 45
1891-1892	337,106 07	136,131 80	5,957 65	42,360 80	788 92	9,302 11	532 14	532,179 49
1892-1893	303,550 86	82,615 22	5,866 21	33,776 90	777 00	10,750 38	1,331 96	438,668 53
1893-1894	214,540 30	47,574 11	2,339 16	22,318 20	864 15	10,358 02	1,982 04	299,975 98
1894-1895	171,085 48	47,665 10	2,752 56	22,645 97	693 85	9,811 77	875 36	255,530 09
1895-1896	174,509 38	56,584 32	8,748 05	17,550 28	502 00	8,737 87	1,920 66	268,552 56
(Total, 10 yrs. to 1895-6).	2,343,835 95	584,692 91	62,212 80	322,791 97	11,435 24	85,765 90	9,069 90	3,419,804 67
1896 1897	187,424 19	24,292 43	9,887 13	9,831 27	1,316 00	8,997 24	2,683 05	244,431 31
1897-1898	780,313 10	52,410 82	12,351 71	22,537 17	529 06	14,263 50	260 92	1,082,666 28
1898-1899	1,563,020 74	41,249 77	12,388 69	12,349 65	2,801 03	19,220 73	2,620 91	1,653,651 52
1899-1900	1,410,883 48	220,874 78	15,271 84	11,013 53	1,452 92	21,751 90	3,664 00	1,684,942 45
1900-1901	1,533,197 07	48,049 83	15,711 63	14,604 47	1,977 96	33,979 77	1,587 57	1,649,108 30
1901-1902	1,254,333 56	193,410 75	20,293 06	16,967 36	1,955 61	50,854 99	3,900 62	1,541,715 95
1902-1903	1,716,597 20	392,206 93	28,789 97	17,612 79	5,220 88	81,401 18	2,230 26	2,244,062 21
1903-1904	1,478,106 33	233,769 62	26,122 30	30,491 34	5,911 92	109,233 73	3,402 94	1,887,941 18
1904-1905	1,314,485 40	332,914 48	16,471 34	10,346 90	10,018 49	123,082 86	4,258 14	1,811,577 61
1905-1906	1,701,580 71	608,960 79	12,577 29	10,893 17	3,304 77	180,310 73	8,496 09	2,526,123 55
(Total, 10 yrs. to 1905-6).	13,139,941 78	2,148,140 20	169,864 96	156,680 65	34,488 64	643,099 63	33,104 50	16,325,320 36
1906-1907 (9 months)	1,478,749 51	724,353 73	10,850 06	6,663 90	21 00	46,124 20	11,785 81	2,278,548 21
1907-1908	1,998,219 92	708,045 83	12,899 84	8,674 95	1,650 00	2,256 65	20,069 03	2,751,816 22
1908-1969	2,254,283 98	687,422 74	53,590 86	205,749 96	281 00	1,352 13	26,224 29	3,228,904 96
(Total, 2 yrs. and 9 months)	5,731,253 41	2,119,822 30	77,340 76	221,088 81	1,952 00	49,732 98	58,079 13	8,259,269 39
Grand total	21,215,031 14	4,852,655 41	309,418 52	700,561 43	47,875 88	778,598 51	100,253 53	28,004,394 42

STATEMENT showing Receipts on Account of Dominion Lands from July 1, 1872, to March 31, 1909.

Fiscal Year.	Homestead Fees.	Pre-emption Fees.	Improvements.	Sales. Cash.	Sales. Scrip.	Map Sales, Office and Registration Fees, &c.	Dominion Lands Surveyors Examination Fees.	Rentals, Survey Fees, Miscellaneous, including Trust Account.	Purchased Homestead, Inspection, Cancellation and Sundry Fees.	Timber Dues.
	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
1872-73	6,960 00			19,170 20						109 25
1873-74	7,310 00			19,834 75				125 50		2,710 55
1874-75	11,510 00			13,666 90		129 90				2,335 25
1875-76	4,680 00			3,478 94	320 00					387 00
1876-77	2,250 00			1,085 86	136,955 16	4 00		100 00	40 00	320 00
1877-78	14,540 00			2,794 86	120,159 54		180 00		290 00	1,620 00
1878-79	17,690 00			4,998 39	210,904 84	81 00	310 00	13 70	410 00	325 00
1879-80	41,255 00	10,241 43		45,708 97	81,685 86	245 40	580 00	183 25	1,780 00	25,121 46
1880-81	20,450 00	10,801 75	269 00	71,170 17	70,828 30	985 40	420 00	37 58		32,028 31
1881-82	54,155 00	39,843 90	1,758 00	1,240,328 27	50,590 84	3,036 45	890 00	58 10		58,753 14
1882-83	73,015 00	54,725 00	7,114 91	516,092 21	33,638 40	3,109 50	890 00	501 77		90,066 46
1883-84	41,580 00	28,810 00	2,596 11	424,863 36	40,919 67	1,289 55	530 00	45,766 53	1,713 45	147,983 10
1884-85	25,645 00	17,100 00	2,328 75	199,275 32	45,875 60	1,621 82	370 00	50,068 57	2,685 00	87,474 99
1885-86	26,110 00	14,371 00	1,101 50	76,140 41	214,657 97	1,339 34	360 00	20,070 00	5,025 00	64,820 31
1886-87	19,614 00	6,887 93	1,971 55	48,175 76	337,640 19	1,171 39	240 00	44,561 00	7,778 40	65,111 74
1887-88	23,691 00	4,830 00	1,918 35	52,238 36	313,522 67	1,660 75	240 00	20,591 41	12,078 53	94,964 55
1888-89	39,460 00	10,550 00	4,128 48	57,513 16	318,238 57	1,410 16	220 00	10,389 57	20,402 50	90,290 00
1889-90	35,920 00	8,580 00	3,250 54	54,896 85	228,744 47	2,099 07	190 00	3,316 23	20,232 50	84,642 95
1890-91	29,164 10		6,302 61	91,664 98	171,425 14	1,854 78	88 00	7,951 05	14,712 50	102,902 71
1891-92	46,994 00		6,472 31	108,901 01	97,822 41	2,147 31	135 00	29,898 49	23,104 50	106,461 35
1892-93	37,689 74		7,113 50	93,671 67	77,231 18	975 20	82 00	18,509 35	22,014 00	105,865 24
1893-94	36,462 26		3,497 76	53,254 71	27,840 96	973 11	40 00	13,457 09	11,097 00	81,290 51
1894-95	29,664 88		3,567 90	37,293 71	23,269 62	695 99		6,271 77	6,566 90	74,079 20
1895-96	18,278 00		3,163 15	46,373 98	46,929 65	610 78	50 00	21,679 31	6,810 50	61,923 47
1896-97	21,179 00		3,737 01	49,335 53	16,929 38	795 05	70 00	19,421 98	8,527 50	68,992 82
1897-98	34,780 00		5,649 63	80,178 64	28,918 14	1,987 40	10 00	21,242 66	10,042 00	119,313 78
1898-99	58,235 00		4,297 62	116,598 35	21,307 58	1,262 05	20 00	75,085 95	13,549 50	155,360 63
1899-1900	72,690 00		4,835 81	103,247 58	88,756 22	1,258 85	190 00	38,072 54	14,937 00	126,345 82
1900-1901	79,910 00		5,213 32	40,360 93	326,270 03	3,874 14	165 00	70,970 54	12,722 00	209,399 32
1901-1902	144,425 00		8,481 46	66,950 21	169,767 13	5,792 96	370 00	71,997 39	663 00	207,790 90
1902-1903	320,409 65		11,829 08	155,507 59	158,452 66	5,911 96	365 00	125,158 56	595 00	470,916 93
1903-1904	255,772 36		15,119 47	196,750 15	188,424 22	5,549 13	463 50	81,550 46	1,081 00	397,344 33
1904-1905	304,806 25		21,571 25	154,128 04	19,644 59	4,879 13	906 50	144,924 31	1,205 00	266,951 46
1905-1906	417,834 25		31,795 19	442,588 69	7,654 57	6,042 34	474 00	141,948 55	976 25	292,684 53
1906-1907 (nine months)	215,449 55		39,763 63	494,117 12	11,349 89	5,449 06	420 00	69,536 31	1,089 51	379,476 32
1907-1908	301,693 73		71,139 47	656,303 03	92,311 24	7,727 29	690 00	148,914 00	1,283 50	473,608 94
1908-1909	389,039 00	141,550 15	70,928 86	951,442 28	20,136 27	7,296 55	1,040 00	75,596 96	9,946 50	269,837 52
Total	3,280,311 77	348,291 16	350,916 12	6,790,100 94	3,799,122 96	83,265 91	10,999 00	1,377,970 39	233,358 54	4,819,609 87

STATEMENT showing Receipts on Account of Dominion Lands from July 1, 1872, to March 31, 1909—*Concluded.*

Fiscal Year.	Grazing Lands.		Hay, Coal, Mining, Stone Quarries, Export Tax on Gold, &c.		Rocky Mountains Park of Canada.	Colonization Lands.		Gross Revenue.	Refunds.	Net Revenue.
	Cash.	Scrip, &c.	Cash.	Scrip.		Cash.	Scrip.			
	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
1872-73								26,239 45		26,239 45
1873-74								29,980 80		29,980 80
1874-75								27,641 15		27,641 15
1875-76								8,865 94		8,865 94
1876-77								140,755 02		140,755 02
1877-78								139,584 40		139,584 40
1878-79								234,732 93		234,732 93
1879-80								206,801 37	4,636 08	202,165 29
1880-81								206,990 54	5,038 22	201,952 32
1881-82	2,245 00		40 00			354,036 17		1,805,734 87	10,687 55	1,795,047 32
1882-83	22,844 43		913 91			248,492 01		1,051,403 60	8,746 05	1,042,657 55
1883-84	11,370 60		640 90			253,713 40		1,001,776 67	9,220 50	992,556 17
1884-85	17,089 75		815 63			1,214 22		451,564 65	12,070 85	439,493 80
1885-86	29,562 51	3,131 08	1,284 83					457,973 95	63,389 12	394,584 83
1886-87	14,242 77	39,487 67	1,570 40	80 00				588,532 80	19,543 16	568,989 64
1887-88	5,922 47	23,023 28	2,273 73	80 00	2,951 58		10,000 00	569,986 68	6,277 66	563,709 02
1888-89	2,207 69	16,802 63	3,946 55		2,528 73		16,000 00	594,088 04	5,226 23	588,861 81
1889-90	1,305 57	9,021 63	9,242 08		1,094 37			462,536 26	8,209 74	454,326 52
1890-91	3,079 55	16,193 77	8,628 44	160 00	2,397 35	5 28	4,460 50	460,990 76	7,195 27	453,795 49
1891-92	3,726 80	17,222 60	5,616 85		3,648 45			452,151 08	15,291 39	436,859 69
1892-93	6,380 80	11,542 39	6,266 13		4,983 23			392,324 43	18,314 97	374,009 46
1893-94	5,740 79	7,687 86	6,213 15		2,523 92			250,069 12	4,544 01	245,525 11
1894-95	5,353 72	8,628 00	5,229 54		2,321 87			202,983 10	4,365 99	198,617 11
1895-96	7,071 86	6,255 90	5,813 51		2,734 82			227,694 93	8,368 79	219,326 14
1896-97	4,715 01	2,500 00	8,518 18		2,132 11			206,853 57	15,010 54	191,843 03
1897-98	4,728 58	510 39	699,334 76		3,045 65			1,009,741 63	4,678 55	1,005,063 08
1898-99	5,245 88		1,130,371 60		2,994 16			1,584,328 32	32,296 39	1,552,031 93
1899-1900	8,382 86	4,083 30	1,038,195 42	20 00	2,727 60			1,503,743 00	23,062 28	1,480,680 72
1900-1901	4,726 28	14,671 99	1,101,808 33	20 00	4,047 31			1,874,159 09	18,368 85	1,855,790 24
1901-1902	7,292 46	8,409 27	737,878 43		*2,861 13			1,432,679 25	27,165 55	1,405,513 70
1902-1903	13,913 33	15,041 33	607,722 05		*5,063 69			1,890,886 83	21,519 84	1,869,366 99
1903-1904	19,790 27	15,202 15	495,579 18		*9,198 48			1,681,824 70	36,721 75	1,645,102 95
1904-1905	36,145 32	5,237 36	364,923 59		*14,059 55			1,339,382 35	25,786 90	1,313,595 45
1905-1906	51,583 89	80 00	296,769 19		18,883 83			1,709,315 28	33,418 36	1,675,896 92
1906-1907 (nine months)	43,711 91	400 00	213,852 59		*15,887 42			1,490,503 31	35,117 48	1,455,385 83
1907-1908*	43,211 78	4,048 01	266,415 31		27,232 87			2,094,579 17	115,080 04	1,979,499 13
1908-1909	53,312 79	3,257 81	252,972 17		31,321 20			2,277,678 09	102,463 78	2,175,214 31
	434,904 67	232,438 45	7,272,866 45	360 00	*164,639 32	857,461 08	30,460 50	30,087,077 13	701,815 89	29,385,261 24

* Including scrip.

STATEMENT of Rocky Mountains Park Revenue for Fiscal Year ended March 31, 1909, as compared with Revenue for previous year.

Particulars.	Fiscal year 1908-9.	Fiscal year 1907-8.	Increase.	Decrease.	Net Increase.
	$ cts	$ cts.	$ cts.	$ cts.	$ cts.
Rent	4,567 82	5,351 49	....	783 67	
Timber dues	1,862 14	1,341 39	520 75		
Water rates	410 00	208 44	201 56		
Transfer fees	32 00	46 00	....	14 00	
Cave and basin (bathing tickets)	2,801 50	3,277 00	....	475 50	
Quarry permits	236 73	488 00	....	251 27	
Dog licenses	372 70	181 50	191 20		
Livery licenses	394 00	567 00	....	173 00	
Pool, billiard and bowling licenses	150 00	160 00	....	10 00	
Boat licenses	89 00	25 00	64 00		
Butcher licenses	50 00	40 00	10 00		
Coal lands	16,252 44	11,866 80	4,385 64		
Grazing lands	180 00	230 00	....	50 00	
Hot Springs (bathing tickets)	2,988 00	3,108 50	....	120 50	
Telephone rent	694 00	242 50	451 50		
Fines	36 00	11 00	25 00		
Sale of lumber	....	20 00	....	20 00	
Pedlars' licenses	54 00	36 00	18 00		
Camping permits	23 00	22 00	1 00		
Lime permits	4 75	....	4 75		
Miscellaneous	123 12	10 25	112 87		
	31,321 20	27,232 87	5,986 27	1,897 94	4,088 33

REVENUE.

The gross cash revenue of the department during the year was $3,228,904.96, which shows an increase of over $477,088.74 as compared with the previous year. The net increase in the cash revenue of the department on account of Dominion Lands was $269,634.73. This increase is largely attributable to the amount received on account of pre-emption fees and the increase in the number of homestead entries granted during the year. It may be pointed out that it is not the policy of the department to dispose of land by sale, and while the statement shows a very large revenue derived under that head it should be explained that this amount is made up largely of moneys received on account of the sale of irrigation, coal, and purchased homestead lands, as provided under the law in that behalf.

The following is a comparative statement of the homestead entries and sales which have been made at the several agencies of the department during the fiscal years ending March 31, 1908, and March 31, 1909, respectively.

	Fiscal year ending March 31, 1908.		Fiscal year ending March 31, 1909.	
	No. of Entries.	Acres.	No. of Entries.	Acres.
Homesteads	30,424	4,867,840	39,081	6,252,960
Sales	....	179,894	....	191,315

The following statement shows the number of homestead entries reported in each year since 1874.

Departmental year ended	Number of Entries.
October 31, 1874	1,376
" 31, 1875	499
" 31, 1876	347
" 31, 1877	845
" 31, 1878	1,788
" 31, 1879	4,068
" 31, 1880	2,074
" 31, 1881	2,753
" 31, 1882	7,483
" 31, 1883	6,063
" 31, 1884	3,753
" 31, 1885	1,858
" 31, 1886	2,657
" 31, 1887	2,036
" 31, 1888	2,655
" 31, 1889	4,416
" 31, 1890	2,955
" 31, 1891	3,523
" 31, 1892	4,840
" 31, 1893	4,067
" 31, 1894	3,209
December 31, 1895	2,394
" 31, 1896	1,857
" 31, 1897	2,384
" 31, 1898	4,848
" 31, 1899	6,689
June 30, 1900	7,426
" 30, 1901	8,167
" 30, 1902	14,673
" 30, 1903	31,383
" 30, 1904	26,073
" 30, 1905	30,819
" 30, 1906	41,869
Nine months ended March 31, 1907	21,647
Year ended March 31, 1908	30,424
" " " 31, 1909	39,081

STATEMENT showing the number of Homestead Entries made during the fiscal year ended March 31, 1909, and the Nationality of the Homesteaders, as reported by the several Agencies of the Department in Manitoba, Saskatchewan, Alberta and British Columbia.

Nationalities.	No. of Entries.
Canadians from Ontario	4,038
" " Quebec	790
" " Nova Scotia	212
" " New Brunswick	91
" " Prince Edward Island	93
" " Manitoba	1,494
" " Saskatchewan	2,372
" " Alberta	1,048
" " British Columbia	131
Persons who had previous entry	3,267
Newfoundlanders	5
Canadians returning from the United States	693
Americans	9,829
English	5,649
Scotch	1,310
Irish	506
French	487
Belgians	167
Swiss	49
Italians	26
Roumanians	123
Syrians	28
Germans	650
Austro-Hungarians	3,342
Hollanders	92
Danes (other than Icelanders)	116
Icelanders	231
Swedes	596
Norwegians	656
Russians (other than Mennonites and Doukhobors)	947
Doukhobors	4
Chinese	6
Japanese	4
Persians	4
Australians	13
Hindoos	2
Spaniards	3
Bulgarians	5
Servians	2
Total	39,081

Representing 93,852 souls

STATEMENT showing the number of Homestead Entries made during the fiscal year ended March 31, 1909, by persons coming from the various States and Territories of the American Union.

States.	No. of Entries.
Alabama	1
Alaska 12, Arizona 4	16
Arkansas	8
California	79
Carolina, North	9
Colorado	25
Columbia, District of	2
Connecticut	10
Dakota, North	3,921
Dakota, South	415
Delaware	1
Florida	4
Idaho	115
Illinois	327
Indiana	123
Indian Territory	2
Iowa	440
Kansas	146
Kentucky	16
Louisiana	3
Maine	30
Maryland	8
Massachusetts	91
Michigan	497
Minnesota	1,826
Missouri	144
Montana	263
Nebraska	198
New Hampshire	10
New Jersey	5
New Mexico	5
New York	171
Ohio	121
Oklahoma	96
Oregon	118
Pennsylvania	108
Rhode Island	7
Tennessee	12
Texas	20
Utah	76
Vermont	9

States.	No. of Entries.
Washington	462
Virginia, West	19
Wisconsin	536
Wyoming	27
	10,522

STATEMENT showing the number of Letters-Patent issued by the Department of the Interior in each year since 1874.

Period.	Number issued.
Year ended October 31, 1874	536
" " 31, 1875	492
" " 31, 1876	375
" " 31, 1877	2,156
" " 31, 1878	2,597
" " 31, 1879	2,194
" " 31, 1880	1,704
" " 31, 1881	1,768
" " 31, 1882	2,766
" " 31, 1883	3,591
" " 31, 1884	3,837
" " 31, 1885	3,257
" " 31, 1886	4,570
" " 31, 1887	4,599
" " 31, 1888	3,275
" " 31, 1889	3,282
" " 31, 1890	3,273
" " 31, 1891	2,449
" " 31, 1892	2,955
" " 31, 1893	2,936
" " 31, 1894	2,553
" December 31, 1894	2,682
" " 31, 1895	2,118
" " 31, 1896	2,665
" " 31, 1897	2,972
" " 31, 1898	3,037
" " 31, 1899	3,904
Six months ended June 30, 1900	1,970
Year " 30, 1901	6,461
" " 30, 1902	8,768
" " 30, 1903	7,349
" " 30, 1904	6,890
" " 30, 1905	8,798
" " 30, 1906	12,370
Nine months ended March 31, 1907	10,596
Year ended March 31, 1908	18,690
" " 31, 1909	22,431

STATEMENT showing number of homestead entries granted in the provinces of Manitoba, Saskatchewan, Alberta and British Columbia, for fiscal year 1908-9, as compared with fiscal year 1907-8.

Provinces.	1908-9	1907-8	Increase.	Decrease.	Total 1908-9.	Total 1907-8.	Increase 1908-9.
Manitoba—							
Winnipeg	1,863	886	977	....			
Dauphin	1,727	772	955	....			
Brandon	137	71	66	....			
	3,727	1,729	1,998	....	3,727	1,729	1,998
Saskatchewan—							
Part of Brandon in Saskatchewan	34	19	15	....			
Yorkton	2,169	2,839	....	670			
Estevan	833	502	331	....			
Regina	1,553	1,653	....	100			
Humboldt	2,412	2,493	....	81			
Prince Albert	2,058	1,622	436	....			
Moosejaw	8,710	5,181	3,529	....			
Battleford	3,385	4,535	....	1,150			
	21,154	18,844	4,311	2,001	21,154	18,844	2,310
Alberta—							
Calgary	2,707	1,278	1,429	....			
Lethbridge	3,818	2,456	1,362	....			
Red Deer	2,080	1,825	255	....			
Edmonton	5,166	4,055	1,111	....			
	13,771	9,614	4,157	....	13,771	9,614	4,157
British Columbia—							
Kamloops	400	195	205	....			
New Westminster	29	42	....	13			
	429	237	205	13	429	237	192
Grand total for fiscal year 1908-9					39,081		
" " " 1907-8					....	30,424	
Net increase " " 1908-9					....	....	8,657

CORRESPONDENCE.

The following statement shows the number of letters received and sent by the department in each year since its establishment.

Departmental Year ended October 31.	Letters Received.	Letters Sent.	Total.
1874	3,482	4,120	7,632
1875	1,974	2,189	4,163
1876	2,256	3,097	5,353
1877	3,137	3,677	6,814
1878	4,642	6,009	10,651
1879	5,586	6,179	11,755
1880	8,222	9,910	18,162
1881	13,605	15,829	29,434
1882	25,500	30,300	55,800
1883	27,180	33,500	60,680
1884	27,525	33,386	60,911
1885	33,970	43,997	77,967
1886	60,964	67,973	128,937
1887	47,845	60,890	108,735
1888	43,407	52,298	95,705
1889	48,316	50,500	98,816
1890	36,200	36,008	72,208
1891	38,000	36,267	74,267
1892	41,990	42,203	84,193
1893	50,794	48,145	98,939
1894	48,619	50,840	99,459
1895	49,991	45,898	95,889
1896	47,501	44,238	91,739
1897	65,714	64,147	129,861
1898	88,913	87,845	176,758
1899	95,023	91,876	186,899
1900	121,219	133,177	254,396
1901	144,978	136,348	281,326
1902	167,200	185,548	352,748
1903 (From June 30, 1902, to July 1, 1903)	185,582	223,463	409,045
1904 (From June 30, 1903, to July 1, 1904)	222,316	274,675	496,991
1905 (From June 30, 1904, to July 1, 1905)	245,470	302,723	548,193
1906 (From June 30, 1905, to July 1, 1906)	407,794	529,465	937,259
1907 (From June 30, 1906, to April 1, 1907)	372,231	620,968	993,199
1908 (From March 31, 1907, to April 1, 1908)	543,647	1,106,772	1,650,419
1909 (From March 31, 1908, to April 1, 1909)	721,217	1,114,380	1,835,597

The number of registered letters during the departmental year ending March 31, 1909, was: received, 14,504; sent, 42,790.

STATEMENT of Land Sales by Railway Companies having Government

Year.	Hudson's Bay Company.		Canadian Pacific Railway Company.		Manitoba South-western Colonization Railway Company.		Qu'Appelle, Long Lake and Saskatchewan Railroad and Steamboat Company.	
	Acres.	Amount.	Acres.	Amount.	Acres.	Amount.	Acres.	Amount.
		$		$		$		$
1893	......	....	93,184	295,288	14,164	57,559	1,603	....
1894	7,526	48,225	43,155	131,628	6,312	28,003	640	....
1895	4,431	23,209	55,453	176,950	5,623	22,330	2,391	....
1896	9,299	52,410	66,624	220,360	21,254	88,568	286	....
1897	10,784	53,277	135,681	431,095	63,800	234,644	2,524	....
1898	62,000	310,000	242,135	757,792	106,473	363,982	22,534	....
1899	56,875	274,625	261,832	814,857	58,019	199,458	61,030	178,517
(Fiscal Year) 1900	70,196	352,631	379,091	1,152,836	133,507	437,449	18,932	53,974
(Fiscal Year) 1901	82,308	399,804	339,985	1,046,665	59,749	214,953	22,266	74,810
(Fiscal Year) 1902	269,577	1,412,332	1,362,478	4,440,500	206,411	713,365	39,835	147,365
(Fiscal Year) 1903	330,046	1,939,804	2,260,722	8,472,250	250,372	699,210	843,900	1,476,900
(Fiscal Year) 1904	144,857	879,910	857,474	3,516,864	29,522	113,303	....	....
(Fiscal Year) 1905	139,721	865,905	411,451	2,045,800	80,342	296,936	....	....
(Fiscal Year) 1906	236,191	1,863,375	1,012,322	6,015,060	83,418	360,889	....	....
(9 months to March 31, 1907)	69,158	742,221	851,083	4,817,632	3,051	22,645	1,353	16,789
(Fiscal Year) 1908	21,184	267,215	81,060	727,367	31,982	153,007	5,621	68,869
(Fiscal Year) 1909	25,449	288,836	29,331	383,390	10,396	84,845	37,662	380,371
Total	1,539,602	9,773,779	8,483,661	35,446,334	1,164,395	4,091,146	1,060,577	2,397,595

* Returns not received in time for publication.

Land Grants and by the Hudson's Bay Company.

Calgary and Edmonton Railway Company.		Canadian Northern Railway Company.		Great Northwest Central Railway Company.		Totals.		Average per Acre.
Acres.	Amount.	Acres.	Amount.	Acres.	Amount.	Acres.	Amount.	
	$		$		$		$	$ cts.
11,260	...	...	...	...	...	120,211	352,847	2 93
11,035	...	...	...	...	...	68,668	207,856	3 02
46,815	...	...	...	...	...	114,713	222,489	1 94
10,553	...	...	...	...	...	108,016	361,338	3 34
9,436	...	...	...	...	...	222,225	719,016	3 23
15,481	...	...	...	...	...	448,623	1,431,774	3 18
24,738	53,335	...	...	...	...	462,494	1,520,792	3 28
46,653	128,256	...	...	...	...	648,379	2,125,146	3 27
116,719	352,037	...	...	...	...	621,027	2,088,269	3 36
323,494	1,033,396	...	...	...	...	2,201,795	7,746,958	3 56
231,800	909,600	183.736	631,503	128,435	522,490	4,229,011	14,651,757	3 46
129,007	563,507	64,469	313,575	41,858	177,081	1,267,187	5,564,240	4 39
109,191	512,898	231,707	1,221,469	17,593	103,564	990,005	5,046,572	5 09
85,784	480,063	204,966	1,014,351	20,003	137,503	1,642,684	9,871,241	6 01
59,515	346,064	289,576	1,711,109	4,023	41,470	1,277,759	7,697,930	6 02
8,606	75,644	196,946	1,746,504	1,294	13,855	341,072	2,985,992	8 78
6,370	66,508	*	*	165	7,935	109,373	1,211,885	11 08
1,246,457	4,521,308	1,171,400	6,638,511	213,371	1,003,898	14,873,242	63,806,102	

LAND SALES.

As regards the sale of land by companies holding grants from the government, it will be observed that there has been a large falling off in the area disposed of, although the average price realized per acre shows a considerable increase as compared with previous years.

I am not aware of any particular reason for this falling off in the area of land sold. However, in view of the ever-increasing demand on the part of settlers with capital for free homestead land, it would have seemed reasonable to suppose that railway companies would have had a corresponding demand for their own lands, as settlers of the type who have been going to the west within recent years, especially from the United States, usually contemplate farming on a large scale. It may be that some of the larger railway companies did not find it to their advantage to place their lands on the market. If such be the case, it is certainly to be regretted in the interests of the country, and especially of the western provinces.

IMMIGRATION.

COMPARATIVE statement of arrivals at inland and ocean ports during the twelve years ending March 31, 1909.

ARRIVALS.

Year.	Great Britain and Ireland.	Other Countries.	United States.	Total.
1896-7	11,383	7,921	2,412	21,716
1897-8	11,173	11,608	9,119	31,900
1898-9	10,660	21,938	11,945	44,543
1899-1900	* 5,141	* 10,211	* 8,543	23,895
1900-1	11,810	19,352	17,987	49,149
1901-2	17,259	23,732	26,388	67,379
1902-3	41,792	37,099	49,473	128,364
1903-4	50,374	34,785	45,171	130,330
1904-5	65,359	37,255	43,652	146,266
1905-6	86,796	44,349	57,919	189,064
1906-7 (nine months ended March 31)	55,791	34,217	34,659	124,667
1907-8	120,182	83,975	58,312	262,469
1908-9	52,901	34,175	59,832	146,908
	540,621	400,617	425,412	1,366,650

The report of the Superintendent of Immigration will be found under Part II. of the general report.

I desire to call special attention to the very complete tables and statements which are again submitted by the superintendent, showing in detail the nationality, occupation and destination of all immigrant arrivals during the period covered by the report. These statistics have been prepared with extreme care and they supply a long-felt want in this relation, as the classification has been so systematized as to readily afford information in connection with any subject dealt with.

* Arrivals for six months only.

As would appear from the foregoing table, there has been a large falling off in the total immigration during the past twelve months as compared with the previous year. It should be pointed out, however, that while the number of arrivals was less than that of last year, which was the largest in the history of the country, the average for the previous six years has been well maintained. In this relation it is satisfactory to note also that nearly one-half of the total male population which arrived in Canada last year was composed of farmers and farm labourers.

BRITISH IMMIGRATION.

The report of the Assistant Superintendent of Emigration at London sets out fully the work that has been conducted in Great Britain and Ireland during the past year, and, although there has been a large falling off in the number of British arrivals, it is gratifying to observe that most of the undesirable elements that have found their way to Canada in previous years have now been almost completely eliminated. This is due largely to the effect of the regulations that came into force in the spring of last year, restricting the emigration to Canada of persons assisted by charitable organizations, and there is no doubt that the results obtained have fully justified the change of policy which was then adopted.

There has been a falling off also in the number of continental arrivals, but this is not surprising, as ever since the termination of the arrangements that had been made for the dissemination of literature throughout various European countries the department has been unable, owing to restrictive laws in force in such countries, to undertake any work of propaganda.

It will be observed with pleasure, however, that there has been a slight increase in the number of arrivals from the United States. In fact, it has been the largest since the movement began in 1897, and it has even exceeded the number of arrivals from Great Britain. The class of settlers coming from the United States is composed chiefly of experienced agriculturists with capital, and the methods followed to engage such movements would appear to have proved so successful that it is proposed to continue the work with increased vigour in future.

IMMIGRATION FROM THE UNITED STATES.

As regards this class of immigration I wish to call particular attention to the report from Mr. W. J. White, inspector of agencies and press agent, which sums up in very striking form the results of the department's work in the neighbouring republic during the past twelve months. In view of Mr. White's close connection with this unprecedented movement of population ever since its inception in 1897, and his thorough knowledge of conditions which have brought it about, I am sure that his opinion will commend itself to all patriotic Canadians. The arrivals from the United States, as will be observed from the returns, were the largest from any one country during the past year, and of the 60,000 Americans who entered Canada every man, woman and child was possessed, on an average, of $1,000 in stock, cash and effects. This large addition to our population represents a community composed of the most experienced tillers of the soil, and although their traditions may be different from ours, it is gratifying to realize that they come here imbued with such sentiments, as regards the ideals of national life, as readily enable them to appreciate the benefits of Canadian citizenship.

IMMIGRATION FROM FRANCE AND BELGIUM.

COMPARATIVE Statement of Immigrant Arrivals from France and Belgium during the thirteen years ending March 31, 1909.

Year.	France and Belgium.
1897	740
1898	545
1899	413
1900	483
1901	492
1902	645
1903	1,240
1904	(1,534)—2,392—(858)
1905	(1,743)—2,539—(796)
1906	(1,648)—2,754—(1,106)
1907 (9 months)	(1,314)—1,964—(650)
1908 (to March 31)	(2,671)—3,885—(1,214)
1909 (to March 31)	(1,830)—2,658—(828)

It will be seen that there has been a falling off in the number of arrivals from France and Belgium during the past year. As explained by both Mr. Treau de Cœli, the Canadian government agent at Antwerp, and Mr. Paul Wiallard, our agent at Paris, while the total immigration has not come up to the figures of the previous year, those who have come to Canada belong to a better class of emigrants than ever before. However, considering that there has been a falling off in the number of arrivals from the British isles and other European countries, I think that the results of our work in France and Belgium are very satisfactory, especially when one considers that during the seven years ending 1903 there only arrived from those two countries 4,558 immigrants, whereas during the past five years and nine months this number was increased by 16,192. It is not as large, it is true, as could be desired, but it is strong evidence that our work is being prosecuted as energetically as the restrictive laws in force, especially in France, will permit.

JUVENILE IMMIGRATION.

From the report of Mr. G. Bogue Smart, chief inspector of British immigrant children and receiving homes, it will be seen that there is an increasing demand for juvenile immigrants, from the country districts in Canada. During the year 1907-8 there arrived 2,375 of these children, which was 920 in excess of the previous year, but large as this number was it could only supply less than one-seventh of the total demand on the part of farmers throughout the country.

The arguments put forth by Mr. Smart in favour of this class of immigration are indeed very forceful, supported as they are by the utterances of some of the most prominent men in the old country, as well as by the opinion of our own inspectors who keep continually in touch with the thousands of juvenile immigrants who have been placed in homes in Canada.

The system of inspection would appear to be as perfect as can be, and it is satisfactory to note that Mr. J. Obed Smith, the assistant superintendent at London, takes occasion to bear testimony to the excellence of the work conducted by the department in this relation.

SURVEYS.

During the year 7,412,870 acres of land were subdivided into sections, a somewhat larger amount than in the preceding year. Resurveys were also made of 1,000,960 acres; four hundred and sixty-seven miles of base lines, initial meridians, and various miscellaneous surveys were run.

Seventy parties in all were employed on the survey of Dominion lands, thirty-one of these working on subdivision surveys under contract and thirty-nine being paid by the day. The distribution of these parties by provinces is shown in the following table:—

Parties.	In Manitoba.	In Saskatchew'n.	In Alberta.	In British Columbia.	In the Territories.	On the Boundary between British Columbia and Yukon Ter.	Partly in one province and partly in another.	Total.
Paid by the day.............	4	6	15	8	2	1	3	39
Under contract..............	7	8	15	....	....	....	1	31
Total...	11	14	30	8	2	1	4	70

Three hundred and twelve whole townships and twenty-three fractional townships were completely subdivided, while one hundred and sixty-one townships were partially subdivided.

Resurveys were made, either partial or complete, of one hundred and seventy-one townships. The large amount of resurvey now found necessary is chiefly owing to the fact that in many townships which were surveyed some twenty or thirty years ago the corner monuments, which were not of as durable a nature as those now used, have to a great extent disappeared. In many districts where lands had been surveyed there was but little settlement and the absence of monuments did not attract much attention till the large recent influx of settlers into these townships made it imperative to re-mark the corners, in order to enable them to locate their homesteads.

The base lines necessary as a preliminary for extending the township surveys were surveyed chiefly in the great almost vacant country lying west of Edmonton and east of the Rocky mountains, and comprise portions of the twelfth, thirteenth and fifteenth bases. The fifth initial meridian has also been extended northward as far as township 107, about three hundred and thirty miles north of Edmonton, and some twenty miles additional of the sixth meridian was surveyed.

The mileage surveyed during the twelve months was 24,502. This, divided among sixty-seven parties, three parties not being included owing to the nature of their work, gives an average of three hundred and sixty-six miles per party.

A number of townships were surveyed along the line of the Grand Trunk Pacific Railway, between the fifth and sixth initial meridians, extending as far west as the Athabaska river.

A demand having arisen for lands in southern Saskatchewan and Alberta in what was formerly known as the 'semi-arid' district, about one hundred and forty-five townships were subdivided in that region and it is expected that all the townships yet remaining unsurveyed will be subdivided next season. Then practically all the open prairie country will have been surveyed, and the land to be laid out for settlement in the future will be more or less wooded.

Mr. P. A. Carson continued the triangulation of the railway belt in British Columbia, south and west of Golden. Several new stations were fixed as reference points upon which subdivision or other surveys may be based or to which they may be connected.

Mr. A. O. Wheeler, with two sub-parties under Messrs. M. P. Bridgland and H. G. Wheeler, made an examination of vacant lands in the valley of the Columbia river in the railway belt, British Columbia, above and below Revelstoke and above Golden. The object of this examination was to determine the amount of land available for different purposes, such as fruit growing, ordinary farming, grazing or lumbering.

In view of the possible construction at an early date of a railway to Hudson Bay, it was deemed advisable to lay out into town lots the land surrounding the harbour at the mouth of Churchill river. This land had been reserved from sale and settlement by order in council dated July 23, 1906. The survey was made by Mr. J. E. Morrier. Sufficient lines were run and marked on the ground to permit of dealing with the lots and cancelling the reservation.

The investigation of water-powers in the western provinces was continued by W. Thibaudeau, C.E. His operations during the last season covered the southwestern part of Alberta.

The Yukon-British Columbia boundary, which is the sixtieth parallel of latitude, was established from Tatshenshini river to Takhini river by J. N. Wallace, a distance of about thirty-six miles.

Two parties were employed on irrigation surveys in southern Alberta, under the direction of the Commissioner of Irrigation. They were in charge of Messrs. P. M. Sauder and R. J. Burley.

Hereunder is the usual table of subdivision or settlement survey work completed each year since the inception of the surveys, with the result of last season's operations added:—

Period.	Acres.	Number of Farms of 160 acres each.
Previous to June, 1873	4,792,292	29,952
1874	4,237,864	26,487
1875	665,000	4,156
1876	420,507	2,628
1877	231,691	1,448
1878	306,936	1,918
1879	1,130,482	7,066
1880	4,472,000	27,950
1881	8,147,000	50,919
1882	10,186,000	63,662
1883	27,234,000	170,212
1884	6,435,000	40,218
1885	391,680	2,448
1886	1,379,010	8,620
1887	643,710	4,023
1888	1,131,840	7,074
1889	516,968	3,231
1890	817,075	5,106
1891	76,560	476
1892	1,395,200	8,720
1893	2,928,640	18,304
1894	300,240	1,876
1895	406,240	2,539
1896	506,560	3,166
1897	428,640	2,679
1898	859,840	5,374
1899	1,022,720	6,392
1900 (first 6 months)	735,480	4,596
1900-1901	1,603,680	10,023
1901-1902	2,553,120	15,957
1902-1903	6,173,440	38,584
1903-1904	12,709,600	79,435
1904-1905	10,671,520	66,697
1905-1906	4,973,920	31,087
1906-1907 (9 months)	3,819,700	23,873
1907-1908	6,123,040	38,269
1908-1909	7,412,870	46,330
	137,840,065	861,495

THE ASTRONOMICAL BRANCH OF THE DEPARTMENT.

Under this branch come the work of the Dominion Observatory, the International Boundary Surveys, and the Geodetic Survey of Canada.

The Observatory is provided with instruments for carrying on observations and investigations in several lines of astronomy, astrophysics and geophysics.

The principal instruments are: the equatorial, aperture, 15 inches; focal length, 19 feet; with several auxiliary instruments which may be attached to it; the meridian circle, aperture 6 inches, focal length 7 feet, diameter of circles, 3 feet; the cœlostat, primary mirror, 20 inches diameter; focal length of concave mirror, 80 feet; Bosch seismograph, registering photographically; Riefler standard clock; and a master-clock for operating the time service of the city.

The attachments to the equatorial instrument include: a camera for solar photography, a stellar photometer, a filar micrometer for visual observation of double stars, a single prism and a three-prism spectrograph, both of which have been designed specially for use in determining the velocity of stars in the line of sight, and have been constructed in the observatory workshop; a stellar camera, which is permanently attached to the tube of the telescope. The meridian circle and the cœlostat have only recently been put in operation. The former is installed in the new wing to the west of the main building. Defects showed themselves in the foundations of the piers built to carry the instrument and its collimators, and they had to be rebuilt, and special drains made to carry off the water which accumulates there. Some alterations had also to be made to the instrument itself. The cœlostat is set up in a building to the north of the main building, with which it is connected by a tunnel. A spectrograph, placed in a room in the basement, receives the solar image formed by the cœlostat mirrors. The purpose of the instrument may be in general terms defined as the investigation of the variations in the light and heat of the sun, the conditions accompanying sun spots, &c.

The time system by which dials in the principal government buildings in the city are operated from the Observatory, has been satisfactory. An additional group of dials has been placed in the Royal Mint, the Archives Building and the Printing Bureau. There are now in operation in all 276 dials and 12 clocks.

Two observers were employed during the summer in the determination of latitudes and longitudes of points with the purpose of improving the existing maps of Canada. Twenty-seven of these astronomical stations were occupied, including points in British Columbia, Manitoba, Ontario, Quebec, New Brunswick and Nova Scotia. One observer was occupied during the summer in magnetic observations at outside points.

The observatory is not connected with the weather service. No meteorological observations are taken at it, except certain self-recording observations of the temperature and the variations of barometric pressure, which are required for the proper interpretation of the records of the seismograph, to separate the effects of atmospheric variations in producing tremors in the earth's crust from the effects of internal movements.

The joint international boundary survey, provided for by the treaty of 1906, of the 141st meridian (between Yukon Territory and Alaska) was continued during the summer of 1908. The meridian was prolonged, and governing points established, for a distance of 75 miles south from the terminal point of 1907, and a point was reached about two miles south of White river. Fifty-two miles of the line, southward from the crossing of Yukon river, was marked by permanent monuments of aluminum bronze. The operations of the survey also comprised the continuation of the triangulation and the topographic survey along the line, and 159 miles of precise levelling, northward from Whitehorse, along the Dawson road.

Mr. A. J. Brabazon, D.L.S., had charge in the field of the Canadian share of the work.

The second annual report by the United States and British Commissioners for this demarcation was laid before parliament on February 22, last.

The operations for the coming summer will include the production of the line northward from Yukon river, and southward from the terminal point of last season, near White river, to the Natazhat Range, the continuance of the triangulation and the topographic survey, and the placing of the final monuments at, and northward from White river, on the portion of the line the permanent marking of which is most immediately needed.

The demarcation of the line separating the coast strip of Alaska from British Columbia and Yukon Territory is carried on under the Treaty of 1903, as interpreted by the Tribunal which met in London in that year, and under the supplementary agreement of 1905.

This demarcation is carried on in sections by United States and Canadian parties, working independently but accompanied by a surveyor of the other party when identification has to be made of mountain peaks or other boundary points.

United States parties were placed at the crossing of Alsek river and in the region east of Unuk river. Each of these parties was accompanied by a Canadian representative.

A Canadian party under Mr. J. D. Craig defined the boundary line on the south branch of the Iskut river (a large tributary of Stikine river), completed the topographical survey of the region about the head of Bradfield river, and, in part, made a triangulation to connect the survey on the south branch of the Iskut with the former survey on the Stikine. This triangulation he was prevented by long continued rains from completing.

A Canadian party under Mr. W. F. Ratz continued the topographical survey east of Stephens passage.

The survey of this region was left incomplete in the joint surveys made in 1893 and 1894, and the Tribunal of 1903, in selecting the mountains which the boundary line should follow, found themselves unable to reach a decision as regards the region lying between a certain mountain situated north of Taku river and another lying some forty miles north of the Stikine. The distance between these two mountains is about 130 miles.

By the agreement made between the governments in March, 1905, seven intervisible peaks between the Taku and Whiting rivers, and one peak to the north of the southern terminal point of the undefined stretch, were chosen as boundary peaks, thus reducing the undefined stretch to about 70 miles. As to this, it was provided in the agreement that the commissioners after making the necessary survey should select, as the final boundary peaks, intervisible summits, no one of which should lie more than 2,500 metres away from the straight line joining the seventh and eighth of the peaks above mentioned. The carrying out of this agreement called for a very difficult topographic survey. The boundary line as defined in the agreement lies from ten to twenty miles from the coast, passing over an immense ice field out of which project the rocky summits of mountains reaching six to seven thousand feet or more above sea level. The coast line is bordered by a rugged range of little less height, and access to the interior is to be had only by a few narrow valleys and over the glaciers which discharge into them. Food, camp outfit and instruments have to be packed in on men's backs.

This survey was entrusted to Mr. W. F. Ratz, D.L.S., who in 1907 surveyed the southern part of this region from behind, penetrating westward from the Stikine river. In 1908 he entered from the west, from Holkham bay and its branches. The work of the two seasons completed the topographic survey of the whole region so that the commissioners have been enabled to select the peaks for the boundary, in accordance with the requirements of the executive agreement of 1905, and nothing remains to be done in this region but to make a triangulation survey connecting the selected peaks, so that the boundary may be properly described. It is hoped that this will be completed during the present year.

It is with great regret that I record the death of Mr. Ratz, which occurred in Ottawa on February 6, after a brief illness. Mr. Ratz was a graduate of the Ontario School of Practical Science, and was employed for some years in the Topographical Surveys Branch of the department. In 1905 he was transferred to the Boundary Surveys. Besides professional skill of a high order he possessed personal energy and practical ability which he proved by his successful management of the most difficult section of a difficult survey. His untimely death is a serious loss to the public service.

The re-survey of the 49th parallel which forms the international boundary from the Gulf of Georgia to the Lake of the Woods, was completed in 1907 from the sea to the summit of the main range of the Rocky mountains, with the exception of a short piece of triangulation in the Cascade range. This has since been finished, and work has been begun to the east of the Rocky mountains, under the direction of Mr. J. J. McArthur, D.L.S., who last summer surveyed one hundred miles of the line, beginning at Coutts, Alberta, and working eastward. Permanent monuments of cast-iron will be planted during the coming summer, to replace the old piles of loose stones of the original survey of 1872-75. These marks were placed at an average distance apart of three miles; the new monuments will be one mile and a half apart.

The re-survey of the boundary line between the provinces of Quebec and New Brunswick and the states of Maine, New Hampshire and Vermont, was continued. The initial point of the season's work was the monument at the source of St. Croix river. From this point the line (approximately a meridian) was surveyed to the St. John river, the vista cut through the woods, a plane table survey made of the country adjacent to the line, and permanent monuments placed. This re-survey and that of the 49th parallel were carried on under agreements between the governments of the United States and Great Britain, without special sanction of any treaty, the work being looked upon as merely a continuation or renewal of work already begun under treaty. As, however, it has been found necessary in many places not only to renew monuments formerly planted, but also to place intermediate ones, and as there were certain sections of the line which had been described by treaty, but had never been surveyed, it appeared desirable that a treaty should be negotiated providing for the systematic survey of the whole boundary line. Accordingly a treaty was negotiated between His Majesty and the United States, which was ratified on June 3, 1908, for the survey of the whole boundary from the Atlantic to the Pacific.

This treaty divides the line into eight sections, as follows:—

1. From the Bay of Fundy, through Passamaquoddy bay to the mouth of St. Croix river.
2. From the mouth to the source of St. Croix river.
3. From the source of St. Croix river to the River St. Lawrence.
4. Along the St. Lawrence river, through the Great Lakes, and along their connecting waters to the mouth of the Pigeon river in Lake Superior.
5. Along Pigeon river and other waters to the northwest angle of the Lake of the Woods.
6. From the northwest angle to the 49th parallel and along the latter to the summit of the Rocky Mountains.
7. From the summit of the Rocky Mountains, along the 49th parallel to the middle of the straits separating Vancouver island from the mainland.
8. Along the Straits of Georgia, Haro and Fuca to the Pacific Ocean.

Of the above sections, the second and the fifth were defined by former treaties, but have never been surveyed as the boundary. The first has been surveyed in part, and the fourth and the eighth have been laid down on charts but not referred to monuments. The other sections have been surveyed and marked with monuments, though in general with not a sufficient number to meet modern requirements. The treaty requires in the case of each section that the line be laid down on modern charts, as well as marked on the ground by monuments wherever that is practicable. Provision is made for the acceptance of the work done on certain sections under the executive agreements above referred to.

The survey of the fourth section in the St. Lawrence river and the Great Lakes is placed in the hands of the International Waterways Commission. Mr. O. H. Tittmann, superintendent of the United States Coast and Geodetic Survey, and Dr. W. F. King, chief astronomer of Canada, have been appointed commissioners for the carrying out of the treaty with respect to the other sections.

THE GEODETIC SURVEY.

Two observing parties for the measurement of the angles of the triangles were in the field during the whole season, but on account of the prevalence of dense smoke were unable to do much work. The district covered lies between Brockville and Toronto, extending back some thirty miles.

Reconnaissance surveys were conducted in the maritime provinces, in the province of Quebec, in western Ontario and along the international boundary west of Lake Superior. The latter reconnaissance was, in part, for a primary triangulation to control the survey of the international boundary along the Pigeon river. The reconnaissance in the province of Quebec, which covered all of that part of the province lying south of the St. Lawrence river from Montreal to a point thirty miles below the city of Quebec, together with a strip north of the river extending far enough back to secure high points to command the country to the southeast, was most gratifying in its results; an excellent system of quadrilaterals was secured and some large five and six-sided figures with central points.

In the maritime provinces reconnaissance has been satisfactory. The stations selected for the triangulation extend from Chamcook mountain in the southwest corner of New Brunswick to the northerly extremity of Cape Breton Island, embracing a district about fifty miles wide between those points, including the easterly portion of Prince Edward Island. Chamcook mountain is one of the primary triangulation stations of the United States Coast and Geodetic Survey and by it in conjunction with Trescott Rock, another primary station of the same survey, a direct connection is made with the Geodetic Survey of the United States.

In 1908, two Geodetic levelling parties were employed and a line of precise levels was carried from Coteau Junction, thirty-eight miles southwest of Montreal, to Fort Erie via Hamilton, and also from Hamilton to London. The computations are now in progress and are sufficiently advanced to show that the results are of a high order of precision.

Reference may be made to the report of the Chief Astronomer, Part No. IV. of this report, for fuller details of the work of the Astronomical Branch.

NATIONAL PARKS.

The national parks continue to grow in popularity, as shown by the large increase in the number of tourists and temporary residents who visited these charming resorts during the year. Over 39,780 persons visited Banff during the past fiscal year, as against 32,209 during the previous year, and 7,389 a decade ago. This increase of visitors was accompanied by an increase of revenue, the collections during the fiscal year closed amounting to $31,321.20 as against $27,232.87 in the previous year and $2,994.16 during the fiscal year 1898-9.

The presence of 25,209 people at the Government Bath Houses during the year indicates very forcibly the need for more adequate bathing accommodation. The erection of a commodious bathhouse at the Hot Springs, equipped according to modern ideas, is a question which is being forced upon the department for early consideration.

Satisfactory progress has been made in the organization and systematization of the work connected with the national parks. Regulations based upon the Rocky Mountains Park Act have been revised and amended, and by order in council have been made to apply to the Rocky mountains, Yoho, Glacier and Jasper parks. It is expected that these regulations will facilitate the administration of these parks and afford increased protection to the game and fish within their precincts, as well as assist in the prevention of fire.

The transfer of some 325 of the buffalo purchased from Mr. Michel Pablo, of Montana, in the year 1907, from Elk Island Park to Buffalo Park, situated near Wainwright on the Grand Trunk Pacific Railway, was successfully accomplished; as was also the delivery of another shipment of 190 head from Montana. The task of rounding up the latter, transporting them individually in specially constructed wagons to the loading point, and shipping them over nearly 1,300 miles of railway to their new home with insignificant loss, constituted a work of such magnitude as only the experienced eye witness can appreciate, and is probably without precedent in history. The work of roundiug up the balance of this famous herd will be continued by Mr. Pablo during the present summer; and when this balance is delivered to Buffalo Park, together with the surplus stock from the Banff herd, Canada will possess the largest number of buffalo (or of any wild animals) within a single inclosure, in the world.

In consideration of the tide of travel to the Seattle Exhibition this summer, a profusely illustrated pamphlet setting forth the attractions of the Canadian National Parks has been issued. This pamphlet, entitled 'The Prince of Playgrounds,' is being freely distributed at the Seattle fair, and will doubtless divert a great deal of tourist traffic through the parks to view the wondrous beauties of this most providentially favoured region of Canada's dominions.

In the years 1904 and 1905 there were transferred to this department to be administered as public parks, a dozen islands in the St. Lawrence river lying between Brockville and Gananoque. These islands, with a single exception, were purchased from the Mississagua band of Alnwick and are reserved for recreative purposes. Upon six of the islands, which are well situated and beautifully wooded, pavilions have been erected and equipped with stoves, tables, benches, &c., and are under the care of a guardian.

The numbers of excursionists, picnic parties and other pleasure seekers visiting these islands would appear to justify their reservation from sale; and it will devolve upon this department to see that the pavilions and other conveniences are maintained in good sanitary condition and repair.

FORESTRY AND IRRIGATION.

The report of the Superintendent of Forestry and Irrigation for the year ended March 31 last, will be found under Part VII. of the general report.

The interest in tree planting still continues and the distribution of young trees for the past year was the largest yet recorded. In order to provide better facilities for handling this increased work, all applications for trees are now dealt with at the office at Indian Head, which is the headquarters of the Chief of the Tree Planting Division, and where the Forest Nursery Station is situated.

An important feature of the year's work was the removal of squatters from the forest reserves. This work is now practically completed, thus removing a great source of danger from fires within the reserves.

The surveys of 'The Pines' and 'Riding Mountains' forest reserves have been completed and similar work is to be undertaken at an early date on the other reserves.

Systematic effort is being made to collect statistics regarding the forest resources of Canada and the annual production of timber, but the collection of such statistics is necessarily tedious, and it will be some time before the record is even approximately complete.

Continued attention has been given to the work of protecting the forests from fire and special efforts have been made to prevent, or control, fires along the line of railways now under construction.

Special attention is being given to stream measurements. This work was previously conducted as part of the irrigation administration, but has now been given a separate organization. This work is at present confined chiefly to the streams in southern Alberta and southwestern Saskatchewan, in the sub-humid or semi-arid district, but it is intended to extend it as rapidly as possible and ultimately to cover all of both provinces. The importance of this work cannot be over-estimated, as upon the water supply will depend, to a very large extent, the future development of a considerable section of the west, and an accurate knowledge of existing conditions should precede any attempt to improve them.

The greatest irrigation development during the past year has been in connection with the larger irrigation projects now under construction by chartered companies, although there has been some development in the Cypress Hills country by individuals.

SCHOOL LANDS.

In consequence of the comparatively poor harvest of the year 1907, and of the financial depression then existing, it was not considered expedient to hold any general auction sales of school lands in the provinces of Manitoba, Saskatchewan and Alberta during the season of 1908, and only a few isolated parcels were disposed of.

As you are aware, special legislation was recently obtained to enable the department to sell by private sales to boards of trustees the land required for school sites in school sections, instead of by public auction, as it was found that the expenses in connection with the auction sales of these small parcels, which were put up separately, were out of all proportion to the amount realized, and also involved a good deal of trouble and inconvenience to the school authorities.

Under the amendment to the Dominion Lands Act referred to, the department is now empowered to sell by private sale to boards of trustees the land required in school sections for school sites, provided that the application of the trustees is endorsed by the Minister or Deputy Minister of Education for the province, and that the parcel does not exceed four acres and fronts on a road allowance.

Under this provision of the Act a number of sales have already been made to trustees, and the system is found to work well.

A number of sales were also made under the Railway Act to railway companies of school lands required for right-of-way and station grounds, ballast pits, and other purposes of the railway.

An important change was made during the fiscal year in the manner of renting school lands for grazing, grazing permits having been substituted for the grazing leases heretofore issued.

Under these leases great difficulty was experienced in collecting the rental, the lessees in many instances paying no attention to the notices sent them from time to time; and although the accounts were in all such cases then placed in the hands of the inspector for collection. he frequently found on visiting the land that the lessee was either absent, or claimed to be unable to meet the payment at the time, and as the sum involved was generally inconsiderable it was not worth while collecting by process of law, and it was consequently lost to the Crown.

Under a grazing permit, however, there can be no arrears of rental, as the permit is not issued until the rental is paid, and it lapses on April 1 in each year, and, while it is renewable from year to year at the option of the department. the renewal is not made unless application for the same is received on or before February 1, accompanied by the rental for the next year.

Where the applicant fails to renew the permit by the date mentioned, the department is at liberty to rent the land to the next applicant.

This system not only prevents any arrears accruing, but also saves a considerable amount of time in correspondence, and also does away with the necessity of keeping accounts in connection with the lands rented.

During the past fiscal year, prior to the issue of the grazing permit, 160 grazing leases were issued, and since then 291 grazing permits have been granted.

The net revenue from these grazing lands for the fiscal year was as follows:—

Manitoba	$1,125 67
Saskatchewan	9,103 89
Alberta	9,552 41

The revenue from coal lands for the fiscal year was $4,141.92.

The report of the Chief of the School Lands Branch shows that the net revenue, from all sources, from school lands during the fiscal year was as follows:—

Manitoba	$365,430 16
Saskatchewan	172,754 90
Alberta	143,440 40
Total	$681,625 46

Of this sum $642,985.87 was collected at head office, and the balance of $38,639.59 through the various Dominion lands agencies.

The expenditure for the fiscal year is as follows:—

Manitoba..	$6,872 13
Saskatchewan	6,947 00
Alberta..	6,840 60
Total..	$20,659 73

This sum is as nearly as possible 3 per cent of the net revenue, which I consider a very moderate amount for the administration of the school lands in the three provinces.

The balance to the credit of the several School Lands Funds on March 31, 1909, is as follows:—

Manitoba..	$2,185,311 51
Saskatchewan..	850,398 41
Alberta..	452,123 39

In accordance with the orders in council in that behalf cheques were issued in favour of the Provincial Treasurer of each of the provinces of Manitoba, Saskatchewan and Alberta covering the revenue collected from school lands during the fiscal year other than principal moneys of sale, the amount paid over to each province on this account after deducting the cost of management being as follows:—

Manitoba..	$108,895 41
Saskatchewan..	52,113 24
Alberta..	54,239 84

In addition to the foregoing, the following amounts were paid over by the Finance Department to the several provinces as interest on the fund for the fiscal year, namely:

Manitoba..	$ 62,161 11
Saskatchewan..	24,289 14
Alberta..	12,790 09

YUKON TERRITORY.

Methods of mining in the Yukon Territory are gradually undergoing a very pronounced change. Individual effort by comparatively primitive methods is being replaced by combined operation with the most modern equipment, the results of which appear to be very satisfactory. Combination, with operations on a more extensive scale, has resulted in materially reducing the cost of production.

The water-powers of the territory are being utilized for the generation of electric energy for the operation of dredges, elevators, &c., and in all cases where possible, mechanical appliances are being substituted for manual labour, with very satisfactory results.

The gold production for the year shows a considerable increase, and it would appear that the completion by The Yukon Gold Company of their extensive water system, as well as the introduction of additional dredges and other forms of improved mining machinery, will result in a steady increase in the annual gold output of the territory.

Quartz prospecting operations appear to have been carried on with greater activity than in the past. A stamp mill is being installed at the head of Victoria gulch, where gold-bearing quartz has been found, and a concentrator has been erected, and is in full operation in the Conrad district, where discoveries were made some years ago, and where considerable development work has been performed.

Agriculture has now become a very important adjunct to the resources of the territory. While formerly all vegetables consumed in the territory were imported, now vegetables in abundance are being locally grown, and continuous cultivation would appear to increase the productiveness of the soil. Entries have been granted for a number of homesteads, and the cultivation of the soil appears in numerous cases to have been undertaken as a permanent occupation.

I have the honour to be, sir,

Your obedient servant,

W. W. CORY,

Deputy of the Minister of the Interior.

PART I.

DOMINION LANDS.

DOMINION LANDS.

No. 1.

REPORT OF THE COMMISSIONER.

DEPARTMENT OF THE INTERIOR,
OFFICE OF COMMISSIONER OF DOMINION LANDS,
OTTAWA, April 1, 1909.

W. W. CORY, Esq.,
Deputy Minister of the Interior,
Ottawa.

SIR,—I beg to submit my report for the twelve months ending March 31, 1909, on the Dominion Lands Branch of this department, together with the reports of the Inspectors of Dominion Lands Agencies and the agents of Dominion Lands for the several districts.

The following summary statement has been prepared of the work transacted during the period mentioned as compared with the corresponding twelve months during the previous year :—

	1909.	1908.
Number of files dealt with	178,830	147,794
Letters written	149,178	125,430
Triplicates	96,707	80,014
Total letters	245,885	205,444
Applications for patent—		
Number examined	30,760	27,557
New applications	19,051	15,269
Certificates issued and notifications sent out	20,256	15,215

I have the honour to be, Sir,
Your obedient servant,

J. W. GREENWAY,
Commissioner of Dominion Lands.

No. 2.

REPORT OF INSPECTOR OF DOMINION LANDS AGENCIES.

(J. W. Martin.)

OFFICE OF INSPECTOR OF DOMINION LANDS AGENCIES,
MEDICINE HAT, ALBERTA, May 15, 1909.

J. W. GREENWAY, Esq.,
Commissioner of Dominion Lands,
Ottawa.

SIR,—I have the honour to submit my annual report for the year ending March 31, 1909.

Prior to the 1st of February last, I was assistant inspector of Dominion lands agencies, assisting Mr. R. E. A. Leech, who had charge of the four provinces of Manitoba, Saskatchewan, Alberta and British Columbia; and on that date, I was appointed as inspector of agencies for the provinces of Alberta and British Columbia, and therefore kept no records in my office of the business transacted throughout the west prior to that date. These records, however, were all carefully kept in the office of Mr. Leech, at Brandon, and as he will no doubt in his annual report give a statement of the business transacted by the agents, sub-agents and homestead inspectors throughout the west, I will not attempt to duplicate these statements. Mr. Leech's report will no doubt cover everything fully.

On the 1st of September last, the new Dominion Lands Act came into force, throwing the odd numbered sections at the disposal of the government open to settlement, and as this made it much easier for intending settlers to secure suitable homesteads, a large immigration commenced at that date, and a great number of quarter sections have been taken up since then. In the month of September, more quarter sections were disposed of than in any month since the land throughout the west became available for settlement. Since the 1st of September, on account of this large influx of intending settlers, and the tremendous volume of business transacted at the agencies, it has been necessary to increase nearly every office staff in my district, in order to cope with the current work successfully, which has, I am pleased to state, been accomplished.

Last year, the government saw fit to distribute seed grain to farmers throughout the west, on account of the scarcity of seed, and for several months I was at Edmonton assisting in the distribution of the grain. In order to distribute this satisfactorily, it was necessary to have most of the homestead inspectors in Alberta assisting the railway agents in distributing, and also for the purpose of seeing that the cars were arriving at the different distribution points promptly. The taking of the homestead inspectors for this work materially interfered with their regular duties, and their absence from their regular duties is still being felt. However, the work in this branch is increasing rapidly, and it was seen fit to appoint three new inspectors in Alberta, and I am very pleased to be able to state that the work is being caught up rapidly.

Most of the sub-agents have also been very busy, and it was necessary to increase the number of sub-agencies in Alberta materially, especially in the northern part of tho province, as settlement has extended back. These sub-agencies have all been inspected regularly and, in most cases, the work has been carried on in a very satisfactory manner. As lands in certain localities are well settled, and people become entitled to patents, the work at the sub-agencies affected will be materially decreased, and it will be necessary from time to time to close up some sub-offices. It will also be necessary, on account of settlement extending a long way back in different directions, to open up new sub-offices, which the department so far has been very prompt in doing.

I have, during the fiscal year just ended, taken up quite a large number of special cases, or investigations, for the department, which have been dealt with promptly and satisfactorily on receipt of the necessary reports.

On account of the settlement which has taken place during the year in what is known as the Peace River country, I understand it is the intention of the department to establish an agency at Lesser Slave lake to attend to this district. This should be a great convenience to people who wish to settle in the northern part of the province, and no doubt from now on, as the land is being surveyed rapidly, a large proportion of intending settlers will visit that district for the purpose of taking up land.

It is expected that before the close of the next fiscal year, branch lines of railways now established through the west will have been run reaching through portions of the province of Alberta which are at present practically unsettled, and also into portions of the province in which, during the past year, settlers have been flocking, and which are at the present time a long way from a railway. These settlers went back into these remote districts with the expectation of having railway facilities in the near future, and a great many of them will apparently not be disappointed in this respect.

Indications point to a very large settlement the coming year, and I look for a large increase over the year just closed.

In the past, a large area of coal land has been disposed of, and it is apparent from all information received, that coal mines are being opened up in all parts of the country for the purpose of supplying settlers with coal for domestic uses, and where these mines are close to railways, large quantities are being shipped to the cities and towns throughout the west. I have no doubt also that as the railway facilities are increased during the coming season, the quantity of coal mined next year will be largely increased over the past season.

This spring has been quite backward, there being a very large rainfall. However, all indications point to the crop being, if anything, above the average.

Your obedient servant,

J. W. MARTIN,
Inspector.

No. 3.

REPORT OF INSPECTOR OF DOMINION LANDS AGENCIES.

(R. E. A. Leech.)

OFFICE OF INSPECTOR OF DOMINION LANDS AGENCIES,
BRANDON, MANITOBA, June 12, 1909.

J. W. GREENWAY, Esq.,
Commissioner of Dominion Lands,
Ottawa.

SIR,—I beg to submit my report for the fiscal year ending March 31, 1909.

The past year has been one of great activity in the administration of Dominion lands in the west, due to the distribution of over a million and a quarter bushels of seed grain, and to the operation of the new Land Act, which became effective September 1, 1908, throwing all unalienated Dominion lands open to entry and also providing for pre-emption and purchased homestead entry on lands within a prescribed area.

The distribution of seed grain referred to is presented in concise form in a report I made to the Deputy Minister, July 20, 1908, a copy of which is appended hereto. I should, upon this point, add that on August 15, 1908, I closed the seed grain offices in Regina, shipping all the records to the Seed Grain Branch, Department of Interior, Ottawa, for the completion of the unfinished business.

The work of the land offices during the past year has been by far the largest yet recorded. The land entries for the twelve months totalled 54,254, which exceeded the previous high water mark, 1905-6, by 12,315.

The largest number of entries put through one land office in a month was 4,447; this was done at Moosejaw in the month of September, 1908, and more than doubled the past record for one month, which was held by Regina. The record for the largest number of entries put through a land office in one day is also held by Moosejaw, where on December 22 last, 724 entries were completed. Also the revenue has, this last year, exceeded the million dollar mark, and the previous record by $358,574.30.

Foreign interest in the Canadian west has not in the least abated, and constant streams of settlers are arriving to take up the free government lands or to make purchases of other lands. These settlers are of a most desirable class, being well supplied with farming requirements or the means to procure the same.

INSPECTION OF OFFICES.

My inspections of the offices have been made and reported to you from time to time, and almost invariably the work has been found in good shape, the books and records well kept and the records in good order, and the routine work well up to date, though this has, in a number of cases, required considerable overtime work on the part of the office staffs.

From the monthly reports received from the agents, sub-agents and homestead inspectors, and by constant travel, I am able to keep in close touch with the work.

During the past year I have travelled 51,121 miles by rail and 375 miles by team, making a total of 51,496 miles.

SUB-LAND OFFICES.

During the past year it has been deemed advisable to close the sub-land offices at Etoimami, Strassburg and Milestone, Saskatchewan, and Pincher Creek, Alberta.

New sub-land offices were opened at St. Paul de Metis, Pine Creek and Entwistle, in Alberta, and Gull Lake and Lanigan, in Saskatchewan. The reports of the inspections made of sub-land offices have been forwarded to you as they were made.

INSPECTION OF THE GOVERNMENT PARK RESERVATIONS.

In addition to the inspection of the land offices, I have also kept in touch with and inspected the Banff, Yoho and Rocky Mountains Parks. During the past winter it was deemed advisable to close the Yoho Park office; my report on this being forwarded at the time.

Attached also are the following comparative statements of the work :—

A. Land offices, principal transactions.

B. Sub-land offices, principal transactions.

C. Homestead inspectors, principal work performed.

I beg to remain, Sir,

Your obedient servant,

R. E. A. LEECH,

Inspector of Dominion Lands Agencies.

REPORT ON DISTRIBUTION OF SEED GRAIN.

REGINA, SASKATCHEWAN, July, 20, 1908.

W. W. CORY, Esq.,
Deputy Minister of the Interior,
Ottawa.

SIR,—In connection with seed grain distribution work I beg to make an interim report, as follows :—

At the request of the Minister of the Interior I took charge of the distribution of seed grain in the provinces of Saskatchewan and Alberta, as per the agreements entered into between the Minister of the Interior and the representatives of the Saskatchewan and Alberta governments. In Ottawa, in the latter part of January and first of February, I arranged for the printing and distribution of notices and circulars, regarding the terms and conditions of the proposed seed grain distribution, forms of applications, liens, mortgages, &c.

On February 11 I arrived in Regina to open offices and organize a staff for handling the work. By the terms of the regulations governing the seed grain distribution, applications were to be made in duplicate before the secretary-treasurers of local improvement districts, Dominion land agents, sub-land agents, homestead inspectors, immigration agents or Northwest Mounted Police; the original to be immediately forwarded to my office, afterwards to be forwarded to the various land offices, or provincial authorities, for verification as to the interest of applicants in the lands described; the duplicate to be approved, or otherwise, by the council of the local improvement district and, subsequently, forwarded to me.

In order to meet the requirements of section 13 of the agreements made in Ottawa, February 3, between the Minister of the Interior and the representatives of the Saskatchewan and Alberta governments, respectively, I was notified that Mr. D. S. McCannel was appointed to represent the Saskatchewan government, and Mr. George Stevenson was appointed to represent the Alberta government. Those representatives opened offices, convenient to my own, and their approval was had to all applications made by non-homesteaders, for the respective provinces, before seed was delivered.

In order to facilitate keeping an accurate and readily available record of applications, I prepared registers and divided the work by land districts. In those registers the following quotations are made :—

'Application Number,' 'Name,' 'Post Office Address,' 'Declaration of Land,' 'Original Application Received,' 'Amount Applied for,' 'Date Original Application sent Land Office,' 'Date Original Application sent Provincial Government,' 'Date Original Application received back,' 'Amount Finally Recommended,' 'Papers sent Railway Agent, giving date and Station,' 'Date Lien received from Railway Agent,' 'Amount of seed supplied, Wheat, Ooas and Barley,' 'Amount charged to Government, Dominion, Saskatchewan, Alberta and Cash Sales.'

On February 13 the first applications were received. February 22 was the first date fixed for closing applications. The time for receiving applications, however, was extended from time to time and was, eventually, left open. The last application received was June 16, and seed was delivered on this application. Altogether, 16,615 applications were received and dealt with by this office.

As applications were finally approved they were listed for shipment under the stations at which the applicants desired their seed delivered. Each day, as the approved applications for any railway station made up a car lot of any given grain, a requisition was issued upon Mr. Charles C. Castle, Purchasing Agent, Winnipeg, for the shipment of the same.

The first of such requisitions was made February 28 for 26 cars, and daily requisitions, as required, were made subsequently during the shipping season. The last requisition was made May 13. The total requisitions are as follows :—

	Cars.
Wheat	500
Oats	482
Barley	39

In addition to this, however, grain was shipped on the requisition of Hon. W. T. Finlay, for the province of Alberta, as follows :—

	Cars.
Wheat	2
Oats	14

which will also be accounted for through this office. In all 1,037 cars of seed were shipped out for distribution.

When seed was shipped by Mr. Castle, the shipping bills were sent to this office, invoices accompanying the same, which were noted in our records. To the shipping bill, for each car, were attached a delivery list with liens and mortgages for execution by the applicants before the railway agents at time of delivery, it being necessary to take a separate mortgage, or lien, for each kind of grain, owing to the deliveries being made at different times. For each car of seed the number of deliveries to be made to applicants varied from 20 to, in one instance, 121, requiring the execution of as many securities. The first shipping bills were received at this office March 11 and were for 67 cars, and on the same day were sent forward to the various railway agents (or in the case of flag stations, to homestead inspectors) with the necessary delivery lists, liens and mortgages attached; also, each applicant was notified of the seed being shipped. As it was important that applicants should be able to receive the seed as soon as it reached its destination, we made it the rule of the office that all the shipping bills should be sent forward, with lists, liens, mortgages, &c., on the day that they were received, and I am pleased to be able to report that while we received as high as 81 shipping bills in one day, none ever remained over night in our office.

Seed was delivered at 175 stations in Saskatchewan and 75 stations in Alberta, making 250 stations in all; and the quantities ranged from a very few bushels up to, in one instance, 32 cars at one station.

In accordance with the arrangements made with the Canadian Pacific and Canadian Northern Railways their agents made delivery of the grain at the railway stations, and had the necessary documents executed. This was a very important part of the work, and, on the whole, has been done in a satisfactory manner. Deliveries at flag stations were attended to by homestead inspectors.

Owing to the enormous amount of work in connection with deliveries, I arranged for homestead inspectors to supervise the work on all railway lines, allotting to each a certain territory which they attended to in addition to flag stations. By this means railway agents having heavy deliveries were given assistance. As the deliveries for each car were completed the railway agent was requested to give a 'return statement' showing the deliveries as they had been made, on a form provided, and attach thereto the securities taken. Up to the present time these 'returns' and securities have not all been received at this office, but they will probably reach a total exceeding 30,000 in number. A separate file was made for each applicant, to which was attached his application in duplicate, all correspondence in connection therewith, and the liens, mortgages or cash sale invoices taken in settlement for seed delivered.

As liens, mortgages or cash sale invoices are received they are entered into our 'out-turn' grain books and our 'application' register, and attached to the proper application files. When all liens, mortgages or cash sale invoices relating to an application file are received, the file with the securities is immediately transferred to Ottawa in the case of homesteaders, and to the provincial authorities respectively in the case of non-homesteaders.

Duplicates of non-homesteaders' files are made and the same forwarded to Ottawa.

At the present time about 50 per cent of the files have been disposed of in the above manner.

UNSATISFACTORY SEED.

In every case where complaint was made about the seed supplied not being satisfactory, I immediately had an investigation made—in most instances by a deputy grain inspector—and where the seed, upon examination, was not thoroughly satisfactory, I immediately stopped delivery of the same and requested applicants who had received such seed to return it, when satisfactory seed would be substituted. Many complaints, however, proved to be not well founded, and more particularly in connection with oats.

The earlier deliveries of oats were western grown. Later, when English oats were being delivered, being of such superior quality, many became dissatisfied with the western oats they had received. Up to the present time, however, I have not had a complaint that the oats supplied have failed to grow satisfactorily.

I have had a few complaints of seed wheat not giving satisfactory germination, and am having each case thoroughly investigated. So far as these cases have been reported upon it is clearly evident that the seed was seriously injured by formalin treatment by the farmer previous to sowing.

ALLOTMENTS NOT CALLED FOR.

Considerable quantities of seed delivered to various points were not called for by applicants. These refer particularly to applications for barley. In the application form each applicant was asked to state whether, in the event of the kind of grain applied for not being available, he would be satisfied to have some other kind of grain substituted. Almost invariably applicants consented to this suggestion.

In connection with barley it was found that only about one-third of the quantity required could be secured, and oats were therefore substituted on applications for barley. When those substituted oats arrived at destination points the farmers appeared to be disappointed in not receiving barley; and the season then being somewhat late, they, in a great many instances, preferred not to take oats. There were also many cases where people living long distances from the railway stations did not receive the notice of their grain being shipped, in reasonable time. Also, there were a number of cases where settlers had rivers and streams to cross to reach the railway station, and having to depend upon ferry crossings, which owing to high water, were unable to operate, they were disappointed in not being able to take the seed they required.

QUALITY OF SEED.

Out of 1,037 cars sent out for distribution the entire complaints received will only refer to about 15 cars, and of this number there does not appear to have been reasonable ground for complaint against more than eight cars, which is quite a small percentage of the entire shipments.

The seed, generally, appears to have been carefully inspected and well cleaned. I have scores of letters expressing appreciation and satisfaction, both as to quality of seed, prices for the same, and the manner in which the business was handled in connection with seed distribution.

Owing to the very short time between the commencement of seed grain distribution operations and seeding time it required a large office staff to handle the business. For three months my staff of about 35 in number worked every day from 7 a.m. until nearly midnight, and sometimes even later. I am pleased, however, to be able to report that each day's business was cleared up on the day it was received, and that no oversight or miscarriage appears to have occurred in connection with a single application.

SEED GRAIN DISTRIBUTION A NECESSITY.

While the distribution did not reach the proportion anticipated, there is no question as to the necessity for making the distribution. In many districts seed was not available, and settlers had not the means to purchase the same. Owing to the general financial stringency settlers were unable to borrow, even upon good securities. I believe I am well within the mark in saying that 500,000 acres have been seeded which would not have been were it not for the present seed grain distribution.

A considerable additional acreage would probably have been sown with inferior seed which would have given poor results. This upon an average crop return will yield an extra eight or ten million dollars to the crop returns for this year in the provinces of Saskatchewan and Alberta.

Attached hereto please find schedules as follows :—

1. The number of applicants by land districts to whom seed grain was advanced, and whether upon homesteaders' liens, seed grain mortgages or cash sales.
2. The number of applications rejected or cancelled, by land districts.
3. Statement of grain distributed at railway stations in Saskatchewan, showing the kind, quantities and grades of grain delivered.
4. Statement of grain distributed at railway stations in Alberta, showing the kind, quantities and grades of grain delivered.
5. A statement showing the total seed grain delivered.

I have the honour to be,

Your obedient servant,

R. E. A. LEECH,

Inspector of Dominion Lands Agencies.

N.B.—Railway agents in some cases not having sent in *final returns* of deliveries made, the figures in the schedules hereto in some cases are approximated, and will be subject to correction when completed returns are available.

SCHEDULE No. 1.—NUMBER of applicants receiving seed grain and terms of settlement.

Land District.	Settlement by Liens.	Settlement by Mortgages.	Cash Sales.	Total.	
Saskatchewan.					
Humboldt					
Battleford	1,472	302	21	1,795	
Prince Albert	728	131	......	859	
Regina	215	154	......	369	
Yorkton	875	1,361	56	2,292	
Moosejaw	1,501	2,100	84	3,685	
Estevan	796	92	11	899	
Brandon	259	1,025	17	1,301	
	90	490	12	592	
					11,792
Alberta.	5,936	5,655	201		
Edmonton	1,125	1,047	144	2,316	
Lethbridge	90	27	13	130	
Red Deer	216	314	24	554	
Calgary	199	219	66	484	
					3,484
	1,630	1,607	247		
Total	....	....	....	....	15,276

R. E. A. LEECH,
Inspector of Dominion Lands Agencies.

SCHEDULE No. 2.—STATEMENT showing the No. of applications rejected and cancelled.

Land District.	Cancelled Applications.	
Saskatchewan.		
Humboldt	115	
Battleford	157	
Prince Albert	37	
Regina	127	
Yorkton	193	
Moosejaw	78	
Estevan	80	
Brandon	29	
		816
Alberta.		
Edmonton	265	
Lethbridge	23	
Red Deer	119	
Calgary	116	
		523
Total	....	1,339

R. E. A. LEECH,
Inspector of Dominion Lands Agencies.

Schedule No. 3.—Statement of Grain Distribution at Railway Stations in Saskatchewan.

Station.	Wheat.				Oats.				Barley.
	1 Nr.	2 Nr.	3 Nr.	4 Nr.	1 Wh.	2 Wh.	3 Wh.	Imported.	
Aberdeen	1,628							13	
Abernethy	1,250		1,750			777		355	
Alameda			6,207	1,050				1,785	
Antler	700		2,888	3,075		5,111		663	
Arcola	2,750	1,050	4,505	4,858	336	2,960		683	
Asquith	1,050			1,309				1,170	
Balcarres	1,034	1,684	3,692			1,200		3,505	
Balgonie		2,232	3,436			1,800		2,013	348
Battleford		2,234	3,924	1,000		5,502		3,650	
Belle Plain			220					380	
Benito			1,050					2,035	
Bethune	1,000			1,419				1,214	
Bienfait		113	4,146					2,746	
Birch Hills		113						1,046	
Bladworth			1,530					970	
Blucher	700			467				1,536	
Borden			905					490	
Bredenbury		205						297	159
Bresaylor		30						180	
Broadview	676		454	1,016				1,565	300
Bruno		200	1,090					1,102	
Buchanan			1,016					6,896	
Canora	830	2,324	2,966	1,008		1,722		29,022	1,187
Carievale		1,000	615					500	
Carlyle			3,196	9		1,710		235	
Caron			1,000					1,620	
Carnduff			1,181					640	
Chamberlain			1,727		89		1,050	861	
Churchbridge	650		902	710		1,800		2,095	429
Condie	1,050		200					55	
Craik			2,425	350		1,236		810	
Creelman	1,922	968	3,357	134		1,800		1,235	
Cupar	1,050	397	3,071	2,200		6,625		635	
Dana			2,448					2,247	
Davidson	1,050	1,050	2,628	3,044		1,836		3,620	1,250
Disley			1,040	609				379	
Drinkwater	253		640					2,678	
Dubuc	180	650	3,147	1,100		1,170		3,216	
Dundurn				1,785				1,084	
Duck Lake	115	115						157	
Earl Grey			3,617					1,018	
Elstow			1,553					1,352	
Ebor			455					72	
Englefeldt			653					1,400	175
Esterhazy	1,000			2,984		1,200		699	
Estevan	1,080	1,309		1,050				1,715	
Fairlight	1,218	128	745					1,425	
Fielding				262				225	
Fillmore			2,635	668		1,791		1,866	
Fleming	370							460	40
Foam Lake			443			2,228			174
Forget	2,008	3,736	8,199	5,087		8,038		200	1,250
Francis		2,072	3,864	1,050		200		1,939	
Frobisher	3,470	2,432	2,050	807		1,800		714	
Gainsboro	334		1,000	666		1,788		250	
Girvin			1,480					318	
Glen Ewen			2,930	682		173		1,382	
Govan		3,000	2,826	1,404		1,166		2,243	
Grayson	380	2,440	3,000	2,693		4,986		3,906	1,150
Grenfell			2,064	1,048		1,215		1,251	385
Gull Lake	972							2,160	
Hague			106						
Halbrite	1,000		1,670	1,400				1,325	
Hanley	637		1,082	261				775	
Harrowby			610					604	
Herbert	506	244	1,292			1,199		301	364

SCHEDULE No. 3.—STATEMENT of Grain Distribution at Railway Stations in Saskatchewan—*Continued.*

Station.	Wheat.				Oats.				Barley.
	1 Nr.	2 Nr.	3 Nr.	4 Nr.	1 Wh.	2 Wh.	3 Wh.	Imported.	
Heward			489	1,110		1,200		1,052	
Hirsch	2,050	3,870	3,449			2,157		641	
Hitchcock			605					245	
Humboldt			2,800					4,791	10
Indian Head		648	2,368					1,973	164
Insinger			575					1,200	13
Invermay		325						5,445	
Kaiser			1,632			1,239		1,103	
Kamsack	1,050			67				9,390	
Kenaston	792			1,038				1,083	
Kennedy				850				483	
Killaly		516	1,112					1,798	
Kinistino		310						610	
Kisbey			1,314	3,010				1,952	
Kronau			100			1,320		548	
Kuroki		24	92					1,775	158
Lang			229					899	
Langenburg	1,597	996	692	1,573		7,986		1,205	682
Langham			202	129				170	
Lanigan	2,234		1,609			3,600		2,490	900
Lashburn	846	954	796			2,364		2,348	588
Lemberg	1,116		1,060	758		128		2,646	
Lipton	3,503	1,040	5,126	2,086		1,839		8,312	
Lockwood	1,050		127					674	
Lloydminster	1,070		2,280	1,000		3,621		9,712	2,705
Lumsden			1,624	978				610	
Macoun	2,086	1,314	4,029	998		3,555		192	594
Maidstone			1,239					1,767	147
Manor		975	3,379	1,105		1,800		1,329	
Maple Creek								202	
Marshall			566	999				1,885	524
Marchwell			1,394			1,800		654	
Margo		34						1,200	101
Maymont			968	75				514	
Melfort			1,050					2,965	
Midale	148	852	1,502					1,547	
Milestone			1,475			2,949			
Moosejaw			1,050			1,701		320	
Moosomin			1,970					897	210
Morse			1,032			1,800		618	110
Mortlach	1,038		1,020	1,732		3,597		2,984	402
Muenster			2,160			2,607		1,512	440
McDowell								236	
McLean		1,050	366					1,540	140
McTaggart			490					180	
Neudorf		214	786	1,050		800		177	
Nokomis	2,138	596	1,058			3,270			
North Battleford				977				1,194	
North Portal			120					200	
Orcadia			260			3,379		1,500	70
Osage		3,100	912					1,897	
Osler		55						104	
Oxbow	1,306		1,298	440				1,078	
Parkbeg			240					120	10
Pasqua			462					630	
Paynton		956						1,413	119
Pense								80	
Pilot Butte			95					320	50
Prince Albert		55						405	
Qu'Appelle		932	1,816			1,158		757	390
Quill Lake			747			1,903		3,032	692
Radisson	1,100		1,051	520				756	
Redvers	2,340	1,970	3,003	1,000		3,651		1,800	1,050
Regina		970	4,436	1,100				4,354	
Rocanville			528					462	
Roche Percée			25					78	50

SCHEDULE No. 3.—STATEMENT of Grain Distribution at Railway Stations in Saskatchewan—*Continued.*

Station.	Wheat.				Oats.				Barley.
	1 Nr.	2 Nr.	3 Nr.	4 Nr.	1 Wh.	2 Wh.	3 Wh.	Imported.	
Rokeby				324		5,895		3,620	211
Rouleau	947	1,050						1,419	
Rush Lake			100					300	
Saltcoats		1,878	2,996	1,026		13,153		9,639	716
Saskatoon	1,986		1,025	958				3,782	
Sedley			2,860					2,521	
Shebo	1,438		13			3,600		4,352	598
Sintaluta			1,052					330	100
Southey		687	532	768		2,297		44	
Springside			372			1,800		3,168	235
Star City	653		644					4,003	
St. Gregor			475					775	38
Stockholm		996	159					1,565	2
Stoughton	1,050	1,024	4,866	1,556		3,750		1,926	
Strassburg			1,319			430		289	
Swift Current		3,124	2,230			3,410		4,186	
Summerberry								78	180
Tantallon			535					562	
Theodore		979	138			2,578		5,365	103
Tiny		72						2,280	
Tisdale	177		1,050	110		1,800		3,069	
Togo		1,760				1,911		6,395	
Tuxford	302		974	1,778				1,842	155
Tyvan			1,976	2,028				875	
Verigin				1,428				8,321	
Vonda		932	1,131					1,583	
Wadena	674		2,093	7,164				14,982	1,240
Walpole			655					805	
Wapella		4	1,576	1,209				1,212	241
Warman				145				696	
Watson	972	1,448	2,110	368		517		7,213	
Wauchope	1,048	1,030	2,010	1,000		1,909		2,383	
Wawota			300					325	
Welwyn			470					330	
Weyburn	1,002		4,215					2,843	
Whitewood		1,090	1,137	222		1,530		155	170
Windthorst	1,658		5,880	3,698		3,693		3,014	1,271
Wolseley			2,000	1,100		2,400		255	465
Yellow Grass	196	2,140	1,668			3,026		470	
Yorkton	398	1,362	2,212			30,711		9,520	902
Total	66,013	74,668	229,506	87,282	425	202,873	1,056	333,492	21,154

SCHEDULE No. 4.—AMOUNT of Grain Distributed at Railways Stations in Alberta.

Station.	Wheat.				Oats.				Barley.
	1 Nr.	2 Nr.	3 Nr.	4 Nr.	1 Wh.	2 Wh.	3 Wh.	Imported.	
Airdrie			25					572	50
Alix			9			558		120	306
Bawlf		314	394			675	1,866	1,392	
Bassano						60			
Blackfalds			8			270			62
Bowden			289			1,920		1,645	351
Bow Island	60					110			
Bruederheim								115	
Calgary			44					2,709	378
Camrose		522				1,634		1,858	740
Canmore								251	
Cardston		55			116				
Carstairs			64					2,001	120
Cayley								1,822	
Chipman			8					120	14
Claresholm	470					265			
Cochrane			75			1,200		25	
Coleridge	46					125		1,781	401
Cowley		95				736			
Crossfield	100		65					700	160
Daysland	1,060	776				810		2,526	512
Didsbury			202			1,800		1,200	854
Edmonton			500					3,590	353
Fort Saskatchewan	524							4,832	748
Gleichen			30			85		100	
Granum		120				1,690		12	
Grassy Lake	15					10			
Hardisty			522					3,201	200
High River		680				8,639		774	
Innisfail			680			8,466		149	1,789
Islay			1,122					4,000	461
Innisfree			1,122			1,800		267	258
Irvine	442					717		10	
Killam		306	710			582	1,200		180
Kitscoty			880					1,605	242
Lacombe			165			2,766		175	648
Lamont			304					2,702	404
Lavoy			154					1,507	145
Langdon						770		698	30
Leduc	178							11,591	1,188
Lloydminster								64	
Lougheed								28	
Lethbridge		72				208			
Manville			537	894				5,089	613
Medicine Hat		712						1,467	
Millet	180					1,399		1,330	
Midnapore								78	
Morinville			5,372					1,699	569
Morley								199	
Morningside			35			915		20	216
Mundare			280					1,132	111
Macleod		430				160			
Nanton	250	100				2,858		475	
Ohaton		360				1,249		1,219	365
Okotoks		10				403		502	
Olds			199			1,842		4,388	660
Penhold			14					568	139
Ponoka		332				1,716	1,893	5,761	1,250
Pincher								10	
Ranfurley			105			380		455	20
Red Deer		700				1,906		3,354	668
Sedgewick		301				764		40	112
St. Albert			55					3,928	24
Sheppard	446					855			
Stettler		214	786					1,289	759
Stony Plain			313					1,240	156
Strathcona			128			677		3,865	1,086

SCHEDULE No. 4.—AMOUNT of Grain Distributed at Railways Stations in Alberta—*Continued.*

Station.	Wheat.				Oats.				Barley.
	1 Nr.	2 Nr.	3 Nr.	4 Nr.	1 Wh.	2 Wh.	3 Wh.	Imported.	
Staveley	......	......	......	......	......	302	......	......	......
Taber	129	......	......	......	......	174	......	......	......
Strathmore	......	......	98	......	......	385	......	......	......
Tees	......	......	28	......	......	1,768	......	......	185
Vegreville	......	......	936	......	......	......	......	4,746	517
Vermilion	1,000	......	1,626	......	345	1,458	......	8,922	1,742
Walsh	160	......	......	......	......	185	......	......	......
Wetaskiwin	686	......	......	......	1,932	5,031	2,898	1,904	1,110
Total	5,746	6,099	17,934	894	2,393	60,323	7,848	110,522	20,886

SCHEDULE No. 5.—STATEMENT showing total Grain Distributed in Saskatchewan and Alberta.

Province.	WHEAT.				OATS.				Barley.
	1 Nr.	2 Nr.	3 Nr.	4 Nr.	1 Wh.	2 Wh.	3 Wh.	Imported.	
Saskatchewan	66,013	74,668	229,506	87,282	425	202,873	1,056	333,492	24,154
Alberta	5,746	6,099	17,984	894	2,393	60,323	7,848	110,522	20,886
Total	71,759	80,767	247,490	88,176	2,818	263,196	8,904	444,014	45,040

Total wheat	488,192
" oats	718.932
" barley	45,040
	1,252,164

A.—Dominion Land Agencies, principal transactions

Agencies.	Homestead Entries granted.	Land Sales			Applications for Patent Received.	Land Entries Cancelled.	Timber Permits Issued.	Hay Permits Issued.
		Ordinary.	Pre-emptions.	Purchased Homesteads.				
Battleford	3,371	25	863	138	1,806	1,755	356	110
Brandon	171	....	....	....	324	53	460	26
Calgary	2,708	263	1 826	115	1,349	715	677	135
Dauphin	1,729	33	....	....	386	329	1,432	90
Edmonton	5,242	53	40	3	2,070	2,137	1,853	262
Estevan	840	89	911	57	1,028	342	324	283
Humboldt	2,421	28	61	16	2,618	1,126	415	60
Kamloops	400	59	....	....	83	70	....	9
Lethbridge	3,820	209	2,656	71	1,201	1,290	402	124
Moosejaw	8,720	338	7,227	249	1,988	2,988	756	429
New Westminster	32	13	....	....	30	....	....	....
Prince Albert	2,079	42	57	52	863	755	1,357	176
Red Deer	2,080	54	128	22	1,042	1,109	423	28
Regina	1,556	90	438	107	2,743	737	315	254
Winnipeg	1,865	72	....	....	300	468	1,185	267
Yorkton	2,183	99	....	....	1,462	963	568	89
	39,217	1,467	14,207	830	19,293	14,837	10,523	2,342
Compared with 1907-8.	37,855	1,112	....	....	11,948	17,370	8,333	1,490
Compared with 1906-7.	30,472	731	....	....	16,364	17,612	10,806	2,046

for the Departmental Year ending March 31, 1909.

Letters.		Revenue.		No. of Staff.	Expenditure.	
Received.	Sent.	Scrip.	Total Scrip and Cash.		Salaries.	Disbursements.
		$ cts.	$ cts.		$ cts.	$ cts.
34,641	31,199	480 00	82,351 62	10	8,905 00	1,681 04
9,304	8,188	934 81	26,127 71	4	3,749 94	175 93
34,740	34,196	2,080 00	132,895 12	13	13,253 20	2,866 99
21,447	12,056	80 00	34,301 01	4	4,079 92	805 42
56,007	45,229	....	87,532 48	25	16,381 68	2,143 54
13,887	12,125	....	35,147 85	5	4,798 42	426 91
30,880	31,081	....	35,052 89	7	4,957 29	2,176 70
4,400	3,876	1,394 89	19,766 27	3	3,394 96	214 79
31,574	24,962	....	148,560 52	7	6,174 96	1,767 16
60,766	77,000	6,794 25	233,735 67	22	15,861 97	5,489 96
2,923	2,614	80 00	2,863 43	2	2,194 96	322 85
15,442	12,706	880 00	75,651 57	6	5,644 93	2,017 91
18,525	17,127	....	38,400 31	6	5,774 98	871 19
37,489	34,660	.. ..	67,637 06	13	12,092 76	1,231 95
24,382	22,130	3,837 36	127,949 83	14	15,428 00	3,113 70
29,766	22,099	....	39,812 29	7	6,479 88	611 89
426,173	391,248	16,561 31	1,187,785 63	148	129,172 85	25,917 93
378,556	292,881	4,280 61	829,211 33	132	96,251 78	18,220 02
373,911	329,444	7,648 15	773,222 65	124	112,887 48	22,073 00

R. E. A. LEECH,
Inspector of Dominion Lands Agencies.

B.—Dominion Land Sub-Agencies, principal work performed during the Departmental year ended March 31, 1909.

Name.	Place.	Applications for Homestead entry taken.	Applications for Patent taken.	Applications for Inspection taken.	Applications for Timber permit taken.	Applications for Hay Permit taken.	Amount remitted to Land office. $ cts.	Expenditure. Salary. $ cts.	Expenditure. Postage and Commission. $ cts.	Remarks.
Alton, W. W.	Leduc, Alberta	66	81	46	43	6	767 70	275 00	10 14	Resigned March 1, 1909.
Toban, S. J.	" "	4	6	3	3	.....	43 75	25 00	75	Appointed March 5, 1909.
Barker, R. T.	Macleod, Alberta	277	174	116	26	16	7,148 75	600 00	33 76	
Barschel, J. F. P.	Canora, Sask.	643	211	222	129	28	7,679 30	600 00	56 85	
Bobier, J. S.	Dubuc, Sask.	25	112	10	.....	18	403 80	300 00	9 91	
Boggs, N. G.	Lanigan, Sask.	125	387	55	.....	1	1,262 00	175 00	16 01	Appointed Sept. 1, 1908.
Bowtell, Frank	Wainwright, Alberta	124	34	32	.....	5	1,392 00	525 00	4 70	Closed February 22, 1909.
Culp, Norman	" "	24	10	3	2	2	258 25	62 70	3 84	Began March 9, 1909.
Brady, J.	St. Paul de Metis	28	2	5	18	27	319 75	125 00	5 51	Three months work January to March, 1909.
Brimacombe, M. A.	Vermilion, Alberta	470	115	210	59	6	4,877 15	300 00	54 50	
Butcher, H.	Westmoor, Sask.	26	77	24	6	6	276 10	120 00	5 40	Three months work January to March, 1909.
Caldwell, M.	Sprague, Man.	46	.....	.....	.....	.....	460 00	.....	.....	
Campbell, A.	Innisfree, Alberta	114	71	79	1	2	1,145 25	300 00	28 18	
Carroll, J. W.	Whitford, Alberta	144	9	20	29	15	1,560 67	180 00	6 28	
Cochran, L. B.	Medicine Hat, Alberta	651	69	146	178	21	10,200 25	900 00	65 24	
Collier, D.	Etoimami	8	.....	.....	.....	.....	80 00	25 00	40	Resigned October 1, 1908.
Cook, C. C.	Arcola	40	104	37	142	49	1,078 40	300 00	16 09	
Davidson, D.	Daysland, Alberta	41	322	61	1	3	565 30	300 00	21 93	
DeCeuninck, A.	Makinak, Man.	291	31	34	52	35	3,382 25	300 00	21 49	
Denovan, R.	Shelio, Sask.	456	247	78	23	9	4,559 50	300 00	61 90	Resigned March 1, 1909.
Dickey, W. J.	Revelstoke, B.C.	10	2	1	.....	.....	65 00	300 00	2 12	
Dubois, M. J.	Duck Lake, Sask.	143	66	48	60	13	2,135 20	345 00	18 78	
Edgson, J. A.	Edison, Alberta	73	47	10	135	8	1,204 16	300 00	10 91	
Elton, D. H.	Cardston	11	9	5	3	.....	150 75	100 00	1 52	Resigned July, 1908.
Wolf, Martin	"	12	8	5	9	.....	147 25	75 00	1 56	Appointed October, 1908.
English, J. J.	Maple Creek, Sask.	492	22	40	34	33	7,279 00	450 00	50 00	
Ferguson, Wm.	Gull Lake, Sask.	829	6	123	153	69	9,738 00	420 00	53 08	
Gray, W. B.	Stettler, Alberta	1,255	486	225	47	71	16,780 90	900 00	90 55	
Gunn, Peter	Lac St. Anne	150	12	41	13	20	1,639 70	300 00	7 85	
Gwynn, J.	Kutawa, Sask.	186	194	105	12	11	1,888 00	360 00	14 80	Resigned January 1, 1909.
Harley, Hugh.	Swan River, Man.	177	24	47	215	26	3,436 90	300 00	25 14	
Henry, J. F.	Pine Creek, Alta.	.....	.....	.....	.....	.....	.....	.....	.....	Appointed March 30, 1909.
Higgs, Rowland	N. Battleford, Sask.	331	166	102	28	30	3,981 20	480 00	26 66	
Holmes, W. E. G.	High River, Alberta	11	77	19	4	.....	184 00	100 00	4 16	
LaPointe, P.	Willow Bunch, Sask.	521	8	46	158	7	4,539 85	400 00	19 41	
Libby, J. J.	Ft. Saskatchewan	195	17	29	151	26	4,638 59	300 00	20 37	

Malcolm, H. A	Innisfail, Alberta	142	12	3	79	11	1,794 93	600 00	11 52	
Marshall, W. A.	Entwistle, Alberta	......	......	......	......	......	......	......	......	Appointed March 1, 1909.
Milburn, Wm.	Swift Current, Sask	1,217	134	177	105	135	15,523 25	325 00	86 23	
Moore, O. S.	Olds, Alberta	612	171	125	88	35	9,285 80	600 00	55 37	
McDonald, G.	Belvedere, Alberta	83	27	26	50	13	899 20	250 00	5 58	Appointed Hmstd. Insp. May 22, 1909.
McDonald, J. S.	Sedgewick "	593	320	314	8	9	8,292 70	300 00	51 91	
McGregor, A. B.	Davidson, Sask	211	147	137	4	21	3,136 20	222 67	27 86	Resigned Sept. 17, 1908.
Robertson, A. J.	"	268	403	74	15	......	3,768 25	215 95	33 21	Began Sept. 8, 1908.
McGregor, D. S.	Rosthern, Sask	633	169	106	104	98	15,701 39	600 00	57 91	
McIntosh, R.	Saskatoon "	2,214	883	727	4	91	39,745 40	1,050 00	179 28	
MacKenzie W. L.	Quill Lake, Sask	223	345	90	78	16	2,363 40	300 00	40 81	
McKerman, Jas.	Athabaska Ld	100	2	4	9	20	1,613 66	300 00	9 25	
Newth, R.	Lipton, Sask	305	330	222	6	19	3,690 00	480 00	48 96	
Orrange, Geo	Lloydminster	441	150	109	60	20	5,216 25	600 00	46 19	
Oxley, R. W	Hanley, Sask.	615	398	230	....	24	17,484 70	600 00	81 67	
Palmerson, P.	Pine Valley, Man	55	9	......	61	10	688 68	180 00	......	
Paul, S. B.	Moosomin, Sask	27	38	19	......	......	261 50	300 00	8 60	
Reed, C. C.	Ponoka, Alberta	144	90	66	26	2	2,361 92	300 00	25 66	
Roberts, A.	Wapella, Sask	21	18	14	......	15	650 76	300 00	3 74	
Robertson, Wm.	Nanton, Alberta	492	365	160	16	1	7,683 75	450 00	51 91	
Spence, Chas. T.	Vegreville, Alberta	224	169	107	24	11	2,375 25	250 00	21 93	Resigned Feb. 4, 1909.
Goodwin, A. H.	" "	29	36	15	3	3	342 30	50 00	3 79	Appointed Feb. 4, 1909.
Stedman, E. F.	Strassburg, Sask	104	187	78	......	7	1,155 30	125 00	11 95	Resigned Sept , 1908.
Stephen, A. M	Redvers, Sask	12	153	35	......	......	475 50	480 00	7 19	
Stewart, Robt.	Whitford, Alta	174	75	18	97	10	1,923 80	420 00	15 79	
Taylor, Robert	Grenfell, Sask.	26	116	28	3	19	383 95	480 00	9 13	
Tompkins, P.	Lesser Slave Lake	59	7	4	32	12	820 67	1,500 00	1 11	
Vickerson, F.	Lacombe, Alta	180	74	85	46	22	2,478 05	450 00	20 09	
Wachna, Theo.	Stuartburn, Man	100	19	6	168	17	1,257 49	300 00	8 32	
Waddell, A.	Weyburn, Sask.	150	186	105	10	27	2,171 30	250 00	11 30	Resigned September 3, 1908.
Wetheral, P. E.	......	704	391	96	2	28	15,385 00	325 00	48 27	Began " "
Ward, D. A.	Wetaskiwin, Alta.	157	55	99	18	16	2,037 10	600 00	13 45	
Wiebe, J. F.	Herbert, Sask	740	89	45	106	88	8,737 45	350 00	55 36	
Wild, A. E.	Melfort, Sask	428	239	70	117	17	4,604 25	600 00	38 64	
Wilson, H. G. W	Indian Head, Sask	37	44	28	7	1	474 00	300 00	8 38	
		19,422	9,057	5,449	3,080	1,387	290,053 82	25,296 32	1,829 95	
Compared with 1908	......	13,380	6,875	8,594	3,543	1,258	175,541 16	24,474 07	1,515 44	
" 1907	......	18,627	6,267	6,400	2,786	909	225,697 80	20,428 53	1,512 41	

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R. E. A. LEECH,
Inspector of Dominion Lands Agencies.

C.—HOMESTEAD INSPECTORS Statement, showing principal work performed during the Departmental Year ended March 31, 1909.

Name.	Headquarters.	Land Inspections made.	Applications for Patent taken.	Miles travelled by Wagon.	Miles travelled by Rail.	Travelling and living Expenses for Self and Team.	Expenses for new and old travelling Equipment.	Remarks.
						$ cts.	$ cts.	
Axford, Fred	Glenboro, Man	253	110	4,402	3,024	1,015 21	89 25	
Bannerman, J. A	Red Deer, Alta	678	3	1,914	8,691	691 65	....	3 months' seed grain; no report (Dec. to March); assistant inspector.
Bell, Geo. A	Estevan, Sask	111	41	1,272	1,371	364 85	91 85	Resigned August 1, 1908.
Bowtell, H.	Vermilion, Alta	447	203	7,184	2,669	1,605 89	29 37	2 months' seed grain.
Brinkmier, J. A	Dead Moose Lake	74	60	827	1,599	280 61	....	Appointed January 20, 1909.
Brooke, A. W	Moosejaw, Sask.	327	352	2,518	1,234	762 25	54 65	2 months' seed grain.
Bryant, T. W	Calgary, Alta	103	43	1,417	647	366 05	33 20	2 months' seed grain; 1½ month Land Office assistant agent.
Buchanan, D	Minnedosa, Man	256	223	4,679	2,799	907 85	26 50	1 month's seed grain.
Budgeon, M. B	Prince Albert, Sask	7	....	99	500	21 70	5 25	Appointed March 18, 1909.
Clouston, Geo. H	Battleford, Sask	258	209	4,728	1,417	679 09	117 75	
Coulter, R. J.	" "	12	....	189	400	38 40	....	1 month's work, February, 1909.
Cunningham, T. J	Vegreville, Alta	197	253	3,265	2,327	1,000 09	58 40	2 months' seed grain.
Currie, A. B	Kamloops, B.C	593	117	2,531	7,184	1,110 35	....	11 months' work; no March report.
Darroch, E. J	Swan River, Man	92	17	1,865	1,692	480 72	2 00	Appointed July 25, 1908.
Dodds, J. T	Swift Current, Sask	562	245	4,524	5,988	1,016 38	34 00	
Doze, J. S.	Pakan, Alta	146	91	4,461	835	1,046 90	10 75	2 months' seed grain.
Duggan, L. H	Humboldt, Sask	224	30	2,453	3,043	759 64	8 75	2 " "
Gibson, J. S.	Brandon, Man	293	71	2,121	6,360	557 91	3 60	1 " "
Gladstone, W. E	Prince Albert, Sask	133	115	2,042	3,295	691 95	28 50	2 " " Resigned February 28, 1909.
Grayson, Chas	Cochrane, Alta	68	20	534	595	150 45	14 95	Appointed January 30, 1909.
Helmer, A. } Robertson, S. N }	Calgary, Alta	1,869	3	5,796	11,592	1,927 35	....	Combined statistics; 4 months' seed grain.
Jonasson, P	Winnipeg, Man	192	84	2,595	1,848	1,147 80	192 20	
Kennedy, F	Whitewood, Sask	208	301	4,389	3,526	976 85	40 00	2 months' seed grain.
Lagimodière, Wm	Winnipeg, Man	287	65	3,362	1,621	1,228 50	238 50	
Liesmer, J. E	Didsbury, Alta	....	....	....	....	....	....	Appointed March 25, 1909.
Link, Adam	Lethbridge, Alta	639	310	4,213	1,159	1,127 90	212 85	¾ month's seed grain.
Magee, W. D	Lamerton, Alta	305	173	5,305	1,803	850 80	30 50	2 months' seed grain.
Moffat, Jas	Marcelin, Sask	159	291	3,220	2,321	637 02	29 25	Resigned September 30, 1908.
MacDonald, G	Belvedere, Alta	111	11	1,133	....	200 35	13 00	Appointed January 22, 1909.
McCallum, N. G	Yorkton, Sask	....	....	....	388	21 45	....	1 month's seed grain; appointed to Land Office.

McCarthy, D. J	Lloydminster, Sask	116	212	3,411	2,865	1,066 65	151 40	2 months' seed grain.
McDiarmid, D. J	Edmonton, Alta	17	27	435	......	332 45	18 55	2½ months' seed grain, ill 7 months.
McGregor, R. E	Gilbert Plains	74	110	2,502	1,511	685 08	53 30	
McLeod, A	Yorkton, Sask	380	224	4,550	2,185	864 36	182 90	2 months' seed grain.
McLeod, D	"	434	171	4,830	2,359	776 83	65 25	11 months' work.
McNab, D. C	Brandon, Man	2	....	11	886	26 75	....	3 months; resigned July 1, 1908.
Nichol, W. F	Estevan, Sask	245	255	3,007	4,053	1,036 53	39 95	2 months' seed grain.
O'Connor, L	Medicine Hat, Alta	30	12	597	485	456 73	304 00	Appointed January 15, 1909.
Oliver, Ed	Moosejaw, Sask	222	166	3,069	2,205	972 63	107 00	2 months' seed grain.
Pentland, R. P	Hanley, Sask	159	147	2,955	1,197	701 72	22 10	" "
Robinson, E	Innisfail, Alta	23	6	433	184	59 95	....	Appointed February 13, 1909.
Seale, John	Dauphin, Man	9	11	330	1,305	189 75	....	23 days' seed grain.
Shandro, Andrew	Shandro, Alta	3	16	585	244	222 50	....	Appointed January 30, 1909.
Skene, Alex	Grand Coulee, Sask	252	620	5,126	2,171	681 22	12 75	1 month's seed grain.
Stauffer, J. E	Didsbury, Alta	359	289	3,188	4,529	811 85	60 35	Resigned March 4, 1909.
Sutton, C	Fertile Valley	768	562	5,469	1,089	1,031 90	83 10	2 months, 11 days' seed grain.
Vollmer, F. J	Moosejaw, Sask	156	200	2,065	1,755	643 55	21 50	2 months' seed grain.
Williamson, C. R	Lethbridge, Alta	281	266	3,135	979	773 85	24 50	
White, M	Langham, Sask	50	16	1,635	1,198	562 05	12 00	Began May 4, 1908, 4 months' work.
		12,184	6,754	130,471	111,128	33,562 31	2,553 72	
Compared with 1908	....	15,476	6,281	150,553	111,378	36,641 51	4,770 04	
" 1907	....	39,679	4,338	118,828	71,560	26,910 79	1,620 15	

R. E. A. LEECH,
Inspector of Dominion Lands Agencies.

No. 4.

REPORT OF THE AGENT AT BATTLEFORD.

DOMINION LANDS OFFICE,
BATTLEFORD, SASKATCHEWAN, April 3, 1909.

The Commissioner of Dominion Lands.
Ottawa.

SIR,—I have the honour to submit the annual report of this office for the year ending March 31, 1909.

Conditions during the past year have on the whole been favourable; the crops were good throughout this district, excepting oats and potatoes, which were under the average.

The weather during the months of January and February last was very cold, but milder than usual during March, and there is every indication of a very favourable spring. The snowfall was normal.

The southern part of this district is now served by two lines of railway, as indicated in my last year's report. Several branch lines are projected, and it is given out that the Grand Trunk Pacific Railway will build this year from Biggar, on their main line to this point, making connection here with the Canadian Northern Railway system. The two lines referred to in the south have been operated since last fall and have been the means of preventing any further trouble caused by the scarcity of fuel in that region. Many new towns have sprung up along these lines, where settlers find a market for their produce within easy reach. Grain elevators are already dotting the prairie and several thousand bushels of grain were shipped to eastern markets during the past fall and winter.

The new regulations coming into force on the 1st September last permitting entries for pre-emptions and purchased homesteads were taken advantage of by a large number of settlers. For several days the services of the police were required to handle and control the huge crowd awaiting admission. The heavy work it occasioned was done without any addition to the staff. Many hours of overtime were put in, and this was done with such good will and so much interest brought to the proper performance of the extra work that special mention must be made of it.

Settlement is now reaching out in every direction, and the opening of a sub-agency in one of the new towns in the south would be a great convenience to settlers coming over the Canadian Pacific and Grand Trunk Pacific Railways. A proper idea may be formed as to how rapidly settlement has been increasing from the fact that three years ago only about fifteen post offices could be found in this district, while at the present moment over one hundred and forty are in operation.

Following is a statement of the work performed during the year:—

Free homestead entries	3,371
Purchased homesteads	138
Pre-emptions	863
Entries cancelled	1,755
Land scrip located (acres)	3,840
Volunteer bounty land grants located (acres)	4,478
Timber permits issued	356
Hay permits issued	209
Grazing leases	31

Applications for patent recommended..	1,306
Letters received....	34,641
Letters written....	31,199
Total revenue..	$82,351 62

I have the honour to be, Sir,

Your obedient servant,

L. P. O. NOEL,

Agent of Dominion Lands.

No. 5.

REPORT OF THE AGENT AT BRANDON.

DEPARTMENT OF THE INTERIOR,
DOMINION LANDS OFFICE,
BRANDON, MANITOBA, April 1, 1909.

The Commissioner of Dominion Lands,
Ottawa.

SIR,—In submitting the annual report for the year ending March 31 last, I beg to say there has been an increase in the several branches of work in this office, owing chiefly to the opening for homesteading of the odd numbered sections not appropriated by the Canadian Pacific Railway Company and a portion of the Spruce Wood reservation, which is shown by the summary of work performed.

The lands thus opened have been secured chiefly by settlers in the vicinity, all being anxious to increase their holdings. These lands are mainly suitable for pasturage and as the farmers have learned the advantages of mixed farming they were secured at once.

The cancellations have increased slightly, land being scarce in this agency. Those wishing to farm keep themselves advised of the standing of the homesteaders, and, where an entry is found in default, promptly apply for an inspection.

The prospects for the coming crop are excellent. There is more than the usual amount of moisture in the ground, owing to the many snowstorms which continued into the spring and not having the high drying winds. The farmers are all busy getting ready to get the crop in and a larger area is being sown yearly. The price of land is steadily increasing and the demand is fair; many farms have already changed hands at a high figure.

Immigration has commenced and from all parts people are pouring into the country; many going further west seeking homesteads, others remaining in the towns, procuring work at their various trades, work of all kinds being plentiful. The people each year are of a better class, many coming from England and the United States and bringing capital enough to settle themselves on their homesteads, others buying improved farms outside the towns.

The following is a statement of the work performed for the past twelve months, ending 31st ultimo :—

Homestead entries granted....	170
Timber permits..	370
Entries cancelled..	53
Applications for patent....	324
Letters received....	9,304
Letters written..	8,118

I am, Sir,

Your obedient servant,

L. J. CLEMENT,

Agent of Dominion Lands.

No. 6.

REPORT OF THE AGENT AT CALGARY.

DEPARTMENT OF THE INTERIOR,
DOMINION LANDS OFFICE,
CALGARY, ALBERTA, May 12, 1909.

The Commissioner of Dominion Lands,
Ottawa.

SIR,—I have the honour to submit my report of the work performed in this office during the twelve months ended March 31, 1909.

The number of homestead entries, 2,710, is an increase over the previous year of 1,430; in addition to which there were 115 purchased homesteads and 1,825 pre-emptions granted.

The revenue from lands amounts to $100,163.42, exclusive of the amount paid at head office on account of sales of lands, grazing leases, &c., being an increase of $62,953.20 over the revenue of the previous year.

As the business for the timber and mines and school lands branches for this district is also conducted at this office, I may mention that the revenue from these sources amounted to $32,661.64, being a decrease of $2,738.57 from the previous twelve months.

The prospects for a good crop this year are excellent, although it has been reported that the fall wheat has been damaged to a certain extent in some localities, but just how far this will prove true remains to be seen, as sometimes it is impossible to say at this particular season whether fall wheat has been damaged to any extent or not.

The winter was not a severe one, so far as bad storms were concerned; the thermometer registered around forty below zero for a short time, but little or no damage was done to stock on the ranges.

The price of beef has been considerably higher this spring than last.

Horses of all kinds never commanded a better price, heavy work horses being greatly in demand.

The settlers throughout this part of the country appear to be very contented, and hopeful, and with another crop this year, such as the one we had last the price of land will likely reach a higher figure, and there will be a greater rush for southern Alberta than ever before, although at the present time a great many people are coming into the country. For instance, entries covering about 1,250 quarter-sections were granted during the month of April this year, being an increase over the entries granted during the corresponding month of the previous year of about one thousand.

The city of Calgary continues to forge ahead very rapidly, the population now being in the neighbourhood of twenty-eight thousand, and the prospects for a very busy season never were better.

The detailed statement of receipts on account of Dominion lands was forwarded to head office on April 1, the day after the fiscal year expired.

I have the honour to be, Sir,
Your obedient servant,

J. R. SUTHERLAND,
Agent of Dominion Lands.

No. 7.

REPORT OF THE AGENT AT DAUPHIN.

DEPARTMENT OF THE INTERIOR,
DOMINION LANDS OFFICE,
DAUPHIN, MANITOBA, March 31, 1909.

The Commissioner of Dominion Lands,
Ottawa.

SIR,—I have the honour to submit my report on the business of the Dauphin Lands Office and District, for the year ending this day.

The year has shown a very marked increase in the number of homestead entries, over any former year during my tenure of office here, this being due principally to the opening of all hitherto undisposed of odd numbered sections on September 1 last. This caused a strenuous rush on the office for some time, and during the first few days it was found necessary to call in the assistance of the homestead inspectors, with some of the forest rangers, to control the great crowd, and keep order. The staff was equal to the occasion and handled the rush of work with despatch, though handicapped on account of the confined office space, and the fact that at the time alterations were being made in the building. A very large number of entries were passed, with little or no friction and but very few applicants went away dissatisfied, these few on account of not being able to secure such lands as they sought for. On the first day the crowd was so great that the stairs leading to the office broke down under the press. Fortunately, only one man was at all hurt, he only slightly, and he being admitted to the office through my private door, with the consent of those waiting in line, secured his entry.

The general work of the office has increased very rapidly, correspondence especially, this largely on account of the timber business, and owing to the fact that so many requisitions for timber permits are prepared by justices of the peace and commissioners who are not qualified to attempt such work, and who prepare the papers in an improper manner, and do not evidently question the applicants as to what timber they may already have had, what timber is on their own lands, or whether they have old permits still unreturned. It has been reported to me that in at least one case, these oversights are not unintentional, as a fee is charged each applicant for each and several affidavit taken by these officers. If it were possible, I would suggest, especially now that the quantities of available timber are becoming restricted, that all such requisitions might be taken only by some duly qualified officer of the department.

Some very heavy cuts of timber have been reported during the past winter, from the larger mill operators, and I expect that when the portable mill books are returned, it will be found that they also have taken out large quantities, the winter having been most favourable for this class of work, and with the exception of a very cold period during December, we had no severe weather. There was sufficient snow to facilitate work, though not too much, and judging from the number of permits issued, all classes of people took full advantage of the favourable conditions.

I would strongly recommend more careful supervision of the working of the portable mills, the owners of which, having no vested interests look only at the immediate profits to be derived, and slash timber without any attempt to economize. This work should, I believe, be kept strictly under the supervision of competent officers of the department, who should be detailed to watch the operations of as many mills as they could safely give attention to, and the tract where cutting is to be done, especially in the reserves, should be distinctly specified, only mature trees taken, and all tops, debris, &c., either piled or taken out of the bush to prevent fires running.

I consider that it is quite impossible for the staff of rangers at present engaged, to keep sufficient watch on these numerous mills, and visit them as often as required in order to check their illegal cutting.

The cordwood business has been prosecuted to a considerable extent, and the Winnipeg market, as that of other larger places, looks for the northern tamarack, paying higher prices than for the product of other parts. Many cases of illegal cutting have been found and the trespassers made to pay the double dues, but in my opinion this penalty, 50 cents per cord, is not sufficient to deter some of the more irresponsible dealers who, if they can manage to get a few cars without dues, can well afford to pay when caught. I would advocate the confiscation of wood where found in possession of any dealer who had at any time previously been found with wood cut illegally and the sale of the wood irrespective of his claims. I think a very few examples along these lines would have a most deterring effect. A frequent, if not constant patrol of the lines of rail, where traversing timbered land should be carried out, as I find that immediately one of our officers leaves a certain section, the parties engaged at once repeat their offences, in the hope that they may dispose of their wood before the next visit.

The penalty of double dues on lumber is in my opinion no deterrent whatever, as parties wanting lumber can well afford to pay this, and still secure cheaper material than they can obtain through the legitimate dealers ; and I find the same parties figuring in seizures time after time, this more especially from lands in the reserves.

Locally the crops were not up to the average, but to compensate for this, many sections of the district were especially well favoured, so that on the whole I am pleased to be able to report a favourable year for the entire district. Prices were high, and all grains for sale were marketed in good condition, so that perhaps quite as much was realized from the crops as in former years.

The last two seasons, when crops had been somewhat below the average, have caused the farmers to pay more attention to mixed farming and stock-raising, which will no doubt result in their advantage in the near future. There is still ample scope for further advancement along these lines, and the establishment of several creameries throughout the district will furnish a ready market for dairy products.

More attention could well be paid to hogs and poultry, as the supply has never as yet met the local demand, and during winter it is almost impossible to purchase fresh eggs, which command fancy prices. This could be remedied with but little trouble, and would yield the poultry man a splendid return on his outlay.

A number of pure bred animals for stud purposes have been imported, the result being easily seen in the improved herds found through the country, and this good line of work is still going on.

The usual amount of improvement in municipal matters is noticed, roads, bridges and ditches being built wherever called for, and though taxes are somewhat high in certain municipalities, the people feel the money is well spent, and the improvements are of a permanent character.

Schools and churches are springing up in all settlements when required, and general business, though perhaps not quite as brisk as in former years, has still been of a very satisfactory nature, but few failures being reported.

I feel that I cannot omit mentioning our various hospitals, which have, as usual, done noble work. Though no epidemics have visited us, still these institutions have been very busy, large numbers of accident cases coming to them from the numerous lumber camps as well as from the railways.

I attach a memo. of the principal lines of business carried through the office.

Your obedient servant,

F. K. HERCHMER,
Agent of Dominion Lands.

	No.	
Homestead entries granted	1,729	$ 17,120 00
Interchanges	2	15 00
Improvements collected	79	1,923 50
Land sales (cash)	32	4,164 03
Land sales (scrip)	1	80 00
Sundries, searches, &c	383	193 45
Total from lands		$ 23,414 98
Timber permits issued	1,432	6,616 21
Timber seizures	98	2,928 73
Hay permits	90	461 25
Grazing leases	1	186 52
Mining locations	1	5 00
Total from timber and mines		$ 10,197 71
School land sales (cash)	2	505 22
Seed grain collections	10	156 10
Total miscellaneous		661 32
Grand total revenue		$ 34,301 01
Letters received	21,447	
Letters written	12,056	
Applications for patent taken	386	
Entries cancelled	329	

No. 8.

REPORT OF THE AGENT AT EDMONTON.

DEPARTMENT OF THE INTERIOR,
DOMINION LANDS OFFICE,
EDMONTON, ALBERTA, April 17, 1909.

The Commissioner of Dominion Lands,
Ottawa.

SIR,—I have the honour to submit the annual report of this office for the year ending March 31, 1909.

The financial year just closed opened under the somewhat unfavourable conditions brought about by the financial stringency which set in during the year 1907, and the partial failure of the crops during that season. The financial stringency continues, though somewhat modified, and another crop has been harvested which has netted the farmer a satisfactory return. Some damage was done to the crops by frost, wheat having suffered more particularly, but any loss sustained in this way was at least partially offset by the unusually high price paid for the products of the farm. The winter was an average one, with abundance of snow, and though the temperature registered unusually low, was free from severe storms. It would be quite safe to state that the condition of the settlers is fairly satisfactory.

There is a slight increase in the revenue of this office over that of last year, being $87,532.46 as against $76,473.35 for the preceding year. The portion of this accruing from the disposal of Dominion lands is $62,011.55 as against $48,400.18 for the preceding year, and the fact that homestead entry fees amounted to $49.167, or about 80 per cent of the whole, shows that there is little activity along other lines, which was doubtless due to the scarcity of money.

While it is noted with satisfaction that there has been an increase of about 30 per cent in the number of entries, it is only fair to state that the showing of this agency in this respect has suffered from the fact that almost none of the pre-emption area lay within its boundaries. The throwing open of odd numbered sections for settlement gave very general satisfaction, and created for a time a very marked activity in homesteading. These, together with some sixty townships that have been thrown open for settlement during the past year, would appear to have been sufficient to meet all reasonable demands.

Compared with the preceding year, the increase in the volume of correspondence is very marked, and the fact that a large percentage of it deals with inquiries of various kinds, is in itself a promise, if not an assurance, of great activity in the settlement of this district during the next fiscal year. The area of open prairie land now available within the district has become comparatively small, and one result is that many are directing their attention toward the Peace River district where it is understood there are larger stretches of open land. Judging from the correspondence, the increased attention being given by the department to this remoter Northwest will be much appreciated.

The following comparative figures will serve to indicate the progress of the district :—

1906-1907 (nine months).		1907-1908		1908-1909.	
Entries.	Revenue.	Entries.	Revenue.	Entries.	Revenue.
2,766	$2,325 72	4,051	$76,473 35	5,242	$87,532 46

SUMMARY OF WORK, 1908-1909.

Letters received	56,007
Letters sent out	46,229
Applications for patent	2,070
Homestead entries cancelled	2,137
Hay permits issued	262
Timber permits issued	1,853
Homestead entries granted	5,242
South African veteran scrips located	29
Half-breed scrips located	25
Revenue	$87,532 46

Your obedient servant,

K. W. MACKENZIE,

Agent of Dominion Lands.

No. 9.

REPORT OF THE AGENT AT ESTEVAN.

DEPARTMENT OF THE INTERIOR,
DOMINION LANDS OFFICE,
ESTEVAN, SASKATCHEWAN, April 15, 1909.

The Commissioner of Dominion Lands,
Ottawa.

SIR,—I have the honour to submit the annual report of this office for the year ending March 31, 1909.

The past year has, on the whole, been very favourable; the yield of wheat, while not so heavy as in some previous years, was satisfactory and the high prices obtained made the crop a profitable one. The past winter has been unusually mild, and stock have come through in excellent condition. Seeding is general at this date, and it is expected that the area brought under cultivation will be about 25 per cent greater than last year. On the 1st September last the odd numbered sections in thirty-one townships in this district were thrown open to the settlers under the new Dominion Lands Act. On the opening of the office on that day a crowd of between 400 and 500 people were in line outside the building and were admitted by ticket ; a large number of these people were homesteaders within the pre-emption area and were anxious to secure an adjoining quarter-section for a pre-emption. Land available for pre-emption entry, and contiguous to lands entered for as homesteads, were reserved for fifteen days so that the actual settlers had ample time to secure a pre-emption. The rush of applicants kept up until after the 19th, and during this time the staff worked cheerfully till a late hour each night.

Appended is a statement of work performed during the fiscal year.

Letters received	13,887
Letters written	12,125
Applications for patent	1,028
Entries cancelled	342
Homestead entries	840
Pre-emption entries	911
Purchased homestead entries	57
Land sales	89
Payments for improvements (2,282.90)	45
Payments on account of sundries ($96.95)	265
Timber permits	324
Grazing rentals	34
Hay permits	283
Mining fees and rentals	7
Coal lands (application fees)	18
Coal lands (sales)	3
Coal lands (royalty)	11
Total revenue collected	$35,147 85

I have the honour to be, Sir,
Your obedient servant,

R. CLAUD KISBEY,
Agent of Dominion Lands.

No. 10.

REPORT OF THE AGENT AT HUMBOLDT.

Department of the Interior,
Dominion Lands Office,
Humboldt, Saskatchewan, April 6, 1909.

J. W. Greenway, Esq.,
Commissioner of Dominion Lands,
Ottawa.

Sir,—I have the honour to submit the annual report of this office for the year ending March 31, 1909.

I regret to say that to the farmer the past year was an unfavourable one, the crops being much below the average. This has necessitated a large number of them raising loans on their farms, where they have procured their patents, at rates of interest none less than 8 per cent and as high as 10 and 12 per cent.

As the farmers' success or otherwise in this country reflects on the whole commercial and industrial situation it would be well if some means could be devised whereby the man developing the resources of the country could procure the funds required for his work at more reasonable rates of interest and the question of the means to this end is one that might well engage the attention of the federal and provincial governments.

Notwithstanding the fact that a lean year has just passed, farmers and merchants, and in fact all business men appear to be singularly optimistic. Confidence is being restored in all lines of business from the financial institutions down, and this generally optimistic spirit is bound to have a great effect in again bringing about those conditions of prosperity that existed up to 1907. The reaction after the period of financial depression has, up to the present time been very gradual, but I look from now on for a greatly accelerated movement in the direction of better times.

The outstanding feature of the year's work was the bringing into force of the Dominion Lands Act of 1908. The opening of the undisposed of odd numbered sections to homestead entry made in this district about double the quantity of land available for entry at the time the Act became operative. The effects in this particular will be far-reaching in the solidifying of settlements, the easing of the burdens of taxation and the greater opportunity through increased settlement for educational development.

The pre-emption and purchased homestead provisions of the Act apply to only one range in this agency, and while it affects only that small portion of the district sixty-one pre-emptions and sixteen purchased homestead entries have been granted.

The purchased homestead privilege has permitted a number of very desirable settlers to acquire land at a very reasonable figure, and has been an undoubted boon to many settlers who have been able to take advantage of its provisions.

Appended is a statement of the transactions of this office for the year just ended.

Your obedient servant,

A. NORQUAY,
Agent of Dominion Lands.

Homestead entries	2,421	
Pre-emption entries	61	
Land sales	27	
South African Veteran scrip	81	
Half-breeds scrip	1	
Purchased homesteads	16	
Patent Branch revenue		$ 33,858 00
		$ 33,858 00
Timber permits	418	
Hay permits	60	
Timber and Mines Branch revenue		293 20
School lands sundries	150	
Provision collections	1	
Seed grain collections	3	
Miscellaneous revenue		901 69
Total		$ 35,053 89
Letters received	30,880	
Letters sent	31,081	
Applications for patent	2,618	
Entries cancelled	1,126	

No. 11.

REPORT OF THE AGENT AT KAMLOOPS.

DEPARTMENT OF THE INTERIOR,
DOMINION LANDS OFFICE,
KAMLOOPS, B.C., April 7, 1909.

The Commissioner of Dominion Lands,
Ottawa.

SIR,—I have the honour to submit my annual report for this office for the year ending March 31, 1909.

The harvest of 1908 was above the average, and the weather being favourable, was well harvested.

The market for grain, roots, hay and stock was good and prices high. Stock of all kinds went into winter quarters in good condition, and the winter season being favourable have come through in good shape without loss, and stockmen report a surplus of hay on hand.

The work of the office shows a decided increase, with the exception of land sales. This is accounted for by all the land in the railway belt being withdrawn from sale. Homestead entries have more than doubled any previous year. The department is contemplating sales in the dry belt under strict conditions as to irrigation; this, in my opinion, is the only manner in which the dry belt can be made productive.

The laws governing the disposal and distribution of water for irrigation were repealed at the last session of the provincial legislature, and many hope that some of the disabilities under which they have suffered in the past have been removed, but as the Act is not yet in force it remains to be seen how beneficial the new Act will prove.

Some small areas which have been logged over have been withdrawn from timber berths and the lands dealt with according to the regulations. I understand that an inspector of timber berths has been appointed by the department with a view to having the lands which have been denuded of timber, and which are suitable for agriculture, withdrawn from the berths and made available for settlement. This action is highly commendable, and if thoroughly carried out will be the means of clearing up a large number of applications in this office.

The district is particularly prosperous, spring has opened up favourably, and with the anticipation of the resumption of mining there is every evidence of continued prosperity.

The following is a summary of the work performed in this office during the fiscal year :—

Letters received	4,400
Letters written	4,400
Homestead entries granted	400
Homestead entries cancelled	70
General sales	50
Townsite sales	5
Hay permits	9
Applications for patent	83
Grazing rents	302
Registrations	17
Total revenue collected	$19,766 27

Your obedient servant,

A. B. CURRIE.
Agent of Dominion Lands.

No. 12.

REPORT OF THE AGENT AT LETHBRIDGE.

DEPARTMENT OF THE INTERIOR,
DOMINION LANDS OFFICE,
LETHBRIDGE, ALBERTA, April 13, 1909.

J. W. GREENWAY, Esq.,
Commissioner of Dominion Lands,
Ottawa.

SIR,—I have the honour to submit for your consideration this office's annual report for the year ending March 31, 1909.

I have much pleasure in stating that the rush of settlers to this district still continues and the numbers far exceed those of any previous year. These settlers come from all parts of the world, but more particularly might I mention those coming from the United States as well as eastern Canada.

Settlement is reaching out in every direction and in order to provide suitable locations for incoming settlers it will be necessary to have surveys in this district proceeded with immediately.

The homestead entries for the Lethbridge agency far outnumber those of any previous year. The work of the office has almost doubled in every branch but has been disposed of satisfactorily.

The sub-agents and homestead inspectors have been very busy and deserve credit for the manner in which they have performed their departmental duties. The staff has worked faithfully and is deserving of special mention.

The following is a partial list of the work performed during the past year :—

Letters received	31,574
Letters written	24,962
Applications for patent received	1,201
Homestead entries granted	3,820
Pre-emption entries granted	2,656
Purchased homesteads granted	71
General sales	209
Entries cancelled	1,290
Hay permits issued	124
Timber permits	402
Timber seizures	6
Grazing rents	249

The total revenue collected for the fiscal year of 1908-9 is $148,560.52.

Your obedient servant,
J. W. STAFFORD,
Agent of Dominion Lands.

No. 13.

REPORT OF THE AGENT AT MOOSEJAW.

DEPARTMENT OF THE INTERIOR,
DOMINION LANDS OFFICE,
MOOSEJAW, SASKATCHEWAN, May 4, 1909.

J. W. GREENWAY, Esq.,
Commissioner of Dominion Lands,
Ottawa.

SIR,—I have the honour to submit the annual report of this office for the fiscal year ending March 31, 1909.

It is with much satisfaction that I am able to allude to the foregoing year as the most successful ever experienced in the settlement of the west from the viewpoint of the number of homestead entries granted, and in this respect the Moosejaw district has been favoured as the centre of unusual attraction to land-seekers.

The greatest stampede for land commenced on September 1 last when the new Dominion Lands Bill came into force, and since that time the opening from time to time of a large number of newly surveyed townships has resulted in some particularly noted rushes for land.

There is still a large unsettled area of good land in different parts of this district, and although these parts, in some cases, are a considerable distance from existing railroads, settlement is going on at a rapid rate.

From present indications the current year will be a most prosperous one. Seeding operations are well advanced at this point and conditions generally are very promising.

Appended is a statement of work performed during the fiscal year.

Your obedient servant,

J. RUTHERFORD,
Agent of Dominion Lands.

	Number.	Revenue.
Patent Branch—		
Homestead entries	8,720	$ 86,970 00
Pre-emption entries	7,229	71,680 00
Purchased homestead entries	249	2,480 00
Improvements	194	9,181 35
Land sales (cash)	293	50,901 45
Land sales (scrip)	45	6,794 25
Land scrip (32,942 acres)	110	
Sundries	443	272 70
		$228,279 75
Timber and Mines Branch—		
Royalty on sales	1	$ 4 00
Timber permits	756	205 47
Hay permits	429	1,322 25
Grazing rents	69	2,363 19
Mining fees	2	10 00
Coal lands fees, &c	4	14 56
Sundries	2	3 50
		$ 3,922 97
Miscellaneous—		
School lands sundries	141	$ 912 79
Seed grain collections	13	620 16
		$ 1,532 95
Total revenue		$233,735 67

Letters received	60,766
Letters written	77,000
Applications for patent received	1,988
Entries cancelled	2,988

No. 14.

REPORT OF THE AGENT AT NEW WESTMINSTER.

DEPARTMENT OF THE INTERIOR.
DOMINION LANDS OFFICE,
NEW WESTMINSTER, B.C., April 6, 1909.

The Commissioner of Dominion Lands,
Ottawa.

SIR,—In accordance with the departmental instructions I have the honour to submit my report for the fiscal year ended March 31, 1909.

There has been a constantly increasing number of people coming to the Pacific coast from the eastern provinces, but the great majority of those who desire lands for homes are purchasing small parcels from the subdivided areas in the New Westminster district, because the remaining Dominion lands are usually in isolated places without roads.

As was the case last year, nearly all to whom formal homestead entries were granted have been residing on their locations many months before surveys reached them. The time of residence is counted when they make their applications for patent, and thus I find that these people exercise great diligence to make a good showing in their period of residence. I may also state that a large number of people pass through this district over the Canadian Pacific Railway on their way from the Pacific states of Washington, Oregon and California to Alberta and Saskatchewan. Many of these arrive in Vancouver city without settler's certificates, and when they come to Canadian Pacific offices for the reduced rate it is necessary that they come to me at New Westminster for the requisite completion of forms of declaration, &c., under which letters of recommendation are issued by me.

This service has gone on for years, but this year has surpassed others in the number of such applications.

Much of my time is consumed in immediate attention to these cases, because delay would mean more expense to them.

I have been hoping for years that the pressure on my time might be relaxing with the settlement of the great bulk of the land matters of the district, but I find that with the increase of population round about there are constantly arising new and perplexing questions and greater intensity in obtaining ready solutions.

Great relief has come to many people by circumstances which caused the removal of mortgages that weighed down the best energies. It is to be hoped that these deadly incumbrances on small and unproductive bush places will pass away in the main.

With the constantly rapid growth of the city of Vancouver and the stimulus given to this city of New Westminster, and the many smaller towns and villages along the lower Fraser valley, it is not too much to hope that nearly all the argicultural lands, or such as are capable of being tilled in the valley will be developed to supply the markets. At the present time there is much encouragement along these lines as the prices of all productions are acknowledged to be very satisfactory.

I extract the following from the monthly summaries furnished the inspector of agencies and the head office :—

Letters received (increase of over 400)...........	2,923
Letters sent (increase of nearly 500)...............	2,614
Applications for patent recommended...............	30
Homestead entries....	32
Total receipts (besides some payments at head office)...	$2,863 85

The receipts include nine payments of $5 each on applications for coal mining leases.

Your obedient servant,

JOHN McKENZIE,
Agent of Dominion Lands.

No. 15.

REPORT OF THE AGENT AT PRINCE ALBERT.

DEPARTMENT OF THE INTERIOR,
DOMINION LANDS OFFICE,
PRINCE ALBERT, SASKATCHEWAN, April 10, 1909.

J. W. GREENWAY, Esq.,
Commissioner of Dominion Lands,
Ottawa.

SIR,—I have the honour to submit for your consideration the annual report of this office for the fiscal year ending March 31, 1909.

The attached statement, marked Schedule 'A,' gives a summary of the work performed and of the revenue collected during the year, also that for the previous year, and shows in detail the increase or decrease as compared with the year ending March 31, 1908.

From this schedule you will see that the revenue collected for the year just closed is $75,651.57 as compared with $53,663.22 for the previous year, being an increase of $21,988.35.

The number of homestead entries granted during the year was 2,079. There were also 57 pre-emption entries and 52 purchased homesteads, making a total of 2,180, being an increase of 562 over the previous year.

There is a large area of surveyed land still available for settlement in this district, the majority of which is excellently adapted for mixed farming, there being abundance of good water and excellent timber for shelter and fuel, and as the past two seasons have shown the profit to be derived from, and the safeness of the investment in this class of farming I anticipate an even greater influx of settlers during the present year than was experienced during that just closed.

Attached hereto is a statement marked Schedule 'B,' showing the revenue collected in connection with the School Lands Branch, from which you will see that the revenue from this source has also increased.

The work and revenue connected with the Timber Branch show a decided increase over the previous year as does also that of the Mines Branch; these will, however, be dealt with under separate reports.

In conclusion I would say that notwithstanding the large and general increase both of work and revenue experienced in this district during the year just closed I anticipate an even greater increase during the present year, this anticipation not being mere conjecture, but borne out by the large number of letters of inquiry received from intending settlers and investors, not only from different parts of Canada and the United States, but from Great Britain and many of her colonies, from continental Europe, Africa and South America, which would appear to show that the large district north of Prince Albert is practically just commencing to be opened up and the immense and varied resources just beginning to be developed.

Your obedient servant,

GEO. L. DEMPSTER,
Agent of Dominion Lands.

SCHEDULE A.

STATEMENT of the business transacted at the Prince Albert Dominion Lands and Timber Agency for the Year ending March 31, 1909, and comparative statements showing previous year's business and increase or decrease therefrom.

	Work and Receipts for Year ending March 31, 1909.			Corresponding Period for Previous Year.			Increase over Previous Year.			Decrease from Previous Year.	
	No.	Amount.	Totals.	No.	Amount.	Totals.	No.	Amount.	Totals.	No.	Amount.
Patent Branch.		$ cts.	$ cts.		$ cts.	$ cts.		$ cts.	$ cts.		$ cts.
Homesteads	2,079	20,165 00		1,626	16,000 00		453	4,165 00		......	......
Pre-emptions	57	570 00		Nil.	......		57	570 00		......	......
Purchased homesteads	52	7,358 59		"	......		52	7,358 59		......	......
Improvements	87	2,841 17		178	5,120 87		......	......		91	2,279 70
Land sales—Cash	26	3,409 73		29	2,066 53		......	1,343 20		3	......
" Scrip	6	880 00		4	1,039 58		2	......		......	159 58
Town site sales	Nil.	......		Nil.	......		......	......		......	
Sundries	230	62 01		50	11 35		180	47 66		......	......
Dominion Lands, total	......	......	35,286 50	......	......	24,241 33	......	......	11,045 17	......	......
Timber and Mines Branch.											
Bonus	Nil.	......		Nil.	......		......	......		......	......
Ground rent	38	4,793 05		28	5,928 50		10	......		......	1,135 45
Royalty on sales	38	27,456 22		32	16,251 93		6	11,204 29		......	......
Timber permits	1,357	3,931 20		1,074	5,494 55		283	......		......	1,563 35
Timber seizures	56	1,621 06		33	445 81		23	1,175 25		......	......
Hay permits	176	428 25		70	209 75		106	218 50		......	......
Grazing rents	Nil.	......		1	3 20		......	......		1	3 20
Mining fees	115	847 50		3	15 00		112	832 50		......	......
Coal lands fees, &c	Nil.	......		3	15 00		......	......		3	15 00
Stone quarries	"	......		Nil.	......		......	......		......	......
Sundries	"	......		"	......		......	......		......	......
Timber dues, &c., total	......	......	39,077 28	......	......	28,363 74	......	......	10,713 54	......	......
Miscellaneous.											
School lands sales	Nil.	......		Nil.	......		......	......		......	......
" sundries	......	857 85		......	679 02		......	178 83		......	......

Seed grain collections		429 94			379 13			50 81			
Miscellaneous, total			1,287 79			1,058 15			229 64		
Grand total			75,651 57			53,663 22			21,988 35		
Letters received	15,442			13,379			2,063				
Letters written	13,081			9,968			3,113				
Applications for patent received	863			848			15				
Entries cancelled	755			667			88				

SCHEDULE B.

SCHEDULE showing Revenue from School Lands collected during the Fiscal Year ending March 31, 1909.

Month.	Grazing and Rental.	Hay Permits.	Timber Permits.	Cultivation Permits.	Grand total.
	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
April, 1908	25 50	96 10			121 60
May	38 64	29 50			68 14
June	12 80	41 60	1 25		55 65
July	70 40	200 30			270 70
August	44 80	25 20			70 00
September	27 81	2 70			30 51
October	32 00		7 75		39 75
November	32 00		6 25		38 25
December	38 40	20	1 50		40 10
January, 1909	6 40	30			6 70
February	25 60	1 00		10 00	36 60
March	57 60		22 25		79 85
Totals	411 95	396 90	39 00	10 00	857 85

No. 16.

REPORT OF THE AGENT AT RED DEER.

DEPARTMENT OF THE INTERIOR,
DOMINION LANDS OFFICE,
RED DEER, ALBERTA, April 13, 1909.

J. W. GREENWAY, Esq.,
Commissioner of Dominion Lands,
Ottawa.

SIR,—In submitting my annual report for the fiscal year ending March 31 it is gratifying to be able to advise you of the great progress made in the Red Deer district. A bountiful harvest, with good prices for all farm products, following the unfavourable summer of 1907, and the general depression owing to the financial stringency, put new life into the settlers. The foresight of the government in rendering assistance to the settlers by supplying them with seed grain came as a welcome relief to many, especially of the newer and poorer class, who, through the unfavourable season before mentioned, were not in a position to import seed grain, and had it not been for this wise action on the part of the government hundreds of acres of land which were broken and prepared for the seed would have been allowed to lie idle, thousands of bushels of grain, consequently a very large sum of money, would have been lost to the country, which would have received a set-back from which it would take a long time to recover. The seed furnished proved to be of excellent quality and great credit is due to all who took part in selecting the grain and in its distribution, which was carried out in a very satisfactory manner. The spring of 1908 was a most propitious one for seeding operations, and was followed by a fine summer, and delightful harvest weather; as a consequence excellent crops of all cereals were garnered, for which good prices were realized, and if the elements are as propitious the coming season, a year of increased prosperity is undoubtedly in store for this district and the province at large. This year will undoubtedly be one of great railway development, and the provincial government are to be commended for their railway policy. The branch line from Lacombe to Stettler will be extended to Castor, on Beaver Dam creek, a distance of some 45 miles, and will be completed in time to handle this year's crop. This extension will serve one of the most productive grain sections of this district, if not of the province, and will encourage the settlers in the eastern portion of the district to put larger areas of land in crop.

The telephone policy of the provincial government is being successfully and satisfactorily carried out, and over six hundred miles of rural telephone wires were stretched in 1908.

The past winter has been a very favourable one for cattle and no losses have been experienced on the ranges. The farmers and ranchers are turning their attention to the improvement of their breeding stock, and the days of the doggie and cayuse are past. In this connection I might mention an importation of pure bred stallions and mares recently made by Mr. G. F. Root, one of our progressive ranchers. This is the second importation made by this gentleman, and includes horses from the stables of such well known breeders of high grade stock as M. Medard, M. Taucheau and M. Lecourt, Department of Sarthe, France, and from Messrs. Watson, Woods Bros. and Kelly, of Lincoln, Nebraska, U.S.A. Messrs. Trimble and Richards, also successful ranchers, have imported some choice Ayrshire cattle selected from the best herds in Ontario and Quebec, and Mr. Sharman has imported a herd of thoroughbred Jerseys. When I mention that all these importers live in the immediate vicinity of Red Deer, you will have some idea of the importance of the cattle industry in this district. Whilst the horse and cattle industries have thus been well looked after, our fish and game have not been neglected. In October last the Dominion government made a shipment of young black bass to the west, of which Red Deer secured 1,000, which were successfully planted in Sylvan lake, a beautiful sheet of water, and famous summer resort, some twelve miles west of the town. Pine lake, Gull lake and other lakes were also stocked with these valuable fish, which I have no doubt will do well. The Alberta Fish and Game Association have done much for the protection and propagation of fish and game and have, at a large expense, imported a number of partridges and pheasants, which are doing well.

The creameries and cheese factories in the district have had a most successful year.

Prairie and forest fires have been practically unknown during the past year.

The new Dominion Lands Act, better known as the 'Oliver Act,' is giving general satisfaction. There were comparatively few quarter sections available for pre-emption entry in this district, and most of them have been taken. A large number of South African bounty warrants have been located in this district. Appended is a statement of work for the fiscal year :—

Homestead entries	20,080	$ 20,755 00
Pre-emptions	128	1,280 00
Purchased homesteads	22	220 00
Inspections	837	
Cancellations	1,109	
Improvements	155	6,288 77
Sales	54	5,298 65
Sundries	47	27 60
Letters received	18,525	
Letters written	17,127	
Applications for patent	1,042	
		$ 33,870 02

There were 9,230 acres located under South African military bounty warrants and 1,202·9 acres under Northwest Half-breed scrip.

Your obedient servant,

W. H. COTTINGHAM,
Agent of Dominion Lands.

No. 17.

REPORT OF THE AGENT AT REGINA.

DEPARTMENT OF THE INTERIOR,
DOMINION LANDS OFFICE,
REGINA, SASKATCHEWAN, April 2, 1909.

The Commissioner of Dominion Lands,
Ottawa.

SIR,—I have the honour to submit my report for the fiscal year ending March 31, 1909.

On account of the bulk of the available homesteading lands in this district being disposed of, occasioned by settlement and opening of new land offices, the work in this particular has materially fallen off.

The opening of the odd numbered sections for homesteading and pre-emption entries was a source of satisfaction to settlers who availed themselves of the privilege of securing good lands, and the lands which became vacant in this district at that time were readily taken up.

The work in the other branches has not decreased to any great extent; especially does this refer to the patents and correspondence.

During the past year and more, especially the last few months, I have received a great number of letters from parties in the United States and other countries for information regarding this country as a place of settlement. These inquiries have received prompt attention, and letters as well as literature have been sent them, and the prospects look bright for a large immigration during the present year.

Spring appears to be opening up early and prospects look bright. Settlers and others seem to be recovering from the depression of the last two years and everything seems to point to a good season with prospects of a bountiful harvest.

Appended is a statement of work performed during the fiscal year.

Patents Branch—			
Homestead entries	1,556	$ 15,779 00	
Pre-emption entries	438	4,380 00	
Purchased homesteads	107	17,575 00	
Improvements	138	7,593 38	
Land sales	90	16,832 89	
Sundries		246 49	
			$ 62,406 76
Timber and Mines—			
Timber permits	315	$ 170 25	
Timber seizures	2	4 50	
Hay permits	254	697 50	
Grazing rents	63	781 71	
Sundries	3	28 15	
			$ 1,682 11
Miscellaneous—			
School lands sales	8	$ 2,140 77	
Seed grain collections	33	1,407 42	
			$ 3,548 19
Grand Total			$67,637 96

Land scrips located, 13 for	2,508 acres.
Letters received	37,489
Letters written	34,660
Applications for patent sent to head office	2,743
Entries cancelled	737

Your obedient servant,

L. RANKIN,
Agent of Dominion Lands.

No. 18.

REPORT OF THE AGENT AT WINNIPEG.

DEPARTMENT OF THE INTERIOR,
DOMINION LANDS OFFICE,
WINNIPEG, MANITOBA, May 25, 1909.

J. W. GREENWAY, Esq.,
Commissioner of Dominion Lands,
Ottawa.

SIR,—I beg to submit my report upon the working of the Dominion Lands Office, at Winnipeg, for the departmental year ended March 31, 1909.

The volume of business in every branch of the work was considerably larger than that of any previous year in the history of the office. The homestead entries granted numbered 1,865, more than double those of the previous year; the revenue also shows a decided increase, the amount being $127,949.83 as against $98,375.70, for the year ended March 31, 1908, of which $30,141.36 was collected from the following sources:—

1,865 homestead entry fees.. .. ..$	18,430 00
53 collections for improvements upon cancelled homesteads..	1,458 42
58 land sales, cash account..	4,671 86
14 land sales, scrip account....	3,837 36
107 townsite lot sales account..	1,286 30
1,649 township plans, searches, &c..	457 42
	$ 30,141 36
School lands..	6,218 56
Timber and mines..	90,885 18
Seed grain..	704 53
	$127,949 83

The collections on account of school lands represented payments received on 19 land sales, 420 hay permits and on 18 payments in settlement for advances for seed grain and provisions made to the settlers who suffered loss from the grasshopper plague in the seventies, and to Galicians more recently, from flooding of their lands.

The office correspondence was large; no less than 24,382 letters were written and 22,130 received. The number of homestead entries cancelled was 468, while 300 applications for patent were taken.

The year has been a most profitable one for the great majority of the farmers in this district. Crops of all kinds gave good returns, and prices for cereals, dairy and other farm products were high, for which there was an active market. Beef sold at a low price during the summer, but improved later and at present is high and nets the stockman a good margin of profit.

Settlers residing upon homesteads in the bush districts in the northern and eastern portions of this agency will be greatly benefited by the opening of the odd numbered sections for homesteading. The opening up and keeping of roads in repair bore very heavily upon the scattered settlers. It was found difficult to support and maintain churches, and frequently there was not a sufficient number of children in a township to secure a public school. Settlement will be made more compact by the opening of the odd numbered sections, and the difficulties pointed out will soon disappear.

I have much pleasure in stating that the members of the staff attached to the Lands Branch have shown great interest in their work and have rendered faithful service.

Your obedient servant,

E. F. STEPHENSON,
Agent of Dominion Lands.

No. 19.

REPORT OF THE AGENT AT YORKTON.

DEPARTMENT OF THE INTERIOR,
DOMINION LANDS OFFICE,
YORKTON, SASKATCHEWAN, April 16, 1909.

The Commissioner of Dominion Lands,
Ottawa.

SIR,—I beg to submit for your consideration the report of the transactions of this office for the year ending 31st ultimo.

Homestead entries show a decrease, being 2,183 as against 2,840 of the former year. On September 1 last a number of odd sections were made available for entry, which occasioned some lively scenes again before the office building, but not of a prolonged duration, as by far the larger part of the odd sections in this agency had been appropriated by railway, colonization and land companies, and the applications for entry were taken without undue interference with the ordinary routine business.

Homesteaders who made entry on former Doukhobor lands last year have generally strictly complied with the regulations, being warned that no leniency or laxity would be tolerated in these cases.

The wisdom of furnishing seed grain last year has been fully justified, as, although the season was rather unfavourable to the growth of oats, the staple crop of the district, the samples marketed were of the highest grade and change of seed proved beneficial. The distribution of seed grain and the gathering together of the surplus being entrusted to the homestead inspectors, deranged inspections and placed the work of these officials somewhat in arrears.

The building of the Grand Trunk Pacific Railway through the south part of the agency has brought many settlements within easy transportation distance for grain and other farm products. The extension of the Canadian Pacific northwestern branch, and the proposed building of the Canadian Northern Rossburn branch, together with lines already in existence, will accommodate every homesteader in the district with close market facilities.

The crop last year was a disappointment. Frost touched most of the wheat and dry weather adversely affected oats.

The following is a summary of the work transacted :—

Homestead entries	2,183
Timber permits	568
Hay permits	199
Letters received	29,766
Letters written	22,099
Applications for patent	1,462
Entries cancelled	963
Revenue	$39,812 29

Your obedient servant,

JAS. E. PEAKER,
Agent of Dominion Lands.

No. 20.

REPORT OF THE MINING LANDS AND YUKON BRANCH.

DEPARTMENT OF THE INTERIOR,
OTTAWA, May 22, 1909.

W. W. CORY, Esq.,
Deputy Minister of the Interior,
Ottawa.

SIR,—I have the honour to submit herewith the report of the Mining Lands and Yukon Branch of the Department of the Interior for the fiscal year which ended on March 31, 1909.

Owing to the fact of there being a 'Mines Branch' in the Department of Mines it was thought advisable to change the name of this branch to 'The Mining Lands and Yukon Branch,' not only to avoid conflict in respect of the similarity of names, but also to more correctly give expression to the character and duties of this branch.

The total revenue of this branch derived from all sources during the fiscal year amounts to $584,157.65, and the statements lettered 'A' and 'B,' showing in different forms how this amount is made up, will be found at the end of the report. Statement lettered 'A' shows the total revenue for each month, and statement lettered 'B' shows the revenue collected at each agency, including the Yukon Territory.

The revenue for the Yukon Territory, which amounts to $230,171.89, is shown separately in statement lettered 'C.'

The reports and statements for the fiscal year from the gold commissioner, the comptroller, the Crown timber and land agent and the government mining engineer at Dawson, and the assistant gold commissioner at Whitehorse will be found under Part VI. of the general report.

TIMBER IN THE YUKON TERRITORY.

The total amount of dues collected on account of timber in the Yukon Territory during the fiscal year was $26,482.64.

There are in existence 114 timber berths held under license to cut timber within the territory, covering an area of 269·86 square miles, which licenses were granted prior to May 10, 1906, on which date the regulations governing the granting of licenses to cut timber in the Territory were rescinded, and regulations for the issue of permits to cut such timber substituted therefor. Two saw-mills are in operation within the Territory, one on the Klondike river, near Dawson, and one on Twelvemile river.

According to returns received in the department the number of feet, board measure, of lumber manufactured during the year was 2,129,413, and the quantity sold 2,358,973, a quantity of the lumber having been held over from the previous year. The number of cords of wood cut during the year was 10,545, and the number sold 8,493¼. This does not include the very large amount of timber and cordwood cut free of dues for mining purposes.

MINING LANDS OTHER THAN COAL.

During the fiscal year 217 entries for quartz mining claims were granted by the agents of Dominion lands in Manitoba, Saskatchewan and Alberta.

In the Yukon Territory 39,199 placer mining claims, 8,971 quartz mining claims and 64,223 renewals and relocations were recorded up to March 31, 1909.

According to the returns received during the fiscal year 909 entries for placer mining claims, 563 entries for quartz mining claims and 4,385 renewals and relocations were recorded during that period. The revenue collected from these sources and from fees for registering documents in connection with mining operations was $88,828.50.

ROYALTY ON GOLD MINED IN THE YUKON TERRITORY.

The total amount collected up to March 31, 1909, for royalty on the gross output of placer mining claims in the Yukon Territory, after deducting the exemption at one time allowed under the regulations, is $3,704,647.15, of which amount $81,507.07 was collected during the last fiscal year. For the purpose of estimating this royalty, the gold is valued at $15 an ounce, which is much below its real value.

The actual value of gold produced from placer mining operations in the Yukon Territory up to the 31st of March last might be safely placed at $104,952,721.82.

The following statement shows the agencies at which the royalty was collected and the amount collected at each during the year :—

Dawson	$79,791 02
Whitehorse	1,715 30
Fortymile	0 75

Sixty-nine leases to dredge for minerals, other than coal, in the submerged beds of rivers in the Yukon Territory are now in force, covering a total frontage of 399·26 miles. The total revenue derived from this source up to March 31, 1909, amounts to $179,672.09, of which amount, $10,272.07 was collected during the fiscal year. Twelve leases, including 96 miles of the beds of rivers, were issued during the fiscal year.

These leases are confined to the Yukon, Stewart, McQuestion, Fortymile, Big Salmon, Klondike and Hootalinqua rivers.

There are in operation in the Yukon Territory thirteen dredges, nearly all of which have an indicated capacity of 3,000 cubic yards in 24 hours. Several additional dredges have been ordered and will be in operation during the present season.

Forty leases to dredge for minerals in the beds of rivers in the provinces of Alberta and Saskatchewan are in force, covering a total frontage of 199 miles. Of these leases 26 are in the province of Alberta, and include 129 miles, and 14 are in the province of Saskatchewan, and include 70 miles in all. Three leases, including a total frontage of 11 miles of the western shore of Cedar lake, in the Northwest Territories to dredge for amber, are also in force. The total revenue derived from this source up to March 31, 1909, amounts to $39,455.30, of which amount $916.27 was collected during the fiscal year.

PETROLEUM.

During the year 21 reservations have been made under the provisions of the regulations to enable the several applicants to conduct petroleum prospecting operations on the tracts reserved. These reservations embraced a total approximate area of 37,622·53 acres, and evidence has been filed in the department to show that at least 17 petroleum prospecting outfits have been installed, and that operations are being actively carried on. Representations have also been made in respect of two of these reservations on the Athabaska river, that oil in paying quantities has been discovered, which representations, however, have not yet been confirmed by an inspection.

HYDRAULIC MINING.

The regulations for the disposal of mining locations in the Yukon Territory to be worked by the hydraulic mining process were withdrawn by order in council, dated February 2, 1904, such withdrawal, however, not to affect leases already granted. Twelve hydraulic mining leases are still in force, covering a total frontage of 38·48 miles. These leaseholds are all situated in the Yukon Territory. Since the regulations were first established in December, 1898, forty-seven hydraulic mining leases have been issued, all of which have now been cancelled with the exception of the above number. Under the grouping provisions of the Placer Mining Act, operators can now acquire and group for operation a sufficient area to warrant the installation of efficient hydraulic machinery.

WATER RIGHTS.

There are now in force in the Yukon Territory 405 grants to divert water for mining purposes, aggregating a total of 179,480 miner's inches. During the fiscal year 36 water rights were issued comprising 19,050 miner's inches.

Five leases have been issued to divert water for power purposes, including in all 70,000 miner's inches. The works in connection with one of these grants have been completed and are now in active operation, and the works in connection with the remaining four are under construction.

STONE QUARRYING IN ROCKY MOUNTAINS PARK.

Seven leases have been issued for stone quarrying purposes in the Rocky Mountains Park of Canada, comprising a total area of 1,328·56 acres. The revenue derived from such leases during the year amounts to $236.73.

Outside the park 2,285·75 acres of Dominion lands have been disposed of during the year, the revenue from which amounts to $1,796.43.

COAL MINING LANDS.

The regulations for the sale of coal mining lands were rescinded on the 5th of March, 1907. These regulations provided for the sale to one applicant of an area not exceeding 320 acres, at the rate of $7 an acre for the coal mining rights only, and at the rate of $10 an acre for the surface and coal mining rights. The regulations of the 9th of May, 1907, provide for the leasing to one applicant of the coal mining rights under an area not exceeding 2,560 acres in a compact block, at the rate of $1 an acre per annum.

As the late regulations for the sale of coal mining lands provided for payment in four equal annual instalments, with interest, the revenue now derived from the sale of such lands is on account of the unpaid balances of the purchase price and interest only.

The total amount collected during the year on account of coal mining lands sold under the provisions of the late regulations was $276,186.86, of which amount $271,-944.39 was on account of coal lands in the province of Alberta, $3,578.65 on account of such lands in the province of Saskatchewan, $96.43 on account of lands in the Railway Belt in the province of British Columbia, and $567.39 in connection with coal lands in the Yukon Territory. The total amount collected on account of the sale of coal mining lands up to the 31st of March, 1909, was $1,503,363.63.

The statement lettered 'D' at the end of this report shows the revenue derived from the sale of coal lands for each fiscal year since 1896.

COAL LEASES.

The total number of coal mining leases in force at the close of the fiscal year was 175, including a total area of 84,258·90 acres, distributed as follows :—

In the province of Alberta—

(*a*) Within the Rocky Mountains Park of Canada 51 leases, embracing a total area of 22,256 acres ;

(*b*) Outside the park, 112 leases, embracing a total area of 61,574·28 acres.

In the province of Saskatchewan 12 leases, comprising an area of 428·62 acres.

The total number of leases of coal mining rights issued during the year was 134, comprising an area of 62,032·90 acres. The total revenue received during the year for rental of coal mining rights was $65,751.10, of which $3,718.20 has been paid in advance on account of rental for leases applied for but not yet issued.

The following is a statement showing the revenue collected in the western provinces and in the Yukon Territory on account of the sale of coal lands during the fiscal year, under the provisions of the late regulations :—

Province of Alberta	$ 271,944 39
Province of Saskatchewan	3,578 65
Railway Belt in the province of British Columbia	96 43
Yukon Territory	567 39
Total	$ 276,186 86

The revenue derived from leases to mine coal within the Rocky Mountains Park during the fiscal year amounted to $16,252.44, and was made up as follows:—

Rental	$13,516 94
Royalty on coal mined	2,735 50

The total amount of rental collected on account of such lands up to the 31st of March last was $27,606.21, and the total amount of royalty collected up to the same date was $18,842.

The following is a statement showing the revenue derived during the fiscal year from royalty on coal mined on Dominion lands in the western provinces (except lands in the Rocky Mountains Park) and in the Yukon Territory:—

In the province of Alberta	$2,586 89
In the province of Saskatchewan	358 11
In the Yukon Territory	371 73
Total	$3,316 73

The total amount of royalty collected on coal mined up to the 31st of March, 1909, including that of the Rocky Mountains Park is $30,512.82.

PERMISSION TO PROSPECT FOR COAL.

By an order in council, dated the 16th of February last, regulations were established for the reservation of the coal mining rights, the property of the Crown, under an area not exceeding 2,560 acres of contiguous land, for a period of two years, for the purpose of enabling the applicant to carry on prospecting operations with the view of discovering coal. An application fee of $100 is charged, which is applied on account of rental or refunded if failure to discover coal is satisfactorily shown. If the surface has been disposed of the applicant must furnish evidence to show that he has obtained permission from the owner of the surface to enter upon the land before the coal mining rights can be reserved for him. The applicant must expend in actual prospecting operations by recognized methods on the tract reserved for him during each of the two years covered by the reservation the sum of at least $1 an acre, and shall be considered the first applicant for a lease of such coal mining rights provided the conditions of the reservation have been fully complied with.

NEW REGISTERS.

During the year a set of township registers, showing the mineral rights that have been disposed of were opened up and completed. These registers not only show the several parcels of mining lands which have been sold or leased by the Crown, but also the lands within each of the townships affected, the surface and mining rights of which have been disposed of to railway companies as a portion of their land grant subsidy. This involved the examination and entry of 1,056 mineral, and 465 coal lands sales distributed as follows:—Total area of mineral sales 210,713·73 acres; total area of coal lands sales, 74,040·02 acres. In the province of Alberta the area of mineral sales is 199,459·51 acres, and the area of coal lands sales, 69,534·93 acres. In the province of Saskatchewan the area of mineral sales is 7,049·13 acres and the area of coal lands sales 1,000 acres. In the Railway Belt, in the province of British Columbia, the area of mineral sales is 700 acres. In the Yukon Territory the area of coal lands sales is 3,505·09 acres.

Within these townships, however, a large number of patents have been issued for the surface rights, which patents do not reserve the mines and minerals. Until these patents have been entered up in the township registers, which would involve a great deal of work, these registers cannot be said to be complete.

A register of group lots in the Yukon Territory has also been opened, which work has already involved the examination of over 1,800 files, and the condensing of the information contained therein. While this work has not yet been completed, it is progressing satisfactorily, and when finished will be of material assistance in expediting the work of the branch, as the information contained therein will render frequent reference to the officers of the department at Dawson unnecessary, which, in the past, has been responsible for such delays as have occurred in dealing with applications in the Yukon Territory.

The following is a statement of the office work performed during the year :—

Letters received and recorded	9,816
Letters sent	17,047
Pages of memoranda and schedule	9,145
Plans and sketches prepared	1,184
Accounts kept posted	3,935
Accounts rendered	6,836
Assignments accepted and registered	147
Returns examined and posted	1,316
Receipts issued	418
Applications for coal locations received covering an approximate area of 441,440 acres	296
New entries and renewals for mining locations granted in the western provinces and territories, not including the Yukon	217
Applications for stone, gypsum and clay	26
Applications for tar, asphalt and petroleum	19
Applications for quartz claims in Alberta and Saskatchewan	231
Applications for iron claims	6
Applications for placer mining claims in Alberta and Saskatchewan	10
Applications for dredging leases	59
Applications for homestead entry in the Yukon Territory	19
Homestead entries granted in the Yukon Territory	17
Placer mining grants, renewals and relocations in the Yukon Territory	5,294
Quartz mining locations granted, Yukon Territory	563
Applications to dredge for sand and gravel	8
Requisitions for patent prepared	170
Number of files transferred and indexed	8,000
Applications to purchase or lease lands in the Yukon Territory	57
Applications for water frontage	6
Agricultural leases in force in the Yukon Territory, comprising an area of 313·11 acres	7
Leases for water frontage issued	1
Water front leases in existence	18
Gold dredging leases issued	11
Coal mining leases issued	134
Timber licenses prepared	114
Stone quarrying leases issued	1
Stone quarrying leases in the Rocky Mountains Park of Canada issued, comprising a total area of 1,322·56 acres	7

I have the honour to be, Sir,
Your obedient servant,

H. H. ROWATT,
Chief of Branch and Secretary of the Yukon.

REVENUE OF DOMINION LANDS

A.—STATEMENT of Receipts on account of Coal and Minerals in the Provinces and Terri
Fees, Rental of Agricultural Lands, Water Power and Water Fronts, Survey Fees

Months.	Improvement.	Confiscated Gold Dust.	Sale of Quartz Acreage.	Yukon Homestead Fees.	Yukon Timber Dues.	Coal Mining.	Mining Fees.	Yukon Hydraulic Leases.	Dredging Leases, Alberta and Saskatchewan.
1908.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
April	.....	....	33 01	....	509 46	2,675 06	4,960 00	956 90	....
May	....	......	66 68	10 00	2,882 31	4,331 61	7,118 00	....	51 00
June	......	...	141 33	10 00	2,058 98	2,704 45	11,890 75	150 00	....
July	....	......	802 68	....	1,033 50	2,492 61	14,235 50	....	100 00
August	...	......	299 48	30 00	1,920 86	1,850 18	7,900 00	300 00	....
September	......	......	101 00	20 00	3,053 00	2,912 05	10,266 50	507 00	200 00
October	......	.....	1,051 54	....	4,003 68	27,266 53	12,254 25	337 50	....
November	135 00	...	176 90	10 00	2,600 12	1,740 66	5,079 45	1,009 82	404 37
December	...	.....	73 52	....	2,271 79	1,456 80	4,656 50	74 85	....
1909.									
January	......	.....	285 17	....	1,460 31	8,977 68	5,027 50	1,152 74	20 90
February	......	75 50	56 65	....	3,418 88	1,656 31	4,866 40	....	....
March	.....	....	534 80	....	1,269 75	13,739 39	4,276 50	....	140 00
Total	135 00	75 50	3,622 76	80 00	26,482 64	71,803 33	92,531 35	4,488 81	916 27

INCLUDING THE YUKON TERRITORY.

tories, also Timber, Hay, Coal, Hydraulic Mining, Dredging, Royalty on Gold, Mining and Sale of Dominion Lands in the Yukon, for the Fiscal Year 1908 and 1909.

Dredging Leases, Yukon.	Gold Export Tax.	Free Certificates Export of Gold.	Rental, Yukon.	Registration Fees.	Hay, Yukon.	Water Power, Yukon.	Sale of Dominion Lands other than Coal, Yukon.	Stone Quarries.	Sale of Coal Lands.	Amount.
$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
31	355 14	1 00	5 00	4 50	......	......	267 53	126 84	14,982 10	24,876 85
100 00	2,569 49	1 00	4,518 50	2 50	32 00	......	585 02	....	8,843 58	31,111 69
... .	19,324 13	20 00	2,128 85	6 00	34 00	250 00	227 77	....	13,750 67	52,696 93
....	13,234 18	20 50	2,077 55	......	69 00	......	176 51	285 00	15,131 24	49,658 27
1,350 00	14,074 16	20 00	....	.. .	5 50	......	276 90	27 86	32,511 92	60,566 86
69 65	14,870 54	66 00	....	6 00	.....	......	764 43	46	8,858 70	41,695 33
3,100 00	13,886 01	29 00	2 66	2 00	... ..	......	627 54	43 15	4,625 00	67,228 86
4,000 00	746 05	1 50	15 00	4 00	......	......	453 69	.. ..	74,893 84	91,270 40
....	2,059 90	2 50	....	......	......	......	199 65	313 42	29,499 55	40,608 48
1,000 00	26 07	1 50	....	14 00	.....	......	60	....	9,614 87	27,581 34
515 65	43 25	2 00	....	2 00	......	......	544 51	145 00	43,524 78	54,850 93
136 46	318 15	1 00	1,080 30	....	......	......	363 37	201 38	19,950 61	42,011 71
10,272 07	81,507 07	166 00	9,827 86	41 00	140 50	250 00	4,487 52	1,143 11	276,186 86	584,157 65

H. H. ROWATT,
Chief of Branch.

DOMINION LANDS

B.—STATEMENT showing the Total Amount of Revenue Collected at each Agency,

Revenue received at Head Office, on account of the sale of coal lands in the Western Provinces

Agency.	Sale of Coal Lands.	Sale of Dominion Lands other than coal, Yukon.	Sale of Quartz Acreage.	Timber Dues.	Coal Mining.	Mining Fees.	Hydraulic Leases.	Dredging Leases N.W.T.
	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
Banff					13,516 94	4 75		
Battleford					25 00			
Calgary	34,132 80				525 25	140 00		
Dauphin						5 00		
Edmonton	32,263 78				2,000 90	641 00		
Estevan	2,533 41				170 00			
Kamloops					15 00			
Lethbridge	196,948 35				3,480 00	60 00		
Moosejaw	125 24				20 00			
New Westminster	96 43		1,034 80		30 00			
Prince Albert						847 50		
Red Deer	8,599 46				379 00			
Winnipeg	920 00		152 66			657 50		
Ottawa					45,574 01	1,347 10	2,341 72	916 27
Dawson Gold Commissioner's Office						71,504 50	2,147 09	
Duncan Mining Recorder's Office						7,174 00		
Sixtymile Mining Recorder's Office						2,008 00		
Whitehorse Asst. G. Commis.'s Office						3,337 00		
Kluane Mining Recorder's Office						2,117 00		
Conrad Mining Recorder's Office						2,688 00		
Dawson Crown Timber Office				21,646 39				
Whitehorse Crown Timber Office				4,836 25				
Dawson Comptroller's Office								
Dawson Royalty Collector's Office								
Whitehorse Royalty Collector's Office								
Fortymile Royalty Collector's Office								
Whitehorse Comptroller's Office								
Dawson Dominion Lands Office	567 39	1,177 71						
Dawson Mining Recorder's Office			510 41					
Conrad Dominion Lands Office			1,148 11					
Whitehorse Dominion Lands Office		3,309 81			15 00			
Whitehorse Mining Recorder's Office			776 78					
Totals	276,186 86	4,487 52	3,622 76	26,482 64	65,751 10	92,531 35	4,488 81	916 27

REVENUE.

including the Yukon Territory, for the Fiscal Year ending March 31, 1909.

is, in this statement, credited to the several agencies in which the lands affected are situated.

Dredging Leases Yukon.	Gold Export Tax.	Free Certificates Export of Gold.	Coal Royalty.	Rental, Yukon.	Stone Quarrying	Improvements.	Registration Fees.	Homestead Fees.	Confiscated Gold Dust.	Hay.	Water Power, Yukon.	Amount.
$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
			2,735 50		236 73							16,493 92
												25 00
			593 95									35,392 00
												5 00
			388 03									35,293 71
			250 25									2,953 66
												15 00
			233 47									200,721 82
			8 56									153 80
					25 00							1,186 23
												847 50
			624 40									9,602 86
												1,730 16
1,456 42			846 34	1 00	881 38						250 00	53,614 24
8,815 65												82,467 24
												7,174 00
												2,008 00
												3,337 00
												2,117 00
												2,668 00
			371 73							140 50		22,158 62
												4,836 25
		165 00							75 50			240 50
	79,791 02											79,791 02
	1,715 30											1,715 30
	75											75
		1 00										1 00
				7,009 36		135 00	34 50	70 00				8,993 96
												510 41
												1,148 11
				2,817 50			6 50	10 00				6,158 81
												776 78
10,272 07	81,507 07	166 00	6,052 23	9,827 86	1,143 11	135 00	41 00	80 00	75 50	140 50	250 00	584,157 65

H. H. ROWATT,
Chief of Branch.

D.—STATEMENT showing the total revenue derived from the sale of coal land for each fiscal year since 1896.

Fiscal Year.	Amount.
	$ cts.
1896-1897	75 76
1897-1898	1,833 74
1898-1899	350 00
1899-1900	5,650 33
1900-1901	101,772 00
1901-1902	16,270 32
1902-1903	31,055 38
1903-1904	68,949 75
1904-1905	35,695 00
1905-1906	125,754 12
For the nine months ending March 31, 1907	335,795 97
1907-1908	346,813 23
1908 1909	276,186 86

H. H. ROWATT
Chief of Branch.

YUKON REVENUE.

E.—STATEMENT showing the total Gold Production, the total subject to Royalty, and the total Royalty collected for each Fiscal Year from May 1, 1898, to March 31, 1909.

Fiscal Year.	Gold Production.	Subject to Royalty.	Royalty Collected.	Total Revenue.
	$ cts.	$ cts.	$ cts.	$ cts.
1897-1898	3,072,773 20	2,732,928 20	273,292 82	273,292 82
1898-1899	7,582,283 02	5,882,626 00	588,262 37	589,943 52
1899-1900	9,809,464 64	7,307,720 00	730,771 99	733,041 04
1900-1901	9,162,082 79	7,234,416 17	592,660 98	596,368 03
1901-1902	9,566,340 52	8,367,225 88	331,436 79	331,532 04
1902-1903	12,113,015 34	12,113,015 34	302,893 48	302,893 48
1903-1904	10,790,663 12	10,790,663 12	272,217 96	272,217 96
1904-1905	8,222,053 91	8,222,053 91	206,760 87	206,760 87
1905-1906	6,540,007 09	6,540,007 09	163,963 25	163,963 25
1906-1907	3,304,791 05	3,304,791 05	82,622 42	82,622 42
1907-1908	2,820,161 60	2,820,161 60	70,504 65	70,504 65
1908-1909	3,260,282 80	3,260,282 80	81,507 07	81,507 07
Total	86,243,919 08	78,575,891 16	3,696,894 65	3,704,647 15

H. H. ROWATT,
Chief of Branch.

No. 21.

REPORT ON TIMBER, GRAZING AND IRRIGATION.

Department of the Interior,
Ottawa, June 14, 1909.

W. W. Cory, Esq.,
Deputy Minister of the Interior,
Ottawa.

Sir,—I have the honour to submit the report of the Timber, Grazing and Irrigation Branch for the fiscal year ending March 31, 1909.

During the year provision was made for the issue of permits in the Railway Belt in the province of British Columbia to cut fire-killed timber for the manufacture of lumber, cordwood, telegraph poles, ties and fence posts, but beyond this no amendments of importance were made to the timber or grazing regulations.

The revenue derived from timber, grazing and hay lands, and irrigation, for the fiscal year amounted to $308,115.95, a decrease of $202,128.15 as compared with the fiscal year ending March 31, 1908. This decrease is mainly due to the fact that during the fiscal year no timber berths were disposed of at public auction and to the depression in the lumber trade, which, however, is showing signs of renewed activity. It may be stated that during the fiscal year ending March 31, 1908, the sum of $212,067·05 was received as bonuses on timber-berths disposed of.

Statement 'A,' showing the total revenue of the branch from its various sources, will be found at the end of this report.

Reports from the Crown timber agents at Calgary, Edmonton, Prince Albert, Winnipeg and New Westminster, showing the revenue collected on Dominion lands within their respective agencies and other information, are appended hereto. The report of the Inspector of Ranches is also attached. The report of the Commissioner of Irrigation will be found with the report of the Forestry Branch.

The total revenue from timber, grazing and irrigation received at the Crown timber agencies above mentioned, together with the ruling price of lumber and the number of mills in each agency, may be summarized as follows:—

Agency.	Total Revenue.	Average price of lumber per M. ft. B.M. at mills.	No. of mills operating under license.	No. of portable mills in operation.
	$ cts.	$ cts.		
Calgary	24,615 81	14 91	16	18
Edmonton	22,080 26	13 70	9	17
Prince Albert	43,229 34	17 54	6	6
Winnipeg	93,411 58	14 55	36	21
New Westminster	55,736 25	14 20	16	Nil.

Saw-mill returns received at the department give the following quantities of building material as having been manufactured and sold under government license during the year in the above mentioned agencies:—

——	Manufactured.	Sold.
Sawn lumber, ft. B.M	162,940,499	183,375,022
Shingles	....	10,000
Shingle bolts, cords	18,110 $\frac{16}{17}$	19,226 $\frac{7}{15}$
Laths	20,120,150	31,979,210

The quantity of lumber manufactured and sold within each agency will be found in the agents' reports appended hereto.

During the year 747 timber licenses were prepared, in duplicate, and issued.

The areas of timbered lands under license and permit in the provinces of Manitoba, Saskatchewan and Alberta, and within the Railway Belt in the province of British Columbia, on March 31, 1909, were as follows:—

——	Under License.	Under Permit.
	Sq. miles.	Sq. miles.
Manitoba	1,207·83	710·43
Alberta	2,655·45	357·94
Saskatchewan	2,338·06	422·02
British Columbia	2,089·00	23·57
Total	8,290·34	1,513·96

Of the above area held under permit 25·57 square miles are covered by portable saw-mill permits: 6·50 square miles by cordwood permits; and 301·96 square miles by permits issued to cut ties for railway construction purposes.

During the year there were received 296 applications to cut timber. The number of berths granted was 71, of which 21 are portable saw-mill berths. The total number of berths covered by permit is 221.

GRAZING LANDS.

There are 990 grazing leases in force, which cover a total area of 3,191,601·70 acres, distributed as follows:—

	Acres.
Province of Manitoba	6,174
Province of Saskatchewan	605,159
Province of Alberta	2,088,736
Railway-Belt, British Columbia	491,532·70
Total	3,191,601·70

IRRIGATION.

A full report of irrigation matters dealt with by this branch will be found in the report of the Superintendent of Forestry.

OFFICE WORK.

The following is a partial statement of the office work performed at Ottawa for the fiscal year ending March 31, 1909:—

Letters received and recorded	20,175
Letters sent	23,635
Plans and sketches prepared	4,704
Cash receipts issued in quadruplicate	1,679
Timber and grazing assignments registered	139

TIMBER.

Berths applied for	296
Berths granted to cut railway construction timber	34
Portable saw-mill berths granted	21
Cordwood berths granted	14
Berths granted to cut mining timber	2
Licenses for timber berths prepared in duplicate	747
Instructions issued for survey of timber berths	49
Returns of survey of timber berths examined and re-examined	83
Returns of operating saw-mills verified and posted	2,532
Timber permits checked and entered	10,171
Ledger accounts kept posted	968
Seizures checked and entered	404
Fire-guarding accounts posted	968

GRAZING.

Applications for grazing lands received	479
Leases of grazing lands issued	161
Applications for hay lands received	58
Ledger accounts kept posted—grazing	990
Ledger accounts kept posted—hay	2
Hay permits checked and entered	1,969

Your obedient servant,

B. L. YORK.

REVENUE OF DOMINION LANDS.

A.—STATEMENT of Receipts on Account of Timber, Grazing, Hay and Irrigation for the fiscal Year ending March 31, 1909.

Year.	Month.	Timber.	Grazing.	Hay.	Irrigation.	Total.
		$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
1908..	April	24,316 98	2,101 61	1,379 40	23 00	27,820 99
	May	30,988 65	3,803 83	941 90	52 75	35,787 13
	June	17,074 15	4,506 12	1,187 45	21 25	22,788 97
	July	20,477 15	3,697 44	1,813 10	26 50	26,014 19
	August	11,391 30	10,068 35	352 15	16 75	21,828 55
	September	17,875 44	2,503 29	27 60	25	20,406 58
	October	15,857 02	4,555 49	20 40	12 50	20,445 41
	November	16,568 57	5,619 59	13 20	50 00	22,251 36
	December	18,629 84	10,607 30	18 40	3 75	29,259 29
1909..	January	31,838 59	2,233 51	3 90	61 50	34,137 50
	February	24,436 29	3,441 94	6 70	50 25	27,935 18
	March	15,763 04	3,612 16	17 10	48 50	19,440 80
		245,217 02	56,750 63	5,781 30	367 00	308,115 95

Timber Dues made up as follows:

Rent $	60,171 55
Royalty	103,207 20
Permit	65,297 21
Seizures	16,541 06
$	245,217 02

F. LOYER,

Bookkeeper, Timber, Grazing and Irrigation Branch.

No. 22.

REPORT OF THE INSPECTOR OF CROWN TIMBER OFFICES.

DEPARTMENT OF THE INTERIOR,
WINNIPEG, MANITOBA, May 26, 1909.

J. W. GREENWAY, Esq.,
Commissioner of Dominion Lands,
Ottawa.

SIR,—I have the honour to submit my annual report in connection with my work as inspector of Crown timber offices for the departmental year ended March 31, 1909.

I visited during the year all the more important offices in Manitoba, Saskatchewan, Alberta and British Columbia, and made a thorough inspection of the books and accounts. My reports regarding this work were sent forward to you as inspections were made. Where there were forest rangers attached to an office they were called in, when their work was taken up and discussed with them and the agent.

All outstanding and unsettled business was gone into, and decision reached as to the action to be taken in the endeavour to effect settlement.

Apart from royalty dues on coal mined the collections are well up and the accounts in fairly satisfactory standing.

There are a large number of expired timber permits outstanding in the books of all the offices. Notices have been sent out to the permittees time and again with but poor result. Lists have been prepared for the forest rangers, who are under instructions to make collection as opportunity offers in the round of their regular duties.

There are but few unsettled seizures. These are receiving the attention of the agents and rangers. While the timber end of the business in all of its details is not being as efficiently dealt with in some of the agencies as could be desired, it is due to the smallness of the staff employed in connection with the work.

It would be a practical impossibility to wholly put a stop to the illegal cutting of timber on the public domain, owing to scattered settlement and the wide area covered by timber. Special attention has been paid to the operations at portable saw-mills and to the cutting of timber as a speculation. The number of timber seizures made during the year in the respective agencies is shown on statement 'A' appended.

Steps are being taken to give closer supervision than has taken place in the past over the operations of the holders of timber berths by license and permit. They will be required in future to conform more strictly to all the requirements of the regulations in the matter of the keeping of bush records of their cutting, of marking the timber cut by a stamp approved by the department, and furnishing at the end of each season of cutting a ground sketch, showing the place or places where timber was cut on the berth. Regular inspections will be made of the sales records of the mill-men and stock will be taken of the lumber in their possession. This work has been done in the past in some of the Crown timber agencies, but not thoroughly and systematically, as it is intended it should be carried on in the future.

LUMBER.

The lumber industry has not recovered from the depression of two years ago, and it is claimed by the operators that the business has not been profitable.

There has been a falling off during the year of fully 15 and 20 per cent in the sales made, wholesale and retail, respectively.

The coming season looks brighter for the trade as money is more plentiful and building is taking place in all parts of the country on an extensive scale. There is an ample supply of Canadian lumber on hand to meet all demands. The present prices are reasonable, being lower than for some years past, and it is not expected that any advance will be made unless at points free from competition.

Very little lumber is now brought in from the United States. Apart from that imported by the Grand Trunk Pacific Railway for construction purposes the amount during the past year would not exceed 7,000,000 feet, board measure, of which quantity there would be less than 1,000,000 feet of hardwoods, the balance fir, principally from the state of Washington.

The cut of logs this past year on Dominion lands has been lighter than for some years previously. The falling off occurred largely in the railway belt in British Columbia, where the millmen obtained their supply chiefly from the lands of the provincial government, the reason for this being that owing to the much heavier ground rent charged by the province for lands held under license it is cheaper to carry Dominion timber for which only a nominal ground rental is charged.

I append hereto the following summary statements, namely :—

A.—Summary of work performed at the respective offices during the year ending March 31, 1909, showing number of transactions under various heads, and amount of revenue collected.

B.—Statement showing manufacture and sale of timber products by the holders of timber berths on Dominion lands during the twelve months ended March 31, 1909.

C.—Statement showing timber material covered by permits issued at the respective agencies during the year ended March 31, 1909.

For purposes of comparison I have given the totals under the headings of each of the above statements for the previous year of 1907-8. It is quite interesting to note the changes that have taken place.

I would again respectfully draw the attention of the department to the large number of roof poles and fence rails authorized to be cut by settlers under free permits issued to them. As pointed out in my last annual report, this class of timber is not to any extent now used by the settler; sawn lumber (scantling) is almost wholly used in roofing, and posts and wire for fencing. In my opinion it would be in the public interest to withdraw the privilege from the settler of cutting this class of timber, which takes a young healthy tree in the manufacture of each piece.

Respectfully submitted,

E. F. STEPHENSON,
Inspector of Crown Timber Agencies.

STATEMENT A.—SUMMARY of Work Performed at the Respective Offices during the year ending March 31, 1909, showing Number of Transactions under Various Heads and Amount of Revenue Collected.

Agency.	Bonus.	Ground Rent.	Royalty on Timber Sales.	Timber Permits.	Timber Seizures.	Hay Permits.	Grazing Rents.	Mining Fees.	Coal Lands, Royalties, &c.	Stone Quarries.	School Lands Revenue.	Sundries.	Total Revenue for Year. $ cts.
Battleford	...	....	....	356	11	110	....	....	7	..	130	..	1,282 22
Brandon	....	....	....	460	...	26	....	....	....	..	177	4	1,335 61
Calgary	....	26	31	677	10	135	87	38	60	..	144	..	27,803 97
Dauphin	....	....	....	1,432	98	90	12	1	....	..	....	..	10,197 71
Edmonton	....	66	68	1,853	46	262	1	39	83	..	not given	..	24,312 64
Estevan	...	....	....	324	....	283	34	....	39	..	....	..	1,904 70
Humboldt	....	....	....	415	....	60	....	....	....	..	150	..	1,042 07
Kamloops	....	....	....	....	....	9	302	....	3	..	....	..	8,509 17
Lethbridge	....	....	....	402	6	124	249	not given	not given	..	....	..	42,602 92
Moosejaw	...	....	1	756	..	429	69	2	4	..	141	2	4,835 76
New Westminster	....	333	149	94	17	.....	....	....	....	..	....	..	48,787 39
Prince Albert	....	38	38	1,357	56	176	....	115	....	..	not given	..	39,935 13
Red Deer	....	....	...	423	1	28	....	....	106	..	189	..	2,562 29
Regina	....	....	....	315	2	254	63	....	....	.	... .	3	1,682 11
Yorkton	...	....	...	568	2	89	....	....	....	..	134	..	1,093 40
Winnipeg	...	112	132	1,185	57	267	6	99	....	..	414	6	93,705 61
Totals for year ending March 31, 1909	....	575	419	10,617	306	2,342	823	294	302	..	1,479	15	311,592 70
Totals for year ending March 31, 1908	6	448	387	10,801	178	2,315	740	161	318	11	1,064	12	329,330 04

This statement does not account for revenue paid direct to the department at Ottawa on account of business of the agencies, which would mainly be on account of bonus and ground rent.

E. F. STEPHENSON.

STATEMEMT B.—SHOWING Manufacture and sale of Timber Products by Holders of Timber Berths on Dominion Lands during the twelve months ending March 31, 1909.

LICENSE.

Agency.	Lumber, Feet—Board Measure. Manufactured.	Lumber, Feet—Board Measure. Sold.	Lumber, Feet—Board Measure. On Hand.	Laths. Manufactured.	Laths. Sold.	Laths. On Hand.	Railway Ties Manufactured.	Shingles. Manufactured.	Shingles. Sold.	Shingles. On Hand.
Calgary	13,730,588	11,211,737	10,012,964	....	....	....	9,681	....	....	....
Edmonton	9,679,117	7,112,690	8,304,652	1,332,430	1,311,380	21,050	8,089	....	....	....
New Westminster	53,923,157	54,621,244	28,718,487	1,189,500	983,250	869,528	....	18,110 6/17	19,226 7/15 Bolts.	6,148 1/8 Bolts.
Prince Albert	39,435,674	48,734,960	20,670,864	7,810,470	12,352,030	3,713,720	25,000	....		
Winnipeg	46,171,963	61,694,391	43,518,001	9,787,750	17,332,550	4,734,200	138,036	....	....	....
Total for year ending March 31, 1909	162,940,499	183,375,022	112,224,968	20,120,150	31,979,210	9,338,498	180,806	18,110 6/17	19,226 7/15	6,148 1/8
Total for year ending March 31, 1908	267,532,730	180,909,384	139,805,143	29,551,839	17,059,889	22,361,860	1,540,674	9,519 1/8	7,597 5/8	7,390 1/2

PERMIT.

Agency.	Lumber Manufactured.	Lumber Sold.	Lumber On Hand.	Laths Manufactured.	Laths Sold.	Laths On Hand.	Railway Ties Manufactured.	Shingles Manufactured.	Shingles Sold.	Shingles On Hand.
Calgary	7,210,191	5,456,779	2,598,646	....	....	....	92,507	....	....	....
Edmonton	5,971,499	4,455,063	4,822,107	....	....	....	26,798	296,000	208,000	88,000
New Westminster	Nil.	Nil.	Nil.	....	....	....	....	....	....	....
Prince Albert	397,960	209,679	188,281	....	....	....	8,673	....	....	....
Winnipeg	5,289,311	5,631,695	2,317,158	....	....	....	8,205	....	....	....
	18,868,961	15,753,216	9,926,192	....	....	....	136,183	296,000	208,000	88,000

E. F. STEPHENSON.

STATEMENT C.—TIMBER Material Covered by Permits Issued at the Respective Agencies during the Year ending March 31, 1909.

Agency.	Lumber and Logs, Feet, B.M.	Roof Poles.	Fence Posts.	Fence Rails.	Cordwood, Cords.	Mine Props.	Shingles.	Railwa Ties.
Battleford	2,494,689	76,140	99,806	371,700	3,595	....	....	
Brandon	249,930	7,135	2,880	100	6,924	....	....	
Calgary	5,989,817	207,458	251,643	1,124,701	16,616	....	....	
Dauphin	3,305,987	22,200	70,300	73,200	8,757	....	15,000	
Edmonton	9,960,236	372,892	438,236	1,855,339	1,089	....	36,000	596,750
Estevan	638,220	41,350	40,870	66,325	4,155	....	....	
Humboldt	3,086,686	38,210	46,885	50,730	1,026	....	....	
*Kamloops	Nil.	Nil.	Nil.	Nil.	Nil.	Nil.	Nil.	
Lethbridge	2,948,677	138,870	153,317	718,867	4,099	3,000	....	
Moosejaw	3,150,000	197,296	273,754	886,080	7,089	....	....	
New Westminster	3,287,849	450	2,250	....	1,299½	....	Crds, bolts. 923	4,902
Prince Albert	5,816,685	185,882	899,012	302,408	18,344	....		
Red Deer	2,998,946	80,562	109,325	406,215	5,667	....	....	
Regina	834,600	52,075	37,850	78,600	3,320	....	....	
Yorkton	3,281,515	76,687	91,785	326,405	3,121	....	....	
Winnipeg	2,108,221	23,640	61,526	68,350	20,935	....	....	
Total for year ending March 31, 1909	50,152,088	1,520,847	2,579,443	6,329,020	106,036½	3,000	51,000 Crds, bolts. 923	601,652
Total for year ending March 31, 1908	57,170,935	1,654,940	2,831,028	6,522,425	190,202¾	....	....	....

* Timber business for Kamloops Agency transacted at New Westminster office.

E. F. STEPHENSON.

No. 23.

REPORT OF THE CROWN TIMBER AGENT AT WINNIPEG.

DEPARTMENT OF THE INTERIOR,
CROWN TIMBER OFFICE,
WINNIPEG, MANITOBA, May 26, 1909.

J. W. GREENWAY, Esq.,
Commissioner of Dominion Lands,
Ottawa.

SIR,—I have the honour to submit my report upon the Timber and Grazing Branch of the department for the year ending March 31, 1909, to which are appended the following classified statements:—

A.—Classified statement showing revenue collected on account of Dominion lands for timber, grazing and hay permits during the year.

B.—Schedule giving list of names of the respective holders of timber berths held under license who are conducting operations, and the extent thereof.

C.—Schedule showing the mills (including portable mills) operated within the Winnipeg agency under government permits.

D.—Schedule, being general office return of the Crown timber agency, Winnipeg.

LUMBER SALES.

The statement given hereunder, showing the amount of lumber and other products of timber sold within this district, exclusive of imports from the United States, was compiled from particulars procured from reliable sources, and may be accepted as approximately correct :—

	1907-08. Feet B.M.	1908-09. Feet B.M.
From province of Ontario, west of Lake Superior—		
From Canadian logs	58,000,000	51,000,000
From American logs	50,000,000	40,000,000
From province of British Columbia	92,000,000	100,000,000
From mills operating under Dominion license	53,485,361	61,694,391
From mills operating under Dominion permit	13,500,000	5,631,695

For purposes of comparison I give hereunder the selling price of the different classes of lumber during the year which ended on March 31, 1908, with that for the year ended March 31, 1909.

	1907-08. Per M. feet B.M.	1908-09. Per M. feet B.M.
Pine, cedar and fir—		
Dimension lumber	$18 00 to $25 00	$18 00 to $25 00
Fir for interior finishing	40 00 to 50 00	40 00 to 50 00
Flooring, siding and ceiling	33 00 to 40 00	33 00 to 40 00
Shiplap and common boards	21 00 to 23 00	20 00 to 23 00
Spruce—		
Dimension lumber	$18 00 to $25 00	$18 00 to $20 00
Siding, flooring and ceiling	23 00 to 28 00	23 00 to 28 00
Shiplap and common boards	18 00 to 24 00	18 00 to 24 00
Lath	4 00 to 5 00	3 75 to 5 00
Shingles	3 00 to 3 65	2 70 to 3 00

The figures given hereunder give approximately the sales of coal and wood during the same year:—

	1907-08. Tons.	1908-09. Tons.
American anthracite	140,000	145,000
American bituminous	150,000	150,000
Canadian anthracite	40,000	42,000
Canadian bituminous	61,731	73,800
Canadian lignite	120,000	146,000
Total	511,731	556,800

These figures are exclusive of coal used in connection with the operations of the railroads.

The following retail prices were obtained at Winnipeg:—

	1907-08. Per Ton.	1908-09. Per Ton.
American anthracite	$10 50	$10 50
American bituminous	8 00 to $8 50	7 00 to $8 50
Canadian anthracite	10 00	10 00
Canadian bituminous	8 00 to 9 00	8 00
Canadian lignite	5 00 to 5 50	5 00 to 5 50

CORDWOOD.

The sales of cordwood in the city of Winnipeg and town of St. Boniface during the year amounted to about 98,000 cords. The retail price charged per cord was for poplar, $2.75 to $3.75; spruce and jackpine, from $4 to $4.75, and tamarack, from $5.50 to $6.

The wood was principally taken from Dominion and provincial lands under the authority of permits.

REVENUE.

The total revenue collected from all sources at this office during the year amounts to $127,949.83, made up as follows:—From Dominion Lands Branch, $30,846.09; Crown Timber Branch, $90,057.57, and from school lands, $6,232.96.

The revenue from mines for the same period amounted to $805.16.

The increase in revenue derived from timber, grazing and mines over the preceding year amounts to the sum of $14,884.85.

TIMBER PERMITS.

The number of timber permits issued to settlers from this office during the year was 989, including 30 on school lands, covering the following quantity of timber.

For purposes of comparison I likewise give the quantities for previous year under the heading of seizures.

	1907-8.	1908-9.
Dominion Lands—		
Building logs (lineal ft.)	318,071	290,837
Lumber (ft. B.M.)	1,131,244	1,235,710
Roof poles	35,885	23,640
Fence rails	94,635	68,350
Fence posts	77,976	61,520
Cordwood	51,082	20,419
School Lands—		
Building logs (lineal ft.)	600	Nil.
Cordwood	2,820	516

SEIZURES.

During the year 63 seizures were made covering timber cut on Dominion lands, including 6 seizures on school lands, as follows:—

	1907-8.	1908-9.
Dominion Lands—		
Building logs (lineal ft.)	8,436	43,365
Lumber (ft. B.M.)	205,365	1,678,572
Railway ties	4,685	35,634
Fence posts	700	17,593
Cordwood	1,673	2,640½
Telegraph poles	Nil.	48
School Lands—		
Lumber (ft. B.M.)	1,000	20,000
Railway ties	1,423	2,795
Fence posts	350	300
Cordwood	193	Nil.
Telegraph poles	185	Nil.

HAY.

The number of settlers acquiring permits to cut hay upon Dominion and school lands was 600, aggregating 12,736 tons. During the previous year 738 permits were issued, covering 16,108 tons of hay.

FOREST FIRES.

Very little damage to the timber from fire was reported during the year. Greater care is being exercised by the public in regard to setting out fires to keep them under control, due in a large measure to the action being taken by the Forestry Branch to post the settlers in the law, and to enforce it against trespassers.

Your obedient servant,

E. F. STEPHENSON,
Crown Timber Agent.

SCHEDULE A.—STATEMENT of receipts from Crown Timber Agency at Winnipeg for fiscal year ending March 31, 1909.

Month.	Bonus under License.	Ground Rent under License.	Royalty Dues under License.	Permit Fees, Dues and Rental.	Seizures.	Grazing Lands Rentals.	Hay Permits, Fees and Dues.	Totals.
1908.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
April	NOTE—Bonuses are collected at head office.	541 64	1,514 18	1,434 08	848 26	....	195 30	4,533 46
May		413 15	1,857 62	5,472 85	161 64	....	51 30	7,956 56
June		1,636 03	3,025 28	2,435 36	362 78	....	71 35	7,530 80
July		495 76	1,589 46	534 16	....	4 45	199 15	2,822 98
August		1,577 35	1,900 58	1,575 83	173 56	....	21 00	5,248 32
September		376 87	3,618 23	8,297 18	274 48	1 20	4 00	12,571 96
October		1,081 24	3,548 33	1,101 61	2,014 53	3 20	11 00	7,759 91
November		660 15	397 10	1,389 48	....	....	....	2,446 73
December		....	4,671 79	4,801 39	32 60	1 60	1 00	9,508 38
1909.								
January		439 45	7,319 03	7,193 00	892 73	....	....	15,844 21
February		4 50	5,786 28	720 15	651 80	....	0 40	7,163 13
March		299 40	2,812 62	2,176 29	1,384 92	4 45	....	6,677 68
Totals	....	7,525 54	38,040 50	37,131 38	6,797 30	14 90	554 50	90,064 12
Collected at head office	....	3,176 40	111 06	....	60 00	....	....	3,347 46
	....	10,701 94	38,151 56	37,131 38	6,857 30	14 90	554 50	93,411 58

NOTE.—Less $6.55, amount paid on account ground rent Berth No. 903, transferred to School Lands Branch.

E. F. STEPHENSON,
Crown Timber Agent.

SCHEDULE C.—Showing the Mills (including the Portable Mills) operating within the Winnipeg Agency, under Government Permits, for the Fiscal Year ending March 31, 1909.

PORTABLE SAW-MILL BERTHS ONLY.

No.	Mill Owner.	Location of Mill.	Berth No.	Species of Timber Cut.	Lumber. Manufactured Ft. B. M.	Lumber. Sold Ft. B. M.	Lumber. On hand Ft. B. M.	Log Count. Logs Cut.	Log Count. Logs Manufactured.	Log Count. Logs on hand.	Average per Log Ft. B. M.
1	Blackburn & Somerville	27-32-20 W 1	1508	Tamarack and spruce	385,000	185,200	200,000	7,295	7,295	.....	52
2	Butson, W. F.	27-39-25 W 1	1519	Spruce	293,200	268,200	25,000	4,495	4,495	.....	65
3	Fulton, Thos.	Etoimami	1345	"	.....	126,650	223,170	.....	.....	.....	.....
4	Gamache, Pierre	9-23-2 W 1	1531	"	137,000	125,000	12,000	3,103	1,666	1,437	82
5	Hall, Erick	24-18-18 W 1	1483	"	75,775	91,799	.....	2,000	2,000	.....	37
6	Heale, Walter G.	2-20-1 E 1	S. L. 42	"	.....	40,000	.....	.....	.....	.....	.....
7	Helgason, Johannes	20-23-4 E 1	1509	Tamarack and spruce	.....	.....	.....	5,500	.....	5,500	.....
8	Hodgins, Alex	19-22-6 W 1	1373	Spruce	22,500	32,500	.....	.....	900	.....	25
9	Hodgins, Alex	30-22-6 W 1	1550	"	70,000	50,000	20,000	1,600	1,600	.....	43
10	Klnnee, C. R.	27-28-23 W 1	1572	Tamarack, spruce, jackpine and poplar.	35,000	30,000	5,000	900	500	400	70
11	Loewen, C. T.	Steinbach	S. L. 61	Tamarack and spruce	150,000	150,000	.....	6,200	6,200	.....	24
12	Marchanski, J.	Net Point	1542	Spruce	31,320	320	31,000	4,215	670	3,545	46
13	McDougall, Alex.	19-23-11 W 1	1568	"	116,270	116,270	.....	3,323	3,283	40	35
14	McHaffie, Peter	4-38-27 W 1	S. L. 41	"	120,000	170,000	.....	.....	2,000	.....	60
15	McHaffie, Peter	4-38-27 W 1	1576	"	.....	.....	.....	250	.....	250	.....
16	Oddleifsson, Gestur	1-21-2 E 1	1559	"	55,000	35,000	20,000	6,000	1,500	4,500	36
17	Pratt, B. M.	16-33-28 W 1	1385	Spruce and poplar	25,000	75,000	.....	.....	500	.....	50
18	Thompson, B. B.	9-24-6 E 1	1421	Tamarack and spruce	85,600	168,600	2,000	1,200	3,200	1,200	26
19	Thompson, J. H.	23-23-4 E 1	1348	" "	83,667	83,667	.....	.....	2,500	.....	33
20	Tyler, D. C.	19-18-15 W 1	1375	Spruce and poplar	134,150	119,578	91,950	3,973	3,973	.....	33
21	Walstrom, V.	26-18-17 W 1	1482	Tamarack, spruce and jack-pine.	100,000	100,000	.....	2,600	2,600	.....	38
					1,919,482	1,967,784	630,120	52,654	44,882	16,872	

PERMIT BERTHS ONLY.

No.	Mill Owner.	Location of Mill.	Berth No.	Species of Timber Cut.	Lumber. Manufactured Ft. B. M.	Lumber. Sold Ft. B. M.	Lumber. On hand Ft. B. M.	Log Count. Logs Cut.	Log Count. Logs Manufactured.	Log Count. Logs on hand.	Average per Log Ft. B. M.
1	Burrows, T. A.	Garland	827	Spruce	153,200	153,200	.....	9,400	2,850	9,400	53
	Caverly, Jefferson	Bowsman River, 27-38-28 W 1	966	"	1,577,911	2,055,441	1,503,590	40,027	34.577	5,450	45
3	Matthews, B. J.	Siglunes	1090	"	120,000	40,000	80,000	11,000	2,500	11,500	48
4	McArthur, J. D.	Lac du Bonnet	872	Tamarack, spruce and poplar	23,316	23,316	.....	.....	.....	.....	.....
5	McArthur, J. D.	"	793	.....	103,448	.....	103,448	.....	3,000	.....	34
6	Robinson, Wm.	Black River	830	Tamarack and spruce	771,374	771,374	.....	.....	23,140	.....	33
7	Wells, A. L., assigned to J. A. Dart, Oct. 7, 1908	Big Grindstone Pt.	1044	Spruce	620,580	620,580	.....	.....	14,475	.....	42
					3,369,829	3,663,911	1,687,038	60,427	80,542	26,350	

SCHEDULE C.—Showing the Mills (including the Portable Mills) operating within the Winnipeg Agency, &c.—*Concluded.*

PORTABLE SAW-MILL BERTHS ONLY.—*Concluded.*

No.	Mill Owner.	Location of Mill.	Berth No.	Species of Timber Cut.	Railway Ties. Manufactured	Sold.	On hand.	Average price of Lumber per M. ft.	No. of Returns made.	Date of last Return.	Remarks.
								$ cts.			
1	Blackburn & Somerville	27-32-20 W 1	1508	Tamarack and spruce				16 00	4	Mar. 31, '09	
2	Butson, W. F.	27-39-25 W 1	1519	Spruce				11 62	4	" 31, '09	
3	Fulton, Thos.	Etoimami	1345	"				20 00	4	" 31, '09	
4	Gamache, Pierre	9-23-2 W 1	1531	"				13 00	3	" 31, '09	
5	Hall, Erick	24-18-18 W 1	1483	"				11 00	4	" 31, '09	
6	Heale, Walter G.	2-20-1 E 1	S. L. 42	"				15 00	3	Dec. 26, '08	Cancelled, Dec. 26, 1908.
7	Helgason, Johannes	20-23-4 E 1	1509	Tamarack and spruce					4	Mar. 31, '09	
8	Hodgins, Alex.	19-22-6 W 1	1373	Spruce				16 00	1	May 31, '08	Cancelled, June 18, 1908.
9	Hodgins, Alex.	30-22-6 W 1	1550	"				15 00	2	Mar. 31, '09	
10	Kinnee, C. R.	27-28-23 W 1	1572	Tamarack, spruce, jack-pine and poplar.				12 00	1	" 31, '09	
11	Loewen, C. T.	Steinbach	S. L. 61	Tamarack and spruce				20 00	2	" 31, '09	
12	Marchanski, J.	Net Point	1542	Spruce				15 00	3	" 31, '09	
13	McDougall, Alex.	19-23-11 W 1	1568	"				10 00	1	" 31, '09	
14	McHaffie, Peter	4-38-27 W 1	S. L. 41	"				15 00	3	Dec. 31, '08	Cancelled, Oct. 21, 1908.
15	McHaffie, Peter	4-38-27 W 1	1576	"					1	Mar. 31, '09	
16	Oddleifsson, Gestur	1-21-2 E 1	1559	"				15 00	1	" 31, '09	
17	Pratt, B. M.	16-33-28 W 1	1385	Spruce and poplar				15 00	1	June 30, '08	Cancelled, Aug. 25, 1908.
18	Thompson, B. B.	9-24-6 E 1	1421	Tamarack and spruce				14 33	4	Mar. 31, '09	
19	Thompson, J. H.	23-23-4 E 1	1348	" "				15 00	1	June 30, '08	Cancelled, July 13, 1908.
20	Tyler, D. C.	19-18-15 W 1	1375	Spruce and poplar				12 00	4	Mar. 31, '09	
21	Walstrom, V.	26-18-17 W 1	1482	Tamarack, spruce and jackpine.				13 33	4	" 31, '09	

PERMIT BERTHS ONLY.—*Concluded.*

No.	Mill Owner.	Location of Mill.	Berth No.	Species of Timber Cut.	Railway Ties. Manufactured	Sold.	On hand.	Average price of Lumber per M. ft.	No. of Returns made.	Date of last Return.	Remarks.
1	Burrows, T. A.	Garland	827	Spruce	5,372		5,372	12 00	4	Mar. 31, '09	
2	Caverly, Jefferson	Bowsman River, 27-38-28 W 1	966	"				15 00	4	" 31, '09	
3	Matthews, B. J.	Siglunes	1090	"				12 50	4	" 31, '09	
4	McArthur, J. D.	Lac du Bonnet	872	Tamarack, spruce & poplar	2,833	2,833		15 00	4	" 31, '09	All cut by the city of Winnipeg and Winnipeg Electric Railway Co.
5	McArthur, J. D.	"	293	" "					4	" 31, '09	
6	Robinson, Wm.	Black River	830	Tamarack and spruce				13 00	4	" 31, '09	
7	Wells, A. L., assigned to J. A. Dart, Oct. 7, 1908	Big Grindstone Pt.	1044	Spruce				12 00	5	" 31, '09	
					8,205	2,833	5,372				

E. F. STEPHENSON, *Crown Timber Agent.*

SCHEDULE D.—GENERAL Office Return of the Crown Timber Agency, Winnipeg, for Fiscal Year ending March 31, 1909.

Particulars.	Number, &c.	As compared with previous year.	As compared with previous year.	Remarks.
		Increase.	Decrease.	
Letters received	24,382	5,048		Includes Land Department; no separate record kept.
Letters written	22,130	2,978		
Permits subject to dues issued	305		426	
Free permits issued	684		18	
Seizures made	63	14		
Mill returns received and verified	584	17		
Mills operating under government license	36	1		
" " permits	22			Permit berths not included in return previous to this year.
Quantity of lumber manufactured, under license	46,171,963		35,405,367	
Quantity of lumber sold, under license	61,694,391	8,209,030		
" on hand "	43,518,001		18,002,621	
Average price at which lumber sold. Per M.	$14.55		$3.45	
Hay permits issued	600		138	

E. F. STEPHENSON,
Crown Timber Agent.

No. 24.

REPORT OF THE CROWN TIMBER AGENT AT CALGARY.

DEPARTMENT OF THE INTERIOR,
DOMINION LANDS AND CROWN TIMBER OFFICE,
CALGARY, ALBERTA, May 14, 1909.

The Commissioner of Dominion Lands,
Ottawa.

SIR,—I have the honour to inclose herewith the following statements for the twelve months ending March 31, 1909:—

Schedule 'A,' statement on account of Crown timber, grazing and hay lands. The amount collected at the office and at headquarters on account of this agency is $24,615.81.

Schedule 'B,' showing the saw-mills within the Crown timber agency in operation under government license.

Schedule 'C,' showing the portable saw-mills operated under permit.

Schedule 'D,' general office work.

Schedule 'F,' showing quantity of timber cut under settlers' permits, &c.

You will observe that the quantity manufactured from licensed berths during the twelve months, amounted to 13,730,588 ft. B.M., quantity sold 11,211,737 ft. B.M.; manufactured by portable mills under permits, 7,210,191 ft. B.M.; quantity sold, 5,476,799 ft.; total quantity on hand 13,611,610 ft.

In addition to the 20,940.779 ft board measure manufactured as above mentioned, there has probably been about 100,000,000 ft. brought into this province from the province of British Columbia, but apparently nothing has been imported from the United States.

The log crop according to an estimate made by the chief forest ranger, Mr. Margach, amounted to 20,000,000 ft., which in addition to the 13,000,000 ft. estimated as being the quantity left over from the cut of 1907 and 1908, will make 33,000,000 ft., which the mill-owners will require to manufacture into lumber during this season.

As requested by you in your letter of instructions, I beg leave to say that $14.91 per thousand feet, is the average price at which the lumber sold throughout this district, during the last year.

GRAZING.

The area under lease for grazing purposes in the Calgary land district is approximately 410,000 acres, 166 leases being still in force.

In regard to this industry, I may say that the day of the large rancher is practically a thing of the past, and the man with the small band of cattle is taking his place. I would recommend, however, that the demands of the stockmen should receive every consideration, as this is no doubt a great stock country, and in my opinion it would be good policy to encourage stock growing as much as possible.

It is a well known fact among those who know anything about this country that there are waste places suitable only for ranching purposes.

It has been demonstrated that some settlers will endeavour to farm almost anywhere, but it is not always in their own interests that they should be allowed to establish themselves on land that is unfit for agricultural purposes.

Special encouragement should be given to those who are desirous of providing plenty of food and shelter for their cattle, and are willing to embark in the business of feeding for the market. Such concerns will buy large quantities of feed from the farmer, and in the event of a crop failure, or partial failure at any time, we will have something to fall back upon. At the present time, I may say that it has been the salvation of farmers who are far away from the railway to have cattle sent to them by large cattle buyers, to feed for the winter, or otherwise there would be absolutely no market for their grains.

Where a stockman has already established himself and embarked in the business of preparing cattle for the market he will necessarily require a considerable area of land for grazing, and to grow feed upon to enable him to successfully carry on his business, and I am of the opinion that he should be allowed to acquire sufficient land for that purpose at a reasonable price. At the same time the rancher should undertake on his part in acquiring the land that it is not for speculative purposes, and that he intends continuing the business in which he is engaged.

Your obedient servant,

J. R. SUTHERLAND,
Crown Timber Agent.

SCHEDULE A.—STATEMENT of Receipts from Crown Timber Agency at Calgary for Fiscal Year ending March 31, 1909.

Month.	Bonus under License.	Ground Rent under License.	Royalty Dues under License.	Permit Fees, Dues and Rental.	Seizures.	Grazing Lands Rentals.	Hay Permits, Fees and Dues.	Totals.
1908.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
April	NOTE.—Bonuses are collected at head office.	313 01	953 17	62 21	....	145 50	428 50	1,902 39
May		689 40	192 34	216 03	....	836 83	154 00	2,088 60
June		119 82	....	10 82	....	12 80	164 05	307 49
July		64 28	774 66	67 52	....	408 85	275 40	1,590 71
August		17 60	447 74	191 29	4 74	1,016 86	44 20	1,722 43
September		26	....	329 28	9 00	8 85	10 50	357 89
October		....	456 27	120 13	....	219 76	....	796 16
November		68 16	1,074 50	74 87	598 25	663 58	7 50	2,486 86
December		....	552 36	549 12	150 00	791 94	8 00	2,051 42
1909.								
January		....	825 55	490 89	....	61 27	....	1,377 71
February		....	95 13	252 91	200 00	344 07	....	892 11
March		....	301 55	248 70	....	257 22	....	807 47
Totals	....	1,272 53	5,673 27	2,613 77	961 99	4,767 53	1,092 15	16,381 24
Collected at head office	....	7,992 10	59 47	183 00	....	....	....	8,234 57
	....	9,264 63	5,732 74	2,796 77	....	....	....	24,615 81

SCHEDULE C.—SHOWING the Mills (including the Portable Mills) operating within the

Mill Owner.	Location of Mill.	Berth No.	Species of Timber Cut.	Lumber. Manufactured.	Lumber. Sold.	Lumber. On Hand.
				Ft., B.M.	Ft., B.M.	Ft., B.M.
Thomas Quigley.........	Cochrane.	1307	Spruce, fir, pine.......	249,000	262,000	....
Wm. J. McIntyre.... ...	Didsbury... .	1344	"	....	16,000	....
David Black.........	On Berth.....	1326	"	103,675	550,000	....
W. W. Channell..........	"	1304	" and pine......	....	....	....
Joseph Fisher............	Millarville....	1358	"	49,000	40,000	35,000
J. R. Shell...............	On Berth.....	1380	" and pine.......	271,865	323,183	.. . ...
Samuel J. Templeton.....	Beaver Creek.	1409	" and fir.......	....	....	20,529
Arthur G. Spooner.	On Berth.....	1406	"	213,000	78,000	189,000
Great West Lumber Co...	Red Deer.....	1472	Cypress pine.	....	....	... .
Charles Stubbs...........	On Berth.....	1396	Spruce and fir.........	41,800	108,280	39,582
West Can. Collieries......	Lille.	1432	" and pine	....	100,000	....
Francis Du Rocher.......	On Berth. ...	1520	"	27,744	39,744	....
Archibald Lake	"	1506	" and fir.........	374,055	354,055	20,000
W. H. Gibson............	"	1521	" and pine.......	1,801,516	1,489,516	312,000
Lineham Lumber Co......	High River...	1428	Pine	2,196,412	1,127,684	1,068,728
" "	" ...	1433	"	1,240,688	533,881	706,807
Joseph Peters............	Cypress Hills..	1553	Spruce	44,000	12,000	32,000
P. W. Halvarson.........	Blk. Diamond.	1427	"	597,436	422,436	175,000
				7,210,191	5,456,779	2,598,646
				Lin. Ft.	Lin. Ft.	
Inter. Coal and Coke Co .	Coleman.... .	1529	Pine and mining props.	56,810	56,810	....
				Cords.	Cords.	
E. G. Hazell..........	Crowsnest	1510	Dry cord wood..	350	350	....
				Lin. Ft.	Lin. Ft.	
Inter. Coal and Coke Co. .	Coleman.. ..	36A	Dry mining props.....	683,236	683,236	....

SESSIONAL PAPER No. 25

Calgary Agency under Government Permits, for the Fiscal Year ending March 31, 1909.

Log Count.			Average per Log.	Railway Ties.		Average Price of Lumber per M ft.	No. of Returns made.	Date of Last Return.	Remarks.
Logs Cut.	Logs Manufactured.	Logs on Hand.		Manufactured.	Sold.				
			Ft., B.M.			$ cts.			
....	3,350	....	74·32	....	....	13 00	4	Mar. 31, '09	
....	....	....	......	....	....	14 00	1	June 30, '08	Berth cancelled.
....	3.000	....	34·33	....	....	14 00	1	Sept. 30, '08	" "
....	....	1,190	......	....	....	....	3	Mar. 31, '09	
....	965	....	50 77	....	....	12 50	4	" 31, '09	
....	6,176	....	44·00	....	....	......	3	Dec. 31, '08	" "
....	....	....	......	....	....	....	....	....	
2,600	4,500	2,900	47·50	....	....	12 25	4	Mar. 31, '09	
865	....	5,281	.. .	....	....	....	4	" 31, '09	Permit for G.T.P.
662	500	662	83·60	....	....	10 00	2	Dec. 31, '08	
....	....	....	......	....	....	....	3	" 31, '08	Products used in
448	503	....	55·15	....	....	10 00	2	Sept. 30, '08	their mine.
18,513	18,013	500	20·70	....	....	12 02	4	Mar. 31, '09	
27,547	25,567	1,980	70·40	....	....	11 00	4	" 31, '09	
137,359	75,216	62,143	29·20	68,675	68,675	13 93	3	" 31, '09	Permit for G.T.P.
47,414	47,810	....	25·90	23,832	23,832	13 82	3	" 31, '09	" "
....	....	....	......	....	....	....	....	....	
12,370	12,370	....	48·21	....	....	14 00	5	Mar. 31, '09	
247,778	197,970	74,656	36·42	92,507	92,507	12 54·33	51		
....	....	....	......	....	....	....	....	....	Used in mine.
....	....	....	......	....	....	....	....	....	Used burning lime.
....	....	....	......	....	....	....	....	....	Taken from timber less than 10 ins. in diameter, used in mines.

J. R. SUTHERLAND,
Crown Timber Agent.

SCHEDULE D.—GENERAL Office Return of the Crown Timber Agency, Calgary for Fiscal Year ending March 31, 1909.

Particulars.	Number, &c.	As compared with previous year, increase.	As compared with previous year, decrease.	Remarks.
Letters received	34,740	....	61	Including Dominion lands.
Letters written	34,196	5,032	....	" "
Permits subject to dues issued	16	....	27	
Free permits issued	620	....	231	
Seizures made	10	....	5	
Mill returns received and verified	115	15	....	
Mills operating under government license	16	....	1	
Mills operating under government permits	20	8	. ...	
Quantity of lumber manufactured, under license	13,730,588	....	7,791,408	
Quantity of lumber sold, under license	11,211,737	....	5,531,508	
Quantity of lumber on hand, under license	11,012,964	2,647,049	....	
Average price at which lumber sold	$14.91	... .	$7.38	
Hay permits issued	195	24	....	

J. R. SUTHERLAND,
Crown Timber Agent.

SCHEDULE E.—STATEMENT showing the Quantity of Timber cut under Permit at the Calgary Agency.

Month.	Lin. ft., B. logs.	Feet B.M. Lumber.	Roof poles.	Fence rails.	Fence posts.	Dry wood.
1908.						
April	21,950	352,972	13,955	73,575	15,840	1,093
May	12,985	283,724	14,510	79,191	17,992	1,156
June	17,800	101,327	12,030	58,128	13,865	880
July	13,730	57,919	9,290	47,400	9,976	719
August	3,000	97,284	4,656	23,800	5,198	376
September	9,028	99,150	5,413	29,290	6,672	431
October	6,000	197,416	9,543	49,400	12,080	746
November	21,739	323,307	16,001	86,820	20,541	1,335
December	10,140	1,082,493	39,170	210,075	47,200	3,006
1909.						
January	33,285	725,993	36,002	204,487	42,719	2,999
February	18,000	1,687,383	27,128	159,170	36,710	2,326
March	14,750	433,652	19,760	103,365	22,850	1,549
Total	182,409	5,442,620	207,458	1,124,701	251,643	16,616

J. R. SUTHERLAND,
Crown Timber Agent.

No. 25.

REPORT OF THE CROWN TIMBER AGENT AT EDMONTON.

DEPARTMENT OF THE INTERIOR,
DOMINION LANDS AND CROWN TIMBER OFFICE,
EDMONTON, ALBERTA, April 2, 1909.

The Commissioner of Dominion Lands,
Ottawa, Ont.

SIR,—I have the honour to report with respect to the timber operations within this agency for the year ending March 31, 1909.

The total operations for the year show some increase over those of last year, the increase in the amount cut under settlers' permits being very marked. The operations of the larger concerns, however, show a decrease, the supply of lumber being more than equal to the demand. Some of the larger mill owners suffered another serious loss in logs by the sudden rise of the Saskatchewan river, and the absence of adequate means to protect them under such circumstances. The past winter was quite favourable for lumbering operations generally. The average price at which lumber was sold would appear to be $13.70 as against $15 for the preceding year.

The following is the cut for the year :—

(*a*) By licensed berth owners. . . . . 6,679,117 ft. B.M.
(*b*) By permit berth owners. . . . . 6,457,236 "
(*c*) By portable mills under settlers' permits . . 11,780,672 "

Your obedient servant,

K. W. MACKENZIE,
Crown Timber Agent.

SCHEDULE A.—STATEMENT of Receipts from Crown Timber Agency at Edmonton for Fiscal Year ending March 31, 1909.

Month.	Ground Rent under License.	Royalty Dues under License.	Permit Fees, Dues and Rental.	Seizures.	Grazing Lands Rentals.	Hay Permits, Fees and Dues.	Totals.
1908.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
April	45 10	184 14	413 20	160 70	....	....	801 89
May..	217 50	353 29	354 65	252 32	....	333 10	1,510 86
June	303 83	60	207 19	40 45	12 80	203 10	767 97
July...... ...	408 78	882 46	186 86	....	....	72 60	1,550 70
August......	20 69	509 36	100 99	104 75	....	11 25	747 04
September...	4 48	....	49 45	38 96	....	6 50	99 39
October......	89 45	1,691 33	150 60	71 32	.. ..	....	2,002 70
November...	17 12	49 58	408 83	82 18	....	20	559 16
December....	....	29 95	473 10	31 05	....	2 40	536 50
1909.							
January	81 24	1,307 25	3,498 38	304 25	....	....	5,191 12
February	....	....	383 69	443 87	....	....	827 56
March	....	....	660 92	265 66	....	1 00	927 58
Totals.....	1,188 19 6,457 79	5,007 96	6,887 86 100 00	1,795 51	12 80	630 15	15,522 47 6,557 79
							22,080 26

SCHEDULE C.—Showing the Mills (including the Portable Mills) operating within the

Mill Owner.	Location of Mill.	Berth No.	Species of Timber Cut.	Lumber. Manufactured Ft. B. M.	Sold Ft. B. M.	On Hand Ft. B. M.
Isaac Gagnon	Athabaska L'dg.	1,298	Spruce	200,000	140,000	126,000
D. R. Fraser & Co., and John Walter	Edmonton and Strathcona	1,306	....	662,979	1,890,268	662,972
Henry Meyer	Berth	1,308	....	238,913	150,433	263,960
J. A. L. McDougall	"	1,309	....	....	13,620	56,380
H. L. McInnis	Pickardville	1,329	....	739,471	156,637	532,834
F. C. Papineau	Berth	1,337	....	42,700	171,720	6,000
A. D. McDiarmid	....	1,347	....	....	....	241,848
R. A. McDonald	....	1,357	....	....	....	135,420
J. E. Gibeault	....	1,381	....	35,272	64,214	25,635
R. T. Telford	....	1,386	....	....	122,000	146,000
White & Short	....	1,505	....	230,000	26,000	204,000
E. J. Dowsett	....	1,515	....	....	....	....
Amedee Roy	....	1,526	....	....	....	64,244
Wm. Brunelle	Chicken Hill	1,571	....	33,650	1,500	32,150
John Walter	Edmonton and Strathcona	Sp'l permit Order in Council. 10-7-'07,	....	3,449,466	1,461,013	2,243,274
Edmonton Lumber Co.	Edmonton	do	....	339,048	257,658	81,390
				5,971,499	4,455,063	4,822,107
John Walter	Edmonton and Strathcona	S. L. No. 33	....	485,737	747,776	....
			Total	6,457,236	5,202,839	4,822,107

Edmonton Agency, under Government Permits, for the Fiscal Year ending March 31, '09.

Log Count.			Average per Log Ft. B. M.	Railway Ties.			Average Price of Lumber per M. ft.	No. of Returns made.	Date of Last Return.	Remarks.
Logs Cut.	Logs Manufactured.	Logs on Hand.		Manufactured.	Sold.	On hand.				
...	3,000	700	66·6	...	...	...	$ 20.00	4	Mar. 31, '09	
...	...	...	...	...	...	...	...	...	...	
...	6,946	10,990	95·45	...	...	...	12.00	3	Dec. 31, '08	
...	2,590	...	92·24	...	...	...	10.00	4	Mar. 31, '09	
...	...	1,300	...	...	...	...	15.00	2	Sept. 30, '08	
...	14,498	...	51·	...	...	...	15.00	4	Mar. 31, '09	Lath—
386	1,030	50	41·47	...	...	...	11.00	3	Dec. 31, '08	Manuf'd......9,000
...	...	...	...	...	...	...	...	...	Apr. 17, '08	Sold..........9,000
...	...	...	...	...	...	...	...	...	Apr. 30, '08	On hand..........
...	592	2,628	59·5	...	...	...	12.90	3	Dec. 31, '08	
...	...	...	...	...	...	...	18.00	4	Mar. 31, '09	Shingles—
4,200	4,600	...	50·	...	...	...	16.00	4	Mar. 31, '09	Manuf'd..... 96,250
389	300	89	...	...	...	...	...	2	Dec. 31, '08	Sold 96,250
...	...	40	...	...	...	...	...	...	Dec. 31, '07	On hand..........
3,925	775	3,152	44·8	...	...	...	15.00	1	Mar. 31, '09	
...	...	...	...	...	...	...	...	...	...	Shingles— Manuf'd. ...199,750 Sold.. .....111,750 On hand.....88,000
...	86,288	96,687	39·19	26,798	26,798	...	16.00	4	Mar. 31, '09	
7,434	6,585	849	51.4	...	...	...	12.00	3	Dec. 31, '08	M'f'd. Sold. On Hd.
16,328	127,204	116,485	...	26,798	26,798	...	...	...	Lath...........	9,000 9,000 ....
2,956	9,223	...	51·5	...	...	...	...	...	Shingles........	296,000 208,000 88,000
19,284	136,427	116,485	...	...	...	...	...	...	...	...

Certified correct.

K. W. MACKENZIE,
Crown Timber Agent.

SCHEDULE D.—GENERAL Office Return of the Crown Timber Agency, Edmonton, for Fiscal Year ending March 31, 1909.

Particulars.	Number, &c.	As compared with previous year, increase.	As compared with previous year, decrease.
Letters received	.....	.....	.....
Letters written	.....	.....	.....
Permits subject to dues issued	366	272	.....
Free permits issued	1,478	1,000	.....
Seizures made	57	25	.....
Mill returns received and verified	292	.....	98
Mills operating under government license	9	.....	.....
" " government permits	16	6	.....
Quantity of lumber manufactured, under license	9,679,117	.....	6,424,970
" " sold, "	7,112,690	5,938,534	.....
" " on hand, "	8,304,652	714,609	.....
Average price at which lumber sold	$13.70	.....	.....
Hay permits issued, Dominion lands	362	139	.....
" " school "	172	.....	8

Correct correct.

K. W. MACKENZIE,
Crown Timber Agent.

No. 26.

REPORT OF THE CROWN TIMBER AGENT AT PRINCE ALBERT.

DEPARTMENT OF THE INTERIOR,
DOMINION LANDS AND CROWN TIMBER OFFICE,
PRINCE ALBERT, SASKATCHEWAN, April 14, 1909.

The Commissioner of Dominion Lands,
Ottawa, Ont.

SIR,—I have the honour to submit for your consideration the annual report of this office for the fiscal year ending March 31, 1909.

Attached hereto you will find the following detailed statements:—

Schedule 'A,' being a statement showing receipts from timber, grazing and hay on Dominion lands.

Schedule 'B,' being a statement showing saw-mills operating under license.

Schedule 'C,' being a statement showing saw-mills (including portable mills) operating under government permits.

Schedule 'D,' being a statement of the general office work performed.

These statements show a decided increase over the preceding year both in volume of work and revenue collected, the total receipts being $38,229.53, as against $28,333.74 for the previous twelve months.

The sales of lumber manufactured under license show an increase of 13,362,450 feet, while the average price per thousand feet shows $17.54⅗, being a reduction of $3.35⅗ as compared with last year.

The average number of feet per log on licensed berths is shown as 58¹⁴⁄₁₅, and on permit berths as 30⅔.

TIMBER PERMITS.

The number of permits issued is 1,357, an increase of 283 over the previous year, covering the following quantity of timber :—

Building logs (lineal feet)	235,225
Lumber (feet B.M.)	5,111,010
Shingles	52,000
Roof poles	185,882
Fence rails	302,408
Fence posts	899,012
Railway ties	30,901
Cordwood (cords)	18,344

SEIZURES.

The number of seizures made during the year is 92, an increase of 46 over the previous year, covering the following quantity of timber :—

Lumber (feet B.M.)	700,641
Fence posts	17,887
Railway ties	315
Cordwood (cords)	976

In conclusion I would call your attention to the fact that the revenue as shown by this report does not include the total revenue derived from this district as a large number of licensed berths in the eastern portion of the district, on which operations are being carried on, report to the Winnipeg Crown Timber office and the revenues derived therefrom are included with that of the Winnipeg office.

Your obedient servant,

GEO. L. DEMPSTER,
Crown Timber Agent.

SCHEDULE A.—STATEMENT of Receipts from Crown Timber Agency at Prince Albert for Fiscal Year ending March 31, 1909.

Month.	Ground rent under license.	Royalty dues under license.	Permit fees, dues and rental.	Seizures.	Hay permits fees and dues.	Totals.
1908.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
April	3,723 00	1,800 52	133 10	587 96	81 05	6,325 63
May	5 00	2,346 27	307 50	....	74 20	2,732 97
June	....	....	59 35	47 80	101 00	208 15
July	....	6,310 05	57 15	27 00	132 90	6,527 10
August	66 66	....	4 50	2 05	31 50	104 71
September	250 00	391 33	50 05	10 50	....	701 88
October	303 56	60 71	87 35	... .. .	2 10	453 72
November	....	6,438 60	470 10	159 00	2 00	7,069 70
December	5 15	....	651 20	35 95	2 50	694 80
1909.						
January	2 18	998 52	839 55	232 25	50	2,073 00
February	.. ..	8,996 75	1,072 85	341 82	50	10,411 92
March	....	101 22	731 70	91 53	1 50	925 95
Totals	4,355 55	27,443 97	4,464 40	1,535 86	429 75	38,229 53
Collected at Head office	4,899 81	....	100 00	....	....	4,999 81
						43,229 34

SCHEDULE C.—SHOWING the Mills (including the Portable Mills) operating within ending

Mill Owner.	Location of Mill.	Berth No.	Species of Timber Cut.	Lumber. Manufactured. Ft. B.M.	Sold. Ft. B.M.	On hand. Ft. B.M.
Crowston, Wm	9-42--16 W 2	853	Spruce	114,606	114,606	
Garneau, Laurence	25-15-4 W 3	1172	"			
Johnston and Brostrom	15-50-27 W 2	876	"	8,000		8,000
Carrot River Lumber Co	3-48-13 W 2	1544	"			
Morrow, W. H	24-46-13 W 2	757	"	86,938		86,938
Meier, John F.	18-50-14 W 2	1408	"			
Sansfield and Adams	Halcro	1507	Spruce and poplar.			
Otte, Joseph	34-49-5 W 3	1459	"	188,416	95,073	93,343
Ross Bros	Turtle Lake	1556	"			
Marcotte, Alcide	17-45-4 W 2	1580	"			
Hendrikson and Johnson						
				397,960	209,679	188,281

the Prince Albert Agency, under Government Permits, for the Fiscal Year March 31, 1909

Log Count.			Average per Log. Ft. B.M.	Railway Ties.			Average price of lumber per M. feet.	No of returns made.	Date of last return.	Remarks.
Logs Cut.	Logs manufactured.	Logs on hand.		Manufactured.	Sold.	On hand.				
							$ cts.			
8,097	5,097	3,000	22	Nil.	Nil.	Nil.	20 00	4	March 31, 1909..	
8,500	....	8,500	......	......	.....	......	....	4	" " ..	
*800										
2,300	296	2,804	27	8,673	8,673	Nil.	....	4	" " ..	
4,283	....	4,283	. ..	.. ..	....	....	....	1	Dec. 31, '08. ...	
1,738	1,738	....	.....	......	......	......	... .	1	March 31, 1909..	
....	... .	... .	..	......	......	... .	....	....	... .	No returns
....	....	....	....	....	......	.....		...	....	"
4,568	4,338	230	43	... .	......	....	14 25	2	Sept. 30, 1908...	
2,893	....	2,893	. .	....	......	......	....	1	Dec. 31, 1908....	
....	....	....	.. .	.....	......	......	....	...	....	"
....	....	....	...	....	. ..	......	....	....	....	"
33,179 Less *800	11,469	21,710	30⅔	8,673	8,673	Nil.	17 12½	17		

*Show amount on hand April 1, 1980.

Certified correct.

GEO. L. DEMPSTER,
Crown Timber Agent.

SCHEDULE D.—GENERAL Office Return of the Crown Timber Agency, Prince Albert, for Fiscal Year ending March 31, 1909.

Particulars.	Number, &c.	As compared with previous year. Increase.	As compared with previous year. Decrease.
Letters received	15,442	2,063	
Letters written	13,081	3,113	
Permits subject to dues issued	370	283	
Free permits issued	987	....	
Seizures made	92	46	
Mill returns received and verified	78	16	
Mills operating under government license	6	....	
" " " permits	11	5	
Quantity of lumber manufactured under license	39,435,674	....	10,773,116
" " sold under license	48,734,960	13,362,450	
" " on hand under license	20,670,864	....	9,299,286
Average price at which lumber sold	$17.54⅝	....	$3.35⅝
Hay permits issued	176	106	

Certified Correct.

GEO. L. DEMPSTER,
Crown Timber Agent.

No. 27.

REPORT OF THE CROWN TIMBER AGENT AT NEW WESTMINSTER.

DEPARTMENT OF THE INTERIOR,
DOMINION LANDS AND CROWN TIMBER OFFICE,
NEW WESTMINSTER, B.C., May 14, 1909.

The Commissioner of Dominion Lands,
Ottawa, Ont.

SIR,—I have the honour to submit herewith my annual report covering the fiscal year ending the 31st of March last. In submitting this report I may say that it gives me pleasure to be able to state that the condition of the lumber business in this province has improved considerably during the past three months, and I consider that with careful management the business this year will be found very satisfactory indeed. The demand from the prairie provinces this spring is much in excess of last year, and as retail stocks on hand there are very much below the average it is expected that with the increase of population the demand will continue all through the summer months. Considerable railway extensions are also contemplated and these will add their quota to the demand.

Schedule 'A,' which is inclosed, shows the receipts of this office for the year, amounting to $48,787.39, and the amount collected at head office on account of this agency, $6,948.86. This is a considerable falling off from the previous year, when the receipts of this office were $63,670.77, and is explained by the fact that during the latter part of last year the mills in the interior found themselves with large stocks of lumber on hand produced by high-priced labour and which it was impossible to dispose of even at the cost of production. Conditions are, however, improved, and the companies are now finding it much easier to meet their obligations.

Schedule 'B,' which is inclosed, shows saw-mills operating in the Railway Belt under government licenses, also shows the names of licensees operating on Dominion lands and who have no saw-mills in connection therewith. This schedule shows that approximately 53,923,157 feet board measure of saw logs was cut during the year. Out of this amount and what was on hand from the previous year, 54,621,244 feet board measure was sold, leaving 28,718,487 feet board measure on hand. The amount shown on hand is considerably less than last year, but does not represent the actual lumber on hand at the different mills for the reason that a number of the larger companies have been placed in a position to make returns on the log scale at the end of each quarter, and while the logs are shown as sold this is not the ease, as in many instances it is months afterwards before they are manufactured into lumber and placed in the yard to be finally disposed of. This system of returns, however, has been found to be very much more satisfactory than the old method of returns on the mill product.

Schedule 'C,' which is also inclosed, gives information relating to the number of letters received and written, permits and seizures made, mill returns received, &c., and will go to show that while the revenue of the office during the year under review has been less than for the previous year the general work of the agency has increased to a very great extent.

Your obedient servant,

JAMES LEAMY,
Crown Timber Agent.

SCHEDULE A.—STATEMENT of Receipts from Crown Timber Agency at New Westminster for Fiscal Year ending March 31, 1909.

Month.	Ground Rent under License.	Royalty Dues under License.	Permit Fees Dues and Rental.	Seizures.	Totals.
1908.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
April	7,729 88	1,023 87	162 75	....	8,916 50
May	2,014 88	1,681 21	434 97	406 22	4,537 28
June	5,636 33	293 68	81 32	610 40	6,621 73
July	85 45	2,591 48	124 50	115 14	2,916 57
August	14 83	509 13	126 00	642 48	1,292 44
September	....	3,021 14	225 75	49 50	3,296 39
October	....	3,993 14	71 70	21 75	4,086 59
November	....	3,257 76	200 75	45 00	3,503 51
December	59 52	3,080 60	397 55	9 00	3,546 67
1909.					
January	....	3,911 86	572 50	186 78	4,671 14
February	....	841 30	458 98	19 65	1,319 93
March	813 69	2,665 80	241 50	357 45	4,078 64
Totals	16,354 78	26,870 97	3,098 27	2,463 37	48,787 39
Collected at Head Office	6,948 86	....	....	....	6,948 86
					55,736 25

SCHEDULE C.—GENERAL Office Return of the Crown Timber Agency, New Westminster, B.C., for Fiscal Year ending March 31, 1909.

Particulars.	Number, &c.	As compared with previous year. Increase.	As compared with previous year. Decrease.
Letters received	3,867	1,682	
Letters written	4,850	1,143	
Permits subject to dues issued	72	30	
Free permits issued	10	9	
Seizures made	18	6	
Mill returns received and verified	1,465		
Mills operating under Government license	16		
" " " Government permits	Nil.		
Quantity of lumber manufactured, under license	53,923,157		20,168,523
" " sold, " "	54,621,244	3,479,851	
" " on hand, " "	28,718,487		2,024,778
Average price at which lumber sold	$14.20		
Hay permits issued	Nil		

No. 28.

REPORT OF THE INSPECTOR OF RANCHES.

DEPARTMENT OF THE INTERIOR,
DOMINION LANDS AND CROWN TIMBER OFFICE,
CALGARY, ALBERTA, April 13, 1909.

The Commissioner of Dominion Lands,
Ottawa, Ont.

SIR,—I have the honour to submit herewith my report of the transactions of the office of the Inspector of Ranches for the fiscal year ending March 31, 1909.

During the year 1,740 inspections have been made and in the discharge of these duties 11,692 miles have been travelled by rail and 5,796 miles were covered by wagon. This is the mileage of Mr. Robertson and myself.

In comparing the number of inspections for the past year with the year previous it will be observed that the number is not as great, but this is due to the following reasons: During the months of April, May and June Mr. Robertson, of this office, was engaged in seed grain distribution, and I myself was engaged in the same work for April and a good part of May. When the pre-emption rush in the month of September was on, Mr. Robertson spent a greater part of the month giving them assistance in the land office here. Then during the months of December, January and February when there was no homestead inspector, Mr. Robertson was acting inspector.

Inclosed for your information is a comparative statement by years of stock shipped and handled from the ranching districts almost entirely. It will be noticed that the stock industry is on the increase and that a considerable advance has been made since the hard winter of 1906-7, when the loss to stock was extremely heavy. It will also be observed that the value of stock for this past year runs into the millions.

Cattle and all stock have wintered well on the range and up to this date there have been no losses because of bad weather conditions. However, during the month of October last the sheep men in the Walsh and Maple Creek districts experienced considerable loss because of the heavy fall of wet snow, for which they were unprepared, as their flocks were on the summer ranges away from the shelter provided at headquarters.

Your obedient servant,

ALBERT HELMER,
Inspector of Ranches.

STATEMENT showing Stock Shipments.

MAIN LINE.—MORLEY TO MOOSEJAW.

Export cattle	32,890
Other cattle	13,790
Horses	9,183
Sheep	29,278

CROWSNEST.—DUNMORE TO PINCHER. ALBERTA RAILWAY AND IRRIGATION CO.

Export cattle	9,471
Other cattle	11,405
Horses	2,001
Sheep	8,665

TOTAL FOR 1908.

Export cattle	48,290
Other cattle	30,516
Horses	12,450
Sheep	38,605

MACLEOD BRANCH.

Export cattle	4,763
Other cattle	4,141
Horses	1,108
Sheep	387

EDMONTON BRANCH.

Export cattle	1,166
Other cattle	1,580
Horses	158
Sheep	285

CATTLE FOR YEAR 1908.

Total export	61,810
To Winnipeg	17,370
To Coast	9,384
To Butchers	10,428
Total	98,992

COMPARATIVE STATEMENT FOR 1905, 1906, 1907 AND 1908.

1905.

Horses	12,882 ;	Carloads	644
Cattle	84,405 ;	"	4,636
Sheep	40,810 ;	"	204
Export cattle	49,991	"	2,940

1906.

Horses	19,549 ;	Carloads	977
Cattle	114,651 ;	"	6,370
Sheep	57,024 ;	"	285
Export cattle	74,733 ;	"	4,383

1907.

Horses	11,382 ;	Carloads	566
Cattle	80,043 ;	"	4,447
Sheep	28,573 ;	"	122
Export cattle	42,960 ;	"	2,527

1908.

Horses	13,636 ;	Carloads	680
Cattle	98,992 ;	"	5,748
Sheep	40,753 ;	"	650
Export cattle	61,810 ;	"	3,628

1907.

Canadian cattle to Chicago:—
Via C. P. R. 249 cars,
Via G. N. R. 190 cars.

1908.

Canadian cattle to Chicago:—
Via C. P. R. 154 cars,
Via G. N.R. 61 cars.

13,636	horses represent	$1,636,320.00	at $120.00 each.
37,182	cattle (butcher's)	$1,102,916.00	at $ 38 00 each.
40,753	sheep "	$ 244,518.00	at $ 6 00 each.
61,810	export cattle "	$3,090.500 00	at $ 50.00 each.

SUMMARY of Work performed by A. Helmer, Inspector of Ranches, and Stanley M. Robertson, Assistant to Inspector of Ranches, from April 1, 1908, to March 31, 1909.

Land inspections made	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Albert Helmer, Inspector of Ranches.	Seed grain.	188	83	503	72	33	Forest reserve.	165	12	24	3	200
Miles driven.......	.....	485	215	327	574	315	221	460	195	173	200	304
Miles by rail..	.....	2,022	835	598	740	672	300	998	866	212	300	747
Stanley M. Robertson asst. to Inspector of Ranches.	Seed grain.	Seed grain.	Seed grain part.	63	74	173	11	130	9	28	nil. With Hmsd Insp.	69
Miles driven..	.....	.....	25	373	240	415	101	327	155	300	nil.	391
Miles by rail........	.....	.....	100	212	362	882	384	400	308	58	nil.	696

No. 29.

REPORT OF THE ACCOUNTANT.

DEPARTMENT OF THE INTERIOR,
ACCOUNTS BRANCH,
OTTAWA, June 10, 1909.

W. W. CORY, Esq.,
Deputy Minister of the Interior,
Ottawa.

SIR,—I have the honour to submit herewith statements of revenue collected from various sources during the fiscal year ended March 31, 1909, as follows :—

A. Dominion lands, including Yukon Territory......	$2,277,678 09
B. Ordnance lands..........................	205,749 96
C. School lands............................	687,422 74
D. Registration fees........................	1,352 13
E. Fines and forfeitures, N.W.T..............	241 00
F. Fines under Immigration Act................	40 00
G. Casual revenue..........................	26,224 29
H. Seed grain repayments....................	53,590 86
	$3,252,299 07

A statement of revenue on account of Dominion lands (Marked I.) shows the receipts monthly, classified under subheads; statement (Marked J) shows a comparison between the receipts on account of Dominion lands for the fiscal year ended March 31, 1909, as compared with the revenue of the previous twelve months.

I would draw attention to the total gross receipts on account of Dominion lands, which are the largest in the history of the department. I might also point out that the gross receipts from all sources for the fiscal year 1908-9 amount to $3,252,299.07, or almost as much as was received during the ten years from 1886-87 to 1895-96, inclusive.

Your obedient servant,

CHAS. H. BEDDOE,
Superintending Accountant.

SESSIONAL PAPER No. 25

A.—Dominion Lands Revenue (cash and scrip) for the fiscal year ended March 31, 1909.

Agencies.	Cash.	Scrip.	Total Cash and Scrip.
YUKON TERRITORY.	$ cts.	$ cts.	$ cts.
Sales of lands	7,495 21	480 00	7,975 21
Rentals of lands	9,827 86	.....	9,827 86
Map sales, office fees, &c	41 00	.....	41 00
Timber dues	26,482 64	.....	26,482 64
Hay permits	140 50	.....	140 50
Coal lands	371 73	.....	371 73
Mining fees	88,838 50	.....	88,838 50
Export tax on gold	81,585 07	.....	81,585 07
Free certificates for export of gold	166 00	.....	166 00
Hydraulic leases	4,488 81	.....	4,488 81
Dredging leases	10,272 07	.....	10,272 07
Homestead fees	80 00	.....	80 00
Improvements	135 00	.....	135 00
Rent of water power	250 00	.....	250 00
Suspense account	2,350 85	.....	2,350 85
Refunds of refunds	36 00	.....	36 00
	232,561 24	480 00	233,041 24
DOMINION LANDS AGENCIES.			
Battleford	96,793 72	660 00	97,453 72
Brandon	23,876 14	2,249 43	26,125 57
Calgary	139,199 90	2,800 00	141,999 90
Dauphin	25,664 08	.....	25,664 08
Edmonton	111,074 70	.....	111,074 70
Estevan	38,508 26	424 60	38,932 86
Humboldt	41,738 44	295 74	42,034 18
Kamloops	10,109 60	1,554 89	11,664 49
Lethbridge	598,740 75	80 00	598,820 75
Moosejaw	242,037 22	6,794 25	248,831 47
New Westminster	2,742 43	80 00	2,822 43
Prince Albert	34,526 55	880 00	35,406 55
Red Deer	42,873 88	.....	42,873 88
Regina	76,882 25	.....	76,882 25
Winnipeg	30,754 97	3,837 36	34,592 33
Yorkton	40,175 07	.....	40,175 07
	1,555,697 96	19,657 27	1,575,354 23
CROWN TIMBER AGENCIES.			
Battleford	364 45	.....	364 45
Brandon	480 60	.....	480 60
Calgary	18,756 13	.....	18,756 13
Dauphin	9,284 69	.....	9,284 69
Edmonton	21,437 31	.....	21,437 31
Estevan	105 50	.....	105 50
Humboldt	238 00	.....	238 00
Lethbridge	247 90	.....	247 90
Moosejaw	209 72	.....	209 72
New Westminster	55,736 25	.....	55,736 25
Prince Albert	42,799 59	.....	42,799 59
Red Deer	375 51	.....	375 51
Regina	87 25	.....	87 25
Winnipeg	92,842 28	.....	92,842 28
Yorkton	389 70	.....	389 70
	243,354 88	.....	243,354 88
Carried forward	2,031,614 08	20,136 27	2,051,750 35

A.—DOMINION Lands Revenue (cash and scrip) for the fiscal year ended March 31, 1909.—*Continued.*

Agencies.	Cash.	Scrip.	Total Cash and Scrip.
	$ cts.	$ cts.	$ cts.
Brought forward	2,031,614 08	20,136 27	2,051,750 35
MISCELLANEOUS.			
Rocky Mountains Park	31,321 20		31,321 20
Survey fees	42,388 31		42,388 31
Irrigation fees	367 00		367 00
Patent fees	991 50		991 50
Map sales, office fees, &c	5,352 20		5,352 20
Fees *re* Board of Examiners, D.L.S	1,040 00		1,040 00
Homestead fees	20 00		20 00
Sales of lands	224 62		224 62
Rentals of lands	10 00		10 00
Mining fees	3,799 10		3,799 10
Grazing lands	53,312 79	3,257 84	56,570 63
Hay permits	5,781 30		5,781 30
Coal lands	55,164 16		55,164 16
Dredging leases	916 27		916 27
Stone quarries	906 38		906 38
Rent of water power	292 28		292 28
Suspense account	1,982 31		1,982 31
Refunds of refunds	18,069 26		18,069 26
Miscellaneous	731 22		731 22
	222,669 90	3,257 84	225,927 74
	2,254,283 98	23,394 11	2,277,678 09
Refunds	101,029 37	1,434 41	102,463 78
	2,153,254 61	21,959 70	2,175,214 31

CHAS. H. BEDDOE,
Superintending Accountant.

DEPARTMENT OF THE INTERIOR,
ACCOUNTS BRANCH,
OTTAWA, June 10, 1909.

B.—STATEMENT of Ordnance Lands Revenue for the Fiscal Year ended March 31, 1909.

1908—	
April	$ 280 50
May	713 90
June	726 75
July	960 41
August	946 60
September	402 45
October	478 72
November	130 00
December	249 88
1909—	
January	409 85
February	200.202 70
March	248 20
Total	$205,749 96

CHAS. H. BEDDOE,
Superintending Accountant.

DEPARTMENT OF THE INTERIOR,
ACCOUNTS BRANCH,
OTTAWA, June 19, 1909.

C.—STATEMENT of Receipts on Account of School Lands for the Fiscal Year ended March 31, 1909.

Month.	Manitoba School Lands.	Saskatchewan School Lands.	Alberta School Lands.	Total.
1908.	$ cts.	$ cts.	$ cts.	$ cts.
April	5,007 97	12,915 78	4,170 34	22,094 09
May	9,025 47	5,657 40	2,488 31	17,171 18
June	30,590 44	7,595 43	3,882 58	42,068 45
July	20,356 92	4,007 82	5,187 47	29,552 21
August	4,008 29	3,803 85	5,062 82	12,874 96
September	2,522 26	2,239 70	3,577 04	8,339 00
October	43,667 04	21,778 29	14,053 59	79,498 92
November	131,517 80	50,326 39	54,523 57	236,367 76
December	62,516 09	25,062 57	23,999 82	111,578 48
1909.				
January	28,250 44	15,161 07	12,429 97	55,841 48
February	12,574 01	10,032 90	8,871 57	31,478 48
March	16,057 36	14,405 76	10,094 23	40,557 35
	366,094 09	172,986 96	148,341 31	687,422 36
Add refund cheque No. 272, account sales (princ.) returned by Canadian Northern Railway not used	38	......	......	38
	366,094 47	172,986 96	148,341 31	687,422 74

CHAS. H. BEDDOE,
Superintending Accountant.

DEPARTMENT OF THE INTERIOR,
ACCOUNTS BRANCH,
OTTAWA, June 10, 1909.

D.—STATEMENT of Registration Fees in the Yukon Territory for the Fiscal Year ended March 31, 1909.

Month.	District.	Registrar.	Amount.
1908.			$ cts.
April	Yukon Territory	Nap Laliberte	136 28
May	"	"	62 75
June	"	"	89 50
July	"	"	106 45
August	"	"	132 10
September	"	"	180 90
October	"	"	138 90
November	"	"	200 50
December	"	"	113 10
1909.			
January	"	"	71 10
February	"	"	32 25
March	"	"	88 30
			1,352 13

CHAS. H. BEDDOE,
Superintending Accountant.

DEPARTMENT OF THE INTERIOR,
ACCOUNTS BRANCH,
OTTAWA, June 10, 1909.

E.—STATEMENT of Fines and Forfeitures in the Northwest Territories for the Fiscal Year ended March 31, 1909.

Month.	From whom received.	Amount.
1908.		$ cts.
August	David Harris	10 00
September	Henry Hunter	25 00
October	J. Whitehead, J. Pedersen, A. L. South, H. Benbow	81 00
1909.		
January	Hudson's Bay Co., R. Massey, Thos. Wallace, W. Connell	100 00
February	Horace Halcrow	25 00
		241 00

CHAS. H. BEDDOE,
Superintending Accountant.

DEPARTMENT OF THE INTERIOR,
ACCOUNTS BRANCH,
OTTAWA, June 10, 1909.

F.—STATEMENT of Fines collected under the Immigration Act for the Fiscal Year ended March 31, 1909.

Month.	From whom received.	Amount.
1909.		$ cts.
March	Wm. Roberts, Thos. Pikering	40 00

CHAS. H. BEDDOE,
Superintending Accountant.

DEPARTMENT OF THE INTERIOR,
ACCOUNTS BRANCH,
OTTAWA, June 10, 1909.

G.—STATEMENT of Casual Revenue for the Fiscal Year ended March 31, 1909.

Name.	Particulars.	Amount.
		$ cts.
J. W. Greenway	Refund acct. travelling expenses	158 30
J. M. Bender	" salary cheque for June, '06	25 00
H. N. Topley	" travelling expenses	1 00
D. D. Penner	" redemption of lien	19 00
B. Neville	Proceeds of sale of tents	80 00
R. G. Wilkinson	" "	10 00
H. H. Rowatt	Refund acct. travelling expenses	228 05
L. P. O. Noel	" contingencies, January, 1908	5 36
L. P. O. Noel	" Mrs. Noel's railway fare	31 45
E. O'Kelly	" expenses	42
F. A. McDiarmid	" survey of 1907	4 25
D. H. Nelles	" "	50
J. B. Challies	" travelling expenses	4 80
S. Maber	" "	100 94
H. H. Rowatt	" "	6 25
Jas. Foster, per Immigration Commissioner	" immigration cheque No. 10519 of Nov. 15, 1907	9 00
W. W. Cory	" travelling expenses	93 10
W. C. Jaques	" survey of 1907	18 00
Albert McLeod	" salary for March, 1908, paid twice	100 00
H. Douglas	" over-payment to J. H. Ashdown in March, 1908	30

G.—STATEMENT of Casual Revenue for the Fiscal Year ended March 31, 1909—*Con.*

Name.	Particulars.	Amount.
		$ cts.
O. A. Miquelon, per Immigration Commissioner	Proceeds of sale of tents	380 00
J. D. Page	Sale of horse used at Detention Hospital, Quebec	100 00
J. T. Lithgow	Refund acct. travelling expenses	102 00
F. H. Gosselin	" "	86 00
J. R. Sutherland	" overpayment acct. C. Sharkaye's salary for March, 1908	7 00
M. J. Cullen	" travelling expenses	109 80
J. B. McNamee, per Immigration Commissioner	" double payment re burials	12 00
J. R. Sutherland	" overpayment on postage March, 1908	20
Immigration Commissioner, Winnipeg	Proceeds of sale of furniture of Immigration Hall at East Selkirk	425 00
C H. Beddoe	Refund acct. travelling expenses	50 70
J. J. McArthur	" survey of 1907	4 05
A. J. Brabazon	" "	9 75
Geo. White-Fraser	" "	2 50
R. D. Foley	" contingencies of October, 1907	13 70
F. S. Neill, per Comptroller Dawson	Amount paid for canoe Crown Timber Office, Dawson	15 00
Thos. Fletcher, per H. Douglas	Refund acct. plough bolts in October, 1907	1 35
Jan. Siatocks, per Immigration Commissioner	" redemption of lien	17 50
N. Demaczenski, per Immigration Commissioner	" "	11 18
Robt. Arnold, per Immigration Commissioner	" overpayment on oats	22 50
Joseph Reichert, per Immigration Commissioner	" redemption of lien	14 10
N. Peudzilo, per Immigration Commissioner	" "	12 55
I. S. Doze	Sale of horse	199 50
N. Morak, per Immigration Commissioner	Refund acct. redemption of lien	11 50
J. W. Robertson	" salary for March, 1908, paid twice	100 00
J. D. Craig	" Alaska boundary survey of 1906-07	172 22
W. F. Ratz	" " "	106 60
W. F. Ratz	" " "	25
J. D. Craig	" " "	15 50
Dominion Express Co., per High Commissioner, London	" general average *S.S. Bavarian*, Nov. 5, 1905	2 78
C. W. Speers	" duplicate charge in contingent acct. of Nov. 1907	9 80
C. A. Bigger	" amounts paid to D. McLean ($30.00) and H. B. Kihl ($63.00) re Geodetic Survey, 1907	93 00
Jas. White	" immigration expenses, 1907	10 00
Johan Reichert, per Immigration Commissioner	" redemption of lien	4 50
Geo. J. Johnston	" immigration expenses 1907	10 00
H. Charlebois	" " "	10 00
Comptroller of Yukon Territory	Unclaimed estates in Yukon	6,084 66
W. A. Fuller, per Immigration Commissioner	Forfeiture of Immigration Cheque No. 9514 acct. stolen supplies	67 50
W. F. Moore, per Immigration Commissioner	Refund of Immigration Cheque No. 9165, being duplicate payment	10 00
New Westminster Insane Asylum	Refund of amount received for maintenance of Robert Flett, December, 1907, Jan. 1909	77 50
N.W. Mounted Police "B" Division	Refund of amount expended re transportation of Robert Flett in 1906-07	1,385 17
Geo. A. Johnston	Refund acct. immigration expenses in 1907	10 00
H. H. Gordon, per High Commissioner	" British Bonuses, February, 1908	14 60
Geo. A. Johnston	" immigration expenses, 1907	10 00
H. Charlebois	" " "	10 00
Immigration Commissioner, Winnipeg	Proceeds of sale of loads of straw	10 00
Jas. McDiarmid	Sale of old horse	25 00
J. C. Wilson Co	Discount on bill for envelopes re immigration	1 46
C. A. French	Refund acct. geographical survey of 1908	6 58
G. C. Rainboth	" boundary survey of 1906	85 25
		10,835 97

G.—STATEMENT of Casual Revenue for the Fiscal Year ended March 31, 1909—*Con.*

Name.	Particulars.	Amount.
Casual Revenue, Northwest Territories.		$ cts.
A. Larose	Liquor permit	2 00
Rev. F. Sevrier	"	1 00
Hudson's Bay Co.	"	50 35
" "	"	4 00
" "	"	3 00
Alex. Gardner	"	2 00
H. Winterton	"	2 00
L. L. Andrews	"	2 00
R. D. Rough	"	2 00
Wm. Campbell	"	2 00
Hudson's Bay Co	"	3 00
" "	"	3 00
Rev. C. G. Fox	"	2 00
Hudson's Bay Co.	"	4 00
E. Carter	"	2 00
O. Lacroix	"	4 00
Hudson's Bay Co.	"	49 00
" "	"	25 50
C. Wood	"	2 00
Wm. Cobban	"	2 00
J. F. Drummond	"	2 00
Fred Fisher	"	2 00
Matthew Buck	"	2 00
		172 85
Casual Revenue Relief Advances.		
Casual Revenue, repayments of Relief Mortgages and seed grain advances		10,780 20
Relief Mortgages 1876		847 86
Seed Grain Advances, 1894		1,380 47
" 1896		344 64
" 1900		95 47
" 1901		716 68
" 1905		1,050 15
		4,435 27
		26,224 29

CHAS. H. BEDDOE,
Superintending Accountant.

DEPARTMENT OF THE INTERIOR,
ACCOUNTS BRANCH,
OTTAWA, June 10, 1909.

H.—STATEMENT showing Repayments on account of Seed Grain Advances and Relief Mortgages for the Fiscal Year ended March 31, 1909.

—	Seed Grain Advances, 1908.	Seed Grain Advances, 1905.	Seed Grain Advances, 1901.	Seed Grain Advances, 1900.	Seed Grain Advances, 1896.	Seed Grain Advances, 1895.	Seed Grain Advances, 1894.	Seed Grain to Settlers Account, 1890.	Territorial Account, 1886-87-88.	Relief Mortgages, 1876.	Total.
	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
	45,719 32	1,050 15	716 68	95 47	344 64	1,247 23	1,380 47	1,143 80	1,045 24	847 86	53,590 86
Refunds	1,314 78	14 51	....	5 30	6 60	52 84	18 54	2 40	52	90	1,416 39
	44,404 54	1,035 64	716 68	90 17	338 04	1,194 39	1,361 93	1,141 40	1,044 72	846 96	52,174 47

CHAS. H. BEDDOE,
Superintending Accountant.

DEPARTMENT OF THE INTERIOR,
ACCOUNTS BRANCH,
OTTAWA, June 10, 1909.

I.—STATEMENT of Gross Receipts on account of Dominion Lands Revenue for the fiscal year ended March 31, 1909.

Month.	Homestead Fees.	Pre-emption & Purchased Homestead Fees.	Improvements.	General Sales of Lands.	Timber Dues.	Rental from Grazing Lands.	Export Tax on Gold, Mining Fees, Hay and Coal Lands, &c.	Rocky Mountains Park of Canada.	Survey Fees.	Map Sales, Rental, Office Fees and Miscellaneous.	Total.
1908.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
April	29,695 00	....	6,441 49	27,584 20	24,799 94	1,495 11	8,999 21	2,709 79	167 92	955 52	102,848 18
May	27,635 00	....	8,713 88	25,908 40	32,546 24	3,723 83	14,472 90	2,811 07	104 73	5,169 07	121,085 12
June	32,115 00	....	6,636 56	36,534 66	18,425 02	4,493 32	35,039 18	1,988 29	224 97	3,435 59	138,892 59
July	28,030 00	....	5,245 70	30,778 18	22,062 72	2,967 51	30,920 79	4,637 20	78 76	2,929 99	127,650 85
August	18,544 00	....	5,463 80	86,835 79	13,218 16	9,908 35	25,745 98	2,219 37	....	826 88	162,762 33
September	79,095 00	78,170 15	5,325 05	93,713 57	20,918 44	2,133 29	26,423 54	3,622 25	41,012 77	663 98	351,078 04
October	52,135 00	23,170 00	4,319 74	40,580 15	19,835 20	4,155 49	53,573 82	4,306 39	273 06	934 41	263,283 26
November	38,225 00	14,310 00	5,365 07	103,302 65	19,080 56	5,335 98	12,812 18	629 50	....	879 90	199,940 84
December	30,950 00	14,810 00	5,961 67	331,557 44	20,882 38	10,093 18	7,934 95	1,005 42	....	1,068 79	424,263 83
1909.											
January	13,040 00	5,715 00	4,279 13	36,296 81	33,193 65	1,967 63	14,776 57	2,048 75	128 50	1,243 12	112,689 16
February	13,610 00	4,110 00	6,400 89	65,475 56	27,855 17	3,426 94	7,209 39	699 67	....	19,123 76	147,911 38
March	25,965 00	9,510 00	6,775 88	72,874 87	17,020 04	3,612 16	15,063 66	4,643 50	397 60	6,015 69	161,878 40
	389,039 00	149,795 15	70,928 86	951,442 28	269,837 52	53,312 79	252,972 17	31,321 20	42,388 31	43,246 70	2,254,283 98

CHAS. H. BEDDOE,
Superintending Accountant.

DEPARTMENT OF THE INTERIOR,
ACCOUNTS BRANCH,
OTTAWA, June 10, 1909.

J.—DOMINION LANDS REVENUE.

STATEMENT of Gross Receipts (Cash and Scrip) on account of Dominion Lands Revenue for the fiscal year ended March 31, 1909, compared with the previous fiscal year.

Particulars.	Fiscal year ended March 31, 1909.	Fiscal year ended March 31, 1908.	Increase.	Decrease.	Net increase
	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
Dominion Lands Agencies	1,575,354 23	1,082,693 22	492,661 01	....	
Crown Timber Agencies	243,354 88	456,053 72	....	212,698 84	
Hay, Mining, Coal, Grazing, &c.	123,797 12	82,274 43	36,522 69	....	
Miscellaneous	70,809 42	180,587 83	....	109,778 41	
Rocky Mountains Park	31,321 20	27,232 87	4,088 33	....	
	2,044,636 85	1,833,842 07	533,272 03	322,477 25	
Yukon Territory	233,041 24	260,737 10	....	27,695 86	
	2,277,678 09	2,094,579 17	533,272 03	350,173 11	183,098 92

NOTE—Increase in Dominion Lands revenue $210,794.78.
Decrease in Yukon Territory revenue $27,695.86.

CHAS. H. BEDDOE,
Superintending Accountant.

DEPARTMENT OF THE INTERIOR,
ACCOUNTS BRANCH,
OTTAWA, June 10, 1909.

No. 30.

REPORT OF THE ORDNANCE AND ADMIRALTY LANDS BRANCH.

DEPARTMENT OF THE INTERIOR,
ORDNANCE AND ADMIRALTY LANDS BRANCH,
OTTAWA, April 30, 1909.

W. W. CORY, Esq.,
Deputy Minister of the Interior.
Ottawa.

SIR,—I have the honour to submit the following report upon the work in connection with this branch of the department covering the fiscal year ending March 31, 1909.

During the period covered by this report two sales of Ordnance lands by public auction were held, at Grand Falls, N.B., and Niagara-on-the-Lake, Ontario, respectively, a detailed report of which is given under the heading of these localities.

Regarding those properties previously sold or held under leases issued by the Imperial authorities, with the right of renewal and option of purchasing upon payment in cash of the amount of consideration money placed thereon, 16 full lots and 8 part lots situated in the several localities hereunder mentioned and in the annexed statement marked 'A,' have been paid for in full and letters patent issued therefor:—

(1) Chambly, P.Q.—Three lots, forming portions of the ordnance reserve situated within the limits of this village which were put up at public auction in 1905 and sold for the sum of $950 were paid for in full and letters-patent issued. The balance of purchase money received during the fiscal year was $237.50.

(2) Gloucester Township.—Sub-lot No. 21 of lot No. 21, Junction Gore, being a portion of the land in this township acquired for the purposes of the Rideau canal, but the same not being required for the use of the canal was transferred to this department to be dealt with in the usual manner. The lot in question was sold in 1905 for the sum of $500, and the balance of purchase money amounting to $100 having been paid within the last fiscal year, letters-patent were issued.

(3) Grand Falls, N.B.—A sale of ordnance lots was held in the town of Grand Falls in May last, at which six farm lots and twenty-two town lots were offered for sale. Three of the former were sold for the sum of $246, and all the latter were disposed of at an average price of $88.32 or a total of $1,943. The total amount realized by this was $2,189, one-fifth, or $437.80, being paid on account.

Nine other lots, forming part of the reserve in this locality and sold at various dates for the sum of $766.50 were paid for in full and letters-patent issued. The balance of purchase money received within the fiscal year was $197.88.

(4) Montreal.—In accordance with the provisions of the Act, Chapter 51, passed last session, confirming the orders in council of December 6, 1905, and July 27, 1907, St. Helen's Island in the St. Lawrence river opposite the city, and part of the Logan farm, now known as Lafontaine Park, were sold to the city of Montreal for the sum of $200,000. This sum was transferred to the credit of the Minister of Militia and Defence, as provided by the Act above mentioned.

(5) Niagara-on-the-Lake.—The five lots situated in this town, being part of the subdivision of the hospital lots, and which were withdrawn from sale in 1907, were again offered for sale by public auction in August last, and were sold for the sum of $1,765, an average price of $353 each and an advance of $515 on the upset price; one-fifth of the purchase money, or $353, being paid down at the time of sale.

Since the date of sale the balance of the purchase money on one of these lots was paid in full and letters-patent issued therefor.

(6) Ottawa.—The lots in this locality are leasehold properties held under provisions contained in the original leases issued by the Imperial authorities with the privilege of converting the leasehold rights into freehold upon payment in cash of the amount of consideration money placed thereon. Within the last fiscal year two whole lots and eight part lots were redeemed and letters-patent issued. The total sum received as consideration money was $836.33.

The following statements are hereto annexed:—

A.—Statement giving the number of lots and part lots sold or redeemed; the amounts for which such lots were originally disposed of and the sums received during the fiscal year as instalments or balances of purchase money.

B.—Statement naming the various localities where ordnance lands are situated on account of which moneys have been receive during the fiscal year.

C.—Statement showing the receipts each month of the fiscal year classified as fees, rent or interest equivalent to rent and principal.

D.—Statement showing amounts due and unpaid on account of purchase money and rent or interest. The total amount shown to be outstanding is $61,632.92.

The correspondence and general routine work in connection with this branch average about the same as for the previous fiscal period. The number of letters received, registered and filed was 441; number of letters written, copied and indexed 452, which, together with 613 letters in the form of accounts and circulars sent out makes a total of 1,045 letters mailed from this branch, an increase of 74 over last year. There were also 56 reports upon various ordnance lands matters prepared and submitted. The number of assignments received, examined and registered during the period covered by this report was 25, an increase of 2; 22 draft letters-patent were prepared and one new lease was issued.

There are 239 accounts with purchasers and tenants of ordnance lands now open in the ledgers of this branch, an increase of 24, necessitated by the sales held within the past year at Grand Falls and Niagara; these have been carefully and regularly posted. The receipt book, cash book and monthly statement book have been diligently and carefully kept, and a monthly return of all moneys received regularly furnished to the accountant of the department.

I beg to supplement the foregoing report upon the work in connection with the ordnance and admiralty lands by a synopsis of the work carried on in this branch in connection with the copying, comparing, recording, printing, indexing and filing of all the orders in council passed from time to time effectively dealing with and regulating the various important matters relating to the administration of this department in its many branches.

The number of orders in council passed during the last year was about the same as that of the previous year, and the volume and importance of the work done in connection with these valuable departmental records, in order that they may be available for immediate reference, cannot be overestimated.

The orders in council, as received, are copied, compared and entered in the record book kept expressly for that purpose, and a requisition issued on the superintendent of printing for a printed supply sufficient for departmental requirements. The proof is carefully read and corrected, and when the printed copies are received they are checked off, numbered and filed for future use. An alphabetical index of the orders passed each year is prepared and printed and a number of volumes of the orders bound for convenience of reference, and distributed among the various branches of the department.

Since the date of the last report the bound volumes of orders in council for the year 1904 were received and distributed among the several branches of the department; an index for the orders for 1905 prepared and printed, while the orders for that year have been collected and checked preparatory to being bound and are almost ready to be placed in the hands of the binder.

Orders in council altering or amending any of the existing regulations are, in accordance with the provisions of the Dominion Lands Act, published for four consecutive weeks in the *Canada Gazette*, and those affecting lands in the railway belt are, in addition, published in *British Columbia Gazette* for a similar period, and a return of these orders is made to the Senate and House of Commons within the first fifteen days after the opening of each session of parliament.

A record of the attendance of the numerous officials in the department is also carefully and regularly kept.

I have the honour to be, Sir,
Your obedient servant,

JOS. P. DUNNE,
Clerk in Charge of Ordnance and Admiralty Lands.

A.—STATEMENT giving the number of Lots and part Lots sold or redeemed; the amount for which such lots were originally disposed of and the sums received as instalments or balances of purchase money during the fiscal year ending March 31, 1909.

Locality.	Number of lots sold or redeemed.	Amount of consideration or purchase money.	Amount received on account during the fiscal year.	Remarks.
		$ cts.	$ cts.	
Chambly	3 lots	950 00	237 50	Balance of purchase money.
Gloucester	1 lot	500 00	100 00	" "
Grand Falls "	3 farm lots 22 town lots	2,189 00	437 80	First instalments.
"	9 lots	766 50	197 88	Balance of purchase money.
Montreal	St. Helen's Island and part of the Logan farm	200,000 00	200,000 00	Purchase price in full.
Niagara-on-the-Lake	5 lots	1,765 00	629 00	First instalment and balance of purchase money.
Ottawa "	2 whole lots 8 part lots	836 33	836 33	Consideration in full.
		207,006 83	202,438 51	
Refund		200,000 00	200,000 00	
		7,006 83	2,438 51	

JOS. P. DUNNE,
Clerk in Charge of Ordnance and Admiralty Lands Branch.

B.—STATEMENT naming the various localities where Ordnance Lands are situated on account of which moneys have been received during the fiscal year ending March 31, 1909.

Locality.	Amount.	Locality.	Amount.
	$ cts.		$ cts.
Amherstburg	2 00	Oxford	13 20
Burlington Beach	280 00	Prescott	2 00
Chambly	250 38	Quebec	800 00
Edmundston	1 00	Queenston	1 00
Elmsley	4 60	Sarnia	200 00
Fort Cumberland	50 00	Shelburne	3 00
Fort Erie	22 00	Sorel	358 72
Gloucester	103 20	Storrington	50 00
Grand Falls	811 66	St. Joseph's Island	7 72
Grenville	2 40	Toronto	122 40
Kingston	154 25	Wolford	2 40
Longueuil	250 00	Registration fees	92 50
Montreal	200,000 00		
Niagara	353 00		205,747 46
Niagara-on-the-Lake	281 75	Less refund	200,037 30
Oromocto	25		
Ottawa	1,446 03	Total	5,710 16
Owen Sound	22 00		

JOS. P. DUNNE,
Clerk in Charge of Ordnance and Admiralty Lands Branch.

C.—STATEMENT showing the Receipts each month of the fiscal year classified as fees, rent, or interest equivalent to rent, and principal.

Month.	Fees.	Rent or Interest.	Principal.	Total.
1908.	$ cts.	$ cts.	$ cts.	$ cts.
April	....	214 50	66 00	280 50
May	....	109 30	604 60	713 90
June	16 00	425 75	285 00	726 75
July	8 00	860 53	91 88	960 41
August	4 00	587 10	353 50	944 10
September	2 00	33 45	367 00	402 45
October	14 00	372 22	92 50	478 72
November	2 00	38 00	90 00	130 00
December	2 50	136 05	111 33	249 88
1909.				
January	18 00	25 85	366 00	409 85
February	8 00	194 70	200,000 00	200,202 70
March	18 00	130 20	100 00	248 20
	92 50	3,127 65	202,527 31	205,747 46
Less refund in month of May	....	....	....	34 80
Less refund in month of August	....	....	....	2 50
Less refund in month of February	....	....	....	200,000 00
Total	....	....	....	5,710 16

JOS. P. DUNNE,
Clerk in charge of
Ordnance and Admiralty Lands Branch.

D.—STATEMENT showing Amounts Due and unpaid on account of purchase money and rent or interest for the fiscal year ended March 31, 1909.

Locality.	Rent or Interest.	Principal.	Total.
	$ cts.	$ cts.	$ cts.
Beaver Harbour	8 00	....	8 00
Burlington Beach	120 00	....	120 00
Carillon	5 20	....	5 20
Chambly	275 49	347 00	622 49
Dalhousie	11 04	23 00	34 04
Edmunston	35 08	38 40	73 48
Elmsley	5 60	....	5 60
Fort Cumberland	156 00	....	156 00
Grand Falls	387 74	972 02	1,359 76
Kingston	108 39	50 96	159 35
Longueuil	2 00	....	2 00
Marlborough	1 00	....	1 00
Montreal	1 00	....	1 00
Nepean	52 00	....	52 00
Niagara	20 72	53 60	74 32
Oromocto	25	....	25
Ottawa	3,147 01	....	3,147 01
Owen Sound	52 00	....	52 00
Oxford	4 00	....	4 00
Point Pelee	1 00	....	1 00
Presqu'isle	2 00	....	2 00
Sorel	1,185 28	....	1,185 28
St. Croix River	2 00	....	2 00
Toronto	2,340 00	52,000 00	54,340 00
Township of Tay	8 00	....	8 00
Turkey Point	37 34	....	37 34
Wolford	179 80	....	179 80
	8,147 94	53,484 98	61,632 92

JOS. P. DUNNE,
Clerk in charge of
Ordnance and Admiralty Lands Branch.

No. 31.

REPORT OF THE CORRESPONDENCE REGISTRATION BRANCH.

DEPARTMENT OF THE INTERIOR,
CORRESPONDENCE REGISTRATION BRANCH,
OTTAWA, May 27, 1909.

W. W. CORY, Esq.,
Deputy Minister of the Interior,
Ottawa.

SIR,—I have the honour to place before you statement A, showing the number of letters filed during the fiscal year ended March 31, 1909, and the amount of money received, registered and sent to the accountant; also statement B, showing the number of letters and the amount of money received during each fiscal year from 1900 to March 31, 1909.

There were 260,142 letters recorded during the year just closed, an increase of 38 per cent over 1908, but much mail matter, in the nature of simple acknowledgments of departmental communications, copies of letters from agents, requests for information usually supplied in pamphlets, &c., which formerly was registered, would, it is estimated, increase the number of letters received to 312,170, making a total average of more than a thousand a day.

Your obedient servant,

J. M. ROBERTS,
Chief of Branch.

A.—STATEMENT showing the number of letters received and recorded and the money received during the Fiscal Year ended March 31, 1909.

—	Letters Received.	Daily Average.	Registered Letters Received.	Registered Letters Sent.	Money Received.
1908.					$ cts.
April	15,215	634	1,664	2,813	91,114 67
May	14,730	614	855	2,510	42,413 22
June	19,240	740	1,054	3,040	73,120 02
July	18,030	700	854	3,024	100,597 11
August	21,547	862	1,046	3,252	63,055 65
September	18,410	735	803	3,111	49,332 04
October	24,525	908	908	3,235	127,554 67
November	26,710	1,113	1,257	4,094	557,446 15
December	27,155	1,131	1,373	4,193	165,255 06
1909.					
January	27,360	1,140	1,466	4,168	90,129 43
February	23,005	1,002	1,420	3,998	305,605 71
March	24,215	897	1,810	4,306	132,652 44
Total	260,142	....	14,510	41,744	1,798,276 17

J. M. ROBERTS,
Chief of Branch.

DEPARTMENT OF THE INTERIOR,
CORRESPONDENCE REGISTRATION BRANCH,
OTTAWA, May 27, 1909.

B.—STATEMENT showing the number of letters received and recorded and the money received during each Fiscal Year from 1900 to March 31, 1909.

Fiscal Year.	Letters Received and Recorded.	Money Received.
		$ cts.
1900	48,663	200,831 71
1901	67,860	333,534 02
1902	67,722	382,999 87
1903	87,851	629,585 47
1904	113,074	630,355 44
1905	135,908	528,219 76
1906	176,729	875,933 54
1907 (nine months)	150,462	1,337,780 94
1908	187,684	1,558,230 32
1909	260,142	1,798,276 17

J. M. ROBERTS,
Chief of Branch.

DEPARTMENT OF THE INTERIOR,
CORRESPONDENCE REGISTRATION BRANCH,
OTTAWA, May 27, 1909.

No. 32.

REPORT OF THE CORRESPONDENCE COMPARING AND MAILING OFFICE.

DEPARTMENT OF THE INTERIOR,
CORRESPONDENCE COMPARING AND MAILING OFFICE,
OTTAWA, April 19, 1909.

W. W. CORY, Esq.,
Deputy Minister of the Interior,
Ottawa.

SIR,—I have the honour to submit to you herewith a statement showing the work done in the comparing and mailing office of the Department of the Interior during the fiscal year ended March 31, 1909.

I have the honour to be, sir,
Your obedient servant,

CHAS. C. PELLETIER,
Clerk in Charge.

STATEMENT of the work done in the Comparing and Mailing Room during the Fiscal Year ended March 31, 1909.

From April 1, 1908, to March 31, 1909.	Letters Sent.	Registered Letters Sent.	Telegrams sent.	Totals.
1908.				
April	23,340	2,813	87	26,240
May	24,453	2,510	76	27,039
June	25,874	3,040	85	28,999
July	23,986	3,024	77	27,087
August	25,564	4,298	102	29,964
September	26,779	3,111	230	30,120
October	28,345	3,235	171	31,751
November	25,542	4,094	202	29,838
December	25,923	4,193	139	30,255
1909.				
January	26,614	4,168	114	30,896
February	29,390	3,998	95	33,483
March	38,712	4,306	237	43,255
Total for fiscal year ending March 31, 1909.	324,522	42,790	1,615	368,927

These outgoing letters were copied in 149 one-thousand paged letter-books, compared with 135 letter-books for the same period last year, or an increase of 10 per cent.

Besides the verifying of each letter and the checking of the thousands of enclosures accompanying them, there were 1,000 pages of documents, &c., compared during the year. The number of inclosures sent with the letters has augmented fully 35 per cent. This can be accounted for through the changes in the Dominion lands regulations and the issuing of volunteer bounty land warrants, the latter being responsible for a very large correspondence asking for information, both general and special, in relation thereto.

The number of pages of letter-books indexed was 148,046, compared with 131,367 last year; increase, 12½ per cent; almost every page was indexed in double entry.

The daily average of letters sent out was 1,083, an increase of more than 12 per cent over last year. The heaviest daily average was during the month of March, when it reached the total of 1,434, as many as 1,820 letters being sent out in one day. The lightest month was July, with an average of 888.

The grand total for this office during the fiscal year was 368,927, or an increase of 40,069 letters.

CHAS. C. PELLETIER,
Clerk in Charge.

No. 33.

REPORT OF THE LAND PATENTS BRANCH.

Department of the Interior,
Land Patents Branch,
Ottawa, May 25, 1909.

W. W. Cory, Esq.,
Deputy Minister of the Interior,
Ottawa.

Sir,—I have the honour to submit for your information the statements hereinafter enumerated for the fiscal year ended March 31, 1909, in connection with the work performed in the Land Patents Branch.

A.—Statement showing the number of homestead entries as compared with the corresponding period of the previous year.

B.—Statement showing the number of pre-emptions, purchased homesteads and South African volunteer homesteads granted in each land agency.

C.—Statement of homesteads, pre-emptions, purchased homesteads, military homesteads and South African volunteer homesteads granted during each month.

D.—Statement showing the number of entries cancelled during the year, also the year in which such entries were made.

E.—Statement of entries affecting Dominion lands which were made at head office.

F.—Statement showing the number of acres of swamp lands in Manitoba transferred by order in council to the province of Manitoba.

G.—Statement showing South African volunteer bounty land certificates of 320 acres each issued under the Volunteer Bounty Act, 1908, by the Department of the Interior.

H.—Statement showing the number of assignments recorded in the Land Patents Branch.

I.—Statement of letters-patent covering Dominion lands situate in Manitoba, Saskatchewan, Alberta, British Columbia and the Yukon Territory.

J.—Statement of letters-patent covering Dominion lands situate in the province of Manitoba.

K.—Statement of letters-patent covering Dominion lands situate in the province of Saskatchewan.

L.—Statement of letters-patent covering Dominion lands situate in the province of Alberta.

M.—Statement of letters-patent covering Dominion lands situate in the province of British Columbia.

N.—Statement of letters-patent covering Dominion lands situate in the Yukon Territory.

O.—Statement showing the number of patents forwarded to the several registrars of the land registration districts of the provinces of Alberta and Saskatchewan and the Yukon Territory, and the number of notifications mailed to the patentees.

I have the honour to be, Sir,
Your obedient servant,

N. O. COTE,
Chief of Branch.

A.—STATEMENT showing the number of Homestead Entries made during the year ended March 31, 1909, as compared with the year ended March 31, 1908.

Agency.	1909.	1908.	Increase.	Decrease.	Remarks.
Battleford	3,385	4,535	....	1,150	Net increase for fiscal year 1908-09, 8,657.
Brandon	171	90	81	....	
Calgary	2,707	1,278	1,429	....	
Dauphin	1,227	772	955	....	
Edmonton	5,166	4,055	1,111	....	
Estevan	833	502	331	....	
Humboldt	2,412	2,493	....	81	
Kamloops	400	195	205	....	
Lethbridge	3,818	2,456	1,362	....	
Moosejaw	8,710	5,181	3,529	....	
New Westminster	29	42	....	13	
Prince Albert	2,058	1,622	436	....	
Regina	1,553	1,653	....	100	
Red Deer	2,080	1,825	255	....	
Winnipeg	1,863	886	977	....	
Yorkton	2,169	2,839	670	....	
Total	39,081	30,424	10,671	2,014	

RECAPITULATION.

Month.	1909.	1908.	Increase.	Decrease.	Remarks.
January	1,308	1,453	....	145	Net increase fiscal year 1908-09, 8,657.
February	1,364	1,420	....	56	
March	2,592	1,869	723	....	
	1908.	1907.			
April	2,987	2,594	393	....	
May	2,773	3,253	....	480	
June	3,247	4,574	....	1,327	
July	2,815	3,690	....	875	
August	1,859	2,814	....	955	
September	7,934	2,395	5,539	....	
October	5,221	2,252	2,969	....	
November	3,876	2,261	1,615	....	
December	3,105	1,849	1,256	....	
Total	39,081	30,424	12,495	3,838	

N. O. COTE,
Chief of Branch.

DEPARTMENT OF THE INTERIOR,
LAND PATENTS BRANCH,
OTTAWA, May 25, 1909.

B.—STATEMENT showing the number of Pre-emptions, Purchased Homesteads and South African Veteran Homesteads granted in each Land Agency during the fiscal Year 1908-09 (from September 1, 1908, to March 31, 1909.

Agency.	Pre-emptions.	Purchased Homesteads.	South African Veteran Homesteads.	—
Battleford	864	137	13	
Calgary	1,736	115	73	
Edmonton	44	2	25	
Estevan	911	57	....	
Humboldt	59	16	18	
Lethbridge	2,656	70	43	
Moosejaw	7,168	250	98	
Prince Albert	62	54	17	
Regina	437	109	5	
Red Deer	124	21	38	
Yorkton	....	....	15	
Total	14,061	831	345	

In Saskatchewan.			In Alberta.		
Pre-emptions.	Purchased Homesteads.	South African Veteran Homesteads.	Pre-emptions.	Purchased Homesteads.	South African Veteran Homesteads.
9,501	623	166	4,560	208	179

NOTE—These grants were authorized by the Dominion Lands Act, which came into force September 1, 1908; and the Volunteer Bounty Act, assented to 20th July, 1908.

DEPARTMENT OF THE INTERIOR,
LAND PATENTS BRANCH,
OTTAWA, May 25, 1909.

N. O. COTE,
Chief of Branch.

C.—STATEMENT of Homesteads, Pre-emptions, Purchased Homesteads, Military Homesteads and South African Volunteer Homesteads granted during each month from April 1, 1908, to March 31, 1909.

1908.	Homesteads.	Pre-emptions.	Purchased Homesteads.	Military Homesteads.	South African Volunteer Homesteads.
April	2,987	....	....	....	....
May	2,773	....	....	....	....
June	3,247	....	....	....	....
July	2,815	....	....	....	....
August	1,859	....	....	....	....
September	7,934	7,374	445	....	....
October	5,221	2,193	126	1	....
November	3,876	1,379	52	1	24
December	3,105	1,334	58	2	55
1909.					
January	1,308	538	32	....	74
February	1,364	378	32	....	52
March	2,592	865	86	....	140
	39,081	14,061	831	4	345

DEPARTMENT OF THE INTERIOR,
LAND PATENTS BRANCH,
OTTAWA, May 25, 1909.

N. O. COTE,
Chief of Branch.

D.—STATEMENT showing the number of entries cancelled during the year ended March 31, 1909, also the year in which such entries were made.

Year.	Homesteads.	Purchased Homesteads.	Pre-emptions.	Time-Sales.	Sales.
1871			1		
1872					
1873	1				
1874			1		1
1875					
1876					
1877					
1878	1		3		1
1879				1	
1880			1		
1881					
1882	3		2		
1883	1		6		
1884			7		
1885	1		4		
1886	1		3		
1887	1		1		
1888					
1889	4		7		
1890					
1891	3				
1892	2				1
1893	1				
1894	1				
1895	2				1
1896	3				
1897	2			1	
1898	2				
1899	9				
1900	6			1	
1901	31				1
1902	79				
1903	187				
1904	315			1	1
1905	899				1
1906	2,925			1	5
1907	5,532			1	
1908	4,647	21	219		
1909	18		5		
	14,677	21	260	6	12

N. O. COTE,
Chief of Branch.

DEPARTMENT OF THE INTERIOR,
LAND PATENTS BRANCH,
OTTAWA, May 25, 1909.

E.—STATEMENT of entries affecting Dominion Lands which were made at Head Office for the year ended March 31, 1909.

	No. of Grants	Acres.
Special grants..	352	4,217·00
Alberta Railway and Irrigation Company..	....	50,603·25
Calgary and Edmonton Railway Company...	....	20,340·10
Canadian Northern Railway Company.. ..	....	231,826·88
Canadian Pacific Railway Co., Main Line..	....	53,105·45
Canadian Pacific Railway Co., Souris Br..	....	470·75
Canadian Pacific Railway Company, Pipestone extension, Souris Branch..	....	1,744·65
Manitoba and South Eastern Railway Co.. ..	....	2,313·26
Manitoba Southwestern Colonization Railway Company....	....	497,538·72
Qu'Appelle, Long Lake and Saskatchewan Railroad and Steamboat Company	....	1,693·19
Area sold and patented to the Grand Trunk Pacific Railway for townsites..	....	12,905·45
Area granted to the Grand Trunk Pacific Railway for right of way..	....	3,534·46
Railway right of way..	96	2,483·77
Hudson's Bay Company's grants..	30	133,696·00
		1,016,472·93

N. O. COTE,
Chief of Branch.

DEPARTMENT OF THE INTERIOR,
LAND PATENTS BRANCH,
OTTAWA, May 25, 1909.

F.—STATEMENT showing the number of Acres of Swamp Lands in Manitoba transferred by Order in Council to the Province of Manitoba, up to March 31, 1909.

	Acres.
Total area transferred to March 31, 1908..	1,917,808·69
No lands were transferred during the year ending March 31, 1909..	
	1,917,808·69

N. O. COTE,
Chief of Branch.

DEPARTMENT OF THE INTERIOR,
LAND PATENTS BRANCH,
OTTAWA, May 25, 1909.

G.—STATEMENT showing South African Volunteer Bounty Land Certificates of 320 acres each issued under the Volunteer Bounty Act, 1908, by the Department of the Interior up to and including March 31, 1909.

	No.	Acres.
Certificates issued..	5,279	1,689,280
Certificates located..	345	110,400

N. O. COTE.
Chief of Branch.

DEPARTMENT OF THE INTERIOR,
LAND PATENTS BRANCH,
OTTAWA, May 25, 1909.

H.—STATEMENT showing the number of Assignments recorded in the Land Patents Branch during the year ended March 31, 1909.

Number of deeds registered	239
Fees received in connection therewith	$476 50

DEPARTMENT OF THE INTERIOR,
LAND PATENTS BRANCH,
OTTAWA, May 25, 1909.

N. O. COTE,
Chief of Branch.

I.—STATEMENT of Letters-Patent covering Dominion Lands situate in Manitoba, Saskatchewan, Alberta, British Columbia and the Yukon Territory issued from the Department of the Interior during the Fiscal Year ending March 31, 1909, as compared with the fiscal Year ending March 31, 1908.

Nature of Grant.	From April 1, 1908, to March 31, 1909.		From April 1, 1907, to March 31, 1908.	
	Patents.	Acres.	Patents.	Acres.
1. Alberta Railway and Irrigation Co. sales	44	15,531	29	17,932
2. Assignment of mortgages	10	......	......	......
3. British Columbia homesteads	103	14,903	102	14,783
4. British Columbia sales	24	1,603	49	2,739
5. Coal lands sales, under rights (1,379 acres)	34	8,460	36	7,903
6. Commutation grants	8	331	6	281
7. Half-breed allotments	......	......	1	240
8. Homesteads	19,929	3,159,779	14,506	2,300,706
9. Hudson's Bay Company	16	3,296	3	1,761
10. Leases	1	516	3	......
11. License of occupation	13	......	6	......
12. Manitoba Act grants	14	842	4	117
13. Manitoba University grants	6	891	......	......
14. Military bounty grants	1	160	......	......
15. Military homesteads	1	320	9	2,872
16. Mineral rights (18,194.38 acres)	91	......	39	......
17. Mining lands sales	1	8	6	102
18. Northwest half-breed grants	131	22,861	220	37,255
19. Parish sales	12	1,311	6	1,546
20. Quit claim, special grants (2,955 09 acres)	18	......	12	......
Railways—				
20A. Alberta Railway and Irrigation Company	3	46,067	......	......
21. Alberta Railway and Coal Co	3	4,644	......	......
22. Calgary and Edmonton Railway Co	24	20,448	93	85,975
23. Calgary and Edmonton Railway Co., under rights	......	......	9	......
24. Canadian Northern Railway Co	234	233,388	1,330	2,138,422
25. Canadian Pacific Railway grants	79	53,745	246	377,427
26. Canadian Pacific Railway grants, Souris branch	11	2,215	50	94,611
27. Canadian Pacific Railway roadbed and station grounds	6	131	76	1,062
28. Grand Trunk Pacific Railway	287	15,793	33	361
29. Manitoba and Southeastern Railway Co	8	2,313	471	676,160
30. Manitoba and Northwestern Railway Co	2	14	34	29,421
31. Manitoba Southwestern Colonization Railway Co.	215	497,693	192	52,779
32. Qu'Appelle, Long Lake and Saskatchewan Railroad and Steamboat Co	11	1,783	10	5,911
33. Saskatchewan and Western Railway	......	......	43	98,886
34. Sales	557	72,349	607	159,050
35. School lands sales	240	27,195	189	21,949
36. Special grants	166	4,500	204	6,579
37. Special grants, under rights (41,538 acres)	71	......	......	......
38. Yukon Territory sales	57	2,236	65	2,147
39. Yukon Territory specials	......	......	1	......
Totals	22,431	4,215,326	18,690	6,138,977

DEPARTMENT OF THE INTERIOR,
LAND PATENTS BRANCH,
OTTAWA, May 25, 1909.

N. O. COTE,
Chief of Branch.

J.—STATEMENT of Letters-Patent covering Dominion Lands situate in the Province of Manitoba, issued from the Department of the Interior during the Fiscal Year ending March 31, 1909.

Nature of Grant.	No. of Patents.	No. of Acres.
Assignment of mortgages	10	
Coal lands sales	4	831
Commutation grants	8	331
Homesteads	1,013	156,621
Manitoba Act grants	14	842
Manitoba University grants	6	891
Northwest half-breed grants	1	80
Parish sales	11	1,165
Railways—		
Canadian Northern Railway Co	47	31,883
Canadian Pacific Railway grants	4	658
Canadian Pacific Railway roadbed and station grounds	1	25
Grand Trunk Pacific Railway	2	23
Manitoba and Southeastern Railway Co	5	1,200
Manitoba Southwestern Colonization Railway Co.	111	160,783
Sales	133	7,083
School lands sales	130	19,010
Special grants	11	703
Total	1,511	382,129

DEPARTMENT OF THE INTERIOR,
LAND PATENTS BRANCH,
OTTAWA, May 25, 1909.

N. O. COTE,
Chief of Branch.

K.—STATEMENT of Letters-Patent covering Dominion Lands situate in the Province of Saskatchewan, issued from the Department of the Interior during the fiscal Year ending March 31, 1909.

Nature of Grant.	No. of Patents.	No. of Acres.
Coal lands sales	1	20
Homesteads	13,054	2,072,668
Hudson's Bay Co	16	3,296
Leases	1	516
License of occupation	6	
Military homesteads	1	320
Mineral rights (320 acres)	1	
Northwest half-breed grants	60	10,420
Parish sales	1	146
Quit claim, special grants (2,955·09 acres)	18	
Railways—		
Canadian Northern Railway	185	201,272
Canadian Pacific Railway grants	29	5,060
Canadian Pacific Railway grants, Souris branch	10	2,015
Grand Trunk Pacific Railway grants	247	12,229
Manitoba and Northwestern Railway	2	14
Manitoba Southwestern Colonization Ry. Co.	83	138,787
Manitoba and Southeastern Railway	3	1,113
Qu'Appelle, Long Lake and Saskatchewan Railroad and Steamboat Co	11	1,783
Sales	263	41,549
School lands sales	88	6,494
Special grants	96	1,588
Special grants, under rights (29, 831·99 acres)	48	
Total	14,224	2,499,290

DEPARTMENT OF THE INTERIOR,
LAND PATENTS BRANCH.
OTTAWA, May 25, 1909.

N. O. COTE,
Chief of Branch.

L.—STATEMENT of Letters-Patent covering Dominion Lands situate in the Province of Alberta, issued from the Department of the Interior during the fiscal year ending March 31, 1909.

Nature of Grant.	No. of Patents.	No. of Acres.
Alberta Railway and Irrigation Company sales	47	61.598
Coal lands sales	29	7,609
Homesteads	5,862	930,491
License of occupation	7	....
Military bounty grants	1	160
Mineral rights (17,874.38 acres)	90	....
Mining lands sales	1	8
Northwest half-breed grants	70	12,361
Railways—		
Alberta Railway and Coal Co	3	4,644
Calgary and Edmonton Railway Co	24	20,448
Canadian Northern Railway Co	2	234
Canadian Pacific Railway grants	46	48,026
" " " " (Souris branch)	1	200
Grand Trunk Pacific Railway	38	3,541
Manitoba Southwestern Colonization Railway Co	21	198,122
Sales	161	23,717
School lands sales	22	1,691
Special grants	59	2,210
" " under rights (11,706·51 acres)	23	....
Total	6,507	1,315,060

N. O. COTE,
Chief of Branch.

DEPARTMENT OF THE INTERIOR,
LAND PATENTS BRANCH,
OTTAWA, May 25, 1909.

M.—STATEMENT of Letters-Patent covering Dominion Lands situate in the Province of British Columbia, issued from the Department of the Interior during the fiscal year ending March 31, 1909.

Nature of Grant.	No. of Patents.	No. of Acres.
British Columbia homesteads	103	14,903
" " sales	24	1,603
Railways—Canadian Pacific Railway roadbed and station grounds	5	105
Total	132	16,611

N. O. COTE,
Chief of Branch.

DEPARTMENT OF THE INTERIOR,
LAND PATENTS BRANCH,
OTTAWA, May 25, 1909.

N.—STATEMENT of Letters-Patent covering Dominion Lands situate in the Yukon Territory, issued from the Department of the Interior during the fiscal year ending March 31, 1909.

Nature of Grant.	No. of Patents.	No. of Acres.
Yukon Territory sales	57	2,236

N. O. COTE,
Chief of Branch.

DEPARTMENT OF THE INTERIOR,
LAND PATENTS BRANCH,
OTTAWA, May 25, 1909.

O.—STATEMENT showing the number of patents forwarded to the several registrars of the land registration districts of the Province of Alberta, Saskatchewan and Yukon Territory, and the number of notifications mailed to patentees during the year, April 1, 1908, to March 31, 1909, inclusive.

Registration District.	No. of Patents sent to Registrars.	No. of Notifications mailed to Patentees.
Assiniboia	8,839	8,851
Yorkton	1,213	1,283
East Saskatchewan	2,638	2,697
West Saskatchewan	1,511	1,603
North Alberta	3,420	3,396
South Alberta	3,031	3,045
Yukon	46	51
Total	20,698	20,926

N. O. COTE,
Chief of Branch.

DEPARTMENT OF THE INTERIOR,
LAND PATENTS BRANCH,
OTTAWA, May 25, 1909.

No. 34.

REPORT OF THE CHIEF GEOGRAPHER.

DEPARTMENT OF THE INTERIOR,
OFFICE OF THE CHIEF GEOGRAPHER,
OTTAWA, March 31, 1909.

W. W. CORY, Esq.,
Deputy Minister of the Interior.
Ottawa.

SIR,—I have the honour to report as follows on the work of my office for the past year.

The staff as constituted under the new Civil Service Act is as follows:—

Division I.—Grade B.

Chalifour, J. E., Chief Draughtsman.

Division II.—Grade A.

Baine, H. E.
Taché, Henri.
Anderson, W.
Inkster, Fred.
Bryant, E. D.
Beveridge, Jas.

Division II.—Grade B.

Akerlindh, A.
Grindlay, T.
Darrach, A. M.
Blatchly, H.
Dumouchel, G. E.
Wilson, H. W.
Chandler, S.
Bennie, J.
Craig, R. W.
Groulx, A.
McElligott, J.
Blue, W. A.
Pigeon, J. H.

Division III.—Grade A.

Waine, Mrs. D. E.
Gagnon, J. S.

Division III.—Grade B.

Stewart, Miss Mary.
Merrifield, J. R.

Miss Mary Stewart was appointed May 1, 1908, to assist in the stenographic work and typewriting.

Mr. T. Grindlay was appointed August 11, 1908, and has since been employed on the Northern British Columbia and Nova Scotia 'Standard' sheets.

Mr. C. G. Wood, who was appointed January 2, 1903, died on February 23, 1909. Mr. Wood was an accurate and painstaking official whose kindly disposition endeared him to all with whom he came in contact.

The routine work of the office has been carried on as usual and a number of the 'Standard' topographical sheets are either completed or are nearing completion.

Sheet 11.—Montreal and Quebec sheet, has been delivered.

Sheet 28.—English River sheet, colour proofs have been received and it will be printed shortly.

Sheet 2, N.E.—Belleville sheet, has been transferred and preliminary proofs from stone have been received.

Sheet 7, N.E.—Sault Ste. Marie sheet, 8 S.W.—Manitoulin sheet, 14 S.E.—Truro sheet, 5 N.W.—Halifax sheet, 14 S.W.—Springhill sheet, 14 S.E.—Charlottetown sheet, 31 S.E.—Abitibi sheet and 30 Missinaibi sheet are in the hands of the engravers.

Sheet 9, S.E.—Pembroke sheet, 10 S.W.—Ottawa sheet, 10 S.E.—Cornwall sheet, 3 N.W.—Kingston sheet, are nearly completed and will be issued at an early date.

The compilation of sheets 41, 42, 43, 44 and 45, covering the area traversed by the Grand Trunk Pacific in northern British Columbia, has been, perforce, suspended, pending the filing of the final location of the railway. As it is the only chained line through this area, it must serve as a base-line upon which the compilation of the other material will be made.

During the year, new editions of the maps of Manitoba, Saskatchewan, Southern Alberta and Northern Alberta have been prepared. Maps of the Winnipeg, Dauphin, Estevan, Humboldt, Yorkton, Prince Albert, Regina, Moosejaw, Battleford, Edmonton, Red Deer, Calgary and Lethbridge land districts were published for use by the agents of these districts. These maps give the available number of quarter-sections in each township, quality of the soil, &c. Similar maps are also required for the new districts of Saskatoon and Peace River.

An 'Elevator' map giving the elevator capacity at each station in Manitoba, Saskatchewan and Alberta has been published. It also contains tabular lists, arranged alphabetically under provinces, of the capacities of the elevators and of the flour and cereal mills in the west. The so-called three-sheet map of Manitoba, Saskatchewan and Alberta has been extended westward to the western boundary of the last-named province and is now, virtually, a four-sheet map.

In connection with the case of Great Britain respecting the North Atlantic fisheries, to be argued before the Hague tribunal during the coming summer, 16 maps and plans were prepared illustrating the main points in the British contention.

On September 5, I left Ottawa to join the excursion of the Canadian Mining Institute to the mines of Central and Western Canada. In 1907 the Canadian Mining Institute issued invitations to the Institution of Mining and Metallurgy, the Iron and Steel Institute, the Institution of Mining Engineers, the South Wales Institute of Engineers, the Mining Institute of Scotland and the Manchester Geological and Mining Society in Great Britain; L'Association des Elèves des Ecoles Spéciales, in Belgium; L'Association Amicale des Elèves de l'Ecole Nationale Supérieure des Mines, in France ; and the Verein Deutcher Eisenhüttenleute in Germany, to appoint official delegates to come to Canada and take part in the excursion as the guests of the Canadian Mining Institute; while a general invitation was issued to the members of these respective societies to join the excursion on the same terms as members of the institute. The invitation was accepted by about thirty-five.

Prior to my joining the party, they had visited the coal mines and steel plants at Sydney and North Sydney, N.S., the asbestos and chrome-iron mines of the Eastern Townships, the hydro-electric power plants at Niagara Falls and the silver-cobalt mines at Cobalt.

On September 7 we left Sudbury for the Moose Mountain mines. At this point the Canadian Northern Company is developing iron properties and, at Key Harbour, on Georgian Bay, has constructed extensive docks, evidently intending to export the ore to the United States. On the return trip a short stop was made at Vermilion river to permit some of the party to test the gravel. A few 'colours' were obtained.

The following day, the smelter and the Crean Hill copper-nickel mine of the Canadian Copper Company were visited. The smelter contains five furnaces; total capacity 2,500 tons daily. The furnaces are fed by electric trains of charging cars with a capacity of 3,000 lbs. each. The plant is operated by electric energy generated at the High Falls of the Spanish river, 27 miles distant.

The Crean Hill mine, at present, consists of an open pit about 200 feet in diameter and 100 feet deep with four underground stopes below the pit floor. About 12,000 tons of ore carrying approximately 4 per cent copper and 2 per cent nickel, are shipped per month. On the return journey a visit was paid to the Mond Nickel Company's smelter at Victoria Mines.

On the 13th, Medicine Hat was reached and its famous natural gas well visited. We were informed that gas is supplied to the householder for 13½ cents per 1,000 cubic feet and to the manufacturer for 5 cents. It is used in practically all the houses for illumination and in ranges and furnaces for heating. At this point Mr. E. Coste, under whose supervision the well was driven, gave an exhibition of the gas escaping burning and unburnt under a pressure of 600 lbs. to the square inch.

The following morning, the great rock slide at Frank was visited. Later, the party entered the mine of the International Coal and Coke Company, the time at their disposal permitting only a brief visit. The present output is about 2,000 tons per day. About one-half is sold to the Canadian Pacific Railway Company for locomotive use; the balance is converted into coke and sold to the British Columbia Copper Company, Greenwood, for its smelter. The estimated tonnage of available coal in the International Coal and Coke Company's mines is estimated at 50,000,000 tons. The length of the main entry in No. 2 seam is 9,000 feet.

Arriving at Hosmer at noon, the new plant of the Hosmer Mines, Ltd.,—a subsidiary corporation of the Canadian Pacific—was examined. At the date of our visit, actual coal mining had not begun, the company being debarred from mining during the continuance of an agreement with the Crowsnest Pass Coal Company. The agreement expired in December last, and mining is now in progress and, when fully developed, will have a capacity of 4,000 tons per day. There are 240 beehive coke ovens with a total capacity of 300 tons per day.

Between Michel and Fernie the line traverses the area then recently swept by the great Fernie fire. Of the town of Fernie, naught remained except the coal company's offices and a half dozen houses. Everywhere rebuilding was being rushed, the population, in the meantime, living and transacting business in tents and hastily erected wooden structures.

In the afternoon the Coal Creek mines of the Crowsnest Pass Coal Company were visited. The company owns approximately 240,000 acres of coal lands. The coal is a high grade bituminous, makes an excellent coke and is a steam coal of unexceptionable quality. The present output is about 4,000 tons per day. The company owns 1,128 beehive ovens, with a total daily capacity of upwards of 2,000 tons of coke, which is sold to smelters in British Columbia and in the state of Washington.

On the 17th the St. Eugène mine and mill at Moyie were visited. The St. Eugène is the largest silver-lead mine in Canada; is owned and operated by the Consolidated Mining and Smelting Company. The crude ore averages about 18 per cent lead, but the concentrates shipped to the Trail smelter contain 65 per cent lead and 32 ounces of silver per ton. In 1907 the 125,000 tons of ore mined contained 607,000 ounces of silver and 27,000,000 pounds of lead.

As the power plant at Bonnington Falls was not reached till 11 p.m., the late hour prevented an extended examination. The West Kootenay Power Company operates this plant and supplies electrical energy to the Rossland, Phœnix and Greenwood districts and to the smelters at Trail, Grand Forks, Greenwood and Boundary Falls. There are 4 main units of 8,000 horse-power each, operating under a head of 70 feet.

The morning of the 16th was spent at the Trail smelter, owned by the Consolidated Mining and Smelting Company. The plant contains five copper blast furnaces with a combined capacity of 1,600 tons and two lead blast furnaces having a combined capacity of 350 tons of lead ore. The copper-gold matte from the furnaces is treated by the Huntington-Heberlein process, resmelted and concentrated to approximately 45 per cent copper and to 25 ounces of gold to the ton. The lead refinery has a daily capacity of 75 tons of, practically, pure lead. Part of the refined lead is manufactured into lead pipe and the balance shipped to the Orient. Copper sulphate is produced and shipped to Manitoba, Saskatchewan and Alberta where it is used for cleaning wheat.

In the year ending June 30, 1908, the smelter produced 121,380 ounces of gold, 2,224,888 ounces of silver, 32,157,139 pounds of lead and 4,004,468 pounds of copper, with a total value of $5,428,501.

Arriving at Rossland at noon, the party divided to visit the Le Roi, Centre Star and War Eagle mines. The souvenir booklet, presented by the entertainment committee, gives the following statistics:—Le Roi mine, gross value of mineral output, 1894-1908, $20,406,627; maximum depth of shaft, 1,700 feet, and total development, 21 miles. Consolidated Mining and Smelting Company, operating Centre Star, War Eagle and other mines, gross value of output, $15,948,133; maximum depth of shaft, 2,200 feet, and total development, 19 miles. Le Roi No. 2, output, 1900-08, $4,413,663, deepest working, 850 feet, and development work, 7 miles.

On September 17, the British Columbia Copper Company's Mother Lode mine and smelter at Greenwood were visited. The ore body is a low-grade copper deposit, approximately 2,000 feet long and from 80 to 110 feet wide, carrying values of $4.50 to $6 per ton. The present plant—which was being enlarged at the time of my visit in 1906—contains 3 large furnaces with a capacity of about 700 tons each per day. The blister copper produced is practically free from objectionable impurities and runs 99 per cent fine.

On the morning of the 18th, the party arrived at Phœnix, receiving a royal salute of twenty-one blasts on Granby hill. After inspecting the shaft-houses, compressor building and 'glory-hole,' a trip was made into the mine in cars hauled by an electric locomotive and the visitors were informed that there were, approximately, 20,000,000 tons of ore in sight. In the year ending June 30, 1908, the Granby mines produced 21,126,926 pounds of copper, 300,593 ounces of silver and 40,139 ounces of gold; gross value $3,790,184. In the afternoon the Granby smelter at Grand Forks, was visited.

On the 19th, a fruit farm on Kootenay lake was visited and, in the afternoon, the Blue Bell mine and concentrator, now being operated by the Canadian Metal Company, were inspected. The deposit—notable for its extent—is chiefly low-grade galena with pyrrhotite, &c., and has been developed by open cuts and by a tunnel driven into the hillside. The lead mill has a capacity of 200 tons per day.

On the 22nd, a meeting of the western branch of the institute was held at Victoria and the visitors were welcomed by the Hon. Richard McBride, Premier of British Columbia, and Hon. Wm. Templeman, Minister of Mines for the Dominion.

On the 26th, the party left Victoria for Nanaimo, stopping at Ladysmith for a hurried visit to the Tyee Copper Co.'s smelter, which was, at that time, operating on custom ore, principally from the Japanese copper mine on the Queen Charlotte islands. At Nanaimo the Western Fuel Co.'s No. 1 shaft and Northfield (No. 4) Brechin mine were visited, also the Hamilton Powder Co.'s powder manufactory at Departure Bay. The No. 1 and Northfield mines are at present producing 600,000 or 700,000 tons per annum.

On the 27th, the Bankhead mines, near Banff, were visited. This is the only mine in Canada producing anthracite or, more properly, semi-anthracite. The three seams that are being mined are from 6 to 9 feet thick. All sizes of coal from 'broken' to 'buckwheat No. 3' are produced and, as the coal is somewhat fragile, a considerable proportion is briquetted. The briquettes are used on the Canadian Pacific locomotives and for domestic use. The present daily output is 750 tons sized coal and 500 tons briquettes.

Reaching Dunmore junction early in the evening of the 28th, Mr. Coste had the natural gas well lit that the party might enjoy the spectacle of a gas well with a daily capacity of 1,500,000 cubic feet and under a pressure of 600 pounds per square inch, burning at night. The gas in this well and in the four other wells in the vicinity was struck at a depth of about 1,000 feet.

The stop at Dunmore ended the technical portion of the trip and Ottawa was reached on the 30th.

During the year 8,903 letters were received, 9,419 sent out, 157,386 maps, parcels, &c., received and 162,308 sent out.

I have the honour to be, Sir,
Your obedient servant,

JAMES WHITE,
Chief Geographer.

MAPS PUBLISHED.

Railway map of the Dominion of Canada and Newfoundland, eight sheets; extends from the Atlantic to the Pacific and from Maryland and Oregon on the south to Cumberland sound and Herschell island on the north. Scale, 35 miles to 1 inch. Price, mounted, with rollers, $3; mounted, without rollers, $2.50.

Dominion of Canada and Newfoundland, Railway edition, 16 inches by 36 inches. Scale, 100 miles to 1 inch.

Dominion of Canada 'School' map. Scale, 58 miles to 1 inch.

Western Canada, map of portion of Canada west of Lake of the Woods, shows railway systems in distinctive colours. Scale, 35 miles to 1 inch.

Relief map of Canada. Scale, 100 miles to 1 inch.

Resource map of Canada. Scale, 200 miles to 1 inch.

Water-power map, average Rainfall at principal points in Canada. Scale, 100 miles to 1 inch.

Map showing principal Mineral Occurrences in Canada. Scale, 100 miles to 1 inch.

Map showing Forests in Canada. Scale, 200 miles to 1 inch.

Map showing Limits of Principal Forest Trees in Canada. Scale, 100 miles to 1 inch.

Elevator map, shows position and capacity of Elevators in Manitoba, Saskatchewan and Alberta, with tables of Elevator capacities in Canada and Milling capacities in western Canada.

National Transcontinental Railway map, shows route of the National Transcontinental Railway, Moncton to the Pacific. Scale, 100 miles to 1 inch.

Explorations in Northern Canada and adjacent portions of Greenland and Alaska. Scale, 75 miles to 1 inch.

Rocky Mountains (Banff sheet) contoured map of mountains in the vicinity of Banff. Scale, 2 miles to 1 inch.

Rocky Mountains (Lake Louise sheet) contoured map of mountains in the vicinity of Laggan and Field. Scale, 2 miles to 1 inch.

Manitoba, Saskatchewan, Alberta and adjoining portions of Keewatin and British Columbia, four sheets. Scale, 12½ miles to 1 inch.

Index map showing townships in Manitoba, Saskatchewan and Alberta, plans of which have been printed. Scale, 35 miles to 1 inch.

General map of the Northwestern portion of the Dominion of Canada. Edition of 1898. In 2 sheets. Scale, 35 miles to 1 inch.

Map showing Railways in Manitoba, Alberta and Saskatchewan. Scale, 35 miles to 1 inch.

Manitoba—map of province showing Dominion Electoral Divisions. Scale, 12½ miles to 1 inch.

Southern Saskatchewan—map of portion of the province south of latitude 55°. Scale, 12½ miles to 1 inch

Southern Alberta—map of portion of the province south of latitude 55°. Scale, 12½ miles to 1 inch.

Northern Alberta—map of portion of the province north of latitude 55°. Scale, 12½ miles to 1 inch.

Regina Land District. Scale, 12½ miles to 1 inch.

Red Deer Land District. Scale, 12½ miles to 1 inch.

Calgary Land District. Scale 12½ miles to 1 inch.

Estevan Land District. Scale, 12½ miles to 1 inch.

Winnipeg Land District. Scale, 12½ miles to 1 inch.

Lethbridge Land District. Scale, 12½ miles to 1 inch.

Edmonton Land District. Scale, 12½ miles to 1 inch.

Dauphin Land District. Scale, 12½ miles to 1 inch.

Yorkton Land District. Scale, 12½ miles to 1 inch.

Prince Albert Land District. Scale, 12½ miles to 1 inch.

Battleford Land District. Scale, 12½ miles to 1 inch.

Moosejaw Land District. Scale, 12½ miles to 1 inch.

Brandon Land District. Scale, 12½ miles to 1 inch.

Peace River District (Northern Alberta)—includes the country between Wetaskiwin and Lake Athabaska, and between Athabaska river and the eastern boundary of British Columbia. Scale, 12½ miles to 1 inch.

Map showing all the Even-numbered sections alienated in Manitoba, Saskatchewan and Alberta, 3 sheets. Scale, 12½ miles to 1 inch.

Odd-section map (Manitoba, Saskatchewan and Alberta)—shows Odd-numbered sections in these provinces that have been alienated as railway land grants, &c. Scale, 12½ miles to 1 inch.

British Columbia 'Railway Belt' map, showing the 'Railway Belt' in British Columbia. Scale, 1/500,000, or 7·89 miles to 1 inch.

Southeastern Alaska and portion of British Columbia. Edition of 1897. Scale, 1/960,000.

Southeastern Alaska and portion of British Columbia. Edition of 1897. Showing award of Alaska Boundary Tribunal, October 20, 1903. Scale, 1/960,000.

Yukon—extends from Lynn canal on the south, to Eagle on the north, and from the Pacific to the Frances river. Scale, 1/750,000 or 11·82 miles to 1 inch.

White, Alsek and Kluane Rivers district, southwestern Yukon. Scale, 1/400,000 or 6·31 miles to 1 inch.

Sheet 1 S.W. Ontario (Windsor sheet)—Essex, Kent and Lambton and portions of Elgin, Middlesex and Huron counties. Scale, 1/250,000, or 3·95 miles to 1 inch.

Sheet 1 S.E. Ontario (London sheet)—Norfolk, Oxford, Brant and portions of Elgin, Middlesex, Huron, Perth, Waterloo and Wentworth counties. Scale, 1/250,000, or 3·95 miles to 1 inch.

Sheets 1 N.W. and 1 N.E. Ontario (Guelph sheet)—Wellington, Grey, Bruce and portions of Huron, Perth, Waterloo, Halton, Dufferin and Simcoe counties. Scale, 1/250,000, or 3·95 miles to 1 inch.

Sheet 2 S.W. Ontario (Hamilton sheet)—Lincoln, Welland, Haldimand and portions of Wentworth and Halton counties. Scale, 1/250,000, or 3·95 miles to 1 inch.

Sheet 2 N.W. and 9 S.W. (part) Ontario (Toronto and Muskoka sheet)—Peel, York, Ontario and Victoria and portions of Halton, Simcoe, Dufferin, Muskoka, Parry Sound, Haliburton, Durham and Peterborough counties. Scale, 1/250,000, or 3·95 miles to 1 inch.

Sheet 2 N.E. Ontario (Belleville sheet)—Northumberland and Prince Edward and portions of Durham, Peterborough, Hastings and Lennox and Addington counties. Scale, 1/250,000, or 3·95 miles to 1 inch.

Sheet 9 N.W. (Timiskaming sheet)—includes the country between Lake Nipissing and the Height-of-Land. Scale, 1/250,000, or 3·95 miles to 1 inch.

Sheet 11 (Montreal and Quebec sheet)—includes the area between Vaudreuil and the Island of Orleans. Scale, 1/500,000, or 7·89 miles to 1 inch.

Sheet 13—includes whole of New Brunswick, with exception of Madawaska and portions of Westmoreland and Albert counties. Scale, 1/500,000, or 7·89 miles to 1 inch.

Sheet 15—Cape Breton Island and portions of Antigonish and Guysborough counties, N.S. Scale, 1/250,000, or 3·95 miles to 1 inch.

Sheet 27, Ontario (Lake of the Woods sheet)—Rainy River district and portions of Thunder Bay district and Keewatin. Scale 1/500,000, or 7·89 miles to 1 inch.

Sheet 28, Ontario (English River sheet)—includes portions of Thunder Bay and Rainy River districts. Scale, 1/500,000, or 7·89 miles to 1 inch.

Sheet 29, Ontario (Lake Nipigon sheet)—includes central portion of Thunder Bay district. Scale, 1/500,000, or 7·89 miles to 1 inch.

MAPS IN PROGRESS.

Sheet 3 N.W. Ontario (Kingston sheet) includes Leeds and Grenville and portions of Hastings, Addington, Renfrew, Frontenac and Lanark counties. Scale, 1/250,000 or 3·95 miles to 1 inch.

Sheet 5 N.W. Nova Scotia (Halifax sheet) includes portions of Halifax, Hants, Kings and Lunenburg counties. Scale, 1/250,000 or 3·95 miles to 1 inch.

Sheets 5 N.E. and 14 S.E. (part) Nova Scotia (Truro sheet) includes Pictou and portions of Guysboro', Halifax and Colchester counties. Scale, 1/250,000 or 3·95 miles to 1 inch.

Sheet 7 N.E (Sault Ste. Marie sheet) includes part of Algoma district. Scale, 1/250,000, or 3·95 miles to 1 inch.

Sheet 8 N.W. (Sudbury sheet) includes part of Algoma and Nipissing districts. Scale, 1/250,000, or 3·95 miles to 1 inch.

Sheet 8 N.E. (Manitoulin sheet) includes portions of Manitoulin, Algoma and Sudbury districts. Scale. 1/250,000, or 3·95 miles to 1 inch.

Sheet 9 S.E., Ontario and Quebec (Pembroke sheet) includes portions of Hastings, Addington, Renfrew, Haliburton and Nipissing, Ontario, and of Pontiac county, Quebec. Scale, 1/250,000 or 3·95 miles to 1 inch.

Sheet 10 S.E. (Cornwall sheet) includes Dundas, Prescott and Russell counties, Ontario, and Vaudreuil and Soulanges and portions of Argenteuil and Ottawa counties, Quebec. Scale, 1/250,000, or 3·95 miles to 1 inch.

Sheet 10 S.W., Ontario and Quebec (Ottawa sheet) includes portions of Carleton, Lanark, Frontenac and Renfrew counties, Ontario, and of Ottawa and Pontiac counties, Quebec. Scale, 1/250,000, or 3·95 miles to 1 inch.

Sheet 14 S.W. (Moncton sheet) includes portions of Colchester and Cumberland counties, N.S., Albert, Westmoreland and Kent, N.B., and Prince, P.E.I. Scale, 1/250,000, or 3·95 miles to 1 inch.

Sheets 14 N.W., 14 S.W. and 14 S.E. (parts) Prince Edward Island sheet—includes the island and mainland in vicinity. Scale, 1/250,000, or 3·95 miles to 1 inch.

Sheet 30, Ontario (White River sheet) includes portions of Algoma and Thunder Bay districts. Scale, 1/500,000, or 7·89 miles to 1 inch.

Sheet 31, Ontario (Abitibi sheet) includes portions of Algoma and Nipissing districts. Scale, 1/500,000, or 7·89 miles to 1 inch.

Sheet 31 S.E. (Lake Abitibi sheet) includes the surveyed townships in vicinity of Lake Abitibi, Nipissing and Algoma districts. Scale, 1/250,000, or 3·95 miles to 1 inch.

Sheet 41, British Columbia (Prince Rupert sheet) includes portions of the province between longitude 128° W. and 131° W., and between latitude 52° N. and 55° N. Scale, 1/500,000, or 7·89 miles to 1 inch.

Sheet 42, British Columbia (Babine Lake sheet) includes portion of the province between longitude 125° W. and 128° W., and between latitude 52° N. and 55° N. Scale, 1/500,000, or 7·89 miles to 1 inch.

Sheet 43, British Columbia (Fort George sheet) includes portion of the province between longitude 122° W. and 125° W., and between latitude 52° N. and 55° N. Scale, 1/500,000, or 7·89 miles to 1 inch.

Sheet 44, British Columbia (Tete Jaune Cache sheet) includes portions of the province between longitude 119° W. and 122° W., and between latitude 52° N. and 55° N. Scale, 1/500,000, or 7·89 miles to 1 inch.

Sheet 45, British Columbia (Jasper House sheet) includes portions of the province between longitude 116° W. and 119° W., and between latitude 52° N. and 55° N. Scale, 1/500,000, or 7·89 miles to 1 inch.

Peace River Land District map. Scale, 12½ miles to 1 inch.

Saskatoon Land District map. Scale, 12½ miles to 1 inch.

Rocky Mountains between the Canadian Pacific Railway and the North Saskatchewan. Scale, 4 miles to 1 inch.

Atlas of Canada, 1906. (Out of print.)

ATLAS OF CANADA MAPS.

1. Territorial divisions.
2. Relief map, west sheet.
3. Relief map, east sheet.
4. Geology, west sheet.
5. Geology, east sheet.
6. Minerals, west sheet.
7. Minerals, east sheet.
8. Forests.
9. Limits of trees.
10. Telegraphs—Quebec and Maritime Provinces.
11. Telegraphs—Ontario and Quebec.
12. Telegraphs—Manitoba, Saskatchewan and Alberta.
13. Telegraphs—British Columbia, Yukon and Alberta.
14. Telephones—Maritime Provinces and Quebec.
15. Telephones—Ontario and Quebec.
16. Telephones—Manitoba, Saskatchewan, Alberta, British Columbia.
17. Railways—Quebec and Maritime Provinces.
18. Railways—Ontario and Quebec.
19. Railways, Manitoba, Saskatchewan and Alberta.
20. Railways—British Columbia, Alberta and Yukon.
21. Transcontinental railways.
22. Canals, lighthouses and sailing routes—St. Lawrence and Great Lakes.
23. Lighthouses and sailing routes—Pacific coast.
24. Lighthouses and sailing routes—Atlantic coast.
25. Isotherms for months of year.
26. Isotherms for summer and year; precipitation, snowfall and isobars.

26*a*. Average possible hours of sunshine in summer months and temperature maps.

27. Density of population—Maritime Provinces and Quebec.

27*a* Density of population—Ontario and Quebec.

28. Density of population—Manitoba and Saskatchewan.

28*a*. Density of population—British Columbia and Alberta.

29. Aborigines of Canada—Alaska and Greenland.

29*a*. Origins of the people—Maritime provinces and Quebec.

29*b*. Origins of the people—Ontario and Quebec.

DIAGRAMS.

71. Currency and banking—Savings banks, deposits and withdrawals.
72. Currency and banking—Chartered banks, liabilities, assets, deposits, loan and reserve fund.
73. Currency and banking—Chartered banks, capital, deposits, liabilities and assets.
74. Marine—Light stations, &c., vessels entered, 1903.
75. Marine—Vessels arrived and departed, coasting vessels.
76. Marine—Sea-going shipping, vessels on inland waters.
77. Marine—Vessels in coasting trade, by provinces.
78. Fisheries—Yield, fishermen, value of vessels, &c., fish exports.
79. Railways—Capital, passengers, freight, mileage.
80. Railways—Earnings, working expenses, receipts, expenditure.
81. Railways—Train mileage, rolling stock, passengers, freight.
82. Government railways—Expenditure and revenue, earnings and operating expenses, receipts.
83. Education, immigration—Literate and illiterate, schools, teachers, pupils, expenditure, number of immigrants.

REPORTS.

Altitudes in the Dominion of Canada. With a relief map of North America, 8vo., pp. 226.

Dictionary of altitudes in the Dominion of Canada. With a relief map of Canada, 8vo., pp. 143.

Altitudes in the Dominion of Canada. 2nd edition (in progress).

No. 35.

REPORT OF THE SCHOOL LANDS BRANCH.

DEPARTMENT OF THE INTERIOR.
SCHOOL LANDS BRANCH,
OTTAWA, June 15, 1909.

W. W. CORY, Esq.,
Deputy Minister of the Interior.
Ottawa.

SIR,—I have the honour to submit the following report on the business of the School Lands Branch of the department for the fiscal year ending March 31, 1909.

SALES.

In view of the comparatively poor harvest of the year 1907, and of the financial stringency then prevailing, it was not considered advisable to hold any general auction sales of school lands in the provinces of Manitoba, Saskatchewan and Alberta during the past fiscal year.

At the instance, however, of the government of Alberta, section 29, township 42, range 25 west of the fourth meridian was offered for sale at Ponoka, Alberta, in order to afford them an opportunity of acquiring it in connection with an insane asylum to be erected at that point. The sale was held on April 7, 1908, and the land was sold at $12 per acre to Mr. L. C. Charlesworth as representing the Minister of Public Works for Alberta.

An auction sale was also held at Chaplin, Saskatchewan, on November 5, 1908, of the lots in the subdivision of a portion of section 29, township 17, range 5, west of the third meridian, fifty-four lots being disposed of for $771.

In regard to this I may say that it was found necessary to sub-divide a portion of this section into town lots for the reason that a number of persons had settled on the section and had erected buildings thereon, and it was, therefore, considered advisable to have the land surveyed and subdivided so as to afford those who had made improvements an opportunity of acquiring the lots on which their buildings are situated.

A number of parcels comprising from one to five acres each were also sold during the past fiscal year for school and cemetery purposes. The lands required for school purposes were sold under the amendment to the Dominion Lands Act which provides that portions of school sections required for school sites, not exceeding four acres, may be sold to boards of school trustees at the minimum price of $10 per acre, provided the application of the trustees is endorsed by the minister or deputy minister of education for the province, and that the parcel selected fronts on a road allowance.

Some forty-three sales were also made to railway companies under the Railway Act, of the lands required in school sections for right of way, station grounds, ballast pit, &c., comprising in all some 350·76 acres, representing the sum of $6,754.86.

The net revenue from payments on sales during the past fiscal year was as follows :—

Manitoba	$360,999 16
Saskatchewan	160,395 91
Alberta	128,301 46
Total	$649,696 53

LEASES.

A radical change was made during the year in the manner of renting school lands for grazing purposes.

Heretofore leases have been issued for grazing purposes covering a period of five years subject to a rental of six cents per acre for the school lands in Manitoba, and four cents for those in Saskatchewan and Alberta.

Great difficulty was, however, found in collecting the rental under these leases, the lessees in many instances paying no attention to the notices sent them. The accounts were then placed in the hands of an inspector for collection, but in many cases they were unable to obtain the rental, the lessees either being away from home or not having the money at the time, and as these leases seldom cover more than one section, the amount owing is so inconsiderable that it would hardly be worth while collecting the amount due by process of law, and it is consequently in such cases lost to the fund.

Under these circumstances it was decided that it would be in the interest of the school lands endowment fund to discontinue the issue of grazing leases of school lands, and to substitute for the leases grazing permits. Provision for this was made by order in council of February 22, 1908.

These permits only cover one year, expiring on the 1st of April next following their issue, but they are renewable from year to year at the option of the department, provided that application for the renewal is made each year on or before the 1st February, accompanied by the rental for the next year. Should the permittee not renew his application by the time mentioned, the department is then at liberty to grant the permit to the next applicant after its expiration on the 1st April.

A great saving of time and labour is effected by the change, as no book-keeping is necessary in connection with the permits, and a large amount of correspondence is also saved. There can, of course, be no arrears as the permit is not issued until rental is paid for the current year, and it is not renewed again until the rental for the next year is paid.

During the past fiscal year prior to the issue of the grazing permits 160 grazing leases were issued. Since then 291 grazing permits have been issued.

The net revenue from grazing leases and permits for the fiscal year was as follows :—

Manitoba	$ 1,125 67
Saskatchewan	9,103 89
Alberta	9,552 41

Nine coal leases were issued during the fiscal year, and the revenue from this source was as follows :—

Manitoba	Nil.
Saskatchewan	$ 981 11
Alberta	3,160 81

Hereto attached are three statements lettered A, B and C, respectively, showing the revenue from all sources collected from school lands in Manitoba, Saskatchewan and Alberta during the fiscal year. From this it will be seen that the total net revenue for that period was as follows :—

Manitoba	$365,430 16
Saskatchewan	172,754 90
Alberta	143,440 40
Total	$681,625 46

Statement D shows the revenue collected through the Dominion lands agencies.

Of the total net revenue of $681,625.46, the sum of $38,639.59 was collected through the Dominion lands agencies, and the balance of $642,985.87 at head office.

The expenditure for the fiscal year was as follows :—

Manitoba	$ 6,872 13
Saskatchewan	6,947 00
Alberta	6,840 60
Total	$20,659 73

As the net revenue for the fiscal year was $681,625.46, the expenditure was as nearly as possible 3 per cent of the revenue, which, I submit, is a very moderate amount for the administration of the school lands in the three provinces.

Statements E, F and G are hereto attached showing the revenue and expenditure on account of the school lands fund for the fiscal year, and also the balance standing to the credit of each of the school lands funds on March 31, 1909. From this it will be seen that the balance to the credit of the Manitoba School Lands Fund on March 31 was $2,185,211.69 ; the Saskatchewan School Lands Fund, $850,398.41, and the Alberta School Lands Fund, $452,123.39.

In accordance with orders in council in that regard, cheques were issued in favour of the provincial treasurer of each of the provinces of Manitoba, Saskatchewan and Alberta covering the revenue collected from school lands during the last fiscal year other than principal moneys of sales after deducting the cost of management. The amount so paid over to each province was as follows :—

Manitoba	$108,895 41
Saskatchewan	52,113 24
Alberta	54,239 84

There is a slight decrease in the gross revenue for the current year as compared with the previous year, namely, $688,466.51, as against $704,963.33.

This is due to the fact that there were no general auction sales held during the past fiscal year. The work of the branch has, however, greatly increased in other respects.

I may say that prior to the close of the fiscal year steps were taken for the inspection and valuation of a large number of school lands in Manitoba and Alberta with a view to holding auction sales in these provinces during the present year, and from present indications it is likely that the sales will be very successful.

The following is a statement of the clerical work of the branch for the past fiscal year :—

Letters received and registered	10,042
Letters and telegrams sent	16,045
Leases and grazing permits issued	460
Cultivation permits issued	30
Receipts issued	2,970
Accounts	6,178
Assignments registered	205

Respectfully submitted,

FRANK S. CHECKLEY,
Chief of Branch.

A.—MANITOBA SCHOOL LANDS.

STATEMENT of Revenue collected from School Lands for the Fiscal Year, from April 1, 1908, to March 31, 1909, both dates inclusive.

Month.	Sales.		Total.	Cultivation Permits.	Grazing.	Timber.	Hay.	Registration Fees.	Total.
	Principal.	Interest.							
1908.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
April	1,843 68	2,242 00	4,085 68	5 50	62 07		40 00		4,193 25
May	4,353 82	4,302 65	8,656 47	10 00	51 20				8,717 67
June	17,217 42	11,798 93	29,016 35	4 00	113 42		3 00		29,136 77
July	11,650 55	7,421 63	19,072 18		112 50	125 00			19,309 68
August	2,610 96	1,216 41	3,827 37		13 92				3,841 29
September	957 76	918 46	1,876 22		28 85				1,905 07
October	30,895 34	10,225 60	41,120 94	5 50	59 10	33 00			41,218 54
November	95,261 12	33,611 31	128,872 43	50 00	48 00				128,970 43
December	40,269 35	20,447 72	60,717 07	6 00	28 80				60,751 87
1909.									
January	29,513 58	6,442 06	26,955 64	73 80	111 25				27,140 69
February	8,955 45	3,236 45	12,191 90	25 50	8 21	6 55			12,232 16
March	9,765 85	5,812 21	15,578 06	18 50	54 60				15,651 16
Total	244,294 88	107,675 43	351,970 31	198 80	691 92	164 55	43 00		353,068 58
Agencies	5.776 27	3,667 16	9,443 43	12 50	591 75	1,850 35	1,254 48		13,152 51
	250,071 15	111,342 59	361,413 74	211 30	1,283 67	2,014 90	1,297 48		366,221 09
Registration fees								204 50	204 50
	250,071 15	111,342 59	361,413 74	211 30	1,283 67	2,014 90	1,297 48	204 50	366,425 59
Transfer of fees to Dominion Lands						62 50	269 00		331 50
Amt. Dep. C.N.R., per bank receipt No. 420 of Nov. 26, 1908	250,071 15	111,342 59	361,413 74	211 30	1,283 67	1,952 40	1,028 48	204 50	366,094 09
	38		38						38
	250,071 53	111,342 59	361,414 12	211 30	1,283 67	1,952 40	1,028 48	204 50	366,094 47
Refunds	408 91	6 05	414 96		158 00	77 00	14 35		664 31
	249,662 62	111,336 54	360,999 16	211 30	1,125 67	1,875 40	1,014 13	204 50	365,430 16

DEPARTMENT OF THE INTERIOR,
SCHOOL LANDS BRANCH,
OTTAWA, June 10, 1909.

FRANK S. CHECKLEY,
Chief of Branch.

B.—SASKATCHEWAN SCHOOL LANDS.

STATEMENT of Revenue collected from School Lands for the Fiscal Year from April 1, 1908, to March 31, 1909, both dates inclusive.

Month.	Sales.		Total.	Cultivation Permits.	Grazing Permits.	Timber.	Hay.	Coal.	Sand.	Registration Fees.	Total.
	Principal.	Interest.									
1908.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
April	9,740 22	1,474 97	11,215 19	12 00	483 45		40 00				11,750 64
May	3,429 58	651 55	4,081 14	10 50	392 28		8 50	498 57			4,990 99
June	4,349 20	1,464 85	5,814 05	33 12	730 32						6,577 49
July	1,069 78	1,352 14	2,421 92		427 05		16 00				2,864 97
August	2,139 78	630 34	2,770 12		525 93						3,296 05
September	1,335 16	469 57	1,804 73	12 50	187 14						2,004 37
October	15,971 27	4,956 50	20,927 77	63 50	528 05		1 00				21,520 32
November	33,236 35	14,449 26	47,685 61		172 54			240 59			48,098 74
December	12,876 09	10,455 13	23,331 22		228 80						23,560 02
1909.											
January	10,756 73	3,772 74	14,529 47		277 35						14,806 82
February	6,508 67	2,051 68	8,560 35	35 50	800 20		2 00				9,398 05
March	10,556 00	2,823 74	13,379 74	10 00	782 97						14,172 71
Total	111,968 83	44,552 48	156,521 31	117 12	5,536 08		67 50	739 16			163,041 17
Agencies	1,765 32	2,148 77	3,914 09	10 00	3,655 65	133 75	2,361 70	241 95	28 15		10,345 29
	113,734 15	46,701 25	160,435 40	187 12	9,191 73	133 75	2,429 20	981 11	28 15		173,386 46
Registration fees										95 50	95 50
	113,734 15	46,701 25	160,435 40	187 12	9,191 73	133 75	2,429 20	981 11	28 15	95 50	173,481 96
Transfer fees to Dominion Lands						12 00	483 00				495 00
	113,734 15	46,701 25	160,435 40	187 12	9,191 73	121 75	1,946 20	981 11	28 15	95 50	172,986 96
Refunds	39 49		39 49	15 50	87 84		89 23				232 06
	113,694 66	46,701 25	160,395 91	171 62	9,103 89	121 75	1,856 97	981 11	28 15	95 50	172,754 90

DEPARTMENT OF THE INTERIOR,
SCHOOL LANDS BRANCH,
OTTAWA, June 10, 1909.

FRANK S. CHECKLEY,
Chief of Branch.

C.—ALBERTA SCHOOL LANDS.

STATEMENT of Revenue collected from School Lands for the Fiscal Year from April 1, 1908, to March 31, 1909, both dates inclusive.

Months.	Sales. Principal.	Sales. Interest.	Total.	Cultivation Permits.	Grazing Permits.	Timber.	Hay.	Coal.	Registration Fees.	Total.
1908.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
April	1,155 57	882 53	2,038 10		401 10			216 00		2,655 26
May	602 35	434 30	1,036 65		283 07			132 00		1,451 72
June	1,166 38	1,130 53	2,296 91		563 95			220 00		3,080 86
July	2,443 50	1,432 51	3,876 01		340 00			226 30		4,442 31
August	2,774 26	703 49	3,477 75		464 45	12 25		58 00		4,012 45
September	1,720 98	1,162 21	2,883 19		159 75	30 00		192 00		3,264 94
October	9,647 56	3,653 35	13,300 91		213 56			53 00		13,567 47
November	29,879 46	19,709 28	49,588 74		370 87			168 15		50,127 76
December	14,113 07	8,190 68	22,303 75	3 25	205 00			192 00		22,704 00
1909.										
January	7,786 82	2,574 11	10,360 93		488 33			170 00		11,019 26
February	4,626 99	2,042 06	6,669 05		657 88			84 00		7,410 93
March	5,701 77	2,131 61	7,833 38	13 80	704 13			985 90		9,537 21
Total	81,618 71	44,046 66	125,665 37	17 05	4,852 15	42 25		2,697 35		133,274 17
Agencies	4,910 83	1,894 84	6,805 67		4,752 59	1,358 27	1,091 80	1,133 46		15,141 79
	86,529 54	45,941 50	132,471 04	17 05	9,604 74	1,400 52	1,091 80	3,830 81		148,415 96
Registration fees									143 00	143 00
	86,529 54	45,941 50	132,471 04	17 05	9,604 74	1,400 52	1,091 80	3,830 81	143 00	148,558 96
Transfer fees to Dominion Lands						26 15	191 50			217 65
	86,529 54	45,941 50	132,471 04	17 05	9,604 74	1,374 37	900 30	3,830 81	143 00	148,341 31
Refunds	4,169 58		4,169 58		52 33		9 00	670 00		4,900 91
	82,359 96	45,941 50	128,301 46	17 05	9,552 41	1,374 37	891 30	3,160 81	143 00	143,440 40

DEPARTMENT OF THE INTERIOR,
SCHOOL LANDS BRANCH,
OTTAWA, June 10, 1909.

FRANK S. CHECKLEY,
Chief of Branch.

D.—School Lands Revenue, collected through Dominion Lands Agencies, during the Fiscal Year ending March 31, 1909.

Agencies.	Sales.		Total.	Cultivation.	Grazing	Timber.	Hay.	Coal.	Sand.	Total.
	Principal.	Interest								
	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
Winnipeg......	1,884 70	1,714 23	3,598 93	12 50	135 80	1,641 35	844 38	......	......	6,232 96
Brandon...	3,639 24	1,700 04	5,339 28	.....	461 21	6 50	274 70	. ....	......	6,081 69
Dauphin...	252 33	252 89	505 22	.....	177 80	202 50	243 20	......	......	1,128 72
Estevan.	.. ..	50 40	50 40	......	475 20	....	390 20	226 95	......	1,142 75
Regina... .. .	1,255 67	885 10	2,140 77	......	781 71	87 00	556 10	. ..	28 15	3,593 73
Yorkton.......	509 65	1,213 27	1,722 92	.. ...	204 80	....	279 30	....	......	2,207 02
Prince Albert..	....	....	....	10 00	411 95	39 00	396 90	.....	....	857 85
Battleford.	....	....	....	. ..	383 62	5 00	192 80	10 00	...	591 42
Humboldt.	....	....	....	....	563 82	25	184 80	. .	......	748 87
Moosejaw.	....	....	... .	.... .	651 49	2 50	253 80	5 00	......	912 79
Lethbridge	....	....	....	......	2,289 01	43 94	69 60	532 61	......	2,935 16
Calgary.	3,022 83	1,836 84	4,859 67	.... .	1,711 28	.. ..	301 10	96 00	...	6,968 05
Red Deer.......	1,888 00	58 00	1,926 00	....	452 38	17 00	289 55	287 25	......	2,992 18
Edmonton.....	....	....	. .....	...	299 92	1,297 33	431 55	217 60	.....	2,246 40
	12,452 42	7,710 77	20,163 19	22 50	8,999 99	3,342 37	4,707 98	1,375 41	28 15	38,639 59

FRANK S. CHECKLEY,
Chief of Branch.

Department of the Interior,
School Lands Branch,
Ottawa, June 10, 1909.

E.—MANITOBA SCHOOL LANDS.

STATEMENT of Revenue and Expenditure on account of Manitoba School Lands for the Fiscal Year ended March 31, 1909.

Particulars.	Period.	Dr.	Cr.
		$ cts.	$ cts.
By balance on April 1, 1908			1,935,791 84
" sales	12 months		360,999 16
" cultivation permits	"		211 30
" timber dues, hay permits and grazing rentals	March 31, 1909		4,015 20
" registration fees			204 50
" interest on fund	12 months to March 31, 1909		62,161 11
To cost of management at Ottawa	" "	3,226 30	
" salaries, printing, advertising and general expenses	" "	3,645 83	
" amount over-credited on account of interest during period ended June 30, 1907		242 77	
" revenue and interest paid to the Manitoba Government	12 months to March 31, 1909	108,895 41	
" interest on fund paid to the Manitoba Government	" "	62,161 11	
" balance on March 31, 1909		2,185,211 69	
		2,363,383 11	2,363,383 11

FRANK S. CHECKLEY,
Chief of Branch.

DEPARTMENT OF THE INTERIOR,
SCHOOL LANDS BRANCH,
OTTAWA, June 10, 1909.

F.—SASKATCHEWAN SCHOOL LANDS.

STATEMENT of Revenue and Expenditure on account of Saskatchewan School Lands for the Fiscal Year ended March 31, 1909.

Particulars.	Period.	Dr.	Cr.
		$ cts.	$ cts.
By balance on April 1, 1908			736,703 75
" sales	12 months to March 31, 1909		160,395 91
" cultivation permits	" "		171 62
" timber dues, hay permits, grazing, coal, &c.	" "		12,091 87
" registration fees	" "		95 50
" interest on fund	" "		24,289 14
To cost of management at Ottawa	" "	3,226 29	
" salaries, printing, advertising and general expenses	" "	3,720 71	
" revenue and interest paid to Saskatchewan Government	" "	52,113 24	
" interest on fund paid to Saskatchewan Government	" "	24,289 14	
" Balance on March 31, 1909	" "	850,398 41	
		933,747 79	933,747 79

FRANK S. CHECKLEY,
Chief of Branch.

DEPARTMENT OF THE INTERIOR,
SCHOOL LANDS BRANCH,
OTTAWA, June 10, 1909.

G.—ALBERTA SCHOOL LANDS.

STATEMENT of Revenue and Expenditure on account of Alberta School Lands for the Fiscal Year ended March 31, 1909.

Particulars.	Period.	Dr.	Cr.
		$ cts.	$ cts.
By balance on April 1, 1908			369,763 43
" sales	12 months ended March 31, 1909.		128,301 46
" cultivation permits	" "		17 05
" timber dues, hay permits, grazing and coal	" "		14,978 89
" registration fees	" "		143 00
" interest on fund	" "		12,790 09
To cost of management at Ottawa	" "	3,226 29	
" salaries, printing, advertising and general expenses	" "	3,614 31	
" revenue and interest paid to Alberta Government	" "	54,239 84	
" interest on fund paid to Alberta Government	" "	12,790 09	
" Balance on March 31, 1909	" "	452,123 39	
		525,993 92	525,993 92

FRANK S. CHECKLEY,
Chief of Branch.

DEPARTMENT OF THE INTERIOR,
SCHOOL LANDS BRANCH,
OTTAWA, June 10, 1909.

PART II

IMMIGRATION

IMMIGRATION

REPORT OF THE SUPERINTENDENT OF IMMIGRATION.

DEPARTMENT OF THE INTERIOR,

OTTAWA, May 3, 1909.

W. W. CORY, Esq.,
Deputy Minister of the Interior,
Ottawa.

SIR,—I have the honour to submit herewith the annual reports of the principal officers engaged in the immigration service in Canada and abroad, having reference to the fiscal year ending March 31, 1909, and at the same time to draw attention to the following statistical tables compiled in my office :—

IMMIGRANT ARRIVALS.

SUMMARY for the fiscal Year 1908-9.

Per ocean travel—			
Quebec		44,070	
St. John		13,601	
Halifax		13,379	
North Sydney		2,390	
Vancouver		1,517	
Victoria		1,302	
New York	8,458		
Portland	1,615		
Boston	675		
Philadelphia	40		
Baltimore	29	10,817	87,076
From the United States (direct)			59,832
Total			146,908

COMPARATIVE STATEMENT.

TOTAL Immigrants arriving for Canada by months, for the fiscal year ending March 31, 1909, and for the fiscal year ending March 31, 1908.

—	Fiscal Year 1907-8.				Fiscal Year 1908-9.			
	Males.	Females.	Children.	Totals.	Males.	Females.	Children.	Totals.
April	30,103	7,155	6,793	44,051	19,311	5,342	5,100	29,753
May	28,493	8,675	8,509	45,677	13,168	5,418	4,998	23,584
June	20,913	8,450	8,280	37,643	7,800	4,439	3,397	15,636
July	14,601	6,150	5,590	26,341	5,611	3,191	2,528	11,330
August	10,744	5,508	4,760	21,012	5,062	2,765	2,255	10.082
September	10,039	5,074	3,944	19,057	5,367	2,829	1,896	10,092
October	9,374	4,779	4,090	18,243	4,248	2,640	2,201	9,089
November	7,516	3,583	3,166	14,265	3,359	1,924	1,747	7,030
December	5,513	1,899	1,624	9,036	2,670	1,215	1,075	4,960
January	3,174	1,274	1,119	5,567	2,247	976	874	4,097
February	3,609	1,434	1,121	6,164	2,963	1,033	795	4,791
March	9,749	2,931	2,733	15,413	10,359	3,011	3,094	16,464
Totals	153,828	56,912	51,729	262,469	82,165	34,783	29,960	146,908

COMPARATIVE STATEMENT.

TOTAL Immigrants arriving for Canada, by ports, for the fiscal year ending March 31, 1909, and for the fiscal year ending March 31, 1908.

—	Fiscal Year 1907–8.				Fiscal Year 1908–9.			
	Males.	Females.	Children.	Totals.	Males.	Females.	Children.	Totals.
North Sydney	2,726	618	378	3,722	1,822	409	159	2,390
Halifax	17,857	5,514	4,948	28,319	7,839	2,916	2,624	13,379
St. John	11,913	3,454	2,527	17,894	8,855	2,743	2,003	13,601
Quebec	57,218	28,708	26,398	112,324	18,452	14,446	11,172	44,070
Vancouver	6,218	208	140	6,566	1,293	103	121	1,517
Victoria	5,401	487	136	6,024	1,003	181	118	1,302
Via United States ports, (New York, Portland, Boston, Baltimore and Philadelphia)	20,960	4,552	3,796	29,308	7,073	2,100	1,644	10,817
From the United States	31,535	13,371	13,406	58,312	35,828	11,885	12,119	59,832
Totals	153,828	56,912	51,729	262,469	82,165	34,783	29,960	146,908

COMPARATIVE STATEMENT.

TOTAL Immigrants arriving from the United States, direct, by months, for the fiscal year ending March 31, 1909, and for the fiscal year ending March 31, 1908.

—	Fiscal Year 1907–8.				Fiscal Year 1908–9.			
	Males.	Females.	Children.	Totals.	Males.	Females.	Children.	Totals.
April	5,131	2,103	2,379	9,613	5,676	1,531	1,877	9,084
May	3,749	1,522	1,651	6,922	3,923	1,209	1,307	6,439
June	2,806	1,279	1,239	5,324	2,876	1,047	961	4,884
July	2,760	1,455	1,180	5,395	2,684	1,003	792	4,479
August	2,160	1,077	839	4,076	3,027	907	750	4,684
September	1,954	1,019	880	3,853	2,965	971	753	4,689
October	2,435	1,139	1,072	4,646	2,582	1,030	973	4,585
November	2,140	951	1,065	4,156	2,145	889	994	4,028
December	1,627	615	695	2,937	1,655	597	610	2,862
January	1,542	606	614	2,762	1,317	480	499	2,296
February	1,446	525	495	2,466	1,566	542	512	2,620
March	3,785	1,080	1,297	6,162	5,412	1,679	2,091	9,182
Totals	31,535	13,371	13,406	58,312	35,828	11,885	12,119	59,832

SEX, OCCUPATION and Destination of total Immigrant arrivals for Canada, for the Fiscal Year ending March 31, 1909.

—	Sex.				Trade or Occupation.											
					Farmers or Farm Labourers Class.			General Labourers.			Mechanics.			Clerks, Traders, &c.		
	Males.	Females.	Children.	Totals.	Males.	Females.	Children.	Males.	Females.	Children.	Males.	Females.	Children.	Males.	Females.	Children.
Via ocean ports........	46,337	22,898	17,841	87,076	16,489	4,253	4,902	13,809	1,997	2,573	8,909	5,090	4,939	4,402	1,960	1,302
From the United States.	35,828	11,885	12,119	59,832	23,214	9,291	10,360	6,312	648	644	3,326	730	491	1,424	411	231
Totals...........	82,165	34,783	29,960	146,908	39,703	13,544	15,262	20,121	2,645	3,217	12,235	5,820	5,430	5,826	2,371	1,533

—	Trade or Occupation—*Con.*							Destination.							
	Miners.			Female Servants	Not Classified.										
	Males.	Females.	Children.		Males.	Females.	Children.	Maritime Provinces.	Quebec.	Ontario.	Manitoba.	Saskatchewan.	Alberta.	British Columbia.	Yukon.
Via ocean ports......	1,264	454	635	6,615	1,464	2,529	3,490	6,144	16,882	27,020	14,930	6,655	6,100	9,341	4
From the United States.	945	95	74	182	607	528	319	373	2,851	2,245	4,772	15,491	21,551	12,521	28
Totals...........	2,209	549	709	6,797	2,071	3,057	3,809	6,517	19,733	29,265	19,702	22,146	27,651	21,862	32

COMPARATIVE STATEMENT.

IMMIGRANTS arriving for Canada, by nationalities, for the fiscal year 1908-9, and for the fiscal year 1907-8, showing increase or decrease of each nationality.

—	Fiscal Year, 1907-8.	Fiscal Year, 1908-9.	Increase.	Decrease.
English	90,380	37,019		53,361
Welsh	1,032	463		569
Scotch	22,223	11,810		10,413
Irish	6,547	3,609		2,938
Total British	120,182	52,901		67,281
African, South	76	53		23
Australian	180	171		9
Austrian, N.E.S	1,899	1,830		69
Bohemian	102	28		74
Bukowinian	2,145	1,546		599
Croatian	224	1		223
Dalmatian	10	1		9
Galician	14,268	6,644		7,624
Hungarian, N.E.S	1,307	595		712
Magyar	321	4		317
Ruthenian	912	149		763
Slovak	188			188
Belgian	1,214	828		386
Bulgarian	2,529	56		2,473
Brazilian	1	4	3	
Chinese	1,884	1,887	3	
Dutch	1,212	495		717
French	2,671	1,830		841
German, N.E.S.	2,363	1,257		1,106
Alsatian	2	1		1
Bavarian	7			7
Prussian	5	74	69	
Saxon		8	8	
West Indian	134	113		21
Bermudian	43	14		29
Jamaican	101	32		69
Greek	1,053	192		861
Hebrew, N.E.S.	1,679	151		1,528
" Russian	5,738	1,444		4,294
" Polish	46	2		44
" Austrian	195	24		171
" German	54	15		39
Italian	11,212	4,228		6,984
Japanese	7,601	495		7,106
Newfoundland	3,374	2,108		1,266
New Zealand	70	65		5
Portuguese	2	2		
Polish, N.E.S.	255	76		179
" Austrian	586	42		544
" German	16	3		13
" Russian	736	255		481
Persian	7	1		6
Roumanian	949	278		671
Russian, N.E.S.	6,281	3,547		2,734
Finnish	1,212	669		543
Spanish	61	32		29
Swiss	195	129		66
Servian	48	31		17
Danish	290	160		130
Icelandic	97	35		62
Swedish	2,132	1,135		997
Norwegian	1,554	752		802
Turkish	489	236		253
Armenian	563	79		484
Egyptian	8	2		6
Syrian	732	189		543
Arabian	50	4		46
U.S.A. Citizens (through ocean ports)	133	94		39
Negro	136	73		63
Hindoo	2,623	6		2,617
Total Continental, &c	83,975	34,175		49,800
United States (direct)	58,312	59,832	1,520	
Total Immigration	262,469	146,908		115,561

ARRIVALS AT OCEAN PORTS.

For the fiscal year 1908-9, there arrived, via Canadian and United States ocean ports 145,431 passengers, of whom 14,588 travelled saloon and 130,843 steerage. Of the saloon passengers, 11,916 were destined to Canada and 2,672 to the United States. Of the steerage passengers, 113,452 were for Canada and 17,391 for the United States. Included in the steerage passengers for Canada were 21,501 returned Canadians and 4,875 tourists, leaving the immigration proper via ocean ports at 87,076 souls, which together with the 59,832 settlers direct from the United States, brings the total immigration to 146,908, a decrease as compared with the preceding fiscal year of 115,561 persons.

The following further statistical information will be of interest :—Table I. deals with the total arrivals of saloon passengers, Table II. with the total arrivals of steerage passengers, Table III. with the monthly arrivals of immigrants for Canada, and Tables IV. and V. give summaries of the information obtained from immigrants for Canada upon arrival.

TABLE I.

NATIONALITY and Sex of Saloon Passengers arriving at Ocean Ports, for the Fiscal Year ending March 31, 1909.

	Canada.				United States.				Canada and United States.			
	Males.	Females.	Children.	Totals.	Males.	Females.	Children.	Totals.	Males.	Females.	Children.	Totals.
African, South	1	1	1	3	2			2	3	1	1	5
Australian	79	92	22	193	25	17	5	47	104	109	27	240
Austrian	13			13	1	1		2	14	1		15
Belgian	7	4		11	2			2	9	4		13
Chinese	12	1	5	18	6	3		9	18	4	5	27
Dutch	13	4		17	1			1	14	4		18
French	132	93	20	245	17	12	5	34	149	105	25	279
German	38	13		51	17	9		26	55	22		77
English	2,246	1,229	188	3,663	135	56	10	201	2,381	1,285	198	3,864
Welsh	38	15		53	4	1		5	42	16		58
Scotch	529	302	42	873	58	34		92	587	336	42	965
Irish	117	71	8	196	9	10		19	126	81	8	215
West Indian	48	55	25	128	9	5	1	15	57	60	26	143
Bermudian	2	5	1	8					2	5	1	8
Jamaican	5			5	1			1	6			6
Greek	1			1					1			1
Italian	17	1		18	1	2		3	18	3		21
Japanese	23	6	3	32	5	5	2	12	28	11	5	44
Newfoundland	312	207	21	540	115	116	3	234	427	323	24	774
New Zealand	41	37	4	82	9	4		13	50	41	4	95
Portugnese	3	1		4					3	1		4
Russian	7	2		9	2	2		4	9	4		13
Finnish					1			1	1			1
Spanish	7	1		8	2			2	9	1		10
Swiss	6	1	1	8	1			1	7	1	1	9
Danish	2	1	3	6	2			2	4	1	3	8
Swedish	10	4		14	5			5	15	4		19
Norwegian	1	4		5	1	1		2	2	5		7
Armenian					1	1		2	1	1		2
Egyptian	2			2					2			2
Syrian	3			3	2			2	5			5
U.S.A. citizens	139	72	16	227	937	837	105	1,879	1,076	909	121	2,106
Negro	2	1		3					2	1		3
Hindoo	2			2					2			2
Canadian	2,279	1,642	317	4,238	17	3	3	23	2,296	1,645	320	4,261
Tonrist	687	466	84	1.237	16	12	3	31	703	478	87	1,268
Totals	6,824	4,331	761	11,916	1,404	1,131	137	2,672	8,228	5,462	898	14,588

TABLE II.

NATIONALITY and Sex of Steerage Passengers arriving at Ocean Ports, for the Fiscal Year ending March 31, 1909.

	Canada.				United States.				Canada and United States.			
	Males.	Females.	Children.	Totals.	Males.	Females.	Children.	Totals.	Males.	Females.	Children.	Totals.
African, South...	21	18	14	53	4	2	13	19	25	20	27	72
Australian........	86	48	37	171	81	73	37	191	167	121	74	362
Austrian, N.E.S..	1,225	316	289	1,830	185	83	33	301	1,410	399	322	2,131
Bohemian	7	14	7	28	7	2	...	9	14	16	7	37
Bukowinian	1,353	101	92	1,546	3	1	...	4	1,356	102	92	1,550
Croatian..........	1	...	...	1	5	...	...	5	6	...	...	6
Dalmatian........	...	1	...	1	...	...	...	...	...	1	...	1
Galician....... ...	4,657	992	995	6,644	21	28	17	66	4,678	1,020	1,012	6,710
Hungarian, N.E.S.	393	107	95	595	42	44	34	120	435	151	129	715
Magyar...	...	1	3	4	...	...	...	...	...	1	3	4
Ruthenian...	127	9	13	149	...	...	...	...	127	9	13	149
Belgian........ ...	401	210	217	828	40	19	26	85	441	229	243	913
Bulgarian.........	52	4	...	56	12	5	3	20	64	9	3	76
Brazilian..........	...	...	4	4	...	...	...	...	...	...	4	4
Chinese.....	1,695	36	156	1,887	130	4	2	136	1,825	40	158	2,023
Dutch.....	227	135	133	495	35	19	19	73	262	154	152	568
French..... ..	1,143	460	227	1,830	47	34	18	99	1,190	494	245	1,929
German, N.E.S...	588	326	343	1,257	186	133	106	425	774	459	449	1,682
Alsatian..........	1	...	...	1	...	...	...	...	1	...	...	1
Prussian..........	22	15	37	74	1	1	3	5	23	16	40	79
Saxon	...	1	7	8	1	...	...	1	1	1	7	9
English..	16,512	11,336	9,171	37,019	938	670	381	1,989	17,450	12,006	9,552	39,008
Welsh...........	231	132	100	463	39	22	12	73	270	154	112	536
Scotch............	5,342	3,959	2,509	11,810	312	206	112	630	5,654	4,165	2,621	12,440
Irish...	1,733	1,278	598	3,609	163	98	30	291	1,896	1,376	628	3,900
West Indian ..	58	48	7	113	16	7	3	26	71	55	10	139
Bermudian.. ..	4	8	2	14	...	...	...	...	4	8	2	14
Jamaican........	20	12	...	32	...	...	...	...	20	12	...	32
Greek.... .. .	165	13	14	192	78	...	6	84	243	13	20	276
Hebrew, N.E.S...	55	46	50	151	24	13	23	60	79	59	73	211
" Russian..	460	486	498	1,444	28	31	39	98	488	517	537	1,542
" Polish...	2	...	...	2	...	...	...	...	2	...	...	2
" Austrian.	9	6	9	24	...	...	...	...	9	6	9	24
" German..	6	5	4	15	...	...	...	...	6	5	4	15
Italian........	3,567	394	267	4,228	31	7	6	44	3,598	401	273	4,272
Japanese...... ...	312	153	30	495	31	20	...	51	343	173	30	546
Newfoundland....	1,605	374	129	2,108	537	372	33	942	2,142	746	162	3,050
New Zealand......	36	17	12	65	32	12	4	48	68	29	16	113
Portuguese...... .	1	1	...	2	7	...	...	7	8	1	...	9
Polish, N.E.S.....	50	15	11	76	23	14	7	41	73	29	18	120
" Austrian...	40	1	1	42	2	...	...	2	42	1	1	44
" German. ..	3	...	...	3	...	...	...	...	3	...	...	3
" Russian...	127	62	66	255	4	10	9	23	131	72	75	278
Persian	1	...	...	1	...	...	...	...	1	...	...	1
Roumanian.. ...	114	82	82	278	14	12	9	35	128	94	91	313
Russian, N.E.S...	1,672	815	1,060	3,547	577	460	507	1,544	2,249	1,275	1,567	5,091
Finnish...... .. .	428	158	83	669	1,579	402	242	2,223	2,007	560	325	2,892
Spanish....... .	24	3	5	32	4	1	...	5	28	4	5	37
Swiss........... .	87	27	15	129	16	18	10	44	103	45	25	173
Servian...........	6	5	20	31	9	5	5	19	15	10	25	50
Danish.....	106	44	10	160	161	69	54	284	267	113	64	444
Icelandic	17	13	5	35	...	1	...	1	17	14	5	36
Swedish...........	633	291	211	1,135	558	287	147	992	1,191	578	358	2,127
Norwegian..	432	181	139	752	977	549	264	1.790	1,409	730	403	2,542
Turkish....	202	21	13	236	33	5	5	43	235	26	18	279
Armenian	44	23	12	79	78	31	23	132	122	51	35	211
Egyptian.........	2	...	...	2	2	...	...	2	4	...	...	4
Syrian............	120	41	28	189	22	10	6	38	142	51	34	227
Arabian	2	2	...	4	...	...	...	...	2	2	...	4
U.S.A. citizens....	56	29	9	94	1,263	1,079	292	2,634	1,319	1,108	301	2,728
Negro....	49	22	2	73	...	...	...	...	49	22	2	73
Hindoo...	5	1	...	6	2	...	...	2	7	1	...	8
Total immigration.	46,337	22,898	17,841	87,076	8,360	4,859	2,540	15,759	54,697	27,757	20,381	102,835
Returned Canadian	15,320	4,438	1,743	21,501	...	...	...	...	15,320	4,438	1,743	21,501
Tourist	3,412	1,279	184	4,875	1,283	258	91	1,632	4,695	1,537	275	6,507
Totals	65,069	28,615	19,768	113,452	9,643	5,117	2,631	17.391	74,712	33,732	22,399	130,843

TABLE III.

MONTHLY arrivals of Immigrants, for Canada, at Ocean Ports, for the Fiscal Year ending March 31, 1909.

—	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Totals
African, South	3	4	2	5	2	13	8	2	4	7	3		53
Australian	9	18	48	16	10	13	8	11	7	9	5	17	171
Austrian, N.E.S.	591	224	223	77	60	96	109	118	54	55	77	146	1,830
Bohemian	7	2	5	2	7		1	1		1		2	28
Bukowinian	969	415	103	11	3	13		6		1	1	24	1,546
Croatian		1											1
Dalmatian		1											1
Galician	3,277	2,080	774	58	106	51	31	55	15	61	20	116	6,644
Hungarian, N.E.S.	105	44	48	37	19	23	35	29	45	55	52	103	595
Magyar	4												4
Ruthenian	122	27											149
Belgian	184	170	65	42	38	50	46	17	23	50	31	112	828
Bulgarian	2	30	5		11	2		2	1			3	56
Brazilian												4	4
Chinese	199	445	154	418	197	133	86	80	58	44	22	51	1,887
Dutch	102	76	41	36	22	44	21	11	19	4	7	112	495
French	270	406	196	169	141	163	144	71	50	34	42	144	1,830
German, N.E.S.	282	162	141	97	87	83	100	67	32	53	45	108	1,257
Alsatian	1												1
Prussian	22	1			3	1			47				74
Saxon						8							8
English	8,360	7,616	4,515	3,373	2,606	2,221	2,149	1,125	664	538	747	3,105	37,019
Welsh	98	67	49	38	38	48	33	31	11	5	5	40	463
Scotch	2,257	2,044	2,338	905	742	1,059	608	297	250	186	216	908	11,810
Irish	669	634	510	358	322	327	204	131	86	41	53	274	3,609
West Indian	6	24	16	13	13	23	3	2	3	2	2	6	113
Bermudian	3			2	2		3	1			1	2	14
Jamaican	3	1	8	4		3	9	2				2	32
Greek	44	12	11	16	27	6	1	3	16	3	7	46	192
Hebrew, N.E.S.	22	23	25	11	19		2	12	8	23	6		151
" Russian	187	151	169	193	131	156	69	89	80	67	75	77	1,444
" Polish	1			1									2
" Austrian	11	6	2			4		1					24
" German	2	4						7		2			15
Italian	1,237	1,005	199	84	111	115	126	112	118	83	275	763	4,228
Japanese	152	113	51	39	27	21	31	12	16	11	13	9	495
Newfoundland	303	307	183	113	193	222	177	218	83	63	37	209	2,108
New Zealand	11	6	23	4	4	2	1	6		1	3	4	65
Portuguese	2												2
Polish, N.E.S.	2	6	23	2	2	14	5	1	1		11	9	76
" Austrian	35	3			4								42
" German		1		2									3
" Russian	33	44	69	25	21	4	7	10		23		19	255
Persian					1								1
Roumanian	50	43	31	34	4	12	20	15	26	3	10	30	278
Russian, N.E.S.	654	510	381	333	157	192	172	312	161	198	162	315	3,547
Finnish	29	29	28	44	39	41	53	50	89	86	86	95	669
Spanish	5		2	7	2	4	9	1		2			32
Swiss	8	28	12	11	6	16	12	4	3	4		25	129
Servian		1							1			29	31
Danish	35	25	13	14	8	7	8	6	5	4	11	24	160
Icelandic	5	2	10	3	2		8		3		1	1	35
Swedish	116	192	120	123	84	106	83	41	50	25	67	128	1,135
Norwegian	93	77	86	64	64	82	58	21	23	21	34	129	752
Turkish	5	38	6	6	1	9	31	17	11	13	27	72	236
Armenian	25	2	5	16		1	5	2	13	1	1	8	79
Egyptian					1				1				2
Syrian	11	6	30	33	37	10	15	1	14	18	10	4	189
Arabian					1		1	1	1				4
U.S.A. citizens	12	15	10	11	18	4	1	1	5	4	6	7	94
Negro	34	2	20		5	1	10		1				73
Hindoo		2	2	1			1						6
Totals	20,669	17,145	10,752	6,851	5,398	5,403	4,504	3,002	2,098	1,801	2,171	7,282	87,076

TABLE IV.

MONTHLY arrivals of Immigrants for Canada, by Occupation and Destination at Ocean Ports, for the Fiscal Year ending March 31, 1909.

—	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	Totals.
Agriculturists..	6,613	5,830	3,533	1,792	1,296	953	913	587	478	306	550	2,793	25,644
General labourers.....	6,528	3,040	1,458	949	696	693	595	663	446	479	605	2,227	18,379
Mechanics	3,888	3,791	2,625	1,711	1,357	1,834	1,172	623	325	334	352	926	18,938
Clerks	1,139	1,576	1,136	842	669	507	469	296	241	167	182	440	7,664
Miners........	355	327	259	236	196	259	183	116	96	99	103	124	2,353
Female servants	1,067	1,055	1,000	564	536	575	562	361	190	150	147	408	6,615
Not classed	1,079	1,526	741	757	648	582	610	356	322	266	232	364	7,483
Totals	20,669	17,145	10,752	6,851	5,398	5,403	4,504	3,002	2,098	1,801	2,171	7,282	87,076
Maritime Provinces....	1,419	836	462	384	438	413	412	395	298	252	170	665	6,144
Quebec	3,566	3,743	1,901	1,268	1,110	1,600	968	672	347	308	500	899	16,882
Ontario........	6,452	5,495	3,239	2,244	1,739	1,469	1,449	811	622	489	676	2,335	27,020
Manitoba......	4,723	3,011	1,969	997	714	636	475	357	245	238	233	1,332	14,930
Saskatchewan..	1,545	1,241	1,079	536	387	345	314	180	162	123	107	636	6,655
Alberta........	1,311	1,150	831	507	403	304	324	182	116	124	169	679	6,100
British Columbia .. .	1,653	1,669	1,271	915	607	634	562	405	308	267	315	735	9,341
Yukon	......	......	....	.....	......	2	......	....	.....	.....	1	1	4
Totals	20,669	17,145	10,752	6,851	5,398	5,403	4,504	3,002	2,098	1,801	2,171	7,282	87,076

TABLE

Nationality, Sex, Occupation and Destination of Immigrant arrivals

—	Sex.				Trade or									
					Farmers or Farm Labourers Class.			General Labourers.			Mechanics.			
	Males.	Females.	Children.	Totals.	Males.	Females.	Children.	Males.	Females.	Children.	Males.	Females.	Children.
African, South	21	18	14	53	9	2	4	1	....	1	5	6	4
Australian	86	48	37	171	19	5	5	16	1	....	22	8	7
Austrian, N.E.S.	1,225	316	289	1,830	560	71	88	545	43	79	66	30	23
Bohemian	7	14	7	28	....	....	....	....	....	....	2	1	1
Bukowinian	1,353	101	92	1,546	325	28	53	985	20	24	24	5	4
Croatian	1	....	....	1	....	....	....	1	....	....	....	....	....
Dalmatian	....	1	....	1	....	1	....	....	....	....	....	....	....
Galician	4,657	992	995	6,644	1,770	391	704	2,681	160	195	144	32	27
Hungarian, N.E.S.	393	107	95	595	294	34	31	67	8	11	20	8	9
Magyar	....	1	3	4	....	....	....	....	....	....	....	....	....
Ruthenian	127	9	13	149	122	4	9	1	1	3	4	....	....
Belgian	401	210	217	828	149	58	86	58	15	10	50	30	26
Bulgarian	52	4	....	56	20	2	....	26	....	....	4	....	....
Brazilian	....	....	4	4	....	....	....	....	....	....	....	....	....
Chinese	1,695	36	156	1,887	24	....	1	559	....	8	46	....	3
Dutch	227	135	133	495	140	60	83	14	5	4	41	21	20
French	1,143	460	227	1,830	572	131	109	128	21	14	196	79	46
German, N.E.S.	588	326	343	1,257	214	91	149	123	40	57	136	48	58
Alsatian	1	....	....	1	1	....	....	....	....	....	....	....	....
Prussian	22	15	37	74	14	8	24	3	1	3	2	....	....
Saxon	....	1	7	8	....	1	7	....	....	....	....	....	....
English	16,512	11,336	9,171	37,019	6,604	2,120	1,972	2,190	983	1,304	4,739	3,036	2,962
Welsh	231	132	100	463	77	23	30	18	8	7	75	35	42
Scotch	5,342	3,959	2,509	11,810	1,901	510	562	549	224	262	1,875	1,023	1,011
Irish	1,733	1,278	598	3,609	745	145	145	243	65	95	308	158	141
West Indian	58	48	7	113	10	....	....	13	1	1	10	3	....
Bermudian	4	8	2	14	....	....	....	1	....	....	1	....	....
Jamaican	20	12	....	32	....	....	....	....	....	....	5	....	....
Greek	165	13	14	192	20	....	....	122	5	7	12	1	1
Hebrew, N.E.S.	55	46	50	151	6	2	1	9	....	4	29	28	35
" Russian	460	486	498	1,444	49	29	30	105	33	51	250	258	269
" Polish	2	....	....	2	1	....	....	....	....	....	1	....	....
" Austrian	9	6	9	24	....	....	....	2	....	....	4	3	3
" German	6	5	4	15	1	1	2	....	....	....	5	1	....
Italian	3,567	394	267	4,228	1,183	45	38	2,069	62	48	182	19	11
Japanese	312	153	30	495	69	6	1	131	22	6	17	3	1
Newfoundland	1,605	374	129	2,108	32	1	4	1,289	33	24	160	26	16
New Zealand	36	17	12	65	9	1	2	5	....	....	11	1	1
Portuguese	1	1	....	2	....	1	....	....	....	....	....	....	....
Polish, N.E.S.	50	15	11	76	10	....	....	23	3	5	4	5	3
" Austrian	40	1	1	42	28	1	1	10	....	....	2	....	....
" German	3	....	....	3	1	....	....	....	....	....	....	....	....
" Russian	127	62	66	255	47	17	26	47	12	14	12	10	16
Persian	1	....	....	1	....	....	....	1	....	....	....	....	....
Roumanian	114	82	82	278	27	13	19	55	11	20	24	20	18
Russian, N.E.S.	1,672	815	1,060	3,547	664	279	493	745	108	204	170	117	105
Finnish	428	158	83	669	61	11	10	291	38	39	34	10	15
Spanish	24	3	5	32	....	....	....	4	....	....	8	1	....
Swiss	87	27	15	129	51	7	10	5	....	....	16	3	....
Servian	6	5	20	31	....	....	....	1	....	....	....	....	....
Danish	106	44	10	160	58	6	4	23	....	....	18	5	2
Icelandic	17	13	5	35	10	5	2	2	1	....	3	2	1
Swedish	633	291	211	1,135	268	87	116	257	32	30	78	22	26
Norwegian	432	181	139	752	176	45	69	203	24	37	30	17	24
Turkish	202	21	13	236	85	2	2	99	5	2	10	....	1

V.

for Canada at Ocean Ports, for the Fiscal Year ending March 31, 1909.

Occupation.										Destination.							
Clerks, Traders, &c.			Miners.			Female Servants.	Not Classified.			Maritime Provinces.	Quebec.	Ontario.	Manitoba.	Saskatchewan.	Alberta.	British Columbia.	Yukon.
Males.	Females.	Children.	Males.	Females.	Children.		Males.	Females.	Children.								
3	5	1	....	....	....	2	3	3	4	5	5	20	3	....	6	14	...
16	6	7	6	1	....	7	7	20	18	2	19	22	6	4	13	104	1
24	7	3	26	13	28	89	4	63	68	94	582	321	472	115	162	84	...
....	....	....	5	3	5	10	....	....	1	1	8	....	3	....	2	14	...
....	....	....	19	2	3	41	....	5	8	140	414	227	540	148	5[illegible]	19	...
....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	...
....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	...
3	....	....	54	3	1	348	5	58	68	131	893	921	3,395	696	54[illegible]	59	...
2	1	2	7	4	4	19	3	33	38	50	37	151	70	112	5[illegible]	119	...
....	....	....	....	....	....	....	....	1	3	....	....	....	....	4	....	....	...
....	....	....	....	....	....	2	....	2	1	1	93	19	24	11	1	....	...
16	5	1	116	58	74	21	12	23	20	219	180	29	230	34	82	54	...
....	1	....	2	....	....	1	....	....	....	22	5	10	13	5	1	....	...
....	....	....	....	....	....	....	....	....	4	....	....	....	....	4	....	....	...
975	7	33	1	....	....	....	90	29	111	11	146	180	9	....	2	1,539	...
17	10	13	....	....	....	19	15	20	13	12	50	70	105	58	131	69	...
94	23	8	29	8	18	85	124	113	32	185	859	106	369	160	99	52	...
63	21	10	26	9	18	71	26	46	51	72	196	134	327	236	203	89	...
....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	...
....	....	....	1	....	....	1	2	5	10	3	....	3	7	39	21	1	...
....	....	....	....	....	....	....	....	....	....	....	....	....	8	....	....	....	...
1,850	1,108	672	372	212	314	2,795	757	1,082	1,947	1,934	6,074	15,204	4,647	2,890	2,614	3,656	...
22	10	4	30	12	11	32	9	12	6	27	65	123	81	37	41	89	...
642	432	278	228	64	93	1,444	147	262	303	468	2,372	3,820	1,886	761	1,005	1,495	3
319	149	91	27	12	15	602	91	147	111	122	778	1,310	694	154	298	253	...
15	2	1	....	....	....	37	10	5	5	41	21	41	1	....	....	9	...
1	....	....	....	....	....	4	1	4	2	7	1	6	....	....	....	....	...
2	....	....	....	....	....	4	13	8	....	3	6	23	....	....	....	....	...
5	2	3	....	....	....	4	6	1	3	1	62	105	3	....	2	19	...
10	2	6	....	....	....	9	1	5	4	2	97	30	19	3	....	....	...
44	68	102	3	1	....	64	9	33	46	43	628	427	292	35	4	15	...
....	....	....	....	....	....	....	....	....	....	....	1	1	....	....	....	....	...
3	2	5	....	....	....	1	....	....	1	....	16	8	....	....	....	....	...
....	1	2	....	....	....	2	....	....	....	....	7	7	1	....	....	....	...
33	7	5	77	2	5	93	23	166	160	161	1,676	1,712	89	8	124	458	...
63	12	....	....	....	....	3	32	107	22	1	5	2	1	....	13	473	...
43	3	....	70	29	18	226	11	56	67	1,894	66	66	24	3	12	43	...
5	2	....	3	....	....	4	3	9	9	2	2	6	5	1	8	41	...
....	....	....	....	....	....	....	1	....	....	....	....	1	....	....	....	1	...
....	....	....	12	2	1	4	1	1	2	18	22	16	11	3	1	5	...
....	....	....	....	....	....	....	....	....	....	....	17	13	11	1	....	....	...
....	....	....	2	....	....	....	....	....	....	2	1	....	....	....	....	....	...
....	2	....	21	5	7	11	....	5	3	31	86	38	54	26	17	3	...
....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	...
4	5	5	....	....	....	16	4	17	20	....	154	33	30	58	3	....	...
31	22	29	47	3	5	170	15	116	224	201	727	562	970	706	211	170	...
2	....	....	40	8	6	84	....	7	22	4	65	483	20	10	33	54	...
5	2	5	2	....	....	....	5	....	....	3	21	7	1	....	....	....	...
8	3	1	1	....	....	8	6	6	4	1	44	14	35	6	8	21	...
....	....	....	....	....	....	....	5	5	20	29	....	....	1	....	....	1	...
6	1	....	....	....	....	28	1	4	4	12	30	25	36	22	24	11	...
2	....	....	....	....	....	5	....	....	2	....	3	....	28	1	3	....	...
7	2	1	20	3	9	130	3	15	29	14	85	338	274	153	133	138	...
7	4	....	11	....	....	73	5	18	9	45	59	119	114	148	152	115	...
4	1	....	3	....	....	9	1	4	8	6	58	147	....	....	1	24	...

TABLE

NATIONALITY, Sex, Occupation and Destination of Immigrant arrivals

—	Sex.				Trade or								
					Farmers or Farm Labourers Class.			General Labourers.			Mechanics.		
	Males.	Females.	Children.	Totals.	Males.	Females.	Children.	Males.	Females.	Children.	Males.	Females.	Children.
Armenian	44	23	12	79	9	4	4	22	4	5	10	4	2
Egyptian	2	....	....	2	....	....	....	1	....	....	....	....	....
Syrian	120	41	28	189	41	2	4	37	5	7	13	5	5
Arabian	2	2	....	4	....	....	....	1	1	....	....	....	....
U.S.A. citizens	56	29	9	94	6	2	1	15	1	1	15	5	....
Negro	49	22	2	73	7	1	1	13	1	....	15	1	....
Hindoo	5	1	....	6	....	....	....	....	....	....	1	....	....
Totals	46,337	22,898	17,841	87,070	16,489	4,253	4,902	13,809	1,997	2,573	8,909	5,090	4,939

V.

for Canada at Ocean Ports, for the Fiscal Year ending March 31, 1909—*Con.*

Occupation.										Destination.							
Clerks, Traders, &c.			Miners.			Female Servants.	Not Classified.			Maritime Provinces.	Quebec.	Ontario.	Manitoba.	Saskatchewan.	Alberta.	British Columbia.	Yukon.
Males.	Females.	Children.	Males.	Females.	Children.		Males.	Females.	Children.								
2	4	1	....	....	....	7	1	....	....	6	18	50	....	....	5	....	...
1	...	...	....	....	....	....	....	....	....	....	1	1	..	....	....	....	...
24	18	7	1	....	....	6	4	5	5	62	82	35	4	....	....	6	...
1	....	....	....	....	..	....	.	1	....	1	2	1	....	....	....	..	...
11	10	6	2	....	....	5	7	6	1	12	31	12	11	3	2	23	..
13	...	....	....	....	....	19	1	....	1	43	10	17	2	....	....	1	...
4	...	....	....	....	....	....	...	1	....	....	2	3	1	..	....	....	...
4,402	1.960	1,302	1,264	454	635	6.615	1,464	2,529	3,490	6,144	16,882	27,026	14,930	6,655	6,100	9,341	4

PORT OF NORTH SYDNEY.

For the fiscal year 1908-9, there arrived at the port of North Sydney 7,292 passengers, of whom 2,720 travelled saloon and 4,572 steerage. Of the saloon passengers, 1,858 were destined to Canada and 862 to the United States. Of the steerage passengers, 3,352 were for Canada and 1,220 for the United States. Included in the steerage passengers for Canada were 795 returned Canadians and 167 tourists, leaving the immigration proper at 2,390 souls, a decrease as compared with the preceding fiscal year of 1,332 persons.

Table I. deals with the total arrivals of saloon passengers, Table II. with the total arrivals of steerage passengers, Table III. with the monthly arrivals of immigrants for Canada, and Tables IV. and V. give summaries of the information obtained from immigrants for Canada upon arrival.

TABLE I.

NATIONALITY and Sex of Saloon Passengers arriving at the Port of North Sydney, for the Fiscal Year ending March 31, 1909.

—	Canada.				United States.				Canada and United States.			
	Males.	Females.	Children.	Totals.	Males.	Females.	Children.	Totals.	Males.	Females.	Children.	Totals.
Australian	1	.....	.....	1	.....	.....	.....	.....	1	...	.....	1
Austrian	2	.....	.....	2	.....	.....	.....	.....	2	...	....	2
French	84	52	18	154	5	8	5	18	89	60	23	172
German	3	.....	.....	3	5	.....	.....	5	8	.....	.....	8
English	116	33	2	151	16	2	.....	18	132	35	2	169
Welsh	5	1	.....	6	3	.....	.....	3	8	1	.....	9
Scotch	37	7	.....	44	8	1	.....	9	45	8	....	53
Irish	8	.	.....	8	1	1	.....	2	9	1	.....	10
West Indian	3	.....	.....	3	1	.....	....	1	4	.....	.....	4
Jamaican	1	.....	.....	1	1	.....	.....	1	2	.....	.....	2
Greek	1	.....	.....	1	.....	.....	.....	.	1	.....	.....	1
Italian	4	.....	.....	4	....	.....	.....	.....	4	..	...	4
Newfoundland	301	188	20	509	114	115	3	232	415	303	23	741
New Zealand	1	....	.....	1	.....	.....	.....	....	1	....	.....	1
Russian	2	..	.....	2	1	2	.....	3	3	2	....	5
Spanish	..	1	.....	1	.....	...	.....	.....	.....	1	.....	1
Syrian	.....	.....	.....	....	1	.....	.....	1	1	.....	.....	1
U.S.A. citizens	39	12	.....	51	421	128	12	561	460	140	12	612
Canadian	652	217	26	895	5	.....	.....	5	657	217	26	900
Tourist	18	3	.....	21	1	2	.....	3	19	5	.....	24
Totals	1,278	514	66	1,858	583	259	20	862	1,861	773	86	2,720

TABLE II.

Nationality and Sex of Steerage Passengers arriving at the Port of North Sydney, for the Fiscal Year ending March 31, 1909.

—	Canada.				United States.				Canada and United States.			
	Males.	Females.	Children.	Totals.	Males.	Females.	Children.	Totals.	Males.	Females.	Children.	Totals.
Austrian	3	....	....	3	1	....	....	1	4	....	....	4
Belgian	2	2	1	5	....	....	....	....	2	2	1	5
Bulgarian	22	....	....	22	6	....	....	6	28	....	....	28
Chinese	13	....	....	13	....	....	....	....	13	....	....	13
French	82	26	26	134	2	4	....	6	84	30	26	140
German	10	....	....	10	6	....	....	6	16	....	....	16
English	46	6	2	54	5	....	....	5	51	6	2	59
Welsh	4	....	....	4	5	....	....	5	9	....	....	9
Scotch	8	1	2	11	2	....	....	2	10	1	2	13
Irish	2	....	....	2	1	....	....	1	3	....	....	3
West Indian	1	....	....	1	....	....	....	....	1	....	....	1
Italian	1	....	....	1	1	....	....	1	2	....	....	2
Japanese	2	....	....	2	1	....	....	1	3	....	....	3
Newfoundland	1,592	368	126	2,086	519	370	33	922	2,111	738	159	3,008
Portuguese	....	....	....	....	5	....	....	5	5	....	....	5
Russian	5	....	....	5	1	....	....	1	6	....	....	6
Danish	2	....	....	2	....	....	....	....	2	....	....	2
Swedish	7	3	1	11	1	....	....	1	8	3	1	12
Norwegian	9	....	....	9	1	....	....	1	10	....	....	10
Syrian	4	2	1	7	8	3	3	14	12	5	4	21
U.S.A. citizens	7	1	....	8	39	4	13	56	46	5	13	64
Total immigration	1,822	409	159	2,390	604	381	49	1,034	2,426	790	208	3,424
Returned Canadian	545	212	38	795	....	....	....	....	545	212	38	795
Tourist	83	77	7	167	13	150	23	186	96	227	30	353
Totals	2,450	698	204	3,352	617	531	72	1,220	3,067	1,229	276	4,572

TABLE III.

MONTHLY arrivals of Immigrants for Canada, by Nationalities, at the Port of North Sydney, for the Fiscal Year ending March 31, 1909.

—	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	Totals.
Austrian	....	....	....	....	2	..	....	....	....	....	....	1	3
Belgian	....	5	....	....	....	....	....	....	....	....	....	....	5
Bulgarian	....	11	....	....	9	2	....	....	....	....	....	....	22
Chinese	....	....	....	....	....	10	....	2	....	....	1	....	13
French	....	21	16	6	7	13	35	20	12	1	1	2	134
German	1	....	....	3	....	2	....	....	3	..	....	1	10
English	3	9	22	4	2	4	8	1	1	....	....	....	54
Welsh	....	....	....	....	....	....	....	4	....	....	....	....	4
Scotch	2	1	4	....	2	....	2	....	....	....	....	....	11
Irish	....	....	1	....	....	....	....	....	1	....	....	....	2
West Indian	..	....	....	....	....	....	....	....	1	....	....	....	1
Italian	....	....	....	....	....	....	....	....	....	....	....	1	1
Japanese	....	....	....	....	....	2	....	....	....	....	....	....	2
Newfoundland	297	305	181	112	193	220	173	217	83	62	37	206	2,086
Russian	....	....	....	....	....	....	....	....	2	3	....	....	5
Danish	1	....	....	....	....	....	1	....	....	....	....	....	2
Swedish	....	....	3	....	....	....	1	....	1	....	....	6	11
Norwegiau	1	2	2	....	....	....	3	1	....	....	....	....	9
Syrian	2	..	3	....	....	1	....	....	....	....	....	1	7
U.S.A. citizens	1	1	....	4	1	....	....	....	....	1	....	....	8
Totals	308	355	232	129	216	254	223	245	104	67	39	218	2,390

TABLE IV.

Monthly arrivals of Immigrants for Canada, by Occupation and Destination, at the Port of North Sydney, for the Fiscal Year ending March 31, 1909.

—	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	Totals.
Agriculturists	1	1	3	3	15	8	2	3	3	3	1	1	44
General labourers	242	213	118	60	115	126	157	181	54	42	24	170	1,502
Mechanics	31	47	27	9	29	34	17	6	24	4	....	24	252
Clerks	3	7	9	4	7	7	2	4	5	4	1	5	58
Miners	9	17	34	19	11	29	3	9	3	5	8	4	151
Female servants	20	45	26	16	20	23	34	27	12	2	2	12	239
Not classed	2	25	15	18	19	27	8	15	3	7	3	2	144
Totals	308	355	232	129	216	254	223	245	104	67	39	218	2,390
Maritime Provinces	265	298	213	115	191	214	212	234	95	65	34	189	2,125
Quebec	17	26	4	8	7	23	4	6	4	1	....	6	106
Ontario	8	20	10	5	2	4	3	5	....	1	1	9	68
Manitoba	2	4	4	1	14	1	....	....	2	....	....	7	35
Saskatchewan	....	....	....	....	....	....	....	....	....	....	....	1	1
Alberta	...	2	....	....	1	4	....	....	....	....	....	5	12
British Columbia	16	5	1	....	1	8	4	...	3	....	4	1	43
Totals	308	355	232	129	216	254	223	245	104	67	39	218	2,390

TABLE

NATIONALITY, Sex, Occupation and Destination of Immigrant arrivals for

—	Sex.				Trade or								
					Farmers or Farm Labourers Class.			General Labourers.			Mechanics.		
	Males.	Females.	Children.	Totals.	Males.	Females.	Children.	Males.	Females.	Children.	Males.	Females.	Children.
Austrian	3	....	....	3	....	....	....	3	....	....	....	....	....
Belgian	2	2	1	5	....	....	....	2	2	1	....	....	....
Bulgarian	22	....	....	22	....	....	....	20	....	....	....	....	....
Chinese	13	....	....	13	1	....	....	12	....	....	....	....	....
French	82	26	26	134	3	....	....	62	4	9	12	7	10
German	10	....	....	10	....	....	....	7	....	....	....	....	....
English	46	6	2	54	....	....	....	17	1	....	7	....	....
Welsh	4	....	....	4	1	....	....	....	....	....	....	....	....
Scotch	8	1	2	11	....	....	....	1	....	....	5	....	....
Irish	2	....	....	2	....	....	....	1	....	....	1	....	....
West Indian	1	....	....	1	....	....	....	1	....	....	....	....	....
Italian	1	....	....	1	....	....	....	1	....	....	....	....	....
Japanese	2	....	....	2	....	....	....	2	....	....	....	....	....
Newfoundland	1,592	368	126	2,086	32	1	4	1,280	33	24	160	25	16
Russian	5	....	....	5	1	....	....	1	....	....	....	....	....
Danish	2	....	....	2	....	....	....	2	....	....	....	....	....
Swedish	7	3	1	11	....	....	....	3	2	....	4	1	1
Norwegian	9	....	....	9	1	....	....	6	....	....	1	....	....
Syrian	4	2	1	7	....	....	....	1	....	....	1	....	....
U.S.A. citizens	7	1	....	8	....	....	....	4	....	....	1	....	....
Totals	1,822	409	159	2,390	39	1	4	1,426	42	34	192	33	27

V.

Canada at the Port of North Sydney, for the Fiscal Year ending March 31, 1909.

Occupation.										Destination.						
Clerks, Traders, &c.			Miners.			Female Servants.	Not Classified.									
Males.	Females.	Children.	Males.	Females.	Children.		Males.	Females.	Children.	Maritime Provinces.	Quebec.	Ontario.	Manitoba.	Saskatchewan.	Alberta.	British Columbia.
										1	2					
										5						
			2							22						
										1	10	2				
3			1			11	1	4	7	116	18					
2			1							10						
4			17	3	2	2	1			49	5					
			3							4						
			2	1	2					9	1		1			
										2						
										1						
										1						
											2					
42	2		70	29	18	225	8	53	64	1,874	66	66	24	1	12	43
2							1			5						
										2						
										2			9			
1										7	1		1			
2								2	1	6	1					
						1	2			8						
56	2		96	33	22	239	13	59	72	2,125	106	68	35	1	12	43

PORT OF HALIFAX.

For the fiscal year 1908-9, there arrived at the port of Halifax 21,528 passengers, of whom 1,829 travelled saloon and 19,699 steerage. Of the saloon passengers, 1,808 were destined to Canada, and 21 to the United States. Of the steerage passengers, 17,096 were for Canada and 2,603 for the United States. Included in the steerage passengers for Canada were 3,419 returned Canadians and 298 tourists, leaving the immigration proper at 13,379 souls, a decrease as compared with the preceding fiscal year of 14,940 persons.

Table I. deals with the total arrivals of saloon passengers, Table II. with the total arrivals of steerage passengers, Table III. with the monthly arrivals of immigrants for Canada, and Tables IV. and V. give summaries of the information obtained from immigrants for Canada upon arrival.

TABLE I.

NATIONALITY and Sex of Saloon Passengers arriving at the Port of Halifax, for the Fiscal Year ending March 31, 1909.

—	Canada.				United States.				Canada and United States.			
	Males.	Females.	Children.	Totals.	Males.	Females.	Children.	Totals.	Males.	Females.	Children.	Totals.
Australian	1			1					1			1
Austrian	2			2					2			2
Chinese	1			1					1			1
French	6	3		9	1			1	7	3		10
German	1			1					1			1
English	272	108	22	402	4	1	3	8	276	109	25	410
Welsh	2	1		3					2	1		3
Scotch	56	16	4	76		1		1	56	17	4	77
Irish	8	7	2	17	2	2		4	10	9	2	21
West Indian	4	3		7	1	1		2	5	4		9
Bermudian	1			1					1			1
Italian	2			2					2			2
Newfoundland	10	19	1	30	1			1	11	19	1	31
Danish		1	3	4						1	3	4
Swedish	2	1		3					2	1		3
Norwegian	1			1					1			1
Syrian	3			3					3			3
U.S.A. citizens	17	3		20	3	1		4	20	4		24
Canadian	277	170	48	495					277	170	48	495
Tourist	424	265	41	730					424	265	41	730
Totals	1,090	597	121	1,808	12	6	3	21	1,102	603	124	1,829

TABLE II.

NATIONALITY and Sex of Steerage Passengers arriving at the Port of Halifax, for the Fiscal Year ending March 31, 1909.

—	Canada.				United States.				Canada and United States.			
	Males.	Females.	Children.	Totals.	Males.	Females.	Children.	Totals.	Males.	Females.	Children.	Totals.
African, South	4	4	......	8	......	......	......	......	4	4	......	8
Australian	3	1	......	4	......	......	......	......	3	1	......	4
Austrian, N.E.S.	24	17	25	66	125	11	3	139	149	28	28	205
Bohemian	1	......	......	1	......	......	......	......	1	......	......	1
Bukowinian	259	25	32	316	......	......	......	......	259	25	32	316
Galician	1,022	264	261	1,547	1	......	......	1	1,023	264	261	1,548
Hungarian, N.E.S.	17	7	7	31	5	......	......	5	22	7	7	36
Ruthenian	11	5	11	27	......	......	......	......	11	5	11	27
Belgian	95	52	68	215	10	4	7	21	105	56	75	236
Bulgarian	3	1	......	4	1	......	1	2	4	1	1	6
Chinese	2	......	......	2	......	......	......	......	2	......	......	2
Dutch	60	22	15	97	11	5	1	17	71	27	16	114
French	279	63	54	396	11	2	4	17	290	65	58	413
German, N.E.S.	89	47	56	192	14	5	......	19	103	52	56	211
Alsatian	1	......	......	1	......	......	......	......	1	......	......	1
Prussian	14	10	24	48	1	......	2	3	15	10	26	51
English	3,404	1,425	1,344	6,173	138	55	33	226	3,542	1,480	1,377	6,399
Welsh	35	21	9	65	3	2	1	6	38	23	10	71
Scotch	1,063	519	365	1,947	28	8	8	44	1,091	527	373	1,991
Irish	211	96	49	356	10	4	4	18	221	100	53	374
West Indian	13	11	......	24	12	......	......	12	25	11	......	36
Bermudian	......	1	......	1	......	......	......	......	......	1	......	1
Jamaican	5	3	......	8	......	......	......	......	5	3	......	8
Greek	27	1	1	29	67	......	6	73	94	1	7	102
Hebrew, N.E.S.	4	8	8	20	7	2	4	13	11	10	12	33
" Russian	117	78	76	271	16	15	11	42	133	93	87	313
" Polish	1	......	......	1	......	......	......	......	1	......	......	1
" Austrian	2	1	1	4	......	......	......	......	2	1	1	4
" German	2	......	......	2	......	......	......	......	2	......	......	2
Italian	133	7	4	144	12	3	4	19	145	10	8	163
Japanese	1	......	......	1	......	......	......	......	1	......	......	1
Newfoundland	7	6	2	15	18	2	......	20	25	8	2	35
New Zealand	3	......	......	3	......	......	......	......	3	......	......	3
Portuguese	......	1	......	1	......	......	......	......	......	1	......	1
Polish, N.E.S.	16	1	......	17	11	1	......	12	27	2	......	29
" Austrian	......	......	......	......	2	......	......	2	2	......	......	2
" German	2	......	......	2	......	......	......	......	2	......	......	2
" Russian	21	3	4	28	2	......	......	2	23	3	4	30
Roumanian	20	9	8	37	5	1	......	6	25	10	8	43
Russian, N.E.S.	367	84	120	571	219	93	89	401	586	177	209	972
Finnish	119	19	2	140	637	112	60	809	756	131	62	949
Spanish	3	1	......	4	1	......	......	1	4	1	......	5
Swiss	22	4	4	30	3	3	......	6	25	7	4	36
Servian	5	5	20	30	6	5	5	16	11	10	25	46
Danish	18	5	......	23	26	4	1	31	44	9	1	54
Icelandic	2	1	1	1	......	......	......	......	2	1	1	4
Swedish	121	24	20	165	107	39	26	172	228	63	46	337
Norwegian	68	18	8	94	140	30	19	189	208	48	27	283
Turkish	3	1	......	4	21	1	......	22	24	2	......	26
Armenian	33	18	8	59	78	31	23	132	111	49	31	191
Syrian	59	16	15	90	12	7	3	22	71	23	18	112
Arabian	......	1	......	1	......	......	......	......	......	1	......	1
U.S.A. citizens	7	3	1	11	51	18	11	80	58	21	12	91
Negro	41	7	1	49	......	......	......	......	41	7	1	49
Hindoo	......	......	......	......	1	......	......	1	1	......	......	1
Total immigration	7,839	2,916	2,624	13,379	1,812	463	326	2,601	9,651	3,379	2,950	15,980
Returned Canadians	2,694	493	232	3,419	......	......	......	......	2,694	493	232	3,419
Tourist	206	77	15	298	2	......	......	2	208	77	15	300
Totals	10,739	3,486	2,871	17,096	1,814	463	326	2,603	12,553	3,949	3,197	19,699

TABLE III.

MONTHLY arrivals of Immigrants for Canada, by Nationalities, at the Port of Halifax, for the Fiscal Year ending March 31, 1909.

—	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	Totals.
African, South	2							1	4	1			8
Australian	3								1				4
Austrian, N.E.S	6	34	11	3		1		1		2	4	4	66
Bohemian	1												1
Bukowinian	28	250	37								1		316
Galician	462	801	280	1				1			2		1,547
Hungarian, N.E.S	10		11	5					4			1	31
Ruthenian		27											27
Belgian	61	16	7	18	1	8	5	3	7	14	14	61	215
Bulgarian	1		3										4
Chinese				2									2
Dutch	44		1		1			1	9		4	37	97
French	199		2	1		8		2	33	16	32	103	396
German, N.E.S	84	11	30	1	2	3	7	5	8	11	13	17	192
Alsatian	1												1
Prussian						1			47				48
English	3,700	189	45	44	69	40	63	134	255	133	301	1,200	6,173
Welsh	38	3			1		1	6	1	1	1	13	65
Scotch	1,070	9	14	40	15	13	8	26	136	90	104	422	1,947
Irish	208	3	14	1	4	1	8	3	21	19	12	62	356
West Indian		6	13	3							1	1	24
Bermudian							1						1
Jamaican				4			2	2					8
Greek	9							1	1	2	7	9	29
Hebrew, N.E.S	9	1							6	2	2		20
" Russian	76	4	2	6	8		8	22	41	27	30	47	271
" Polish	1												1
" Austrian	4												4
" German	2												2
Italian	31	18			4		3	1	1	14	32	40	144
Japanese	1												1
Newfoundland	2	1	2	1			4	1		1		3	15
New Zealand										1		2	3
Portuguese	1												1
Polish, N.E.S			2			10			1			4	17
" German				2									2
" Russian		6		5	8		1			7		1	28
Boumanian	15	9	4	1					2			6	37
Russian, N.E.S	237	44	49	56	1			3	31	40	28	82	571
Finnish	13						1	5	24	11	34	52	140
Spanish					1			1		2			4
Swiss	2				1				1	2		24	30
Servian									1			29	30
Danish	11										7	5	23
Icelandic									3			1	4
Swedish	43							4	22	8	32	56	165
Norwegian	21		1			3			11	1	21	36	94
Turkish	1	2		1									4
Armenian	21	2	5	10					13			8	59
Syrian	8	3	1	6	33			1	12	13	10	3	90
Arabian									1				1
U. S. A. citizens	1				2				2	1	2	3	11
Negro	34		11		3				1				49
Totals	6,461	1,439	545	211	154	88	112	224	700	419	694	2,332	13,379

TABLE IV.

MONTHLY arrivals of Immigrants for Canada, by Occupation and Designation, at the Port of Halifax, for the Fiscal Year ending March 31, 1909.

—	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	Totals.
Agriculturists	3,215	874	316	58	29	11	13	52	228	113	235	1,288	6,432
General labourers	708	180	75	40	39	9	13	29	106	67	103	292	1,661
Mechanics	1,461	83	88	27	31	8	27	76	117	109	127	325	2,479
Clerks	329	10	7	5	9	6	6	15	76	29	48	125	665
Miners	191	50	28	52	31	42	23	19	56	33	28	29	582
Female servants	333	70	23	15	9	....	9	19	61	39	54	167	799
Not classed	224	172	8	14	6	12	21	14	56	29	99	106	761
Totals	6,461	1,439	545	211	154	88	112	224	700	419	694	2,332	13,379
Maritime Provinces	636	302	137	122	137	86	94	86	126	83	75	249	2,133
Quebec	667	182	12	17	6	....	7	32	94	83	200	245	1,545
Ontario	2,369	205	56	25	7	....	3	65	223	105	213	700	3,971
Manitoba	1,279	523	170	46	3	2	4	5	105	56	68	527	2,788
Saskatchewan	555	133	83	1	....	..	1	18	70	43	37	258	1,199
Alberta	376	85	69	..	1	....	1	10	38	20	44	201	845
British Columbia	579	9	18	.. .	....	....	2	8	44	29	57	152	898
Totals	6,461	1,439	545	211	154	88	112	224	700	419	694	2,332	13,379

TABLE

Nationality, Sex, Occupation and Destination of Immigrant arrivals for

	Sex.				Trade or								
					Farmers or Farm Labourers Class.			General Labourers.			Mechanics.		
	Males	Females.	Children.	Totals.	Males.	Females.	Children.	Males.	Females.	Children.	Males.	Females.	Children.
African, South	4	4		8	2							1	
Australian	3	1		4	1						2		
Austrian, N.E.S.	24	17	25	66	10	4	6	2			6	2	
Bohemian	1			1							1		
Bukowinian	259	25	32	316	164	11	25	87	3	1	7	1	1
Galician	1,022	264	261	1,547	822	162	238	136	12	6	60	9	9
Hungarian, N.E.S.	17	7	7	31	5	1	2	4	1	1	4	2	
Ruthenian	11	5	11	27	10	2	7	1	1	3			
Belgian	95	52	68	215	46	17	22				6	4	7
Bulgarian	3	1		4	2	1		1					
Chinese	2			2									
Dutch	60	22	15	97	45	16	14	3		1	11	4	
French	279	63	54	396	188	38	36	20	4	1	38	9	6
German, N.E.S.	89	47	56	192	48	22	34	8	5	5	21	9	9
Alsatian	1			1	1								
Prussian	14	10	24	48	12	8	24	1			1		
English	3,404	1,425	1,344	6,173	1,975	435	492	345	95	114	712	313	331
Welsh	35	21	9	65	15	6	5	2			9	3	2
Scotch	1,063	519	365	1,947	516	83	106	89	27	36	262	103	87
Irish	211	96	49	356	127	18	10	23	7	12	30	17	14
West Indian	13	11		24	6			3			1	2	
Bermudian		1		1									
Jamaican	5	3		8							3		
Greek	27	1	1	29				25		1	1		
Hebrew, N.E.S.	4	8	8	20		1	1				4	5	6
" Russian	117	78	76	271	5	4	4	19	3	3	68	46	51
" Polish	1			1							1		
" Austrian	2	1	1	4							1		
" German	2			2							2		
Italian	133	7	4	144	7			114	4	3	7	1	
Japanese	1			1									
Newfoundland	7	6	2	15				5				1	
New Zealand	3			3	2								
Portuguese		1		1		1							
Polish, N.E.S.	16	1		17				5			1		
" German	2			2									
" Russian	21	3	4	28	1			6					
Roumanian	20	9	8	37	10	3	5	5			5	2	1
Russian, N.E.S.	367	84	120	571	170	51	81	158	9	19	35	10	17
Finnish	119	19	2	140	29	3		70	5	2	15	1	
Spanish	3	1		4							3		
Swiss	22	4	4	30	18	4	4				1		
Servian	5	5	20	30									
Danish	18	5		23	10						6	1	
Icelandic	2	1	1	4	2							1	1
Swedish	121	24	20	165	74	11	16	33	1	4	9		
Norwegian	68	18	8	94	32	5	1	29	2	3	5	2	3
Turkish	3	1		4	1			2	1				
Armenian	33	18	8	59	6			15	4	5	9	3	2
Syrian	59	16	15	90	18	2	2	27	3	4	5	3	4
Arabian		1		1					1				
U.S.A. citizens	7	3	1	11							5	1	
Negro	41	7	1	49	6	1	1	10	1		15		
Totals	7,839	2,916	2.624	13,379	4,386	910	1,136	1,248	189	224	1,372	556	551

V.

Canada, at the Port of Halifax, for the Fiscal Year ending March 31, 1909.

Occupation.										Destination.						
Clerks, Traders, &c.			Miners.			Female Servants.	Not Classified.			Maritime Provinces.	Quebec.	Ontario.	Manitoba.	Saskatchewan.	Alberta.	British Columbia.
Males.	Females.	Children.	Males.	Females.	Children.		Males.	Females.	Children.							
2	3									4		2				2
						1				1	1	2				
3	1		3	6	18	3		1	1	37	10	4	3	10		2
										1						
			1	1	2	7		2	3	29	86	73	70	42	16	
1			2	1		72	1	8	8	21	178	207	868	146	122	5
1			2	2	4	1	1			9	2	2	5	6	1	6
						1		1	1	1	6	1	8	11		
1			40	25	39	4	2	2		100	28	1	65	8	10	3
													1	3		
2												2				
1						1		1		10	5	16	22	7	34	3
11			8	1	5	9	14	2	6	45	133	21	111	46	24	16
2			8	3	7	7	2	1	1	36	16	17	81	20	20	2
													1			
						1		1		2		1	6	39		
202	83	59	78	40	79	344	92	115	269	1,129	478	2,330	813	548	363	512
1	1		6	2	1	8	2	1	1	17	2	16	8	11	1	10
92	39	32	74	23	34	215	30	29	70	268	148	692	309	121	171	238
18	3	2	9	1	5	39	4	11	6	67	24	158	59	13	16	19
						9	3			13	6	4				1
						1				1						
1						3	1			3	1	4				
						1	1			1	2	24	1		1	
						1		1	1	1	12	5	2			
22	16	15	1			6	2	3	3	26	129	78	38			
											1					
1	1	1									4					
											1		1			
1	2		3		1		1			45	73	15	7		1	3
							1			1						
1	1					1	1	3	2	15						
1												1	2			
																1
			10			1				14		3				
			2							2						
			14	3	4					20	4	4				
						2		2	2		13	2	1	21		
1	1	1	3			11		2	2	67	97	54	210	95	19	29
1			4			10					10	117			4	9
	1									3	1					
3											5		17	1		7
							5	5	20	29			1			
2						4				2	3	2	5	5	5	1
													3	1		
1			4			12				3	5	38	45	29	24	21
			1			7	1	2	1	21	2	20	19	16	11	5
										3		1				
2	4	1				7	1			5	17	37				
5	5	4	1			3	3		1	47	30	9	4			
												1				
1			1			2			1	1	5				2	3
9						5	1			33	7	7	2			
389	161	115	275	108	199	799	169	193	399	2,133	1,545	3,971	2,788	1,199	845	898

PORT OF ST. JOHN.

For the fiscal year 1908-9, there arrived at the port of St. John 21,213 passengers, of whom 1,024 travelled saloon and 20,189 steerage. Of the saloon passengers, 999 were destined to Canada and 25 to the United States. Of the steerage passengers 17,300 were for Canada and 2,889 for the United States. Included in the steerage passengers for Canada were 3,505 returned Canadians and 194 tourists, leaving the immigration proper at 13,601 souls, a decrease as compared with the preceding fiscal year of 4,293 persons.

Table I. deals with the total arrivals of saloon passengers, Table II. with the total arrivals of steerage passengers, Table III. with the monthly arrivals of immigrants for Canada, and Tables IV. and V. give summaries of the information obtained from immigrants for Canada upon arrival.

TABLE I.

Nationality and Sex of Saloon Passengers arriving at the Port of St. John, for the Fiscal Year ending March 31, 1909.

—	Canada.				United States.				Canada and United States.			
	Males.	Females.	Children.	Totals.	Males.	Females.	Children.	Totals.	Males.	Females.	Children.	Totals.
Australian	1	2		3					1	2		3
Austrian	1			1					1			1
Belgian	1			1					1			1
Dutch	3	2		5					3	2		5
French	4	4		8					4	4		8
English	223	101	18	342	5	2		7	228	103	18	349
Welsh	5	3		8					5	3		8
Scotch	37	15	2	54	2			2	39	15	2	56
Irish	13	5	2	20					13	5	2	20
West Indian	31	46	19	96	3			3	34	46	19	99
Bermudian	1	5	1	7					1	5	1	7
Italian	1	1		2	1	1		2	2	2		4
New Zealand	1	1		2					1	1		2
Portuguese		1		1						1		1
Spanish					1			1	1			1
Swiss	1	1	1	3					1	1	1	3
Egyptian	1			1					1			1
U. S. A. citizens	8	5		13	5	5		10	13	10		23
Negro	1	1		2					1	1		2
Canadian	192	131	17	340					192	131	17	340
Tourist	32	36	22	90					32	36	22	90
Totals	557	360	82	999	17	8		25	574	368	82	1,024

TABLE II.

NATIONALITY and Sex of Steerage Passengers arriving at the Port of St. John, for the Fiscal Year ending March 31, 1909.

—	Canada.				United States.				Canada and United States.			
	Males.	Females.	Children.	Totals.	Males.	Females.	Children.	Totals.	Males.	Females.	Children.	Totals.
African, South	1	2	2	5	......	......	.....	......	1	2	2	5
Australian	3	4	.....	7	......	......	.....	......	3	4	.....	7
Austrian, N.E.S	148	37	41	226	18	22	6	46	166	59	47	272
Bohemian	......	8	....	8	3	.....	.....	3	3	8	....	11
Bukowinian	903	40	26	969	1	1	..	2	904	41	26	971
Galician	2,415	353	256	3,024	13	14	5	32	2,428	367	261	3,056
Hungarian	35	16	23	74	21	21	13	55	56	37	36	129
Belgian	91	33	42	166	9	6	8	23	100	39	50	189
Bulgarian	......	....	......	.....	1	......	......	1	1	....	......	1
Chinese	1	.....	....	1	....	...	.....	.....	1	..	....	1
Dutch	26	13	28	67	2	1	1	4	28	14	29	71
French	19	11	8	38	......	...	.....	...	19	11	8	38
German, N.E.S	81	47	60	188	44	22	24	90	125	69	84	278
Prussian	5	4	13	22	.....	1	1	2	5	5	14	24
English	2,906	1,405	981	5,292	131	82	68	281	3,037	1,487	1,049	5,573
Welsh	57	17	16	90	3	1	.....	4	60	18	16	94
Scotch	638	268	180	1,086	53	16	10	79	691	284	190	1,165
Irish	343	132	83	558	36	8	1	45	379	140	84	603
West Indian	28	27	4	59	3	4	.....	7	31	31	4	66
Bermudian	3	3	1	7	......	......	......	....	3	3	1	7
Jamaican	....	1	....	1	......	.....	......	....	......	1	......	1
Greek	15	....	2	17	....	...	....	...	15	.....	2	17
Hebrew, N.E.S	9	3	3	15	4	1	2	7	13	4	5	22
" Russian	63	57	57	177	2	2	1	5	65	59	58	182
" Austrian	1	1	......	2	....	....	..	......	1	1	......	2
" German	1	1	..	2	....	..	..	.....	1	1	......	2
Italian	185	4	2	191	3	1	1	5	188	5	3	196
Japanese	....	......	.....	..	5	1	.....	6	5	1	...	6
Newfoundland	4	....	......	4	...	......	....	....	4	...	......	4
Polish, N.E.S	10	3	....	13	5	6	......	11	15	9	.....	24
" Russian	23	13	14	50	....	6	6	12	23	19	20	62
Roumanian	26	18	27	71	1	1	......	2	27	19	27	73
Russian, N.E.S	361	110	88	559	127	100	104	331	488	210	192	890
Finnish	178	41	21	240	730	114	53	897	908	155	74	1,137
Swiss	4	.....	....	4	2	2	4	8	6	2	4	12
Servian	......	.....	....	..	1	......	...	1	1	...	......	1
Danish	27	7	2	36	60	15	13	88	87	22	15	124
Icelandic	1	....	......	1	....	......	....	.....	1	..	......	1
Swedish	123	29	11	163	148	27	8	183	271	56	19	346
Norwegian	107	18	11	136	317	105	60	482	424	123	71	618
Turkish	...	...	......	....	1	1	......	2	1	1	....	2
Egyptian	1	...	....	1	...	...	......	.....	1	......	.....	1
Syrian	2	1	....	3	......	....	...	......	2	1	......	3
U. S. A. citizens	3	1	.....	4	100	38	21	159	103	39	21	163
Negro	8	15	1	24	...	......	....	.....	8	15	1	24
Total immigration	8,855	2,743	2,003	13,601	1,844	619	410	2,873	10,699	3,362	2,413	16,474
Returned Canadians	2,665	535	305	3,505	....	.....	.....	....	2,665	535	305	3,505
Tourists	123	48	23	194	13	3	......	16	136	51	23	210
Totals	11,643	3,326	2,331	17,300	1,857	622	410	2,889	13,500	3,948	2,741	20,189

TABLE III.

MONTHLY arrivals of Immigrants for Canada, by Nationalities, at the Port of St. John, for the fiscal Year ending March 31, 1909.

—	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Totals
African, South	1									4			5
Australian	2								1	2		2	7
Austrian, N.E.S.	133							20	2	14	28	29	226
Bohemian	6											2	8
Bukowinian	941							3		1		24	969
Galician	2,793							21	15	61	18	116	3,024
Hungarian	28								13	18		15	74
Belgian	67							3	9	34	10	43	166
Chinese	1												1
Dutch	13							2	2		1	49	67
French	19							4	1	3		11	38
German, N.E.S.	99							5	7	20	25	32	188
Prussian	22												22
English	2,708			1		1		121	343	309	364	1,445	5,292
Welsh	45							7	8	2	3	25	90
Scotch	461				1			18	81	61	78	386	1,086
Irish	293							7	43	12	28	175	558
West Indian	6	11		6	8	17	3	1	2	2		3	59
Bermudian	3				1		2	1					7
Jamaican							1						1
Greek	4											13	17
Hebrew, N.E.S.	5									6	4		15
" Russian	63							24	21	40	17	12	177
" Austrian	2												2
" German										2			2
Italian	169								1	3	2	16	191
Newfoundland	4												4
Polish, N.E.S.	2										11		13
" Russian	25							5		16		4	50
Roumanian	32							8	4	3	5	19	71
Russian, N.E.S.	218							17	39	104	97	84	559
Finnish	14							19	64	75	36	32	240
Swiss	2							1		1			4
Danish	18							1	4	2		11	36
Icelandic											1		1
Swedish	43							5	22	13	25	55	163
Norwegian	37							2	9	5	8	75	136
Egyptian									1				1
Syrian						2			1				3
U.S.A. citizens	2								1	1			4
Negro		2	9		2	1	10						24
Totals	8,281	13	9	7	12	21	16	295	694	814	761	2,678	13,601

TABLE IV.

MONTHLY arrivals of Immigrants for Canada by Occupation and Destination, at the Port of St. John, for the fiscal Year ending March 31, 1909.

—	April.	May.	June.	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Totals
Agriculturists	1,671	1	...	......	......	1	......	24	111	67	111	850	2,836
General labourers	3,983	3	1	...	3	2	......	70	169	282	249	777	5,539
Mechanics	1,249	2	....	3	....	1	......	53	121	171	156	455	2,211
Clerks	367	4	4	1	2	8	1	20	80	51	73	224	835
Miners	93	......	......	.....	......	....	....	26	30	45	41	61	296
Female servants	421	3	4	1	6	9	11	34	58	58	53	158	816
Not classed	497	......	....	2	1	....	4	68	125	140	78	153	1,068
Totals	8,281	13	9	7	12	21	16	295	694	814	761	2,678	13,601
Maritime Provinces	469	4	2	6	6	11	8	30	59	93	37	217	942
Quebec	1,328	6	2	....	2	2	......	64	98	131	111	179	1,923
Ontario	1,935	1	5	1	3	8	8	74	237	237	229	705	3,443
Manitoba	2,751	......	....	...	1	.....	.....	34	80	127	124	659	3,776
Saskatchewan	732	......	...	......	......	.....	.....	19	48	54	54	298	1,205
Alberta	690	...	.....	......	..	......	......	32	56	74	84	350	1,286
British Columbia	376	2	......	......	......	....	......	42	116	98	121	270	1,025
Yukon	.....	....	......	....	.....	......	...	.....	.....	.....	1	......	1
Totals	8,281	13	9	7	12	21	16	295	694	814	761	2,678	13,601

TABLE

NATIONALITY, Sex, Occupation and Destination of Immigrant Arrivals for

	Sex.				Trade or								
					Farmers or Farm Labourers Class.			General Labourers.			Mechanics.		
	Males.	Females.	Children.	Totals.	Males.	Females.	Children.	Males.	Females.	Children.	Males.	Females.	Children.
African, South	1	2	2	5	1	1	2					1	
Australian	3	4		7	2						1		
Austrian, N.E.S.	148	37	41	226	6	3	5	131	17	31	8	5	5
Bohemian		8		8									
Bukowinian	903	40	26	969	73	2		822	15	21	5		
Galician	2,415	353	256	3,024	287	28	48	2,098	115	153	18	5	3
Hungarian	35	16	23	74	6	2	5	25	4	6	1	3	4
Belgian	91	33	42	166	23	13	20	33	5	7	9	3	
Chinese	1			1				1					
Dutch	26	13	28	67	20	4	18	2					
French	19	11	8	38	4	1		2			3		
German, N.E.S	81	47	60	188	15	9	14	46	14	31	8	5	7
Prussian	5	4	13	22				2	1	3	1		
English	2,906	1,405	981	5,292	1,094	275	190	442	131	110	834	324	326
Welsh	57	17	16	90	19	2	1	5			21	2	7
Scotch	638	268	180	1,086	234	47	68	75	9	2	209	64	57
Irish	343	132	83	558	138	15	27	56	8	10	67	12	17
West Indian	28	27	4	59	2			8			5	1	
Bermudian	3	3	1	7				1			1		
Jamaican		1		1									
Greek	15		2	17				14		2	1		
Hebrew, N.E.S	9	3	3	15	1			5		1	2	1	
" Russian	63	57	57	177	2			30	9	13	30	28	20
" Austrian	1	1		2							1	1	
" German	1	1		2							1	1	
Italian	185	4	2	191				180	3	1	1		
Newfoundland	4			4				4					
Polish, N.E.S	10	3		13				10					
" Russian	23	13	14	50	3			17	5	8	3	1	3
Roumanian	26	18	27	71	1			20	8	17	4	3	5
Russian, N.E.S	361	110	88	559	22	4	3	297	28	40	19	12	3
Finnish	178	41	21	240	17	2		154	9	3	3		
Swiss	4			4	2						2		
Danish	27	7	2	36	12	1		10			4	2	2
Icelandic	1			1	1								
Swedish	123	29	11	163	12	2	2	100	7	3	9		
Norwegian	107	18	11	136	20	1	3	82	4	4	3	1	1
Egyptian	1			1									
Syrian	2	1		3									
U. S. A. citizens	3	1		4				2	1		1		
Negro	8	15	1	24	1			3				1	
Totals	8,855	2,743	2,003	13,601	2,018	412	406	4,677	396	466	1,275	476	460

V.

Canada at the Port of St. John, for the Fiscal Year ending March 31, 1909.

Occupation. Clerks, Traders, &c. Males.	Clerks, Traders, &c. Females.	Clerks, Traders, &c. Children.	Miners. Males.	Miners. Females.	Miners. Children.	Female Servants.	Not Classified. Males.	Not Classified. Females.	Not Classified. Children.	Destination. Maritime Provinces.	Quebec.	Ontario.	Manitoba.	Saskatchewan.	Alberta.	British Columbia.	Yukon.
....	....	....	....	....	....	....	....	....	....	1	....	1	....	....	3	....	....
....	1	....	....	....	....	1	....	2	....	1	....	3	....	....	....	3	....
....	....	....	2	....	....	10	1	2	....	23	57	17	54	22	33	20	....
....	....	....	....	....	....	8	....	....	....	....	6	....	....	....	....	2	....
....	....	....	3	....	....	20	....	3	5	106	279	112	376	56	32	8	....
1	....	....	10	....	....	162	1	43	52	91	457	428	1,673	169	182	24	....
....	....	....	2	....	....	3	1	4	8	11	7	8	11	29	....	8	....
3	1	....	23	6	7	2	....	3	8	34	23	2	43	4	50	10	....
....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....
3	5	9	....	....	....	2	1	2	1	1	1	3	1	7	37	17	....
4	2	....	5	4	8	....	1	4	....	3	3	1	12	1	12	6	....
8	3	1	3	1	3	10	1	5	4	19	21	10	28	56	41	13	....
....	....	....	1	....	....	....	1	3	10	1	....	....	....	....	21	....	....
388	101	62	59	25	36	302	89	244	257	365	420	1,874	885	597	535	616	....
6	1	1	5	3	4	4	1	5	3	5	10	21	24	8	9	13	....
64	17	7	39	3	4	81	17	47	42	69	74	292	241	114	153	142	1
68	24	12	4	3	3	55	10	15	14	9	53	184	153	30	86	43	....
13	1	1	....	....	....	24	....	1	3	27	9	21	1	....	....	1	....
1	....	....	....	....	....	2	....	1	1	6	....	1	....	....	....	....	....
....	....	....	....	....	....	1	....	....	....	....	....	1	....	....	....	....	....
....	....	....	....	....	....	....	....	....	....	....	....	17	....	....	....	....	....
1	....	....	....	....	....	....	....	2	2	....	13	2	....	....	....	....	....
....	3	4	....	....	....	6	1	11	20	8	97	37	29	6	....	....	....
....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....
....	....	....	....	....	....	....	....	....	....	....	1	1	....	....	....	....	....
....	....	....	4	....	....	....	....	1	1	24	129	37	....	....	1	....	....
....	....	....	....	....	....	....	....	....	....	4	....	....	....	....	....	....	....
....	....	....	....	1	....	2	....	....	....	....	2	9	2	....	....	....	....
....	....	....	....	....	....	3	....	4	3	2	23	4	17	....	4	....	....
....	....	....	....	....	....	3	1	4	5	....	28	5	18	17	3	....	....
1	1	5	20	....	....	47	2	18	37	90	146	101	120	46	20	36	....
....	....	....	4	....	....	27	....	3	18	4	29	166	6	5	10	20	....
....	....	....	....	....	....	....	....	....	....	....	2	2	....	....	....	....	....
1	....	....	....	....	....	4	....	....	....	7	5	2	13	1	6	2	....
....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....
....	....	....	1	....	....	17	1	3	6	6	15	55	42	3	22	20	....
2	1	....	....	....	....	6	....	5	3	10	6	14	27	34	26	19	....
1	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....
2	1	....	....	....	....	....	....	....	....	2	....	1	....	....	....	....	....
....	....	....	....	....	....	....	....	....	....	3	1	....	....	....	....	....	....
4	....	....	....	....	....	14	....	....	1	10	3	10	....	....	....	1	....
571	162	102	185	46	65	816	129	435	504	942	1,923	3,443	3,776	1,205	1,286	1,025	1

PORT OF QUEBEC.

For the fiscal year 1908-9, there arrived at the port of Quebec 71,218 passengers, of whom 6,698 travelled saloon and 64,520 steerage. Of the saloon passengers, 5,539 were destined to Canada and 1,159 to the United States. Of the steerage passengers, 56,198 were for Canada and 8,322 for the United States. Included in the steerage passengers for Canada were 10,113 returned Canadians and 2,015 tourists, leaving the immigration proper at 44,070 souls, a decrease as compared with the preceding fiscal year of 68,254 persons.

Table I. deals with the total arrivals of saloon passengers, Table II. with the total arrivals of steerage passengers, Table III. with the monthly arrivals of immigrants for Canada, and Tables IV. and V. give summaries of the information obtained from immigrants for Canada upon arrival.

TABLE I.

NATIONALITY and Sex of Saloon Passengers arriving at the Port of Quebec, for the Fiscal Year ending March 31, 1909.

—	Canada.				United States.				Canada and United States.			
	Males.	Females.	Children.	Totals.	Males.	Females.	Children.	Totals.	Males.	Females.	Children.	Totals.
African, South	1	.....	.....	1	2	.....	.....	2	3	.....	.....	3
Australian	9	6	.....	15	1	.....	.....	1	10	6	.....	16
Austrian	6	.....	.....	6	.....	1	.....	1	6	1	.....	7
Belgian	4	3	.....	7	1	.....	.....	1	5	3	.....	8
Chinese	2	.....	.....	2	1	.....	.....	1	3	.....	.....	3
Dutch	2	1	.....	3	1	.....	.....	1	3	1	.....	4
French	30	22	2	54	2	2	.....	4	32	24	2	58
German	9	7	.....	16	3	3	.....	6	12	10	.....	22
English	1,196	765	101	2,062	66	35	5	106	1,262	800	106	2,168
Welsh	24	8	.....	32	.....	.....	.....	.....	24	8	.....	32
Scotch	325	229	31	585	42	30	.....	72	367	259	31	657
Irish	67	45	4	116	3	5	.....	8	70	50	4	124
Jamaican	1	.....	.....	1	.....	.....	.....	.....	1	.....	.....	1
Italian	6	.....	.....	6	.....	.....	.....	.....	6	.....	.....	6
Newfoundland	.....	.....	.....	.....	.....	1	.....	1	.....	1	.....	1
New Zealand	1	.....	.....	1	.....	.....	.....	.....	1	.....	.....	1
Spanish	2	.....	.....	2	.....	.....	.....	.....	2	.....	.....	2
Swiss	4	.....	.....	4	.....	.....	.....	.....	4	.....	.....	4
Danish	2	.....	.....	2	.....	.....	.....	.....	2	.....	.....	2
Swedish	4	3	.....	7	1	.....	.....	1	5	3	.....	8
Norwegian	.....	3	.....	3	.....	.....	.....	.....	.....	3	.....	3
Armenian	.....	.....	.....	.....	1	1	.....	2	1	1	.....	2
Syrian	.....	.....	.....	.....	1	.....	.....	1	1	.....	.....	1
U. S. A. citizens	29	30	7	66	354	544	40	938	383	574	47	1,004
Canadian	1,033	1,009	192	2,234	6	2	.....	8	1,039	1,011	192	2,242
Tourist	161	135	18	314	1	4	.....	5	162	139	18	319
Totals	2,918	2,266	355	5,539	486	628	45	1,159	3,404	2,894	400	6,698

TABLE II.

Nationality and Sex of Steerage Passengers arriving at the Port of Quebec, for the Fiscal Year ending March 31, 1909.

—	Canada.				United States.				Canada and United States.			
	Males.	Females.	Children.	Totals.	Males.	Females.	Children.	Totals.	Males.	Females.	Children.	Totals.
African, South	12	9	9	30	1	....	....	1	13	9	9	31
Australian	25	11	8	44	1	1	4	6	26	12	12	50
Austrian, N.E.S.	143	57	58	258	31	42	24	97	174	99	82	355
Bohemian	3	5	7	15	4	1	....	5	7	6	7	20
Bukowinian	191	36	34	261	2	....	....	2	193	36	34	263
Croatian	1	....	....	1	5	....	....	5	6	....	....	6
Galician	1,220	375	478	2,073	7	14	12	33	1,227	389	490	2,106
Hungarian, N.E.S.	27	15	18	60	16	23	21	60	43	38	39	120
Belgian	164	93	86	343	19	9	11	39	183	102	97	382
Bulgarian	20	2	....	22	2	5	2	9	22	7	2	31
Chinese	20	....	....	20	....	....	....	....	20	....	....	20
Dutch	97	69	63	229	21	13	17	51	118	82	80	280
French	617	296	131	1,044	29	27	14	70	646	323	145	1,114
German, N.E.S.	246	128	121	495	100	100	82	282	346	228	203	777
Prussian	2	1	....	3	....	....	....	....	2	1	....	3
Saxon	....	1	7	8	....	....	....	....	....	1	7	8
English	9,163	7,969	6,329	23,461	596	495	279	1,370	9,759	8,464	6,608	24,831
Welsh	116	89	72	277	25	19	11	55	141	108	83	332
Scotch	3,412	3,024	1,928	8,364	205	175	94	474	3,617	3,199	2,022	8,838
Irish	1,037	928	443	2,408	99	79	25	203	1,136	1,007	468	2,611
West Indian	2	....	....	2	....	....	....	....	2	....	....	2
Bermudian	....	1	1	2	....	....	....	....	....	1	1	2
Greek	29	4	5	38	9	....	....	9	38	4	5	47
Hebrew, N.E.S.	37	26	27	90	13	10	17	40	50	36	44	130
" Russian	248	318	329	895	10	14	27	51	258	332	356	946
" Polish	1	....	....	1	....	....	....	....	1	....	....	1
" Austrian	4	3	6	13	....	....	....	....	4	3	6	13
" German	3	4	4	11	....	....	....	....	3	4	4	11
Italian	201	24	10	235	9	1	....	10	210	25	10	245
Japanese	2	....	....	2	....	....	....	....	2	....	....	2
Newfoundland	2	....	....	2	....	....	....	....	2	....	....	2
New Zealand	7	4	1	12	....	1	....	1	7	5	1	13
Portuguese	....	....	....	....	1	....	....	1	1	....	....	1
Polish, N.E.S.	22	10	9	41	5	7	7	19	27	17	16	60
" Austrian	8	1	1	10	....	....	....	....	8	1	1	10
" German	1	....	....	1	....	....	....	....	1	....	....	1
" Russian	81	42	40	163	2	4	3	9	83	46	43	172
Persian	1	....	....	1	....	....	....	....	1	....	....	1
Roumanian	25	36	33	94	7	10	9	26	32	46	42	120
Russian, N.E.S.	503	371	561	1.435	228	265	314	807	731	636	875	2,242
Finnish	102	93	56	251	212	176	129	517	314	269	185	768
Spanish	12	1	....	13	....	....	....	....	12	1	....	13
Swiss	45	15	10	70	10	13	6	29	55	28	16	99
Servian	1	....	....	1	2	....	....	2	3	....	....	3
Danish	34	18	4	56	66	48	36	150	100	66	40	206
Icelandic	14	12	4	30	....	1	....	1	14	13	4	31
Swedish	303	198	162	663	292	219	113	624	595	417	275	1,287
Norwegian	176	121	99	396	516	413	185	1,114	692	534	284	1,510
Turkish	2	....	....	2	10	3	5	18	12	3	5	20
Armenian	4	5	4	13	....	....	....	....	4	5	4	13
Egyptian	....	....	....	....	2	....	....	2	2	....	....	2
Syrian	33	12	6	51	....	....	....	....	33	12	6	51
Arabian	2	....	....	2	....	....	....	....	2	....	....	2
U.S.A. citizens	26	18	8	52	915	959	201	2,075	941	977	209	2,127
Hindoo	5	1	....	6	1	....	....	1	6	1	....	7
Total immigration	18,452	14,446	11,172	44,070	3,473	3,147	1,648	8,268	21,925	17,593	12,820	52,338
Returned Canadian	5,910	3,095	1,108	10,113	....	....	....	....	5,910	3,095	1,108	10,113
Tourist	1,005	944	66	2,015	26	27	1	54	1,031	971	67	2,069
Totals	25,367	18,485	12,346	56,198	3,499	3,174	1,649	8,322	28,866	21,659	13,995	64,520

TABLE III.

MONTHLY arrivals of Immigrants for Canada, by Nationalities, at the Port of Quebec, for the Fiscal Year ending March 31, 1909.

—	April.	May.	June.	July.	August.	September.	October.	November.	Totals.
African, South		3	2	4	1	11	8	1	30
Australian		10	12	7	8	3	3	1	44
Austrian, N.E.S.	1	17	105	26	19	56	22	12	258
Bohemian			5	2	7		1		15
Bukowinian		165	66	11	3	13		3	261
Croatian		1							1
Galician	22	1,279	494	57	106	51	31	33	2,073
Hungarian, N.E.S.		13	9	16	8	1	6	7	60
Belgian	22	135	50	24	29	37	37	9	343
Bulgarian	1	19	1		1				22
Chinese		1	2	1	16				20
Dutch	15	75	31	35	16	36	18	3	229
French	7	361	159	146	118	120	97	36	1,044
German, N.E.S.	7	120	86	58	54	57	72	41	495
Prussian					3				3
Saxon						8			8
English	1,149	7,285	4,331	3,265	2,474	2,123	2,014	820	23,461
Welsh	3	60	48	38	37	46	31	14	277
Scotch	646	2,006	2,295	840	715	1,035	588	241	8,364
Irish	85	597	476	344	305	308	177	116	2,408
West Indian		599	1			1			2
Bermudian				2					2
Greek	7		5	9	14	3			38
Hebrew, N.E.S.		21	25	11	19		2	12	90
" Russian	12	147	167	187	123	156	60	43	895
" Polish				1					1
" Austrian		6	2			4		1	13
" German		4						7	11
Italian	2	135	26	17	21	20	7	7	235
Japanese								2	2
Newfoundland						2			2
New Zealand	2	2	1	3	3		1		12
Polish, N.E.S.		6	21	2	2	4	5	1	41
" Austrian	3	3			4				10
" German		1							1
" Russian	8	38	69	20	13	4	6	5	163
Persian					1				1
Roumanian		17	18	33	4	2	16	4	94
Russian, N.E.S.	72	375	298	197	101	98	115	179	1,435
Finnish		29	25	44	39	41	49	24	251
Spanish			2	6	1	2	2		13
Swiss	1	24	8	8	5	13	8	3	70
Servian		1							1
Danish		18	10	10	2	6	6	4	56
Icelandic	5	2	10	3	2		8		30
Swedish	13	162	113	121	75	101	55	23	663
Norwegian	4	67	74	57	64	67	48	15	396
Turkish			1				1		2
Armenian				6		1	5	1	13
Syrian		3	19	27			2		51
Arabian					1		1		2
U. S. A. citizens	6	14	6	7	15	2	1	1	52
Hindoo		2	2	1			1		6
Totals	2,093	13,224	9,075	5,646	4,129	4,430	3,504	1,669	44,070

TABLE IV.

MONTHLY arrivals of Immigrants for Canada, by Occupation and Destination, at the Port of Quebec, for the Fiscal Year ending March 31, 1909.

—	April.	May.	June.	July.	August.	September.	October.	November.	Totals.
Agriculturists	656	4,369	3,063	1,636	1,134	819	736	386	12,799
General labourers	300	1,970	1,080	617	483	388	343	260	5,441
Mechanics	673	3,481	2,435	1,617	1,258	1,744	1,081	459	12,748
Clerks	249	1,234	891	535	485	427	343	169	4,333
Miners	31	247	182	162	149	184	150	58	1,163
Female servants	140	883	917	503	475	508	467	247	4,140
Not classified	44	1,040	507	576	445	360	384	90	3,446
Totals	2,093	13,224	9,075	5,646	4,429	4,430	3,504	1,669	44,070
Maritime Provinces	29	209	89	118	85	90	84	27	731
Quebec	505	3,009	1,736	1,133	999	1,474	837	488	10,181
Ontario	830	4,598	2,945	2,034	1,591	1,271	1,263	506	15,038
Manitoba	338	2,335	1,715	886	661	595	411	248	7,189
Saskatchewan	124	1,069	968	487	344	291	254	85	3,622
Alberta	119	1,006	727	481	365	274	262	113	3,347
British Columbia	148	998	895	507	384	433	393	202	3,960
Yukon	......	......	..	......	....	2	......	......	2
Totals	2,093	13,224	9,075	5,646	4,429	4,430	3,504	1,669	44,070

TABLE

NATIONALITY, Sex, Occupation and Destination of Immigrant Arrivals for

—	Sex.				Trade or								
					Farmers or Farm Labourers Class.			General Labourers.			Mechanics.		
	Males.	Females.	Children.	Totals.	Males.	Females.	Children.	Males.	Females.	Children.	Males.	Females.	Children.
African, South..	12	9	9	30	6	1	2	1			4	4	4
Australian	25	11	8	44	13	3	1	2	1		6	5	5
Austrian, N.E.S.	143	57	58	258	49	13	23	49	7	9	19	15	14
Bohemian	3	5	7	15							1	1	1
Bukowinian	191	36	34	261	88	15	28	76	2	2	12	4	3
Croatian	1			1				1					
Galician	1,220	375	478	2,073	661	201	418	447	33	36	66	18	15
Hung'r'n, N.E.S.	27	15	18	60	18	4	6	3	1	3	3	2	5
Belgian	164	93	86	343	63	26	42	15	4	1	28	18	15
Bulgarian	20	2		22	17	1					3		
Chinese	20			20				4					
Dutch	97	69	63	229	50	31	36	7	4	3	23	11	18
French	617	296	131	1,044	340	85	73	23	10	3	116	59	29
German, N.E.S.	246	128	121	495	97	41	63	44	11	13	68	22	32
Prussian	2	1		3	1								
Saxon		1	7	8		1	7						
English	9,163	7,969	6,329	23,461	3,351	1,374	1,242	1,196	689	807	2,919	2,308	2,203
Welsh	116	89	72	277	37	14	21	8	8	7	40	29	33
Scotch	3,412	3,024	1,928	8,364	1,114	377	388	355	185	221	1,347	840	863
Irish	1,037	928	443	2,408	468	108	107	133	42	61	183	126	110
West Indian	2			2	1						1		
Bermudian		1	1	2									
Greek	29	4	5	38	2			14	1	1	6		
Hebrew, N.E.S.	37	26	27	90	5	1		3			20	17	21
" Russian	218	318	329	895	41	24	22	44	18	26	135	169	191
" Polish	1			1	1								
" Austrian	4	3	6	13				2			2	2	3
" German	3	4	4	11	1	1	2				2		
Italian	201	24	10	235	21	2	2	135	5	1	18	6	4
Japanese	2			2	2								
Newfoundland	2			2									
New Zealand	7	4	1	12	4			2			1	1	1
Polish, N.E.S.	22	10	9	41	10			6	2	3	3	5	3
" Austrian	8	1	1	10	3	1	1	4			1		
" German	1			1	1								
" Russian	81	42	40	163	41	13	18	24	7	6	9	9	13
Persian	1			1				1					
Roumanian	25	36	33	94	8	6	13	3			12	13	11
Russian, N.E.S.	503	371	561	1,435	263	167	314	129	51	119	68	60	70
Finnish	102	93	56	251	15	6	10	44	20	22	15	9	15
Spanish	12	1		13							4	1	
Swiss	45	15	10	70	26	3	6	3			11	2	
Servian	1			1				1					
Danish	34	18	4	56	25	5	4	4			4	1	
Icelandic	14	12	4	30	7	5	2	2	1		3	1	
Swedish	303	198	162	663	168	71	94	76	19	23	44	17	24
Norwegian	176	121	99	396	111	36	58	35	15	19	15	13	20
Turkish	2			2							1		
Armenian	4	5	4	13	2	4	4	1			1	1	
Syrian	33	12	6	51	11			8	2	3	4	2	1
Arabian	2			2				1					
U.S.A. citizens	26	18	8	52	4	2	1	7		1	5	3	
Hindoo	5	1		6							1		
Totals	18,452	14,446	11,172	44,070	7,146	2,645	3,008	2,913	1,138	1,390	5,224	3,797	3,727

V.

Canada at the Port of Quebec, for the Fiscal Year ending March 31, 1909.

Occupation.										Destination.							
Clerks, Traders, &c.			Miners.			Female Servants.	Not Classified.			Maritime Provinces.	Quebec.	Ontario.	Manitoba.	Saskatchewan.	Alberta.	British Columbia.	Yukon.
Males.	Females.	Children.	Males.	Females.	Children.		Males.	Females.	Children.								
...	1	...	...	...	...	1	1	2	3	...	3	16	1	...	3	7	...
2	2	2	...	...	...	...	2	...	...	...	18	11	...	4	3	8	...
5	1	1	21	7	10	13	...	1	1	12	55	23	66	32	43	27	...
...	...	...	2	3	5	1	...	...	1	...	2	...	3	...	...	10	...
...	...	...	15	1	1	14	...	...	...	5	49	42	94	50	10	11	...
...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...
1	...	...	42	2	1	114	3	7	8	19	258	286	854	381	245	30	...
...	1	1	3	2	...	3	...	2	3	...	11	12	9	23	5	...	...
6	3	1	47	21	21	12	5	9	6	76	96	11	110	14	21	15	...
...	...	...	...	...	...	1	...	...	...	...	2	5	12	2	1	...	...
14	...	...	...	...	...	...	2	...	...	...	19	1	...	...	...	...	...
8	3	3	...	...	...	10	9	4	3	1	29	30	47	32	59	31	...
54	19	8	13	3	5	56	71	64	13	20	588	49	213	103	55	16	...
20	10	...	10	5	8	32	7	7	5	4	117	32	161	82	56	43	...
...	...	...	...	...	...	...	1	1	...	...	...	2	...	...	...	1	...
...	...	...	...	...	...	...	...	...	...	...	...	...	8	...	...	...	...
1,043	874	533	191	139	191	2,012	463	573	1,353	370	4,904	9,859	2,739	1,670	1,631	2,288	...
13	8	3	15	7	6	18	3	5	2	1	52	70	48	15	27	64	...
419	367	239	103	36	53	1,070	74	149	164	117	2,048	2,671	1,311	513	674	1,028	2
185	116	77	13	6	7	435	55	95	81	36	620	864	447	101	174	166	...
...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	1	...
...	...	...	...	...	...	1	...	...	1	...	...	2	...	...	...	...	...
2	2	3	...	...	...	1	5	...	1	...	18	14	1	...	...	5	...
8	2	6	...	...	...	6	1	...	...	...	70	12	5	3	...	...	...
22	45	72	2	1	...	49	4	12	18	9	374	273	196	25	4	14	...
...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...
...	1	3	...	...	...	...	...	...	...	...	10	3	...	...	...	...	...
...	1	2	...	...	...	2	...	...	...	...	5	6	...	...	...	...	...
4	1	1	19	1	...	5	4	4	2	21	161	38	4	...	5	6	...
...	...	...	...	...	...	...	...	...	...	...	2	...	...	...	...	...	...
...	...	...	...	...	...	...	2	...	...	...	...	...	...	2	...	...	...
...	...	...	...	...	...	1	...	2	...	2	2	1	3	...	1	3	...
...	...	...	2	1	1	1	1	1	2	4	20	4	9	3	1	...	...
...	...	...	...	...	...	...	...	...	...	...	1	1	7	1	...	...	...
...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...
...	2	...	7	2	3	8	...	1	...	9	59	19	37	26	11	2	...
...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...
1	5	5	...	...	...	7	1	5	4	...	66	5	7	16	...	...	...
9	14	18	23	2	5	59	11	18	35	15	266	159	514	333	122	26	...
1	...	...	27	8	6	47	...	3	3	...	25	171	13	1	18	23	...
1	...	...	2	...	...	...	5	...	...	...	10	2	1	...	...	...	...
2	2	...	...	...	...	6	3	2	4	1	29	7	15	5	3	10	...
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...
1	1	...	...	...	...	11	...	...	...	1	17	13	9	5	9	2	...
2	...	...	...	...	...	5	...	...	2	...	2	...	25	...	3	...	...
1	1	1	13	3	9	83	1	4	11	3	59	219	149	101	67	65	...
2	1	...	10	...	...	52	3	4	2	2	41	73	58	76	91	55	...
1	...	...	...	...	...	...	...	...	...	...	2	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	1	7	...	...	5	...	...
9	6	2	...	...	...	2	1	...	...	2	40	9	...	...	...	...	...
1	...	...	...	...	...	...	...	...	...	1	1	...	...	...	...	...	...
7	9	6	1	...	...	2	2	2	...	...	25	11	11	3	...	2	...
4	...	...	...	...	...	...	...	·1	...	...	2	3	1	...	...	...	...
1,848	1,498	987	581	250	332	4,140	740	978	1,728	731	10,181	15,038	7,189	3,622	3,347	3,960	

PORT OF VANCOUVER.

For the fiscal year 1908-9, there arrived at the port of Vancouver 8,651 passengers, of whom 1,755 travelled saloon and 6,896 steerage. Of the saloon passengers, 1,278 were destined to Canada and 477 to the United States. Of the steerage passengers, 5,121 were for Canada and 1,775 for the United States. Included in the steerage passengers for Canada were 1,446 returned Canadians and 2,158 tourists, leaving the immigration proper at 1,517 souls, a decrease as compared with the preceding fiscal year of 5,049 persons.

Table I. deals with the total arrivals of saloon passengers, Table II. with the total arrivals of steerage passengers, Table III. with the monthly arrivals of immigrants for Canada, and Tables IV. and V. give summaries of the information obtained from immigrants for Canada upon arrival.

TABLE I.

NATIONALITY and Sex of Saloon Passengers arriving at the Port of Vancouver, for the Fiscal Year ending March 31, 1909.

	Canada.				United States.				Canada and United States.			
	Males.	Females.	Children.	Totals.	Males.	Females.	Children.	Totals.	Males.	Females.	Children.	Totals.
African, South	......	......	1	1	......	......	......	......	......	......	1	1
Australian	62	81	22	165	22	15	5	42	84	96	27	207
Austrian	2	......	......	2	1	......	......	1	3	......	......	3
Belgian	2	......	......	2	1	......	......	1	3	......	......	3
Chinese	5	......	1	6	5	3	......	8	10	3	1	14
Dutch	8	1	......	9	......	......	......	......	8	1	......	9
French	7	8	......	15	8	2	......	10	15	10	......	25
German	21	6	......	27	6	6	......	12	27	12	......	39
English	345	164	35	544	37	13	2	52	382	177	37	596
Welsh	2	1	......	3	1	1	......	2	3	2	......	5
Scotch	58	29	1	88	4	2	......	6	62	31	1	94
Irish	19	12	......	31	3	2	......	5	22	14	......	36
West Indian	4	1	3	8	1	1	......	2	5	2	3	10
Italian	2	......	......	2	......	1	......	1	2	1	......	3
Japanese	16	5	3	24	5	5	2	12	21	10	5	36
Newfoundland	1	......	......	1	......	......	......	......	1	......	......	1
New Zealand	37	36	3	76	9	4	......	13	46	40	3	89
Portuguese	3	......	......	3	......	......	......	......	3	......	......	3
Russian	5	2	......	7	1	......	......	1	6	2	......	8
Spanish	4	......	......	4	......	......	......	......	4	......	......	4
Swiss	1	......	......	1	1	......	......	1	2	......	......	2
Swedish	3	......	......	3	1	......	......	1	4	......	......	4
Norwegian	......	1	......	1	......	1	......	1	......	2	......	2
Egyptian	1	......	......	1	......	......	......	......	1	......	......	1
U. S. A. Citizens	40	18	9	67	109	120	47	276	149	138	56	343
Hindoo	2	......	......	2	......	......	......	......	2	......	......	2
Canadian	63	45	15	123	4	1	3	8	67	46	18	131
Tourist	38	21	3	62	13	6	3	22	51	27	6	84
Totals	751	431	96	1,278	232	183	62	477	983	614	158	1,755

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TABLE II.

NATIONALITY and Sex of Steerage Passengers arriving at the Port of Vancouver, for the Fiscal Year ending March 31, 1909.

	Canada.				United States.				Canada and United States.			
	Males.	Females.	Children.	Totals.	Males.	Females.	Children.	Totals.	Males.	Females.	Children.	Totals.
African South	......	.....	..	.....	2	2	6	10	2	2	6	10
Australian	49	27	23	99	27	27	17	71	76	54	40	170
Austrian	......	......	....	......	4	....	....	4	4	......	......	4
Belgian	2	......	.....	2	.....	......	......	.....	2	.....	.....	2
Chinese	978	18	78	1,074	129	1	2	135	1,107	22	80	1,209
French	5	2	.....	7	1	1	......	2	6	3	......	9
German	4	......	......	4	1	.....	.....	1	5	....	......	5
English	86	19	5	110	23	14	1	38	109	33	6	148
Welsh	2	1	......	3	1	....	.....	1	3	1	.....	4
Scotch	32	8	2	42	11	2	......	13	43	10	2	55
Irish	10	5	..	15	7	3	....	10	17	8	......	25
West Indian	2	1	2	5	......	1	.....	1	2	2	2	6
Greek	2	......	......	2	.....	......	......	......	2	...	....	2
Japanese	30	6	1	37	25	19	......	44	55	25	1	81
New Zealand	23	11	10	44	8	5	2	15	31	16	12	59
Russian	51	......	.....	51	......	......	......	......	51	.....	.....	51
Spanish	......	.....	.....	.....	1	....	....	1	1	......	......	1
Swiss	1	......	.....	1	......	......	......	......	1	......	......	1
Danish	3	......	....	3	2	1	4	7	5	1	4	10
Swedish	2	......	......	2	4	......	...	4	6	....	.....	6
Syrian	.....	.....	......	......	2	.....	....	2	2	.....	.....	2
U. S. A. citizens	11	5	......	16	64	24	8	96	75	29	8	112
Total immigration	1,293	103	121	1,517	312	103	40	455	1,605	206	161	1,972
Returned Canadian	1,386	31	29	1,446	....	......	......	......	1,386	31	29	1,446
Tourist	1,962	123	73	2,158	1,205	60	55	1,320	3,167	183	128	3,478
Totals	4,641	257	223	5,121	1,517	163	95	1,775	6,158	420	318	6,896

TABLE III.

MONTHLY arrivals of Immigrants for Canada, by Nationalities, at the Port of Vancouver, for the Fiscal Year ending March 31, 1909.

	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Totals.
Australian	4	7	34	5	2	6	4	5	5	7	5	15	99
Belgian		1			1								2
Chinese	98	325		291	78	113	49	30	27	23	14	26	1,074
French			1		1							5	7
German		1							2			1	4
English	11	16	28	5	2	15	1	8	3	10	3	8	110
Welsh	1					1				1			3
Scotch	4	7	7	2	1	4		7	2	5		3	42
Irish	3	2	4	1	1		1	2				1	15
West Indian					4						1		5
Greek			2										2
Japanese	9	14	3		1	3	4		1		2		37
New Zealand	8	4	20		1			6			3	2	44
Russian			1									50	51
Swiss						1							1
Danish				1				1		1			3
Swedish	2												2
U.S.A. citizens	1		4			1			2	1	4	3	16
Totals	141	377	104	305	92	144	59	59	42	48	32	114	1,517

TABLE IV.

MONTHLY arrivals of Immigrants for Canada, by Occupation and Destination, at the Port of Vancouver, for the Fiscal Year ending March 31, 1909.

	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Totals.
Agriculturists	15	11	12	1	1	1	1	3	....	9	1	2	57
General labourers	80	141	17	125	1	88	3	15	2	7	3	62	544
Mechanics	12	40	15	3	1	6	2	3	4	7	6	5	104
Clerks	21	151	24	152	64	34	32	20	25	15	12	11	561
Miners	1	4	5	1	....	3	....	....	....	2	1	7	24
Female servants	....	4	2	1	....	1	3	....	1	2	....	....	14
Not classified	12	26	29	22	25	11	18	18	10	6	9	27	213
Totals	141	377	104	305	92	144	59	59	42	48	32	114	1,517
Maritime Provinces	1	....	....	5	3	2	....	....	....	1	....	....	12
Quebec	8	23	....	41	14	14	8	5	2	1	4	....	120
Ontario	26	37	14	63	12	22	8	10	4	4	1	3	204
Manitoba	1	....	5	10	....	....	1	....	....	1	....	2	20
Saskatchewan	3	....	....	....	....	....	....	....	....	....	....	....	3
Alberta	12	1	8	....	1	1	....	3	....	8	4	3	41
British Columbia	90	316	77	186	62	105	42	41	36	33	23	105	1,116
Yukon	....	....	....	....	....	....	....	....	....	....	....	1	1
Totals	141	377	104	305	92	144	59	59	42	48	32	114	1,517

TABLE

NATIONALITY, Sex, Occupation and Destination of Immigrant arrivals for

—	Sex.				Trade or								
					Farmers or Farm Labourers Class.			General Labourers.			Mechanics.		
	Males.	Females.	Children.	Totals.	Males.	Females.	Children.	Males.	Females.	Children.	Males.	Females.	Children.
Australian	49	27	23	99	3	2	4	14	.....	.....	10	2	...
Belgian	2	....	......	2	...	..	......	1	....	....	....	....	...
Chinese	978	18	78	1,074	......	.....	....	429	.....	6	34	....	....
French	5	2	.. ...	7	....	......	......	2	....	......	2	....	...
German	4	......	.....	4	1	....	.....	....	......	......	2	....	...
English	86	19	5	110	15	1	......	15	4	.....	18	....	...
Welsh	2	1	....	3	1	.. ..	....	......	.....	....	.....	....	....
Scotch	32	8	2	42	7	......	......	6	.....	.....	9	1	1
Irish	10	5	.....	15	1	......	......	2	.....	.....	6	....	....
West Indian	2	1	2	5	......	....	......	......	... ..	.....	1	...	....
Greek	2	....	......	2	1	......	......	1	.. ...	. ...	...	..	....
Japanese	30	6	1	37	12	....	....	6	1	...	1	1	1
New Zealand	23	11	10	44	3	1	2	3	.....	. ..	9	...	....
Russian	51	.... .	......	51	.... .	.....	......	50	......	......	......	....	....
Swiss	1	......	..	1	......	....	.....	1	......	... .	......	....	....
Danish	3	.... .	... .	3	1	......	......	1	......	.....	1	....	....
Swedish	2	.....	......	2	.... .	. .	......	.....	......	... ..	1	....	....
U.S.A. citizens	11	5	.....	16	2	.....	.....	2	......	... ..	3	1	....
Totals	1,293	103	121	1,517	47	4	6	533	5	6	97	5	2

V.

Canada at the Port of Vancouver, for the Fiscal Year ending March 31, 1909.

Occupation.										Destination.							
Clerks, Traders, &c.			Miners.			Female Servants.	Not classified.			Maritime Provinces.	Quebec.	Ontario.	Manitoba.	Saskatchewan.	Alberta.	British Columbia.	Yukon.
Males.	Females.	Children.	Males.	Females.	Children.		Males.	Females.	Children.								
13	3	5	4	1	....	5	5	14	14	......	......	6	4	...	10	78	1
....	....	...	....	...	....	....	1	....	...	......	......	......	....	....	......	2	...
481	3	8	1	.	...	....	33	15	64	10	117	175	9	....	2	761	...
.....	....	....	..	....	....	....	1	2	..	....	......	....	....	...	.....	7	..
.....	....	....	....	....	....	..	1	......	....	...	...	....	...	...	......	4	...
18	3	....	11	...	....	2	9	9	5	2	2	16	5	2	7	76	...
......	...	....	...	...	....	1	1	......	.....	.....	....	...	1	....	1	1	...
6	2	...	3	....	...	3	1	2	1	....	1	2	......	....	....	39	...
1	....	...	....	...	..	1	.....	4	.....	.....	......	1	.....	....	2	12	...
......	....	...	....	....	...	...	1	1	2	.....	......	......	...	...	....	5	...
.....	....	....	..	....	....	....	.....	.	...	....	......	.....	......	....	.....	2	...
7	2	...	....	...	....	....	4	2	......	...	......	1	1	....	11	24	...
3	2	....	3	....	....	2	2	6	8	.....	.....	3	...	1	7	33	...
1	....	....	....	....	...	....	....	......	......	..	......	......	..	....	.....	51	...
......	....	....	....	....	...	....	....	.....	......	....	....	......	......	....	......	1	...
......	....	....	....	....	....	...	.....	.....	......	......	......	....	.....	....	1	2	...
......	.. .	....	1	....	....	....	.....	......	......	......	......	......	......	....	.....	2	...
2	1	....	...	....	....	....	2	3	......	......	.....	......	......	....	.....	16	...
532	16	13	23	1	..	14	61	58	94	12	120	204	20	3	41	1,116	1

PORT OF VICTORIA.

For the fiscal year 1908-9, there arrived at the port of Victoria 4,260 passengers, of whom 395 travelled saloon and 3,865 steerage. Of the saloon passengers, 267 were destined to Canada and 128 to the United States. Of the steerage passengers, 3,285 were for Canada and 580 for the United States. Included in the steerage passengers for Canada were 1,953 returned Canadians and 30 tourists, leaving the immigration proper at 1,302 souls, a decrease as compared with the preceding fiscal year of 4,722 persons.

Table I. deals with the total arrivals of saloon passengers, Table II. with the total arrivals of steerage passengers, Table III. with the monthly arrivals of immigrants for Canada, and Tables IV. and V. give summaries of the information obtained from immigrants for Canada upon arrival.

TABLE I.

NATIONALITY and Sex of Saloon Passengers arriving at the Port of Victoria, for the Fiscal Year ending March 31, 1909.

—	Canada.				United States.				Canada and United States.			
	Males.	Females.	Children.	Totals.	Males.	Females.	Children.	Totals.	Males.	Females.	Children.	Totals.
Australian	5	3	....	8	2	2	....	4	7	5	....	12
Belgian	....	1	....	1	....	....	....	....	....	1	....	1
Chinese	4	1	4	9	....	....	....	....	4	1	4	9
French	1	3	....	4	1	....	....	1	2	3	....	5
German	4	....	....	4	3	....	....	3	7	....	....	7
English	78	45	7	130	7	3	....	10	85	48	7	140
Welsh	....	1	....	1	....	....	....	....	....	1	....	1
Scotch	12	3	4	19	2	....	....	2	14	3	4	21
Irish	2	1	....	3	....	....	....	....	2	1	....	3
West Indian	....	....	....	....	3	3	1	7	3	3	1	7
Japanese	7	1	....	8	....	....	....	....	7	1	....	8
New Zealand	1	....	1	2	....	....	....	....	1	....	1	2
Finnish	....	....	....	....	1	....	....	1	1	....	....	1
Spanish	1	....	....	1	1	....	....	1	2	....	....	2
Danish	....	....	....	....	2	....	....	2	2	....	....	2
Swedish	1	....	....	1	3	....	....	3	4	....	....	4
Norwegian	....	....	....	....	1	....	....	1	1	....	....	1
U.S.A. citizens	6	4	....	10	45	39	6	90	51	43	6	100
Canadian	21	12	13	46	2	....	....	2	23	12	13	48
Tourist	14	6	....	20	1	....	....	1	15	6	....	21
Totals	157	81	29	267	74	47	7	128	231	128	36	395

TABLE II.

Nationality and Sex of Steerage Passengers arriving at the Port of Victoria, for the Fiscal Year ending March 31, 1909.

—	Canada.				United States.				Canada and United States.			
	Males.	Females.	Children.	Totals.	Males.	Females.	Children.	Totals.	Males.	Females.	Children.	Totals.
African, South	....	1	1	2	1	.....	7	8	1	1	8	10
Australian	4	4	6	14	55	53	16	124	59	57	22	138
Austrian, N.E.S.	....	......	......	......	4	....	......	4	4	......	......	4
Bohemian	......	......	......	......	......	1	.....	1	......	1	......	1
Belgian	......	...	...	......	2	......	......	2	2	......	.....	2
Chinese	681	18	78	777	1	.....	......	1	682	18	78	778
Dutch	......	....	....	......	1	.....	......	1	1	......	......	1
French	......	......	......	......	4	......	....	4	4	.....	....	4
German, N.E.S.	......	......	...	....	21	6	.....	27	21	6	......	27
Saxon	......	......	.....	......	1	......	......	1	1	......	...	1
English	31	6	3	40	45	24	....	69	76	30	3	109
Welsh	.....	....	.....	.....	2	.....	.....	2	2	......	......	2
Scotch	5	1	......	6	13	5	......	18	18	6	......	24
Irish	1	......	.....	1	10	4	.....	14	11	4	......	15
West Indian	......	1	......	1	1	2	3	6	1	3	3	7
Greek	...	......	......	......	2	......	......	2	2	....	....	2
Italian	1	......	.....	1	6	2	1	9	7	2	1	10
Japanese	277	147	29	453	......	......	.....	......	277	147	29	453
New Zealand	2	2	1	5	24	6	2	32	26	8	3	37
Portuguese	......	......	......	......	1	....	.....	1	1	......	......	1
Polish	....	.....	.....	....	2	...	......	2	2	......	......	2
Roumanian	......	....	......	......	1	......	......	1	1	......	....	1
Russian	.....	....	......	.....	2	2	......	4	2	2	....	4
Spanish	....	......	....	......	2	1	......	3	2	1	......	3
Swiss	......	1	......	1	1	......	......	1	1	1	......	2
Danish	......	......	......	....	7	1	......	8	7	1	....	8
Swedish	......	......	......	....	6	2	......	8	6	2	...	8
Norwegian	......	.....	......	.....	3	1	.....	4	3	1	......	4
Turkish	....	.....	......	.....	1	....	.....	1	1	....	......	1
U.S.A. citizens	1	..	......	1	94	36	38	168	95	36	38	169
Total immigration	1,003	181	118	1,302	313	146	67	526	1,316	327	185	1,828
Returned Canadian	1,921	19	13	1,953	..	.	......	......	1,921	19	13	1,953
Tourist	25	5	......	30	24	18	12	54	49	23	12	84
Totals	2,949	205	131	3,285	337	164	79	580	3,286	369	210	3,865

TABLE III.

Monthly arrivals of Immigrants for Canada, by Nationalities, at the Port of Victoria, for the Fiscal Year ending March 31, 1909.

——	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	Totals.
African, South	....	....	....	....	...	....	....	....	....	....	2	...	2
Australian	....	1	2	4	...	4	....	3	..	....	....	....	14
Chinese	100	119	152	124	103	10	37	48	31	21	7	25	777
English	1	2	17	2	....	5	....	2	1	1	3	6	40
Scotch	1	1	1	....	....	1	....	....	..	1	1	....	6
Irish	....	....	....	1	....	....	....	....	....	....	....	....	1
West Indian	...	....	1	....	..	....	....	..	..	....	....	...	1
Italian	...	..	1	....	....	....	.	....	....	....	.	....	1
Japanese	142	99	48	39	26	16	27	10	15	11	11	9	453
New Zealand	1	....	2	....	..	2	....	..	...	....	....	....	5
Swiss	..	....	....	....	....	....	....	....	....	1	.	....	1
U. S. A. citizens	....	....	....	....	....	1	....	....	....	....	....	...	1
Totals	245	222	224	170	129	39	64	63	47	35	24	40	1,302

TABLE IV.

MONTHLY arrivals of Immigrants, for Canada, by Occupation and Destination, at the Port of Victoria, for the Fiscal Year ending March 31, 1909.

—	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	Totals.
Agriculturists	36	30	5	4	10	2	1	....	1	1	...	....	90
General labourers	117	40	16	41	14	9	6	1	3	3	9	9	268
Mechanics	13	7	8	2	6	8	....	1	2	1	2	3	53
Clerks	46	110	138	89	57	3	37	43	24	19	5	15	586
Miners	....	....	1	....	..	....	....	2	....	....	1	1	5
Female servants	1	...	2	...	1	1	....	..	....	....	....	..	5
Not classified	32	35	54	34	41	16	20	16	17	11	7	12	295
Totals	245	222	224	170	129	39	64	63	47	35	24	40	1,302
Maritime Provinces	....	....	....	....	....	....	....	....	....	....	....	....	......
Quebec	....	....	....	....	....	....	....	....	1	....	....	....	1
Ontario	....	....	...	...	....	....	1	....	....	....	....	..	1
Manitoba	....	....	....	....	....	....	....	....	..	....	....	1	1
Saskatchewan	....	....	....	....	....	....	....	....	....	....	....	....	......
Alberta	....	....	....	....	....	1	2	...	....	....	....	....	3
British Columbia	245	222	224	170	129	38	61	63	46	35	24	39	1,296
Totals	245	222	224	170	129	39	64	63	47	35	24	40	1,302

TABLE

NATIONALITY, Sex, Occupation and Destination of Immigrant Arrivals for

—	Sex.				Trade or								
					Farmers or Farm Labourers Class.			General Labourers.			Mechanics.		
	Males.	Females.	Children.	Totals.	Males.	Females.	Children.	Males.	Females.	Children.	Males.	Females.	Children.
African, South	......	1	1	2	......	...	......	......	....	....	......	.....	......
Australian	4	4	6	14	......	......	......	......	......	......	2	1	2
Chinese	681	18	78	777	23	......	1	113	....	2	12	......	3
English	31	6	3	40	1	1	2	1	......	...	11	1	.. ...
Scotch	5	1	......	6	......	......	......	2	......	... ...	1	....	... ..
Irish	1	.....	.....	1	......	......	......	......	......	... .	.....	.....	......
West Indian	......	1	. . .	1	......	......	......	......	......	.. .	.... .	.....	... ..
Italian	1	......	. ...	1	.... .	....	......	.. ...	......	.....	....	......	......
Japanese	277	147	29	453	55	6	1	123	21	6	16	2	.....
New Zealand	2	2	1	5	......	......	......	......	......	......	1	......	......
Swiss	. ...	1	......	1	......	......	......	......	......	.....	......	1	......
U.S.A. citizens	1	......	......	1	......	......	......	......	......	....	......	.....	......
Totals	1,003	181	118	1,302	79	7	4	239	21	8	43	5	5

V.

Canada at the Port of Victoria, for the Fiscal Year ending March 31, 1909.

Occupation.										Destination.						
Clerks, Traders, &c.			Miners.			Female Servants.	Not Classified.			Maritime Provinces.	Quebec.	Ontario.	Manitoba.	Saskatchewan.	Alberta.	British Columbia.
Males.	Females.	Children.	Males.	Females.	Children.		Males.	Females.	Children.							
...	...	...	...	...	...	...	...	1	1	...	...	...	...	...	...	2
...	...	...	2	...	...	...	...	3	4	...	...	...	...	...	...	14
478	4	25	...	...	...	...	55	14	47	...	...	...	...	...	...	777
8	2	1	3	...	...	...	7	2	...	...	...	...	1	...	...	39
...	...	...	...	...	...	...	2	1	...	...	...	...	...	...	1	5
...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	1
...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	1
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
56	10	...	...	...	...	3	27	105	22	...	1	1	...	...	2	449
...	...	...	...	...	...	1	1	1	1	...	...	...	...	...	...	5
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
544	16	26	5	...	...	5	93	127	75	...	1	1	1	...	3	1,296

UNITED STATES PORTS.

For the fiscal year 1908-9, there arrived in Canada, via ports in the United States, 11,267 passengers, of whom 167 travelled saloon and 11,100 steerage. Included in the steerage passengers were 270 returned Canadians and 13 tourists, leaving the immigration proper at 10,817 souls, a decrease as compared with the preceding fiscal year of 18,491 persons.

Table I. deals with the total arrivals of saloon passengers, Table II. with the total arrivals of steerage passengers, Table III. with the monthly arrivals of immigrants, and Tables IV. and V. give summaries of the information obtained from immigrants upon arrival.

TABLE I.

NATIONALITY and Sex of Saloon Passengers for Canada, via Ports in the United States, for the Fiscal Year ending March 31, 1909.

—	Canada.			
	Males.	Females.	Children.	Totals.
African, South		1		1
French		1		1
English	16	13	3	32
Scotch	4	3		7
Irish		1		1
West Indian	6	5	3	14
Jamaican	3			3
Italian	2			2
Negro	1			1
Canadian	41	58	6	105
Totals	73	82	12	167

TABLE II.

NATIONALITY and Sex of Steerage Passengers for Canada, via Ports in the United States, for the Fiscal Year ending March 31, 1909.

—	Canada.			
	Males.	Females.	Children.	Totals.
African, South	4	2	2	8
Australian	2	1	....	3
Austrian, N.E.S	907	205	165	1,277
Bohemian	3	1	....	4
Dalmatian	....	1	....	1
Hungarian, N.E.S.	314	69	47	430
Magyar	....	1	3	4
Ruthenian	116	4	2	122
Belgian	47	30	20	97
Bulgarian	7	1	....	8
Brazilian	....	....	4	4
Dutch	44	31	27	102
French	141	62	8	211
German, N.E.S	158	104	106	368
Prussian	1	....	....	1
English	876	506	507	1,889
Welsh	17	4	3	24
Scotch	184	138	32	354
Irish	129	117	23	269
West Indian	12	8	1	21
Bermudian	1	3	....	4
Jamaican	15	8	....	23
Greek	92	8	6	106
Hebrew, N.E.S	5	9	12	26
" Russian	32	33	36	101
" Austrian	2	1	2	5
Italian	3,046	359	251	3,656
Newfoundland	....	....	1	1
New Zealand	1	....	....	1
Portuguese	1	....	....	1
Polish, N.E.S	2	1	2	5
" Austrian	32	....	....	32
" Russian	2	4	8	14
Roumanian	43	19	14	76
Russian, N.E.S	385	250	291	926
Finnish	29	5	4	38
Spanish	9	1	5	15
Swiss	15	7	1	23
Danish	22	14	4	40
Swedish	77	37	17	131
Norwegian	72	24	21	117
Turkish	197	20	13	230
Armenian	7	....	....	7
Egyptian	1	....	....	1
Syrian	22	10	6	38
Arabian	....	1	....	1
U.S.A. citizens	1	1	....	2
Total immigration	7,073	2,100	1,644	10,817
Returned Canadian	199	53	18	270
Tourist	8	5	....	13
Totals	7,280	2,158	1,662	11,100

TABLE III.

MONTHLY arrivals of Immigrants for Canada, by Nationalities, via Ports in the United States, for the Fiscal Year ending March 31, 1909.

—	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	Totals.
African, South		1		1	1	2				2	1		8
Australian							1	2					3
Austrian, N.E.S.	451	173	107	48	39	39	87	85	52	39	45	112	1,277
Bohemian		2						1		1			4
Dalmatian		1											1
Hungarian, N.E.S.	67	31	28	16	11	22	29	22	28	37	52	87	430
Magyar	4												4
Ruthenian	122												122
Belgian	34	13	8		7	5	4	2	7	2	7	8	97
Bulgarian			1		1			2	1			3	8
Brazilian												4	4
Dutch	30	1	9	1	5	8	3	5	8	4	2	26	102
French	45	24	18	16	15	22	12	9	4	14	9	23	211
German, N.E.S.	91	30	25	35	31	21	21	16	12	22	7	57	368
Prussian		1											1
English	788	115	72	52	59	33	63	39	61	85	76	446	1,889
Welsh	11	4	1			1	1		2	1	1	2	24
Scotch	73	20	17	23	8	8	10	5	31	29	33	97	354
Irish	80	32	15	11	12	18	18	3	21	10	13	36	269
West Indian		7	1	4	1	5		1				2	21
Bermudian					1						1	2	4
Jamaican	3	1	8			3	6					2	23
Greek	24	12	4	7	13	3	1	2	15	1		24	106
Hebrew, N.E.S.	8	1							2	15			26
" Russian	36						1		18		28	18	101
" Austrian	5												5
Italian	1,035	852	172	67	86	95	116	104	116	66	241	706	3,656
Newfoundland		1											1
New Zealand				1									1
Portuguese	1												1
Polish, N.E.S.												5	5
" Austrian	32												32
" Russian												14	14
Roumanian	3	17	9			10	4	3	20		5	5	76
Russian, N.E.S.	127	91	33	80	55	94	57	113	89	51	37	99	926
Finnish	2		3				3	2	1		16	11	38
Spanish	5			1		2	7						15
Swiss	3	4	4	3		2	4		2			1	23
Danish	5	7	3	3	6	1	1		1	1	4	8	40
Swedish	15	30	4	2	9	5	27	9	5	4	10	11	131
Norwegian	30	8	9	7		12	7	3	3	15	5	18	117
Turkish	4	36	5	5	1	9	30	17	11	13	27	72	230
Armenian	4							1		1	1		7
Egyptian					1								1
Syrian	1		7		4	7	13		1	5			38
Arabian								1					1
U. S. A. citizens	1											1	2
Totals	3,140	1,515	563	383	366	427	526	447	511	418	621	1,900	10,817

TABLE IV.

MONTHLY arrivals of Immigrants for Canada, by Occupation and Destination, via Ports in the United States, for the Fiscal Year ending March 31, 1909.

—	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	Totals.
Agriculturists	1,019	544	134	90	107	111	160	119	135	113	202	652	3,386
General labourers	1,098	493	151	66	41	71	73	107	112	78	217	917	3,424
Mechanics	449	131	52	50	32	33	45	25	57	42	61	114	1,091
Clerks	121	60	63	56	45	22	48	25	31	49	43	60	626
Miners	30	9	9	2	5	1	7	2	7	14	24	22	132
Female servants	152	50	26	28	25	33	38	34	58	49	38	71	602
Not classified	268	228	128	91	111	156	155	135	111	73	36	64	1,556
Totals	3,140	1,515	563	383	366	427	526	447	511	418	621	1,900	10,817
Maritime Provinces	19	23	21	18	16	10	14	18	18	10	24	10	201
Quebec	1,041	497	147	69	82	87	112	77	148	92	185	469	3,006
Ontario	1,284	634	209	116	124	164	163	151	158	142	232	918	4,295
Manitoba	352	149	75	54	35	38	59	70	58	54	41	136	1,121
Saskatchewan	131	39	28	48	43	54	59	58	44	26	16	79	625
Alberta	114	56	27	26	35	24	59	24	22	22	37	120	566
British Columbia	199	117	56	52	31	50	60	49	63	72	86	168	1,003
Totals	3,140	1,515	563	383	366	427	526	447	511	418	621	1,900	10,817

TABLE

Nationality, Sex, Occupation and Destination of Immigrant arrivals for Canada,

—	Sex.				Trade or								
					Farmers or Farm Labourers Class.			General Labourers.			Mechanics.		
	Males.	Females.	Children.	Totals.	Males.	Females.	Children.	Males.	Females.	Children.	Males.	Females.	Children.
African, South	4	2	2	8						1	1		
Australian	2	1		3							1		
Austrian, N.E.S.	907	205	165	1,277	495	51	54	360	19	39	33	8	4
Bohemian	3	1		4									
Dalmatian		1		1		1							
Hungarian, N.E.S.	314	69	47	430	265	27	18	35	2	1	12	1	
Magyar		1	3	4									
Ruthenian	116	4	2	122	112	2	2				4		
Belgian	47	30	20	97	17	2	2	7	4	1	7	5	4
Bulgarian	7	1		8	1			5			1		
Brazilian			4	4									
Dutch	44	31	27	102	25	6	15	2	1		7	3	2
French	141	62	8	211	37	7		19	3	1	25	4	1
German, N.E.S.	158	104	106	368	53	19	38	18	10	8	37	12	10
Prussian	1			1	1								
English	876	506	507	1,889	168	34	46	174	60	273	238	90	102
Welsh	17	4	3	24	4	1	3	3			5	1	
Scotch	184	138	32	354	30	3		21	3	3	42	15	3
Irish	129	117	23	269	11	4	1	28	8	12	21	3	
West Indian	12	8	1	21	1			1	1	1	2		
Bermudian	1	3		4									
Jamaican	15	8		23							2		
Greek	92	8	6	106	17			68	4	3	4	1	1
Hebrew, N.E.S.	5	9	12	26				1		3	3	5	8
" Russian	32	33	36	101	1	1	4	12	3	9	17	15	7
" Austrian	2	1	2	5									
Italian	3,046	359	251	3,656	1,155	43	36	1,639	50	43	156	12	7
Newfoundland			1	1									
New Zealand	1			1									
Portuguese	1			1									
Polish, N.E.S.	2	1	2	5				2	1	2			
" Austrian	32			32	25			6			1		
" Russian	2	4	8	14	2	4	8						
Roumanian	43	19	14	76	8	4	1	27	3	3	3	2	1
Russian, N.E.S.	385	250	291	926	208	57	95	110	20	26	48	35	15
Finnish	29	5	4	38				23	4	3	1		
Spanish	9	1	5	15				4			1		
Swiss	15	7	1	23	5			1			2		
Danish	22	14	4	40	10			6			3	1	
Swedish	77	37	17	131	14	3	4	45	3		11	4	1
Norwegian	72	24	21	117	12	3	7	51	3	11	6	1	
Turkish	197	20	13	230	84	2	2	97	4	2	9		1
Armenian	7			7	1			6					
Egyptian	1			1				1					
Syrian	22	10	6	38	12		2	1			3		
Arabian		1		1									
U. S. A. citizens	1	1		2									
Totals	7,073	2,100	1,644	10,817	2,774	274	338	2,773	206	445	706	218	167

V.

via Ports in the United States, for the Fiscal Year ending March 31, 1909.

Occupation. Clerks, Traders, &c.			Miners.			Female Servants.	Not Classified.			Destination. Maritime Provinces.	Quebec.	Ontario.	Manitoba.	Saskatchewan.	Alberta.	British Columbia.
Males.	Females.	Children.	Males.	Females.	Children.		Males.	Females.	Children.							
1	1	1				1	2				2	1	2			3
1								1					2			1
16	5	2				63	3	59	66	21	458	277	349	51	86	35
			3			1									2	2
													1			
1		1				12	1	27	27	30	17	129	45	54	50	105
								1	3					4		
						1		1			87	18	16		1	
6	1		6	6	7	3	4	9	6	4	33	15	12	8	1	24
	1										3	5				
									4					4		
5	2	1				6	5	13	9		15	21	35	12	2	17
22	2		2			9	36	37	6	1	117	35	33	10	7	8
31	8	9	4			22	15	33	41	3	42	75	57	78	86	27
													1			
187	45	17	13	5	6	133	96	139	63	19	265	1,125	204	73	78	125
2			1			1	2	1			1	16		3	3	1
61	7		7	1		75	23	34	26	5	100	163	24	13	6	43
47	6		1	2		72	21	22	10	8	81	103	35	10	20	12
2	1					3	6	3			5	16				
							1	3			1	3				
1							12	8			5	18				
3						2		1	2		42	50	1		1	12
1						2		2	1	1	2	11	12			
	4	11				3	2	7	5		28	39	29	4		1
2		1				1			1			5				
27	4	4	51	1	4	88	18	161	157	70	1,313	1,622	78	8	117	448
									1	1						
1												1				
							1					1				
																5
											16	12	4			
												11			2	1
3						4	2	6	9		47	21	4	4		
17	6	5	1	1		53	1	78	150	24	218	248	126	232	50	28
			5					1	1		1	29	1	4	1	2
4	1	5									10	5				
3	1	1	1			2	3	4			8	5	3		5	2
2						9	1	4	4		5	8	9	11	3	4
5	1		1			18	1	8	12		6	26	29	20	20	30
2	2					8	1	7	3	5	9	12	9	22	24	36
3	1		3			9	1	4	8	3	56	146			1	24
										1		6				
											1					
6	6	1				1		3	3	5	11	16				6
								1			1					
							1	1				1				1
462	105	59	99	16	17	602	259	679	618	201	3,006	4,295	1,121	625	566	1,003

STATEMENT showing the number of Immigrants debarred at Ocean ports since December, 1902, when the Medical Act went into force, also the number held for further inspection.

—	No. held for further inspection.	No. rejected.
Fiscal year 1902-1903	273	273
" 1903-1904	1,835	274
" 1904-1905	2,559	611
" 1905-1906	3,570	524
" 1906-1907	3,543	440
" 1907-1908	4,573	1,172
" 1908-1909	3,544	509
Totals	19,897	3,803

Inspection of Immigrants seeking admission to Canada from the United States was begun in April, 1908, and during the fiscal year 1908-1909, 4,580 intending immigrants were debarred.

STATEMENT showing the number of Immigrants who were deported, that is, Immigrants who passed inspection and who afterwards became a public charge in one way or another, and were returned to the country from which they came, during 1902-3, 1903-4, 1904-5, 1905-6, fractional fiscal year (9 mos.) 1906-7, 1907-8 and 1908-9.

English	2,007
Scotch	206
American	149
Bulgarian	137
Irish	81
Russian, N.E.S.	56
Galician	49
Roumanian	44
Hebrew, N.E.S.	40
Swedish	33
Greek	32
Italian	31
Hindoo	29
Norwegian	29
French	26
Dutch	22
Hebrew, Russian	21
Turkish	20
Austrian, N.E.S.	20
Danish	17
German	15
Finnish	14
Welsh	9
Bukowinian	9
Hungarian	8
Icelandic	8
Japanese	4
Belgian	3
Bohemian	3
West Indian	3
Polish, Russian	3
Polish, N.E.S.	2

Australian	2
Chinese	2
Swiss	2
Syrian	2
Hebrew, Austrian	2
South African	1
Doukhobor	1
Hebrew, German	1
Hebrew, Polish	1
Newfoundland	1
Negro	1
Jamaican	1
Ruthenian	1
Spanish	1
Total	3,149

STATEMENT showing the number of Immigrants deported since December, 1902, by Years.

Fiscal year 1902-03	67
" 1903-04	85
" 1904-05	86
" 1905-06	137
" 1906-07	201
" 1907-08	825
" 1908-09	1,748
Total	3,149

The following is a statement showing Immigration literature, &c., ordered during the year :—

	Copies.
L'Alberta Nord	20,000
Land Regulations in Canada	100,000
Nova Scotia pamphlet	35,000
Eastern Townships of Quebec	20,000
Mercantile and Financial Times	500
Canadian Courier	25,000
Immigration Act (English)	10,000
Immigration Act (French)	5,000
Calendar 'Welcome Stranger'	50,000
Canada West Magazine	10,000
British Columbia pamphlet	20,000
Danish pamphlets	1,500
Opportunities in Canada	20,000
Prince Edward Island pamphlet	10,000
Post Cards (French)	100,000
La Colombie Britannique	200
Grand Trunk Pacific folder Map	60,000
A trip through Canada by Scottish Agriculturists	200
Homestead Regulation Sheets	70,000
Canada the Land of Opportunity	110,000
Agriculture tour through Canada	100,000

Classes wanted in Canada..	100,000
Alberta Red winter wheat..	100,000
East Indians in British Columbia..	2,000
Canada as it appeared to Scottish Agriculturists..	100,000
New Brunswick pamphlet..	10,000
Thunder Bay and Rainy River District....	5,000
Prosperity follows Settlement..	100,000
Canadian Life and Resources..	6,000
Atlas of Canada (English)..	178,000
Atlas of Canada (Bound, English)..	6,000
" " (French)..	55,000
" " (Bound)..	3,000
" " (Flemish)..	10,000
" " (Dutch)..	10,000
'Last Best West' (English)....	252,500
" (French)..	25,000

MAPS.

School maps (English)..	5,000
" (French)..	5,000
Pre-Emption maps..	88,000
Small Dominion of Canada map..	6,000
Nova Scotia map..	10,000
New Brunswick map..	10,000
Prince Edward Island..	10,000
British Columbia..	10,000

NEWSPAPERS.

Saskatoon *Phœnix*....	13,500
Vermilion *Signal*.	3,000
The Canada Posten (Swedish)..	5,000
Canadian Hungarian..	15,000
Der Nordwesten....	26,000
" Special Edition..	50,000
Christmas Globe..	200
Saskatchewan *Courier*..	15,580
" " Special..	5,000
Vegreville *Observer*..	2,500
Canada Scotsman..	5,000
Alberta *Herold* (German)....	26,000
Canada (Swedish weekly)..	24,000
Danebrog..	12,000
Logberg (Icelandic)..	26,000
Le Nouvelliste....	1,000
Lethbridge *Herald*..	1,000

One hundred and eighty-six thousand two hundred and seventy-nine pieces of mail were received and attended to in my office during the fiscal year, an increase of 23,164 upon the figure for the previous fiscal year; 315,006 requests for information, direct and indirect, were received and attended to.

Your obedient servant,

W. D. SCOTT,
Superintendent of Immigration.

OPERATIONS IN EUROPE.

No. 1.

REPORT OF J. OBED SMITH.

11 and 12 Charing Cross,
London, S.W., April 2, 1909.

The Right Honourable
Lord Strathcona and Mount Royal, G.C.M.G.,
High Commissioner for Canada,
17 Victoria Street, S.W.

My Lord,—I have the honour to submit the report of the Emigration Branch of the Department of the Interior, covering the agencies in the United Kingdom and the agency at Antwerp, in Belgium, for the fiscal year ending March 31, 1909, together with the individual reports of the various emigration agents for the same period.

As the result of personal inspections of the various agency premises during the past year, I am able to state with confidence that they are suitably situated, easily accessible to the public, and generally well adapted for the purposes of this branch of the department. I would, however, recommend that, on the expiry of the present lease of the Liverpool agency office, steps be taken to secure premises on the street level of a public thoroughfare, with ample window space for the display of exhibits, &c., which principle has been adopted in all the other agencies with marked success.

A striking feature in connection with the emigration propaganda during the past year has been the constantly changing displays of products and exhibits in the various agencies of the department, at large and small agricultural shows and fairs, at many small county exhibitions; and, as far as the stock would permit, miniature displays in the offices of a large number of booking agents throughout the country. This feature in my opinion is one capable of considerable extension with profitable results to the Dominion, and although the supply of suitable display material in the past has been large, I would respectfully recommend that it be largely increased in the future. In this connection I venture to believe that Canada has now reached a position in the knowledge of British people and others that her capacity to grow the finest wheat is established and admitted to be a fact, and while this prime object of our emigration work must ever be kept to the front, there are other branches of agriculture and kindred industries from which substantial, attractive and suitable exhibits could be made with great advantage.

The adopted programme of advertising in the country and provincial papers, in preference to the large and expensive city journals, has been continued and extended during the past year. Our agents are constantly on the watch for a newspaper that reaches the class of emigrants most sought after by Canada, and it is gratifying to note that practically without exception the provincial press in the British isles is now favourably disposed towards Canada. Perhaps some exception might be made to this statement in some parts of Ireland, where there is a strong feeling against any attempt to emigrate people from those districts, but in all other parts of the British isles Canada has so established her reputation, that the next step of developing emigration and trade, as a result of that knowledge, becomes natural and easy.

During the past twelve months our exhibition motor cars have travelled from the south of England to the north of Scotland, calling at hundreds of small country villages and school-houses, and distributing literature and information at all points. In addition, the exhibition horse-wagons have covered very effectually several large districts that are more or less inaccessible or inconvenient for motor cars. I cannot too strongly recommend the continuance and extension of this desirable missionary work.

On April 15, 1908, there became effective an order in council, approved by His Excellency the Governor General on February 25, 1908, as follows :—

'On a memorandum, dated February 20, 1908, from the Minister of the Interior, stating that a very considerable number of emigrants arriving in Canada from the British isles have either been rejected at Canadian ports or afterwards deported from Canada as undesirables, for causes named in the Immigration Act ;

'That during the year 1907 there were some 141 rejections and 441 deportations of British emigrants ;

'That among the many charitable and philanthropic associations actively engaged in the British isles in sending and financially assisting immigrants to Canada are some whose work is chiefly among the unemployed, destitute and incompetent classes in the congested centres of population.

'While the minister does not contend that some of these immigrants may not make successful citizens of Canada, nevertheless it is true that it is not the object of these associations to encourage the immigration of the really competent, industrious and ambitious man so long as he succeeds in supporting himself, and that their operations are confined almost exclusively to the class from which it is very unlikely that the needs of Canada can be properly supplied.

'The class referred to includes not only the unemployed but a large proportion of those who are a drug in the labour market from misfortune, incompetence or indifference. In the case of these it is no alleviation of their condition to transfer them here, because our experience is that they simply continue in the same condition, and are a detriment to Canada.

'While the associations engaged in this work often claim, and perhaps endeavour to use discrimination in the matter of selection, in effect it is found that emigrants are sent here who are entirely unsuited to the conditions prevailing in this country, and who are unlikely to succeed even under the most favourable circumstances.

'The work of these associations does not come under the supervision of the Canadian Immigration Department in the British isles, and it is very advisable that more effective measures should be adopted, supervisory and restrictive, in regard to the undesirable classes.

'It might be mentioned that the Department of the Interior exercises a degree of supervision over a certain very limited class of immigrants, who are sent out by the Poor Law Guardians. If the guardians of a district are satisfied that a person, who has been a charge on them, is really capable of working his way in Canada, or elsewhere, under new conditions, and with a fair start, they secure an appropriation from public moneys for the purpose of the emigration of such person. When an emigrant is sent out in this way, it is imperative that the consent of the assistant superintendent of emigration for Canada be obtained. In this way the department exercises some control. Independent inquiry is made, a medical certificate is obtained, and other precautions taken to make sure of the suitability of the emigrant.

'The minister is of the opinion that a similar system of inspection should be extended to all charitable and philanthropic societies or organizations operating in England, whether using public money or funds provided by public generosity so that persons whom they propose sending to Canada may be subject to inspection by the officer representing the Canadian Government Emigration Department in London, as to their antecedents, both morally and physically, and as to their general suitability for settlement in Canada; such persons to be allowed entry into Canada only upon presentation of a proper certificate from the assistant superintendent of emigration; and to be subject to exclusion and deportation in the usual way, should they succeed in gaining admittance to Canada in contravention of the regulations.

'The Immigration Act (Sec. 10) provides that—

'"The Governor in Council may on the recommendation of the minister, make such orders and regulations, not inconsistent with this Act, as are considered necessary or expedient for the carrying out of this Act according to its true intent and meaning and for the better attainment of its objects."

'The minister, therefore, recommends that an order in council be passed prohibiting, from and after the fifteenth day of April, 1908, the landing in Canada of any person whose passage has been paid, wholly or in part, by any charitable organization or out of public moneys, unless it is shown that the authority in writing of the assistant superintendent of emigration for Canada in London, has been obtained for the emigration of such person, and that such authority has been acted upon within a period of sixty days.

'The committee submit the same for approval.

'RODOLPHE BOUDREAU,
'Clerk of the Privy Council.

'The Honourable
'The Minister of the Interior.'

This was followed by a general circular from the department on May 12, 1908, as follows:—

'IMMIGRATION BRANCH,
'DEPARTMENT OF THE INTERIOR,
'OTTAWA, CANADA, May 12, 1908.

'Notice is hereby given that the only classes of immigrants wanted in Canada at the present time are experienced farm labourers, farmers financially able to take homesteads or purchase lands, and female domestic servants.

'The demand for railway labour is filled for this season.

'All concerned are requested to note the above carefully, and also to note that the regulation now in operation in Canada requiring every immigrant 18 years of age or over, to have in his possession at least $25 cash at time of landing, besides ticket to destination, will be enforced strictly and impartially in the case of all immigrants outside of the classes above mentioned.

'W. D. SCOTT,
'Superintendent of Immigration.'

An order in council approved by His Excellency the Governor General on September 11, 1908, became operative and is as follows :—

'PRIVY COUNCIL, CANADA,
'At the Government House at Ottawa,
'FRIDAY, the 11th day of September, 1908.

'Present,

'His Excellency the Governor General in Council.

'His Excellency the Governor General in Council, in virtue of the provisions of section 20 of the Immigration Act, chapter 93, Revised Statutes of Canada, 1906, is pleased in view of the labour conditions and of the probable supply and demand for labourers in Canada during the coming winter, to order and it is hereby ordered that in the case of immigrants arriving at Canadian ports between the 1st day of January and 15th day of February, 1909, the immigration agent at any port shall require every immigrant, male or female, 18 years of age or over, to have in his or her possession money to the minimum amount of $50, in addition to a ticket to his or her destination in Canada, unless satisfactory evidence is furnished that the immigrant is going to some definite employment, or to relative or friends already settled in Canada who would take care of such immigrant and that on the last mentioned date the money qualification above prescribed be reduced to the minimum amount of $25 for each immigrant and so remain until further ordered.

'RODOLPHE BOUDREAU,
'*Clerk of the Privy Council.*

'The Honourable
'The Minister of the Interior.'

The evident intention of the above mentioned regulations has, in my opinion, been effected. Though there was a tendency in some quarters to construe these regulations as wholesale restrictions, and an indication that Canada wanted no more emigrants, subsequent facts clearly show that during the last fiscal year Canada received as many emigrants as she required, and who could be suitably settled in the Dominion, and the percentage of undesirables was reduced to a minimum.

In this connection I am pleased to be able to report that the various emigration societies especially affected by the order in council of the 25th February, 1908, have, without exception, loyally accepted the conditions imposed by the said order in council, and while realizing the duty of this office to strictly carry out these regulations, the method of doing so did not necessarily tend to prejudice the existence or continuance of such societies' propaganda. The societies in question undoubtedly sent much diminished numbers to Canada, and their funds were appreciably diminished accordingly, but their officers speedily realized that the regulations were imposed not only as a safeguard against undesirable and unsuitable persons being admitted to Canada, but it was actually to the advantage of such intending emigrants as were rejected that they should know by the personal selection carried on through this office that there was little or no chance of their succeeding in Canada.

The above regulations of 1908, together with the general trade conditions, unquestionably affected the number of emigrants leaving these shores; but while the number is less, I submit that the figures are not in the least disappointing, especially when they convey the fact that the number was sufficient for Canada's needs during the year, and that the undesirable element had been eliminated to a great extent.

During the past fiscal year other portions of the British empire have entered the emigration field in active competition with Canada. The province of Ontario has opened a separate office in the city of London, and their officers very heartily cooperate with us in all necessary business matters. But some states of the Australian Commonwealth not only offer a bonus to booking agents, but on certain conditions give assisted passages to intending emigrants, and while the number that such states of the commonwealth can take each year is relatively small, yet there is a competition which has to be met, and after discussing the matter at length with our various agents, and with many booking agents, and discussing conditions under which work has to be undertaken to secure the desirable class required by Canada, I am firmly of the opinion that the payment of bonuses to licensed booking agents should be continued without change.

During the year our agents have continued the inspection of booking agents, and the reports have been placed on file with the department at Ottawa from time to time.

The continuance of the policy of sending successful farmer delegates to tell their personal story of success has been productive of excellent results throughout the British isles, and I am of the opinion that the policy in question should be continued next season. Strive as the department does to prepare literature absolutely correct in every detail, there, is perhaps owing to competition from other colonies, a lingering opinion among intending emigrants that government literature requires to be fortified by the personal opinion of some actual settler or farmer from Canada, with whom they can converse. The type of farmer delegate sent during the past year has been all that could be desired.

The demand from school children for the School Atlas has been very great during the past year, and it has been the ambition of agents to cultivate the personal application of school children for this valuable adjunct to their education. The Wall Map of Canada, which was a splendid advertisement by its free distribution to schools, should, in my opinion, be followed by a pictorial chart, similar in size and displaying by illustrations and reading matter the principal resources of Canada. These I feel satisfied would be very heartily welcomed by the many thousands of school-masters throughout the British isles as a method of educating the children.

While it is self-evident that the magnificent display provided by the Canadian government at the Franco-British exposition held in this city during 1908, induced a wide-world interest in Canada, and unquestionably maintained a foremost position amongst the world's exhibitors, it is apparent that the full beneficial results of that exhibition cannot be counted observable in the first or second years, indeed one cannot say where the effect of that magnificent display will end.

The special efforts required of our agents during the past fiscal year in order to secure suitable and deter unsuitable emigrants from going to Canada, have been successful and creditable. All the agents have transacted the business of the department during the past fiscal year with much business ability and great personal tact and energy. The correspondence received has had immediate and careful attention, and their extensive distribution of literature resulted frequently in their being short of this material. I would respectfully urge that literature of an inexpensive kind in very large quantities be supplied for the purposes of work on this side of the Atlantic.

The inspection of out-going emigrant steamers from London, Liverpool and Glasgow has been continued by our respective agents at these ports, and a statement concerning each such steamer carrying emigrants has been forwarded to the department at Ottawa.

I have much pleasure in recording the cordial co-operation which this office has received from the Imperial Government Emigrants' Information office, and the Board of Trade office. The latter department controls the issuing of licenses to booking agents, and it is a special duty to see that no booking agent takes advantage of any intending emigrant. I am pleased to report that our system of inspection is such that seldom, if ever, is it necessary to discipline or criticise booking agents in this respect. The transportation companies are fully alive to the necessity of continuing this policy, and without hesitation have agreed to the suggestions made by this branch of the department.

In addition to the general supervision of all emigration work (except in France) on this side of the Atlantic, the staff in London have had special charge of the London agency district, consisting of fifteen counties, with an enormous population, and during the past year there have been distributed from this office (not including those sent to other agencies), by correspondence, over the counter, and through the steamship companies in the London district, nearly half a million pamphlets of various kinds.

Twenty thousand and forty-one persons visited the London office during the past fiscal year to make personal inquiry, and discuss proposed emigration, &c., and a reasonable estimate, based on actual count for several days, shows that nearly a million people stop to inspect our window display in Charing Cross.

During the year nearly 62,000 attachments have been made to the files in the London office alone.

All the provinces of the Dominion, with the exception of Manitoba, have furnished this office and our agencies with large quantities of up to date literature, specially informing the public regarding their respective provinces, and so great has been the demand through our correspondence for the literature that we are constantly requisitioning further supplies. It is gratifying to realize that the auxiliary efforts of the various provinces of the Dominion, made available through the extensive propaganda of this branch of the Department of the Interior, have reached a large number of people to whom otherwise the name of a province in Canada would have no significance.

The provinces of British Columbia, Ontario and Nova Scotia by their excellent special fruit and vegetable exhibits last year created an attention regarding these branches of agricultural work which must produce substantial and favourable results. With all the provincial governments and the agents thereof in the British isles the federal government agents maintain the most cordial co-operative relations.

The steamship and railway companies operating to and from Canada have through their officers earned the just appreciation of the department for their assistance in many ways in the work of the department, and I have continued to assure them that they may depend upon the hearty sympathy of the department in the work of transporting desirable passengers to the Dominion.

In view of the very large and successful emigration of children to Canada I have taken advantage of opportunities, when time permitted, of visiting industrial, training and other schools from which the children were selected, and in company with Mr. G. Bogue Smart, the inspector of British immigrant children and receiving homes, gathered a large amount of information which will the better enable this office to make careful selection before consenting to the emigration of such children. The reports of the special inspection of such children have been received with much gratification by public officials and others privately interested in this work in the British isles. Considering the great number of applications received by the department for such children from very desirable citizens of Canada, it is apparent that there is a large field for this class of emigration, and the satisfactory reports which have been received from the department, after inspection of these children in their foster homes in Canada, appeal to the British public with much credit to the department.

In connection with your lordship's multifarious duties, connected with the important office of High Commissioner for Canada, the personal, kind attention you have been able to give at all times to the emigration branch of the public service is at once an evidence to the department of your appreciation of the great value that branch of the government work is to the Dominion of Canada, and your determination not to spare yourself for Canada's sake. I beg to offer my personal thanks to your lordship for very special consideration at all times.

Your obedient servant,

J. OBED SMITH,
Assistant Superintendent of Emigration.

No. 2.

REPORT OF A. F. JURY.

OLD CASTLE BUILDINGS, PREESON'S ROW,
LIVERPOOL, April 1, 1909.

The Assistant Superintendent of Emigration,
11 and 12 Charing Cross, London, S.W.

SIR,—When all the circumstances are taken into consideration, I think the result of last year's work has been most satisfactory, and while the numbers have not been as large as in the two previous years, the quality is much improved, and their usefulness to Canada greater than in any previous year of my experience. The new departmental regulations have enabled us to exercise a stricter supervision of the charitable society class, who frequently are not well fitted for pioneer farm work.

They have also dissipated the idea that prevailed to a certain extent in this country that Canada was so anxious to obtain population that she would receive the undesirables from the police courts and the slums. In most cases the man who is unable to make a living in this country will be unable to do so in Canada, but the man who has been able to make a living here and save enough to have twenty-five dollars, in addition to his inland railway fare to his destination in Canada, is most likely to be able to do much better there, and is not only a valuable addition, but a good advertisement for Canada. The extension of the period during which undesirables can be deported, which I understand is proposed, will, I think, act as a deterrent to people who want to get rid of their ne'er-do-well sons by shipping them to Canada. This class of emigrants not only gives Canada a bad name when writing to this country, but their lazy, drunken, shiftless habits give Englishmen a bad name in Canada, and cause the impression to get abroad that they are not wanted there.

There are thousands of village clubs and reading rooms in this country that offer a good field for propaganda work if a suitable handbook of Canada was published and circulated among them. A revised edition could be issued every year to keep the statistics up to date. By this means we should reach the class most required in Canada at the lowest possible cost. This work could be followed up by the agents in this country sending all their old Canadian newspapers to the reading rooms that receive our handbook, which would have the effect of keeping the interest in Canada alive all the year round.

I must again emphasize the necessity for a good supply of Canadian agricultural products, with special reference to choice fruits and corn cobs in the husk and on the stalk, to be exhibited in the agency windows and at the various agricultural shows. There is nothing that tends so much to disabuse the public mind here with regard to the Canadian climate, as exhibiting products that cannot be grown out of doors in this country.

I would also again take the liberty of suggesting the issuing of a double crown coloured poster respecting farming in Canada, with a space left at the bottom for the local steamship agent's name and address. If this was done the local steamship agents would not only show them in their windows in the principal streets of the cities, towns and villages of the United Kingdom, but they would go to the expense of posting them throughout the British isles.

There has been little demand for lectures this season, and those I have delivered have been poorly attended.

The agricultural shows at which I have exhibited have been well attended and a large amount of literature has been distributed, but the supply of government pamphlets for this purpose has not been equal to the demand, and I have had to distribute a large amount of steamship literature, which is not as satisfactory as having our own.

The letters of inquiry as a result of our advertising have been disappointing, and I think the best method would be to use only the great papers that are noted for being the medium through which the most successful business men reach the public, these naturallly being the papers that people read who are looking for opportunities to improve their condition.

The number of souls on whom bonus has been claimed during the past year, through this office, was 638.

The work of receiving and handling the deports has increased very largely during the past year.

Mr. Edwin MacLeod, my assistant, made a trip to Canada during the year and visited all the leading points. While he has always been efficient and useful, his trip has made him far more helpful in the work.

Your obedient servant,

A. F. JURY.

No. 3.

REPORT OF L. BURNETT.

16 Parliament Street,
York, March 31, 1909.

J. Obed Smith, Esq.,
Assistant Superintendent of Emigration for Canada,
London.

Sir,—I have the honour to submit to you my annual report for the year ending March 31, 1909.

Emigration from this country to Canada has been somewhat checked during this year, owing to the depression in America affecting Canada, and reports that prevented many people from going who otherwise would have gone. I find that the greatest drawback to emigration from this country is the lack of funds by the parties who are willing to emigrate, and who would undoubtedly make good citizens for Canada, if once they were in the country where there is plenty of scope for their energies and so many golden opportunities for them to possess their own land and become independent in a few years by exercising good judgment and frugality. Another reason why the agriculturalists and domestic servants are not leaving this country for Canada in larger numbers is on account of the wages here being increased, so that there is very little difference between the wages in England and Canada at the present time for good servants of either sex. The agriculturists in this district make very suitable settlers for Canada, and very few of them fail to make a success of life there. This year I have had a great many young men visit this office who have only been in Canada a short time, and have come to England to spend the winter, and induce others to return with them. In one case a young man took back with him seven farm hands, and all purposed taking up land. The booking agents in my district have been a little discouraged at the numbers going to Canada, compared with two years ago, and to a great extent they attribute this to the restrictions imposed by the Canadian government, but the latest reports from them are encouraging, and they are looking forward to a brisk business this spring. I have visited the booking agents whenever I deemed it necessary, and endeavoured to co-operate with them in every possible way to secure the right class of emigrants. This winter my district has been well covered by lectures and farmer delegates, but the booking agents have not been so enthusiastic in arranging for lectures, as owing to business being slack they did not care to go to too much expense.

The geography of Canada is being taught in all schools this year, and I have numerous applications every day from school teachers and scholars for copies of our Canadian atlas. I comply with their requests as far as possible, thereby getting the parents interested, which may ultimately result in their making their homes in the 'Land of Promise.'

Your obedient servant,

L. BURNETT.

No. 4.

REPORT OF G. H. MITCHELL.

139 Corporation Street,
Birmingham, March 31, 1909.

J. Obed Smith, Esq.,
Assistant Superintendent of Emigration,
London.

Sir,—I beg to submit my report for the year ending to-day.

During 1908 there was a very heavy decrease in the number leaving for Canada owing to the very alarmist reports which reached this country of the state of the labour market in the Dominion; that the depression was caused by non-Canadian influences which affected the rest of the world was of course immaterial to the man seeking work, but the accounts received such extraordinary publicity that the effects will take a considerable time to disappear. The department's restrictive regulations had a tendency to confirm the impression that no more emigrants were wanted, the general public failing to make the discrimination that was necessary accurately to understand the position. However, the regulations ensured that of those who did sail a greater proportion than ever before was desirable from a Canadian standpoint. This spring a much better feeling prevails and I anticipate that the year will show greater returns than 1908 although still much below the figures of 1907. Competition has become keener on the part of the Australian colonies and New Zealand, and they are securing an increasing number of emigrants of the kind most wanted in Canada; their literature is very attractive in appearance as well as in other ways, their exhibitions of produce are particularly well done, and their commissions to booking agents equal to our own. It will be necessary to continue to use every effort to keep Canada to the front.

The newspaper press in my district as a whole has not been unfriendly; some of the papers at times insert unfavourable letters from men who have returned and from dissatisfied settlers but they show a willingness also to give the other side of the case.

My time has been fully occupied in the usual way, answering correspondence, interviewing personal enquirers, visiting booking agents, attending agricultural shows with exhibits, arranging itineraries for delegates, and for the motor and horse wagons, and giving and arranging lectures, the lantern slides being in constant use during the winter season.

A good start has been made in securing correspondents in the villages and some of these have already proved very useful.

The office daily record shows an increase in the number of communications received, 5,776 against 3,803, and letters sent out 6,604 compared with 4,207 last year, but the callers were fewer, 2,930 against 3,965.

Acting under instructions I paid a visit to the Dominion during August and September, and I was glad to have the opportunity of renewing my acquaintance with various places, of seeing the developments which had taken place since my last visit six years previously, and of going through districts which were not at that time opened up. It gave me a chance of looking up many men who had gone out on my recommendation; some of them were working on farms and others were now on farms of their own, and it was very gratifying to find them without exception doing well. Needless to say the trip enabled me to gather much fresh material which has already proved invaluable in my work.

Your obedient servant,

G. H. MITCHELL.

No. 5.

REPORT OF H. M. MURRAY.

Exeter, March 31, 1909.

The Assistant Superintendent of Emigration,
London.

Sir,—I have the honour to present my annual report for the year ending March 31, 1909.

Like other districts there was a distinct falling off in emigration to Canada during the year just closed. I, however, do not consider this as being a drawback but rather a help, as it has enabled the general public in this country to understand that Canada will no longer admit into the Dominion the undesirable, unwilling to work, and shiftless men from Great Britain, but rather have the numbers reduced and receive emigrants of a higher standard both morally and physically. Bearing this in mind as being the desire of the minister and the department, I have during my periodical visits to booking agents endeavoured to impress upon these gentlemen that we are only desirous of securing men and women of the best class, and of the former only those willing to go on the land, and the latter for domestic service, of course keeping before them the fact that there are many openings in western Canada for men and women with capital and grit. I am pleased to say that my efforts directed on this point have been highly successful, many fine specimens of the typical agriculturist having gone out from the west of England.

I think shipping agents now thoroughly understand the class of men required in Canada. They are not so prone, as was the case with many of them some years ago, to accept any one as a passenger to Canada, caring little or nothing as to his future or progress so long as a commission was received on the booking. The certain amount of control the bonus arrangement gives to government officers over these agents has in my opinion had a very salutary and steadying effect.

The counties of Somerset, Devon and Gloucester have this year, as during 1907, given the best results. In this connection I may say that on one steamer alone, which sailed on the 12th inst., there were over 150 good sturdy farmers and farm servants, secured between Plymouth and Bristol, many of them, especially from Somerset, having capital at their command and intending to settle in southern Alberta. These men will be an acquisition to Canada. The returns from Gloucester do not give a fair estimate, as the Canadian Pacific Railway Company, who have a branch office in Bristol and to whom no bonuses are paid, booked over 800 passengers, of whom many belonged to the bonus classes.

In the county of Wiltshire we have a decided increase in the farming class of bookings, and a decrease of 25 per cent in Hereford. In the latter county there is a considerable acreage taken up with apple, pear and plum orchards. It is also to a considerable extent a dairying and cattle raising centre. Farmers are, as a rule, pretty well off and labourers are paid fair wages. We did well here a couple of years ago and I am confident good returns will come again.

Dorset is purely a pastoral and dairying county, and we have never been able to secure large numbers there, although I am aware that several from Dorset book their passages at Bournemouth, in the neighbouring county of Hampshire.

In Cornwall there are a sturdy set of men engaged in the slate and tin mines. A few years ago many of these mines were closed, owing to want of demand for the output. Now, however, it is the opposite. Many mines which have been closed for years are working full time and workers are scarce.

South Wales has been fairly good, but as you are aware coal is the principal product, the country from Swansea to Newport, Mon., being honeycombed with mines, Swansea itself up to Llanelly in Carmarthen being occupied in the manufacture of tinplate. On the whole in this part of the country at least 90 per cent of the people derive their living in some way or other from the industries mentioned. Of course a great many of these people, especially the miners, have in early years worked on the land, but owing to higher wages drifted to the mines. In times of depression quite a number have gone to Canada for farming purposes, but recently high wages at home have been received, preventing emigration, although quite a number still go out to the mines in Pennsylvania, U.S.A.

The general work in this office has been carried out in the usual manner. Every attention has been given to callers and correspondents. During the year 3,281 persons called for information; 7,563 letters were received, and 8,651 sent out. Pamphlets are sent out with every letter as also an inquiry form, asking the addresses of friends who may be interested in Canada, to whom also pamphlets are sent.

The following agricultural shows were attended :—

Somerset county, Devon county, Bath and West, Gloucester county, Hereford and Worcester and Wiltshire. As a rule favourable weather prevailed and large quantities of literature were given away; on the whole I should say not less than 80,000 pamphlets. At these shows we come into direct contact with the special class we are after, viz., the agriculturists, and I am certain that by means of these meetings, where people come around the stand, examine our samples and get direct information, many are induced to make their homes in Canada.

The removal of our office from Cardiff, Wales, to the centre of the west of England has resulted in nothing but good. With a couple of capital show windows, exhibits of grain, grasses, fruit and minerals, helped by attractive pictures and transparencies of Canadian scenery, we have, especially on market days, a continuous crowd around.

Mr. Aylesworth gave several lectures in my district, as did also one or two gentlemen from British Columbia, the halls as a rule being crowded.

Farmer delegates were also with me, going around to the booking agents, seeing inquirers, &c.

Our sets of lantern slides have been loaned out for about sixty lectures by clergymen, school teachers and others, and as these lectures are nearly all given in young men's institutes, or such like meeting places in the country districts much good should result.

Fully 10,000 copies of the Canadian atlas have been so far given away, as also some thousands of wall maps. When these publications were announced applications came pouring in, and I received as many as 540 in one day. The school children and teachers seem to appreciate them, and either they or the teachers write that they are now for the first time taking Canada as part of their scholastic course. This is satisfactory. I was glad to have the privilege in July last of paying another visit to the Dominion. I travelled from Quebec to the coast through all the western provinces and the fruit-growing districts of British Columbia. On my return journey I was able to see the splendid harvest of western Canada gathered in. I visited farmers in every district, being driven over the country by government immigration agents. Much information of a practical nature was gained which since my return I find most helpful in my work. While in Canada I met quite a number of successful farmers from my district who blessed the day they went to Canada.

ACREAGE and Population of Counties in my District.

Counties.	Acreage.	Population.
South Wales—		
Brecon	473,087	53,951
Carmarthen	464,587	123,570
Glamorgan	576,537	866,250
Pembroke	357,118	82,424
West of England—		
Cornwall	886,384	318,591
Devon	1,633,269	664,697
Dorset	624,341	199,968
Hereford	539,226	112,549
Monmouth	395,849	316,864
Somerset	1,070,078	466,193
Wilts	809,220	263,944
Gloucester	712,757	648,627
	8,542,453	4,117,628

Your obedient servant,

H. M. MURRAY.

No. 6.

REPORT OF JOHN McLENNAN.

ABERDEEN, March 31, 1909.

J. OBED SMITH, Esq.,
Assistant Superintendent of Emigration,
London.

SIR,—I beg to submit the following report of the work of this agency during the year ending March 31.

The year opened in the midst of the great commercial and industrial depression which has prevailed everywhere for the past eighteen months. This stringency had the effect of largely stopping the movement from this district; even the classes for which we had openings were sceptical, and it was difficult to convince them that there was any work to be had, in view of the many conflicting reports and the requirements of the department. It made it often disagreeable for myself and other government representatives on account of the wide publicity given by newspapers to these reports, and no matter how strenuously we might deny the statements, the public were disposed to accept the press news in preference to our denials.

I am glad to report, however, notwithstanding the difficulties, that a large number of desirable farmers and farm servants left the north part of Scotland during the past year for Canada. Since the gathering of harvest, when it became an assured fact that the country would have a bountiful supply of money and that there would be extensive building of railroads and other public works during 1909, I have used every effort to revive the interest in my district.

During the past four months I have delivered 28 lectures, illustrated with limelight and cinematographic views, and addressed over 15,000 people, many of those lectures having been given in purely agricultural districts, while all of them have been attended by a large number from the country. Besides directing attention to the great possibilities of Canada, I have been enabled by those lectures to partly neutralize the growing opposition among many people here to our propaganda. I tried to impress upon the audiences that our aim is not to depopulate Scotland, but to divert the stream of emigration from the centres from which it has been flowing for the past forty years, to our own shores.

I am glad to report that I have been enabled to secure the hearty commendation of the leading men in all the large centres by these lectures.

The outlook for the present year is exceedingly promising, and I look for a large increase over that of last year. I am hopeful that the number of agricultural labourers and farmers from my district will even exceed the number of the banner year 1907. While we have opposition from some of the leading farmers, on account of the heavy drain made upon agricultural labourers, the feeling on the whole is very well disposed towards Canada, as nearly every family in my district is interested through relatives or friends.

Your obedient servant,

JOHN McLENNAN.

No. 7.

REPORT OF M. McINTYRE.

35 and 37 St. Enoch Square,
Glasgow, March 30, 1909.

J. Obed Smith, Esq.,
11-12 Charing Cross,
London.

Sir,—I beg to report that during the greater part of the year, the depression of last season still being felt, Scotch emigrants' attention turned quite largely to other fields than Canada. The monetary regulation has kept some back, but this is cutting two ways; while it has kept out some who would make good settlers, it has also kept out a good number of an undesirable class. I am pleased, however, to report that during the last few months prospects seem much brighter, and there is a splendid class going.

The trip to Canada during the year, of the Scotch Agricultural Commission has been helpful to emigration, as most of the members have been giving lectures on Canada as seen by themselves. To aid these men in their lectures, I have lent them lime-light views with which to illustrate their remarks regarding the different localities.

The visit of the Canadian curlers during this winter was very opportune, as Canada was being brought largely before the people, and this, followed by lectures, and the visits of Canadian farmer delegates to Scotland, along with the usual efforts from this office, has given a stimulus to emigration, and the tone of things is considerably improved.

The policy of supplying atlases and wall maps of Canada to schools, is one which should bear fruit in the future. The schooling of the young is the best way to provide for emigration in the coming years, and through the children, knowledge of Canada reaches many homes that otherwise would be missed.

Distributing literature from a wagon is a splendid means of getting in touch with the agricultural classes, but the best kind of wagon is a light one that can depart from the main roads, getting into the less frequented parts.

With a view to keeping Canada and her advantages before the public, I have attended agricultural shows and exhibitions, having exhibits at same, distributing literature from these stands, and giving information to all inquirers. I have given lectures in different localities, have also rendered assistance to all those I knew intended giving lectures on Canada, and have found it beneficial to work in conjunction with the clergy, as I find a great number of them are favourable to Canadian emigration. In fact, I have used all means so far as my ability goes, to further the object of this office.

Your obedient servant,

M. McINTYRE,
Canadian Government Agent.

No. 8.

REPORT OF E. O'KELLY.

CANADIAN GOVERNMENT OFFICES,
44 DAWSON STREET, DUBLIN, March 31, 1909.

The Assistant Superintendent of Emigration,
11-12 Charing Cross, London.

SIR,—I beg to present my twelfth annual report, covering the period from March 31, 1908, to March 31, 1909.

The work of my office has increased satisfactorily since the Dublin office was reopened in September, 1907.

Number of letters received	2,557
Number of letters sent out	3,895
Number of callers	2,491

In addition to attending at a number of the most important show fairs, with my stand of exhibits and literature, I have also attended a number of stock fairs, had literature distributed amongst the farmers with whom I spent a considerable portion of the day comparing farming on rented and highly taxed land in Ireland, and farming on free and lightly taxed lands in Canada. The advantage Canada offers to farmers in the much smaller amount of capital required to stock land there than in Ireland, next to being able to acquire free farms, appears to impress Irish farmers most and I am sure will prove a great inducement to many of them to emigrate. In very few instances have I had a pamphlet left at the end of a fair day and my supply, a fairly liberal one, has often not been equal to the demand.

I have supplied schools and reading rooms with the wall map, atlas, and larger pamphlets, where those institutions are not dominated by the Nationalist party, who are now more anxious than ever to keep people in this country.

In the past twelve months I have inspected 157 booking agencies and forwarded my reports on them to you. I found the agents as a rule intelligent men, but most of them careless and indifferent to the booking branch of their business, and notably to advertising Canadian emigration in any shape. In this connection I may mention that while the American lines are largely advertised at most of the railway stations, in the provinces of Leinster and Munster, and the Australian and New Zealand lines in many stations, the Canadian lines are totally unrepresented, a grave lack of enterprise to my mind, and a circumstance I have brought to the Canadian steamship companies' notice, but so far without result.

The country people, who are always ahead of their trains when travelling to fairs and markets, if we believe in advertising, must be influenced by the splendid posters of the American lines, which they see at every station. The agents show more interest in their work, and more care in their correspondence since I commenced my visits of supervision and encouragement to them. The class of emigrant leaving Ireland for Canada is still improving, but the number this year falls far short of the season of 1907-8, in fact the total emigration from Ireland has not been so low for fifty years. This decline is mostly the result of the state of unrest and excitement caused by the continuous change in the land laws, aided by the depression in Canada and the United States, but these causes will pass away, and the people will continue to leave the country as before. In the poor districts the landing money required has also proved an obstacle to emigration. With reference to the landlord class there can be no second opinion, but that they will leave Ireland in large numbers, for the oversea states of the empire, when they get paid the price of their properties by the government. They will all be possessed of capital varying in amounts from hundreds of pounds to thousands, and will prove a valuable addition to the population of the country they select to settle in. The callers at my office are largely composed of this class.

I have had no complaints from Irish importers of Canadian apples in the past year, and those I have conversed with appear quite satisfied with their purchases.

Your obedient servant,

EDWARD O'KELLY,
Canadian Government Agent.

No. 9.

REPORT OF JOHN WEBSTER.

CANADIAN GOVERNMENT OFFICES,
17-19 VICTORIA STREET, BELFAST, March 31, 1909.

J. OBED SMITH, Esq.,
Assistant Superintendent of Emigration,
11-12 Charing Cross, London.

SIR,—I beg to submit my report for the year ending March 31, 1909. My work during the summer season was divided between official duties—visiting steamship agents—and making exhibition of Canadian products at various agricultural shows. During the year I have placed 246 school maps and 3,577 copies of the school atlas. The total number of pamphlets distributed through the office, and in conjunction with the exhibit wagon, amounts to 36,215 for the year. The number of letters received was 2,656; outgoing letters, 4,329; callers at office, 8,686. Extensive alterations in the office have been carried out under my supervision, the landlord being responsible for a share of the cost; the office now presents a good appearance and is in every way satisfactory. I have called on nearly every agent of importance in my district, and with these have discussed matters of mutual interest. I have generally found them willing and anxious to carry out any useful suggestions I make to them. It would be a wise policy on the part of one or more of the steamship companies to revise the list of their agents; they could with advantage weed out many who are making no effort, and who take no interest in their work. Sometimes in a small town you will find two or three agents for same line, where one good man would do the work much better.

I made exhibition at six important fixtures, as follows:—

Belfast spring show, 20th, 21st, 22nd May.
Ballymena summer show, 3rd June.
Portadown summer show, 10th and 11th June.
Armagh summer show, 24th and 25th June.
Omagh summer show, 15th and 16th July.
Belfast summer show, 23rd and 24th July.

At the first of above I made use of the elaborate 20-ft. stand supplied by the department, and had a most attractive display. At the five subsequent shows I found it necessary to use a smaller stand, as the large one would not fit into the tent space provided. It would be an advantage to me if the large stand were say, five feet shorter. At all the shows I was ably assisted by our Mr. John Mullan. Inquiries were numerous, and a large amount of literature was distributed; naturally at an agricultural show we meet the most desirable class. For exhibition purposes, I am frequently handicapped owing to the lack of good material; this year the supply of stuffed wild fowl received, was most acceptable, and made an attractive display. It would be very helpful if, at short intervals, a small consignment of selected fruits were sent over, this would be useful for the shows and afterwards serve for display in the windows of the office. Some set up fish and small animals would come in for the same purpose.

On May 5, Mr. George Robinson started out on his itinerary with team of horses and democrat wagon exhibit, he was out almost continuously until November 14, a period of over six months. The counties visited were Armagh, Antrim, Down, Derry, Donegal, Cavan, Monaghan, Fermanagh, Leitrim, Longford, Louth, Westmeath and Meath. We endeavoured to arrange that his visit to a town or village should be timed with the market or fair taking place that day. He was therefore continually meeting throngs of agricultural people and had a fine opportunity for distribution of literature with which I kept him supplied. The wagon accomplishes a most useful purpose.

During the winter I fulfilled four lecturing engagements, and have others still in view. Acting on your authority I have recently purchased a full lecturing outfit, including lantern and stand, portable screen, and acetylene generator ; I am very glad to have these as I am now in a position to accept invitations from anywhere, including, which is important, outlying rural districts.

I am glad to again report that the calling of Canadian Pacific steamers at Belfast, has, for the company, proved a decided success and a venture which they should have no reason to regret, as each ship secures a fair number of passengers. By the last sailing, on March 18, the ss. *Lake Champlain* took 107 emigrants for Canada. The fine boats of the Allan line from Liverpool and Glasgow, calling at Derry, are also getting a fair share of the business.

I was pleased, this spring, to have the services of Delegate Mr. John Kennedy from Edmonton, Alta. He is one of the best delegates ever placed under my direction, a north of Ireland man himself, having many friends and relatives here, and this being his third trip to Ireland as delegate, he is a well known and popular man amongst the farmers. While with me, I had a wide itinerary arranged for him. I trust his visit may prove useful.

My relations with the local press are cordial; I therefore experience no great difficulty in having interesting Canadian items, including copy of weekly bulletin received by the High Commissioner from the Minister of the Interior, appear in the leading papers. Naturally in a country like Ireland with a declining population, an emigration propaganda is not popular, but in the north the sentiment prevails, 'If they must go, let Canada be the selection.'

Your obedient servant,

JOHN WEBSTER,
Canadian Government Agent.

No. 10.

REPORT OF D. TREAU DE CŒLI.

23 Place de la Gare, Antwerp, March 31, 1909.

J. Obed Smith, Esq.,
Assistant Superintendent of Emigration,
London.

Sir,—I have the honour to submit my report for the year ending March 31, 1909.

The emigration from Belgium and Holland has not been so heavy this year as previously but it is pleasing to state that those who left for Canada belonged in every sense of the word to a better class of emigrants than ever before. This proves clearly that the importance of our country is beginning to be known more favourably every day, and that the Belgian people have confidence in its future. It is but just to remark that this is greatly due to the interest the primary or common school teachers in Belgium have taken in Canada, to the free distribution of our propaganda literature and the teaching of our geography, and to the numerous lectures delivered. The introduction of our propaganda literature in the schools commenced in 1905, immediately after the World's Expansion Congress at Mons, where the committee on education decided that it became absolutely necessary for Belgians to have a knowledge of the new countries, in order that they might be prepared to make a judicious choice if they should decide to emigrate, whether it be to seek their fortune as merchant, manufacturer or farmer.

This view was unanimously accepted and steps were taken to make the study of the different countries part of the educational course. I seized the opportunity which presented itself and immediately offered our atlases to a certain number of the teachers. Canada was the only country which at that time could boast of an up-to-date propaganda literature and the demands for it have increased yearly, from 22 in 1905 to over 3,200 schools now using the geography of Canada. Amongst these a good many are winter schools in farmers' communities, where young men from 16 to over 20 receive general instruction, together with lessons on agriculture, gardening, &c.

A few of these scholars left last year and others will leave shortly, and I am confident that they will make the best of colonists and will cause quite a number of their friends and relatives to follow them.

The month of March, being the first one favourable for emigration, promises a very good season. Many have already left and will be followed weekly by others, a certain number taking their families, while farmers and farmers' sons are going, to have everything in readiness to receive at the earliest possible time the rest of the family.

I consider that 25 per cent has been added since January to the number of emigrants of the nine previous months.

The Dutch emigration will also be much better than last year. Already a few families have sailed who had the proper means for settling and as they are generally good workers and sober men, I am quite sure that they will be a credit to their new country.

I have given fourteen lectures on Canada this winter, and besides this, no less than twenty have been given by teachers and private individuals, who either had visited Canada, had lived there or had made it a point to study it. As far as possible I have provided everything necessary for these lectures by giving special information and also sending views.

I acknowledge with pleasure that the assistauce I received from the teaching staff greatly facilitated my work. The reappearance of the monthly paper *West Canada*, which contains the most interesting up to date information concerning crops and values thereof, letters from Belgians and Dutchmen, the regulations and laws on emigration and Dominion land, have also been greatly appreciated and although it causes a surplus of work in one way, it facilitates it in another, the most important information being available to a great number of correspondents by this publication.

No special advertising having been done this year, the correspondence has been normal. The number of letters reeeived during the year was 4,090, of which 3,015 called for an answer. I had interviews with 910 persons who visited the office for verbal information on Canada. Any others with whom I was corresponding. I always considered it my duty to meet before their emigration was completely decided, so that I might judge if they really were desirable emigrants, also to prevent long and tedious answers to inquiries. In order to attain this point the more easily I designed as place of meeting the town or city most centrally situated where I eould meet a certain number of interested parties.

As the office work allowed me I visited the agricultural fairs in summer and fall to have propaganda literature distributed.

Your obedient servant,

D. TREAU DE CŒLI,
Canadian Government Agent.

No. 11.

REPORT OF PAUL WIALLARD.

PARIS, April 1, 1909.

The Superintendent of Immigration,
Ottawa.

SIR,—I have the honour to submit my report for the year ending the 31st ultimo.

Until last year, though the Canadian government did not encourage any but the agricultural class to emigrate, many other persons could set out with some degree of certainty of finding work immediately at remunerative wages. But now, with the marked decrease in construction work, and the invasion of our country by a considerable crowd of workmen of different trades driven from the United States by the industrial conditions in that country, Canada finds itself under the necessity of applying greater restrictions to those, other than agriculturists and domestic servants, presenting themselves as immigrants, and this, naturally, has caused a reduction in the volume of emigration from France to Canada.

Nevertheless, although in all the agencies there has been a very noticeable decrease in the number of departures, nearly 50 per cent in some cases, I believe that we have been very fortunate to keep up to figures which are not far from those of last year; the statistics tell us in what proportion.

Our work has not diminished, but the contrary. Canada is known better and better in France, and owing to the commercial convention between the two countries we have had still more requests for information than last year. Our correspondence has been about 12,000 letters, which shows the great favour Canada now enjoys here. If conditions continue to improve, of which there seems no doubt, this season will see a great number of settlers set out who are desirous of taking their share in the advantages offered by our country.

I gave, and had Messrs. Geoffrion and Montpetit give, many lectures on Canada, economical, geographical and historic, setting forth all points of a nature to demonstrate well the prosperity of Canada in all its relations. Besides that we have distributed a large quantity of pamphlets which have contributed to spread the Canadian idea in the public mind, and to cause to spring up seeds which sooner or later will produce excellent fruits.

In this respect I was able recently to make an arrangement with the National Bureau of Popular Lectures, subsidized by the French government, and which counts among its subscribers ten thousand teachers and officers of the French army, to publish a lecture with photographic illustrations of Canada. I hope that this lecture will be given by a great number of these subscribers or by all, since on the one hand Canada is a subject of actuality on account of the recent commercial treaty, and since on the other hand all the subscribers to this publication belong to it only for the purpose of receiving each month a lecture all ready for delivery to their regular audiences, pupils or soldiers. I must add that no advertising appears to me so well calculated to show what our country now is and what it will be in the future.

I was authorized to go to Canada last summer to take personal account of the progress constantly realized in all parts of our country. I saw that the French settlers, spirited, energetic and knowing how to adapt themselves to the methods of work in the country, have succeeded quite perfectly, whether they settled in the province of Quebec or in the other provinces.

Your obedient servant,

PAUL WIALLARD.

OPERATIONS IN THE UNITED STATES.

No. 1.

REPORT OF W. J. WHITE, INSPECTOR OF AGENCIES AND PRESS AGENT.

OTTAWA, April 2, 1909.

The Superintendent of Immigration,
Ottawa.

SIR,—The statistical portion of your report shows that the number moving across the boundary to Canada during the past fiscal year for the purpose of becoming settlers in this country fell a trifle short of sixty thousand, but it is so near this figure that there is reason to congratulate the agents who have had charge of the work of soliciting and securing so many and such a splendid class of settlers.

You also show in classified order the number who have entered upon homesteads. The aggregate wealth of these settlers is also given. There is no necessity for repetition.

Your attention is, however, directed to the fact that the number who have accepted the privilege of homesteading does not afford a fair basis of computation of the number that has moved across the border. The allurement of a free grant of 160 acres of land—such land as central Canada possesses—with the added opportunity to select an additional 160 acres, within a certain area, is tempting to a great many. But during the past year many more have preferred to purchase lands more contiguous to existing and projected lines of railway; the homesteader now has to make his selection some distance away, and many have gone back sixty and seventy and even a hundred miles. The land they get is fully as good and, with increasing settlement around them, it will not be long before they have a railway.

It is not alone to the personal stamp of the 59,832 new arrivals from the United States that your attention is directed, but, besides being men of splendid character, physically strong and of an integrity that comes from close connection with the uplifting surroundings of farm life, these people crossed the line bringing with them at a reasonable estimate, in stock, cash and effects, upwards of $60,000,000. Not only this, but what is worth fully as much, they took with them the experience that years of life on the prairie of the middle west of the United States gave. This experience had taught them methods of farming that were readily adaptable to the central Canada farm; it was an experience that was not useful to them alone, but one that was made profitable by the settler from other lands, who did not bring with him the advantages that the experience of the settler from the United States gave; he was valuable as a settler not only for himself but the use he was to others less experienced. Conditions in his new life were so little different from the one he had left that no time was lost in adapting himself. He found that the manner of working the soil was similar, methods of cultivation the same, the principles of the laws were alike and it was as if he but moved from one part of his own country to another. As a rule he arranged his affairs so as to arrive at his new home just at the right time, so as to secure a crop the same year—probably a crop of flax—erect his house, send for his family and then count the months that would elapse before he could become a Canadian citizen. It is not only on the farm that the class of settler, of which this report speaks, becomes a strong factor in building up central Canada and Canada as a whole. The farmer from

——county, Minnesota, is followed by the merchant and the tradesman with whom he has done business since he first came to the country from Ohio. Then the manufacturer, anxious to retain the trade of the people he has known for years, follows. Thus are these settlers helping to build up the towns and cities of central Canada, becoming part of the life that causes the hamlet to grow into the town, and so on. Pork-packing industries are now headed by American money; brick and tile plants are managed by men who have brought with them from Ohio, Nebraska and Indiana, the cash and the experience so necessary in establishing any enterprise. Mills of all kinds are erected and made to become paying institutions by the same forces.

The opening up of central Canada as a farming proposition seems to have come at the psychic period. With the rapid growth of the population of the United States and such a great percentage of it filling the cities, the time was certain to come when the energies of the farmer would become severely taxed to raise sufficient food-stuffs to provide for the millions that were dependent upon them. Lands that had in earlier years been prolific in their yield of wheat, oats and barley, had become drained of the elements that supplied the generating properties, and gradually, year by year, averages were growing less, and these fields were given over to corn and coarse grains. It was evident that some other source of supply would have to be discovered. True there was the height of land east of the Rockies. There, there was plenty of land, but while the soil might be of good quality, the indifferent climatic conditions made it impossible to grow grains without resort to the expensive methods of irrigation. Then central Canada was presented. The middle state farmer knew how to cultivate such soil, and he was anxious to repeat his earlier experiences on his old home farm when he raised large crops of wheat. When he examined he found Canada offered more than he expected. It offered broader acres, more tillable areas, long, level stretches of rich prairie land with subsoils the most suitable for the purposes to which he wished to put them. He could get more land of as good quality as he had ever worked, for lower figures. He could use his machinery to better advantage, and the man with the steam plough came forward and demonstrated what work could be done, and the steam plough is to-day one of the great factors satisfactorily introduced to the Canadian prairie by the American farmer. In every province they are now being worked. Splendid results in good yields of grain followed; the nutritious grasses gave the fodder that fattened his cattle without feeding any grain, the climate was what he had been led to believe, and in a short time his friends were advised that what the Canadian government agents had told him was true and that the literature that they distributed contained nothing of an exaggerated character. Conditions, such as I have set out, were healthful conditions, and were of prime assistance to the agent in his work during the past, as in previous years.

It has been the ambition of the United States branch of the service to make the year just closed the most successful of any, and while hoping that the showing has been satisfactory to the department, I wish to express to you, on behalf of the agents, their appreciation of the consideration that has been given by the department to such matters as were helpful to them in their campaign.

In past annual reports I have outlined as far as was practicable the methods that have been adopted in carrying on the work in the United States. These consist of making use of every means of publicity that is possible, with the dignity that should surround a work carried on under government auspices. Use has been made of the public press that reached desired communities; a series of four journals, in the smaller country weeklies, and in the county-town papers. These were run alternately during about six months of the year, beginning with November and closing with June. The replies to the advertisements were carefully answered, and literature mailed. In addition to this the work of the agent consists in visiting the different communities where interest in Canada is shown, holding meetings and in other ways giving the information generally desired by the prospective settler. During the fall, exhibits carefully prepared by the branch at Winnipeg have been put in place at different fairs throughout the states, and the results of this class of advertising are quite far-reaching. In some of the schools throughout the country we have been permitted to place exhibits of grain in the straw and specimens of the different wild and cultivated grasses. But these are only a few of the various methods adopted to bring Canada to the attention of the United States public. During the past year the National Editorial Association of the United States made a tour through the prairie provinces visiting some of the most important agricultural and commercial centres. The party comprised newspaper men from every state of the Union, and the resultant 'write-ups' were very interesting and valuable. Other interests in rivalry with ours have carried on a vigorous campaign to secure settlers for the lands in which they are interested, and this too in the districts and amongst the people our agents hoped to secure. It is safe to say that the figures of 59,832 for the past fiscal year would have been considerably increased but for this fact. During the past year the movement to Texas has fallen off, and we now find that the attention of the land agent is directed elsewhere. In the western and Pacific coast states, in the Dakotas, Montana, Washington, Idaho, Arizona, New Mexico, Nebraska, Minnesota and Wisconsin, scarcely a month passes but the announcement is made throughout the press that large areas of lands have been thrown open for settlement. These comprise Indian reservations, lands that were formerly fitted only for grazing, but with irrigation plants at various points are now made possibly valuable, and tracts that have been held by railways. The United States government has spent within the past few years millions of dollars in ditches, reservoirs, and whatever else was needed in the reclamation of lands once considered barren. Since the Canadian west opened up the splendid inducements its lands offer, the United States government has been very active in its efforts to open up lands, and hence the big irrigation projects, &c.

For every big irrigation project the government reclamation service has appointed a manager. The manager is an expert irrigationist and knows all the ins and outs of this kind of cultivation. Before he can have the job he must have learned all this by careful training and hard experience.

It is the business of the manager to guard against the failure of any settler in his district. He is there to tell the newly arrived settler what machinery to buy, how to build his laterals, how much water to let on to his land, how to plough and cultivate his soil and what he should plant. Considerable money is required to undertake this class of farming, however, and only the man of means can take advantage of it. There are also so many conditions surrounding the purchase that careful thought has to be given before entering upon it. One project is on the lower Yellowstone, which embraces an area of 67,000 acres. At the time of writing 700,000 acres of government land, located in three Indian reservations, are about to be thrown open for settlement. The greatest portion of this land is located on the Flathead reservation, just north of the Northern Pacific Railway tracks and west of the main range of the Rocky mountains, in northwestern Montana, where about 450,000 acres will be allotted to settlers. Another tract of 150,000 acres has been thrown open in Shoshone Indian reservation in Wyoming. It is said, too, that large tracts are to be opened up in Arizona, which will be sold at $1 an acre, with settlement conditions.

In Mexico plans are now under way for opening up 1,000,000 acres of land, and it is said that some of the irrigation canals used in this will be so large that it will be possible to use them for transportation purposes.

The United States Reclamation Service announces the completion on May 1, 1909, of the Pathfinder dam, which has been built on the North Platte river, Wyoming. It consists of a vertical concrete-rubble arch, 215 feet in height, which closes the river where it flows through a narrow gorge. The length of the dam on its crest is only 500 feet, yet the storage capacity is 1,025,000 acre-feet or 358,000,000,000 gallons. Its great capacity is shown by comparison with the largest reservoirs in the east, of which the Wachusett dam has a capacity of 192,000 acre-feet, the Croton dam of 92,000 acre-feet and the Ashokan dam now under construction of 369,000 acre-feet.

It will be seen from these facts that there is still a large quantity of vacant land in certain of the states, and that no time is being lost, and no effort spared to bring these lands into service.

But there will still be enough people for all, for we find a great and a growing interest in farm life. The young man who left the farm years ago to take up city life does not find it as congenial as he hoped. Farm life to-day is free from many of the difficulties and drawbacks it then possessed, and the splendid returns that are now realized in the pursuit of agriculture are bringing back to that life those who once discarded it, and others are now giving the home on the farm earnest consideration. It is just a matter of decision now. Shall it be the land in the arid reclaimed west, that requires considerable money to operate it, a lot of hard work to keep the farm in condition, or a farm in central Canada, that requires but little hard work to secure splendid results and the opportunity to enjoy a climate that is unanimously considered to be healthy and otherwise desirable ?

In the course of the work of the agents in the different states it is found that there are a great many former Canadians, and a large number of them devoted to agricultural pursuits. Special directions have been given from time to time that they be advised of the opportunities that Canada offers as a field for farming efforts, and it is a pleasure to report that great success has followed this line of the work. The reports of the department reveal more clearly than I shall attempt to show here how successful this has been. Amongst the French Canadians who are to be found both in the eastern, middle and western states, specially qualified men of their own extraction have had their labours well rewarded, and have induced large numbers to return to Canada. Some have gone to the farms of Quebec, while others have taken up homesteads and purchased lands in central Canada. What they have accomplished there is carefully watched and noted, and the reports sent back to their friends. This work is valuable and the results have been such that I strongly recommend its continuance.

In conclusion I may say that the correspondence at the various offices during the past winter months satisfies me that the 59,832 settlers from the United States during the past fiscal year will be increased to 70,000 in the next.

Your obedient servant,

W. J. WHITE.

No. 2.

REPORT OF DR. G. W. ELLIOTT.

746 St. Nicholas Ave.,
New York City, N.Y., April 10, 1909.

The Superintendent of Immigration,
Ottawa.

Sir,—I have the honour to submit the following report for the fiscal year ending March 31, 1909. showing the number of aliens that arrived at this port destined to different parts in the Dominion of Canada, also number of aliens who were rejected for various causes :—

Aliens Arriving.

	3rd Class.	2nd Class.
April, 1908	1,938	295
May, 1908	1,122	178
June, 1908	359	141
July, 1908	259	101
August, 1908	224	102
September, 1908	302	109
October, 1908	353	98
November, 1908	277	66
December, 1908	309	51
January, 1909	249	85
February, 1909	361	119
March, 1909	1,101	288
Total	6,854	1,633
Grand Total		8,487

Aliens Rejected.

Tuberculosis	3
Lupus	1
Trachoma	19
Favus	3
Insane	2
Imbecile	1
Syphilis	1
Psoriasis	1
Venereal disease	1
Organic heart disease	3
Cirrhosis of liver	1
Muscular atrophy	1
Herniæ	2
Hysteria	1
Paralysis	1
Varicose veins	1
Pregnancy	1
Illegitimate children	4
Moral turpitude	5
Criminals	4
Deformities	1
Defective vision	3
Insufficient funds	60
Physically defective	1
Accompanying	10
Total	131

Your obedient servant,

GEO. W. ELLIOTT,
Canadian Government Official.

OPERATIONS IN WESTERN CANADA.

REPORT OF THE COMMISSIONER OF IMMIGRATION.

DEPARTMENT OF THE INTERIOR,
WINNIPEG, MANITOBA, April 1, 1909.

The Superintendent of Immigration,
Ottawa.

SIR,—I beg leave to report that during the past year, as in former years, by means of the employment bureau in this office, ably aided by agents at the principal points of importance in Manitoba, Saskatchewan and Alberta, a thorough system of distributing and finding suitable employment for immigrants was successfully conducted; and, although the figures showing the number of those for whom employment was secured indicate a considerable decrease as compared with those of last year, unfilled applications for farm hands were on file at this office during the whole twelve months. The number of applications received for farm hands was 4,667, of which 3,237 were filled. In addition to these, 328 applications were received for married couples, of which 185 were filled.

During the year large numbers of intending settlers from eastern Canada, the United States, the British isles and continental Europe called at this office in quest of information and advice in order to enable them to secure locations on which to settle; and I have much pleasure in reporting that so successfully and satisfactorily has the work of locating settlers been conducted that no complaints have been received of parties having been directed to undesirable locations. In this connection I would bring to your notice the valuable aid which the department has received, not only from agents of Dominion lands, immigration agents, sub-land agents and other officers of the department, but also from the secretaries of many boards of trade throughout the west and also from private individuals.

Homesteads well adapted for mixed farming can be secured in Manitoba, Saskatchewan and Alberta within reasonable distances of existing railways, and I would draw the attention of intending settlers to the Winnipeg and Dauphin districts in Manitoba, and especially that part of the latter which embraces the Swan River valley. There is still a number of homesteads to be secured in the Yorkton district, and I am informed by the land agent at Humboldt that there are large numbers of good homesteads in that district—both north and south of the Canadian Northern Railway—to which the attention of incoming settlers should be directed. With the exception of a number of homesteads in the western part of the Estevan district, the districts before mentioned are the most easterly which afford a large selection of homesteads to choose from. There are still 90,000 vacant homesteads in the Moosejaw, Battleford and Prince Albert districts in Saskatchewan, and 70,000 vacant homesteads in the Lethbridge, Calgary, Red Deer and Edmonton districts in Alberta. It will therefore be seen that, no matter what district in the three western provinces an intending settler decides to locate in, he will have no difficulty in securing suitable land.

English.—During the past year the immigrants from England were the best class that has ever come to the country; and I consider that this is due, in a great degree, to the restrictive measures which were adopted by the department in regulating the emigration work of charitable institutions in Great Britain.

Welsh.—It is to be regretted that only a comparatively small number of Welsh agricultural labourers came to this country during the year.

Scotch.—Scotch immigrants during the year were mostly of the agricultural class, and no difficulty was experienced in getting them farm work on their arrival.

Irish.—The immigrants from Ireland were mostly of the agricultural class, and I have again to express my regret that a larger number of these people cannot be secured for Canada.

The number of immigrants from continental Europe shows a considerable falling off as compared with last year. Those who came belonged mostly to the agricultural class, and went on the land.

Settlers from the United States came into the country in large numbers during the year. About 95 per cent of them either entered for homesteads or purchased land. The others went to work on farms. In this connection it is gratifying to note also the immense volume of wealth in the shape of money, stock, machinery, implements and household effects which these people have brought into the country.

I take pleasure in drawing your attention to the fact that the requests made by immigrants for assistance in the shape of provisions, clothes and fuel show a marked decrease as compared with former years.

Immigration Accommodation, Winnipeg.

Thirty-eight thousand nine hundred and eighty-eight days accommodation was given to immigrants in Buildings Nos. 1 and 2 during the year.

Immigrant Hospital.

This building was closed on February 1 last, its services not being required for the present.

New Immigration Halls, &c.

During the year immigration halls were erected at Wainwright and Yonkers; temporary buildings at Mortlach, Herbert and Gull Lake, and premises were leased at Vegreville, Sedgwick and Irvine for the accommodation of incoming settlers.

Correspondence.

During the year there were sent from this office 2,492 registered and 29,095 unregistered letters. The number of letters received was 22,952.

Exhibits.

During the year 789 cases of agricultural exhibits were sent to the agents in the United States, Great Britain and British colonies, besides 297 samples of grain to public schools in the United States.

Deportations.

There were 257 undesirable immigrants deported during the year.

Annual Reports.

Annual Reports have been received from officers and agents stationed at Port Arthur and Fort Frances, Ontario; Emerson, Brandon, Teulon, Dauphin and Swan River, Manitoba; Regina, Yorkton, Humboldt, Prince Albert, Saskatoon, Battleford, North Portal, Maple Creek, Lloydminster, Duck Lake, Craik, Sinnett and Gravelburg, Saskatchewan; Edmonton, Calgary, Lethbridge, Medicine Hat, Strathcona, Red Deer and Sedgwick, Alberta, and New Westminster and Kingsgate, British Columbia. Many of these reports give information which is of much value in directing incoming settlers to desirable locations, and all give valuable statistical information.

I have again pleasure in saying that much of the success that has attended the work of this branch of the department is in no small measure due to the faithful and conscientious services of the officials in this office and at outside points.

Your obedient servant,

J. BRUCE WALKER,
Commissioner of Immigration.

SESSIONAL PAPER No. 25

JUVENILE IMMIGRATION.

REPORT OF G. BOGUE SMART, CHIEF INSPECTOR OF BRITISH IMMIGRANT CHILDREN AND RECEIVING HOMES.

DEPARTMENT OF THE INTERIOR,
OTTAWA, March 31, 1909.

The Superintendent of Immigration,
Ottawa.

SIR,—I have the honour to submit my tenth annual report as Chief Inspector of British Immigrant Children and Receiving and Distributing Homes.

A year of strenuous activity has been maintained and the work of this branch of the department has been conducted with due appreciation of the responsibility involved therein.

Statement showing progress of the work of inspection during the year 1908.

January	103
February	122
March	187
April	206
May	174
June	190
July	208
August	106
September	160
October	152
November	142
December	71
Total	1,821
Individual inspections of new arrivals before being placed in situations, not included in above statement	192
Grand Total	2,013

The probation in the 'Home' before leaving England is most valuable as, apart from the benefits accruing to the children, it enables the societies to weed out those who are not likely to 'make good' in Canada. The demand for juvenile immigrants in the country districts of Canada is well indicated by the following statement which shows the number of children emigrated to Canada during the fiscal year by some of the principal societies, and the number of applications received for children during the same period :—

Society or Agency.	Children Emigrated.	Applications received for Children.
Dr. Barnardo's Homes, Toronto and Peterboro', Ontario, and Winnipeg, Manitoba	1,034	9,942
Miss Macpherson, Stratford	175	724
Mr. J. W. G. Fegan, Toronto	75	*500
Rev. Dr. A. E. Gregory, Hamilton	90	515
Rev. Robert Wallace, 'Marchmont Home,' Belleville	38	513
'Fairknowe' Home, (Mr. Quarrier's,) Brockville	173	723
The Misses Smyly, Hespeler	22	103
Mrs. Birt, Knowlton	142	770
The Catholic Emigration Association	308	638
Church of England Waifs' and Strays' Society, Sherbrooke	64	104
Church of England Waifs' and Strays' Society, Niagara-on-the-Lake	59	410
Bristol Emigration Society	....	....
Mr. Middlemore, Halifax	152	*300
Salvation Army Emigration Agency	42	*130
Mrs. Wallis, Toronto	13	45
Mrs. Close, Nauwigewauk, N.B	....	....
Women's National Immigration Society, Montreal	....	....
The Children's Aid Society of London, England	24	‡
Self-Help Emigration Society	13	‡
	2,424	15,417

Mr. Bruce Walker, commissioner of immigration, has stated that he could place twenty-five British immigrant boys per month, from March to October, in the western provinces of the Dominion.

Table showing the number of juvenile immigrants who arrived in Canada during the past eight years, together with the number of applications received by the various agencies during the same period :—

Fiscal Year.	Children Immigrated.	Applications Received.
1900-1	977	5,783
1901-2	1,540	8,587
1902-3	1,979	14,219
1903-4	2,212	16,573
1904-5	2,814	17,833
1905-6	3,258	19,374
1906-7 (9 months)	1,455	15,800
1907-8	2,375	17,239
Total	16,610	115,408

During my tenure of office I have personally inspected many hundreds of these child-immigrants whilst they were engaged in doing their share of domestic and farm work in various parts of our Dominion, and having listened to the testimony of employers I feel quite justified in reporting that many of the farmers of this country consider the services of the 'Home Child' indispensable.

In passing I should like to say that the designation 'Home boy' or 'Home girl' is perhaps open to misconstruction. It is applied for convenience to immigrant children who have been trained in philanthropic homes or schools in Great Britain, before, and as a preparation for their emigration to Canada, and who are usually taken into the family circle of their employers in this country. The name 'hired boy' or 'hired girl' is often used to describe the same class and is perhaps more appropriate.

On April 1 the Children's Act of 1908 will come into operation throughout Great Britain and Ireland.

* Estimated. ‡ Not reported.

This enactment is, in my estimation, one of the wisest and most important and valuable measures of recent times. It teems with provisions for the better treatment of the young, their training and education, and declares in effect that every British child has an inalienable right to good food, clothes and a chance to become a useful citizen. It further recognizes the fact that numbers of young children in the old land are so unhappily surrounded as to be deprived of these rights. This legislation will have an important bearing on what is generally conceded to be the finishing touch of the work of juvenile reclamation, namely, emigration.

The transplantation of poor, unoffending children from the motherland to our shores is promoted and carried on by responsible and competent associations of persons —philanthropists in the truest sense—persons prominent in the religious and social world on both sides of the Atlantic, their work being regarded with ever increasing popular favour.

The opinion of Sir John Kirk, of London, one of the most eminent authorities of the day on philanthropic and charitable work and whom it was my great privilege to meet during my visit to the old land last summer, is expressed thus in a recent letter to the London *Daily Post:* 'As an advocate of emigration and as one who has seen the benefits arising from the presence of English children in Canada, I endorse what the commission says on the subject. I would urge the necessity of sending the children over to Canada as soon as possible, because the sooner they get into the Canadian atmosphere the better it is for Canada and for them.' I feel myself the strength of this view. The emigration of juveniles should certainly be effected at as early an age as it is possible to secure situations and foster homes for them in Canada. It is important to remark that it is only under very exceptional circumstances that children whose parents are both living are emigrated by organized agencies and societies. The children to be emigrated are taken in hand at a very early age, and a training along religious and secular lines is immediately begun. During their tutelage they must prove themselves to be worthy before the responsibility of their emigration is assumed. The length of residence in the training homes is not limited but is made to suit each case. A large majority of the children under my supervision have spent the major portion of their lives under the training and influence of the home.

During my visit to Great Britain I had the pleasure of meeting the Right Honourable John Burns, president of the local government board, and in the short interview I had with him he expressed satisfaction with the manner in which the children were looked after in Canada, and said that he believed the emigration of children at the impressionable age could not result otherwise than beneficially.

Four years ago I visited Great Britain and Ireland with the purpose of familiarizing myself with the conditions of pauper and destitute children, both before being received into institutions of a reclamatory character and after their reception, and at that time found much to commend in the work of the various agencies. On my second visit during the summer of 1908 I found that remarkable progress had been made during the intervening period, and it was most gratifying to observe a more cheerful and promising outlook than had hitherto existed for the future of the nation's needy and ill-cared for children.

To the people of Canada this is important, as for well nigh half a century there has been annually transplanted to our shores a large emigration from the British isles, amounting it is estimated to an aggregate of nearly sixty thousand juveniles.

The emigration of children has always been a voluntary work as far as it concerns the government of Canada, and, from my point of view, must so continue in order to be successful. No propaganda is, therefore, promoted on behalf of the federal government for the emigration of juveniles. The movement can only be consistently carried on through charitable and religious organizations who undertake it voluntarily.

Sir John Kirk has said : 'Before Queen Victoria ascended the Throne there was not a single measure for the saving of the children ; when Her reign closed there were over one hundred.'

The state has in fact awakened to its responsibility in the matter, and to the national and economic importance of the children of the neglected class, and is actively co-operating with the private and voluntary agencies operating so successfully in their behalf.

While paying visits to these agencies and surveying the wide field of their efforts, I have been made aware of great and unceasing devotion to the cause on the part of persons in various walks of life, and I confess that, as a British subject I have experienced a feeling of pride at the Christian and benevolent attitude of so many of the people of Great Britain in this behalf.

But, notwithstanding the great work that has been accomplished, a survey of the field irresistibly forces one to admit that the result, after all, amounts merely to a drop in the ocean. The necessity for continued effort is patent to any one who pays a visit to the thickly populated and pauperised districts of the old world. But this is evidently well understood over there.

While one must with sadness acknowledge that there is always a class which is, humanly speaking, beyond the hope of rehabilitation in the social scale, it has been most completely demonstrated that there is another class, or one might say another stage in the development of the hapless class for which there is great hope. The juvenile on the verge of the moral precipice may be saved to a life of usefulness and integrity. His loss is the nation's loss, his well-being the nation's gain. But they must be helped to rise and systematically helped.

During my recent visit to England and Scotland I spent a great part of many days and nights in the congested districts of the large cities, and witnessed sights that not only filled me with sadness but with shame for our common humanity. Hundreds and thousands of young children, half-clad, half-fed and wholly untaught in anything that would make for their future happiness or well-being roam these crowded streets, by night as by day. While it is not the wisest policy to relieve the parents of their responsibility towards their children and such action should as far as possible be avoided, yet there is the well-being of the child to be considered and the state also stands in a position of responsibility towards the child which may, and often must, necessitate the removal of such children to environments morally and physically more wholesome.

It has been estimated, and some say conservatively, that there are 250,000 needy children under the age of 18 in Great Britain and Ireland. Of this large army, 25,000 are in industrial and other schools under the Home Office, and 69,000 are under the care of guardians of the poor in scattered village homes. In addition to this census there should be included the fluctuating number dealt with by the Ragged School Union, the Barnardo and other voluntary and private agencies, not overlooking the children who are suffering from want of any supervision whatever. These agencies, I have referred to, are doing a work that cannot at present be fully estimated and the highwater mark in this branch of philanthropy has, I believe, been attained. While a cause such as this necessarily makes demands of magnitude on the state exchequer and on private charity, it is far above all monetary consideration and cannot fail to return to the nation more than is expended. The children require individual attention and moral training far more than they do mental training; at the same time I do not wish to under-estimate the latter.

It was my good fortune to meet in convention at Manchester workers from various parts of the Kingdom. This gathering, which is held triennially, was one of deep interest and most instructive. Those who participated in the deliberation were zealous and enthusiastic and the addresses were remarkably interesting and helpful to one who has the interests of the necessitous juvenile at heart. The audiences were large, thus evincing the keen interest taken in the work of child rescue. It occurred to me, however, if I might be permitted to offer a suggestion, that the scope of the conference might with advantage be enlarged so as to include representatives of the Poor Law and voluntary organizations, whose aims and labours are identified with those of the reformatory and refuge unions.

One very interesting feature of the convention was the opportunity afforded of visiting the schools and homes within convenient distances of Manchester. Among these were the industrial and other schools under the Home Office. These industrial schools differ from the industrial schools of Canada which are always semi-penal institutions.

In the English industrial schools useful trades are efficiently taught, and music and gymnastic exercises form, very properly, a feature of the school life. Where children are, necessarily, brought up under strict discipline, and in narrow confines, as I found to be the case in many industrial schools in the cities, such pastimes are essential to their health and physique. The buildings are planned to economize space, yet the interior appeared to me to be up to date and conducive to comfort. In only one school did I feel that the arrangements, in case of fire or other danger, might have been better. The children are not required to wear any uniform or distinguishing badge, but were rather better clad and cleaner than those of the same class outside. The food was good and wholesome and the healthy appearance of the children gave evidence of the care bestowed on them.

The officials impressed me as very capable and as possessing that necessary force of character required for those in their position.

A special visit was paid to the Nile street (Liverpool) Day Industrial School, which differs from other schools mentioned in that it is practically a public elementary school; the children living at home and attending as day pupils. This school is modern and splendidly equipped and must be a great boon to the poor children of that great seaport city. The refining influence of this institution on the children was very marked. What a blessing these schools are! This was impressed on me as I gazed upon the crowds of ill-fed, ragged children who were lined-up opposite this school, drawn there by curiosity at seeing the members of the conference enter the school. There were nearly 100 juveniles and adults in the crowd and one was able to contrast their condition with that of their more fortunate brothers enrolled in the school.

In company with Mr. Courtenay Lord, J.P., of Birmingham, I had the privilege of attending, and being honoured by a seat on the bench, at a sitting of the juvenile court, which, by the way, is the original juvenile court of Great Britain. The first children's court in England was organized in 1905, and, like similar institutions in the United States very soon demonstrated its usefulness. As constituted, there are three magistrates who deliberate collectively and I was pleased to find an entire absence of that judicial atmosphere which, as a rule, pervades police courts. The offenders, or delinquents as they are designated, are summoned for gambling, tossing pennies constituting that charge, vagrancy, sleeping out, being found under prejudicial guardianship, and more serious misdeeds, such as theft in its various degrees. When brought into the court room, the children are spoken to with kindness and tact and given to understand that they are amongst friends and have nothing to fear. I had not been in the court room many minutes before it was apparent to me that the magistrates on the bench were gentlemen, chosen on account of their sympathy with, and desire to help unfortunate children.

The officials of this model court do all that they can to prevent a conviction being recorded against a young person who, in their opinion, is not competent to know what is right and what is wrong. Such a one has never been taught what constitutes good conduct, does not know how to act without committing offence. This coincides with my long formed and deep-rooted opinion that no child under the age of 12 years should be considered competent to answer in court for any transgression, as at such an age its character is still in a plastic condition and is not sufficiently formed to bring it within the range of individual responsibility. In the Birmingham court there is neither undue haste nor formality in the proceedings, the magistrates are most patient with the children and their parents, who are required in nearly every case to accompany their child to the court. Since this more humane mode of dealing with youthful offenders was adopted, a remarkable reduction has taken place in the number of children committed to prisons, as the following table indicates :—

1904	(committed from Birmingham)	112
1905	"	33
1906	"	9
1907	"	0

It is reasonable to anticipate that with the adoption of juvenile courts in Canada similar results will follow.

Unless a child is convicted of a very serious crime, and possesses a bad record, it is not sent to prison, but allowed to go on probation for a definite period of supervision under voluntary workers, some of whom are young men of means and university graduates. They report *viva voce*, at each sitting of the court, as to the behaviour, school attendance, &c., of the children individually.

Industrial schools are for the reception of children under 14 who have been found begging, wandering, homeless, &c.

One of the striking features of British justice in relation to the work of reclaiming poor and needy children is that parental rights are, as far as possible, maintained. When children are committed to industrial schools, an order is made by the court requiring the payment by the parent of a nominal amount towards the maintenance of the child in the school. Many, in fact, it may be said the majority of parents, are so impoverished that they are unable to make this small contributien, and in such cases no effort is made to enforce the order.

In addition to the institutions to which I have referred, there are those schools under the supervision of the boards of guardians, which are known as poor law schools, and are conducted under the supervision of the local government board of London.

The children admitted to these excellent training homes are of the orphaned and destitute classes and are there, not from any fault of their own but purely through misfortune. The old morally dangerous system of placing children of the impressionable age in workhouses is being abandoned. Under the guardians, children are placed in cottage homes or boarded out, instead of being housed in large buildings, and are under the supervision of carefully selected foster parents. These Homes are not only distinct from the workhouse, but in many cases are situated in rural districts. An efficient government inspection is maintained and the health of the children receives careful attention. The school curriculum is much the same as that of the public elementary schools.

Another important branch of the work of uplifting needy children is that of the voluntary and private homes and schools. In no other branch of philanthrophy is there more beneficial work being carried on. No needy and deserving child is ever turned away from their doors. Agents and voluntary workers are ever at work, searching through the bespattered fringes of British civilization and seeking out cases of unbefriended and forlorn juveniles.

Mr. Thomas R. Ackroyd, of Manchester, has fittingly defined the character of the work of the societies in the following well chosen words :—

'We constrain ourselves to look steadily for our own heartening at the primary object of the work to take the child in all its distress and helplessness from surroundings of misery and degradation, and place it under conditions where it may have a normal chance of a happy child life, and the prospect of growing up to be an honest, industrious and respected member of the community.'

After an arduous career of many years of patient work in the cause of social reform these agencies have had the gratification of seeing their labours rewarded in a degree far beyond their most sanguine expectations.

In the larger cities of England I observed that the policeman is a real friend of the ragged and neglected juvenile and co-operates with the various agencies engaged in rescue work. Many a homeless wanderer is stopped at night by the policeman's friendly hand. I have on many occasions seen a policeman late at night leading by the hand a poor, ragged, derelict child of from 10 to 12 years, and endeavouring to locate his home. In London, and in that great seaport, Liverpool, the relation of the police to the child, was much impressed upon me. In his admirable paper, on 'The Police and the Child,' read at the Manchester Conference, Mr. Dunning, head constable of Liverpool, stated :—

'We hope, not without reason, I think, that the child who, in the fright of being lost in the street, has found a friendly hand in that of a policeman, that the child who has to thank a policeman for getting him the first, perhaps the only decent suit of clothes he ever had, that the child whose possession of a trading belt has brought him into relations of intimacy with the police, will as he grows up be more inclined to look upon a policeman as his friend rather than as his enemy and to realize that the law personified in the policeman is something to be respected as a protection to himself rather than as something to be hated and feared as a means of oppression and punishment.'

One of the most admirable features of the work of helping needy children is that exemplified by the system now in operation at Liverpool.

When a policeman finds a poorly clad child in the street special inquiry is made by the officer into the child's home, and it is ascertained whether the parents are in a position to clothe the child properly. The police committee decide if a case be deserving of the attention of the Police Aid Clothing Association, and, if so, the boy, or girl, is supplied with a complete outfit of good, substantial clothing, is granted a special license to sell papers, matches and other articles in the streets and is known as a 'Street Trader.' No child under eleven is allowed to trade in the streets, it being recognized that the street is the worst place for the child.

The license reads as follows :—

YOU MUST NOT SELL ANYTHING IN THE STREETS ON SUNDAYS.

CITY OF LIVERPOOL.

Child Trading License No..........

I certify that.... ...., of.... ...., is licensed by the Watch Committee to trade in the streets of the City, under the provisions of the Liverpool Corporation Act, 1902, section 50.

Description of child: Sex............, Age.........., Years........., Height: feet...., inches....., Complexion........ Eyes........ Hair........ Figure........ Marks..........

Certified this.... ....day of.... ....190 .

(*Facsimile signature.*)
(*Facsimile signature*)
LEONARD DUNNING,
Head Constable.

0 407 L.P.S. Co., 11/7 Est. 3,813.

This certificate will expire on the 31st day of December, 190 .

A special belt, bearing the consecutive number of the license, is worn and the street trader is then permitted to engage in business. It is stipulated that, if possible, the juvenile trader shall repay a nominal amount of the cost of the clothing supplied and it is manifest that this wise system tends to inculcate habits of thrift and industry in this class of children. It prevents their feeling that they are beggars dependent on the charity of the municipality.

The Ragged Schools' Union of London, the pioneer of philanthropic enterprises, is one of the greatest influences at work for the benefit of humanity in general, and needy childhood in particular in Great Britain. For upwards of 64 years its workers have freely and enthusiastically given their time and have met with an abundant measure of success. The scope of their work includes 285 Sunday schools, with 44,502 scholars, and 4,721 teachers, and 219 bible classes, having 5,334 members; 69 industrial classes attended by 3,029 boys and girls; 116 bands of hope, with 1,962 members.

During the present year the London County Council are expending a considerable amount of money for the purchase of cooking utensils, for the various schools in London where meals are provided for needy children.

Under an Act for the feeding of necessitous school children, those who cannot procure food, have the right to make a demand on the state for relief in their necessity.

In conclusion, let me say that the admirable efforts now being made in Great Britain for the removal of this great stumbling-block from the paths of national and moral progress cannot be over-estimated, and the growing spirit of interest and enthusiasm amongst moral reformers in Great Britain is manifested by such evidences as the admirable 'Children's Bill' previously referred to.

Mr. K. J. Henry's report for the year is as follows :—

'The inspection of British children by me during the past year I found to be much as in previous years—children and employers in the main being satisfactory. Many of those seen before by me showed a marked improvement, not only in growth, dress and knowledge of the farm, but in being more obedient, truthful and inclined to do their part cheerfully and well, attributable largely, I should say, to fair treatment, better sense and the knowledge of shortly being thrown on their own resources. Very many seen will in a few months have reached the age limit and are perfectly competent to look after themselves. Some remain on with their present employers for another year, others in doubt or who have decided to go west take land or work on railways.

'The demand for girls and boys is still as general as in previous years and the desire for fair treatment is even more marked. There are exceptional cases where terms of agreement are not being carried out, whilst in many others they exceed the terms in schooling, clothing and even remuneration. Generally, then, I may say my season's work has been very gratifying.'

Mr. R. W. Hillyard states :—

'Since my last report ample opportunity has been afforded me of becoming more familiar with the interesting work of child emigration to Canada. As my territory comprised a large portion of the provinces of Ontario and Quebec I found myself in touch with children from different homes and agencies. It is my pleasing duty to bear testimony to the general good behaviour and industry of the great majority of those inspected and the satisfactory class of homes selected for them. On inquiry at the public schools where these children attend, the teachers have reported most favourably as to their character and aptitude to learn, in fact some stand first in their forms. Cases have come under my observation emphasizing the importance and value of the work. A youth, now 18, is in receipt of a wage of $160 and keep for this year. He is a fine looking lad, and employer says "without a stain upon his character." Another boy of 17 took such a deep interest in his work that his employer has purchased a farm for him and will set him up as a farmer. Numbers of these former immigrants I have found in positions of trust and responsibility; some as honoured ministers of churches and others upon their own farms. It is difficult to comprehend the great good accomplished by the various agencies and time is revealing the importance of child immigration to our Dominion.'

Mr. Annand, Inspector for the Maritime Provinces, reports as follows :—

'I have the honour to submit my annual report as assistant inspector for Nova Scotia and New Brunswick of British immigrant children. To what extent it has been accomplished may be examined a little in detail.

'First—As to the value of child immigration to Canada of a desirable class. From closest inspection and investigation of many years' experience mingling with all classes and conditions of immigrants, I have not the slightest hesitation in stating that child immigration, under judicious management, is far more advantageous to the country than the adult immigrant with small capital and without energy and ability to take advantage of the resources of Canada. My contention is that the younger the child the easier for it to assimilate the habits of the people of the country. The child of tender years lives and grows up in the land of his or her adoption, acquiring a knowledge of Canadian farm life and other work, as carried out under present surroundings, whereas the adult has set ideas, which are difficult to remove.

'During my inspection last year I found that most of the immigrant boys had made remarkable progress. It was pleasing to find so many proving themselves suitable for farm life and work in our agricultural districts and the girls adapting themselves to domestic work, which proves that later on they will become good housekeepers.

'I was very much impressed with the carefulness displayed by the management of the distributing homes in placing their children so well. I found in most instances that they were contented and well provided for, and the feeling of satisfaction manifested between child and employer was a splendid indication of the improvement over other years. To my mind child immigration has proved an unqualified success.

'In some cases the children's schooling might be given more attention, although it must be said that in certain localities the school is so remote from the home that during inclement weather it would be a hardship for the children to attend.'

Mr. Thomas Cory, Inspector for the Western Provinces of Canada, says :—

'I beg to report that the children under departmental inspection in the western provinces of Canada have been indentured with a good class of farmers, and that, save in one instance, their employers were well pleased with them.

'After their first year's experience the general policy is to increase their wages, and I found in the majority of cases the boys were in receipt of adequate remuneration for their services. Many under the age of 17 have become quite as efficient in their particular work on the farms as men.

'It is a significant fact that I heard no complaints as to character and behaviour. The children were of good types, and reminded me much of the average English school boy. The value of this branch of immigration cannot be over-estimated. During my itinerary it was almost of daily occurrence to receive applications for this class of farm help.'

RECEIVING AND DISTRIBUTING HOMES.

Brief reports follow on my inspection of the various receiving and distributing homes during the year. The great importance of these centres cannot be over-estimated, on account of their helpful influence on the children. While not encouraged to retreat to these homes at a mere whim, the children are given to understand that those in charge are their friends and it is to them they may look for advice and counsel when required.

MR. MIDDLEMORE'S HOME,

Fairview, Halifax, N.S.

The superintendent of this home, which I inspected February 19, reports a very satisfactory year's work. There were eight hundred and two children under the protection of this agency. During 1908, ninety-five completed their apprenticeships and were allowed to do for themselves. Health reports were good, only one death amongst their number having occurred. An efficient supervision is maintained, the visitors' reports which I examined showing that particular attention is paid to this branch of the work. Three children were at the home to-day, two boys and a girl having recently returned from their former places.

The home is well equipped and is kept in good order.

THE NEWCOMERS' INN.

Salvation Army Receiving Home, Toronto, Ontario.

On January 6, date of my inspection, there were only two boys in residence. The house is splendidly adapted for a receiving and distributing centre, being within easy distance of the railway stations. It is in charge of Salvation Army officers.

The army is gradually increasing its juvenile emigration work. I have personally inspected a number of its wards and have found them doing very well, being, with few exceptions, suitable types for farm work.

MRS. BIRT'S DISTRIBUTING HOME.

Knowlton, Quebec.

On February 25 my annual visit of inspection to this home was paid.

Twelve children, five boys and seven girls, were in residence. A staff of ladies have charge of the work here and perform their duties efficiently. The home was in good order throughout. Of the large number of Mrs. Birt's immigrants inspected during the year, reports show that, with few exceptions, they are well placed and making satisfactory progress.

THE GIBB HOME FOR BOYS,

Sherbrooke, Quebec.

There was one boy at this home February 24. Seventy boys were received and placed in situations during the year. A larger number of applications than usual for boys for farm work were received.

SELF-HELP EMIGRATION SOCIETY OF LONDON, ENGLAND.

Thirteen boys were emigrated to the Dominion by this society during the past year. They were sent to situations in the provinces of Ontario and Quebec. Of those inspected by this branch of the service few were not doing well.

THE 'COOMBE' HOME,

Hespeler, Ontario.

I paid my annual visit to this interesting distributing home on January 28. The arrangements for the reception, accommodation and employment of children are excellent. Eleven boys and seven girls were in residence, some temporarily, others changing places and a few attending the Hespeler schools before being placed out. I was greatly struck by their intelligence and well kept appearance. They were all engaged, the girls sewing, sweeping or at other domestic duties and the boys at outdoor work.

MARCHMONT HOME,

Reverend Robert Wallace, Belleville, Ontario.

On January 7 I officially visited Marchmont Home.

Four children only were in residence, two boys and two girls. The system of visiting the children is regularly kept up and their welfare is not in any way, I believe, overlooked. A complete history of each child is recorded.

Mr. Wallace has again found it impossible to supply the applications of the past year for juvenile labour.

MR. J. W. C. FEGAN'S HOME,

Toronto, Ontario.

On April 24 I visited Mr. Fegan's distributing home and as his first party for 1909 had just reached Toronto I was afforded the opportunity of inspecting the children before they had been sent out to their new situations. They were a fine lot, of good physique and intelligence and apparently well selected. A small number only have been removed from their situations during the year. The visitors' reports were most interesting and showed that with few exceptions the boys were doing well and with good farmers and generally in a prosperous condition.

A pleasing feature of the year was the hearty and voluntary manner in which Mr. Fegan's young immigrants contributed towards the expense of emigrating next year's party.

Mr. George Greenway, after a faithful service of many years, has retired and has been succeeded as superintendent by Mr. Richard Render, who had long been identified with Mr. Fegan's work in England.

DR. BARNARDO'S HOMES.

The Barnardo branch homes of this organization are situated in Toronto, Peterborough and Winnipeg. A very active year's work has been prosecuted by these agencies. During the past twelve months their young immigrants numbered 1,034, and the proposed immigration for the approaching year it is estimated will exceed that of previous years.

The demand for juvenile farm labour from these agencies has been insatiable and the general condition of the children under departmental inspection has been found satisfactory. In dealing with such a large number of children it is obvious that some disappointments and failures should rise to the surface. In this connection it may not be uninteresting to quote the following statement from a recent editorial in *Night and Day*, one of the many publications issued under the auspices of Dr. Barnardo's organization : 'Out of nearly twenty-one thousand young people sent by the home to Canada and the colonies not twenty in a thousand have disappointed our hopes.'

The system of placing out and supervising the children in Canada has contributed in a large measure to the success of the work. A large staff is permanently employed for this purpose and visits are made at least once a year. The children are educated, before leaving England, to the fact that in coming to Canada they are to be placed on farms with the result that few are found in other occupation than farming. A regular correspondence is encouraged and carried on with their wards.

The receiving home at Toronto is well equipped and efficiently managed. The children have comfortable quarters during their stay there. For younger children a private elementary school is provided.

The Margaret Cox Home for Girls, at Peterborough, is the chief point of distribution for girls. The house has recently been enlarged by the addition of a wing, through the munificence of the Honourable Senator Cox, who for many years has taken a deep interest in Dr. Barnardo's work. The responsibilities entailed by the management of the home and the supervision of such a large number of girls of various ages are discharged by a competent staff of ladies.

THE CHILDREN'S HOME AND ORPHANAGE,

Reverend Dr. Gregory, Hamilton, Ontario.

I personally inspected fifty-four boys at this home, on their arrival from England. In type and intelligence they were a splendid party. Each boy had spent from twenty-one months to five years in their training homes preparatory to emigration. At least twenty of the party left for their places during my visit at the home and all had been allotted places before they actually reached Canada. During the year a large number of their wards have been personally inspected by me in their situations. They were doing well, adequately paid for their services and given good reports by their employers. The home is well arranged and managed.

MISS MACPHERSON'S HOME,

Stratford, Ontario.

On January 26 I paid my annual visit to this home. There were four small children in residence. Their visitor's report indicates that the children under supervision are doing well. The record of each child is carefully kept and information concerning their progress readily available. The home throughout is well maintained and the children receive every attention and comfort during their stay at Stratford.

ST. GEORGE'S HOME,

Catholic Emigration Association, Ottawa.

On March 31 last there were 1,279 juveniles under the direct supervision of the association, nearly all of whom are to be found on farms.

Fewer children were in residence on the occasion of my visit to the home than one might reasonably expect, a circumstance that speaks well for their suitability and contentment with the situations provided for them.

The home is well arranged and in splendid order throughout. There has been a fair emigration of juveniles to the Dominion during the past year, the total number being 307. Of this number 5 only were returned to England. Four visitors are employed in maintaining a supervision of their wards. The system of an annual visitation is kept up and the welfare of the children is not overlooked.

FAIRKNOWE HOME,

Brockville, Ont.

One hundred and seventy-three children from the orphans' homes, Bridge of Weir, Scotland, were placed in situations by this agency during the present fiscal year. They were located chiefly in the eastern counties of Ontario and with few exceptions with farmers.

The superintendent maintains a careful supervision of their wards and their visitors' reports indicated that the children were doing well. The work of this home is held in high esteem by the citizens of Brockville.

OUR WESTERN HOME,

Niagara-on-the-Lake, Ontario.

My annual visit of inspection to this home occurred August 22 and, as on former occasions, I found the home well maintained and children comfortably quartered during their residence. There were a number of little girls in the home at this date, all of whom I inspected. The younger were attending classes in the private school in connection with the home and others were busily engaged sewing and doing other domestic work.

The pleasure was afforded me of meeting Reverend Mr. Rudolf, of London, England, the executive head of the society, with whom I had an opportunity of discussing the work in its various branches.

Your obedient servant,

G. BOGUE SMART,

Chief Inspector of British Immigrant Children and Receiving Homes.

REPORT OF THE CHIEF MEDICAL OFFICER.

OTTAWA, March 31, 1909.

W. W. CORY, Esq.,
Deputy Minister of the Interior,
Ottawa.

SIR,—I beg to submit my sixth annual report as chief medical officer of the medical inspection of immigrants carried on during the year ending March 31, 1909.

The work has not notably increased in extent during the past year, except in so far as it has been more searching and exact.

The development of the coastwise trade between British Columbia ports and the neighbouring cities of Puget Sound, in the United States, is becoming so rapid, and the influx of immigrants for employment at railway construction, lumbering and mining, so great that it is making the inspection work, both civil and medical at the coast of increasing importance and difficulty. The many avenues of ingress between the Crowsnest Pass and Puget Sound, where only an imaginary line intervenes, create a situation regarding which it is difficult to determine just what the best interests of Canada from the medical standpoint demand. Other questions both moral and social are intimately associated with the physical health of a class of immigrants who have been essentially drifters from one mining camp to another or one railway camp to another in the United States. As the class of labour supplied by them is there constantly in demand, it would appear that, until supplied from elsewhere, the situation requires that through inspection the unfit and undesirable should be weeded out. This is done in part by inspecting officers being placed at Sumas, Blaine and Seattle, inspecting for civil cases, while any physical defects are reported for further examination to the medical officer at Vancouver.

Inspection is carried on with ever increasing care at Atlantic coast ports, the many requirements before sailing serving as well to keep from taking passage immigrants of inferior type physically. In addition, however, to this further measures are being constantly adopted for making the medical supervision by the medical officer, during the voyage, more constant and exact. The bill of health required to be signed by him was printed in last year's report, wherein he is required to state in detail the cases of disease which have come under his observation during the voyage and to sign the report to the effect that such are all that occurred during the voyage. This has been followed up by this year's circular which requires a signed statement that the medical officer has made a yet closer and more detailed examination :—

'CANADIAN IMMIGRATION SERVICE.

'Ship Surgeon's List for Medical Examining Officer.

> 'This is to certify that I am the ship's surgeon of the SS...........of the..........SS. line, and that I have daily during the present passage made a general inspection of the passengers on this vessel, and that I have, at least, once during the passage made a detailed individual examination of each immigrant on board, and that I have seen no passenger thereon who, I have reason to believe, is, or is likely to become insane, epileptic or consumptive, or who is idiotic, feeble-minded or afflicted with a contagious, infectious or loathsome disease, or who is deaf, dumb or blind, or otherwise physically defective or whose present appearance would lead me to believe that he or she might be debarred from entering Canada under the Immigration Act, with the exception of the..............persons enumerated below; and that no births or deaths occurred during the passage with the exception of those mentioned underneath.'

(List follows here.)

To make the requirements of this circular yet more effective the medical superintendent of the immigration hospital of a seaport is required to notify the head office of the steamship company in the following terms of cases which have been overlooked by the medical officer of the vessel :—

'Port of.. ....

'SIR,—I beg to inform you that on the SS...........which arrived here on the ....day of..........there were detained the immigrants mentioned underneath for reasons stated opposite their names. Of this number those whose names are underlined were cases which with proper care should have been reported by your ship's surgeon on "list for medical examining officer," but which were not so reported, and I bring the matter to your attention for such action as you deem advisable.

'Name Age. Manifest. Page. Line. Reason for Detention.'

In this way the steamship company is advised as to the neglect of one of its officers, and ought not to complain, if, after notification and no action is taken to correct the neglect, the medical inspection of their vessel should thereafter take more time on arrival in port.

To illustrate, the following notes are taken from the report of the medical officer at Quebec, on three different ships arriving on the same day :—Detained at hospital, general observation, 1; high temperature, 2; observation of eyesight, 1; mental observation, 2; suspected trachoma, 1; feeble-minded, 1; observation of scalp, 1; suspected epilepsy, 1; observation of eyes, 4.

It will be recalled that, as illustrated by the form printed in last year's report, these requirements of the medical officers are preceded by a signed statement made by the immigrant on purchasing a ticket that he has given correct answers as to his civil status, and in the case of assisted immigrants, accompanied with a complete report to be filled out by a registered practitioner in the country where the emigrant takes passage. When to these really complete precautions, every immigrant is subjected to a thorough observation by a trained medical officer at the port of landing, it must again be insisted upon as was stated in the report for 1907-8 :

'When in addition to these various measures taken to sift out undesirable immigrants the examination of each person in succession is made by one, and at the large seaports by two medical officers, followed by a thorough civil examination or inquiry into their age, occupation, destination, financial standing and an estimate of their moral qualities and likelihood to succeed in Canada and become good citizens, it would appear that little more could reasonably be done to prevent the ingress of improper persons to the country.'

That the precautions taken to prevent physically undesirable persons from taking refuge in Canada do not cease at the port of landing is seen from the requirements of sections 28 and 33 of the Immigration Act 1906 making it the duty of all clerks of municipalities to report to the Minister of the Interior any cases of insanity, crime or pauperism in immigrants occurring within two years of their landing in Canada.

How effective the operations of these provisions has been is seen in the detai's set forth in Table IX. giving particulars of the deportations in 1908-9.

TABLE I.—STATEMENT showing the Total Number of Vessels Carrying Immigrants Arriving at the Ports of Quebec, Halifax, St. John, North Sydney, Vancouver and Victoria, during the Fiscal Year 1908-9.

Port.	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	Totals
Quebec	4	28	28	30	27	29	24	15	...	....	...	....	185
Halifax	20	7	9	8	5	2	4	6	14	13	14	18	120
St. John	11	2	2	3	3	3	3	4	9	12	8	12	72
North Sydney	10	18	16	15	16	17	17	15	18	12	7	13	174
Vancouver	2	3	4	5	3	4	3	3	3	3	2	4	39
Victoria	8	6	6	11	7	7	5	7	7	7	5	6	82
Totals	55	64	65	72	61	62	56	50	51	47	36	53	672

As compared with 1907-8 there was a less number by 63 of vessels bringing immigrants to Canada, but that the companies lessened so slightly the number of sailings even though the immigrants by seaports were 87,076 as compared with 204,157 in 1907-8, indicates the conviction that the falling off was but temporary.

TABLE II.—STATEMENT showing the Number of Immigrants Detained and the Number Debarred at Ports since December, 1902 when Medical Inspection was first begun.

Port.	Fiscal Year 1902-3		Fiscal Year 1903-4.		Fiscal Year 1904-5.		Fiscal Year 1905-6.		Fractional Fiscal Year (9 months) 1906-7.		Fiscal Year 1907-8.		Fiscal Year 1908-9.		Totals.	
	Det'd.	Deb'd	Det'd.	Deb'd	Det'd.	Deb'd	Det'd.	Deb'd	Det'd.	Deb'd	Det'd.	Deb'd	Det'd.	Deb'd	Det'd.	Deb'd
Quebec	15	15	817	179	1,422	454	1,163	320	523	117	873	278	1,835	251	6,648	1,614
Halifax	124	124	705	27	449	36	366	10	392	7	730	274	572	39	3,338	517
St. John	134	134	313	68	145	6	396	32	113	13	296	46	502	43	1,899	342
Montreal	....	....	.....	....	146	2	137	...	208	11	589	9	165	10	1,245	32
North Sydney	....	....	.....	....	.....	...	.....	....	......	...	4	4	4	4	8	8
Vancouver and Victoria	....	....	.....	....	397	113	1,456	118	2,257	242	2,040	455	335	31	6,485	959
New York	....	....	.....	....	.....	....	52	44	50	50	106	106	131	131	339	331
Totals	273	273	1,835	274	2,559	611	3,570	524	3,543	440	4,638	1,172	3,544	509	19,962	3,803

An analysis of the above table is of much interest, and can only be understood by a reference to conditions prevailing in different years. Thus in 1902-3 only a few persons were detained as there was no detention hospital, and the 273 were kept on board ship and returned. In 1903-4 medical inspection was carried on, but the detention hospital was temporary and managed by the steamship companies, except for May and June in 1904. Since then the hospitals have been erected and controlled by the medical officers of the department, but as the hospitals are the only places arranged for compulsory detention of immigrants from any cause, it has occurred that during the year 1908-9 a notable number of detentions have been for causes other than medical, chiefly indeed for lack of funds. Hence the anomaly is explained of how in 1907-8 there were only 4,638 detained and 1,172 debarred, while in 1908-9 there were 3.544 detained but only 509 debarred, the matter of funds having been arranged by friends in Canada.

Remembering that but 87,076 immigrants arrived in Canada via seaports as compared with 204,157 in 1907-8, the increasing strictness of inspection which detained more than five-sevenths as many and debarred nearly half as many may be fairly estimated.

TABLE III.—STATEMENT for the Ports of Halifax, St. John and Quebec, showing the Number of Immigrants Detained and Debarred during the Fiscal Year 1908-9.

SS. Line.	Port.	Number Examined.	Detained.		Debarred.	Ratio of detained to Number examined.	Ratio of debarred to Number examined.
			Males.	Females			
Allan SS. Line..........	Halifax.........	14,124	183	112	19	1 in 48	1 in 743
" "	St. John........	....	....	....	....	....	....
" "	Quebec.........	28,413	316	180	105	1 in 57	1 in 270
	Totals......	42,537	499	292	124	1 in 54	1 in 343
C. P. R. SS. Line	Halifax.........	130	....	....	....	....	....
" "	St. John........	19,261	261	228	43	1 in 39	1 in 448
" "	Quebec.........	23,792	778	205	62	1 in 24	1 in 384
	Totals......	43,183	1,039	433	105	1 in 29	1 in 411
Dominion SS. Line.......	Halifax.........	2,312	20	14	5	1 in 68	1 in 462
" "	Quebec....	9,875	172	127	54	1 in 33	1 in 183
	Totals.. ...	12,187	192	141	59	1 in 36	1 in 206
Donaldson SS. Line.. ...	St. John........	676	12	1	.....	1 in 52	....
" "	Quebec..... ...	2,370	22	12	16	1 in 70	1 in 148
	Totals......	3,046	34	13	16	1 in 65	1 in 190
Other Lines.............	Halifax........	3,133	175	68	15	1 in 13	1 in 209
"	St. John........	252	......	....	....	....	....
"	Quebec.....	70	23	....	14	1 in 3	1 in 5
	Totals	3,455	198	68	29	1 in 13	1 in 119
Grand Totals	....	104,408	1,962	947	333	1 in 56	1 in 314

It has always been a matter of much interest and importance to compare the ratio of detentions and deportations by different steamship lines since it has been to some extent a measure of the care exercised by the agents in booking desirable immigrants.

It will be noted that the number of detentions at Quebec of the Allan Line passengers was 1 in 57 in 1908-9 as compared with 1 in 202 in 1907-8, while the rejections were 1 in 270 as compared with 1 in 530 in 1907-8. There were of total passengers via Canadian Pacific Railway to Quebec 1 in 24 in 1908-9 detained as compared with 1 in 151 in 1907-8, while the debarred were 1 in 384 in 1908-9 as compared with 1 in 513 in 1907-8.

The Dominion line had 1 in 33 in 1908-9 detained at Quebec as compared with 1 in 141 in 1907-8, and 1 in 183 in 1908-9 debarred as compared with 1 in 590. The Donaldson line had 1 in 70 in 1908-9 detained at Quebec as compared with 1 in 100 in 1907-8, and 1 in 148 debarred as compared with 1 in 253. As regards the totals as compared with 1907-8, while the grand total of detentions is 1 in 36, the total debarred was 1 in 314, as compared with 1 in 327 for last year.

Table IV.—Statement showing Number of Immigrants Detained and Debarred at Montreal, New York, North Sydney, Vancouver and Victoria, for Fiscal Year 1908-9.

Port of Entry.	Port of Arrival.	Total Arriving.	Total Detained.	Total Debarred.	Total Released.	Still in Hospital.
Montreal	Philadelphia	43	....	....	....	....
	Baltimore	29	....	....	....	....
	Portland	1,806	165	10	155	....
	Boston	759	....	....	....	....
	New York	8,463	....	....	....	....
	New York	As above	131	131	....	....
North Sydney	North Sydney	4,572	4	4	....	....
Vancouver	Vancouver	6,896	64	14	50	....
Victoria	Victoria	3,865	271	17	254	....
		26,433	635	176	459	....

The most notable feature in the table is the increased care exercised by the medical officer of the department stationed in New York. Although the total number of immigrants for Canada arriving via New York decreased from 22,381 in 1907-8 to 8,463 in 1908-9, yet the number of rejections has increased from 106 to 131, or relatively from 1 in 211 to 1 in 65. In New York it is evident as at Canadian ports, that relatively the larger the number of immigrants the less is the relative number rejected, probably in part because the larger number up to even 9,000 in a single day, taxes at times the physical capacity of the inspectors beyond the limit of highest efficiency. At Vancouver the ratio of detentions to the total is much lower than at Victoria, as are also those refused admission, viz., of those detained 1 in 107 compared with 1 in 14 and of those debarred 1 in 492 as compared with 1 in 228. It will be remembered that a very notable number of immigrants landed at Victoria are booked to the United States, and that the detention is often made upon reasons given by the United States inspector. Further, as there are many vessels touching at Victoria which afterwards make for American ports, there would seem to be a less select lot of passengers than on vessels of the regular transpacific Canadian lines.

As in other years, the fact that almost all passengers coming from Newfoundland directly to Canada are on business or going to employment either in Canada or the United States adequately explains why only 4 in 4,572 passengers were detained and refused admission. The fact of the inspection has been sufficient to completely prevent the moving by the roundabout route of undesirables, sailing from Havre, debarking at St. John's from ships and then coming overland by rail and entering Canada by the regular mail steamers from the island.

TABLE V.—STATEMENT by Nationalities of Number of Immigrants Debarred at Ocean Ports, showing Total Arrivals of the same Nationalities for the Fiscal Year 1908-9.

Nationality.	Total Arrivals for Canada and United States.	Atlantic Ports.		Pacific Ports.		Via United States Ports.	Totals.		Totals.
		For Canada.	For United States.	For Canada.	For United States.	For Canada.	For Canada.	For United States.	
Australian	362			2	1		2	1	3
Austrian, N.E.S.	2,131	1				5	6		6
Bohemian	37		1					1	1
Bukowinian	1,550	8					8		8
Croatian	6	1	3				1	3	4
Galician	6,710	16					16		16
Hungarian, N.E.S.	715	3				3	6		6
Ruthenian	149					29	29		29
Belgian	913					2	2		2
Chinese	2,023			1			1		1
Dutch	568	2					2		2
French	1,929	15	1			2	17	1	18
German, N.E.S	1,682	11	6			2	13	6	19
English	39,008	84	5		1	3	87	6	93
Scotch	12,440	29	1				29	1	30
Irish	3,900	15		1		6	22		22
Greek	276		3					3	3
Hebrew, N.E.S	211					3	3		3
Hebrew, Russian	1,542	16	14			2	18	14	32
Hebrew, Austrian	24					1	1		1
Hebrew, German	15		1					1	1
Italian	4,272	4				29	33		33
Japanese	546		5	15	3	3	18	8	26
Newfoundland	3,050	3					3		3
Poles, N.E.S.	120	1					1		1
" Austrian	44					9	9		9
" Russian	278	6					6		6
Persian	1		1					1	1
Roumanian	313			1		2	3		3
Russian, N.E.S	5,091	36	21			30	66	21	87
Finns	2,892	1	6			1	2	6	8
Spanish	37	3					3		3
Servian	50					1	1		1
Danish	444		1					1	1
Swedish	2,127	1	4				1	4	5
Norwegian	2,542					5	5		5
Turks	279	2	1				2	1	3
Armenians	211	1	1				1	1	2
Syrian	227	2				2	4		4
Arabian	4					1	1		1
United States citizens	2,728		1	1			1	1	2
Hindoo	8			5			5		5
Totals	101,455	261	76	26	5	141	428	81	509

As remarked in regard to other tables, the smaller the number of any nationality, the less reliable are any statistics dealing with them. Thus, in the preceding table the Ruthenians are rejected to the number of 29 in a total of 149, the abnormal number debarred being really due to Ruthenian being an ethnic term applicable to Galicians, Bukowinians or Slovaks, referring rather to language and country, and not generally used, the nationality being given. It appears, however, that more than twice as many proportionately of Bukowinians were debarred as compared with Galicians. Both French and German show an abnormally high number debarred, over 9 per 1,000 as compared with English and Scotch between 2 and 3 per 1,000. Russians appear high, being 17 per 1,000, while the Italians are 8 per 1,000 or half as numerous. There were 48 Japanese per 1,000, but only 0·5 of Chinese. Both Swedes and Norwegians are low, being 2 per 1,000, but the Finns are 3 per 1,000.

Taken together, however, the total 509 debarred was rather less per 1,000 than in 1907-8, compared with the total immigration, the ratio being 1 in 171 as compared with 1 in 174 in 1907-8. It will not be forgotten that the great precautions taken, especially in England and at Hong Kong in 1908-9, prevented, doubtless, numbers sailing of the less desirable class.

TABLE VI.—STATEMENT showing the Total Number of Chinese, Japanese and Hindoos detained, released and debarred at the Ports of Vancouver and Victoria, during the Fiscal Year 1908-9.

Nationality.	Total Number Arriving.	Detained.	Released.	Debarred.	Number still in Hospital.
Vancouver—					
Chinese	1,209	36	35	1	.....
Japanese	81	22	15	7	.....
Hindoos	.....	.....	.....	.....	.....
Totals	1,290	58	50	8	.....
Victoria—					
Chinese	778	247	247	.....	.....
Japanese	453	18	7	11	.....
Hindoos	5	.....	.....	5	.....
Totals	1,236	270	254	16	.....

For 1908-9 the total number of Orientals arriving at Vancouver and Victoria was 2,526, as compared with 12,920 in 1907-8, the Chinese immigration maintaining a very even ratio from year to year, but the Japanese to Vancouver having practically ceased arriving. The number arriving by the various transpacific lines touching at Victoria is greater, it being not unusual for Japanese, going to the United States ultimately, to book to Victoria on the steamers which make it their first port of call. The total debarred of the whole immigration was 24 in 2,526 or 10 per 1,000.

TABLE VII.—STATEMENT showing the Disease and other causes for which Immigrants were detained at the Ports of Quebec, Halifax, St. John, Montreal, North Sydney, Vancouver, Victoria and New York, during the Fiscal Year 1908-9.

Class of Disease.	Cause of Detention.	Number Detained.	Number Released.	Number Rejected.	Number still in Hospital.
I. Contagious diseases	Scarlet fever	1	(died 1)	.....	.....
	Measles	10	(died 1) 9	.....	.....
	Erysipelas	3	3	.....	.....
	Typhoid fever	1	1	.....	.....
	Totals	15	15	.....	.....
II. General diseases	Tuberculosis	18	(died 1) 5	12	.....
	Lupus	1	.....	1	.....
	Alcoholism	8	3	5	.....
	Furuncle	1	1	.....	.....
	Rheumatism	3	3	.....	.....
	Totals	31	13	18	.....

TABLE VII.—STATEMENT showing the Disease and other causes for which Immigrants were detained at the Ports of Quebec, Halifax, St. John, Montreal, North Sydney, Vancouver, Victoria and New York during the Fiscal Year 1908-9—*Continued.*

Class of Disease.	Cause of Detention.	Number Detained.	Number Released.	Number Rejected.	Number still in Hospital.
III. Eye diseases	Trachoma	456	340	94	22
	Conjunctivitis	330	329	1	....
	Corneal ulcer	4	4	....	....
	Choroiditis	1	....	1	....
	Trachomatous cicatrization	19	19	....	....
	Cataract	1	....	1	....
	Defective sight	18	10	7	1
	Blindness	1	....	1	....
	Loss of an eye	9	....	9	....
	Pterygium	2	2	....	....
	Corneal opacity	1	....	1	....
	Observation of the eyes	66	65	....	1
	Totals	908	769	115	24
IV. Nervous system	Insanity	15	1	13	1
	Hysteria	1	....	1	....
	Epilepsy	2	1	....	1
	Paralysis	4	2	1	1
	Feeble-minded	37	14	23	....
	Locomotor ataxia	1	....	1	....
	Muscular atrophy	2	....	2	....
	Nervousness	1	1	....	....
	Homicidal delusions	1	....	....	1
	Observation of mind	4	4	....	....
	" nervous system	2	2	....	....
	Totals	70	25	41	4
V. Circulatory system	Heart disease	9	4	5	....
	Varicose veins	1	....	1	....
	Totals	10	4	6	....
VI. Respiratory system	Bronchitis	1	1	....	....
	Tonsilitis	2	2	....	....
	Pneumonia	10	(died 1) 8	....	1
	Inflammation of lungs	1	1	....	....
	Emphysema	1	....	1	....
	Hemorrhage	1	(died 1)	....	....
	Observation of lungs	1	1	....	....
	Non-malignant growth on vocal chords	1	1	....	....
	Totals	18	16	1	1
VII. Digestive system	Hernia	5	1	3	1
	Appendicitis	4	(died 1) 3	....	....
	Enteritis	1	1	....	....
	Cirrhosis liver	1	....	1	....
	Dysentery	3	3	....	....
	Intestinal hemorrhage	1	1	....	....
	Totals	15	10	4	1
VIII. Genito-urinary system	Syphilis	2	....	2	....
	Gonorrhœa	1	....	1	....
	Conjestion of kidneys	1	1	....	....
	Totals	4	1	3	....

TABLE VII.—STATEMENT showing the Disease and other causes for which Immigrants were detained at the Ports of Quebec, Halifax, St. John, Montreal, North Sydney, Vancouver, Victoria and New York during the Fiscal Year 1908-9—*Concluded.*

Class of Disease.	Cause of Detention.	Number Detained.	Number Released.	Number Rejected.	Number still in Hospital.
IX. The skin	Favus	9	6	2	1
	Scabies	2	1	1	....
	Eczema	1	1	....	....
	Tinea (ringworm)	19	14	5	....
	Impetigo	1	1	....	....
	Acne	1	1	....	....
	Leprosy	1	....	1	....
	Psoriasis	1	....	1	....
	Pediculosis	1	1	....	....
	Totals	36	25	10	1
X. Malformations and diseases of old age and infancy	Cripple	1	....	1	....
	Deafness	4	3	1	....
	Old age	2	....	2	....
	Hare lip	1	....	1	....
	Cholera infantum	1	(died 1)	....	....
	Tumor	1	1	....	....
	Abscess	2	2	....	....
	Totals	12	7	5	....
XI. Accidents	Bruise	1	1	....	....
	Scald	2	(died 1) 1	....	....
	Frostbite	1	1	....	....
	Amputated fingers	1	1	....	....
	Hip operation	1	1	....	....
	Sprained ankle	1	1	....	....
	Concussion	1	(died 1)	....	....
	Totals	8	8	....	....
XII. Ill-defined causes	Poor physique	20	11	8	1
	Physical debility	8	(died 1) 3	4	....
	Lack of nutrition	1	(died 1)	....	....
	High temperature	6	6	....	....
	Totals	35	22	12	1
XIII. Other causes	Accompanying patients	255	194	61	....
	Likely to become a public charge	1,976	1,837	130	9
	Stowaways	78	8	70	....
	Contract labour for United States	7	7	....	....
	Held for inquiry	14	14	....	....
	Contravention of Order in Council	6	....	6	....
	Fraudulent pass	1	....	1	....
	Criminal	11	5	6	....
	Prostitute	1	....	1	....
	Illegal co-habitation	4	....	4	....
	With illegitimate child	3	2	1	....
	Confinement	2	2	....	....
	Pregnancy	1	....	1	....
	Moral turpitude	7	....	7	....
	Held for observation	10	10	....	....
	Not continuous journey from native land	6	....	6	....
	Totals	2,382	2,079	294	9
	Grand totals	3,544	2,994 (died 11)	509	41

The preceding table gives the list of persons detained and placed in the detention hospitals at the several seaports for all causes in 1908-9 as 3,544, as compared with 4,638 in 1907-8. The marked falling off in the total immigration this year has been already noted and it will be seen that in 1908-9 more proportionately have been under the heading of 'Likely to become a public charge,' there having been 1,976 detained as compared with 178 in the previous year. The financial requirements were met especially by friends in Canada as seen in the fact that 1,837 were subsequently released and sent forward. The criminals were 11 as compared with 21 in the previous year. Under the classes of disease there were a few cases of acute contagion, especially 'measles,' developed, as in former years. Their paucity during the past five years has been very remarkable, there having been only the following :—

Disease.	1904-5.	1905-6.	1906-7.	1907-8.	1908-9.
Scarlet fever	......	....	....	....	1
Diphtheria	....	2	....	....	....
Quinsy	....	1	....	....	....
Chickenpox	....	....	1	....	....
Measles	1	19	4	18	10
Erysipelas	....	....	....	1	3
Typhoid	....	....	1	2	1
Mumps	....	....	1	1	....

Of the constitutional diseases in Class II. as might be expected, 'tuberculosis' shows the most cases, 18 in all, of whom 1 died in hospital and 10 were deported. Last year 27 were detained and 11 deported. Cases of chronic drunkenness have been dealt with promptly, 8 having been detained and 5 deported as 'alcoholics' as compared with one last year. Such are clearly a class for which Canada has no need or any room. Probably the most notable decrease in disease is in Class III., including eye diseases. Last year 2,856 were detained and 385 deported, whereas in 1908-9 there were 908 only detained and but 115 deported. The notable decrease is in consequence of the less detentions on account of ophthalmia in Orientals. Class IV. includes diseases of the nervous system under which are the detentions for insanity, these being 15 as compared with 20 in the previous year, of whom 13 were debarred.

There were fewer epileptics, 2 as compared with 8 in the previous year, but 37 were detained as 'feeble-minded' as compared with 18, of whom 23 were rejected as compared with 13 least year.

Class V., 'Diseases of Circulation,' has but 10 cases, of which 5 cases of heart disease were deported. Similarly Class VI. has but 18 cases, including bronchitis and pneumonia, this being good proof that there was not overcrowding on shipboard.

Class VII., 'Diseases of the Digestive system,' naturally has few, most of them being chronic 'hernia.'

Similarly, Class VIII. has, as could be expected, but few cases.

Class IX. has the usual number of 'Diseases of the Skin,' especially of the two chronic contagious ones, 'favus' and 'ringworm,' there being 9 of the former and 19 of the latter as compared with 10 and 64 last year. They were either deported or kept in hospital and treated at the expense of the steamship companies, being otherwise desirable.

Under Classes X., XI. and XII. were included 55 cases of malformations, injuries and other ill-defined causes.

Taken all together the competent observer will agree that in the total inspected at the seaports, the list illustrates a remarkable freedom from disease in the immigrants arriving in Canada, and that the sifting has been thorough will be drawn from a later table showing the small number of cases deported on account of disease.

TABLE VIII.—STATEMENT of Deportations from Canada during the Fiscal Year 1908-9, by Nationalities.

African, South	1	Hebrew, N.E.S.	32
Australian	1	Hebrew, Russian	11
Austrian, N.E.S.	17	Hebrew, Austrian	2
Bohemian	3	Italian	13
Buckowinian	4	Japanese	4
Galician	16	Polish, Russian	3
Hungarian, N.E.S.	1	Roumanian	42
Ruthenian	1	Russian, N.E.S.	49
Belgian	2	Finnish	3
Bulgarian	74	Spanish	1
Chinese	1	Swiss	2
Dutch	12	Danish	4
French	18	Swedish	7
German	7	Norwegian	2
English	1,081	Turkish	20
Welsh	1	Syrian	1
Scotch	119	U. S. Citizens	98
Irish	34	Negro	1
West Indian	3	Hindoo	24
Jamaican	1	Grand total	1,748
Greek	32		

TABLE IX.—STATEMENT of Deportations from Canada during Fiscal Year 1908-9, by Causes.

I. General—		VI. Digestion—	
Tuberculosis	54	Hernia	2
Alcoholism	27	Fistula	1
Rheumatism	15	VII. Genito-urinary—	
Syphilis	4	Chronic cystitis (bladder)	1
Diabetes	2	Kidneys (Bright's)	2
Cancer	2	VIII. The skin—	
Abscess	1	Eczema	1
Anaemia	1	IX. Malformation—	
Exophthalmia	1	Senility	10
Hip disease	1	Deafness	4
II. Eyes—		Blindness	3
Defective sight	11	Spinal curvature	1
Cataract	1	Crippled	11
Trachoma	1	Potts disease	2
III. Nerves—		X. Accident—	
Insane	113	Frostbite	3
Feeble-minded	35	Injured	3
Epilepsy	22	Rupture	6
Paralysis	4	XI. Ill-defined—	
Nervous debility	1	Physical debility	82
Loss of memory	1	Physical and mental debility	14
Paresis	1	XII. Other—	
Acute nostalgia	1	Public charge	1,074
IV. Circulatory—		Criminal	115
Heart disease	13	Vagrancy	56
Varicose veins and ulcer	7	Accompanying	21
V. Respiratory—		Prostitution	8
Bronchitis	1	Bad character	7
Emphysema	1		

The causes for deportation are seen to have been chiefly civil rather than medical, there having been 1,074 public charges. Those deported for criminal causes show a remarkable increase over the previous year, there being 115 as compared with 49. It illustrates the truth contained in immigration returns of different past periods that whenever there has been a depression in business and a lack of employment, there is an increase in criminal returns, part of it being due to the fact that many vagrants and others have charges preferred against them in order that they may be taken charge of.

As usual the larger number of deports are included in two classes of general constitutional diseases and nervous diseases. Of the first there were 108, including 54 cases of tuberculosis and 27 of alcoholism. Of nervous diseases there were in all 178, including 113 cases of insanity, 35 feeble-minded and 22 cases of epilepsy.

The cases both of tuberculosis and insanity approximate the total of 1907-8, being 54 as compared with 70 and 113 as compared with 122. That the deportation of 'chronic' undesirables is being steadily carried out is best illustrated by the fact that 27 were deported on account of alcoholism as compared with 1 in 1907-8, as well as by the fact that 35 feeble-minded were deported as compared with 13 last year and 22 epileptics as compared with 10 the previous year.

The remarkable results of constant inspection of immigrants for eye trouble are seen in the fact that only 1 person was deported on account of trachoma and 12 for defective sight from all causes.

Various other diseases were causes of deportation, but no one of them assumed any degree of importance.

The foregoing tables have illustrated the various features of medical interest in the immigration of 1908-9, so far as the work in Canada is concerned. What was done in foreign countries, as England, to prevent the unfit from taking passage, will appear elsewhere ; but that many were so prevented through an examination and certificate being required in many cases may fairly be inferred. Comparison of those rejected with those of previous years shows that the number finally rejected at the seaports has not notably differed in ratio from those in 1907-8 and seems to indicate that the approximate maximum of efficient work at the seaports under existing methods of inspection and requirements of the Act has been reached. The deportations as illustrated in the preceding table for the most part of persons from Great Britain and Europe, have removed from amongst the newcomers the derelicts, until it is probable that fewer defectives per 1,000 actually exist in the immigrants than in an equal number of the same class amongst the native born. The notable absence of mental defectives amongst the peoples from southern countries is a matter of much interest and, contrary to a too popular opinion, it appears that if compulsory education can be generally enforced we have in such races not only an industrial asset of great value but also the assurance of a population remarkably free from the degenerative effects seen in those classes which have been for several generations factory operatives and dwellers in the congested centres of large industrial populations. Recognizing the constant and increasing need of a population, not only capable of but willing to do the rougher work of opening up new areas by building railways and canals, we may consider it a fortunate matter if such can be obtained of clean blood and much native energy, only requiring the influence of social and educational environments to transform them into good citizens and absorb them into the masses of our law-abiding and progressive communities.

Respectfully submitted,

P. H. BRYCE,
Chief Medical Officer.

PART III

SURVEYS

SURVEYS

REPORT OF THE SURVEYOR GENERAL.

Department of the Interior,
Topographical Surveys Branch,
Ottawa, May 27, 1909.

The Deputy Minister of the Interior,
Ottawa.

Sir,—I have the honour to submit the following report of the Topographical Surveys Branch for the fiscal year ended March 31, 1909.

During 1908 there was a demand for extensive surveys in what was formerly called the 'semi-arid' district, those portions of the northwest provinces lying between the Canadian Pacific railway and the international boundary and between Moosejaw and Lethbridge. About one hundred and forty-five townships in this district were subdivided during the year. It is expected that the surveys in this tract will be completed during 1909. Surveys were also extended in the country north and west of Edmonton, north and east of Prince Albert and in the northern part of Manitoba.

To secure more permanent monuments for quarter section corners it was decided to use iron posts instead of wooden ones. Formerly iron posts were used only at section corners. Many surveys in wooded country are performed during the winter. Iron posts as well as being more permanent, are much more easily driven into the frozen ground.

Formerly the laws governing the survey of Dominion lands were comprised within the Dominion Lands Act, but in 1908 they were embodied in a separate Act called the Dominion Lands Surveys Act which was assented to March 17, 1908. The chief changes by the new Act are in relation to the resurveys of lands and the correction of errors; the Minister is given power to order a resurvey upon receipt of a petition from the owners of the lands or from parties interested as homesteaders, licensees, &c., and after public notice has been given in the *Canada Gazette* and a local newspaper for a period of four weeks. In the case of the correction of errors provision is made for compensation on account of the loss of improvements by the correction. This compensation is payable by the party acquiring the improvements, and the amount is fixed by the Minister or by an award of three arbitrators. Several resurveys and a few correction surveys have been already made under the provisions of the new Act.

SURVEYS FOR THE YEAR ENDED MARCH 31, 1909.

Like the spring of 1907, the spring of 1908 was unusually wet and surveyors had great difficulties in taking their outfits and supplies to the different localities where they were to work. Progress in the early part of the season was slow but after the wet period was over, the weather generally was very favourable for survey operations. Complete subdivision was made of three hundred and twelve whole and of twenty-three fractional townships, while a partial subdivision was made of one hundred and sixty-one other townships. In addition a complete resurvey was made of fifteen whole townships and of five fractional ones as well as a partial resurvey of one hundred and fifty-one others.

Seventy survey parties were in the field, sixty of which were engaged on township work and ten on miscellaneous surveys. Thirty-nine of these parties were paid by the day and thirty-one worked under contract. Of the parties under daily pay, four were employed in Manitoba, six in Saskatchewan, fifteen in Alberta, eight in British Columbia, one on the boundary between British Columbia and Yukon Territory and two in the Northwest Territories, while three others were part of the time in one province and part of the time in another. Of the parties under contract seven were located in Manitoba, eight in Saskatchewan and fifteen in Alberta, while one contract was partly in one province and partly in another.

Five parties under daily pay in charge of Messrs. P. R. A. Belanger, E. W. Hubbell, G. J. Lonergan, C. F. Miles and L. E. Fontaine were engaged for the greater part of the time on the inspection of surveys performed under contract. Forty contracts were examined during the year. The balance of the time of the inspectors was given to the investigation of reported errors, the correction of errors and the performance of other miscellaneous surveys.

The reports of the surveyors who were working under daily pay are given as appendices No. 13 to No. 50 of this report. The field of operations embraced the country extending from the eastern boundary of Manitoba to the western boundary of Alberta and from the international boundary as far north as township 107, a distance of about 650 miles. It embraced, also, almost the entire railway belt in British Columbia.

MISCELLANEOUS CORRECTION, RESTORATION AND TOWNSHIP SUBDIVISION SURVEYS.

Mr. C. F. Aylsworth, D.L.S., continued resurvey work in the vicinity of Beausejour, in eastern Manitoba.

Messrs. C. E. Bourgault, D.L.S., and W. J. Deans, D.L.S., made several correction surveys and some resurveys in eastern Saskatchewan. Mr. Deans travelled more than 500 miles during the performance of his surveys. He found the great need in that country to be an adequate system of drainage.

Messrs. T. A. Davies, D.L.S., Jas. Warren, D.L.S., and W. H. Young, D.L.S., were engaged in extending subdivision surveys in southwestern Alberta, in the foothills of the Rocky mountains. Owing to the nature of the country survey operations in this vicinity are very tedious and difficult.

Mr. Thos. Fawcett, D.T.S., retraced a portion of the fourth meridian in southern Alberta and made several correction surveys in Saskatchewan. His report contains an interesting description of the country he passed over.

Messrs. Geo. McMillan, D.L.S., W. R. Reilly, D.L.S., and R. H. Montgomery, D.L.S., were engaged in miscellaneous resurveys and correction surveys in the vicinity of Prince Albert, Saskatchewan. Mr. Reilly expresses the opinion that the north country offers special inducements to the settler of small means, as the wooded homestead furnishes timber for building and wood for fuel, while winter employment may always be had with the lumbering companies.

Mr. T. H. Wiggins, D.L.S., was engaged for only a short period on a correction survey near Saskatoon, Saskatchewan.

SUBDIVISION SURVEYS IN THE PEACE RIVER DISTRICT.

Messrs. H. S. Holcroft, D.L.S., J. B. Saint Cyr, D.L.S., and H. W. Selby, D.L.S., were employed on necessary township subdivision and settlement surveys in the Peace River district. They all speak well of the success which settlers are meeting with in that country and foretell a prosperous future, when satisfactory means of transportation will be available.

SURVEYS OF BLOCK OUTLINES.

Portions of the eighth and ninth base lines west of the principal meridian were resurveyed by Wm. Christie, D.L.S., to locate an error which was indicated by the closings of these lines with other lines previously surveyed. The accuracy of subdivision surveys depends on the accuracy of the base lines ; it was therefore necessary to locate and correct the error before the dependent subdivision surveys could be proceeded with.

Mr. A. H. Hawkins, D.L.S., surveyed a portion of the twelfth base and completed the survey of the thirteenth base west of the sixth meridian while Mr. A. Saint Cyr, D.L.S., surveyed a portion of the fifteenth base west of the fifth meridian and produced the sixth meridian from the fourteenth base south to the quarter section corner on the east boundary of section 25 in township 47. A perusal of the reports of Messrs. Hawkins and Saint Cyr will give a clear idea of the almost insurmountable difficulties encountered by surveyors who undertake the surveys of the governing lines in our system of survey.

Mr. A. W. Ponton, D.L.S., produced the fifth initial meridian through townships 85 to 107, inclusive. It was necessary to establish this meridian in order that base lines might be extended from it in any direction where subdivision may be required. Large settlements are already in existence on Peace river and there is some demand for subdivision surveys.

Mr. B. J. Saunders, D.L.S., produced the eleventh base line west of the fifth meridian from range 8 to range 19.

MISCELLANEOUS SURVEYS.

Mr. David Beatty, D.L.S., made a compass survey of the limits of Porcupine forest reserve northwest of Swan River, Manitoba.

Mr. A. McFee, D.L.S., surveyed the boundaries of Buffalo Park reserve near Hardisty, Alberta.

Some necessary surveys at The Pas in the Northwest Territories were performed by Mr. E. R. Bingham, D.L.S. He foretells an important future for this settlement when the Canadian Northern railway is completed that far.

Mr. P. A. Carson, D.L.S., continued the triangulation in the railway belt, British Columbia, south and west of Golden.

A survey to locate some coal lands on the south branch of Brazeau river in Alberta was made by Mr. T. D. Green, D.L.S.

Mr. J. E. Morrier, D.L.S., surveyed a townsite at Fort Churchill. His report gives much valuable information as to the conditions of life there and the possibilities of the country.

Necessary surveys at lakes Louise and Minnewanka, in the Rocky Mountains park, were done by Mr. A. C. Talbot, D.L.S.

Mr. W. Thibaudeau, C.E., made a preliminary investigation of the water-powers of several streams in southwestern Alberta. A mass of valuable information is furnished by his report and the maps to accompany it, which are published herewith.

Mr. J. N. Wallace, D.L.S., established the Yukon-British Columbia boundary between the Tatshenshini and Takhini rivers, a distance of about thirty-six miles.

An examination of the vacant lands in the valleys of the railway belt, British Columbia was undertaken by Mr. A. O. Wheeler, D.L.S., for the purpose of classifying them under five heads, viz., fruit land, farming land, grazing land, timber land and worthless land. Mr. Wheeler had under his direction two sub-parties in charge of Messrs. M. P. Bridgland, D.L.S., and H. G. Wheeler respectively. The valley lands above and below Revelstoke and above Golden were examined.

BRITISH COLUMBIA SURVEYS.

For some years past two surveyors, Messrs. J. E. Ross, D.L.S., and A. W. Johnson, D.L.S., have conducted practically all the Dominion land surveys in the railway belt. Owing to the great increase of work consequent upon the assumption by the Department of the control of timber berth surveys and upon the considerable increase in the applications for subdivision surveys it was found necessary last year to employ two more parties under Messrs. T. H. Plunkett, D.L.S., and E. W. Robinson, D.L.S., respectively. These two parties, as well as the party under Mr. A. W. Johnson, were engaged in the Kamloops district. Mr. J. E. Ross was employed in the western portion of the railway belt. Some small surveys were performed by Mr. J. A. Kirk, D.L.S.

LATITUDE ON THE FIFTH MERIDIAN.

In the spring of 1908 Mr. G. Blanchard Dodge determined the latitude of the fifth meridian near the Athabaska river in order to ascertain the error in latitude of the corner monuments near that place. The fifth meridian was being extended northerly to the Peace river by Mr. A. W. Ponton and to guard against errors in chainage, he was instructed to observe for latitude from time to time, but this could not serve as a check unless he knew the error at his starting point near the Athabaska river. It was shown by Mr. Dodge's observation that the error was practically nothing.

The following is a comparison of the mileage surveyed every year since 1906:—

—	April 1, 1908, to March 31, 1909.	April 1, 1907, to March 31, 1908.	Jan. 1, 1906, to March 31, 1907.
	Miles.	Miles.	Miles.
Township outlines	2,019	1,674	1,306
Section lines	16,985	13,710	8,962
Traverse	3,323	3,193	1,848
Resurvey	2,175	2,917	4,948
Total for season	24,502	21,494	17,064
Number of parties	67	59	56
Average miles per party	366	364	305

The following table shows the mileage surveyed by the parties under daily pay, and by the parties under contract :—

WORK OF PARTIES UNDER DAILY PAY.

—	April 1, 1908, to March 31, 1909.	April 1, 1907, to March 31, 1908.	Jan. 1, 1906, to March 31, 1907.
	Miles.	Miles.	Miles.
Township outlines	512	542	756
Section lines	1,004	975	1,035
Traverse	1,158	1,313	643
Resurvey	2,175	2,782	4,815
Total for season	4,849	5,612	7,249
Number of parties	36	29	29
Average miles per party	135	194	250

WORK OF PARTIES UNDER CONTRACT.

—	April 1, 1908, to March 31, 1909.	April 1, 1907, to March 31, 1908.	Jan. 1, 1906, to March 31, 1907.
	Miles.	Miles.	Miles.
Township outlines	1,507	1,132	550
Section lines	15,981	12,735	7,927
Traverse	2,165	1,880	1,205
Resurvey	.....	135	133
Total for season	19,653	15,882	9,815
Number of parties	31	30	27
Average miles per party	634	529	364

NOTE.—Owing to the nature of their work the parties under Messrs. P. A. Carson, W. Thibaudeau and A. O. Wheeler are not included in the statement of mileage for the year ended March 31, 1909.

The following statement shows the average cost per mile of surveys done by contractors and by surveyors under daily pay for the year ended March 31, 1909 :—

	Surveys made under day pay.	Surveys made under contract.
Total mileage surveyed	4,849	19,653
Total cost	$ 323,054 13	$ 358,364 61
Average cost per mile	66 62	18 23

DESCRIPTIONS OF TOWNSHIPS.

Descriptions of the townships subdivided during the year have been compiled from the surveyors' reports and are given as appendix No. 51 of this report. The descriptions are in the order of township, range and meridian and are preceded by a list of the townships described.

A map accompanies this report which shows in different colours the surveys performed prior to March 31, 1908, the subdivision surveys between March 31, 1908 and March 31, 1909, and the resurveys during the same period.

ALLOWANCES AND REMUNERATION FOR SURVEYORS UNDER DAILY PAY.

In order to induce properly educated men to qualify as Dominion land surveyors, so that the Department would have no difficulty in securing the services of competent men to carry on the surveys according to the improved, accurate and scientific methods of the present day, an Order in Council was passed on April 6, 1908, increasing the rates of pay from $6.50 and $7.50 per day for ordinary and block outline surveys to $8 and $10 per day, respectively. The remuneration of Inspectors of Surveys who are employed continuously was set at $9 per day while in the field and $5 per day while engaged at office work. Allowances to surveyors engaged under daily pay were set by Order in Council of April 11, 1905. These allowances were intended only for surveyors in charge of full survey parties and were found insufficient when a surveyor was engaged on a survey where he was accompanied by an assistant only. To meet this case a living allowance of $2.50 per day each was granted to the surveyor and his assistant by Order in Council of October 16, 1908.

RATES FOR SUBDIVISION SURVEYS.

Previous to the spring of 1908 the rates for subdivision surveys had been fixed by several Orders in Council. For convenience of reference and to better define the different classes of work and thus remove causes for differences of opinion between contractors and the Department these several orders were consolidated by Order in Council of May 12, 1908. No change was made in the rates. The schedule of rates annexed to the Order in Council is as follows :—

Schedule of rates to be paid for township subdivision surveys of Dominion Lands executed under contract.

1. Section lines shall be paid for at the rate of three dollars and fifty cents per mile of line surveyed.

2. A further payment at the rate of fifty cents per chain up to ten chains in a section side, shall be made for opening, cutting and blazing the line through woods, windfalls, under-brush or heavy scrub.

3. Any opening, cutting and blazing of the line in excess of ten chains in a section side shall be paid for at the rate of twenty-five cents per chain. If the mileage charged for by the contractor for opening, cutting and blazing of lines exceeds that reported by the Inspector of Surveys, the contractor's account shall be reduced accordingly, the deduction being applied over the whole contract. No deduction, however, shall be made if the contractor's charge does not differ from the Inspector's by more than five per cent. If the lines are not sufficiently blazed a deduction may be made at such rate as the Inspector of Surveys recommends, but not exceeding two dollars per mile.

4. For the interpretation of Clauses 2 and 3, a section line shall mean the distance between two monuments at section corners or the places assigned to such corners, and this distance may include a road allowance.

5. No payment shall be made under the provisions of Clauses 2 and 3 where the line could have been measured without opening and cutting. A strict interpretation shall be given to these clauses and the field notes must show every opening of half a chain or more where no cutting was necessary in order to measure the line.

6. The part of a line chained across a marsh or other body of water, except on the ice, or measured across water by means of a triangulation, shall up to half a mile, be paid for as opening through woods when the body of water is surrounded by continuous woods. When such measurement exceeds a mile in length, one-half the distance shall be paid for as opening through woods. Distance measured by means of improper triangles shall not be paid for.

7. When the side of a section, exclusive of road allowance, is greater than ninety chains or smaller than seventy chains, the number of chains of opening or cutting which may be paid for at the rate of fifty cents per chain shall be increased or reduced in proportion to the length of the section side.

8. Only the lines actually run and marked in the field shall be paid for. Nothing shall be allowed for random and trial lines, bases of triangles and offsets. A single payment only shall be made for the north and south boundaries of townships, although they must always be run twice under the provisions of the Manual of Survey.

9. A further payment at the rate of three dollars per mile shall be made for section lines surveyed over rough or hilly country. A section side shall be classed as rough or hilly when the field notes show that it crosses a ravine not less than 100 feet deep or two ravines not less than fifty feet deep, or that the difference of level between two points of the line not more than half a mile apart exceeds 200 feet, the depths or heights being measured by aneroid barometer. In case the corner of the section falls in the ravine or on the side of the hill, payment shall be made for either of the adjoining sections but not for both.

10. A further payment at the rate of four dollars per mile may be made upon a report of the Inspector of Surveys, concurred in by the Surveyor General, stating that the survey presented unusual difficulties on account of large rivers flowing through

deep valleys with the surrounding country broken by gullies ; or on account of exceptional extensive and deep marshes. This payment shall not be made for difficulties other than those mentioned or for marshes which have been crossed on the ice. Payment, if made, shall be for the number of miles recommended in the Inspector's report.

11. A further payment at the rate of four dollars per mile shall be made for surveying the meridian outlines of a township when such outlines are included in a subdivision survey contract, but such payment shall not be made for resurveying or retracing lines previously surveyed.

12. Section lines resurveyed or retraced by direction of the Surveyor General, or under the provisions of the Manual of Survey, shall be paid for at the same rate as original section lines in the subdivision of a township, but no payment shall be made for the part of an outline chained under the provisions of the Manual of Survey for testing the chainage. Lines resurveyed or retraced without authority shall not be paid for. The fact that a line is obliterated or that a monument cannot be found shall not be deemed sufficient authority to resurvey or retrace the line.

13. A further payment at the rate of twenty-five cents per pit in prairie, and forty cents per pit in the woods, shall be made for erecting a boundary monument, such payment to cover the cost of planting and marking the post, building the mound and otherwise completing the monument. A witness trench shall be paid for as four pits. A stone mound shall be paid for as four pits in the woods. A long quarter section post planted in a marsh shall be paid for as two prairie pits.

14. Traverses of lakes and rivers and connecting traverses shall be paid for at the rate of eleven dollars per mile, for traverses of lakes and rivers, the distance to be paid for shall be measured along the bank of the lake or river from every point fixed by the survey in a straight line to the next point. Nothing shall be paid for offsets, but one dollar shall be deducted for every offset short of the number required by the Manual of Survey.

15. One dollar shall be paid for every statutory declaration of a settler.

16. A payment at such rate as the Surveyor General may allow, but not exceeding two dollars per mile of township outline or section line surveyed, may be made for the determination of the astronomical direction of the line of the survey.

17. The above allowances shall cover the cost of preparing the returns of the survey.

18. Iron posts used on the survey of Dominion lands will be supplied free of cost at Winnipeg and at every other place where they are kept in stock. Posts not used shall, if not returned to stores, be charged to the surveyor at forty cents each.

19. A deduction at the rate of six cents per cubic foot for deficiency in the size of the pits in excess of a foot and a half per pit shall be made from the payments to survey contractors. Further deductions at such rates as the Inspector of Surveys may recommend, shall be made for deficiencies in survey monuments, whether the deficiency be in the scattering of earth away from the pits, the marking or driving of the posts or in the general character of the monument. These deductions shall be averaged on the monuments examined by the Inspector and shall be applied to the whole contract, Should the total amount of the deductions calculated as above, exceed thirty per cent of the amount allowed for erecting the monuments, or should the Inspector report that the monuments are too unsatisfactory to be accepted, the contractor shall be required to repair and correct them according to the standard required by the Manual of Survey.

20. The lines embraced in any survey under contract must be surveyed by the surveyor in person ; no payment shall be made on such contract work if otherwise performed.

SUPPLEMENT TO THE MANUAL OF SURVEY.

In 1892 a fourth edition of the Manual of Instructions for the Survey of Dominion Lands was issued containing thirteen tables specially adapted to the survey of Dominion lands. The fifth and sixth editions issued in 1903 and 1905, respectively, contained only eight tables. The tables omitted were those seldom used and it was thought that when needed they could be referred to in the fourth edition.

The fourth edition having become scarce a reprint of the tables was necessary. The Manual proper, owing to the nature of its contents, has to be revised at frequent intervals and as no change is necessary in the tables it was considered advisable to publish them separately as a supplement. This has been done and the supplement in a convenient form has been issued to all Dominion land surveyors and to a few others closely connected with those surveys. It will not be necessary to publish the tables in future editions of the Manual proper.

The construction and use of the tables are fully explained in the supplement and are further elucidated by means of problems connected with the system of survey.

MANUAL OF SURVEY.

Some important changes have been made, since the issue of the sixth edition of the Manual in 1905, in the methods of survey and in the rates of remuneration for surveyors under daily pay. A booklet of amendments was issued in 1906 and a circular making a few further amendments was issued in 1908. The sixth edition of the Manual being almost exhausted, it is necessary to prepare another revision. Amendments and improvements have been introduced where necessary and the manuscript is now almost complete. It is expected that the new edition will be ready for distribution during the coming season.

THE BOUNDARY BETWEEN THE PROVINCE OF BRITISH COLUMBIA AND YUKON TERRITORY FROM TESLIN LAKE TO TATSHENSHINI RIVER.

The boundary between the province of British Columbia and Yukon Territory is defined by the Imperial British Columbia Act of 1866 (29 and 30 Victoria, Chapter 67) as being the sixtieth parallel of north latitude. For other boundaries of the same kind and particularly in marking the forty-ninth parallel between Canada and United States it was agreed that the term, 'parallel of latitude,' means a line passing through all points of the same astronomical latitude, and having between any two adjoining observed latitudes the curvature of the theoretic parallel.

In the year 1898, with the development of the country adjoining the boundary, questions of jurisdiction between the province and the Dominion arose and a demarcation of the boundary became imperative. In November of that year the Provincial Secretary and Minister of Mines, Victoria, B.C., addressed a communication to the Minister of the Interior, calling attention to the necessity of defining the northerly boundary of British Columbia, more particularly of that portion of country situated between the Pacific coast and Teslin lake, and asking the co-operation of the Dominion Government in order to have this boundary line established. The Minister of the Interior directed that the work of defining the boundary should be proceeded with at once, and this was done without the assistance of the province. It is expected, however, that the Provincial Government will adopt the boundary as established by the Dominion officers.

The boundary has been surveyed from Teslin lake to the west crossing of Tatshenshini river, a distance of one hundred and sixty-five miles. Sixteen points on the boundary were established from astronomical observations for latitude on the sixtieth parallel and these points were joined in adjacent pairs by arcs having the curvature of the theoretic parallel; one hundred and fifty additional monuments were established thereon.

From Teslin lake to Takhini river, eleven points were established by G. White-Fraser, D.T.S., in 1899 and 1900, by astronomical observations for latitude with a twelve-inch altazimuth instrument, with two micrometer microscopes reading to one second of arc. The probable error in latitude of any of these points is about twenty feet.

From Takhini river to Tatshenshini river five points were established by J. N. Wallace, D.L.S., in 1907 and 1908, by astronomical observations for latitude with a Troughton and Sims zenith telescope, of twenty-eight-inch focal length, Talcott's method for observing latitude being employed. The probable error in latitude of any of these five points is from six to ten feet.

The intermediate monuments from Teslin lake to Takhini river were established by A. Saint Cyr, D.L.S., in 1899, 1900 and 1901; and those from Takhini river to Tatshenshini river by J. N. Wallace, D.L.S., in 1907 and 1908.

The method employed in establishing the intermediate monuments between stations fixed by astronomical observations is as follows:—Each latitude station was joined to the next one by a line having the curvature of the theoretic parallel at sixty degrees of north latitude, by running, as a trial line, a series of tangents to the prime vertical circles passing through the initial latitude station, and the offsets to the sixtieth parallel were calculated according to the formula:

$$\text{Offset (to parallel from tangent)} = \frac{D^2 \text{ Sin } \varphi}{2N \text{ Cos } \varphi}$$

or log of offset (in chains) = 2 log D + log C, where D is the distance in chains measured from the points of tangency of the trail line with the assumed, or theoretic parallel passing through the initial astronomical station, and C is a constant whose logarithm is $\bar{6}\cdot4352819$.

In closing on an astronomical station the residual offset due to difference in station error of the two latitude stations was distributed proportionately at all the monuments.

Linear measurements along the trial line were made by Mr. Saint Cyr with a Lugeol micrometer, and by Mr. Wallace by triangulation with chained bases.

The monuments consist of an iron post, three feet long and three-quarters of an inch in diameter, driven flush with the ground. This iron post defines the boundary. Its position is shown by a wooden post planted beside it, standing, as a rule, about four and one-half feet out of the ground, and surrounded by a circular cairn of stones, or an earth mound, about seven feet in diameter and four feet high. In some cases, owing to the nature of the ground or for other reasons, the iron post was omitted, and the wooden post defines the boundary. A complete description of each monument was recorded by the surveyor and is shown on the plan of the boundary.

Between monument 118 (station L) on Takhini river, and station T, on Hendon river, a distance of nine miles, no monuments were established, owing to the roughness of this part of the country, over which it was impracticable to run the boundary line.

The wooden posts are marked with the letters B. C. (signifying British Columbia) on the south side, and Y. (signifying Yukon) on the north side. The posts are not numbered on the ground, although a system of consecutive numbers has been adopted to designate the monuments, beginning with No. 1 at Teslin lake and ending with No. 166 at the west crossing of Tatshenshini river. It is the intention to have them numbered on the ground according to this system in the near future.

The monuments have been established where the boundary intersects the most important lakes, rivers and valleys, such as Teslin lake, Narrows lake, Happy valley, Atlin lake, Taku arm, Windy arm, Bennett lake, Munroe lake, Partridge lake, Primrose river, Takhini river, Hendon river, Kusawa river, Blanchard river, and Tatshenshini river, and also at intermediate points wherever practicable, the distance between the monuments averaging about one mile. In many places ranges of high mountains have been crossed, the highest point of the boundary line being on Mt. Nevin (elevation 7,259 feet).

A plan of the boundary between the province of British Columbia and Yukon Territory at a scale of one mile to an inch is published in connection with this report. The plan shows the boundary as surveyed from Teslin lake to Tatshenshini river. The monuments are shown by square black marks and the nature of each monument indicated thus: I.P., W.P.M., signifying iron post together with a wooden post and mound. The monuments established by astronomical observations for latitude are distinguished by letters, in addition to their numbers. The distances between the monuments are shown in chains and decimals. The bearings of the lines joining adjacent monuments are shown to the nearest second, and are referred to the meridian passing through each monument. The topography is shown in the immediate vicinity of the boundary line. Elevations are shown in feet above sea level.

Detailed information regarding the several seasons' surveys, the nature of the country, climate and other miscellaneous data may be found in the reports of G. White-Fraser, D.T.S., and A. Saint Cyr, D.L.S. (Reports of the Department of the Interior, 1900, 1901, 1902), and the reports of J. N. Wallace, D.L.S., for 1907 and 1908 (Reports of the Topographical Surveys Branch, 1907-8 and 1908-9). A few of the photographs taken by the surveyors while working on the boundary accompany this report.

CORRESPONDENCE.

The correspondence consisted of :

Letters received	10,592
Letters sent	13,987

ACCOUNTS.

The accountant's record shows :

Number of accounts dealt with	703
Amount of accounts	$892,231
Number of cheques forwarded	3,622

OFFICE STAFF.

The office staff of the Topographical Surveys Branch at Ottawa consists of one hundred and sixty-eight employees. A list of the staff is given as appendix No. 10. There are at present seventeen vacancies, sixteen in the chief draughtsman's office and one in the geographer's office.

Many changes took place again during the past year in the personnel of the staff.

The following resigned from the staff of the chief draughtsman's office:—

Messrs. J. R. Akins, W. B. Bucknill, P. A. Carson, T. A. Davies, H. S. Day, F. H. Maynard, J. E. Morrier, A. G. Stewart, C. H. Taggart and M. B. Weekes. Messrs. A. S. Cram and C. H. Wilding were transferred to the Land Patents Branch, Messrs. G. A. Grey, J. B. Hutton and S. H. Shore to the Registration Branch and Mr. G. A. Gaudry to the Railway Lands Branch.

Messrs. G. B. Dodge, F. H. Kitto and D. F. Robertson were absent part of the time on surveys in the field.

The following new members were appointed:—Messrs. W. B. Bucknill, M. B. Bonnell, J. P. Cordukes, A. d'Orsonnens, E. J. Ebbs, A. H. Flindt, A. M. Grant, K. D. Harris, J. B. Milliken, J. P. MacMillan, B. E. Norrish, H. Osmond, W. J. Peaker, S. H. Shore, R. S. Stronach and L. N. Wadlin. Mr. H. F. Hayward returned to the staff from the Timber, Grazing and Irrigation Branch where he had been working temporarily.

Mr. W. G. Addison was added to the correspondence staff and Miss M. F. Percival was transferred to the Registration Branch.

Three new members were appointed to the staff of the geographer's office, viz., Messrs. E. D. Bryant and Thos. Grindlay and Miss M. Stewart. Mr. C G. Wood died; he had been attached to the staff for five years.

Mr. E. E. Bryce was transferred from the Land Patents Branch to the survey records office. Mr. Mudie of this office resigned.

Mr. H. N. Topley of the photographic office has been transferred.

Messrs. E. B. Burnett and P. Kane were appointed to the lithographic office. Mr. H. G. Grant was employed temporarily for three months during the year.

CHIEF DRAUGHTSMAN'S OFFICE.

(P. B. Symes.)

The changes made by the Civil Service Amendment Act of last year have affected this office to a very great extent. For twenty-five years previous to September 1 last all the draughtsmen had been 'temporary employees' with the single exception of the chief draughtsman, although a number of them spent many years in the office. Many, however, remained a very short time and changes were so frequent that it was a continual problem how to arrange the work to the best advantage. The staff being now included in the permanent organization of the service and their remuneration being adequate it is anticipated that changes will in future be few, and this will no doubt tend towards securing a more competent staff, experience in the office itself being of great importance in a branch like this, where the business differs considerably from that in any other office.

The greater permanence of the staff has already shown results in increased efficiency, the routine of the office running more smoothly and more work being turned out without any increase in the number of draughtsmen which is the same as a year ago. This does not mean that we have sufficient help for keeping up with our requirements; in fact we need a considerable increase, being at present sixteen short of the number estimated as necessary and authorized by Order in Council. We are doing the most pressing work but there is much that ought to be done.

The tendency noted in the last report to occupy much of the time of the draughtsmen in correspondence still continues, about six thousand five hundred letters having been drafted in this part of the branch during the year.

The assistant chief draughtsman superintends the preparation of the instructions for surveyors as to the field work allotted to them and this occupies a large part of his time. The instructions vary with every case and often involve a considerable amount of study and research to provide the necessary information to arrange that the work needed in a certain locality shall be done if possible while a surveyor is in the neighbourhood and to avoid overlapping in the distribution of the field work. On the whole, our system seems to be successful; it is very seldom that any misunderstanding arises with reference to the instructions and very seldom that any surveyor has to complain of any incompleteness or mistake in getting them out.

Reports below from the heads of the different divisions give details as to operations carried on in each in the last twelve months.

DRAUGHTING OFFICE—FIRST DIVISION—INSTRUCTIONS AND GENERAL INFORMATION.

(T. E. Brown.)

Owing to the augmentation of the work in this division the staff has been increased from nineteen to twenty-one employees.

Two employees are engaged in preparing instructions to the surveyors in charge of parties in the field. Instructions were drafted for one hundred and twenty-four survey parties. Before instructions for any particular survey can be intelligently compiled, it is necessary to collect all available information as to Dominion land, Indian reserve or other surveys already made in the vicinity; this takes the time of five employees. Nineteen hundred and one sketches and 334 maps and tracings were made to accompany the instructions.

The various office registers, in which a record is kept of the surveys performed each year by each surveyor, and of the progress of each surveyor's work in the field take the whole time of two men. It is very important that these records be carefully and accurately kept, as a slight error might entail difficulties and serious losses to the surveyors as well as errors in the township and other plans compiled in the office. Thirteen hundred and eight progress sketches were received from surveyors in the field, also 673 books of field notes of township surveys, 77 books and 503 plans of miscellaneous surveys, 276 timber reports, 436 statutory declarations of settlers and 11 sheets of observations for magnetic declination. Returns of the surveys of 300 separate blocks of timber berths were also received.

After complete examination 615 books of field notes were placed on record, together with 429 notes and plans of miscellaneous surveys and 436 statutory declarations.

Plans of 609 townships and 14 settlements or townsites, and 48 sectional maps were received from the lithographic office, posted in the registers and distributed.

Preliminary plans were issued for 416 townships, four copies of each being furnished. Two members of the staff are occupied a considerable part of the time in preparing these plans; the remainder of their time is devoted to preparing sketches for instructions.

One employee deals with communications from settlers and others on miscellaneous subjects, answers inquiries from other branches of the Department and prepares descriptions of parcels of land for the purpose of transfers and patents. The number of communications in this connection was 1,270, involving the preparation of 329 sketches, 38 maps and tracings and 463 pages of copies of field notes.

A set of sectional maps on a scale of three miles to the inch is being prepared, showing the closings of township surveys. These maps illustrate in a convenient form all discrepancies in the surveys and enable the officials when drafting instructions to point out to the surveyors irregularities they may expect to find in the surveys on the ground. Two employees have been engaged the whole year on these maps, twenty-three of which have been completed.

A general report of survey operations from 1869 to 1889 was published in the annual report of the Department of the Interior for 1891. Two members of the staff are now working on a similar report embracing operations up to the present time. The need of such data for reference has been felt for a long time, but, owing to the pressure of other work, its compilation has been deferred from year to year. It is hoped to have it ready for publication in the next annual report of this branch.

It is expected that there will be ready for publication in the same report a short history of photo-topographical survey operations in the Rocky mountains from their inception up to the present. Two other members of this division have this work now in hand. There is at present no comprehensive description of these operations, hence it is expected that this compilation will prove a valuable aid in the office as a reference, and will be of value to persons interested in photographic surveying.

Considerable work is involved in the collection of data for the annual reports of the Branch. Descriptions of the townships surveyed have to be compiled from the field notes. The reports of the surveyors on their operations for the season have to be examined and put in shape for publication. The employee who is editing the annual report devotes the whole of his time to it.

The storage vault for the branch is in charge of another member of the first division. The work of keeping in order the thousands of documents stored there keeps him busily occupied most of the time. In addition, he attends to the distribution of stationery, drawing instruments, &c., to the officials of the Branch.

The Manual of Instructions for the Survey of Dominion Lands was revised in this division. This revision has already been mentioned. The Supplement to the Manual of Surveys was also prepared and proofread in this division.

Four thousand and ninety draft letters and memoranda were written during the year.

DRAUGHTING OFFICE—SECOND DIVISION—EXAMINATION OF SURVEYORS' RETURNS.

(T. S. Nash.)

In this division all returns of surveys of Dominion lands in the provinces of Manitoba, Saskatchewan and Alberta are examined and the plans of the surveys are compiled. The reports of the inspectors of contract surveys are examined; the contractors are notified of any discrepancies and they are given the opportunity to make the necessary corrections on the ground. These reports are used in finally accepting the work and in making up the accounts for surveys performed under contract.

The progress sketches which show the progress of the work in the field and upon which advances to the contractors are made are examined to see that all the work closes within the limits required by the Manual and that all areas made fractional by water are shown. During the past year, 1,166 of these sketches were examined including 360 sketches from inspectors.

Upon being received the final returns are first given a cursory examination, the purpose of which is to detect any serious omissions or discrepancies and if necessary, they are returned to the surveyor for correction. After this the returns of all previous surveys in the township, townsite, or settlement are collected and the compiling of the plan is proceeded with. During the year, 478 subdivision surveys, 370 outline surveys, and 63 miscellaneous surveys were examined and the compiled plans of 591 townships were sent to the draughtsmen. This number included first edition plans of 331 townships which shows the rapid rate at which the country is being opened up. Compiled plans of 13 miscellaneous surveys were also sent to be drafted. While the compiling is being carried on a very careful examination is made of the returns of the new survey and a memorandum of any discrepancies or omissions is sent to the surveyor. During the year 525 such memoranda were sent, 486 answers to memoranda were received and the necessary corrections made in the returns, and 1,240 letters in connection with the work were drafted.

This division also examined plans of 280 road diversions made by the provincial governments of Saskatchewan and Alberta, 76 plans of right-of-way of railways, and plans of survey of 74 timber berths.

DRAUGHTING OFFICE—THIRD DIVISION—DRAWING FOR REPRODUCTION.

(C. Engler.)

The staff of this division is smaller than for two or three years past. The nominal strength is thirteen since September 1 last when the employees were admitted into the service on a permanent footing, as compared with fourteen a year ago, and fifteen the year previous. Since September 1, however, one has been permanently transferred and two temporarily employed in another Branch of the Department, one for over a month, the other for nearly three months; at the time of writing the latter is still there. It is needless to add that under these circumstances it is somewhat difficult to keep up with the work of the division.

Owing to the increased demand for space in the building at the corner of Metcalfe and Slater streets it was deemed advisable to move one of the divisions to the Imperial building on Queen street. As the work of this division is for the most part that of preparing plans for printing and consequently does not involve frequent reference to original plans, field notes and files of correspondence, it was thought that this division could be best separated from the others and it was accordingly moved to its present quarters. They are large and well lighted, facts which offset to some extent the disadvantage of being at a distance from the Metcalfe street building.

As said above, the principal work of the division consists in preparing plans for printing. These plans are compiled in the second and fourth divisions. In their compilation the main object is accuracy as to data; no special effort is made to form well made figures or letters, in fact the data are usually put on the plans in ordinary handwriting. In the third division these plans are copied, care being taken to make a neat, well arranged plan with all letters and figures carefully made. At present almost all the letters and figures are stamped on the plans in type, thus securing uniformity.

In 1906 a Pilot printing press 6 x 10½ inches inside chase measurement was purchased in order to print titles, footnotes, &c. When the use of a printing press was first suggested for this work it was feared that it might not prove satisfactory; so in order not to have too large an outlay on what seemed a somewhat doubtful venture, the smallest and least expensive press was purchased. Two years' trial proved the press to be very useful and the results fully justified the expenditure, but it has been found to be scarcely large enough for some of the work required. The small press was therefore returned to the makers in part payment for a larger and better one 10 x 15 inches inside chase measurement. An expert printer is in charge; he also looks after all the type, ink, &c., used in connection with stamping plans. He has been kept so busy of late that a 'printer's devil' will doubtless be his next requirement.

Another improvement in the office equipment consists in a larger and better tracing frame. It may be explained that a tracing frame is simply a device to enable the draughtsman to trace out on a blank sheet of paper any plan or drawing to be copied. The credit of designing the new tracing frame belongs largely to Mr. J. E. May. In the frame formerly in use sunlight was reflected so as to pass through the plan and make the lines visible to the draughtsman. There were two objections to this: the frame could not be used to advantage when the day was dark and clouded, and it had to be placed near a window in the best light which, of course, left less good light for the ordinary work of the draughtsmen. The present frame is lighted by a series of six electric lights placed below a sheet of plate glass. Provision is made for ventilating the space around these lights so as not to heat the glass. A hood of black cloth shuts out all light from the room and renders the artificial light more effective. Two slits along the edges of the frame make it possible to trace the largest plan by simply sliding the plan through them and rolling it up as it is traced.

During the year, 612 plans of townships have been prepared for printing, together with 167 plans and drawings of a miscellaneous nature. As indicated in the annual report of 1908 the miscellaneous plans and drawings are of great variety. A mere statement of their number gives no idea of the amount of work involved in their production.

With a view to ascertaining the cost of publication of township plans a statement of the actual time spent in preparing each township plan has been kept. This practice has been followed for about five years. Occasionally the cost of publishing plans of other descriptions has been called for and therefore a statement is now being kept of the time spent in preparing all plans and drawings.

DRAUGHTING OFFICE—FOURTH DIVISION—BRITISH COLUMBIA SURVEYS.

(E. L. Rowan-Legg.)

The staff of this division has been engaged in the examination of the returns of subdivision surveys, of mineral claims, of railway rights-of-way and of timber berths in the railway belt. Township and townsite plans for the British Columbia surveys are compiled and the fair copies of such plans for reproduction by photo-zincography are compared. Instructions for surveys, together with sketches and other information for the use of surveyors in the field are prepared. Replies are made to requests for information, which frequently involves the preparation of sketches and long searches for data. Preliminary plans, which allow of lands being opened for entry previous to the issue of the official plan, are prepared for lands subdivided in the railway belt.

A large number of the returns of survey of timber berths in the railway belt were examined. The work of this division has been greatly increased, not only by the examination of these returns, which heretofore was made in another branch of this Department, but also by the drafting of letters and memoranda in connection therewith.

Discrepancies having been discovered in some of the old surveys in the vicinity of Kamloops lake, the compiling of the plans of several townships, which were urgently needed, could not be proceeded with until check surveys had been made to locate the cause of the discrepancies. As soon as possible, after the completion of these surveys, the plans were compiled and copies issued.

A resurvey of the townsite of Hope was made by Mr. A. W. Johnson, D.L.S., in 1906, and a plan of the same was then commenced in this office, but could not be completed because it was found that some further surveys and corrections would be required. These were made by Mr. Johnson last year, and the plan was finished and copies were issued in January of this year.

On account of the rough character of the country in the railway belt a survey of the whole of any township is not proceeded with at one time, but section, or quarter section lines are surveyed to govern lands for which there are, or may be applications. All additional surveys which have been made since the issue of the first edition of the township plan are added to the original compiled plan, and copies are issued as a second, third or fourth edition corrected as the case may be.

The work of compiling plans of townships in the railway belt has been much complicated by having to show on them the lands which were disposed of by the Provincial Government, and which, therefore, did not form part of those transferred to the Dominion. As the boundaries of these lands do not coincide with section lines of the Dominion lands system of survey they have to be accurately plotted on the plan so as to allow of the areas of fractional legal subdivisions of adjoining Dominion lands being shown. This adds greatly to the time spent in the work of compiling.

DRAUGHTING OFFICE—FIFTH DIVISION—MAPPING.

(J. Smith.)

The principal occupation of the fifth division is the interminable work of keeping the sectional maps up to date. These maps cover the surveyed area of the fertile belt of the northwest provinces from Lake of the Woods to the Rocky mountains and also the railway belt in British Columbia. Each sheet covers eight townships from south to north and an average of fourteen townships from east to west, thus comprising about one hundred and twelve townships or a little over four thousand square miles or two million five hundred and sixty thousand acres.

Up to the present time seventy-six sheets have been published and the number will be increased as the surveys are extended. No new sheets have been published during the past year but forty-six have been revised, thirty-four of these have been reprinted and the remainder are in the printers' hands and will be issued before long. Apart from the actual drawing and tracing of the sectional maps, a very considerable part of the work is the obtaining of the information required in revising. During the past year eight hundred and fifty-three plans of surveyed trails were obtained from the record office and examined for information, one hundred and fifty-five field books of township and other surveys were also obtained from the record office and used in compiling, besides two hundred and sixty-eight field books which had not yet been placed on record. The positions of four hundred and twenty-seven post-offices were ascertained through the Post Office Department, and a large amount of information about new railways and other items had to be collected.

In connection with the Yukon surveys the number of returns received is more than double that of last year, and a more rigid scrutiny of the surveyors' returns has caused a great increase in the correspondence and in the office work generally.

The miscellaneous drawings made by the fifth division consist of a plan of the mouth of Klondike and Bonanza rivers showing the complication of surveys at that point, a small plan of a ford across the Athabaska river, a copy of W. Thibaudeau's plans and profiles of water-powers on the Winnipeg river, a plan of the electoral districts of Yukon Territory, plans of the first system of surveys near Prince Albert and the fifth system near Port Moody, a map of the boundary between the province of British Columbia and Yukon Territory from Teslin lake to Tatshenshini river, and a plan defining the foot of the eastern slope of the Rocky mountains from the international boundary to Peace river. The search for definite information on this last subject and a report thereon entailed the examination of one hundred and five field books besides a large amount of other literature.

One draughtsman resigned his position since the last report but two others were appointed to the staff which now numbers eleven.

DRAUGHTING OFFICE—SIXTH DIVISION—SCIENTIFIC AND TOPOGRAPHICAL WORK.

(G. Blanchard Dodge.)

This division was formed during the year and is to consist of thirteen employees. The duties of the division will be the control and supervision of the scientific and topographical part of the surveys.

Almost from the inception of the surveys it has been realized that valuable topographical and scientific information could easily be obtained at a small extra cost by the surveyors who are subdividing Dominion lands. A few attempts were made to collect such information but from motives of economy they were soon discontinued, the work of the surveyors being strictly limited to what was necessary for the purposes of settlement. The value of such information being now better appreciated by the public, the surveys are being made somewhat more elaborate.

As a beginning, surveyors of base lines are now taking levels along the lines. These will be ultimately connected and will form the basis for maps showing the relief of the country. A knowledge of this relief is of the utmost importance in questions of irrigation or drainage, construction of roads, railways or canals, for the classification of agricultural lands and many other purposes.

The field notes of the surveyors contain much topographical information which has never been plotted because the office staff was insufficient ; this work will now be taken up and put in shape for publication.

Although the lines of the Dominion Lands System of survey are established upon astronomical bearings, the compass is very useful in exploratory surveys and for work of a like character. Considerable information is gathered by surveyors regarding the declination, inclination and intensity, but the observations have to be co-ordinated and properly recorded. Improvements in the instruments supplied to surveyors will greatly add to the value of the observations.

The preparation of the astronomical field tables and diagrams and the calculations incidental to the business of the topographical surveys have now assumed such proportions that a special staff of mathematical experts has become a necessity. Work of this character will all be done in this division.

SURVEY RECORDS OFFICE.

(C. J. Steers.)

The rapid increase in the routine work of the office has made it very difficult to get the time needed for readjustment of indexes and general supervision. During the months of the year when work was not so pressing some progress was made on the new loose leaf indexes. The portions being entered first are those which experience has shown most required adjustment.

A new index for field notes of township surveys has also been started and is being worked at as time is available. This index is made necessary as the old one is very congested owing to the smallness of its scale and the increasing numbers of field books affecting many of the townships.

A large portion of one man's time has been taken up supplying information for the sub-agents, chiefly in preparing for them skeleton maps of sub-agencies on a large scale showing the lands disposed of.

The increase in the number of printed and preliminary plans has been so great that it has been found necessary to divide up the work of sending them out ; one person now attends to the printed plans and letters, while another has charge of the preliminary plans and letters accompanying them.

A list is now kept of plans asked for which are out of print, so that these plans may be sent to the parties desiring them as soon as the reprints are received.

PHOTOGRAPHIC OFFICE—*(Process Work).*

(H. K. Carruthers.)

After the clean copy of a plan has been completed it is handed over to the process photographer for reproduction. The plan is photographed on a wet plate and then printed on a zinc plate. From the zinc, the plan is transferred either to stone or to another zinc plate, according as it is to be printed on the flat bed or rotary offset press.

A new copying camera has been installed ; it takes plates from 4 x 5 inches to 24 x 34 inches, while the largest size with the old camera was 17 x 20 inches. A great advantage of the new camera is that it is provided with very complete means of adjustment; this will improve, not only the quality of the work but its accuracy.

Corrections to plans have hitherto been made mostly on the lithographic stones or zinc plates; they are now being made as much as possible on the negatives, before printing on zinc. It is found that the corrections are not only more easily made on the negatives, but the work is also finer. The only extra trouble is the striking of a proof from the negative on plue print paper.

The number of negatives made was about 200 in excess of last year.

PHOTOGRAPHIC OFFICE—*(General Work).*

(John Woodruff.)

During dark days in winter some difficulty has been experienced in handling the large number of silver prints which we were called upon to furnish. To expedite printing, an aristo-electric lamp and cabinet have been procured. The cabinet is revolving; it holds forty 5 x 7-inch frames and twelve 11 x 14-inch frames. In the centre is a powerful arc lamp. The apparatus is a great convenience and there is no longer any delay in printing.

A dry mounting press has been purchased. With it photographs can be mounted on the thinnest mounts without curling. The improvement is particularly manifest in the case of large photographs.

A considerable part of the chief photographer's time is taken by the work of the Immigration Branch. In this connection, he made two trips during the summer, one to the Niagara district for photographing farms and orchards, and one to the Ontario oil fields for photographing oil wells and plants. He secured a large collection of fine views. He also attended the Tercentenary celebration at Quebec and secured views of the most interesting events.

LITHOGRAPHIC OFFICE.

(A. Moody.)

The rotary offset press mentioned in the annual report for 1907-8 has been installed and is now in operation. It has given some trouble, but it is expected that all the difficulties will soon be overcome and that it will be turning out fine work. It is a fast press and particularly useful in printing large editions.

The machine for graining zinc plates set up at the same time as the rotary press is proving quite satisfactory. By using zinc instead of lithographic stones, plans or maps can be kept on the plates for new issues, the plates being easily stored away. If the plans or maps were on stone, they would have to be cleared away after printing.

A lithographic artist has been added to the staff; when not engaged in preparing lithographic stones or plates, he helps in spotting and making corrections on negatives.

Part of the plant is in the building at the corner of Metcalfe and Slater streets, the other part being in the Imperial building. This division is very inconvenient ; moreover, the places are too small and too crowded for working to advantage.

GEOGRAPHIC BOARD.

(A. H. Whitcher.)

The seventh report of the Geographic Board of Canada, being a consolidation of the decisions published in previous reports and bulletins to June 30, 1908, was published and distributed. In addition to the large number issued in 'blue-book' form with other sessional papers of the Government, the Board receives 800 copies which are sent to Dominion and Provincial officials, colleges, school inspectors and libraries, also to geographical societies and map publishers in Canada and elsewhere, and the bulletins containing the decisions published in the *Canada Gazette* are distributed from time to time in like manner.

The regular monthly meetings of the Board have been well attended and special meetings have been held during the year.

Mr. Whitcher, who is a member of the Board and its secretary, has also continued the special work assigned to him as a member of the staff of the Topographical Surveys Branch.

BOARD OF EXAMINERS FOR DOMINION LAND SURVEYORS.

(F. D. Henderson.)

Three meetings of the Board of Examiners were held during the year. The first was a special meeting lasting from May 2 to May 28, 1908, during which examinations were held at Ottawa, Toronto and Calgary. The second one was a special meeting held on July 28, 1908. The third one was the regular annual meeting which began on the second Monday in February, 1909 (February 8), as provided by the Dominion Lands Surveys Act, section 9, and lasted until March 26, 1909. During this meeting examinations were held at Ottawa, Halifax, Toronto, Winnipeg, Calgary, Edmonton and Vancouver.

At the two examinations (May, 1908, and February, 1909), eighty-eight candidates passed the preliminary examination, thus becoming eligible to serve as articled pupils, twenty-seven candidates passed the final examination for commission as Dominion land surveyor, and one candidate passed the examination for certificate as Dominion topographical surveyor. The names of the successful candidates are as follows :—

PRELIMINARY EXAMINATION.

Barnes, F. M., St. John, N.B.
Banting, E. W., Toronto, Ont.
Beale, A. M., Ottawa, Ont.
Bennett, G. A., Eden, Ont.
Beresford, H. E., Grandview, Man.
Berry, E. W., Seaforth, Ont.
Bidouze, P., Edmonton, Alberta.
Blanchet, G. H., Ottawa, Ont.
Boulton, W. J., Wallaceburg, Ont.
Bowman, H. D., London, Ont.
Brown, E. C., Grenfell, Sask.
Buchanan, J. A., Comber, Ont.
Calder, J. A., Ashcroft, B.C.
Cameron, A., Ottawa, Ont.
Cannell, H. W., Ottawa, Ont.
Casey, J. M., Ottawa, Ont.
Churchill, H. W., Westport, N.S.
Cline, C. G., East Aurora, N.Y.
Colter, A. A., Keswick, N.B.
Dann, E. M., London, Ont.
Dawson, F. J. Truro, N.S.
de la Condamine, C., High River, Alta.
Donnelly, C., Winnipeg, Man.
Duff, M. O'R., Hamilton, Ont.
Elder, P. M., Ottawa, Ont.
Evans, S. L., Corinth, Ont.
Ewart, D. M., Ottawa, Ont.
Fletcher, J. A., Fletcher, Ont.
Glover, A. E., Beaverton, Ont.
Graham, D. A., Toronto, Ont.
Gray, J. E., Uxbridge, Ont.
Hamilton, C. T. Fort William, Ont.
Harvey, D. W., London, Ont.
Higgins, C. J., Vancouver, B.C.
Hobbs, W. E., Winnipeg, Man.
Huffman, K., Toronto, Ont.
Jackson, W., Toronto, Ont.
Johnson, R. H., Toronto, Ont.
Johnston, H. F., Toronto, Ont.
Jost, L. G., Guysborough, N.S.
Lloyd, N. C. A., Schomberg, Ont.
Loucks, R. W. E., Delisle, Sask.
Macdonald, G. A., Muirkirk, Ont.
Manny, D. E., Beauharnois, P.Q.
Martindale, E. S., Kingsmill, Ont.
Martin, W. H., St. Thomas, Ont.

Martyn, O. W., Mitchell, Ont.
Meader, C. H., Toronto, Ont.
Mitchell, A. B., Toronto, Ont.
Munro, F. V., Chatham, Ont.
Murdock, C. R., Toronto, Ont.
McCusker, K. F., St. Louis de Gonzague, P.Q.
McGarry, P. J., Merritton, Ont.
McKenzie, M., Lake Megantic, P.Q.
McLean, D. L., Ottawa, Ont.
McMaster, W. A. A., Palmerston, Ont.
McRoberts, A. A., Pontypool, Ont.
Narraway, A. N., Ottawa, Ont.
Neelands, R., Hamiota, Man.
Neville, E. A., Toronto, Ont.
Patterson, E. B., Toronto, Ont.
Peckover, H. J., Toronto, Ont.
Peters, F. H., Ottawa, Ont.
Pounder, J. A., Toronto, Ont.
Purser, R. C., Windsor, Ont.
Ransom, J. T., Toronto, Ont.
Redfern, C. R., Toronto, Ont.
Ritson, C. W., Edmonton, Alberta.
Robertson, E. D., Ottawa, Ont.
Robinson, W. A., Winnipeg, Man.
Roe, B. J., Ottawa, Ont.
Seibert, F. V., Southampton, Ont.
Sharpe, G. P., Agassiz, B.C.
Soars, N., Edmonton, Alberta.
Stewart, N. C., Nelson, B.C.
Stirrett, G. P., Petrolia, Ont.
Tate, H. W., Wimbledon, Eng.
Tremblay, A. J., Edmonton, Alberta.
Theriault, L. L., Fredericton, N.B.
Underwood, J. A., Lakelet, Ont.
Van Skiver, L. A., Fish Lake, Ont.
Walcott, W. H., Montreal, P.Q.
Walker, C. M., Guelph, Ont.
Warren, J. S., Strathcona, Alberta.
Waugh, B. W., Chicago, Ill.
Wilson, W. S., Sault Ste. Marie, Ont.
Wing, D. O., Berlin, Ont.

FINAL EXAMINATION.

Ashton, A. W., Ottawa, Ont.
Baker, M. H., St. Thomas, Ont.
Campbell, A. J., Toronto, Ont.
Campbell, A. S., Kingston, Ont.
Chilver, H. L., Walkerville, Ont.
Christie, U. W., Ottawa, Ont.
Clunn, T. H. G., Ottawa, Ont.
Cochrane, M. F., Ottawa, Ont.
Cumming, A. L., Ottawa, Ont.
Cummings, A., Fernie, B.C.

Dennis, E. M., Ottawa, Ont.
Dodge, G. B., Ottawa, Ont.
Johnson, P. N., Edmonton, Alberta.
Lang, J. L., Toronto, Ont.
McCallum, G. H., Ottawa, Ont.
McCaw, R. D., Welland, Ont.
McFarlane, J. B., Toronto, Ont.
Rannie, J. L., Ottawa, Ont.
Rice, F. W., Ottawa, Ont.
Rolfson, O., Walkerville, Ont.
Scott, W. A., Galt, Ont.
Summers, G. F., Winchester, Ont.
Sykes, F. H., Toronto, Ont.
Tremblay, A., Quebec, P.Q.
Westland, C. R., Ottawa, Ont.
Williams, G. L., Vancouver, B.C.
Wilson, N. D., Toronto, Ont.

D. T. S. EXAMINATION.

McColl, G. B., Winnipeg, Man.

Oaths of office and allegiance and bonds for the sum of one thousand dollars each, as required by section 25 of the Dominion Lands Surveys Act, were received from twenty-five candidates who had previously passed the examination for commission as Dominion land surveyor.

Twenty-three commissions as Dominion land surveyors were issued, as follows:—

Ashton, A. W., Ottawa, Ont.
Baker, M. H., St. Thomas, Ont.
Campbell, A. S., Kingston, Ont.
Christie, U. W., Chesley, Ont.
Clunn, T. H. G., Ottawa, Ont.
Cochrane, M. F., Ottawa, Ont.
Dodge, G. B., Ottawa, Ont.
Lang, J. L., Toronto, Ont.
McAuslan, H. J., Euphrasia, Ont.
McCaw, R. B., Welland, Ont.
McFarlane, J. B., Toronto, Ont.
Mitchell, B. F., Hamilton, Ont.
Rannie, J. L., Ottawa, Ont.
Rinfret, C., St. Stanislas, P.Q.
Robinson, E. W. P., Victoria, B.C.
Rolfson, O., Walkerville, Ont.
Scott, W. A., Galt, Ont.
Soars, H. M. R., Edmonton, Alberta.
Steele, I. J., Ottawa, Ont.
Stewart, A. S., Edmonton, Alberta.
Sykes, F. H., Toronto, Ont.
Williams, G. L., Vancouver, B.C.
Wilson, N. D., Toronto, Ont.

A certificate as Dominion topographical surveyor was issued to G. B. McColl, D.L.S., Winnipeg, Manitoba.

Every Dominion land surveyor is required to have in his possession a subsidiary standard of length (D.L.S. Act. section 35). Eighteen such standards were issued by the Secretary, and one surveyor reported that he had secured a standard from the estate of a deceased surveyor. A list of surveyors who have been furnished with standard measures up to March 31, 1909, will be found in Appendix No. 11.

The correspondence of the Board was as follows:—

Letters received	1,717
Letters sent	1,196

Circular letters, pamphlets and parcels sent, 600 (approx).

The questions put at the examination in February, 1909, are submitted as Appendix No. 12.

At the special meeting in May, 1908, 62 candidates presented themselves for the full preliminary examination, 15 for the limited, 18 for the final, and 1 for the examination for certificate as Dominion topographical surveyor. The affidavits and certificates of the final candidates were examined and the answers of all the candidates were read.

The meeting of July 28 dealt with a communication to the Board relative to a survey in the Yukon Territory.

At the regular meeting in February, 1909, 126 candidates presented themselves for the full preliminary examination, 21 for the limited preliminary, 34 for the final, and 2 for the D.T.S. The affidavits and certificates of the final candidates were examined and the answers to the examination papers were read. Several communications were dealt with, and it was decided that when a surveyor obtains a standard measure from any one except the Secretary, he shall at once submit it to the Secretary to be tested.

Applications having been received from several candidates for an examination in May, the necessary question papers were prepared before adjournment.

The number of candidates examined during the year was 279 as compared with 161 during the previous year.

Mr. F. D. Henderson is the Secretary of the Board.

APPENDICES.

The following schedules and statements are appended :—

No. 1. Schedule of surveyors employed and work executed by them from April 1, 1908 to March 31, 1909.

No. 2. Schedule showing for each surveyor employed from April 1, 1908, to March 31, 1909, the number of miles surveyed, of township section lines, township outlines, traverses of lakes and rivers and resurvey ; also the cost of the same.

No. 3. List of lots in the Yukon Territory, surveys of which have been received from April 1, 1908, to March 31, 1909.

No. 4. List of miscellaneous surveys in the Yukon Territory returns of which have been received from April 1, 1908, to March 31, 1909.

No. 5. Statement of work executed in the office of the chief draughtsman.

No. 6. List of new editions of sectional maps issued from April 1, 1908, to March 31, 1909.

No. 7. Statement of work executed in the survey records office from April 1, 1908, to March 31, 1909.

No. 8. Statement of work executed in the photographic office from April 1, 1908, to March 31, 1909.

No. 9. Statement of work executed in the lithographic office from April 1, 1908, to March 31, 1909.

No. 10. List of employees of the Topographical Surveys Branch at Ottawa giving the name, classification, duties of office and salary of each.

No. 11. List of Dominion land surveyors who have been supplied with standard measures.

No. 12. Examination papers of the board of examiners for Dominion land surveyors.

Nos. 13 to 50. Reports of surveyors employed.

No. 51. Descriptions of surveyed townships submitted by Dominion land surveyors form April 1, 1908, to March 31, 1909.

NOTE.—Appendices Nos. 12 to 51 appear in the report of the Topographical Surveys Branch in monograph form.

MAPS.

The following maps accompany this report :—

Map showing surveys and resurveys made from April 1, 1908, to March 31, 1909.
Map of the boundary between British Columbia and Yukon Territory.
Maps accompanying reports of surveyors.

NOTE.—The above maps accompany the report of the Topographical Surveys Branch in monograph form.

I have the honour to be, Sir,
Your obedient servant,

E. DEVILLE,
Surveyor General.

TOPOGRAPHICAL SURVEYS BRANCH.

SCHEDULES AND STATEMENTS.

APPENDIX No. 1.

SCHEDULE of Surveyors employed and work executed by them, from April 1, 1908, to March 31, 1909.

Surveyor.	Address.	Description of Work.
Aylsworth, C. F.	Madoc, Ont.	Partial subdivision of township 22, range 4; retracement and restoration survey of townships 16, range 1, and 11, range 7; partial retracement and restoration of townships 12, range 5, 16, range 7, and 17, range 8; all east of the principal meridian. Retracement and restoration survey of township 18, range 3, west of the principal meridian.
Baker, J. C.	Vermilion, Alta.	Contract No. 7 of 1908; subdivision of townships 53, 55, and 56, range 14, townships 52, 53, and 55, range 15, and townships 52, ranges 16 and 17; the northerly one-third of townships 54, ranges 14 and 15, and the southerly one-third of township 53, range 16, also the east outline of township 56, range 16; all west of the fifth meridian.
Beatty, David	Parry Sound, Ont.	Survey of the east and south boundaries of Porcupine forest reserve in townships 39, ranges 29, 30, 31 and 32, township 40, range 28, and township 41, range 27 west of the principal meridian.
Belanger, P. R. A.	Ottawa, Ont.	Completion of inspection of contract No. 27 of 1906; inspection of contracts Nos. 14, 26, 30 and 32 of 1907, and partial inspection of contracts Nos. 17 and 20 of 1908; traverse of Winnipeg river in townships 13 and 14, ranges 12 and 13, and in townships 15 and 16, ranges 14 and 15; traverse of Pinawa channel in township 14, range 12; traverse of islands and lakes and verification surveys in townships 15, ranges 14 and 15; all east of the principal meridian.
Bingham, E. R.	Fort William, Ont.	Survey of a parcel of land between blocks A and B of The Pas Indian reserve and extending southerly a distance of one mile from the Saskatchewan river.
Bolton, Lewis	Listowel, Ont.	Contract No. 2 of 1908; subdivision of townships 31 and 32, ranges 14, 15 and 16, and townships 28, 29, 30, 31 and 32, range 17; all west of the fourth meridian.
Bourgault, C. E.	St. Jean Port Joli, P.Q.	Retracement and correction surveys in townships 11, 19 and 20, range 2; 9 and 30, range 3; 9, range 4; 21 and 22, range 5; 14, range 9; 17, 20 and 21, range 13; 20 and 21, range 14; 16, range 15, and 29, range 17; survey of Doukhobor village in township 31, range 3; retracement of township 20, range 4, and

APPENDIX No. 1—*Continued.*

SCHEDULE of Surveyors employed, and work executed by them, from April 1, 1908, to March 31, 1909—*Continued.*

Surveyor.	Address.	Description of Work.
		partial retracement of townships 21 and 23, range 8; all west of the second meridian. Partial retracement of township 16, range 28, west of the principal meridian.
Bourgeault, A.	St. Jean Port Joli, P.Q.	Contract No. 5 of 1908; complete subdivision of townships 20, ranges 8 and 9, and partial subdivision of township 18, range 11; all east of the principal meridian.
Bray, Edgar	Oakville, Ont.	Contract No. 6 of 1908; subdivision of township 38, range 2; partial subdivision of townships 38, ranges 1 and 3; the east outlines of townships 39 and 40, ranges 2 and 3, and traverse of lakes, in township 37, range 2; all west of the second meridian.
Carson, P. A.	Ottawa, Ont.	Triangulation surveys in British Columbia in connection wth the Trigonometrical Section of the Topographical Survey of Canada. Subdivision and traverse in townships 26 and 27, range 26, west of the fifth meridian.
Cautley, R. H.	Edmonton, Alta.	Contract No. 13 of 1908; subdivision of townships 5 and 6, ranges 4, 5, 6 and 7; townships 7, 8 and 9, ranges 3, 4, 5 and 6; townships 10, ranges 3 and 6, and townships 6, ranges 2 and 3; all west of the third meridian.
Cautley, R. W.	Edmonton, Alta.	Contract No. 29 of 1908; completion of subdivision of townships 31, range 15, 32, range 18, and 34, range 19; subdivision of townships 31, range 16; 32, ranges 15, 16 and 17, 33, ranges 16, 17 and 18, 34, range 18, and 35, ranges 18, 19 and 20; partial resurvey of township 34, range 20; traverses in townships 30 and 31, range 17, and 33, range 19; survey of the east outlines of townships 36, ranges 20 and 21; all west of the principal meridian.
Christie, Wm.	Chesley, Ont.	Survey of portions of the seventh base across ranges 9 and 10; resurvey of the eighth base across ranges 11 and 12; resurvey of the ninth base across ranges 15, 16, 17 and parts of ranges 14 and 18; retracement of the ninth base across ranges 10, 11, 12, 13 and part of 14; survey of the east ontlines of townships 29, 30 and part of 31, range 10, 31 and 32, range 16, and 33, 34, 35 and 36, range 17; all west of the principal meridian.
Coté, J. L.	Edmonton, Alta.	Contract No. 21 of 1908; subdivision of townships 64, ranges 19 and 20, township 66, range 18, and townships 67, ranges 16, 17, 19, 20, 21, 22 and 23; survey of the east outlines of townships 63, ranges 19 and 20, townships 65, 66 and 68, range 17, and of townships 65 and 68, range 18; all west of the fourth meridian.
Davies, T. A.	Ottawa, Ont.	Retracement of the fifth meridian from the north-east corner of section 24, township 4, to the third base; partial retracement of townships 5, 6, 7 and 8, range 1; partial subdivision of townships 8, 9, 10, 12 and 13, range 3, and of township 8, range 4; all west of the fifth meridian. Partial retracement of townships 5, 6, 7, 8 and 9, range 30, and township 9, range 29; all west of the fourth meridian.

APPENDIX No. 1—*Continued.*

SCHEDULE of Surveyors employed, and work executed by them, from April 1, 1908, to March 31, 1909—*Continued.*

Surveyor.	Address.	Description of Work.
Deans, W. J.	Brandon, Man.	Part subdivision of townships 23, ranges 20 and 21, townships 29 and 30, range 23, township 26, range 24, and township 23, range 26; miscellaneous retracement and correction survey in townships 23, range 10, 22 and 23, range 11, 28, range 18, 30 and 31, range 21, 22, range 27, and 24, range 30, west of the principal meridian.
Driscoll, A. (*See* A. G. Stacey.)	Edmonton, Alta.	Contract No. 8, 1908; subdivision of townships 1 and 2, ranges 2, 3 and 4, townships 3, ranges, 7, 8 and 9, townships 4 and 5, ranges 2, 3, 7, 8 and 9; survey of the east outlines of townships 3, ranges 2, 3, 4 and 5; all west of the fourth meridian.
Dumais, P. T. C.	Hull, Quebec	Contract No. 33 of 1907; subdivision of townships 27, 28 and 29, ranges 12 and 13, and township 30, range 13; all west of the principal meridian.
Edwards, Geo.	Ponoka, Alta.	Contract No. 25 of 1908; subdivision of townships 52, ranges 7 and 8; partial subdivision of township 52, range 9; all west of the fifth meridian.
Fairchild, C. C.	Edmonton, Alta.	Contract No. 16 of 1908; subdivision of townships 61, ranges 6 and 7, townships 62, ranges 4, 5, 6 and 7; partial subdivision of township 62, range 1; survey of the east outlines of townships 63 and 64, ranges 4, 5, 6, 7 and 8; all west of the fifth meridian. Partial subdivision of township 62, range 27, west of the fourth meridian.
Farncomb, A. E.	Lacombe, Alta.	Contract No. 12 of 1908; subdivision of townships 52, ranges 21, 22, 23 and 24, townships 53, ranges 21, 22 and 23; all west of the fifth meridian.
Fawcett, A.	Gravenhurst, Ont.	Contract No. 26 of 1908; subdivision of townships 50, 51 and 52, ranges 12 and 13, and township 50, range 14; survey of east outline of township 49, range 12; all west of the second meridian.
Fawcett, A.	Niagara Falls	Retracement and restoration survey of the fourth meridian through townships 6 to 26 inclusive. Miscellaneous surveys in townships 10 and 11, range 22, west of the fourth meridian; miscellaneous surveys in townships 12 and 28, range 1, 50, range 6, 35, range 13, 14 and 15, range 24, and 14, range 30, all west of the third meridian. Miscellaneous surveys in townships 23 range 13, 25 range 22, 50 range 26, and 41 range 27; all west of the second meridian.
Fontaine, L. E.	Levis, Quebec	Inspection of contracts Nos. 29 and 31 of 1907, and completion of the inspection of contracts Nos. 2, 16 and 24 of 1907; inspection of contracts Nos. 7, 18 and 27 of 1908; miscellaneous surveys in townships 55, range 5, and 57, range 7, west of the fifth meridian.
Green, T. D.	Ottawa, Ont.	Survey of the east outlines of townships 43 and 44, ranges 19 and 20, west of the fifth meridian; a traverse to locate coal lands on the south branch of Brazeau river.
Hawkins, A. H.	Listowel, Ont.	Survey of the twelfth base across ranges 15 to 19 inclusive; survey of the thirteenth base across ranges 24 to 28 inclusive; partial subdivision of township 49, range 27; sur-

APPENDIX No. 1—*Continued.*

SCHEDULE of Surveyors employed, and work executed by them, from April 1, 1908, to March 31, 1909—*Continued.*

Surveyor.	Address.	Description of Work.
		vey of the east outline of township 50 and part of east outline of township 49, range 27, all west of the fifth meridian; survey of the thirteenth base across part of range 1, west of the sixth meridian.
Heathcott, R. V.	Edmonton, Alta.	Contract No. 28 of 1908; subdivision of townships 55 and 56, ranges 12 and 13, and partial subdivision of townships 54, ranges 12 and 13; all west of the fifth meridian. Contract No. 31 of 1907; subdivision of townships 52 and 53, ranges 18, 19 and 20, west of the fifth meridian.
Holcroft, H. S.	Toronto, Ont.	Subdivision of townships 81, ranges 24, 25 and 26, and township 82, range 24; resurvey of the east outline of township 82, range 24, and of the north outlines of townships 80, ranges 24, 25 and 26; all west of the fifth meridian; resurvey of the sixth meridian through township 81; survey of an addition to Shaftsbury settlement.
Hopkins, M. W.	Edmonton, Alta.	Contract No. 19 of 1908; subdivision of townships 61, 62 and 63, range 1, townships 61, 62, 63 and 64, range 2, townships 61 and 62, ranges 3, 4, 7, 8, 9 and 10; survey of the east outlines of townships 63 and 64, ranges 8 and 10; all west of the fourth meridian.
Hubbell, E. W.	Ottawa, Ont.	Inspection of contracts Nos. 6, 7, 11, 13, 27 and 28 of 1907, and contracts Nos. 6 and 11 of 1908; completion of inspection of contracts Nos. 15, 20 and 21 of 1907; mounding the east boundary of townships 39 and 40, range 17, and correction survey in township 39, range 16, west of the second meridian; traverse in township 52, range 4, west of the third meridian.
Johnson, A. W.	Kamloops, B.C.	Subdivision in townships 5 and 12, range 27, west of the sixth meridian, and in township 21, E.C.M.; resurvey in townships 7, 8, 9 and 11, range 22, in townships 3, 4, 5, 6, 9, 10, 11 and 12, range 23, west of the sixth meridian, and in township 26, E.C.M.; traverse survey in township 5, range 26, and in township 14, range 27, west of the sixth meridian; subdivision and resurvey in township 2, range 29, west of the sixth meridian, and in townships 3 and 4, range 5, west of seventh meridian; traverse and resurvey in townships 12, 13 and 16, E.C.M.; traverse and subdivision in townships 6 and 7, range 26, west of the sixth meridian; traverse, subdivision and resurvey in township 15, range 27, and townships 3, ranges 29 and 30, west of the sixth meridian; two triangulations from the Canadian Pacific railway to the boundary of the railway belt.
Kimpe, M.	Edmonton, Alta.	Contract No. 18 of 1908; subdivision of townships 49, 50 and 51, range 7, and townships 55 and 56, ranges 9, 10 and 11, and completion of the subdivision of township 54, range 11; all west of the fifth meridian.
Kirk, J. A.	Revelstoke, B.C.	Partial subdivision of townships 23, ranges 2 and 5, west of the sixth meridian.

APPENDIX No. 1—*Continued.*

SCHEDULE of Surveyors employed, and work executed by them, from April 1, 1908, to March 31, 1909—*Continued.*

Surveyor.	Address.	Description of Work.
Kitto, F. H.	Ottawa, Ont.	Contract No. 11 of 1908; subdivision of townships 52, ranges 3 and 4, west of the third meridian.
Knight, R. H.	Edmonton, Alta.	Contract No. 14 of 1908; subdivision of townships 61, 62 and 63, ranges 23 and 24, and township 65, range 24; all west of the fourth meridian.
Lonergan, G. J.	Buckingham, Que.	Inspection of contracts Nos. 4 and 31 of 1907, and of contracts Nos. 2, 10, 14, 16, 21 and 23 of 1908; restoration surveys in townships 54 and 55, ranges 20 and 21, and miscellaneous surveys in township 62, range 12, township 61, range 13, townships 52, ranges 15 and 16, townships 64 and 65, range 21, township 50, range 26, and townships 51 ranges 25, 26 and 27; all west of the fourth meridian. Miscellaneous surveys in township 59, range 4, west of the fifth meridian.
McFarlane, W. G.	Toronto, Ont.	Contract No. 1 of 1908; subdivision of townships 7, 8, 9, and 10, ranges 7, 8, 9, 10, 11 and 12, and townships 5 and 6, range 8; survey of the east outlines of townships 5 and 6, ranges 10, 11, 12 and 13; all west of the third meridian.
McFee, A.	Red Deer, Alta.	Survey of the boundaries of Buffalo Park reserve through townships 42 and 43, range 6, 42, 43 and 44, ranges 7 and 8, and township 43, range 9, west of the fourth meridian.
McGrandle, H.	Wetaskiwin, Alta.	Contract No. 10 of 1908; subdivision of townships 60, ranges 19, 20, 21 and 22, township 59, range 21, and part of township 60, range 18 all west of the fourth meridian.
McMillan, Geo.	Ottawa, Ont.	Resurvey of township 49, range 25, west of the second meridian; resurvey of townships 42, 43 and 44, range 1, west of the third meridian, including a resurvey of St. Laurent settlement; partial resurvey of township 35, range 5, west of the third meridian.
Miles, G. F.	Toronto, Ont.	Inspection of contracts Nos. 1, 3, 8, 9, 13 and 15 of 1908; retracement and restoration survey of townships 23, ranges 1 and 4, and township 24, ranges 2, 3 and 4; miscellaneous surveys in townships 23, range 2, and 18, range 14; all west of the third meridian; miscellaneous surveys in township 1, range 12, township 19, range 29, and township 18, range 30; all west of the second meridian.
Molloy, John.	Winnipeg, Man.	Contract No. 24 of 1908; subdivision of townships 9 and 10, ranges 14, 15 and 16, and township 10, range 13; all east of the principal meridian.
Montgomery, R. H.	Prince Albert, Sask.	Miscellaneous surveys in townships 43 and 44, range 8, 43, range 9, 48, range 13, and 51, ranges 14 and 15, west of the third meridian, and in township 42, range 24, west of the second meridian.
		Contract No. 4 of 1908; subdivision of townships 51 and 52, ranges 14 and 15, townships 51, ranges 16, 17 and 18, and partial subdivision of township 50, range 14, all west of the second meridian.

APPENDIX No. 1—*Continued.*

SCHEDULE of Surveyors employed, and work executed by them, from April 1, 1908, to March 31, 1909—*Continued.*

Surveyor.	Address.	Description of Work.
Morrier, J. E..	Ottawa, Ont..	Survey of Churchill townsite.
Ord, L. R..	Calgary, Alta..	Contract No. 30 of 1908; subdivision of townships 32, range 7, 31 and 32, range 8, 30 and 31 range 9, and townships 29, 30 and 31, range 10; survey of the east outlines of townships 29, range 9, and 32, range 11; all west of the principal meridian.
Plunkett, T. H..	Salmon Arm, B.C.. ..	Partial subdivision of townships 26, range 19, 26 and 27, range 21, 26 and 28, range 22, 28, range 23, 21, range 27, and township 21, range 28, west of the fifth meridian; partial subdivision of township 23, range 2, west of the sixth meridian; partial subdivision and resurvey of township 25, range 28, west of the fifth meridian; traverse in township 27, range 22, and township 20, range 29, west of the fifth meridian; traverse in township 20, range 1, west of the sixth meridian.
Ponton, A. W..	Macleod, Alta..	Survey of the fifth meridian from township 85 to township 107 inclusive.
Reilly, Wm. R..	Regina, Sask..	Retracement and restoration survey in townships 46, ranges 21 and 22, townships 47a, ranges 24 and 25, and township 49, range 23; partial retracement and restoration survey of townships 45 and 49, range 21, townships 44, 45 and 49, range 22, and townships 46, ranges 23 and 24; traverse in township 42, range 27; all west of the second meridian.
Robinson, E. W..	Chase, B.C..	Partial subdivision of township 23, range 5, townships 21 and 23, range 7, and township 22, range 8; traverse survey in township 23, range 4; subdivision and traverse in township 23, range 2; subdivison and resurvey in township 22, range 6; traverse, subdivision and resurvey in township 23, range 6, and township 22, range 7; all west of the sixth meridian.
Ross, Jos. E..	Kamloops, B.C..	Partial subdivision in townships 20 and 21, range 12, townships 16 and 23, range 22, townships 20 and 21, ranges 23 and 24, and township 18, range 25; partial resurvey of townships 18 and 19, range 17, and townships 21, ranges 20 and 21; traverse, subdivision and resurvey in township 18, range 16, townships 19, ranges 12, 14, 15, 16 and 24, townships 20, ranges 13, 15, 16, 19 and 21, and township 22, range 17; subdivision and traverse in township 15, range 22, township 16, range 26, township 19, range 13, township 20, range 21, and township 23, range 23; subdivision and resurvey in township 20, range 14, township 22, range 21, and townships 17, 18 and 19, range 25; all west of the sixth meridian.
Roy, Geo. P..	Quebec..	Contract No. 27 of 1908; subdivision of townships 57, ranges 10 and 11, and township 58, range 11; all west of the fifth meridian.
Saint Cyr, A..	Ottawa, Ont..	Survey of the sixth meridian through townships 52, 51, 48 and part of 47; survey of the fifteenth base west of the fifth meridian across ranges 24, 23, 22, 21 and part of range 20.

APPENDIX No. 1—*Continued.*

SCHEDULE of Surveyors employed, and work executed by them, from April 1, 1908, to March 31, 1909—*Continued.*

Surveyor.	Address.	Description of Work.
Saint Cyr, J. B.	Montreal	Subdivision of townships 80, ranges 3 and 4; survey of the east outlines of townships 77, 78 and 79, range 5, the south outline of township 79, range 3, and the north outline of township 78, range 4; all west of the sixth meridian; survey of Dunvegan settlement in township 80, range 4, west of the sixth meridian, and of an addition to Peace River Landing settlement in township 83, range 21, west of the fifth meridian.
Saunders, B. J.	Edmonton, Alta.	Survey of the eleventh base through ranges 8 to 18 inclusive, and part of range 19, west of the fifth meridian.
Selby, H. W.	Toronto, Ont.	Subdivision of townships 73 and 74, range 10, and township 74, range 13; partial subdivision of townships 72, ranges 3, 5, 6, 9 and 10, townships 73, ranges 4, 5, 6, and 11, township 74, range 9, township 80, range 19, and townships 81, ranges 19 and 20; survey of the east outline of township 73, range 13, and part of the east outline of township 74, range 12; all west of the fifth meridian; retracement of the Hudson's Bay Company reserve at Lesser Slave lake.
Seymour, H. L.	Edmonton, Alta.	Contract No. 29 of 1907; subdivision of townships 44 and 47, range 4, townships 48 and 49, range 5, and township 49, range 6; partial resurvey of township 43, range 4; survey of the east outlines of townships 45 and 46, range 5; all west of the fifth meridian. Contract No. 22 of 1908; subdivision of townships 45 and 46, ranges 4, 5 and 6; survey of the east outlines of township 47, range 6, and townships 47 and 48, range 7; all west of the fifth meridian.
Stacey, A. G. (Deceased, balance of contract performed by A. Driscoll, D.L.S.)	Ottawa, Ont.	Contract No. 8 of 1908; subdivision of townships 4 and 5, ranges 4 and 5; all west of the fourth meridian.
Steele, I. J.	Ottawa, Ont.	Contract No. 15 of 1908; subdivision of townships 1, 2, 3 and 4, ranges 19, 20, 21 and 22, townships 2 and 3, ranges 23, 24, 25 and 26, and township 2, range 27; survey of the east outlines of townships 1, ranges 24, 25, 26, 27 and 28, and the south outlines of townships 1, ranges 23, 24, 25, 26 and 27; partial resurvey of the south outline of township 1, range 18; all west of the second meridian.
Talbot, A. C.	Calgary, Alta.	Survey of villa lots at lake Minnewanka; survey of a road from Laggan to lake Louise; partial subdivision of township 28, range 16, west of the fifth meridian.
Teasdale, C. M.	Concord, Ont.	Contract No. 26 of 1907; subdivision of townships 27 and 28, ranges 10 and 11, west of the principal meridian. Contract No. 20 of 1908; subdivision of townships 25, ranges 3, 4, 5, 6 and 7, and township 26, range 7; all west of the principal meridian.
Thibaudeau, W.	Ottawa, Ont.	Preliminary exploration and hydro-topographic surveys on St. Mary, Waterton, Southfork and Crowsnest rivers, and on Oil Pass and Tib creeks; preliminary explorations on Belly, Oldman and Livingstone rivers, and on Pincher, Lee, Mills, Gold and Blairmore creeks.

APPENDIX No. 1—*Continued.*

SCHEDULE of Surveyors employed, and work executed by them, from April 1, 1908, to March 31, 1909—*Continued.*

Surveyor.	Address.	Description of Work.
Tyrrell, J. W..	Hamilton, Ont..	Contract No. 17 of 1908; subdivision of townships 25 and 28, range 1, east of the principal meridian: subdivision of townships 25, 26, 27 and 28, range 1, and townships 25, 26 and 27, range 2; survey of east outlines of township 28, range 3; all west of the principal meridian.
Waddell, W. H..	Hamilton, Ont..	Contract No. 23 of 1908; subdivision of townships 63 and 64, range 13, townships 63, 64 and 65, ranges 14 and 15; all west of the fourth meridian.
Waldron, John..	Moosejaw, Sask..	Contract No. 3 of 1908; subdivision of townships 4, 5, 6 and 7, range 20, townships 5, ranges 21 and 22, townships 5 and 6, range 23, townships 1, 2, 3 and 4, ranges 26 and 27, and townships 2, 3 and 4, range 30; completion of subdivision of townships 6 and 7, ranges 21 and 22; all west of the third meridian; subdivision of townships 1, 2, 3, 4 and 5, range 1, west of the fourth meridian.
Wallace, J. N..	Calgary, Alta..	Survey of the Yukon-British Columbia boundary from Tatshenshini river to Takhini river
Warren, Jas...	Walkerton, Ont..	Resurvey of the fourth base across ranges 2, 3 and 4; partial subdivision of township 13, range 2, townships 11, 12 and 13, range 3, townships 10 and 11, range 4, and townships 22 and 23, range 5; traverse in township 14, range 1; all west of the fifth meridian.
Watt, Geo.....	Ottawa, Ont..	Contract No. 9 of 1908; subdivision of townships 1, 2, 3, 8 and 9, range 13, township 8, ranges 14 and 15, townships 4, 5 and 7, ranges 16 and 17, townships 4, 5, 6 and 7, ranges 18 and 19; partial subdivision of townships 7, ranges 13, 14 and 15; survey of the east outlines of township 4, range 13, and townships 6, ranges 16 and 17; all west of the third meridian.
Wheeler, A. O.	Calgary, Alta..	Examination and classification of the lands undisposed of in the railway belt, British Columbia, above and below Revelstoke, above and below Golden and in the vicinity of Shuswap lake.
Wiggins, T. H...	Saskatoon, Sask..	Correction survey in township 34, range 9, west of the third meridian.
Young, W. H...	Lethbridge, Alta..	Partial subdivision of township 4, range 1, township 6, range 2, townships 5, 6 and 7, range 3, and township 7, range 4; all west of the fifth meridian; partial subdivision of township 3, range 30, and traverse in townships 11, ranges 22 and 23; all west of the fourth meridian.

APPENDIX No. 2.

SCHEDULE showing for each surveyor employed from April 1, 1908, to March 31, 1909, the number of miles surveyed of township section lines, township outlines, traverses of lakes and rivers and resurvey, also cost of same.

Surveyor.	Miles of section lines.	Miles of outlines.	Miles of traverse	Miles of resurvey	Total mileage.	Total cost.	Cost per mile.	By day work or by contract.
						$ cts.	$ cts.	
Aylsworth, C. F.			5·30	270·50	275·80	9,855 00	35 73	Day.
Baker, J. C.	421·38	62·32	82·23		565·93	16,024 84	28 31	Contract.
Beatty, David			52·50		52·50	6,733 00	128 24	Day.
†Belanger, P. R. A			87·11	5·50	92·61	13,386 35		"
Bingham, E. R.			5·31		5·31	282 90	53 28	"
Bolton, Lewis	514·65		44·08		558·73	4,286 63	7 67	Contract.
Bourgault, C. E			26·05	334·75	360·80	9,063 96	25 12	Day.
Bourgeault, A.	94·34	10·08	10·50		114·92	3,363 16	29 26	Contract.
Bray, Edgar	106·00	30·00	5·50		141·50	4,381 27	30 96	"
Cautley, R. H.	1,148·60	50·20	42·33		1,241·13	9,141 66	7 60	"
Cautley, R. W.	359·88	31·28	368·58		759·74	12,773 40	16 81	"
Christie, Wm.	10·00	52·00		64·50	126·50	7,310 57	57 79	Day.
Côte, J. L.	532·92	73·46	140·83		747·21	19,980 71	26 74	Contract.
Davies, T. A	62·00			58·50	120·50	10,273 17	85 25	Day.
Deans, W. J.	33·00		16·80	127·50	177·30	8,000 00	45 12	"
*Driscoll, A.	880·79	90·84	117·52		1,089 15	8,880 35	8 15	Contract.
Dumais, P. T. C.	162·90	17·00	60·02		239·92	5,861 82	24 43	"
Edwards, Geo.	133 10	18·09	30·01		181·20	5,058 37	27 91	"
Fairchild, C. C.	348·63	113·56	131·14		593·33	16,959 50	28 58	"
Farncomb, A. E.	340·12	42·19	77·81		460·12	12,361 24	26 86	"
Fawcett, Adam	316·21	42·20	51·46		409·87	10,957 21	26 73	"
Fawcett, Thos.			14·55	171 75	186·30	4,466 78	23 98	Day.
†Fontaine, L. E.			7·00	12·00	19·00	12,679 62		"
Green, T. D	1·00	24·00	4·32		29·32	4,200 00	143 24	"
Hawkins, A. H.	8·00	65·50			73·50	13,500 00	183 67	"
Heathcott, R. V	516·59	56·34	180·66		753·59	19,485 37	25 85	Contract.
Holcroft, H. S.	163·75	24·00	72·16	27·25	287·16	14,688 63	51 15	Day.
Hopkins, M. W.	779·23	70·29	259·05		1,108·57	27,364 48	24 68	Contract.
†Hubbell, E. W.			3·95		3·95	12,628 23		Day.
Johnson, A. W.	20·00		70·00	90·00	180·00	14,733 43	81 85	"
Kimpe, M	451·21	32·68	27·33		511·22	15,334 43	29 99	Contract.
Kirk, J. A	4·04		3·61	7 00	14·65	344 10	23 48	Day.
Kitto, F. H	86·72		29·11		115·83	2,989 01	25 80	Contract.
Knight, R. H.	336·15	35·96	42·71		414·82	11,842 63	28 55	"
†Lonergan, G. J			34·40	206·75	241·15	12,319 35		Day.
McFarlane, W. G.	1,260·81	88·13			1,348·94	10,137 27	7 51	Contract.
McFee, A			69·50		69·50	1,300 00	18 70	Day.
McGrandle, Hugh	248·45		21·30		269·75	7,045 59	26 12	Contract.
McMillan, Geo.			96·75	221·00	317·75	10,714 79	33 72	Day.
†Miles, C. F.			8·00	265 00	273 00	11,492 51		"
Molloy, John	476·80	42·66			519·46	15,418 30	29 68	Contract.
Montgomery, R. H			19·25	8·25	27·50	828 20	30 11	Day.
Montgomery, R. H	379·18	18·09	33·70		430·97	12,706 92	29 48	Contract.
Morrier, J. E.			66·12		66·12	5,339 04	80 74	Day.
Ord, L. R	228·62	30·08	64·44		323·14	7,512 99	23 25	Contract.
Plunkett, Thos. H.	33 96		34·77	5·00	73·73	9,270 11	125 73	Day.
Ponton, A. W.		138·00			138·00	10,925 00	79 17	"
Reilly, Wm. R.			154·34	242·50	396·84	8,817 98	22 22	"
Robinson, E. W	22·01		47·98	1·94	71·93	12,000 00	166 83	"
Ross, Jos. E.	116·32		68·09	31·20	215·61	11,274 80	52 29	"
Roy, Geo. P.	139·12		1·50		140·62	4,262 33	30 31	Contract.
Saint-Cyr, A.		47·50			47·50	15,000 00	315 79	Day.
Saint-Cyr, J. B.	115·00	20·00	55·60		190·60	10,450 00	54 82	"
Saunders, B. J		67·50			67·50	15,100 00	223 70	"
Selby, H. W.	255·25	52·90	67·72		375·87	12,505 00	33 27	"
Seymour, H. L	514·48	66·94	32·16		613·58	16,510 01	26 90	Contract.
*Stacey, A. G	181·42	12·06			193·48	1,574 59	8 13	"
Steele, I. J	1,287·55	126·03	114·14		1,527·72	10,809 58	7 07	"
Talbot, A. C.	2·00		8·00		10·00	667 75	66 77	Day.
Teasdale, C. M.	462·74	30 07	75·85		568·66	14,978 77	26 34	Contract.
Tyrrell, J. W.	511·22	23·59	5·77		540·58	15,996 50	29 59	"
Waddell, W. H.	375·22		106·73		481·95	12,304 99	25 53	"
Waldron, John	1,260·51	118·59	2·93		1,382·03	10,931 49	7 91	"
Wallace, J. N.			36·80		36·80	15,530 09	422 01	Day.
Warren, Jas	77·50	8·00	18·00	19·00	122·50	9,308 77	75 99	"
Watt, Geo. H.	1,125·15	173 50	5·75		1,304·40	10,829 20	8 30	Contract.
Wiggins, T. H.				3·50	3·50	65 00	18 57	Day.
Young, W. H	79·90	13·00	4·49	2·00	99·39	9,000 00	90 55	"
	16,984·42	2,018 63	3,323·61	2,175·39	24,502·05	681,418 74		

* Mr. A. G. Stacey, D.L.S., died and the contract was completed by A. Driscoll, D.L.S., with the same party. † Inspector of contract surveys.

APPENDIX No. 3.

List of Lots in the Yukon Territory, surveys of which have been received from April 1, 1908, to March 31, 1909.

GROUP No. 1.

Lot No.	Area in Acres.	Surveyor.	Year of Survey.	Date of Approval.	Claimant.	Remarks.
41	68·1	C. S. W. Barwell	1908	*....	Albert P. Shulze	Surface.

GROUP No. 2.

Lot No.	Area in Acres.	Surveyor.	Year of Survey.	Date of Approval.	Claimant.	Remarks.
N 1	0·363	James Gibbon .	1907	June 10, 1908..	....	Surface.
K24	....	C. W. MacPherson..........	1908	*...	White Channel Gold Hill Hydraulic Co., Ltd.......	"
180	46·2	C. S. W. Barwell	1908	*..........	Capt. T. H. Alcock.........	Riverview M. C.
375	51·6	" ..	1908	Feb 23, 1908..	Ernest Sleuter	New Hope M. C.
376	51·6	" ..	1908	Nov. 11, 1908..	Lizzie Olivia Craig.........	Iron Duke M. C.
377	51·6	" ..	1908	" 11, 1908..	"	Black Prince M. C.
378	51·6	" ..	1908	" 11, 1908..	"	Belle M. C.
378	....	" .	1908	*..............	N. A. T. & T. Co...........	Klondike Lode M.C.
380	51·3	" ..	1908	Nov. 11, 1908..	Lizzie Olivia Craig..... ...	Chas. L. M. C.
387	640·0	C. W. MacPherson	1907	*..............	Dept. of Indian Affairs. ..	Indian Reserve.
389	20·85	James Gibbon .	1908	Sept. 11, 1908..	John Nicholas..............	Tacoma M. C.
392	51·3	C. S. W. Barwell	1908	Nov. 11, 1908..	Lizzie Olivia Craig..	Walter D. M. C.
393	51·6	" ..	1908	" 11, 1908..	"	Thelma M. C.
394	51·6	" ..	1908	" 11, 1908..	"	Lottie M. C.
395	45·9	" ..	1908	*.............	N. A. T. & T. Co...........	Klondike Lode Ext'n No. 1 M. C.
396	32·73	James Gibbon ..	1908	Sept. 11, 1908..	Margaret J. Mitchell *et al*..	Comstock M. C.
398	51·65	" ..	1908	" 11, 1908..	Jane S. Orrell..............	Silver Knight M. C.
400	47·5	C. S. W. Barwell	1908	Oct. 2, 1908..	Emil Mohr.........	Edna M. C.
401	11·5	" ..	1908	*.......	N. A. T. & T. Co.	Surface.
402	11·5	" ..	1908	*.	"	"
403	51·0	" ..	1908	*............ ...	"	Klondike Lode Ext'n No. 3 M. C.
404	50·5	" ..	1908	*..............	L. Schmidt....	An Curd M.C.
405	51·6	" ..	1909	*.	Thos. Mulcahey *et al*	Dunsmuir M. C.
406	51·6	" ..	1909	*............ .	"	Bald Eagle M. C.
407	51·6	" ..	1909	*.	"	Black Jack M.C.

GROUP No. 4.

Lot No.	Area in Acres.	Surveyor.	Year of Survey.	Date of Approval.	Claimant.	Remarks.
B 3	11·24	C. W. MacPherson	1908	Oct. 3, 1908..	The English Church Missions	Surface.

*Not yet approved.

GROUP No. 5.

Lot No.	Area in Acres.	Surveyor.	Year of Survey.	Date of Approval.	Claimant.	Remarks.
110	51·55	H. G. Dickson..	1907	*	A. B. Palmer	Centre Star M. C.
111	46·37	"	1907	*	"	Papoose M. C.
112	49·14	"	1907	*	"	Morning M. C.
113	30·35	"	1907	*	"	Mack M. C.
115	45·56	"	1908	*	Wm. Clark	Verona M. C.
121	0·77	N. A. Burwash..	1908	Sept. 25, 1908..	F. R. Alley	Flora M. C.
122	13 15	"	1908	" 25, 1908..	"	Alma M. C.
123	9·88	"	1908	" 25, 1908..	"	Midget M. C.
124	.2·09	"	1908	" 25, 1908 .	"	Flora No. 2 M. C.
125	49·07	"	1908	" 25, 1908..	W. S. Thomas	Copper Chief M. C.
126	39·58	"	1908	" 25, 1908..	"	Copper Nugget M.C.
127	138·67	"	1908	Oct. 17, 1908.	L. E. Belney and Karl Weik	Manitou Copper M.C
128	49·48	"	1908	" 17, 1908 .	W. S. Thomas	Kluane M. C.
129	48·91	"	1908	" 17, 1908..	"	Little Johnnie M. C.
130	31 62	"	1908	" 17, 1908..	"	Overland M. C.
131	3·98	"	1908	Sept. 25, 1908..	"	Corsair M. C-
132	47·58	"	1908	Oct. 17, 1908..	L. E. Belney and Karl Weik	Grover M. C.
133	51·65	"	1908	July 15, 1908..	W. S. Thomas	Paragon M. C.
134	48·17	"	1908	Sept. 25, 1908..	"	Ora M. C.
135	47·08	"	1908	" 25, 1908..	"	Alvia M. C.
136	44·74	"	1908	July 15, 1908..	"	Little Frank M. C.
137	51·65	"	1908	" 15, 1908..	"	I. O. U. M. C.
138	51·65	"	1908	" 15, 1908..	"	I. and E M. C.
139	51·38	"	1908	" 15, 1908..	"	Reta M. C.
140	51·63	"	1908	" 15, 1908..	"	Bernice M. C.
141	51·49	"	1908	" 15, 1508..	"	York M. C.
143	45·94	"	1908	" 8, 1908..	"	Helena M. C.
144	17·58	"	1908	" 8, 1908 .	"	Florence M. C.
145	31·02	"	1908	" 8, 1908..	"	Iron Horse M. C.
146	13·74	"	1908	" 8, 1908..	S. C. Barrington	Carnage M. C.
148	47 03	"	1908	" 8, 1908..	W. S. Thomas	Rothsay, M. C.
149	39·24	"	1908	Sept. 28, 1908..	"	Autumn M C.
150	12 02	"	1908	July 7, 1908..	"	Sour Dough M. C.
154	28·48	H G. Dickson..	1908	June 29, 1908..	E. A. Dickson	Dick M, C.
155	45·77	"	1908	" 29, 1908..	Paul Jameson	Hope M. C.
156	51·65	"	1908	*	William Maher	Copper Cliff M. C.
157	11·35	"	1908	March 2, 1909	C. H. Johnston	Mabel Extension Frac'n M. C.
176	33·65	N. A. Burwash..	1908	July 15, 1908..	W. S. Thomas	Pueblo Star No. 2 M. C.
177	1·37	"	1908	Sept. 25, 1908..	W. L. Forrest	Flora No. 3 (Fractional) M. C.
178	16 46	"	1908	" 25, 1908..	K. Weik	Dawson M. C.
179	14 00	"	1908	Feb. 2, 1909..	P. F. Scharschmidt.	Surface.
180	21·91	"	1908	Oct. 2, 1908..	A. B. Palmer	Prudence M. C.
181	6·36	"	1908	" 2, 1908..	"	Pocahauntus M. C.

*Not yet approved.

GROUP No. 6.

Lot No.	Area in Acres.	Surveyor.	Year of Survey.	Date of Approval.	Claimant.	Remarks.
20	51·44	H. G. Dickson..	1907	*	J. H. Conrad	Venus M. C.
21	51·13	"	1907	*	"	Venus No. 2 M. C.
22	11·12	"	1907	*	"	Venus Fraction M.C.
24	3·52	"	1907	*	"	Mars M. C.
25	51·08	"	1907	*	"	M. & M. M. C.
26	21·48	"	1907	*	"	Vault M. C.
27	51·65	"	1907	*	"	Uranus M. C.
28	50·83	"	1907	*	"	Uranus No. 2 M. C.
29	23·02	"	1907	*	"	Cappella M. C.
30	44·31	"	1907	*	"	Joe Petty M. C.
31	46·75	"	1907	*	"	Little Johnny M. C.
32	32·58	"	1907	June 24, 1908..	"	Reliance M. C.
33	51·65	"	1907	*	"	Black Jack M. C.
34	51·65	"	1908	Jan. 19, 1909..	"	Montana M. C.
35	50·94	"	1908	" 19, 1909..	"	Mountain Hero M.C.
36	51·16	"	1907	*	"	Monarch M. C.
37	42·10	"	1908	Jan. 19, 1909..	"	Commander M. C.
38	36·09	"	1908	" 19, 1909..	"	Jumbo M. C.
39	35·03	"	1908	" 19, 1909..	"	O. K. M. C.
40	37·33	"	1908	*	W. P. Granger	Lake Shore M. C.
41	10·15	"	1908	Jan. 19, 1909..	J. H. Conrad	Fox M. C.
42	17·45	"	1908	" 19, 1909..	"	Mountain Lion M.C.
43	35·97	"	1908	" 19, 1909..	"	Elephant M. C.
44	51·65	"	1907	Apr. 24, 1908..	"	4th of July M. C.
45	50·11	"	1907	" 19, 1908..	"	Gurteen M. C.
46	43·86	"	1907	*	"	Empress M. C.
47	40·01	"	1907	*	"	Princess No. 2 M. C.
48	45·84	"	1907	*	"	T. & B. M. C.
49	40·80	"	1907	*	"	Sunrise M. C.
50	39·62	"	1907	*	"	Sunset M. C.
51	35·75	"	1907	*	"	Thistle M. C.
52	44·01	"	1907	*	"	Rose M. C.
53	6·61	"	1907	*	"	Fair Play M. C,
55	40·21	"	1907	*	"	Aurora M. C.
56	51·65	"	1907	*	"	Glacial Lake M. C.
57	19·15	"	1907	*	"	Columbian M. C,
58	24·21	"	1907	*	"	Westover M. C.
59	8·98	"	1908	Jan. 19, 1909..	"	Mamouth M. C.
61	51·65	"	1907	*	"	Caribou M. C.
62	51·55	"	1907	*	"	Pride of Yukon M.C.
63	47·48	"	1907	*	"	Pride of Yukon No. 2 M. C.
64	40·16	"	1907	*	"	Jupiter M. C.
65	51·64	"	1907	*	"	Lone Jack M. C.
66	44·79	"	1907	*	"	Chesley M. C.
67	47·67	"	1907	*	"	Eureka M. C.
68	47·42	"	1907	*	"	Eureka No. 2 M. C.
69	9·04	"	1907	*	"	Nipper M. C.
70	49·65	"	1907	*	"	Royston M. C.
71	42·90	"	1907	*	"	Pedro M. C.
72	24·80	"	1907	*	"	Vega M. C.
73	29·29	"	1907	*	"	Vanguard M. C.
74	29·14	"	1907	*	"	Dawson M. C.
75	49·86	"	1907	*	"	Bellajara M. C.
76	34·69	"	1907	*	"	Annex M. C.
77	79·91	"	1997	Mar. 2, 1909..	"	Surface.
78	14·00	"	1908	*	J. M. Pooley & J. M. Stewart	Maybelle (Fraction M. C.
98	48·89	"	1907	*	Jas. C. Grace	Washington M. C.
99	51·65	"	1908	*	Laura Hill.	Legal Tender M. C.
100	50·40	"	1908	*	E. M. Morgan	Azurite M. C.
101	47·74	"	1908	*	"	Malachite M. C.
102	49·83	"	1908	*	"	Cromwell M. C.

*Not yet approved.

APPENDIX No. 4.

LIST of Miscellaneous Surveys in the Yukon Territory, returns of which have been received from April 1, 1908, to March 31, 1909.

Year.	Surveyor.	Description of Survey.
1901	P. T. C. Dumais	Glacier creek base line (part of) a tributary of Gold creek.
1901	"	Moose creek base line (part of) a tributary of Fortymile river.

APPENDIX No. 5.

STATEMENT of work executed in the office of the chief draughtsman:—

Letters of instruction to surveyors	225
Progress sketches received and filed	1,308
Declarations of settlers received and filed	436
Returns of separate blocks of timber berths received	300
Plans received from surveyors	503
Field books received from surveyors	750
Timber reports received	276
Observations for magnetic declination received	11
Preliminary township plans prepared	492
Sketches made	2,163
Maps and tracings made	342
Plans of Yukon lots received	154
Plans of miscellaneous Yukon surveys received	6
Tracings of Yukon survey plans made	163
Yukon lots reduced to 40 chains to 1 inch and plotted on group plans	242
Yukon traverses reduced to 40 chains to 1 inch and plotted on group plans	8
Returns of surveys examined—	
Township subdivision	501
Township outline	370
Road plans	280
Railway plans	76
Mineral claims	17
Timber berths	213
Correction and other miscellaneous surveys	105
Township plans compiled	692
Townsite settlement and other plans compiled	14
Proofs of plans examined	487
Township plans printed	609
Townsite and settlement plans printed	14
Descriptions written	9
Pages of field notes copied	463
Applications for various information dealt with	2,034
Files received and returned	2,124
Letters drafted	6,476
Books received from record office and used in connection with office work	5,237
Books returned to record office	6,136
Plans other than printed township plans received from record office and used in connection with office work	1,038
Plans returned to record office	1,061
Volumes of plans received from record office and used in connection with office work	93
Volumes of plans returned to record office	105
Books sent to record office to be placed on record	615
Plans other than township plans sent to record office to be placed on record	429

APPENDIX No. 5—*Continued.*

Sectional maps (3 miles to 1 inch)—	
Revised	46
Reprinted	34
New drawings of old worn out sheets	1
New tracings of old worn out sheets	8
Sectional maps (6 miles to 1 inch)—	
Reprinted	11
Proofs of sectional sheets examined	47

APPENDIX No. 6.

LIST of new editions of sectional maps issued from April 1, 1908, to March 31, 1908.

[Scale 3 miles to 1 inch.]

No.	Name.	No.	Name.	No.	Name.	No.	Name.
18	Wood Mountain.....	72	Portage la Prairie ..	166	Sounding Creek	268	Carlton.
19	Willowbunch.	114	Calgary	167	Bad Hills.	269	Prince Albert
20	Souris	115	Blackfoot	169	Touchwood	270	Pasquia.
21	Turtle Mountain.....	116	Rainy Hills.	170	Yorkton	271	Mossy Portage.
23	Emerson.......	117	Red Deer Forks ..	214	Rocky Mt. House ..	317	Fort Pitt.
24	Lake of the Woods ..	118	Rush Lake	217	Tramping Lake.....	318	Shell River.
64	Porcupine.....	119	Regina.....	218	Saskatoon	319	Prince Albert N.
69	Moosejaw	121	Riding Mountain....	219	Humboldt..........		
70	Moose Mountain.....	123	Fort Alexander.....	221	Swan River		

[Scale 6 miles to 1 inch.]

22	Dufferin.....	215	Red Deer	265	Peace Hills..... ...	366	Saddle Lake.
164	Morley	216	Sullivan Lake.......	266	Ribstone Creek	416	La Biche.
168	The Elbow..........	264	Brazeau...	267	Battleford..........		

APPENDIX No. 7.

STATEMENT of work executed in the survey records office from April 1, 1908, to March 31, 1909.

Files received and dealt with	15,078
Letters drafted	4,741
Reports, memos. to Council, drafts	1
Plans, tracings, &c., copied or compiled	742
Statutory declarations copied or mailed	407
Plans sent to agents, registrars, &c	19,578
Pages of field notes copied	892
Prints of plans received and stored	179,725
Original plans received and recorded	1,238
Original field notes received and recorded	596
Letters written to agents	1,444
Registered parcels mailed	1,739

Work performed for the Topographical Surveys Branch.

Books searched for	7,552
Books sent	5,973
Books returned	6,775
Plans searched for	3,386
Plans sent	2,515
Plans returned	1,229
Volumes searched for	99
Volumes sent	69
Volumes returned	132

Work done for the Patents Branch.

Plans searched for	1,070
Plans sent	1,034
Plans returned	916
Field books searched for	83
Field books sent	82
Field books returned	37

Work done for other Branches.

Plans searched for	533
Plans sent	529
Plans returned	464
Field books searched for	360
Field books sent	352
Field books returned	424

APPENDIX No. 8.

Statement of work executed in the photographic office from April 1, 1908, to March 31, 1909.

—	3¼ x 3¼	4 x 5	5 x 7	8 x 10	10 x 12	11 x 14	16 x 18	18 x 20	24 x 30	30 x 36	36 x 42	42 x 48	Total.
Dry plate negatives	......	316	848	......	....	48	......	....	......	......	...	..	1,212
Bromide prints	......	36	44	311	82	139	179	141	50	24	8	3	1,017
Vandyke prints	.....	......	......	5	17	48	108	89	86	61	32	13	459
Silver prints	......	1,322	4,293	52	......	21	9	......	.....	......	......	......	5,697
Lantern transparencies	390	......	.....	......	.....	......	.....	......	....	......	......	.....	390
Photographs mounted	......	.....	468	46	1	67	93	10	.....	....	......	.....	685
Wet plate negatives	.....	......	..	127	......	134	770	230	......	......	.....	......	1,261
Photo litho plates	....	......	.....	.....	......	......	......	872	.....	......	.....	....	872
	390	1,674	5,653	541	100	457	1,159	1,342	136	85	40	16	11,593

APPENDIX No. 9.

STATEMENT of work executed in the lithographic office from April 1, 1908, to March 31, 1909.

Month.	Maps.		Townships.		Forms, &c.	
	No.	Copies.	No.	Copies.	No.	Copies.
1908.						
April	11	750	50	10,000	13	7,140
May	1	200	38	7,600	22	7,370
June	11	3,850	96	19,200	4	3,550
July	10	55,200	....	....	3	3,200
August	7	6,750	7	1,400	10	14,950
September	....	....	92	18,400	1	3,000
October	3	2,700	25	5,000	6	10,175
November	3	3,200	25	5,000	3	750
December	10	4,600	73	14,600	5	8,350
1909.						
January	10	4,725	105	21,000	....	....
February	10	11,850	33	6,600	1	2,000
March	17	46,025	38	7,600	5	1,700
Total	93	139,850	582	116,400	73	62,185

RECAPITULATION.

—	No.	Copies.	Impressions.	Cost.
				$ cts.
Maps	93	139,850	305,317	2,659 28
Townships	582	116,400	118,400	4,493 04
Forms, &c.	73	62,185	70,735	975 68
Total	748	318,435	494,452	8,128 00

APPENDIX No. 10.

List of employees of the Topographical Surveys Branch at Ottawa, giving the name, classification, duties of office and salary of each.

(Metcalfe Street, Corner of Slater.)

Name.	Classification. Division	Classification. Sub-division.	Duties of Office.	Salary.
				$ cts.
Deville, E., D.T.S., LL.D	1	A	Surveyor General	3,200 00
	CORRESPONDENCE.			
Brady, M	1	B	Secretary	2,100 00
Cullen, M. J	3	A	Stenographer	1,000 00
Moran, J. F	3	B	Typewriter and clerk	550 00
Williams, E. R	3	B	Correspondence clerk	600 00
Lynch, F	3	B	Typewriter	700 00
Addison, W. G	3	B	Typewriter	500 00
Paquette, A	3	B	Clerk	700 00
Pegg, A	....	....	Messenger	700 00
	ACCOUNTS.			
Hunter, R. H	2	A	Accountant	1,800 00
Wilkinson, Percy	3	A	Asst. accountant	900 00

Draughting Office.

General direction and supervision of the technical work.

Symes, P. B	1	B	Chief draughtsman	2,100 00
Shanks, T., B.A.Sc., D.L.S	1	B	Asst. chief draughtsman	2,100 00

Draughting Office—First Division.

Registration of Surveyors' plans, field notes and other documents; preparation of instructions to surveyors, annual and other reports; answering inquiries about surveys and preparing preliminary plans of townships.

Name.	Classification. Division	Classification. Sub-division.	Duties of Office.	Salary. $ cts.
Brown, T. E., B.A	1	B	Chief of division	2,100 00
Green, W. T., B.A., D.L.S	2	A	Asst. chief of division	1,600 00
Umbach, J. E., Grad. S.P.S., D.L.S	2	A	" "	1,600 00
Barber, H. G., Grad. S.P.S., D.L.S	2	A	" "	1,600 00
Rice, F. W., Grad. School of Mining, D.L.S	2	A	" "	1,600 00
Belleau, J. A., D.L.S	2	A	" "	1,600 00
McRae, A. D., B.A., B. Sc	2	B	Draughtsman	1,100 00
Carroll, M. J., Grad. S.P.S	2	B	"	1,300 00
Grant, A. W., B.A	2	B	"	1,100 00
Peaker, W. J., Grad. S.P.S	2	B	"	1,000 00
Grant, A. M., B. Sc	2	B	"	1,000 00
Milliken, J. B., B.A., B. Sc	2	B	"	1,000 00
MacMillan, J. P., B.E	2	B	"	1,000 00
Cordukes, J. P., B. Sc	2	B	"	900 00
Wadlin, L. N., B. Sc	2	B	"	900 00
Hayward, H. E., B. Sc	2	B	"	1,000 00
Sylvain, J	2	B	"	1,450 00
Rochon, E. C	2	B	"	1,100 00
McLaughlin, M. J	2	B	"	1,100 00
Holbrook, C. H	3	B	Clerk	700 00
Burkholder, E. L	3	B	"	550 00

Draughting Office—Second Division.

Examining the returns of surveys in Manitoba, Saskatchewan and Alberta; plotting the plans of townships and checking the accounts for contract surveys.

Nash, T. S., Grad. S.P.S., D.L.S	1	B	Chief of division	2,100 00
Henderson, F. D., Grad. S.P.S., D.L.S	2	A	Asst. chief of division	1,600 00
Burgess, E. L., Grad. S.P.S., D.L.S., O.L.S	2	A	" "	1,600 00
Dennis, E. M, B. Sc., D.L.S	2	A	" "	1,600 00
Elder, A. J., Grad. S.P.S., D.L.S	2	A	" "	1,600 00
Hill, S. N., Grad. S.P.S	2	A	" "	1,600 00
Elwell, Wm., Grad. S.P.S	2	A	" "	1,600 00
Cumming, A. L., B. Sc., D.L.S	2	A	" "	1,600 00
Sutherland, H. E., B. Sc	2	B	Draughtsman	1,100 00
Robertson, D. F., Grad. S.P.S	2	B	"	1,300 00
Clunn, T. H. G., D.L.S	2	B	"	1,450 00
Kitto, F. H., D.L.S	2	B	"	1,200 00
Bonnell, M. B., B.A. Sc	2	B	"	1,000 00
Norrish, B.E., B. Sc	2	B	"	900 00
McClennan, W. D	2	B	"	1,350 00
Roger, A	2	B	"	1,350 00
Spreckley, R. O	2	B	"	1,200 00
Goodday, Leonard	2	B	"	1,100 00
Williamson, F. H. H	2	B	"	1,100 00
Webb, G. C	2	B	"	1,100 00
Bray, R. P	2	B	"	1,100 00
Harrison, E. W	2	B	"	1,000 09
Ault, H. W	2	B	"	1,000 00
d'Orsonnens, A	2	B	"	1,300 00
Stronach, R.S	2	B	"	1,000 00
Macdonald, J. A	3	B	Clerk	550 00
Vacant	2	B	Draughtsman	1,000 00
Vacant	2	B	"	1,000 00
Vacant	2	B	"	1,000 00

Draughting Office—Third Division.

(Imperial Building, Queen Street.)

Copying plans for reproduction.

Name.	Classification. Division	Sub-division.	Duties of Office.	Salary.
				$ cts.
Engler, Carl, B.A., D.L.S.	2	A	Chief of division	1,750 00
May, J. E.	2	A	Asst. chief of division	1,600 00
O'Connell, J. R.	2	B	Draughtsman	1,450 00
Moule, W. J.	2	B	"	1,350 00
Helmer, J. D.	2	B	Clerk	800 00
Dawson, R. J.	2	B	"	800 00
Archambault, E.	2	B	"	800 00
Tremblay, A.	3	B	"	750 00
Brown, A.	3	B	"	650 00
Binks, C. R.	3	B	"	600 00
Ebbs, E. J.	3	B	"	500 00
Watters, James	3	A	Printer	1,000 00
Vacant	3	B	Clerk	500 00

Draughting Office—Fourth Division.

(Metcalfe Street, Corner of Slater.)

Supervising British Columbia surveys; preparing instructions; examining the returns and plotting the plans of the surveys.

Rowan-Legg, E. L.	2	A	Chief of division	1,750 00
Gillmore, E. T. B., Grad. R. M. C.	2	A	Asst. chief of division	1,700 00
Lawe, H., D.L.S.	2	A	" "	1,600 00
MacIlquham, W. L., B. Sc.	2	A	" "	1,600 00
Morley, R. W.	2	A	" "	1,600 00
Weld, W. E.	2	A	" "	1,600 00
Wilson, E. E. D.	2	B	Draughtsman	1,400 00
Osmond, H.	2	B	"	1,000 00
Harris, K. D.	2	B	"	1,000 00

Draughting Office—Fifth Division.

(Imperial Building, Queen Street.)

Compiling sectional maps and township index.

Smith, J.	1	B	Chief of division	2,100 00
Begin, P. A.	2	A	Asst. chief of division	1,650 00
Genest, P. F. X.	2	A	" "	1,600 00
Lepage, J. B.	2	A	Draughtsman	1,600 00
Blanchet, A. E.	2	B	"	1,450 00
Davies, T. E. S.	2	B	"	1,300 00
Perrin, V.	2	B	"	1,300 00
Davy, E.	2	B	"	1,100 00
Flindt, A. H.	2	B	"	1,000 00
Villeneuve, E.	2	B	"	800 00
Bergin, W.	2	B	"	800 00

Draughting Office—Sixth Division.

(Imperial Building, Queen Street.)

Plotting topographical plans; examining and plotting returns of levels on base lines; calculating and recording barometric elevations and magnetic observations; calculating astronomical field tables; testing and adjusting survey instruments.

Name.	Classification. Division	Classification. Sub-division	Duties of Office.	Salaries. $ cts.
Dodge, G. B., D.L.S.	1	B	Chief of division	2,100 00
Vacant	2	B	Computer & draughtsman.	1,000 00
Vacant	2	B	" "	1,000 00
Vacant	2	B	" "	1,000 00
Vacant	2	B	" "	1,000 00
Vacant	2	B	" "	1,000 00
Vacant	2	B	" "	1,000 00
Vacant	3	B	Clerk	500 00
Vacant	3	B	"	500 00
Vacant	3	B	"	500 00
Vacant	3	B	"	500 00
Vacant	3	B	"	500 00
Vacant	3	B	"	500 00

Geographer's Office.

(Woods Building, Slater Street.)

Name.	Division	Sub-division	Duties of Office.	Salaries.
White, James, F.R.G.S	1	A	Chief Geographer	3,000 00
Chalifour, J. E	1	B	" draughtsman	2,100 00
Baine, H. E	2	A	Draughtsman	1,850 00
Taché, Henri	2	A	"	1,600 00
Anderson, W	2	A	"	1,600 00
Bryant, E. D	2	A	"	1,600 00
Inkster, Fred	2	A	"	1,600 00
Beveridge, J	2	A	"	1,600 00
Akerlindh, A	2	B	"	1,250 00
Darrach, A. M	2	B	"	1,100 00
Blatchley, H. M	2	B	"	1,050 00
Dumouchel, G. E	2	B	"	1,050 00
Grindlay, Thos	2	B	"	1,200 00
Wilson, H. W	2	B	"	1,050 00
Chandler, S	2	B	"	1,000 00
Bennie, J	2	B	"	1,000 00
Craig, R. W	2	B	"	1,000 00
Groulx, A	2	B	"	900 00
Gagnon, J. S	2	B	"	900 00
McElligott, J. P	2	B	"	800 00
Blue, W. A	2	B	"	800 00
Pigeon, J. H	2	B	"	800 00
Waine, Mrs. F. E	3	B	Clerk	700 00
Martin Miss M. P	3	B	Stenographer	600 00
Stewart, Miss M	3	B	"	500 00
Merrifield, J. R			Messenger	700 00
Vacant	2	B	Draughtsman	800 00

SURVEY RECORDS OFFICE.

(Canadian Building, Slater Street.)

Name.	Classification. Division	Sub-division	Duties of Office.	Salary.
				$ cts.
Steers, C. J.	2	A	Clerk in charge	1,700 00
Currie, P. W., B.A., B.Sc., D.L.S.	2	A	First assistant	1,750 00
Surtees, W. S.	2	A	Clerk	1,600 00
Lecourt, Eugène	2	B	Draughtsman	1,550 00
Ashton, A. W., D.L.S.	2	B	"	1,250 00
Gillis, W.C., B.Sc.	2	B	"	1,200 00
Brice, E. E.	2	B	"	1,000 00
Smith, F. W.	2	B	"	900 00
Sowter, T. W. E.	3	A	Clerk	1,100 00
Belleau, Eugène, B.L.	3	A	"	1,100 00
Lambart, O.H.	3	A	"	1,100 00
Yeilding, Miss A. B.	3	A	"	1,100 00
Routh, C. T	3	A	"	900 00
Moore, R. T	3	B	"	700 00
Landry, Narcisse	3	B	"	600 00

GEOGRAPHIC BOARD.

(Woods Building, Slater Street.)

Whitcher, A. H., F.R.G.S., D.L.S.	2	A	Secretary	1,900 00

PHOTOGRAPHIC OFFICE.

(Metcalfe Street, Corner of Slater Street.)

Carruthers, H. K.	2	A	Process photograher	1,600 00
Woodruff, John	2	A	Chief "	1,600 00
Whitcomb, H. E.	3	A	Photographer	1,000 00
Morgan, W. E.	3	A	"	900 00
Kilmartin, A.	3	B	Asst. photographer	800 00
Devlin, A	3	B	"	800 00
Ouimet, E. G.	3	B	Clerk	700 00

LITHOGRAPHIC OFFICE (Unclassified).

(Metcalfe Street, Corner of Slater Street.)

Name.	Occupation.	Salaries.
Moody, A.	Foreman	$25 00 per week.
Burnett, E.	Lithographer	25 00 "
Thicke, C. R.	"	22 00 "
Deslauriers, J. H.	Transferrer	20 00 "
Bergin, J.	Printer	18 00 "
Thicke, H. S	"	18 00 "
Boyle, S.	Stone polisher	14 00 "
Gagnon, J.	Press feeder	11 00 "
Kane, P.	"	7 00 "

APPENDIX No. 11.

LIST of Dominion Land Surveyors who have been supplied with Standard Measures.

Name.	Address.	Date of Appointment.	Remarks.
Austin, G. F.	Dewdney, Alta	April 14, 1872	
Aylen, J	North Bay, Ont	May 29, 1885	
Aylsworth, C. F	Madoc, Ont	" 13, 1886	
Baker, J. C.	Vermilion, Alta.	" 18, 1906	
Baker, M. H	Maple Creek, Sask	Aug. 6, 1908	
Barwell, C. S. W.	Dawson, Yukon Territory	" 21, 1894	
Bayne, G. A.	Winnipeg, Man.	April 14, 1872	
Beatty, D	Parry Sound, Ont.	" 14, 1872	
Beatty, W	Delta, Ont.	" 14, 1872	
Belanger, P. R. A.	Ottawa, Ont.	May 17, 1880	Inspector of Surveys. Topographical Surveys Branch, Dept. of Interior.
Belleau, J. A.	"	" 15, 1883	Topographical Surveys Branch, Dept. of Interior.
Bigger, C, A	"	Mar. 30, 1882	Astronomer, Dept. of Interior.
Bingham, E. R.	Fort William, Ont.	Oct. 25, 1906	
Bolton, L.	Listowel, Ont	April 14, 1872	
Boswell, E. J	Not known	Mar. 18, 1903	
Bourgeault, A	St. Jean Port Joli, Que.	" 29, 1883	
Bourgault, C. E.	" "	Feb. 21, 1888	
Bourget, C. A	Levis, Que	May 14, 1884	
Bowman, H. J	Berlin, Ont	Feb 16, 1888	
Brabazon, A. J	Ottawa, Ont.	May 13, 1882	
Brady, J.	Golden, B.C.	April 14, 1872	
Bray, S.	Ottawa, Ont.	Nov. 14, 1883	Dept. of Indian Affairs.
Bray, L. T	Amherstburg, Ont.	Feb. 18, 1903	
Bridgland, M. P	Calgary, Alta	Mar. 10, 1905	Topog. Surveys Branch, Dept. of Interior.
Brownlee, J. H	Victoria, B.C	April 15, 1887	
Bucknill, W. B.	Vancouver, B.C	Mar. 19, 1908	
Burke, W	Minnedosa, Manitoba	April 14, 1872	
Burnet, H	Ottawa, Ont.	June 22, 1885	
Burwash, N. A.	Whitehorse, Yukon Territory	Mar. 6, 1907	
Burwell, H. M	Vancouver, B.C	Feb. 17, 1887	
Campbell, A. S	Kingston, Ont.	Mar. 6, 1909	
Carbert, J. A	Medicine Hat, Alta	May 12, 1880	
Carpenter, H. S.	Regina, Sask	Feb. 20, 1901	Dept. of Public Works for Saskatchewan.
Carroll, C.	Prince Albert, Sask	April 14, 1872	
Carson, P. A	Ottawa, Ont	Feb. 22, 1906	Topog. Surveys Branch, Dept. of Interior.
Cautley, R. H	Edmonton, Alta	May 1, 1905	
Cautley, R. W.	"	Sept. 2, 1896	
Cavana, A. G.	Orillia, Ont	Nov. 16, 1876	
Charlesworth, L. C.	Edmonton, Alta.	Mar. 24, 1903	Dept. of Public Works, Alberta.
Chilver, C. A.	Walkerville, Ont	Feb. 22, 1907	
Christie, W.	Chesley, Ont	Mar. 22, 1906	
Coates, P. C	Golden, B.C.	April 19, 1907	
Cleveland, E. A.	Vancouver, B.C	June 27, 1899	
Côté, J. A	Prince Albert, Sask	May 14, 1884	
Côté, J. L	Edmonton, Alta	Mar. 21, 1890	
Cotton, A. F	New Westminster, B.C.	May 11, 1880	
Craig, J. D.	Ottawa, Ont	Feb. 24, 1902	Boundary Surveys, Dept. of Int.
Cummings, A.	Fernie, B.C	Mar. 3, 1909	
Cummings, J. G	Calgary, Alta	Feb. 17, 1904	
Dalton, J. J.	Weston, Ont	April 17, 1879	Dominion Topographical Surveyor.
Davies, T. A	Ottawa, Ont.	Feb. 22, 1906	
Deans, W. J.	Brandon, Man.	May 13, 1886	
Dennis, J. S	Calgary, Alta	Nov. 19, 1877	Dominion Topographical Surveyor, Inspector of Irrigation and British Columbia Land Commissioner, C.P.R.

APPENDIX No. 11.

LIST of Dominion Land Surveyors who have been supplied with Standard Measures—*Continued.*

Name.	Address.	Date of Appointment.	Remarks.
Denny, H. C	Not known	April 1, 1882	
Dickson, H. G	Whitehorse, Yukon Territory	Mar. 19, 1899	
Dickson, J.	Fenelon Falls, Ont	April 14, 1872	
Dobie, J. S.	Regina, Sask	Mar. 22, 1906	Dept. of Public Works for Saskatchewan.
Doupe, J.	Winnipeg, Man.	April 14, 1872	
Doupe, J. L	"	Oct. 6, 1888	Asst. Land Commissioner, C. P.R.
Drewry, W. S	New Denver, B.C	Nov. 14, 1883	
Driscoll, A.	Edmonton, Alta	Feb. 23, 1887	
Drummond, T	Montreal, Que.	June 24, 1878	Dominion Topographical Surveyor.
Ducker, W. A	Winnipeg, Man	Mar. 30, 1883	Swamp Land Commissioner.
Dumais, P. T. C	Hull, Que.	" 29, 1882	
Edwards, Geo	Ponoka, Alta	April 14, 1872	
Ellacott, C. H	Victoria, B.C	Feb. 22, 1899	
Empey, J. M	Calgary, Alta	" 23, 1905	
Fairchild, C C.	Brantford, Ont	" 20, 1901	
Farncomb, A. E	Lacombe, Alta	Mar. 12, 1902	
Fawcett, T.	Niagara Falls, Ont	Nov. 18, 1876	Dominion Topographical Surveyor.
Fawcett, A.	Gravenhurst, Ont	Feb. 22, 1893	
Findlay, A.	Winnipeg, Man	Mar. 21, 1908	
Fontaine, L. E	Levis, Que	Nov. 30, 1892	Inspector of surveys, Topographical Surveys Branch, Dept. of Interior.
Foster, F. L	Toronto, Ont	April 14, 1872	
Francis, J	Poplar Point, Man	June 17, 1875	
Garden, J. F.	Vancouver, B.C	May 13, 1880	
Garden, G. H.	Lethbridge, Alta	April 14, 1872	
Garden, C.	Not known	" 14, 1872	
Garner, A. C.	South Qu'Appelle, Sask	May 27, 1907	
Gauvreau, L. P.	Not known	April 14, 1872	
Gibbons, J.	Dawson, Yukon Territory	Feb. 12, 1891	
Gordon, M. L	Vancouver, B.C	" 18, 1904	
Gordon, R. J.	Raymond, Alta	Mar. 12, 1902	
Gore, T. S	Victoria, B.C	April 19, 1879	
Green, A. H.	Nelson, B.C	Feb. 23, 1905	
Green, T. D	Prescott, Ont	May 19, 1884	
Green, W. T.	Ottawa, Ont	Feb. 22, 1907	Topographical Surveys Branch, Dept. of Interior.
Grover, G A.	Norwood, Ont.	" 18, 1901	
Harris, J. W.	Winnipeg, Man	April 14, 1872	City Surveyor, Winnipeg.
Harvey, C.	Indian Head, Sask	Feb. 17, 1904	
Hawkins, A. H	Listowel, Ont	Mar. 6, 1906	
Heathcott, R. V	Edmonton, Alta.	May 13, 1907	
Henderson, W	Not known	Nov. 17, 1883	
Holcroft, H. S.	Toronto, Ont	Feb. 18, 1903	
Hopkins, M. W.	Edmonton, Alta.	" 20, 1901	
Hubbell, E. W	Ottawa, Ont.	May 19, 1884	Topographical Surveys Branch, Dept. of Interior, President of D.L.S. Association.
James, S.	Toronto, Ont	April 14, 1872	
Jephson, R. J	Brandon, Man	May 12, 1880	
Johnson, A. W.	Kamloops, B.C	Mar. 12, 190[illegible]	
King, W. F	Ottawa, Ont	Nov. 21, 187[illegible]	Dominion Topographical Surveyor, Chief Astronomer, Dept. of Interior.
Kimpe, M	Edmonton, Alta.	May 13, 1907	
Kirk, J. A.	Revelstoke, B.C.	" 11, 188[illegible]	
Kitto, F. H	Ottawa, Ont.	Mar. 6, 1908	Topographical Surveys Branch Dept. of Interior.
Klotz, O. J	"	Nov. 19, 1877	Dominion Topographical Surveyor, Astronomer, Dept. o the Interior.

APPENDIX No. 11.

LIST of Dominion Land Surveyors who have been supplied with Standard Measures—*Continued.*

Name.	Address.	Date of Appointment.	Remarks.
Knight, R. H.	Edmonton, Alta.	Feb. 18, 1904	
Latimer, F. H.	Detroit, Mich.	Nov. 13, 1885	
Laurie, R. C.	Battleford, Sask.	April 27, 1883	
Lawe, H.	Ottawa, Ont.	" 14, 1872	Topographical Surveys Branch, Dept. of Interior.
Lemoine, C. E.	Quebec, Que.	Mar. 31, 1882	
Lendrum, R. W.	Strathcona, Alta.	May 15, 1880	
Lonergan, G. J.	Buckingham, Que.	Feb. 28, 1901	Inspector of Surveys, Topographical Surveys Branch, Dept. of Interior.
Lumsden, H. D.	Ottawa, Ont.	April 14, 1872	Chief Engineer Trans. Ry.
MacPherson, C. W.	Dawson, Yukon Territory	Mar. 7, 1900	Director of Surveys, Y.T.
Magrath, C. A.	Lethbridge, Alta.	Nov. 16, 1881	Dominion Topographical Surveyor, Member of Parliament.
Meadows, W. W.	Maple Creek, Sask.	Feb. 23, 1905	District Surveyor and Town Engineer.
Miles, C. F.	Toronto, Ont.	April 14, 1872	Inspector of Surveys, Topographical Surveys Branch, Dept. of Interior.
Moberly, H. K.	Innisfail, Alta.	" 21, 1903	
Molloy, J.	Winnipeg, Man.	" 14, 1872	
Montgomery, R. H.	Prince Albert, Sask.	Feb. 23, 1905	
Moore, H. H.	Calgary, Alta.	Feb. 17, 1904	
Morrier, J. E.	Ottawa, Ont.	May 16, 1907	
McArthur, J. J.	Ottawa, Ont.	April 17, 1879	Boundary Surveys, Dept. of Interior.
McColl, G. B.	Winnipeg, Man.	Mar. 20, 1907	Dominion Topographical Surveyor.
McDiarmid, S. S.	Vancouver, B.C.	Feb. 23, 1905	
McFadden, M.	Neepawa, Man.	April 14, 1872	
McFarlane, J. B.	Toronto, Ont.	June 3, 1908	
McFarlane, W. G.	Toronto, Ont.	May 19, 1905	
McFee, A.	Red Deer, Alta.	April 19, 1879	
McGrandle, H.	Wetaskiwin, Alta.	May 30, 1883	
McKenna, J. J.	Dublin, Ont.	April 14, 1872	
McKenzie, J.	New Westminster, B.C.	Nov. 18, 1887	Dominion Lands Agent, New Westminster.
McLean, J. K.	Ottawa, Ont.	April, 1, 1882	Dept. of Indian Affairs.
MacLennan, A. L.	Toronto, Ont.	Feb. 23, 1905	
McMillan, G.	Ottawa, Ont.	" 22, 1906	
McPherson, A. J.	Dawson, Yukon Territory	" 21, 1901	
McPhillips, G.	Winnipeg, Man.	June 17, 1875	
McVittie, A. W.	Blairmore, Alta.	Mar. 30, 1882	
Nash, T. S.	Ottawa, Ont.	Feb. 18, 1904	Topographical Surveys Branch, Dept. of Interior, secretary-treasurer of the D.L.S. Assn.
Ogilvie, W.	Paris, Texas	April 14, 1872	
O'Hara, W. F.	Ottawa, Ont.	Feb. 19, 1895	
Ord, L. R.	Hamilton, Ont.	April 1, 1882	
Parsons, J. L. R.	Regina, Sask.	Feb. 23, 1905	
Patrick, A. P.	Calgary, Alta.	Nov. 19, 1877	Dominion Topographical Surveyor.
Pearce, W.	Calgary, Alta.	May 10, 1880	
Phillips, E. H.	Saskatoon, Sask.	Feb. 24, 1902	Dept. of Public Works for Saskatchewan.
Plunkett, T. H.	Meaford, Ont.	Mar. 12, 1908	
Ponton, A. W.	Macleod, Alta.	May 18, 1881	
Proudfoot, H. B.	Saskatoon, Sask.	Mar. 28, 1882	
Rainboth, E. J.	Ottawa, Ont.	May 19, 1881	
Rainboth, G. C.	Aylmer, Que.	April 14, 1872	Boundary Surveys, Dept. of Interior.
Reid, J. L.	Ottawa, Ont.	" 14, 1872	Dept. of Indian Affairs.
Reilly, W. R.	Regina, Sask.	Nov. 17, 1881	
Richard, J. F.	Ste. Anne de la Pocatière, Que.	May 13, 1882	
Rinfret, R.	Quebec, P.Q.	Feb. 20, 1900	
Ritchie, J. F.	Nelson, B.C.	Jan. 7, 1889	

APPENDIX No. 11.

List of Dominion Land Surveyors who have been supplied with Standard Measures.—*Concluded.*

Name.	Address.	Date of Appointment.	Remarks.
Robertson, H. H.	Not known	April 14, 1872	
Roberts, S. A.	Victoria, B.C.	May 16, 1885	
Roberts, V. M.	Sturgeon Falls, Ont	" 17, 1886	
Robinson, E. W.	Victoria, B.C.	" 1, 1908	
Robinson, F. J.	Regina, Sask	Feb. 20, 1906	Dept. of Public Works for Saskatchewan.
Rolfson, O.	Walkerville, Ont.	July 11, 1908	
Rombough, M. B.	Morden, Man	April 14, 1872	
Rorke, L. V.	Toronto, Ont	Aug. 13, 1891	
Ross, G.	Welland, Ont.	Nov. 21, 1882	
Ross, J. E.	Kamloops, B.C.	Feb. 12, 1891	
Roy, G. P.	Quebec, Que.	Nov. 17, 1881	
Saint Cyr, J. B.	Montreal, Que.	Feb. 17, 1887	
Saint Cyr, A.	Ottawa, Ont.	" 17, 1887	
Saunders, B. J.	Edmonton, Alta	Nov. 16, 1884	
Scott, W. A.	Galt, Ont.	Mar. 19, 1909	
Seagar, E.	Kenora, Ont.	April 14, 1872	
Selby, H. W.	Toronto, Ont	Nov. 15, 1882	
Seymour, H. L.	Edmonton, Alta.	Feb. 22, 1906	
Sewell, H. de Q.	Toronto, Ont	May 16, 1885	
Shaw, C. A. E.	Victoria, B.C.	" 10, 1880	
Shepley, J. D.	Maple Creek, Sask	Mar. 12, 1906	
Smith, C. C.	Ottawa, Ont.	Feb. 22, 1906	Dominion Observatory, Dept. of Interior.
Speight, Thos.	Toronto, Ont	Nov. 16, 1882	
Starkey, S. M.	Starkey's P. O., N.S.	April 14, 1872	
Steele, I. J.	Ottawa, Ont.	" 16, 1908	
Stewart, G. A.	Calgary, Alta.	" 14, 1872	
Stewart, L. B.	Toronto, Ont	Nov. 22, 1882	Dominion Topographical Surveyor, Professor of Surveying, School of Practical Science.
Stewart, E.	Montreal, Que.	April 14, 1872	
Stewart, W. M.	Hamilton, Ont.	June 6, 1907	
Talbot, A. C.	Calgary, Alta	May 13, 1880	
Taylor A.	Not known	June 9, 1904	
Teasdale, C. M.	Concord, Ont.	Mar. 9, 1906	
Thompson, W. T.	Fort Qu'Appelle, Sask.	Nov. 19, 1877	Dominion Topographical Surveyor.
Tracey, T. H.	Vancouver, B.C.	April 14, 1872	City Engineer, Vancouver.
Tremblay, A. J.	Les Eboulements, Que.	Feb. 18, 1890	
Turnbull, T.	Winnipeg, Man.	Mar. 29, 1882	
Tyrrell, J. W.	Hamilton, Ont.	Feb. 16, 1887	
Vaughan, J. W.	Vancouver, B.C.	June 11, 1878	
Vicars, J.	Kamloops, B.C.	May 17, 1886	
Waddell, W. H.	Hamilton, Ont.	Mar. 25, 1907	
Waldron, J.	Moosejaw, Sask.	April 2, 1907	
Walker, E. W.	Regina, Sask.	Mar. 27, 1907	Dept. of Public Works for Saskatchewan.
Wallace, J. N.	Calgary, Alta.	Feb. 20, 1900	
Warren, J.	Walkerton, Ont.	April 14, 1872	
Watt, G. H.	Prince Albert, Sask.	Feb. 24, 1902	
Weekes, A. S.	Edmonton, Alta.	" 11, 1892	
Weekes, M. B.	Regina, Sask	" 18, 1903	Dept. of Public Works for Saskatchewan.
Wheeler, A. O.	Calgary, Alta.	Nov. 21, 1882	Topographer of the Department of the Interior.
White-Fraser, G. W. R.	Ottawa, Ont.	Feb. 21, 1888	Dominion Topographical Surveyor.
Wiggins, T. H.	Saskatoon, Sask.	" 18, 1896	
Wilkins, F. W.	Norwood, Ont.	May 18, 1881	Dominion Topographical Surveyor.
Wilkinson, W. D.	Not known	Feb. 22, 1893	
Williams, G. L.	Vancouver, B.C.	June 24, 1908	
Woods, J. E.	Frank, Alta.	Nov. 14, 1885	
Young, W. B.	Winnipeg, Man.	Mar. 25, 1905	
Young, W. H.	Lethbridge, Alta.	May 17, 1907	

PART V

DOMINION PARKS

DOMINION PARKS

REPORT OF THE COMMISSIONER OF DOMINION PARKS.

DEPARTMENT OF THE INTERIOR,
BANFF, ALBERTA, July 15, 1909.

To the Honourable FRANK OLIVER,
Minister of the Interior,
Ottawa, Ont.

SIR,—I have the honour to submit herewith my first annual report as commissioner of Dominion parks for the fiscal year ending March 31, 1909.

It is a source of very great pleasure to me to be able to report that with each succeeding year the popularity of Canada's western recreation grounds is increasing with rapidity that has far exceeded the most sanguine expectations of those who a few years ago saw the immense possibilities of these parks as a pleasure and health resort. Tho usefulness of these parks is becoming more and more recognized as they become better known, and their future development and expansion will, it is expected, be much more rapid than in the past. The remarkable growth of interest manifested in these charming resorts is not only very marked in the increasing number of temporary summer visitors and tourists, but in the rapidly increasing numbers of permanent residents in the town of Banff. The presence of an up-to-date school of three rooms in charge of a competent staff of teachers and fully equipped with modern educational facilities, is having the effect of inducing many families to take up their residence in Banff for a part of each year.

During the past ten years there has been an increase of almost five hundred per cent in the number of visitors to the different mountain parks, as may be seen by the comparative figures compiled for each year since 1899, which are as follows :—

Year.	No. of Visitors.
1899	7,389
1900	6,533
1901	8,456
1902	8,516
1903	10,696
1904	11,752
1905	17,605
1906	30,136
1907 (9 months)	288,735
1908	32,209
1909	39,780

In the above figures I have not included the very large number of persons who visit the parks on excursions for a day and who do not register at the hotels, &c. Among the visitors were people from almost every country of the world, no less than forty-five different nationalities being represented last year. I may say that every one of them has gone away charmed and delighted with the scenic wonders of Canada's national parks.

During the past year the parks were visited by an unusually large number of British, eastern Canadian and American press associations and delegations consisting of many of the leading magazine and newspaper writers in those countries. On their return home well-written leading articles descriptive of the grandeur of the mountains, valleys, waterfalls, caves and other wonders which they saw, made known to hundreds of thousands of their readers that Canada has beauty spots to make men happy as well as fertile plains to make them wealthy.

They were also particularly impressed with the cosmopolitan character of the people met at the different resorts in the park. One of them, an extensively travelled and leading newspaper writer of New York, remarked : 'Between New York and Shanghai, where I spent five years, there is no spot more cosmopolitan than the rotunda of the Canadian Pacific Hotel at Banff.' After noting some of the men that he had met in far distant parts of the world and whose acquaintance he had renewed on his visit to Banff, he said : 'The women in this group of people in the rotunda of the hotel are dressed as attractively as any women in any hotel in the world, and when the orchestra plays and the people move about talking to each other I could imagine myself in Buenos Ayres, in Bombay, in Melbourne, in Malta, in Cape Town or in any other city in which the currents of world traffic come together.'

The tide of travel for the season of 1909 has commenced in an unprecedented volume, and already the accommodation of the parks is taxed to its utmost limit, and judging from present indications it is confidently expected that it will be almost double in volume that of any former year. This is due in a great measure to the crowds of people from eastern Canada, the eastern and New England states who are visiting the Alaska-Yukon Exposition at Seattle, and are taking advantage of the opportunity of seeing the magnificent scenery of the Canadian mountains, either on their going or homeward trip. A very large percentage of these stop off for a day or two and many of them for a longer period at some of the resorts in the mountain parks. The task of providing for the comfort and accommodation of so many of these pleasure-seekers, in addition to the regular number of visitors and tourists, necessarily involves a large amount of extra work for the staff at each park.

THE TOWN OF BANFF.

The town of Banff, the business centre of the Rocky Mountains Park and the chief objective point for tourists, is an up-to-date little town of close to one thousand permanent residents, which is generally increased to about fifteen hundred during the summer months by temporary residents who either own or lease cottages which they occupy from two to six months each year.

Eight excellent hotels and six livery barns well supplied with saddle horses and carriages cater to the tourist and other trade for trips to the many points of interest to which roads and trails lead from the town. Outfitting stores of all kinds furnish supplies to the residents or camping parties at reasonable prices.

The town is supplied with all modern utilities in the way of electric light, water and sewer systems, telephone exchange connected with the Alberta government long-distance telephone system, churches, schools, fraternal societies, athletic and social clubs, &c.

The principal streets are all well graded and gravelled, but a large amount of work is required to be done each year in keeping up new streets where new houses are being built, extending to water and sewer system, regrading streets which are torn up by the extension of the water works and sewer system.

OTHER IMPROVEMENTS IN THE PARK.

In addition to the large amount of necessary work done last year in the maintenance and repair of the roads and trails in the town of Banff and other parts of the park a considerable amount of new work was undertaken. In the town about a mile of street was regraded and gravelled and a cinder path constructed from the Bow River bridge to the Banff Springs Hotel, a distance of about three-quarters of a mile.

Six miles of new road was constructed between Canmore and Exshaw, to facilitate communication by rigs between those two points. This new road will also form a part of the proposed coach road from Calgary to Banff, on its part of which the provincial government of Alberta is doing a considerable amount of work each year. It is expected that the road for this entire distance will be completed in another year and made passable for all kinds of vehicles.

Three miles of road were built as an extension of the road from Laggan to Moraine lake in the valley of the Ten Peaks. It is hoped to have the remaining three miles of this road to the lake completed this year.

With the additions made during the past year there are now in operation and in a good state of repair nearly eighty miles of carriage road at Banff, nineteen miles at Laggan, and thirty-five miles at Field.

I am glad to be able to report that notwithstanding the greatly increased travel over them there has not been a single serious accident or any unnecessary delay on any of them.

THE MUSEUM AND GROUNDS.

The number of visitors to the museum as shown by the report of the curator (which is appended), continues to increase each year and is one of the chief attractions of the park. The different specimens of the big game, the smaller mammals, the fish and bird-life, the flora and minerals of the park are proving a continued source of interest to the lay visitor as well as to the student of natural science. Its educative value in enabling the visitors to classify the different specimens of plants and rocks which they find in their tours is greatly appreciated, so much so that an appreciative visitor styled it 'The University of the Hills.'

To the younger generation of the visitors the mounted specimens of wild animals, birds and insects and the caged live animals are a source of great interest and delight. The additions to the specimens last year included the head of an elk which was killed in a fight with another elk, some birds, &c.

The wild animals confined in the new cages have been in perfectly good health and condition during the year, and have taken very kindly to their enforced captivity in their new homes and appear to enjoy their comfortable and clean environments. The animals confined in them at present are :—

Black bear	1
Brown bear	1
Cinnamon bear	1
Mountain lions	1
Timber wolves	2
Coyotes	2
Kit fox	3
Red fox	2
Lynx	2
Racoons	2
Badgers	2
Marmots	2

During the year a considerable amount of work was done on the grounds to make it more convenient and comfortable for visitors to see the animals in captivity. This included the completion of a gravelled drive around the grounds, a cinder path between and around the cages, fencing, levelling, draining and filling low ground, &c.

THE SULPHUR BATHS.

The revenue from the baths at the Cave and Basin continues steadily to increase and the number of bathers who enjoyed their beneficent and curative waters during the past year was greatly in excess of that of any previous year since the baths were opened. This was the case, notwithstanding the growing popularity of the baths at the Hot Springs.

In my report of last year I drew your attention to the inadequacy of the accommodation at the Cave and Basin for the swarms of bathers who patronize it especially during the months of July and August. Intending bathers have in many cases every day during those months to wait for a considerable length of time before they can secure a dressing room.

At the Hot Springs baths the lack of sufficient accommodation is even more apparent. At no season of the year can the number of bathers be satisfactorily accommodated and during the hot summer months large numbers of intending bathers are, owing to the lack of accommodation, unable to secure baths.

The erection of a large up-to-date bath-house at the Hot Springs, equipped with all the latest modern conveniences is imperative if the baths are to continue to increase in popularity, as no doubt they will. In my opinion the revenue would increase in proportion to the expenditure and be a good paying investment for the department.

It may be of interest to the public to reproduce the report of the analyst of the Canadian government, who says officially :—

'The water is free from organic impurities and gives no albuminoid nitrogen. Each gallon contains dissolved sulphuretted hydrogen to the amount of 0·3 grains (equivalent to 0·8 cubic inch).

'The dissolved solids are as follows :—

'Chloride (in chlorides)	0·42	grains.
'Sulphuric acid (SO3)	38·50	"
'Silica (SiO2)	2·31	"
'Lime (CaO)	24·85	"
'Magnesia (Mg)	4·87	
'Alkalis (as Soda, Na20)	0·62	"
'Lithium	a decided trace.	

'The temperature of the spring is 114·3 degrees Fahrenheit.'

During the year a large number of complete and permanent cures of diseases, especially of rheumatism and other blood diseases, were reported as a result of the curative qualities of the Banff sulphur water baths.

ANIMALS IN THE PADDOCKS.

The animals in the paddocks at Banff continue to be one of the most popular of the attractions in the park and the caretaker's register shows a largely increased number of visitors each year. Especial interest is taken by them in the herd of buffalo, as being the relics of the countless monarchs of the plains, which but for the action of the Interior Department of the government of Canada would have been doomed to total extinction.

That there has not been a large natural increase during the year is accounted for by the fact that the paddock in which they are inclosed has become entirely too small for such a large herd and the animals are too much crowded for successful breeding. It is my intention during this year to have the majority of them removed to one of the large buffalo parks, leaving about twenty-five or thirty head at Banff. This number will be quite sufficient for the purpose for which the animals are kept at Banff

The small increase in the number of the other animals is due almost entirely to the destruction of their young by coyotes and wolves. A wire inclosure to keep out these carniverous and destructive animals will be built during the year, which will ensure the protection of the young animals from their enemies. It is only by experience that the best way of caring for wild animals in such partial captivity and under such circumstances can be learned and this appears to me to be the best way of protecting them.

It is with regret that I have to report the death of 'Sir Donald,' the patriarch of the buffalo herd, whose tragic end occurred early in March, he having been gored to death by a number of young buffalo bulls.

For several years it had been the intention to preserve and take the best of care of 'Sir Donald' as a matter of scientific historical interest in ascertaining the longevity of the buffalo race. For that reason he was cared for until he became too decrepit from age to care for himself. When he was attacked by the younger bulls and knocked down, he was helpless to defend himself and the aged hero was gored and trampled beyond recognition, in which condition he was found next morning. There is not the slightest doubt but that 'Sir Donald' was the last specimen of the buffalo that a few years ago roamed the prairie at will in their wild free state. He was captured as a buffalo calf by the Indians in 1872 and was consequently in his thirty-eighth year at the time of his death. His history during his thirty-seven years of captivity has been one of romantic interest to thousands of people as the sole survivor of a noble type of animals, that in their wild state have become only a memory to Indians, buffalo hunters and old-time white pioneers.

Shortly after his capture he was sold by the Indians to Mr. James McKay, then chief factor for the Hudson's Bay Company at Fort Garry, and afterwards became a part of and headed the herd of Sir Donald A. Smith (now Lord Strathcona) at Silver Heights. In 1898 Lord Strathcona donated the remnant of his herd, consisting of thirteen animals, among which was 'Sir Donald,' to the National Park at Banff, to be cared for as the wards of the Canadian government.

It had been intended to have the skin preserved and mounted as a whole specimen for the new national museum at Ottawa, but unfortunately his carcass was so gored and disfigured beyond recognition that this was impossible. The head has, however, been preserved and is now being mounted and will serve in a measure as a memento of the last and noblest specimen of the buffalo of the by-gone days.

The animals now in the paddocks are as follows :—

Buffalo	107	Increase	14
Moose	21	"	3
Elk	15	"	3
Mule deer	11		
Persian sheep	3		
Angora goats	6		
Virginia deer	4		

The only antelope in the paddock was killed during the year by another deer.

THE COAL MINES.

The coal mines at Bankhead and Canmore have been in operation for almost full time during the year and the companies report a largely increased output over any former year in their history.

The capacity of the briquetting plant at Bankhead has been almost doubled owing to the rapidly increasing demand, and briquette bricks are largely used for steam purposes on the Western Division of the Canadian Pacific Railway. The Bankhead coal is the only anthracite coal found in western Canada.

The high pressure air lines have been extended further into the mines and additional charging stations are being installed for the motors used in hauling the newly mined coal to the breakers. New workings are being driven north and south from the new slope below the tunnel level and the force of miners is being continually increased. As a consequence of this development and the employment of so many men in the mines, the town is in a prosperous condition and is rapidly increasing in size and population.

Considering that so many foreigners are employed, law and order are well observed and there is very little cause of complaint on this score.

At Canmore a new shaft, which almost doubles the capacity of the mines, was opened during the year about three miles east of the old shaft and the coal is mined from it.

A ready market is always available for the increasing tonnage mined owing to the fact that the Canadian Pacific Railway Company has contracted ahead for the total output of the mines. Canmore coal is considered the best steam coal on the entire Canadian Pacific Railway system and is largely used on the locomotives between Medicine Hat and Revelstoke.

PRESERVATION OF GAME AND TIMBER.

At the last session of parliament provision was made for the employment of three game and fire wardens and for combining the duties in connection with the protection of game and the prevention of forest fires in the Rocky Mountains Parks. These appointments have been made and the new wardens will enter on their duties with the beginning of the fiscal year.

They will patrol all portions of the parks and regular patrol trails and small cabins will be constructed in different portions of the parks where the men can remain over night and avoid the necessity of packing tents, &c., with them. Each will be furnished with a saddle pony and a pack pony carrying supplies, so that they can remain out for several days at a time or as long as their patrol duty in any locality may require. By this means it is hoped that the killing of game by the Indians and tourists, which in the past was not of uncommon occurrence in the outlying portions of the parks owing to insufficient patrol, may be checked if not altogether prevented.

The adoption of the proposed new regulations prohibiting the carrying of unsealed firearms by persons within the limits of the parks should also have a beneficial effect in the way of minimizing the temptation to shoot and kill game in the park.

The wild animals appear to be increasing in numbers, and the regulation prohibiting dogs running at large within the parks will doubtless have the effect of making the animals less timid at the approach of mankind and less fearful of their mortal enemies, dogs and guns.

The question of the prevention of forest fires in the parks is also very serious, and one which causes a great deal of anxiety, especially during the dry months of July and August. During the past year the expense in connection with fighting forest fires was much greater than in former years, but this additional expense was counterbalanced many times over by the saving from destruction of large quantities of fine valuable timber. The instituting of a systematic patrol and the adoption of more stringent regulations in respect to the care of camp-fires by tourists should have the effect of greatly reducing the danger from this source and assist us in the effort to preserve the forests of the parks in the state of primeval nature which is one of their chief charms.

THE ALPINE CLUB OF CANADA.

The Canadian Alpine Club, the headquarters of which is at Banff, was permanently organized three years ago and has at present a membership of over five hundred, among whom are numbered some of the most distinguished and enthusiastic mountain climbers in the world.

A very successful camp was held last year, and under the able direction of Mr. A. O. Wheeler, F.R.G.S., president of the club, a number of difficult ascents, as far as known never previously attempted, were successfully accomplished. At the camp of last year all the leading alpine clubs of Europe and American were represented by experienced and ardent scalers of mountain peaks.

Membership in the club is divided into five grades: Honorary, consisting of persons distinguished in mountaineering, exploration or research ; associates, who may be active members or may not but who contribute twenty-five dollars to the club's treasury; active members, who have made an ascent of at least ten thousand feet in some recognized alpine region or who have contributed to Canadian alpine literature by scientific publications based on personal experience ; and grading members, who are given two years to qualify as active members.

Funds have been raised for the erection of a commodious up-to-date club-house at Banff, for the accommodation of the executive and members, which will be completed in time for the annual meeting of the club in July, 1909. The site selected is on the slope of the Sulphur mountain, near the middle hot springs and commands a magnificent view of the town of Banff, the Bow river and valley and of the surrounding mountains.

The club-house and tents to be erected by the club will furnish comfortable and commodious accommodation for over seventy-five persons.

It is also the intention of the club to build during the coming summer a smaller club-house at Lake O'Hara and later on houses in different localities in the park.

The scope of the work of the club is not confined entirely to climbing mountains during the summer camps, but to stimulate the members to do all in their power to promote the extension of knowledge of the scenic and other wonders to be found only in the Canadian Rockies and Selkirk mountains.

REVENUE OF THE PARK.

In my report of last year attention was drawn to the steady and continuous increase in the revenues of the park from nearly every source, and to the fact that the increase in appropriations by parliament for the extension of new work has not kept pace with the increase of revenue. It was estimated last year that over one and a quarter millions of dollars were spent in Canada by the tourists from foreign countries who visited the Rocky Mountains Parks, and it is expected that this amount will be almost, if not quite, doubled during the season of 1909.

The value of the parks as an asset of the Dominion of Canada cannot be measured by immediate results in dollars and cents, but they have been the means of spreading the fame and beauty of Canada to parts of the world where it otherwise would have been unheard of. Hundreds of visitors have said that they were induced to visit the Rocky Mountains Park through reports of its beauties given by tourists who had been there in former years. Its benefit to the Dominion of Canada, as a whole, as an advertising medium in the Department of Immigration alone, is of inestimable value, and it is doubtful if equal results for the money expended could be secured by any other means. Every additional dollar of expenditure on the national parks in the way of building and improving trails, carriage roads, bridges, &c., for the opening up of new points of interest and for making those already opened up more accessible, would, in my opinion, be money well invested and return a hundredfold in benefit to the country.

YOHO PARK.

During the past year about three miles were added to the carriage road up the Yoho valley leading to Takakkaw falls. In this were the most difficult portions of the road, including considerable heavy rock work and a couple of switch-backs put in to make the grade of the ascent easier. From the summit of the second switchback a magnificent view of the river valley below and Cathedral mountain in the back ground is obtained. From this point it is intended as soon as possible to construct a foot-path through the undergrowth to the river canyon about one hundred yards distant, and to have a number of rustic seats placed for the convenience and accommodation of tourists who will avail themselves of the opportunity of visiting this wonderful view. The narrow canyon is over one thousand feet deep, walled in on either side by almost perpendicular rock walls. Tourists from all parts of the world have pronounced this valley one of the most beautiful they had ever seen and the carriage road one of the best of mountain roads. When the remaining three and a half miles of extension to the falls is completed (which we hope to have done early in August) the drive will be one of the pleasantest and most beautiful in the entire Rocky Mountains Parks and cannot fail to prove of annually increasing popularity.

The Takakkaw Falls, themselves one thousand four hundred and sixty feet in height, are among the wonders of the world, far surpassing in grandeur, if not in volume of water, the famed Niagara Falls or the falls of the Yellowstone Park. Where necessary the road has been gravelled and a great many small bridges built across the small streams that rush down the mountain sides from the glaciers above. The completion of the Yoho valley carriage road will overcome the arduous climb over the summit on the trail from Emerald lake to the falls.

The right of way for a carriage road from the Emerald lake road to the natural bridge over the Kicking Horse river, two miles in length, was cleared during the year and the work of grading the road will be commenced on the completion of the Yoho valley road.

This natural wonder is about three miles from Field and at present is reached only by a foot-path, and the construction of a carriage road will afford visitors an opportunity of visiting this beautiful spot over a short and pleasant driveway.

In addition to this, considerable repair work was done on the Emerald lake and Ottertail carriage roads, in cleaning out culverts and ditches, rendered necessary by the spring snow and mud slides which are usual in all mountain regions. These roads were kept in good condition from their opening up in the spring until they were closed for the winter and necessarily entailed considerable labour and expense.

Repairs were also made to the pack trail from Hector station to Lake O'Hara along the valley of Cataract creek. The opening up and making easy of access of these new places of interest in the Yoho Park is having the effect of largely increasing the number of tourists who spend some time at the different resorts as may be seen by the records of the registers at the different hotels in another part of this report.

GLACIER PARK.

At Glacier Park most of the new work outlined in my report of last year was undertaken, in addition to the repair work which is necessary to maintain the trail from Glacier House, which suffers every year from slides. At the Caves, the ladders at the more dangerous places in the descent were replaced by wooden stairways and railings, the lumber for which was packed on ponies from the railway to the Caves. This improvement was deemed necessary in order that accidents to nervous visitors might be averted and to make access to the Caves easier by all classes of people. During the year over one thousand people visited and explored the Caves, and every one returned enchanted with the wonders they had seen in these quaint rock caverns eaten out by the water action of centuries.

The Cascade trail and the Asulkan Valley trail are also becoming very popular with tourists who linger for a few days at the Glacier House and wish to make easy excursions among the beautiful scenery in that vicinity.

To the more ambitious the ascents of Mounts Abbott and Sir Donald offer ample opportunity for the powers of the most ardent mountain climbers.

I hope during the coming year to complete the trail mentioned in my report of last year connecting the trail from Rogers Pass to the head waters of Bear creek with the end of the present trail at the Caves. This will make a good trail for the round trip of about fifteen miles from Glacier House at a comparatively small cost, which will be of great interest and pleasure to tourists.

ELK ISLAND PARK.

Elk Island Park, with an area of sixty-four square miles, is located along the Canadian Northern Railway at Lamont Station, about forty miles east of Edmonton, in the Beaver Hills.

This park was originally acquired by the Alberta provincial government as a forest and game preserve. When the first and second shipments of buffalo were made from Montana in 1907 there was no other place to put them, consequently permission was obtained from the provincial government to range them in this park until such time as a larger and more suitable range could be acquired by the Dominion government. These two shipments numbered four hundred and ten head and have since temporarily ranged in the Elk Island Park.

When I was appointed commissioner of Dominion parks in 1908, this park was placed under my jurisdiction, but it is the intention during the present year to remove the buffalo to the new Buffalo Park which will be their future home, leaving about thirty-five head in the Elk Island Park to serve as the nucleus of another herd.

There are also in the park a considerable number of elk and deer, it being the natural home of these animals; when the fence was built they were inclosed in the park.

BUFFALO PARK.

The new Buffalo Park reserved by the Dominion government in 1907 as a grazing range contains four hundred and thirty square miles. It is located in townships 42, 43 and 44, ranges 6, 7, 8 and 9 west of the fourth principal meridian on the Grand Trunk Pacific Railway about one hundred and twenty miles east of Edmonton. The northern end of the park is within one-half mile of Wainwright, a railway divisional point and the southern boundary three miles from Rosyth station, on the Wetaskiwin branch of the Canadian Pacific Railway.

During the past year one hundred and ten thousand acres of Buffalo Park has been inclosed by a fourteen-strand wire fence, seventy-three miles in length, with two cross fences forming inclosures for the buffalo during the breeding season. The new park is a magnificent stretch of rolling prairie and numerous small lakes giving it a park-like appearance, and is in every respect an ideal place for the purpose to which it has been devoted. The large number of buffalo bones and skulls, buffalo wallows, and other evidence of their former occupancy found on it prove it to have been a favourite grazing ground for the herds of buffalo when in the wild state.

Besides the lakes, which furnish abundance of water for the animals, the Battle river passes through the western portion and Ribstone creek through the eastern part of the park. The banks of both streams are well wooded and form an excellent protection for the animals from the heat of summer and the storms of winter. The area inclosed at present is considered sufficient for the support of from five thousand to seven thousand head of buffalo. Hay is found in abundance in the eastern portion of the park and can be put up in stacks at a cost not exceeding from $2 to $2.50 per ton. In this item alone there will be a saving of several thousand dollars in favour of Buffalo Park as compared with Elk Island Park. This guarantees the maintenance of the buffalo at the lowest possible cost to the government.

A fire-guard twenty feet in width has been ploughed around the inclosure, besides two cross fire-guards across the park. These were made with a view to not only protect the park from all danger of fire from without, but eventually to serve a double purpose of a carriage driveway around the park without entailing any extra expense to the department. It is also intended to move about eighty head of the buffalo now in the Rocky Mountains Park to Buffalo Park during the summer, where they will have freer range and better accommodation. Buildings for the accommodation of the caretaker's horses, &c., will be erected at Wainwright and also at the eastern end of the park where the animals will be wintered.

With the removal of the buffalo from Elk Island Park, the shipments yet to come from Montana and the surplus buffalo at Banff, there will be at least seven hundred head of buffalo in the herd before the close of the coming summer.

The cost of caring for the animals will be very small, as only about three men will be required in summer and five in winter.

With the expected annual natural increase of the herd of from one hundred and fifty to two hundred calves from the commencement, instead of the buffalo being an expense to the government they should prove a considerable source of revenue and be more than self-sustaining, as from the very start the surplus male stock can be readily disposed of at good prices.

The park being located near the main line of the Grand Trunk Transcontinental Railway, and near the point from which the branch to Calgary leaves the main line of the Grand Trunk Pacific Railway, thousands of visitors will be attracted to Buffalo Park each year to see the largest herd of buffalo in the world.

JASPER PARK.

I have as yet been unable to officially visit the Jasper Park—the latest addition to Canada's magnificent system of national park reserves—containing five thousand four hundred and fifty square miles of as yet almost entirely unexplored territory. I intend, however, to make a trip to this park during the month of August of this year, when I shall be able to report more fully upon it.

The only available recent information in regard to this park is obtained from a report of a trip made in 1908 through this territory by Mrs. Charles Schaffer, of Philadelphia, Pa., a celebrated botanist and traveller, who has been a regular annual visitor to the Canadian national parks for the past seventeen years. Mrs. Schaffer devotes the winter to lecturing on the results of her exploratory trips to remote parts of the Canadian Rockies and Selkirk ranges before scientific and literary associations in the leading cities of the United States. She has done more than any other living person in making known and arousing interest in the floral and other natural attractions of these regions for scientific research.

Mrs. Schaffer's report to me of her trip is as follows :—

'During the summer of 1908, a party of six, composed of Mr. Stewardson Brown, Botanist of the Academy of National Sciences, Philadelphia; Miss Adams, of New Haven, Connecticut; three guides and myself, left Laggan, Alberta, for an extended trip into the little-known hills lying to the north. Our outfit consisted of twenty-two horses with food sufficient (about two thousand pounds) for a four months' sojourn in a land where game though plenty is quite uncertain.

'We had two objects in view: Mr. Brown to make a more exhaustive study of the flora of the higher altitudes, Miss Adams and myself to search for a lake whose existence had been reported to us the year before by a Stony Indian.

'Our one guiding star was a decidedly dim one, a crude map drawn by the Indian, a grown man at the time; his sketch was from his memory when, as a small boy, he visited it with his father on a hunting expedition.

'The first part of our trail lay for seventy-five miles through the National Park. The date of departure being June 8, we were forced, owing to its lower altitude, to use the Bow Pass, reaching it via Bow river and lakes. Though I have now travelled many hundreds of miles between Laggan and the Yellowhead Pass, this valley, near home, stands pre-eminent as the worst section for muskeg I have known. A partially constructed trail on the hill-side cancels a good deal of the explorer's trouble, but there are several miles still left through which to plough. From the Bow across Nigel Pass, then down a branch of the Brazeau to the outlet of Brazeau lake was an old story; from then on, the ground to be travelled was new. After crossing Pobocton Pass and traversing a goodly portion of the creek of the same name, all other maps than the Indian's ceased to be anything but a blank.

'The scenery, however, continued to be wild and beautiful, growing more interesting as we advanced. One or two valleys were penetrated on foot to see if the lake could be located. Finally, in the beginning of our third week from Laggan, we crossed a short pass of about seven thousand feet elevation and gazed down on one of the fairest grass-covered, flower-strewn valleys I have seen in the Canadian Rocky range.

'After traversing it for three days, our second in command climbed to a height of eight thousand feet and returned about 10.30 p.m. to report that the lake was at the terminus of the green valley.

'The following day we reached the shores of our long-sought goal. Plenty of feed was found for the horses a half mile back from the lake. A raft was soon constructed which carried tents, bedding and food for three days, and those most interested pushed for the head of the lake.

'Later developments proved the stretch of water to be about twenty miles long. At the outlet a fire a few years ago destroyed about one-quarter of a mile of timber, otherwise the slopes from tree line to shore are covered with a dense growth of spruce and pine. This growth is so heavy it is not only impracticable to take horses to the head of the lake, but even should they reach there there seems to be no grass for them.

'We found several fine peaks at the head of the lake, the conditions of the snow and ice proclaiming them between ten thousand and twelve thousand feet high. Glaciers swept down almost to the water's edge and at one place from a ragged rock precipice plunged a ribbon of water. In its thousands of feet fall, it was lost in spray. I think without exception it is one of the most beautiful sections I have ever visited, and the lake is undoubtedly the largest one yet recorded in the Rocky range. The outlet is comparatively a narrow one and looks quite harmless, but experience proved, at least during high water, that no horse could stem the flow with pack or saddle.

'Later investigation proved that this river empties into Medicine lake and from there as Maligne river flows into the Athabaska river, almost opposite to the mouth of the Miette river, which has its source in the Yellowhead Pass. Hence we have called the short pass, the stream flowing from it to the lake, the green valley, the lake itself and one of the peaks Maligne. Being but a matter of thirty to thirty-five miles south of the line of the advancing Grand Trunk Pacific road, it will undoubtedly at some future day become a famous resort for the lover of the beautiful.

'Since writing the above short sketch I have learned that the government has set aside 5,400 square miles (with Jasper House as a centre) of land as a national park. I can but trust that for the sake of the beauty of the lake, its almost unblemished forest and the game, Maligne lake may pass under the care of a government whose foresight and generosity to future lovers of the wild have been equalled by no other nation.

'MRS. CHARLES SCHAFFER.'

THE MONTANA HERD OF BUFFALO.

In connection with the balance of the shipment of buffalo purchased in 1907 from Michel Don Pablo, of Missoula, I have to report that owing to unforeseen and uncontrollable circumstances, we were unable to accomplish our purpose of having them transferred to Canadian soil during the year just closed.

Owing to sickness in his family and his own serious illness, Mr. Pablo was unable to commence the round-up of the animals until late in the season. I urged that operations should be started earlier, but it was not until my second visit to Montana in August that a move could be made. After several weeks of strenuous work we succeeded in gathering together in the corral one hundred and twenty of the animals preparatory to driving them thirty-six miles to be loaded on the train at Ravalli. On the night following their being corralled the enraged animals stampeded, climbed the high, almost perpendicular clay cut-bank at the rear of the inclosure and escaped to their native homes among the mountains of the Flathead reservation.

As it was getting late in the season and the early snows were falling in the mountains, which would render the difficulties in the way of again collecting the frightened animals insurmountable, we decided to abandon the attempt until the following spring. We were also induced to take this course, owing to the fact that after their recent exhausting struggle and flight for freedom, the animals were in very poor condition for shipment such a long distance so late in the season.

For the unsuccessful round-up, Mr. Pablo was at several thousands of dollars of expense for supplies, wages of men, &c., besides having a number of his horses disabled, for which he will not receive one cent of remuneration. He, however, acted throughout the whole affair in a perfectly honest and straightforward manner, and faithfully promised that as soon as the snow was off the ground sufficiently to allow of the animals being rounded up he would start his men to work. He is very anxious that his contract for the delivery of the entire herd to the Canadian government shall be carried out with as little delay as possible.

The result of our operations this year has been very disappointing to him and also to myself, as I had confidently expected this year to see the work of landing the buffalo at their future home in Buffalo Park on Canadian soil, reach a successful conclusion. I have every hope, however, that this will be successfully accomplished early in the next fiscal year.

Since the above was written, I am glad to be able to report that the first shipment consisting of one hundred and ninety head, one hundred and seventeen of which were young females, has been successfully landed in Buffalo Park, and the remainder, of about one hundred and twenty head, will be shipped early in the summer.

A new plan for transferring them from the corral to the loading pens was devised. Instead of the animals being driven in a herd they were transported individually in wagons over the thirty-six miles to Ravalli for loading. Experienced spectators of the work expressed their surprise and wonder at the magnitude of the task of rounding-up, transporting in wagons to the loading station and shipping over almost thirteen hundred miles of railway, such a large number of these wild, untamed animals and landing them successfully and safely in their new homes. The undertaking involved a vast amount of work, anxiety and expense, and it is doubtful whether a similar enterprise of rescuing from threatened extermination a once noble and numerous type of animal, was ever before undertaken.

A fuller and more detailed report of the shipments will be made in my next year's report, when I hope to be able to congratulate the government of the Dominion of Canada on having safely secured in its Buffalo Park reserve, the largest herd, not only of buffalo but of any wild animals in one inclosure, in the world.

In conclusion I desire to express my appreciation of the support which I have at all times received from the department in furthering the development of the Canadian national parks, and especially in the matter of securing the buffalo which would at times have been so discouraging as to suggest the abandoning of the undertaking entirely had I not been assured of the hearty support and co-operation of the Honourable Minister and every one connected with the department in the work.

I also wish to acknowledge the valuable services rendered by the members of the Royal Northwest Mounted Police in maintaining law and order in the different parts of the national parks where they were stationed.

I have the honour to be, Sir,

Your obedient servant,

HOWARD DOUGLAS,
Commissioner of Dominion Parks.

APPENDICES.

VISITORS AT HOTELS.

Number of visitors registered at the Banff Springs Hotel from April 1, 1908, to April 1, 1909 :—

Canada	2,318
United States	4,082
England	384
Australia	62
Scotland	50
India	28
Japan	56
China	46
France	24
Honolulu	18
Ireland	37
New Zealand	64
Switzerland	3
Mexico	1
Norway	7
Italy	5
Holland	6
Denmark	4
Chili	2
Total	7,197

Number of visitors registered at the Mount Royal Hotel from April 1, 1908, to April 1, 1909 :—

Canada	1,240
United States	482
England	64
Scotland	22
Ireland	18
New Zealand	10
Australia	6
Italy	4

China	4
Germany	2
Switzerland	2
India	1
Total	1,955

Number of visitors registered at the Sanitarium Hotel from April 1, 1908, to April 1, 1909 :—

Canada	6,018
United States	1,490
England	152
Scotland	86
Ireland	42
Japan	43
New Zealand	72
Denmark	16
Australia	80
India	8
China	26
Holland	10
Germany	27
Chili	14
Italy	18
Switzerland	41
Portugal	16
Korea	4
France	14
Austria	2
Philippine Islands	31
South Africa	28
Total	8,238

Number of visitors registered at the Hotel King Edward, from April 1, 1908, to April 1, 1909.

Canada	4,284
United States	1,282
England	94
Scotland	43
Ireland	78
Switzerland	6
New Zealand	59
Australia	28
South Africa	1
Japan	13
India	4
Germany	4
Austria	4
China	11
Total	5,911

Number of visitors registered at the Hot Springs Hydropathic Hotel, from April 1, 1908, to April 1, 1909 :—

Canada	792
United States	204
England	22
Scotland	18
New Zealand	9
Germany	6
Australia	9
Ireland	11
Japan	6
Total	1,077

Number of visitors registered at the Alberta Hotel from April 1, 1908, to April 1, 1909 :—

Canada	4,340
United States	1,622
England	238
Scotland	209
Ireland	107
Sweden	22
New Zealand	69
Australia	20
China	28
India	2
South Africa	1
Germany	6
Total	6,664

Number of visitors registered at the Grand View Villa, Banff, from April 1, 1908, to April 1, 1909 :—

Canada	1,120
United States	322
England	46
Japan	2
India	9
Ireland	22
China	10
Scotland	28
Australia	13
Switzerland	1
Ceylon	3
Holland	4
New Zealand	11
France	3
Total	1,594

SUMMARY.

Banff Springs Hotel	7,197
Mount Royal Hotel	1,955
Sanitarium	8,238
Hotel King Edward	5,911
Hot Springs Hydropathic	1,077
Alberta Hotel	6,664
Grand View Villa	1,594
Park Hotel	1,500
Excursionists not registered	3.684
Cottagers	1,960
Total	39,780

Number of visitors at the Cave and Basin, from April 1, 1908, to April 1, 1909:—

Canada	4,105
United States	3,302
England	203
Scotland	93
Ireland	7
New Zealand	49
Australia	25
New South Wales	7
South Africa	11
India	5
Ceylon	2
China	11
Japan	5
France	7
Germany	10
Sweden	8
Holland	4
Total	7,854

Number of visitors at the Upper Hot Springs, from April 1, 1908, to April 1, 1909:—

United States and Canada	14,032
Newfoundland	2
England	151
Scotland	53
Ireland	28
Australia	46
South Africa	4
India	2
Hawaiian Islands	2
Germany	6
China	8
Japan	4
Denmark	14
Sweden	2
Total	14,355

Number of visitors registered at the Chalet, Lake Louise, Laggan, from April 1, 1908, to April 1, 1909:—

Canada	1,904
United States	4,028
England	402
Scotland	68
Ireland	14
Japan	2
Russia	9
France	3
Cuba	5
Australia	32
India	9
Holland	16
China	4
New Zealand	38
Honolulu	9
Denmark	2
Jamaica	1
Germany	43
Poland	1
South America	2
Sweden	9
Switzerland	12
Africa	1
Italy	22
Alaska	4
Belgium	6
South Ancholia	1
Hawaii	9
Total	6,656

List of visitors at the Mount Stephen House, Field, from April 1, 1908, to April 1, 1909:—

United States	1,922
Canada	2,019
British Isles	486
Australia	64
New Zealand	96
Germany	29
India	6
Japan	1
China	14
South America	6
France	9
Switzerland	38
Hungary	6
Hawaii	9
South Africa	6
Holland	14
Italy	18
Denmark	2
Jamaica	1
Sweden	9
Tasmania	9
Belgium	6
Total	3,770

MUSEUM.

REPORT OF THE CURATOR.

ROCKY MOUNTAINS PARKS OF CANADA,
BANFF, ALBERTA, July 2, 1909.

HOWARD DOUGLAS, Esq.,
Commissioner of Dominion Parks,
Banff, Alberta.

SIR,—As will be seen by the attached list of visitors for the twelve months there has been a decided increase.

Additions.—Two young cariboo heads and a few birds collected by myself, as well as a number of birds' eggs have been added to the museum ; also a collection of sponges, shells, corals, &c., from the Bahama Islands, and garnets from Alaska was donated by Mr. A. C. Talbot, of Calgary. The former, although not in the collecting grounds, are most interesting. Promises of loans and donations are becoming more numerous but do not always materialize.

Work done.—The collection of insects is being rapidly added to, and I have to thank Dr. E. M. Walker, of the Biological Section of Toronto University, for giving much help in naming orthoptera and odonta; Dr. L. O. Howard, the eminent chief of the entomological branch of the Department of Agriculture, Washington, D.C., and his expert assistants for valuable assistance in naming specimens in the orders hymenoptera, diptera, coleoptera, hemiptera, &c.; also the Experimental Farm Entomological Branch for much assistance in naming lepidoptera and other orders.

Suggested improvements.—As soon as at all possible the mammals of the park should be completed and represented in the museum by full sized specimens. Many common animals are not yet on exhibition, and to make the best specimens these should be taken in the fall, winter or early spring.

The mineral collection should be made more complete by additional specimens from the neighbourhood, as also from British Columbia and New Ontario.

Some method of displaying the maps received from the Geological Survey Department would be of advantage as they prove most interesting as well as useful and instructive to many of the visitors.

Any addition to the Indian collection would be money well invested, as the day for procuring these things will soon be past. I may say that nearly all the visitors are very much interested in the display of Indian work now on loan. It might be well to purchase the Reverend Canon Stocken's collection, which I understand he is desirous of selling at a reasonable price.

Many useful and interesting pamphlets are now in my possession relative to museum work, &c., which, to be of more use for the purpose of reference, should be placed in a suitable book case and catalogued.

As usual, I have during the past year named many plants for visitors and also given much other information.

I append the weather report for the past year.

I am, Sir,

Your obedient servant,

N. B. SANSON,
Curator.

Visitors at the Museum, from April 1, 1908, to April 1, 1909 :—

Canada	6,450
Yukon Territory	18
Newfoundland	2
United States	2,221
England	432
Scotland	197
Ireland	42
South Wales	3
Wales	1
Isle of Man	1
Channel Islands	
Australia	84
New South Wales	4
New Zealand	97
South Africa	4
Zululand	1
Orange River Colony	4
Germany	47
The Hague	1
Holland	16
Belgium	18
China	24
Thibet	1
Italy	7
India	10
France	19
Norway	7
Austria	22
Japan	19
Sweden	12
Russia	7
South America	4
Switzerland	28
Denmark	14
Total	9,817

METEOROLOGICAL TABLES

ROCKY MOUNTAINS PARK.

MAXIMUM and Minimum Temperatures and the General State of the Weather between July 1, 1908, and June 30, 1909.

Date.	Thermometer Readings. Maximum for day.	Thermometer Readings. Minimum for day.	Weather.
1908.	°	°	
July 1	77·1	38·2	Fair; very fine day.
" 2	78·0	39·7	Cloudy; thunder; rain.
" 3	67·4	44·0	Cloudy; squally wind.
" 4	58·7	42·8	Cloudy; light rain; river high and muddy; lightning.
" 5	63·9	37·2	Fair; fine day.
" 6	71·6	36·3	Fair.
" 7	77·4	40·0	Fair; very fine day.
" 8	77·4	43·3	Fair.
" 9	67·5	60·4	Cloudy; squally wind.
" 10	77·4	48·8	Fair; perfect day.
" 11	81·7	43·7	Fair; perfect day; campanula in flower.
" 12	69·6	44·7	Cloudy; fine day; cirro-stratus and cirrus clouds.
" 13	68·0	52·8	Cloudy; rain.
" 14	67·3	52·8	Cloudy; strawberries abundant.
" 15	75·9	47·2	Fair; perfect day; river very high.
" 16	71·6	45·2	Cloudy; light rain; lightning; Shepherdia in fruit.
" 17	76·1	48·8	Fair; light rain; asters in flower; thunder and lightning.
" 18	76·6	42·2	Fair; fine day.
" 19	78·1	55·0	Fair.
" 20	84·4	41·0	Fair; very fine day; many insects.
" 21	87·5	42·3	Fair; very fine day; forest fire.
" 22	86·5	44·9	Fair; forest fire; very fine day.
" 23	73·4	50·0	Cloudy; rain; thunder and lightning; forest fire out.
" 24	77·5	49·6	Fair
" 25	69·2	48·0	Cloudy; rain; fine sunset.
" 26	65·5	37·6	Fair; very fine day.
" 27	70·8	33·5	Fair; forest fire.
" 28	53·8	41·3	Cloudy; rain; thunder and lightning.
" 29	69·4	35·0	Fair; very fine day.
" 30	79·0	39·8	Fair; very fine day.
" 31	84·5	42·9	Fair; very fine day; smoke from forest fire.
Aug. 1	80·2	43·0	Fair; rain; thunder and lightning.
" 2	68·0	46·0	Fair; very fine day.
" 3	69·5	50·6	Cloudy.
" 4	78·4	44·0	Fair; fine sunset; forest fire still burning.
" 5	81·2	46·3	Fair; very fine day; large cumulus clouds over fire, &c.; rivers, &c., dropping.
" 6	78·4	44·8	Fair; brilliant meteor, noise in bursting; very fine day, but dense smoke.
" 7	76·2	43·3	Fair; light rain.
" 8	81·1	36·2	Fair; very fine day; fire bad in afternoon.
" 9	79·4	40·0	Fair; smoke from forest fire about.
" 10	68·4	43·9	Fair.
" 11	51·2	43·9	Cloudy; rain; forest fire nearly out.
" 12	64·2	39·9	Fair; light rain; forest fire up again.
" 13	66·5	33·1	Fair; fine day.
" 14	76·1	32·2	Fair; aurora; very fine day.
" 15	76·4	44·8	Fair; fine day.
" 16	70·0	47·1	Fair.
" 17	82·0	36·0	Fair; very fine day.

Maximum and Minimum Temperatures, &c.—*Continued.*

Date.	Thermometer Readings. Maximum for day.	Minimum for day.	Weather.
1908.	°	°	
Aug. 18....	77·0	44·0	Fair ; very fine aurora ; very fine day.
" 19....	84·7	42·0	Fair ; very fine day.
" 20....	73·4	43·5	Fair ; thunder ; much smoke from fire.
" 21....	71·4	43·5	Fair ; very fine day.
" 22....	77·4	37·5	Fair ; very fine day.
" 23....	66·5	38·6	Cloudy ; rain ; thunder and lightning ; forest fire out.
" 24....	62·0	45·6	Cloudy.
" 25....	47·1	37·8	Cloudy ; rain.
" 26....	54·1	38·7	Cloudy ; fine sunset.
" 27...	62·4	32·2	Fair ; light rain.
" 28....	59·3	42·1	Fair.
" 29....	58·3	40·3	Cloudy.
" 30....	55·8	36·0	Cloudy ; rain ; very fine rainbow.
" 31....	62 2	35 4	Fair.
Sept. 1....	66·9	38·2	Fair.
" 2 ...	62·0	50·2	Cloudy ; rain.
" 3....	63 4	45·7	Fair.
" 4...	69 3	45·8	Fair ; fine sunrise ; very fine day.
" 5....	73·2	46·2	Fair ; aurora ; very fine day.
" 6....	76·7	40·2	Fair ; very fine day.
" 7....	62·9	46·6	Cloudy ; rain ; heavy thunder and vivid lightning.
" 8....	53·1	38·3	Cloudy ; light rain.
" 9....	53·0	40·3	Cloudy ; very squally chinook kind of wind.
" 10....	67·4	49·4	Fair ; very fine day.
" 11....	73·4	36·0	Fair ; very fine day.
" 12....	75·4	34·7	Fair ; very fine day ; brilliant aurora.
" 13....	75·4	37·9	Fair ; very fine day and night ; sheet lightning.
" 14....	70·0	44·0	Fair ; light rain ; fine sunrise.
" 15...	55·8	40·7	Cloudy ; rain.
" 16....	48·8	42·6	Cloudy ; rain.
" 17....	62 5	39·9	Fair ; few butterflies still about ; very fine afternoon.
" 18....	54·3	35·9	Cloudy ; heavy dewfall.
" 19 ...	61·5	44·0	Fair ; heavy dewfall.
" 20....	65·4	53·3	Fair ; very fine day and night.
" 21 ..	64·2	45·7	Fair ; fine sunrise ; squally wind.
" 22. ..	50·7	37·3	Fair ; fine day ; squally wind.
" 23....	42·8	27·3	Cloudy ; rain and snow ; geese flying over town.
" 24....	32·3	27 0	Cloudy ; light snow ; snow on mountains.
" 25....	40·3	18·0	Fair ; cool but fine day.
" 26....	41·4	18 0	Cloudy ; fine sunrise.
" 27 ...	54·0	33.9	Cloudy.
" 28....	55·4	29 8	Cloudy.
" 29. ..	58 4	38·5	Cloudy; squally chinook kind of wind ; ducks flying east ; fine sunset.
" 30....	64·6	29·8	Fair ; very fine day ; fine sunrise and sunset ; vanessa antiopa butterflies.
Oct. 1 . .	53·9	38·2	Cloudy ; heavy rain ; fine sunrise.
" 2....	38·0	34·3	Cloudy.
" 3....	53·3	26·9	Fair ; very fine day ; aurora ; few insects about.
" 4 ...	57·4	24·0	Fair ; light rain ; few moths and other insects.
" 5....	50·4	38 8	Cloudy.
" 6...	52·9	29·0	Fair ; fine day.
" 7....	60·2	33·9	Fair ; very fine day.
" 8....	64·6	33·1	Fair ; very fine day and night.
" 9....	49·3	36·6	Cloudy ; trees becoming leafless
" 10 ...	61·0	35·2	Fair ; very fine day.
" 11....	59·4	25·3	Fair ; very fine day.
" 12....	59·0	26·8	Cloudy ; fine day.
" 13 ...	47·3	37·9	Cloudy ; rain.
" 14....	36·2	32·0	Cloudy ; snow ; patches of snow on ground.
" 15....	39·3	23·6	Cloudy ; patches of snow on ground.
" 16....	37·6	24·6	Cloudy.
" 17....	39·1	18·2	Fair.
" 18....	40·9	24·2	Cloudy ; fine sunrise ; few birds still about.

MAXIMUM and Minimum Temperatures, &c.—*Continued.*

Date.	Thermometer Readings. Maximum for day.	Minimum for day.	Weather.
1908.	°	°	
Oct. 19...	34·7	30·1	Cloudy; snow; about 5·25 in. of snow on ground; few sleighs out; grosbeaks.
" 20....	34·1	25·9	Cloudy; longspurs on way south.
" 21....	34·2	21·7	Fair; fine day.
" 22....	34·1	14·9	Cloudy.
" 23....	41·9	17·4	Fair; skating on ponds; no sleighing.
" 24....	42·9	31·7	Fair.
" 25....	44·7	22·3	Fair; fine sunrise; fine day; redpolls.
" 26....	52·2	27·2	Fair; chinooking.
" 27....	30·3	24·9	Cloudy.
" 28....	14·3	9·8	Cloudy; snow; very stormy all day; sleighing but bad; duck flying south.
" 29....	21·1	6·5	Cloudy; Bow river frozen over in places; sleighing but bad.
" 30....	46·3	16·0	Cloudy; no sleighing.
" 31....	43·3	35·8	Fair; aurora; fine day.
Nov. 1....	48·2	24·7	Fair.
" 2....	49·1	38·2	Fair; rain.
" 3...	55·1	42·7	Cloudy; very light rain; very squally; dry warm wind.
" 4....	58·4	49·7	Fair; very squally wind; fine warm day.
" 5....	54·2	46·8	Fair; squally wind all day and night; fine and warm.
" 6...	51·2	41·7	Fair; very squally wind; fine and warm.
" 7....	49·7	41·3	Fair; squally wind; fine and warm day; aurora.
" 8...	34·3	20·8	Fair; very fine day.
" 9....	28·8	17·7	Fair.
" 10..	21·5	7·6	Fair; heavy hoar frost; river frozen over above boat house.
" 11....	20·0	—1·7	Fair; river frozen over; about 5 inches thick.
" 12..	20·0	—3·4	Fair.
" 13....	32·4	10·1	Fair.
" 14....	31·2	7·0	Fair.
" 15...	33·8	13·1	Fair; very squally wind late afternoon and through midnight.
" 16....	39·2	26·2	Cloudy; very light rain; thaw; very squally wind; river ice becoming unsafe.
" 17....	39·9	32·7	Cloudy; rain; large flock snowbirds.
" 18....	43·6	33·5	Cloudy; light rain and snow; very squally wind; river open in places.
" 19....	42·4	32·7	Cloudy; squally wind.
" 20....	42·0	34·3	Cloudy; rain with snow at night.
" 21...	36·4	31·4	Cloudy; brilliant meteor.
" 22...	36·3	28·7	Fair.
" 23....	34·2	23·8	Cloudy; fine sunset.
" 24....	32·3	23·3	Cloudy.
" 25....	28·6	21·2	Cloudy.
" 26....	26·0	12·8	Fair; fine day.
" 27...	28·2	13·8	Fair; Bow river partly frozen over.
" 28....	34·8	25·0	Cloudy; fine sunrise; squally wind.
" 29....	31·2	7·0	Cloudy; light snow.
" 30....	5·2	—7·8	Fair; Bow river all frozen over; good skating.
Dec. 1....	8·3	—14·0	Fair; heavy hoar frost; only about ½ inch snow on ground.
" 2...	15·0	—1·1	Fair; fine sunset; squally wind.
" 3..	17·3	0·3	Fair; fine sunset; very fine day.
" 4....	25·0	7·8	Cloudy; mostly patches of snow on ground.
" 5....	30·7	18·9	Cloudy; fine sunset.
" 6....	25·8	9·3	Fair; very fine day.
" 7....	27·2	15·5	Fair.
" 8....	27·2	8·7	Cloudy.
" 9....	30·3	24·0	Fair; light snow.
" 10...	24·0	2·0	Fair; fine day.
" 11....	30·6	18·7	Cloudy; very squally wind; light snow.
" 12....	34·3	25·8	Cloudy; squally wind; snow.
" 13....	31·2	26·6	Cloudy; squally wind; about 6 inches snow on ground; sleighing but bad.
" 14...	25·2	15·0	Fair; fine day.
" 15....	20·0	2·9	Fair; fine day.
" 16....	10·1	—9·2	Fair; fine day.

Maximum and Minimum Temperatures, &c.—*Continued.*

Date.	Thermometer Readings. Maximum for day.	Minimum for day.	Weather.
1908.	°	°	
Dec. 17....	20·8	—12·0	Fair; fine day; very fine sunrise and sunset.
" 18....	23·2	11·7	Fair; squally cold wind; very fine sunset; waxwings and grosbeaks.
" 19....	25·0	11·1	Cloudy; very squally wind.
" 20....	19·3	11·8	Fair; squally wind.
" 21....	21·2	8·3	Fair; very fine sunrise and sunset; squally wind.
" 22....	22·2	8·7	Cloudy.
" 23....	26·8	12·7	Fair.
" 24....	25·0	19·4	Cloudy; squally wind; fine sunrise.
" 25....	32·0	19·7	Cloudy; snow; about 13 inches snow on ground.
" 26....	28·3	21·2	Cloudy; sleighing good.
" 27....	31·0	24·2	Cloudy.
" 28....	33·1	23·6	Cloudy; snow.
" 29 ...	13·3	—0·8	Fair; fine day; loud reports of frost through midnight; mostly calm all day.
" 30....	—11·4	—27·6	Fair; Lake Minnewanka frozen over; calm all day.
" 31....	—8·8	—33·8	Fair; mostly calm all day.
1909.			
Jan. 1....	12·1	—16·8	Fair; very squally wind; snow drifting.
" 2....	17·2	8·0	Cloudy; snow; squally wind; snow drifting.
" 3....	1·9	—10·2	Cloudy; heavy snow; very gusty wind; snow drifting much.
" 4....	—16·6	—20·4	Cloudy; squally wind; about 20 inches of snow on ground.
" 5....	—18·6	—46·0	Fair; fine sunset; mist from river obscuring near objects
" 6....	—15·6	—27·8	Cloudy; squally cold wind.
" 7....	—30·0	—45·0	Fair; mostly calm all day; light snow; much mist rising from river.
" 8 .	—25·0	—47·0	Fair; mountains veiled in mist 5 p. m.
" 9 ...	—21·2	—35·9	Fair; parhelia.
" 10....	—22·4	—44·9	Fair; very bright clear day and calm.
" 11....	—6·0	—29·8	Fair.
" 12....	—4·0	—12·9	Cloudy; squally wind.
" 13....	—10·7	—24·2	Cloudy; squally wind.
" 14....	—12·4	—26·7	Fair; mostly calm all day.
" 15....	18·0	—1·5	Cloudy; snow; squally wind.
" 16....	34·2	24·8	Cloudy; squally wind; ice on river about 19 inches.
" 17....	31·0	22·7	Cloudy; snow.
" 18....	29·8	24·7	Cloudy; light snow.
" 19....	30·0	21·3	Cloudy; snow; snow changing to rain about 10 p.m
" 20....	31·1	23·7	Fair.
" 21....	28·1	14·3	Cloudy; snow.
" 22....	23·7	2·6	Cloudy; snow; about 20 inches of snow on ground.
" 23....	19·9	—8·2	Cloudy; snow-flurries.
" 24....	23·9	9·4	Cloudy.
" 25....	27·0	13·2	Cloudy; light snow; ice cutting on Bow river.
" 26....	28·3	21·0	Cloudy; chinooking; ice on Bow river 26 inches.
" 27....	33·2	17·6	Cloudy; snow; a gale.
" 28....	9·3	—13·4	Fair; about 22 inches of snow on ground.
" 29....	14·9	—21·4	Fair; loud reports from frost early morning; squally wind.
" 30....	26·7	8·0	Fair; squally wind; fine mild day.
" 31....	33·0	19·4	Cloudy.
Feb. 1....	36·2	20·8	Cloudy; light rain and snow; thaw.
" 2....	38·7	25·8	Cloudy.
" 3....	39·0	32·3	Cloudy; thaw; very light rain; very heavy snow-storm 10 p.m.
" 4....	28·3	14·3	Cloudy; light snow.
" 5....	26·3	7·3	Fair.
" 6....	8·4	—0·8	Cloudy; squally wind; snow drifting.
" 7....	—9·8	—14·5	Cloudy; very squally, cold wind; light snow; loud reports frost upheaving.
" 8....	0·3	—32·1	Fair; fine sunset.
" 9....	21·4	—14·3	Fair; fine day.
" 10....	7·0	— 6·9	Cloudy; light snow; very squally wind afternoon and through midnight.
" 11....	—14·8	—20·2	Cloudy; snow; very squally wind; stormy.
" 12....	— 4·9	—33·7	Fair; calm all day; comparatively warm in sun.

Maximum and Minimum Temperatures, &c.—*Continued.*

Date.	Thermometer Readings. Maximum for day.	Minimum for day.	Weather.
1909.	°	°	
Feb. 13....	— 3·3	—38·0	Fair; mostly calm; fine sunset.
" 14....	19·3	—25·3	Cloudy; squally wind.
" 15....	29·0	16·3	Cloudy; snow flurries.
" 16....	34·1	23·1	Cloudy; light snow.
" 17....	37·3	28·2	Cloudy; fine sunset; squally wind.
" 18....	37·3	26·8	Cloudy; ice on Bow river 28 inches thick.
" 19....	32·2	20·6	Cloudy.
" 20....	29·8	9·8	Fair; ice on Lake Minnewanka 23 inches; fine sunrise.
" 21....	29·1	— 5·3	Fair; very fine day; mostly calm all day.
" 22....	25·0	5·8	Fair; snow in woods about 23 inches deep.
" 23....	28·7	9·5	Cloudy; squally wind.
" 24....	35·5	22·1	Cloudy; thaw; light snow evening.
" 25....	38·0	28·0	Fair; thaw.
" 26....	34·2	27·3	Cloudy; squally wind.
" 27....	34·3	24·3	Cloudy.
" 28....	30·1	18·9	Cloudy; light snow.
Mar. 1....	32·4	14·0	Cloudy.
" 2....	32·2	24·6	Fair; very squally wind.
" 3....	43·7	17·9	Fair; thaw.
" 4....	41·2	24·6	Cloudy; light snow; fine sunset.
" 5..	30·4	11·2	Fair.
" 6....	31·4	— 5·9	Fair; very fine day; mostly calm all day.
" 7....	32·0	— 4·0	Fair.
" 8....	34·8	18·5	Fair; snow.
" 9....	33·2	10·3	Fair; light snow.
" 10....	26·2	— 4·9	Fair; mostly calm day.
" 11....	37·2	11·2	Cloudy.
" 12....	29·6	24·0	Cloudy; snow.
" 13...	44·0	12·3	Fair; thaw; 20 inches of snow on ground.
" 14....	41·0	30·2	Cloudy; mostly calm all day; thaw.
" 15....	46·0	13·8	Fair; fine day; fine sunset; thaw.
" 16....	47·2	20·0	Fair; thaw.
" 17....	34·2	27·8	Cloudy; light snow; small flies appearing.
" 18....	34·8	13·0	Fair.
" 19....	37·0	21·7	Cloudy; red winged blackbird; crow.
" 20....	32·7	12·3	Fair; light snow; mostly calm all day; aurora.
" 21....	33·2	11·2	Cloudy; sleighing becoming bad; some wheels in use.
" 22...	36·9	7·3	Cloudy; aurora; fine sunset.
" 23....	45·8	10·8	Fair; very fine day; sleighing bad; thaw.
" 24....	47·0	16·4	Fair; very fine day; thaw.
" 25....	42·2	32·3	Fair; very gusty wind; chinooking; robin.
" 26....	38·6	10·6	Cloudy.
" 27...	42·2	26·8	Cloudy; mostly calm all day; light rain and snow.
" 28....	29·0	19·0	Cloudy.
" 29....	39·2	8·4	Fair.
" 30....	44·3	26·1	Fair.
" 31...	45·2	35·4	Cloudy; Bow river open in places.
April 1....	36·3	18·3	Cloudy; light snow.
" 2....	35·2	15·7	Fair; snow flurries; fine sunrise.
" 3....	33·8	12·2	Fair; snow flurries; aurora.
" 4....	33·0	6·6	Fair; very fine sunrise; mountain bluebirds.
" 5....	34·8	15·9	Cloudy; light snow; juncos.
" 6....	33·2	9·3	Fair; thaw.
" 7....	42·6	5·9	Fair; fine day; sleighing on sheltered roads; fine sunset.
" 8....	47·3	21·3	Fair; fine sunrise.
" 9....	48·3	30·2	Cloudy; light snow; river rising.
" 10....	38·2	28·1	Fair.
" 11....	35·6	18·5	Cloudy; wild geese about.
" 12....	30·4	14·8	Cloudy; Bow river mostly open; light snow.
" 13....	33·6	19·8	Cloudy; snow flurries; golden-eye duck.
" 14...	36·3	12·9	Cloudy; snow.
" 15...	39·1	25·4	Cloudy; snow; thaw.
" 16....	33·0	25·2	Cloudy; light snow; no sleighing
" 17....	36·3	13·0	Fair; fine day but cold wind; hawks.

MAXIMUM and Minimum Temperatures, &c.—*Continued.*

Date.	Thermometer Readings. Maximum for day.	Thermometer Readings. Minimum for day.	Weather.
1909.	°	°	
April 18....	43·6	11·8	Fair ; Bow river open.
" 19....	41·0	14·9	Cloudy ; light snow.
" 20....	33·0	19·0	Cloudy ; anemone, patens variety, in flower ; snow flurries.
" 21....	42·3	18·8	Cloudy ; juncos.
" 22 ...	44·2	18·6	Cloudy ; snow flurries ; robins numerous.
" 23....	41·3	21·2	Cloudy.
" 24....	55·2	33·8	Cloudy.
" 25....	45·1	34·0	Cloudy ; light snow ; sharpshined hawks.
" 26....	42·2	22·9	Cloudy.
" 27....	39·0	25·9	Cloudy ; light snow.
" 28....	27·4	24·8	Cloudy ; light snow ; gusty wind morning ; horned larks.
" 29....	33·9	13·9	Fair ; snow mostly in patches.
" 30....	41·3	13·0	Cloudy ; grebe.
May 1 ...	52·8	28·7	Fair ; fine afternoon ; thaw ; petasites partly in flower.
" 2....	61·5	29·3	Cloudy ; very fine and warm wind ; ants out ; vanessa milberti.
" 3 ...	64·5	32·5	Cloudy ; very fine and warm wind ; strong wind ; frogs piping.
" 4....	52·3	35·1	Cloudy ; rain ; squally wind ; belted kingfisher ; catkins on aspen poplars.
" 5....	41·1	21·9	Cloudy ; squally wind.
" 6....	43·0	30·7	Cloudy ; gull.
" 7....	49·3	20·4	Fair ; fine day.
" 8....	52·1	21·8	Fair ; American merganser ; swallow.
" 9....	57·3	22·9	Fair ; ruby crowned kinglet ; yellow throat warbler ; Brewer's blackbird.
" 10....	54·4	34·9	Cloudy ; light rain ; white crowned sparrows ; chipping sparrows ; osprey, nuthatch, sparrow hawk, grouse drumming ; grass green ; anemones plentiful ; shepherdia Canadensis in flower ; swallows, bees, water insects, midges, mosquitoes, ground bees ; vanessa antiopa ; Audubon's warbler.
" 11....	39·1	33·7	Cloudy ; light rain and snow.
" 12....	59·2	29·9	Fair ; fine day.
" 13....	42·2	32·2	Cloudy ; snow and light rain ; bright aurora.
" 14....	52·4	23·3	Fair ; heavy hoar frost.
" 15....	39·1	30·8	Cloudy ; snow ; Swainson's leucosticte.
" 16....	36·2	28·2	Cloudy ; squally wind ; yellow throat warbler.
" 17....	42·2	28·1	Cloudy ; light rain and snow ; song sparrow.
" 18....	53·9	30·8	Cloudy ; mostly calm all day ; aurora.
" 19....	57·8	26·0	Fair ; aurora.
" 20....	52·7	31·5	Cloudy ; light rain ; mostly calm.
" 21...	48·1	30·4	Cloudy ; rain ; olive backed thrush ; Calypso-borealis.
" 22....	48·2	37·9	Cloudy ; Arctostaphylos Uva-Ursi in flower.
" 23....	52·1	37·8	Cloudy ; rain ; primula mistassinica in flower.
" 24....	63·5	38·7	Cloudy ; light rain ; aurora ; lycæna butterfly.
" 25....	63·5	37·0	Fair ; rain ; thlaspi Orvense in flower ; river rising.
" 26....	59·6	34·6	Cloudy ; river rising ; robins building ; fly catchers.
" 27 ...	57·9	35·3	Cloudy ; rain ; fine afternoon.
" 28...	61·8	39·9	Cloudy ; anemone parviflora ; dodocatheon meadia ; viola fragaria glauca in flower ; adunea.
" 29....	56·4	38·9	Cloudy ; light rain.
" 30....	61·0	37·2	Fair ; very squally wind.
" 31....	67·1	48·9	Cloudy ; viola Canadensis ; aspens in young leaf.
June 1....	75·5	34·9	Fair ; thunder ; thaspium cordata.
" 2....	62·8	47·2	Fair ; rain ; Bow river very muddy and high.
" 3....	60·4	38·9	Fair ; astragalas alpina.
" 4....	55·7	38·7	Cloudy ; rain : commandra livida.
" 5....	47·0	36·8	Cloudy ; rain ; chickweeds in flower.
" 6....	51·1	36·4	Cloudy ; light rain.
" 7....	57·0	32·9	Cloudy ; Lake Minnewanka open.
" 8....	66·5	28·9	Fair ; wasps ; cow birds ; corralhoriza innata.
" 9....	71·0	31·1	Fair ; heavy dewfall ; very fine day and night.
" 10....	75·1	34·8	Fair ; very fine day and night ; several plants out.
" 11....	75·5	34·5	Fair ; very fine day and night.
" 12....	71·8	36·9	Fair ; light rain.
" 13....	61·4	43·3	Cloudy ; rain.

MAXIMUM and Minimum Temperatures, &c.—*Continued.*

Date.	Thermometer Readings.		Weather.
	Maximum for day.	Minimum for day.	
1909.	°	°	
June 14....	72·9	32·7	Fair; heavy dewfall; very fine day.
" 15....	76·3	38·4	Fair; lycæna butterflies numerous; aspen poplars in good leaf.
" 16....	69·0	48·9	Cloudy; light rain; fine day; clematis.
" 17....	66·9	43·5	Cloudy; wood anemones out.
" 18....	70·0	48·3	Fair; fine day.
" 19....	69·1	40.2	Fair; yellow columbine; fine sunset.
" 20....	63·2	46.8	Cloudy; rain.
" 21....	65·9	38·2	Cloudy; rain.
" 22....	62·4	40·2	Cloudy.
" 23....	60·4	43·8	Cloudy.
" 24 ...	54·1	41·0	Cloudy; rain.
" 25....	59·2	33·9	Cloudy; rain.
" 26 ...	61·4	31·7	Cloudy; river about clear again.
" 27.. .	66 3	40·9	Fair; fine day.
" 28....	66·0	35·2	Fair; fine day.
" 29....	66·2	38·8	Cloudy; rain; thunder.
" 30....	79·4	47·4	Fair; very fine day and night; many beetles.

N. B. SANSON,
Meteorological Agent.

PART VI

YUKON TERRITORY

YUKON TERRITORY

REPORT OF THE COMMISSIONER.

COMMISSIONER'S OFFICE,
DAWSON, Y.T., April 23, 1909.

The Honourable FRANK OLIVER,
Minister of the Interior,
Ottawa.

SIR,—I have the honour to submit the report of the Yukon Territory for the fiscal year ending March 31, 1909.

GOLD PRODUCTION.

The gold production for the year ending March 31, 1909, shows a considerable increase over that of last year, ending March 31, 1908. According to the returns in the Comptroller's office, the number of ounces produced was 217,350·92, which, at the valuation of $15 per ounce for royalty purposes, amounts to $3,260,263.75, or an increase of $440,000 over last year's output. It is considered that there will now be a steady increase in the annual gold production of the Territory.

HYDRAULIC MINING AND DREDGING.

The completion of the water system by the Ynkon Gold Company will enable it to begin hydraulic operations on a large scale during the present year. This company will also operate seven dredges—four on Bonanza and three on Hunker—and three hydraulic elevators. All the other dredges already installed will be in full operation as soon as the season opens, and probably other new dredges will be placed on the Stewart river during the early part of the season. Attention is called to the exhaustive report of Mr. A. J. Beaudette, the mining engineer, herewith attached, which contains much valuable and carefully collected information.

INDIVIDUAL MINING.

Considerable work has been carried on by individual miners at Granville, Quartz and Blackhills, in what is known as the Klondike district, and numbers are also working on Glacier and other creeks in the Fortymile district with considerable success.

QUARTZ.

Prospecting has been carried on all winter, particularly at the head of Dominion creek, where considerable work has been done by a local company. The rock found carries good values, and the parties concerned are most encouraged. They intend proceeding with the work most vigorously during the summer months. Other miners are arranging for the installation of a stamp mill at the head of Victoria gulch, a tributary of Bonanza creek, where splendid specimens of gold-bearing quartz have been found. It is considered that the time is not far distant when the numerous quartz propositions will add materially to the development of the Territory. At Conrad, in the southern end of the Territory, a concentrator has been erected and is now in full operation. The development of quartz on a large scale in any new country always takes considerable time, but it is confidently expected that the day is not far distant when the stamp mill will be at work in many parts of the Territory. The report of Mr. R. C. Miller, Assistant Gold Commissioner, gives important details concerning the mining industry in the southern portion of the Territory.

AGRICULTURE.

The development of this industry during the past few years has been most remarkable. Constant cultivation seems to increase the fertility of the soil. A few years ago all vegetables consumed in the Yukon were imported, but now potatoes, carrots, turnips, celery, cabbage, cauliflower, besides radishes and lettuce in abundance, are locally grown. In many cases the Yukon vegetables are decidedly superior to those imported. Oats are also grown but usually cut green for fodder. Native hay is used in outside districts, and butter-making has been successfully attempted but not as yet upon a large scale. In a recent report of the president of the White Pass and Yukon Route, a falling off of the traffic for last year is attributed, to a certain extent, to the smaller importation of perishables, consisting mainly of vegetables.

YUKON COUNCIL.

The session of the Yukon Council commenced on July 21 and lasted until August 10. Ten ordinances were passed, among the most important being the Employers' Liability Ordinance. Under the provisions of an amendment to the Yukon Act, which amendment comes into force on May 1 next, the Yukon Council will now consist of ten elected members. There are five electoral districts in the Territory, and two members will be elected for each district. The revision of the lists is now taking place preparatory to the election. The revenue of the Territory for the nine months ending March 31 was $293,188.97, and the expenditure, $232,918.88.

EDUCATION.

The schools throughout the Territory have been maintained in a high state of efficiency. Under the auspices of the Ontario Department of Education local examinations were held at Dawson for matriculation into Toronto University. The percentage of passes was high, as well as the average of marks obtained. Several graduates of the Dawson high school are now taking courses in arts and engineering at the universities of Toronto, Chicago and Ann Arbor.

ADMINISTRATION OF JUSTICE.

I am glad to be able to report that the Territory, during the past year, has been almost entirely free from crime of a serious nature. The members of the Royal Northwest Mounted Police, under the efficient command of the Assistant Commissioner, Major Wood, continue to perform their duties with zeal and promptitude. Although numbers of foreign miners come into the Territory each year, the police protection afforded has been adequate, and no disturbances of any kind have occurred.

INDIANS.

The Indians of the Territory have received the care of the government as in the past. An outbreak of small-pox occurred in an Indian tribe near Eagle, Alaska, but the prompt establishment of a quarantine prevented the spread of this dread disease. No sickness of the nature of an epidemic has visited the Yukon Indians during the past year. They are generally hard-working and self-sustaining, living principally by hunting and fishing, but the absence of game in close proximity to their settlements makes it more difficult each year for them to obtain the means of sustenance. It is estimated that the present Indian population of the Territory is about 1,000. Three schools, where elementary instruction and training are given to Indian children, are being conducted by teachers under the auspices of the Church of England.

GENERAL.

Perhaps the most noticeable feature of the mining industry during the past year has been the increased confidence that the Territory is just about entering on an era of great quartz development. Recent investigations are most gratifying, and within a few months it is believed the question will have been advanced a long way towards solution.

I desire to express my appreciation of the efficient service rendered by all the officials of the different departments of government in the Territory.

Reports from the Comptroller, Gold Commissioner, Crown Timber and Land Agent, Director of Surveys and Government Mining Engineer are herewith inclosed.

I have the honour to be, sir,

Your obedient servant,

ALEXANDER HENDERSON,

Commissioner.

No. 1.

REPORT OF THE GOLD COMMISSIONER.

Office of the Gold Commissioner of the Yukon Territory,
Dawson, Y.T., April 21, 1909.

The Commissioner of the Yukon Territory,
Dawson, Y.T.

Sir,—I have the honour to submit herewith my report for the twelve months ending 31st ultimo.

The total receipts shown by the said report amount to the sum of $94,236.13, which is a decrease of $27,009.87 from the receipts of the previous fiscal year. The decrease in question is accounted for principally by the reduction of the fees for renewal of placer mining claims which took effect on July 20 last, and also by the decrease in the receipts from the issuing of placer mining grants and relocation grants, and from the recording of documents.

On the other hand it will be seen from my report that the sum of $8,815.65 was received in this office during the last fiscal year, whilst no money was received from the same source, namely, rentals for dredging leases, during the previous fiscal year.

Hereto attached will be found also the financial statement, giving the receipts of this office during the said fiscal year, together with the revenues collected at the offices of the mining recorders for the Duncan and Sixtymile mining districts, accounted for during the said fiscal year.

A comparative statement with the receipts of the previous fiscal year will also be found attached to the said financial statement.

Another statement will also be found attached hereto, giving a list of the first locations (generally called discoveries placer mining claims) which have been recorded in the Dawson mining district during the said fiscal year, and the names of the creeks, hills, benches, bars or plains where these locations were made. They number 76 in all, and although they are commonly called discoveries, they are not entitled to be called so in every instance, because the applicants for the same have not established, and have not had to establish to the satisfaction of the mining recorder that they had made a discovery of gold.

The returns for the Duncan mining district, which are embodied in our financial statement, show an increase in placer mining grants and a slight decrease in the receipts from renewal grants and a considerable decrease from relocation grants.

The returns for the Sixtymile mining district show a decrease in the receipts from renewal grants, which is fully accounted for by the reduction of the renewal fee as herein above stated, but the receipts from placer mining grants and relocation placer mining grants are about the same as during the previous fiscal year.

As regards the mining operations which were carried on during the said fiscal year, I do not see any occasion to devote any attention to that matter in this report, as the government mining engineer has prepared a report in that respect which gives, I understand, full particulars.

Your obedient servant,

F. X. GOSSELIN,
Gold Commissioner.

SCHEDULE showing the placer discovery claims recorded in the Dawson district during the fiscal year ending March 31, 1909.

Date of Location.	Locator.	Description of Property.
2 April	Geo. R. Clark	Hill Dago Gulch, tributary of Hunker.
2 "	Geo. R. Clark	Bench R. L. Henry Gulch.
3 "	John Fawcett	Bar Kimber Island opposite Fort Reliance.
3 "	Chas. D. Connor	Creek David, tributary of Goring.
3 "	D. J. R. Cameron	Creek Donald, tributary of Black Hills.
10 "	James Archibald	Creek on tributary of Hunker at 36 below Discovery.
14 "	J. T. Rosman	Creek Dion Gulch, tributary of Yukon.
29 "	Jujiri Wada	Creek High Cache, tributary of Firth River.
1 May	John Bruholski	Creek Brook, tributary of Clear.
15 "	F. C. Graham	Creek U½ Gravel, tributary of Flat.
15 "	Murdo Miche	Creek L½ Gravel, tributary of Flat.
21 "	R. A. Fox	Creek Log Cabin, tributary of Fortymile.
29 "	Wm. Hayhurst	Creek Little Dome, tributary of Herbert.
2 June	Joseph Toseo	Hill R. L. Hubrick, tributary of Hunker.
2 "	F. H. Osborn	Hill L. L. 4, 5, 6 above Discovery Blackhills.
10 "	N. A. Watt	Creek Spring Gulch, tributary of Bonanza.
15 "	Wm. Preido	Creek Preido Gulch, tributary of Hunker.
20 "	E. Rogers	Creek on 19 Pup, tributary of Bonanza.
26 "	L. W. Steele	Creek on tributary at 1 above Discovery Last Chance.
29 "	Jas. Sample	Creek on Slough, tributary of Clear.
29 "	Jas. Sample	Hill on L. L. Slough.
2 July	J. H. Baker	River R. L. Stewart ½ mile below Lake.
2 "	L. Matchett	Creek Dome, tributary of Blackhills.
8 "	T. W. Kirkpatrick	Creek L½ Windy Bill, tributary of Klondike.
8 "	H. Kuchman	Creek U½ " " "
8 "	T. W. Kirkpatrick	Creek Turgeon, tributary of Windy Bill L½.
15 "	H. Kuchman	Creek U½ " " "
15 "	Geo. Hodgins	Creek Hodgins, tributary of Blackhills.
21 "	Richard Berling	Creek U½ Leotta.
21 "	Geo. Waldt	Creek L½ Leotta.
3 August	Geo. Hodgins	Creek Gough, tributary of Blackhills.
3 "	Geo. Hodgins	Dugas Creek, tributary of Blackhills.
3 "	O. W. Hobbs	Creek Stephens, tributary of Scroggie.
3 "	W. J. Lee	Creek L½ Walhalla, tributary of Scroggie.
3 "	C. E. Hirding	Creek U½ " "
14 "	A. B. Thornton	Creek Moosehorn, tributary of Henderson.
18 "	Thomas Burke	Creek Milway, tributary of Scroggie.
8 Sept	Fred. Hurst	Creek Lapoite, tributary of Slough.
16 "	G. M. Brown	Creek Nodine, tributary of Moose.
22 "	R. W. Brazil	Creek Brazil, " "
3 October	H. E. Boucher	Canoe, tributary of Blackhills.
5 "	I. G. Preston	Creek L½ Britton, tributary of Maisie Mae.
5 "	Jas. Britton	Creek U½ " " "
12 "	E. J. Corp	Creek Corp, tributary of Goring.
22 "	J. L. Walters	Creek Selwyn, tributary of Yukon.
29 "	J. Butler	Creek Dixie, tributary of Barker.
30 Nov	Thomas O'Hara	Hill R. L. Slough.
2 Dec	Wm. Nicoll	Creek Partridge, tributary of Stewart.
3 "	L. A. Kephart	Creek Viola, tributary of Maisie Mae.
5 "	W. S. Barkley	Creek left fork Henderson.
14 "	Alex. Walker	Bench R. L. Yukon at mouth of Thistle.
16 "	John Shaller	Creek James, tributary of Log Cabin.
16 "	Richard Burke	Creek Pete " "
17 "	Oswald Heinze	Creek Heinze, tributary of Blackhills.
17 "	E. A. Froberg	Creek Barette " "
21 "	D. G. Robertson	Creek Just " "
29 "	Duncan McPhail	Creek Mitchell, tributary of Hunker.
29 "	Duncan McPhail	Creek Hubrick " "
29 "	Duncan McPhail	Creek Johanna " "
6 January	Joseph Butler	Creek Hines, tributary of Barker.
7 "	Carrie Korbo	Creek on tributary of Rob Roy.
15 "	O. F. Jenkins	Creek Franklin, tributary of Barker.
15 "	O. F. Jenkins	Creek Iron " "
20 "	A. O. Backe	Creek, tributary of Hunker at 77 below Discovery.
10 February	S. J. Thurber	Creek U½ Preacher, tributary of Barker.
10 "	G. E. Nichols	Creek L½ " " "
19 "	W. D. McKay, Jr	Bar Indian Island in Yukon.
19 "	A. Dunlop	Hill L. L. Cameron, tributary of Yukon.

SCHEDULE showing the placer discovery claims recorded in the Dawson district during the fiscal year ending March 31, 1909.—*Concluded.*

Date of Location.	Locator.	Description of Property.
3 March..	J. Tilton	Creek Durkee, tributary of Yukon.
3 "	Percy Dent	Creek Agate, tributary of McRae.
12 "	J. G. Morin	Creek Jensen, tributary of Dominion.
13 "	D. J. McIntyre	Creek Slough.
16 "	C. A. Smith and B. Silverman	Creek Brewer, tributary of Stewart.
22 "	Nelson Ponshay	Creek 99 Gulch, tributary of Thistle.
25 "	O. F. Jenkins	Creek Jenkins, tributary of Yukon.
25 "	W. H. Misener	Creek Misener, tributary of Yukon.

Certified correct,

G. P. MACKENZIE,
Mining Recorder.

FINANCIAL statement of the Gold Commissioner's Office, from April 1, 1908, to March 31, 1909.

RECEIPTS.

Placer—		
To Grants	$ 6,140 00	
Relocations	4,960 00	
Renewals	50,775 00	
Registered documents	5,267 00	
Abstracts	87 00	
		$ 67,229 00
Quartz—		
To Records	$ 1,460 00	
Certificate of work	1,215 00	
Certificate of partnership	72 50	
Registered documents	615 00	
Lieu of assessment	100 00	
Certificate of improvements	27 50	
Acreage	510 41	
Abstracts	4 00	
		$ 4,004 41
Sundry Accounts		
To Water grants	$ 950 00	
Hydraulics	2,147 09	
Dredging	8,815 65	
Advance deposits	1,907 98	
		$ 13,820 72
Duncan—		
To Placer grants	$ 2,630 00	
Relocations	370 00	
Renewals	3,405 00	
Registered documents	669 00	
Quartz records	40 00	
Quartz registered documents	10 00	
Water grants	50 00	
		$ 7,174 00
Sixtymile—		
To Placer grants	$ 100 00	
Relocations	170 00	
Renewals	1,398 00	
Registered documents	145 00	
Quartz records	20 00	
Water grants	175 00	
		$ 2,008 00
		$ 94,236 13
Disbursements—		
By Receiver General	$ 92,159 65	
Gold Commissioner's Suspense Account	168 50	
Balance account	1,907 98	
		$ 94,236 13

Certified correct,

F. A. H. FYSH,
Accountant.

RECAPITULATION.

FINANCIAL Statement Gold Commissioner's Office, Year ending March 31, 1909.

—	Placer Grants.	Renewals.	Relocations.	Registered Documents.	Abstracts.	Water Grants.	Hydraulics.	Dredging.	Quartz Records.	Certificates of Work.	Certificates of Partnership.	Registration of Documents.	Lieu of Assessment.	Certificates of Improvements.	Abstracts.	Acreage.	Advance Deposits.
	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
Dawson	6,140 00	50,775 00	4,960 00	5,267 00	87 00	950 00	2,147 00	8,815 65	1,460 00	1,215 00	72 50	615 00	100 00	27 50	4 00	510 41	1,907 98
Duncan	2,630 00	3,405 00	370 00	669 00	.....	50 00	.....	.....	40 00	.....	.....	10 00	.....	.....	.....	.....	.....
Sixtymile	100 00	1,398 00	170 00	145 00	.....	175 00	.....	.....	20 00	.....	.....	.....	.....	.....	.....	.....	.....
	8,870 00	55,578 00	5,500 00	6,081 00	87 00	1,175 00	2,147 00	8,815 65	1,520 00	1,215 00	72 50	625 00	100 00	27 50	4 00	510 41	1,907 98

COMPARATIVE STATEMENT.

Returns Gold Commissioner's Office.

——	Year ending March 31, 1908.	Year ending March 31, 1909.	Increase 1909.	Decrease 1909.
	$ cts.	$ cts.	$ cts.	$ cts.
Placer grants	15,180 00	8,870 00		6,310 00
Renewals	73,935 00	55,578 00		18,357 00
Relocations	7,160 00	5,500 00		1,660 00
Registered documents (placer)	13,444 00	6,081 00		7,363 00
Abstracts	59 00	87 00	28 00	
Water grants	1,250 00	1,175 00		75 00
Hydraulics	3,464 67	2,147 09		1,317 58
Dredging		8,815 65	8,815 65	
Quartz records	2,605 00	1,520 00		1,085 00
Quartz registered documents	665 00	625 00		40 00
Quartz certificate of work	747 50	1,215 00	467 50	
Quartz certificate of partnership	67 00	72 50	5 50	
Quartz lieu of assessment	200 00	100 00		100 00
Quartz certificate of improvements	27 50	27 50		
Quartz acreage	459 60	510 41	50 81	
Quartz abstracts	2 50	4 00		1 50
Advance deposit	1,907 98	1,907 98		
Free miner's certificate	71 25			71 25
	121,246 00	94,236 13	9,368 96	36,378 83
Net decrease				27,009 87

Certified correct.

F. A. H. FYSH,
Accountant.

No. 2.

REPORT OF THE CROWN TIMBER AND LAND AGENT.

OFFICE OF THE CROWN TIMBER AND LAND AGENT OF THE YUKON TERRITORY,
DAWSON, Y.T., April 21, 1909.

The Commissioner of the Yukon Territory,
Dawson, Y.T.

SIR,—I have the honour to submit herewith my report of the business transacted in this office during the last fiscal year ending on the 31st ultimo, namely:—

1. A statement of revenues in the Timber and Mines Branch amounting to the sum of $22,158.62.

2. A statement of revenues in the Dominion Lands Branch amounting to the sum of $8,993.96.

These statements show a total revenue of $31,058.58 during the said fiscal year from the two sources in question, which is in excess of the revenues collected from the said sources during the previous fiscal year.

Only one coal mine, the Tantalus coal mine, was operated during the said fiscal year.

Seven entries for homestead were granted during the said fiscal year, as against five during the previous fiscal year.

Only one saw-mill, namely, the Klondike mill, owned by the North American Transportation and Trading Company, and situated on the island in the Klondike river at its mouth, was operated last season, by the Yukon Saw-mill Company under a lease.

The wood cutting operations and timber cutting operations along the Lewes, Yukon, Stewart and Klondike rivers, and in the vicinity of Dawson, show about the same activity as in the previous years.

The wood camps within a radius of about ten miles around Dawson were visited several times during the winter by the Crown Timber Inspector, and were generally found operating under proper authority, either on timber berths, or under timber permits, or under contracts from claim owners and operators.

The wood and timber camps up the Klondike river were visited by the Crown Timber Inspector last November, and were found to be operating under proper authority.

Your obedient servant,

F. X. GOSSELIN,
Crown Timber and Land Agent.

Dominion Lands Branch.

	General Sales.	Rentals.	Registration Fees.	Survey Fees.	Homestead Fees.	Total.
1908.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
April	77 90	5 00	4 50	.....	.....	87 40
May	.....	1,750 00	.....	.....	10 00	1,760 00
June	.....	2,078 85	6 00	.....	10 00	2,094 85
July	.....	2,077 55	.....	.....	.....	2,077 55
August	12 00	.....	.....	.....	20 00	32 00
September	293 52	.....	4 00	.....	20 00	317 52
October	20 00	2 66	2 00	.....	.....	24 66
November	899 59	15 00	.....	.....	10 00	924 59
December	114 67	.....	.....	.....	.....	114 67
1909.						
January	60	.....	14 00	.....	.....	14 60
February	386 33	.....	2 00	.....	.....	388 33
March	77 49	1,080 30	.....	.....	.....	1,157 79
	1,886 10	7,009 36	28 50	.....	70 00	8,993 96

Crown Timber Branch.

	Royalty.	Timber Permits	Seizures.	Hay Permits.	Coal Royalty.	Total.
1908.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
April	104 96	286 50	118 00	.....	.....	509 46
May	1,197 31	358 50	189 00	32 00	.....	1,776 81
June	1,371 83	603 65	28 50	34 00	.....	2,037 98
July	.....	1,005 50	28 00	69 00	36 52	1,139 02
August	1,019 24	825 21	76 41	5 50	77 02	2,003 38
September	14 00	1,697 00	82 00	.....	.....	1,793 00
October	1,090 18	2,488 00	174 25	.....	91 14	3,843 57
November	965 62	1,336 00	16 00	.....	167 05	2,484 67
December	10 04	886 25	40 50	.....	.....	936 79
1909.						
January	1,175 31	285 00	.....	.....	.....	1,460 31
February	1,596 88	1,562 00	.....	.....	.....	3,158 88
March	88 25	917 00	9 50	.....	.....	1,014 75
	8,633 62	12,250 61	762 16	140 50	371 73	22,158 62

Certified correct.

F. A. H. FYSH,
Accountant.

No. 3.

REPORT OF THE COMPTROLLER.

Comptroller's Office,
Dawson, Y.T., April 10, 1909.

The Honourable Alexander Henderson,
Commissioner of the Yukon Territory,
Dawson, Y.T.

Sir,—I have the honour to submit my annual report for the year ending March 31, 1909.

Under the appropriation through the Department of the Interior, 'Administration of the Yukon Territory,' the expenditure for the fiscal year just ended was $148,695.74, as shown by the monthly statements and vouchers forwarded to the department.

On account of subsidy to river steamers, the amount expended was $750, the unexpended balance being deposited to the credit of the Receiver General, this vote having been discontinued.

From July 1, 1908, to March 31, 1909, the local revenues and expenditures of the Yukon Territory were:—Revenue, $293,188.97; expenditure, $232,918.88, as per balance sheet attached. Statements and vouchers were forwarded to the Auditor General at the end of each quarter as required by the ordinance.

The expenditure on account of the Department of Justice for the year just closed was $24,739.08; monthly returns being made to that department.

The expenditure on account of Department of Indian Affairs for the relief of sick and destitute Indians was $6,936.

Under the Letter of Credit account, Department of Public Works, for the maintenance and repairs of public buildings, in the name of the Superintendent of Public Works and myself, the expenditure was $89,658.78.

From the vote for river improvements, in the name of the Commissioner and myself, the expenditure was $5,054.12.

The royalty collected in the Territory for the year ending March 31, amounted to $81,502.92; collected at Dawson, $79,791.02, Whitehorse, $1,711.15, and Fortymile, 75 cents.

The revenue from free certificates issued to exporters of gold from Alaska was $166.

From confiscated gold dust, there was a sum of $75.50 realized.

The revenue from these sources was deposited to the credit of the Receiver General, drafts being sent to the department weekly and statements at the end of each month.

From the sale of Yukon Territorial Court law stamps, the revenue received was $3,344.

The returns of the revenue received in the office of the Gold Commissioner and Crown Timber and Land Agent have been checked each month as formerly, and returns forwarded to the department; the suspense account in the Gold Commissioner's office also being checked monthly and the cheques countersigned in payment of disbursements.

In accordance with your instructions, I made a thorough and exhaustive inspection of the office of the Mining Recorder for the Duncan mining district. A copy of my report was forwarded to the department under date of March 30.

Your obedient servant,

J. T. LITHGOW,
Comptroller.

BALANCE SHEET GOVERNMENT OF YUKON TERRITORY, MARCH 31, 1909.

Appropriation.	Dr.	Expenditure.	
$ cts.		$ cts.	
	Balance from 1907-08	271 46	
23,500 00	Salaries and travelling expenses	16,071 10	
49,560 00	Schools	32,935 12	
5,000 00	Contingencies	3,166 56	
4,300 00	Dawson free library (Terr'y)	3,125 00	
107,090 00	Roads, bridges and public works	88,443 39	
13,000 00	Election of 10 members Yukon Council		
4,000 00	Indemnity " " "	3,060 00	
950 00	Preventive service	621 64	
5,000 00	Printing and Stationery (Terr'y)	2,132 06	
900 00	Whitehorse free reading room	600 00	
34,600 00	Hospitals, charities and quarantine	25,389 02	
4,600 00	Assay office, Whitehorse	2,432 00	
5,000 00	Miscellaneous expenditure	2,974 85	
10,500 00	Town of Whitehorse	9,924 90	
3,500 00	Street lighting (city)	2,770 30	
500 00	Printing and stationery (city)	246 75	
2,100 00	Dawson free library "	1,575 00	
34,300 00	Dawson fire department "	24,343 87	
10,000 00	Streets and sidewalks "	8,347 75	
1,000 00	Contingencies "	392 63	
4,700 00	Salaries "	3,524 94	
2,000 00	Dog pound "	842 00	
	Balance on Hand	59,998 63	293,188 97

Estimated Revenue.	Cr.	Revenue Received.	
$ cts.		$ cts.	
59,375 00	Dominion Government grant roads and bridges	50,000 00	
125,000 00	" " " local purposes	93,750 00	
23,500 00	Liquor licenses (Terr'y)	38,420 30	
35,000 00	" permits	46,347 26	
16,000 00	Local taxation and Sundry Revenue	15,651 70	
21,500 00	Proportion liquor licenses (city)		
5,000 00	City licenses	756 00	
40,625 00	City taxation	48,263 71	293,188 97

No. 4.

REPORT OF THE GOVERNMENT MINING ENGINEER.

DAWSON, Y.T., April 1, 1909.

The Commissioner of the Yukon Territory,
Dawson, Y.T.

SIR,—I have the honour to submit to you my annual report on the mining operations in the Yukon Territory for the year ending March 31 last.

The mining conditions have not, within the last year, changed very materially, at least not more than what would be expected in a placer camp of this age. In the districts of early gold discoveries the transition period, which has been in existence for the last few years, is nearly completed. The individual miner who worked the cream of the pay has given way to the large operator and gone to develop the outlying districts. This has been the case in that part of the Dawson mining district tributary to the Klondike river; that portion tributary to Indian river is gradually undergoing the same change, such as the upper part of Dominion creek and the upper part of Sulphur creek, and will likely last until the claims are consolidated and the plants installed on them.

Miller and Glacier creeks, tributaries of the Sixtymile river, situated in the Sixtymile district, are also in a stage of transition similar to that part of the Dawson mining district tributary to Indian river. Nearly the whole of Miller creek is included in a leasehold acquired by the N. A. T. & T. Company, which is now preparing the creek bed for dredging operations in the near future. There are a few claims situated on Miller creek, outside the limits of this leasehold, but there is very little work being done on them. All the claims situated on Glacier creek are rapidly being consolidated.

The number of productive mining operations on the old gold-bearing streams, which are still in a stage of transition are few, and such a condition is expected to last until there is a complete consolidation of the claims in these particular localities. In many instances there is only enough work being done, as required by the Placer Mining Act, to keep the claims in good standing.

With the aid of the grouping system, for the purpose of consolidation, it is possible to apply all the work of one plant as representation work for any number of claims in the group. It is obvious that many have taken advantage of this section of the regulations, and really abused it in order to avoid representation work, and it has, naturally, lessened the number of operations in the Territory. On the other hand it has helped many miners of limited means who are sinking in very deep ground, which has been the means of locating pay streaks which could not otherwise be found, and I must say that the conditions at present demand such a grouping system to be kept in force.

INDIVIDUAL MINING OPERATIONS.

The bulk of individual mining is still confined to the Dawson mining district. Apart from the few plants scattered here and there on the old gold-bearing streams upon which large operations are concentrated, as on Bonanza, Eldorado, Hunker, and in those parts of the Territory where consolidation of claims is being made, as on the upper part of Dominion creek, the upper part of Sulphur creek and a portion of Miller and Glacier creeks, the individual mining done, from which the main output is derived, is confined to the lower portion of Dominion creek, the middle of Sulphur creek, the lower portion of Gold Run creek, the whole of Quartz creek, the upper parts of Black Hills creek and some of the tributaries of Hunker creek.

Black Hills creek, a tributary of Stewart river, is productive from Discovery to No. 23 above discovery. I am informed that pay has been located at four places in the lower portion of the creek, but no output is expected this coming year from the lower portion.

It is estimated that the spring washup and the summer work on this creek during the last year gave an output of $45,000.

Livingston creek, a tributary of the South Fork of the Big Salmon river, is a steady producer. Over fifteen outfits were operating during the summer, and many are prospecting this winter. There is a transient population of 300 during the summer months and a stationary one of over 150 during the winter. The estimated output during the last year was $100,000.

You will find herewith attached (Table No. 1), in a tabulated form, the number of individual mining operations conducted during the last year within the several mining districts in the Yukon Territory, together with the methods employed, and a few remarks on the existing conditions in each locality.

LARGE SCALE OPERATIONS.

These operations include dredging, hydraulicking, steam shovelling and electric elevators, or any other method employed whereby mechanical appliances have been substituted for manual labour; therefore, these operations are expected to be situated in localities where the individual miner could not operate any more at a profit or where the tenor of the gravels was too low grade for individual operations ever to be attempted.

The existing fields for these large operations are, at present, on Bonanza creek, Hunker creek, the hills and benches bordering on these streams and tributaries and in the valleys of the Klondike, Indian, Stewart and Fortymile rivers.

DREDGING.

The operation of dredges in frozen ground has been materially improved both in the manner of digging and in the way of thawing ahead of the dredges. The cost of thawing has been reduced fully 50 per cent, due principally to cheaper transportation of the fuel and the increase of point duty. The reduction in the cost of digging is due to the installation of hydro-electric transmission plants.

Most improvements have been made in the manner of digging. Where the bed-rock is soft and the gold is evenly distributed through the gravels the manner of digging has not changed, but as the gold, in this territory, is invariably close to or in bed-rock the manner of digging has been made to conform to the conditions of the bed-rock.

In localities where the bed-rock is hard, cracked and slabby it has been found necessary to go over the same area twice: the first time the buckets will take up all the material possible and 'bull dose' the bed-rock and the second time the bed-rock material itself will be taken up. Some dredge men have found it impossible to take up everything, in the shape of values, by going over only once.

You will find in Table No. 2, in a tabulated form, the number of dredges in operation in this territory together with other data in connection with the operations.

HYDRAULICKING.

There have been no new improvements in either the manner of working or the gold-saving appliances employed. In spite of the wet season during the last year the number of hydraulic operations was less than the previous year. This was due to the Yukon Gold Company having acquired many of the small hydraulic outfits which were operating during the previous year. There will be no increase in the number of hydraulic operations until the Yukon Gold Company has completed its water system, which will be in the course of a couple of years.

Although the past season was a most favourable one for the hydraulic operator, it is only local water which is used, and the supply is not sufficient at its best. The dam constructed by the Yukon Gold Company at No. 57 above Discovery on Bonanza creek conserved all the water available to operate the hill and bench gravels of upper Bonanza creek, but there was not enough for all the hills and the elevators that were installed in the creek bed.

You will find herewith attached, in Table No. 3, in a tabulated form, the number of hydraulic operations conducted during the past season, together with some other data in connection therewith.

ELECTRIC ELEVATORS.

There are three elevators installed in the territory, two on Bonanza creek, owned by the Yukon Gold Company, and the other one on Hunker creek, owned by Messrs. Burke Bros. The Yukon Gold Company operates its elevators with electric power transmitted over its line from Little Twelvemile river, where the hydro-electric plant is situated; the other has steam as a motive power.

These elevators will do as much work as a dredge, cost less and will also operate in localities where the conditions are inimical to dredging. They are installed for the purpose of operating shallow creek diggings where the bed-rock is slabbly and hard and where there is no grade for the disposal of the tailings.

All the water used must be under pressure the same as in hydraulic operations. It is an open-cut mining method and subdivided into an hydraulic method.

All the elevators have proved successful. Considerable trouble was encountered with the pumps, which would plug up with moss and other waste material when the overburden was removed, but I am informed that this trouble will be obviated during the coming season, as other pumps have been installed for the purpose.

You will find in Table No. 2, in a tabulated form, the depth and area of ground worked, the quantity of water used and other data in connection therewith.

THE ASSAY OFFICE.

The Assay Office is situated in the town of Whitehorse, and is controlled by the local government. It is in charge of Mr. Robert Smart, whose work has been entirely satisfactory to both the public and the several smelting companies.

During the year, 806 assays were made sent from different parts of the Territory and Atlin, B.C. In addition to the above number of assays many qualitative determinations of ores were made which are not herewith tabulated.

The capacity of the office has been materially increased in the way of a 3 horse-power gasoline engine for pulverizing and crushing.

There was a decrease in the number of assays made this year in comparison with the last year, and that is due, no doubt, to the lack of prospection for copper ores, on account of the great reduction in price.

As we have no assay office in Dawson, all samples received here are sent to Whitehorse, through the White Pass Company, for assay.

You will find herewith attached, in Table No. 4, in a tabulated form, a statement of the number of assays made during the year.

Your obedient servant,

A. J. BEAUDETTE,
Government Mining Engineer.

TABLE No. 1.—INDIVIDUAL MINING OPERATIONS.

LOCALITY.		Number of Operations and the Mining Methods Employed.				Remarks.
Main Creek.	Tributaries.	Drifting.	Open-cutting.	Ground-Sluicing.	Total.	
Dawson Mining District.						
Bonanza Creek		41	3	8	52	All the operations herewith tabulated are conducted by manual labour. With the exception of the self-dumper, to elevate the material to the sluices, and the scraper, to remove the overburden, there are no mechanical appliances employed.
	Lovett Gulch	8			8	
	Trail Gulch	3		1	4	
	Adams Creek	4	1	1	6	
	Stampede Gulch		1		1	In many instances, if the conditions will allow, the method of ground-sluicing is employed to remove the overburden of placer claims when the pay underneath is to be excavated with the pick and shovel. In other instances the whole of the claim, from top to bottom, is washed into the sluices and the pay is recovered in that way.
	Little Skookum	2			2	
	Big Skookum	1		2	3	
	Homestake Gulch	2			2	
	Victoria Gulch	1	3	2	6	
	No. 7 Pup, on Victoria			2	2	
Eldorado Creek		5	9		14	Each operation herewith tabulated represents, in most cases, a group of placer claims ranging from two to upwards of twenty in number and a shift of from two to twenty men. Many of these men work on the productive claims in the summer and prospect in the winter.
	Irish Gulch			1	1	
	French Gulch	3			3	
	Nugget Gulch	1			1	
	Gay Gulch	4	1		5	
	Ora Grande			2	2	In the Bonanza Creek bed there are nine individual mining operations, five dredges and two electric elevators. All the claims now lying idle are kept in good standing by reason of being grouped with the claims operated.
	Chief Gulch	1		1	2	
Hunker Creek		10	12		22	
	Last Chance Creek	12	2	2	16	
	Henry Gulch	2			2	As only one claim can be worked at a time many of them are bound to be idle for a number of years to come. No one claim will justify the expenditure of either a dredge, an electric elevator or an hydraulic plant.
	Discovery Pup (tributary)	2	1	1	4	
	No. 80 Pup	2	2		4	
	Hattie Gulch	2			2	
	Hester Creek	2		1	3	In the Hunker Creek bed there are twenty individual mining operations, three dredges and one steam elevator. The conditions on this creek are precisely the same as they are on Bonanza Creek.
	Independence Creek			1	1	
	Gold Bottom Creek	4			4	
	Rogers Pup		1		1	The bulk of the individual mining operations is on the upper part of Quartz Creek, the middle of Sulphur Creek, and the lower part of Dominion Creek. The work on the other creeks is not concentrated at any one point, but is more or less scattered from mouth to head.
Dominion Creek		80	8	9	97	
	Little Dominion Creek	2			2	
	Caribou Creek	1		1	2	
	Gold Run Creek	14			14	
	Lombard Creek	2			2	

Indian River		1		3	4
	Sulphur Creek	35			35
	Green Gulch (tributary)	2			2
	Eureka Creek	4		1	5
	Quartz Creek	25		2	27
	Little Blanche Creek (tributary)	1	1		2
	Canyon Creek (tributary)	3			3
	Claffy Pup (tributary)	1			1
Klondike River		2			2
	Goring Creek	2			2
	All Gold Creek	3		2	5
Stewart River			*3		3
	Henderson Creek	2		1	3
	Barker Creek	4		1	5
	Scroggie Creek	2			2
	Black Hills Creek	18		1	19
	Child's Gulch	4			4
Yukon River		4		1	5
	Summit Creek	3			3
	Livingstone Creek	14		1	15
	Lake Creek	3			3
	Thistle Creek	15		2	17
Macmillan River	Russell Creek			1	1
Fortymile River			*1		1
	Moose Creek	3			3
	Bear Creek	3			3
	Falls Creek	4			4
					469
Duncan Mining District.					
McQuesten River		1	*1		2
	Vancouver Creek	1			1
	Haggart Creek	14		1	15
	Dublin Gulch (tributary)			1	1
Mayo River					
	Minto Creek			2	2
	Highet Creek (tributary)	3		1	4
	Davidson Creek	2			2
	Ledge Creek	1			1
					28
	Duncan Creek	2		1	3
					31
Sixtymile Mining District.					
Miller Creek		4			4
Glacier Creek		4	4		8
	Big Gold Creek	2		1	3
Ten-mile Creek				1	1
Bedrock Creek		1			1
					17

*Bar diggings.

Many of the outfits here tabulated are merely taking enough gold out of their claims, or on lays for grubstake purposes, and consequently they do not figure very much in the output. The amount taken out by these searchers of grubstakes ranges from $800 to $2,000 for every two men.

The submerged bed of the Fortymile River is being dredged at a point about six miles above the mouth.

Bar digging operations are still being conducted on the Fortymile and Stewart Rivers with success, but that can only be done at low water.

On Dominion Creek, from the mouth of Gold Run Creek to creek claim No. 132 below lower discovery, a distance of about seven miles, there is no work going on and it does not appear that any will be done in the near future. From creek claim No. 132 below lower to the head of the creek the operations are very scattered. Most of the claims lying idle are kept in good standing by reason of the work being done on adjoining claims to which they are grouped.

The number of placer mining outfits of all kinds in operation in the Dawson mining district is, as near as I can find, 473.

Only individual mining is being done in this district, and it does not appear that any other class of mining will be attempted in the near future, although I just received some information that a company is contemplating installing a dredge at the mouth of the McQuesten River.

The prospectors in this district have been very unfortunate in that the deposits are deep and only partly frozen, the unfrozen part being near bedrock, and admit uncontrollable quantities of water, which makes it impossible for a miner of limited means to make a success.

The greater portion of the miners on Duncan Creek have gone away from the district on account of the wet ground, above mentioned.

The pumps installed by the government on Duncan Creek were not a success, as the quantity of water to be controlled was too great.

Some fairly good pay was found on Haggart Creek last year, which created quite a stampede. I was there last year shortly after the pay was discovered and again this winter. There are nine different outfits sinking on the benches and so far only one has found enough pay to justify drifting.

I saw some shafts being sunk which were 124 feet in depth and gravel had not yet been reached.

Of the fifteen outfits mentioned in the table herewith, only four are producing gold.

The conditions and the quantity of work done in the Sixtymile district have not changed within the last year.

TABLE No. 2.

DREDGING OPERATIONS.

Name of Company.	Locality.	Capacity of Buckets.	Condition of Gravel.	Type of Dredge.	Days in Operation.	Output, Cu. Yds.
Yukon Gold Company	104 B D. Bonanza Creek	5 cu. ft.	Thawed ahead of dredge	Bucyrus	*	....
" "	104 " " "	5 "	" " "	"	*	....
" "	90 " " "	5 "	" " "	"	*	....
" "	85 " " "	7 "	" " "	"	*	....
" "	Mouth of Hunker Creek	7 "	" " "	"	*	....
" "	Anderson Concession, Hunker Creek	7 "	" " "	Marion Shovel Co.	*	....
" "	37 B.D. Hunker Creek	7 "	" " "	"	*	....
Canadian Klondike Mining Company.	Klondike River Valley	7½ "	No thawing required	"	155	450,000
Bonanza Basin Gold Dredging Company	" "	6½ "	" "	Allis Chalmers	110	200,000
Lewis River Gold Dredging Company	6 B.D. Bonanza Creek	3½ "	Thawed ahead of dredge	Risdon Iron Works	136	150,000
Davidson Bros	Fortymile River, submerged bed	6½ "	No thawing required	Allis Chalmers	120	225,000
Yukon Basin Gold Dredging Company	Stewart River, submerged bed	3½ "	" "	Risdon Iron Works	14	No information.
Indian River Development Company	Indian River Valley	2½ "	Thawed ahead of dredge	Robinson, M'ntreal	60	"

* I have no information as to the number of days each dredge worked or its output, but the number of cubic yards excavated was 1,500,000 for the whole fleet.

ELECTRIC ELEVATOR OPERATIONS.

Yukon Gold Company	3-A. A.D. Bonanza Creek	2½ cu. ft.	No thawing required	Special Patent	....	60,000
" "	30 B.D. Bonanza Creek	2½ "	" "	"	....	8,000
Burke and Company	17 B.D. Hunker Creek	2½ "	" "	"	29	39,725

TABLE No. 3.

HYDRAULIC OPERATIONS.

Name of Operator.	Locality.	Length of Ditch.	Capacity of Ditch.	Pressure of Water.
Yukon Gold Company	Acklen Farm, R.L. Klondike River	7½ miles	1,000 miner's inches	360 feet.
" "	Paradise Hill, L.L. Hunker Creek	4 "	300 "	75 "
" "	American Hill, L.L. Bonanza Creek	8 "	1,000 "	250 "
Bonanza Creek Mining Company	Adams Hill, L.L. Bonanza Creek	3½ "	800 "	175 "
O. R. Brener	French Hill, Eldorado Creek	2 ditches, 3 and 4 miles	500 miner's inches in all	150 "
Canadian D. and H. Company	Lovett Hill, R.L. Bonanza Creek	2½ miles	150 inches	150 "
Grotschier Concession	Leasehold, L.L. Klondike River	1½ "	150 miner's inches	75 "
Younkins, J.	Hill, L.L. Last Chance Creek	3 "	300 "	75 "
Ellbeck & Collins	" " "	3½ "	200 "	100 "
Dolan, *et al.*	" " "	3½ "	200 "	100 "
Cook, *et al.*	Boulder Hill, L.L. Bonanza Creek	2½ "	250 "	80 "
Elliott, *et al*	Paradise Hill, Hunker Creek	4 "	300 "	75 "
Murphy and Gould	Nugget Hill, L.L. Hunker Creek	2¼ "	150 "	75 "
Larson, A.	Temperance Hill, Gold Bottom Creek	1½ "	150 "	75 "
De Blegier and Company	" " "	4 "	200 inches	100 "
Burke, *et al.*	Whisky Hill, R.L. Hunker Creek	1½ "	150 miner's inches	75 "
William's Concession	Hills, R.L. Hunker Creek	9 "	300 inches	150 "
Delhie, *et al*	Hills, L.L. Hunker Creek	4½ "	300 "	100 "
Geisler Bros.	Hill, L.L. Dominion Creek	1 "	75 miner's inches	75 "
Kellner and Steffens	Hill, R.L. Quartz Creek	2 "	100 "	50 "
Canadian D. and H. Company	Hill, L.L. Bonanza Creek	3 "	200 "	100 "
Finlayson, E. O.	Hill, L.L. Klondike River	6 "	300 "	150 "
J. W. Park	Hill, L.L. " "	5½ "	75 inches	75 "
Ballarat Creek Mining Company	Leasehold, Ballarat Creek	5 "	300 miner's inches	175 "
Yukon Gold Company	Hill, L.L. Bonanza Creek	4 "	500 "	150 "

TABLE No. 4.

Assays made in the Government Assay Office, Whitehorse, Y.T., during the Year ending March 31, 1909.

Elements.	April, 1908.	May, 1908.	June, 1908.	July, 1908.	Aug., 1908.	Sept., 1908.	Oct. 1908.	Nov., 1908.	Dec., 1908.	Jan., 1909.	Feb., 1909.	March, 1909.	Total.
Gold and silver	11	25	131	73	81	96	52	23	13	9	18	......	532
Copper	5	18	81	19	24	48	21	16	2	2	6	......	242
Lead	......	......	1	......	2	......	......	......	......	......	......	......	3
Antimony	1	......	1	......	8	6	......	......	......	......	......	......	16
Manganese	......	......	......	1	......	2	......	......	......	......	......	......	3
Nickel	......	......	......	......	......	......	......	......	......	1	......	......	1
Platinum	......	......	......	......	......	......	1	......	......	......	......	......	1
Carbon	......	......	......	......	......	......	3	......	......	......	......	......	3
Magnesia	......	......	......	......	......	......	......	......	......	1	1	......	2
Aluminum	......	......	......	......	......	......	......	......	......	......	1	......	1
Calcium	......	......	......	......	......	......	......	......	......	......	1	......	1
Carbon dioxide	......	......	......	......	......	......	......	......	......	......	1	......	1
Totals	17	43	214	93	115	152	77	39	15	13	28	......	806

No. 5.

REPORT OF THE DIRECTOR OF SURVEYS.

SURVEY OFFICE, YUKON TERRITORY,
DAWSON, Y.T., April 12, 1909.

The Hon. ALEXANDER HENDERSON, K.C.,
Commissioner of the Yukon Territory,
Dawson, Y.T.

SIR,—I have the honour to submit the following report of the work done in the Survey Department for the year ending March 31 last.

The staff has consisted of Mr. Gibbon, Captain Bennet and myself. Captain Bennet relieved the correspondence clerk during part of January, February and March while the latter was absent on leave.

During the year traverses were made of the location on 'Tab Hill,' 'McInnes Hill' and on Indian River from No. 10 above 'Hobbs' Discovery to the mouth, a distance of about ten miles. In the above instances staking and restaking had taken place until it was quite impossible for the mining recorder to ascertain by description, as given by the stakers, if grants were being given to more than one applicant for the same ground.

These traverses proved of valuable assistance to the gold office, for which plans were furnished. Mr. Gibbon also made traverse of the location stakes on a portion of Moose creek in the Fortymile district for the same purpose.

During July, August and September Mr. Gibbon established thirty-four miles of base lines on Black Hills creek and its tributaries, including end boundaries of claims, returns of which will soon be ready to file. Base lines were established on a portion of Black Hills creek in the spring of 1901 by Mr. Cautley, D.L.S., under contract made with Mr. Ogilvie, who was about that time succeeded by Commissioner Ross, who considered the survey too expensive and did not have Mr. Cautley make the returns. The lines established by Mr. Cautley were used as far as possible by Mr. Gibbon.

I surveyed base lines on 'Examiner Gulch,' 'Dion Gulch' and 'Falconer Gulch,' returns of which are being prepared. 'Examiner Gulch' is a tributary on the left limit of Bonanza at No. 98 below Discovery. 'Falconer Gulch' and 'Dion Gulch' are the first two tributaries of the Yukon river on its right limit above the Klondike river.

Captain Bennet has been employed in general office work draughting and keeping up as far as possible compiled sheets of the surveys brought into the office, making tracings and blue-prints of plans on file, and giving general information to the public, which by the way occupies almost half the time of one clerk.

A large plan was compiled by Capt. Bennet and myself of the whole territory, showing all the general topography at present to hand and particularly the location of all roads and trails that have been constructed in the territory. The plan also contains a table showing the number of miles of roads and trails constructed and the year in which they were made.

This map was made for the information and at the request of the Minister of the Interior.

Plans and returns of the following surveys were filed in this office during the past year :—

Group lots including quartz claims	124
Advertised placer claims	24
Base lines and traverses	11

These include surveys made by surveyors in private practice in the territory.

There were also 168 blue-prints and 87 tracings made in the office.

Your obedient servant,

C. W. MACPHERSON,
Director of Surveys, Y.T.

No. 6.

REPORT OF THE ASSISTANT GOLD COMMISSIONER.

OFFICE OF THE ASSISTANT GOLD COMMISSIONER,
WHITEHORSE, Y.T., April 16, 1909.

The Hon. ALEXANDER HENDERSON,
Commissioner of the Yukon Territory,
Dawson, Y.T.

SIR,—I beg to submit the following report concerning the development and general conditions existing in the southern Yukon, including the Whitehorse, Conrad and Kluane districts, during the past year, and also concerning the prospects and possibilities for the coming year.

WHITEHORSE DISTRICT.

During the first several months of last year the White Pass Railway continued work on the spur from its main line to the Whitehorse copper belt, completing seven miles of track. This line is now in a position to serve the southern half of the above belt but up to date none of the mine owners in that section have seen fit to ship ore. This is undoubtedly owing to two facts, first the low price of copper, and second, the very high freight rate demanded by the above railway. Prior to 1908 the ore rate from Whitehorse to the smelters was $5 per ton for sacked ore and $6 for ore in bulk. At present the railway ask $13.50 from Carcross to the smelter, and from Whitehorse to smelter from $5 per ton for ore valued at $8 per ton to $30 per ton and over on higher grades of ore.

The only properties on the Whitehorse belt that worked during 1908-9 were the Copper King and the War Eagle, the former shipping 300 tons of ore, valued at $11 per ton, but losing money by so doing.

On the whole it may be said that the Whitehorse copper belt has not developed at all during the last year, neither of the claims worked having made much progress. For the number of quartz and copper claims in good standing in this district, see Table No. 1 and for general data concerning principal claims see Table No. 2.

The Big Salmon Placer district produced about $60,000, employing about 50 men. No new discoveries were made in this district and it is probable that the coming year will be much the same as last. For general information as to quantity and value of gravel in this district see Table D.

The collections on account of timber and land were greater than during the previous year and the overdue payments on land have been practically all met. Only one application for a homestead entry was filed during the year. For total collections from all sources for the year see Table No. 5.

CONRAD DISTRICT.

In the Windy Arm section of the above district the Yukon District Gold Mining Company, successor to the Conrad Consolidated Company, is installing a 60-ton concentrating mill at a cost of $60,000 and is developing several other properties to a considerable extent and with encouraging results. For general data concerning the mining operations in this section see Table No. 2 (from Venus claim to end of table). The Wheaton and Watson Divisions of the Conrad District have been rather quiet, although the small operations carried on in these sections have given the operators every encouragement. For general data respecting mines in these divisions see Table

No. 2 (Gold Hill to Tally-Ho claim inclusive). For total collections made in the Conrad office for the year see Table No. 6. There will be little or no work in this district under the present ore rate. If, however, the railway company meets the miners half way the whole district will undoubtedly be very active.

KLUANE DISTRICT.

The Kluane placers, including Sheep, Ruby, Burwash and Fourth of July creeks, were worked to about the same extent as last year, producing about $20,000 and employing about 25 men. During last winter a hill channel has been found on Burwash Creek which is said to prospect very well and from which it is expected good results will be obtained during the coming summer. For quantity and value of placer deposits yet unworked in this district see Table D.

The Kluane and White river copper areas were simply represented during the past year. Until this district is served by a railway it will be impossible to do more than prospect the copper areas.

For collections made in the Kluane office during 1908-9 see Table No. 7. This table is incomplete, as February and March, 1909, have not yet been received from the recorder for the above district; when the above returns are received a statement will be forwarded to you at once as to the amounts collected for the above months.

I also beg to inclose tables showing the distances between points in the southern Yukon and freight rates between principal points, see Tables 3 and 4.

The tables inclosed are—

No. 1. Quartz claims in good standing, &c.
No. 2. General information respecting quartz mines.
No. 3. Table of distances.
No. 4. Table of freight rates.
No. 5. Collections in Whitehorse office.
No. 6. Collections in Conrad office.
No. 7. Collections in Kluane office.
No. D. Respecting values of unworked placer deposits.
No. E. Respecting ore deposits.

Your obedient servant,

R. C. MILLER,
Assistant Gold Commissioner.

TABLE No. 1.

STATEMENT showing Number of Quartz Claims in Good Standing in Whitehorse, Conrad and White River Districts, also Number of Claims Crown Granted in each of above Districts.

Districts.	Total Claims under lease.	Number of Locations 1908-9.	Number of Renewals, 1908-9.	Claims Crown Granted.
Whitehorse	275	97	178	42
Conrad	285	70	201	14
White River	44	31	13	....

TABLE No. 2.

GENERAL INFORMATION RESPECTING QUARTZ MINES.

Claim.	Owners.	Date record.	Ore shipped.	Ore on dump.	Cost transportation.	Men employed 1908-9.	Men employed 1909-10.	P. C. copper or value of ore.	Machinery.	Work completed during 1908 9 and prior to then.	Work contemplated 1909-10.
			Tons.	Tons.	$			p. c.			
Anaconda and Rabbit's Foot.	Dickson, Puckett & Whitney....	July 11, '99 " 9, '03	20	350	10 00	none	.....	7	none.	1907, shafts 60 ft., stripping 750 ft., drift 25 ft.; 1901-2, tunnel 400 ft..	
War Eagle and Leroi........	Lucas & Kessler.	" 19, '99 Aug. 7, '99	250	250	11 00	6	6	6	none.	1907-9, shaft 86 ft., tunnel 155 ft., open cut 100 ft; prior to 1907 shaft 35 ft...........	
Pueblo.........	Yukon Pueblo Mines.	July 17, '99	1,400	3,000	12 00	6	......	5	none.	1907-8, tunnel 250 ft., 3,000 tons ore quarried; 1899-1901, shaft 100 ft., drift 60 ft.	6 men developing.
Copper King....	Whitney, McIntyre & Grainger estate.....	Aug. 20, '98	1,000	100	10 00	15	6	10	$15,000 60 h.p. boiler, 3 drill comp. 15 h.p. engine.	1908, 500 ft. tunnels and drifts; 1907, 100 ft. shaft; prior to 1907, shaft 153 ft., drifts 800 ft.......	15 men sinking and developing.
Carlisle.........	Yukon Pueblo Mines.	July 6, '99	100	50	10 00	none	......	22	none.	1906-7, shaft 50 ft.; prior to 1906, shaft 50 ft. and 50 ft. drift.	
Spring Creek....	Mrs. H. G. Dickson.....	Aug. 11, '05	10	100	10 00	none	......	10	none.	1907, shaft 40 feet, drift 20 ft.	
Empress of India	Kate Ryan......	July 8, '99	6	nil	10 00	none	.....	10	none.	1907-8, drift 150 ft.	
Best Chance....	Arctic Chief Mining Co....	July 25, '00	14	100	8 00	none	......	20	none.	1907-8, shaft 26 ft., drift 50 ft.; prior to 1907 a number of shallow hole and open cuts.	
Grafter.........	Whitney, Lowe & E. A. Dixon.	Aug. 17, '99	2,200	nil	8 00	none	.. ..	6	$1,000 5 h.p. hoist, 25 h p. boiler.	1907, shaft 50 ft., stoped 2,000 tons ore; prior to 1907, shaft 50 ft. and 100 ft. drifts.	
Arctic Chief....	Arctic Chief Co.	July 17, '99	650	600	8 00	12	......	6	none.	1907-8, tunnel 700 ft., winze 50 ft., stoped 500 tons; prior to 1907. tunnel 300 ft.; 1908, upraise 60 ft.	
Corvette.......	Baxter, Whitney & Nicholson...	Sept. 9, '99	nil	100	8 00	none	...	5	none.	1907, tunnel 30 ft.; prior to 1907, shaft 60 ft. and drift 100 ft.	
Valerie...	A. B. Palmer...	Aug. 23, '99	20	300	8 00	6	....	5	$1,000 10 h.p. hoist, 15 h.p. boiler.	1908, shaft 50 ft., drifts 200 ft.; prior to 1908, shaft 50 ft, shaft 22 ft.	
Gold Hill.. ..	J. H. Conrad....	July 7, '06	1	50	20 00	4	.....	$1500	none.	1908, tunnel 50 ft.; 1907, tunnels 100 ft.	

Legal Tender...	Mrs. L. Hill....	" 24, '06	nil	200	20 00	4	.....	35	none.	1908, tunnel 87 ft.; 1907, surface work.	
Golden Slipper..	Geo. Stevens....	Aug. 2, '06	nil	25	20 00	6	1	60	none.	1908, tunnel and drift 80 ft.	
Silver King.....	Jno. McDonald.	" 5, '06	nil	50	20 00	5	......	50	none.	1908, shaft 50 ft.	
Tally-Ho........	C. Irving, *et al.*.	" '06	50	100	20 00	5	......	80	none.	1908, tunnel 300 ft.	
Venus-Mars—Venus No. 2—Vault.	Yukon District Gold Mining Co...........	....	800	2,000	16 00	45	....	93	3 gas engines, 3 hoists, 1 air compressor with 10 drills, aerial tram, and concentrating mill; total value $80,000.	Shafts and upraises 1,145 feet, tunnels, drifts and crosscuts 1,760 ft.	None unless better transportation rates are secured; 180,000 tons ore in sight worth $20 per ton.
Vault..........	Yukon District Gold Mining Co.	....	20	......	16 00	6	....	60	none.	Tunnels and drifts 590 ft..........	None under present cost of transportation. $35,000 tram if rates are improved.
M. & M. Ibex..	Yukon District Gold Mining Co., Conrad...	....	3	50	18 00	nil	......	227	none.	Tunnels 134 ft., upraises 40 ft.	
Dalton-Annex & Black Fox.....	Bristol, Singer & Vance........	....	0	0	18 00	0	......	40	none.	Tunnel 50 feet.	

TABLE No. 2.—*Continued.*

Claim.	Owners.	Date Record.	Ore Shipped.	Ore on Dump.	Cost Transportation.	Men Employed 1908-9.	Men Employed 1909-10.	Value of Ore Shipped.	Machinery.	Work done on Claim.	Ore in Sight.	Work Projected for 1909-10.
					$ c.			$ c.				
Uranus, Capella, Uranus No. 2	Yukon District Gold Mining Company..	.....	3	......	20 00	0	.....	84 00	None	Drift 300 feet, crosscut 250 feet....	...	To connect mine with mill at 'Venus' by tram.
Caribou Group..	Conrad, McKenzie Grace, Bristol.	....	100	.....	15 50	12	.....	52 00	1 gas hoist, value $600.00	Shafts 98 feet and 137 feet, drifts 190 feet and 122 feet.	......	Five mile tram $100,000; mill $75,000.
Montana Group.	J. H. Conrad *et al*..	....	2	...	14 00	0	......	97 00	1 aerial tram, 1 gas hoist and 1 engine and air drills $102,000.	Shafts 53, 24 and 312 feet, winzes 78 feet, upraise 112 feet, drifts 40, 90, 80, 427 and 42 feet.	....	Will be mined by large force if rates to smelter are satisfactory.
Thistle Group...	Conrad & Bristol....	......	0	.....	17 00	0	......	50 00	None	Shaft 52 feet......................	......	

NOTE.—Values given are in $ per ton; where only a few tons have been shipped the value cannot be accepted as the mine run as the shipments have been carefully hand picked.

Until recently a $5.00 ore rate prevailed but this rate has been increased to $13.50 (from Carcross to smelter). This increase in rate will probably close down all the Conrad Mines. No property in the Southern Yukon can ship their mine run under the present rates. Unless the old rate is restored it is almost certain that the work done during the coming year will be nil.

TABLE NO. 3.—SHOWING DISTANCES BETWEEN POINTS IN WHITEHORSE DISTRICT.

Distances are given following roads and established routes. To reach any two points, one of which is situated in one group and one in another, it is necessary to pass through Whitehorse.

—	Whitehorse.	Robinson.	Carcross.	Conrad.	Gold Hill.	Carbon Hill.	Big Bend.	Tagish.	Venus Mine.
Whitehorse	0	21	42	54	41	59	43	50	57
Robinson	21	0	21	33	20	38	22	45	36
Carcross	42	21	9	12	41	59	43	24	15
Conrad	54	43	12	0	53	71	55	20	3
Gold Hill	41	20	41	53	0	18	14	65	53
Carbon Hill	59	38	59	71	25	0	20	83	74
Big Bend (Wheaton)	43	22	43	55	14	20	0	67	58
Tagish	50	45	24	20	65	83	67	0	23
Venus Mine	57	36	15	3	53	74	58	23	0

—	Whitehorse.	Lake Labarge.	Hootalinqua.	Big Salmon.	Tantalus.	Yukon Crossing.	Livingstone.	Mason's Landing.	Teslin Lake.
Whitehorse	0	50	87	117	126	149	132	111	230
Lake Labarge	50	0	37	67	129	166	76	55	180
Hootalinqua	87	37	0	30	90	127	45	24	150
Big Salmon	117	67	30	0	60	97	75	54	180
Tantalus	126	129	90	60	0	23	135	111	240
Yukon Crossing	149	166	127	97	23	0	172	151	277
Livingstone Creek	132	76	45	75	135	172	0	21	147
Mason's Landing	111	55	24	54	111	151	21	0	126
Teslin Lake	230	180	150	180	240	277	147	126	0

—	Whitehorse.	Champagne.	Bear Creek.	Kluane Lake.	Burwash Creek.	Canyon City.
Whitehorse	0	64	109	141	189	295
Champagne Landing	64	0	45	77	125	231
Bear Creek	109	45	0	32	80	184
Kluane Lake	141	77	32	0	48	154
Burwash Creek	189	125	80	48	0	106
Canyon City (White River)	295	231	184	154	106	0

TABLE NO. 4.—SHOWING FREIGHT RATES TO POINTS IN WHITEHORSE DISTRICT.

—		Robinson.	Carcross.	Conrad.	Gold Hill.	Big Bend.	Lower Labarge.	Hootalinqua.	Big Salmon.	Livingstone.	Mason's Landing.	Champagne Landing.	Kluane Lake.	Burwash Creek.	Canyon City (White River).
		$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
Whitehorse...	Summer, per 100 lbs...	0 64	1 04	1 37	2 64	2 64	0 45	0 60	0 70	3 84	1 55	5 00	15 00	18 00	45 00
	Winter, per 100 lbs....	0 64	1 04	1 54	2 00	2 00	3 00	5 00	7 00	5 00	7 00	4 00	10 00	12 00	35 00
Carcross	Summer, per 100 lbs...	0 64	......	0 33	2 64	2 64	......	......	......	......	......	......	......	......	......
	Winter, per 100 lbs....	0 64	......	0 50	2 00	2 00	......	......	......	......	......	......	......	......	......
Hootalinqua..	Summer, per ton......	......	......	......	......	......	......	......	......	25 00	15 00	......	......	......	......
	Winter, per lb	......	......	......	......	......	0 01	......	0 01	0 02	0 01	......	......	......	......
Kluane Lake..	Summer, per lb	......	......	......	......	......	......	......	......	......	......	......	......	0 03	0 33
	Winter, per lb	......	......	......	......	......	......	......	......	......	......	......	......	0 02	0 25
Teslin Lake...	Summer, per 100 lbs...	......	......	......	......	......	......	2 00	......	......	......	......	......	......	......
	No winter freight.....	......	......	......	......	......	......	......	......	......	......	......	......	......	......

TABLE D.—VALUE OF UNWORKED PLACER DEPOSITS.

Name of Creek.	No. Claims Held.	No. Men Employed.	Surface Pay Gravel (in cubic yards).	Value per Cubic Yd.	Creek Channel Gravel (in cubic yards).	Value per Cubic Yd.	Hill Channel Gravel (in cubic yards).	Value per Cubic Yd.	Unprospected Gravels (in cubic yards).	Total Pay Gravel (in cubic yards).	Average Value per Yd.	Size and Quantity of Available Timber.
Big Salmon Division.				$ c.		$ c.		$ c.			$ c.	
Livingstone	53	45	nil.	nil.	12,000	4 00	4,000	5 00	100,000	16,000	4 50	Enough wood and saw-logs for use of camp are available in Big Salmon District.
Cottoneva	18	6	nil.	nil.	10,000	3 00	Unprospected.	.....	200,000	10,000	3 00	
Summit	15	5	nil.	nil.	10,000	4 00	"	.....	50,000	10,000	4 00	
Little Violet	7	5	nil.	nil.	10,000	4 00	"	.....	50,000	10,000	4 00	
Mendocina	2	....	nil.	nil.	?	2 50	"	.....	500,000	....	......	
Kluane Division.												
Bullion	20	4	10,000	1 00	nil.	nil.	"	.....	1,000,000	10,000	1 00	Limited quantity of fuel and saw-logs available for Sheep and Bullion, 3 to 5 miles from working claims.
Sheep	35	10	150,000	1 00	nil.	nil.	"	.....	500,000	150,000	1 00	Coal used for fuel on Sheep.
Fourth of July	30	15	50,000	1 00	?	2 50	"	.....	500,000	50,000	1 00	Plenty fuel and limited quantity logs on Fourth of July and Ruby Creeks.
Ruby	10	5	10,000	1 00	Unprospected.	......	"	.....	100,000	10,000	1 00	
Burwash	80	30	100,000	1 00	6,000	7 50	10,000	7 50	1,000,000	16,000	7 50	Very limited quantity fuel or logs near workings on Burwash but plenty below Canyon, available in winter.

TABLE E.—CONCERNING ORE BODIES.

Claim.	Width of Ore body.	Strike.	Dip.	Ore in Sight.	Estimated value per Ton.	Principal Metal.	Added Values for.
Whitehorse Belt	1 to 200 feet	N 20° E to N 50° E	50° N W to 70° N W	1,200,000 tons	$ 11.00 (copper at 12½)	Copper	Gold.
Watson and Wheaton	....	N 45° W	....	....	25.00	Silver	"
Venus	3 to 20 feet	N & S	45° S	180,000	22.00	"	"
Vault	1 to 6 feet	N & S	30° W	....	22.00	"	"
M & M	2 feet	N 45° E	22° N W	....	150.00	"	"
Uranus	3 to 20 feet	N & S	14° W	....	50.00	"	"
Caribou	16 feet	E & W	12° N to 40° N	....	50.00	"	"
Montana	3 to 7 feet	N & S	25° W	....	20.00 (?)	"	"
Thistle	2 to 3½ feet	N & S	25° W	....	100.00	"	"

TABLE No. 5.—STATEMENT showing the Collections Made in the Office of the Asst. Gold

Month.	Mining Dues.									
	Placer.				Quartz.					
	Grants.	Relocations.	Renewals.	Registration of Documents.	Grants.	Certificate of Work.	Payment in Lieu.	Certificate of Payment.	Registration of Documents.	Acreage and Cr'n Grant.
1908.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts	$ cts.	$ cts.	$ cts.
April	130 00	10 00	....	37 00	140 00	20 00	100 00	....	15 50	.. ....
May	.. ....	60 00	42 00	7 00	30 00	57 50	....	5 00	9 50	....
June	....	20 00	15 00	28 00	110 00	60 00	... ..	2 50	10 00	.. ...
July	70 00	50 00	275 00	99 00	35 00	45 00	300 00	5 00	55 00	189 48
August	....	....	10 00	10 00	20 00	67 50	....	5 00	50 00	....
September	....	....	300 00	26 00	30 00	62 50	.. ..	....	7 50	....
October	....	20 00	150 00	43 00	20 00	32 50	.... ..	5 00	7 50	160 95
November	... ..	....	.... ..	8 00	20 00	17 50	....	5 00	7 50	124 31
December	....	30 00	120 00	4 00	25 00	22 50	......	....	17 50	73 50
1909.										
January	....	....	....	12 00	20 00	17 50	. .....	2 50	17 50	228 52
February	....	20 00	....	... ..	105 00	27 50	....	....	55 00	....
March	....	....	60 00	....	5 00	7 50	....	....	....	......
Total	200 00	210 00	972 00	274 00	560 00	437 50	400 00	30 00	252 50	776 78
Number of receipts issued.	20	21	61	64	97	174	4	12	88	36

SESSIONAL PAPER No. 25

Commissioner and Crown Timber and Land Agent During the Fiscal Year 1908-9.

Timber and Land Dues.					Export Tax.		Total for Month for	
Dominion Lands Receipts.	Timber.	Seizure.	Coal.	Homestead.	Royalty.	Free.	1908-9.	1907-8.
$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
221 77	....	....	....	....	....	....	674 27	4,100 88
3,365 08	137 50	1,000 00	15 00	....	24 38	....	4,752 90	1,132 00
277 77	55 00	....	....	....	259 21	....	837 48	1,660 34
176 51	....	....	....	....	152 80	....	1,452 79	1,276 48
264 90	....	....	....	10 00	511 04	....	948 44	1,246 15
472 91	200 00	1,000 00	....	....	112 03	1 00	2,271 94	1,152 19
657 54	251 25	....	....	....	570 14	....	1,917 88	1,790 51
163 62	282 50	....	....	....	45 40	....	673 89	509 50
149 65	335 00	1,000 00	....	....	50	....	1,777 67	608 10
....	....	....	....	....	....	....	298 02	215 81
158 18	260 00	....	....	....	39 80	....	665 48	558 00
285 88	255 00	....	....	....	....	....	613 38	853 25
6,193 81	1,836 25	3,000 00	15 00	10 00	1,715 30	1 00	16,884 14	15,109 71
48	16	3	3	1	49	1	698	

TABLE No. 6.—STATEMENT showing the Collections made in the Office of the Mining Recorder for the Conrad District during the Year 1908–9.

—	Quartz Mining Dues.						Total for 1908-9.	Total for 1907–8.
	Grants.	Certificate of Work.	Certificate of Partnership.	Payment in Lieu.	Registration of Documents.	Acreage Crown Grant.		
1908.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
April	10 00	12 50	5 00	....	26 00	....	53 50	30 00
May	5 00	7 50	....	100 00	2 50	....	115 00	47 50
June	30 00	57 50	22 50	200 00	17 00	....	327 00	321 00
July	60 00	235 00	5 00	....	60 00	....	360 00	336 00
August	75 00	187 50	....	900 00	30 00	242 88	1,435 38	884 50
September	115 00	45 00	....	200 00	32 50	....	392 50	255 00
October	50 00	....	....	....	62 50	848 58	961 08	55 00
November	5 00	20 00	....	....	30 00	....	55 00	41 50
December	....	5 00	....	....	2 50	....	7 50	18 00
1909.								
January	....	5 00	....	....	5 00	....	10 00	104 50
February	....	....	....	....	15 00	56 65	71 65	22 50
March	....	12 50	....	....	35 00	....	47 50	202 50
Total	350 00	587 50	32 50	1,400 00	318 00	1,148 11	3,836 11	2,319 00
No. receipts	70	201	13	14	73	54	425	....

TABLE No. 7.—STATEMENT showing the Collections made in the Office of the Mining Recorder for the Kluane District during 1908–9.

	Placer Mining Dues.				Quartz Mining Dues.					Total for 1908-9.	Total for 1907-8.
	Grants.	Re-locations.	Renewals.	Registration of Documents.	Grants.	Certificate of Work.	Certificate of Partnership.	Payment in Lieu.	Registration of Documents.		
1908.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
April	....	20 00	15 00	30 00	....	....	....	....	....	65 00	828 00
May	....	....	....	6 00	....	....	....	....	....	6 00	80 00
June	....	30 00	330 00	12 00	....	50 00	....	....	....	422 00	1,102 50
July	....	40 00	93 00	4 00	....	7 50	....	....	....	144 50	100 00
August	20 00	80 00	125 00	32 00	....	....	....	....	....	257 00	292 00
September	70 00	....	335 00	30 00	5 00	7 50	....	....	5 00	452 50	392 50
October	140 00	....	120 00	26 00	....	10 00	....	....	....	296 00	124 00
November	30 00	....	30 00	4 00	....	30 00	....	....	....	94 00	201 50
December	....	90 00	15 00	....	235 00	110 00	....	200 00	27 50	737 50	77 50
1909.											
January	....	....	....	....	....	20 00	....	....	....	20 00	2 50
February	....	....	....	....	....	....	....	....	....		81 00
March	....	....	....	....	....	....	....	....	....	....	77 00
Total	260 00	260 00	1,063 00	144 00	240 00	295 00	....	200 00	32 50	2,494 50	3,358 50

PART VII

FORESTRY AND IRRIGATION

FORESTRY AND IRRIGATION.

REPORT OF THE SUPERINTENDENT OF FORESTRY AND IRRIGATION.

DEPARTMENT OF THE INTERIOR,
FORESTRY BRANCH,
OTTAWA, May 25, 1909.

W. W. CORY, Esq.,
Deputy Minister of the Interior,
Ottawa.

SIR,—I have the honour to submit the report of the work of the Forestry and Irrigation Branch for the year 1908-9 and also the reports of the officials in charge of the different divisions of the work.

ORGANIZATION.

The only addition to the technical staff of the Forestry Branch during the year was made in the Tree Planting Division by the addition of Jas. Kay and Jas. N. B. McDonald to the staff of inspectors.

The hydrographic survey was given a separate organization with Mr. P. M. Sauder in charge. Mr. Sauder has had charge of one of the parties making inspections under the Irrigation Act and conducting stream measurements during several years and has shown himself competent.

Mr. H. R. Carscallen and Mr. H. C. Ritchie have been appointed assistants for the hydrographic survey.

Mr. J. S. Tempest was appointed to take charge of the inspection work formerly done by Mr. Sauder.

The death of Mr. R. S. Cook, Crown timber agent at Prince Albert, is greatly to be regretted and will be a decided loss to the forest service, as he took a great interest in the protection of the forests and the adoption of improved methods of administration. It was on his suggestion that the fire patrol was extended to Churchhill river last year and that an effort is being made to enlist the interest of the Indians.

An important change in administration has been made by providing for the handling at the office at Indian Head of all applications for trees for planting. Formerly all such applications were received at the head office at Ottawa and dealt with here. It was felt that it would be an economy of time to have the applications sent to Indian Head, and that the inspectors who visited the different districts would be best qualified to deal with these applications and to give any necessary explanations in special cases. An office for this purpose has therefore been organized at Indian Head and it is hoped that it will increase the promptness and efficiency of the service.

The work of the Forest Service of the United States is spoken of in the highest terms of praise and with good reason, but it may be pointed out that, although the extent of Canada is not less than that of the United States, the forest service of the latter has an appropriation of $4,640,000 and a permanent staff of over 2,000, while the Canadian forest service has an appropriation of $100,000 and a permanent staff of about forty. If the Canadian people wish a service equally efficient with that of the United States they must be prepared to deal much more generously with it than they now do.

In May of last year I accompanied Dr. W. F. King to Washington in connection with the discussion of the terms of agreement for the division of the waters of St. Mary and Milk rivers between the United States and Canada, and also accompanied Mr. Geo. C. Gibbons to Washington for a similar purpose in December.

During the summer I visited the various districts of the West where the work under charge of this branch is located and consulted with the officers in charge. I also attended the Second Canadian Irrigation Convention held at Vernon in August. The discussions at the convention were very interesting, but related mainly to the administration of irrigation in British Columbia and a proposed revision of the Act governing the subject in the province.

In December I accompanied Hon. W. C. Edwards to the meeting of the Internal Harbours and Waterways Convention and also the Conservation Convention held at Washington.

STATISTICS.

Mr. A. H. D. Ross, lecturer at the forest school of the University of Toronto, was appointed during last summer to collect such statistics as were available in regard to the forests and the timber production of Canada, and the result of his investigations is being published. The reliable information was found to be so small as to leave all calculations incomplete and indefinite. The forest area may, however, be put at between 500 and 600 million acres with a stand of about as many billion feet, but neither these nor any other figures available are entitled to any great reliability in the present state of knowledge of the forests of Canada. The production of timber in Canada in 1900, according to the last census, was about nine billion feet board measure. This quantity has probably increased, but there are no later figures to determine the matter. The conclusions reached in regard to the whole matter were as follows :—

1. In order to have reliable information in regard to the forest resources of Canada it is necessary that forest surveys should be begun and systematically carried out by the Dominion and provincial governments on the forest lands under their control, respectively.

2. Statistics in regard to the production of timber in Canada should be collected annually by the Forestry Branch in conjunction with the Census Bureau and published for the information of the public.

3. Official returns in regard to timber production should give more detailed information in regard to species.

In accordance with the second suggestion steps have been taken towards compiling a list of names of firms using wood products throughout Canada, and circulars asking for the desired information have been sent out to all parts of the Dominion. It will take several years to get the lists fully completed and to have the purposes of the inquiry so understood that information will be given willingly and without reservation. The results will, however, be published from year to year, whether at first they can be made complete or not.

FOREST SURVEYS.

Forest surveys are of different characters. The simplest is the exploratory survey. Such a survey is required for the whole of the northern forested districts. The fact may be again emphasized that there is a large tract of land more or less forested stretching from Hudson bay to the Rocky mountains, a distance of 1,000 miles, and having a general depth of 400 miles, which is under Dominion administration, and that the forest on this tract is of great value for local consumption. It has already suffered greatly from fire and the timbered areas that remain should be carefully protected. In order to do so effectively and economically more definite information is necessary as to their location and this would be obtained by an exploratory survey. All of this tract has been travelled along certain lines by members of the Geological Survey staff and other explorers, but their travels have followed canoe routes and fixed lines of travel, and large areas are still left uninspected.

The province of Ontario explored its northern forest area of sixty million acres in 1899 at a cost of $40,000. A similar exploration of the northern forested area under Dominion control, which comprises about five times the extent of territory, could be made on similar lines for $200,000, or $20,000 for ten years. Such an exploratory survey is not beyond the resources of the Dominion and is absolutely necessary for an intelligent management of this extensive district.

Following the exploratory survey and the location of the timbered lands and non-agricultural areas, a more careful examination of the timber would be made by reconnaissance survey as it became necessary, as is now being done on the forest reserves. Such a survey gives information as to the species, the stand and the condition of the timber, the topography, and matters generally that affect the management of the forest and the handling of the timber.

Timber surveys on the forest reserves were continued during the past year, and about one million and a quarter acres of the ten million in forest reserves and parks have now been surveyed. The results show that the reserves, so far as the survey has extended, are in poor condition, the result of fire and careless cutting, and a long course of careful management will be required before they are brought into proper forest condition again. The survey is the first step toward that end. Having a knowledge of the condition and location of the forest stands, their accessibility, the possibility of their utilization, and the extent to which natural reproduction is providing for the replacement of the stand, it is possible to pursue an intelligent plan in the handling of the timber and the administration of the reserve.

Plans for the management of the reserves which have been surveyed will be prepared and it is hoped that, with proper protection and management, they will in time be brought into good producing condition again. But the process will be slow and will take many years to accomplish. The records of growth of white spruce, for instance, on the Riding Mountain reserve, which may be taken as a reasonable average, show that it has taken 75 years for trees of this species to reach a diameter of ten inches. The sooner, therefore, that the process of reproduction can be begun the better.

The surveys of the forest reserves should be continued systematically until the whole area has been covered.

FOREST RESERVES.

The survey of the Riding Mountain Forest reserve was continued under charge of Mr. J. R. Dickson and was practically completed. A full report of the results of the survey of this reserve, and a map showing the location of the timber have been prepared and published separately. Of a total area of 982,400 acres in this reserve, only 221,319 acres are described as timbered. The timber of over eight inches in diameter at breast height is 210,740,346 feet board measure, and of this poplar forms 54 per cent and white spruce only 20 per cent. There are only a little over 42 million feet board measure of white spruce. This reserve is one of those on which there is the greatest demand for timber and wood and every effort will be made to assist reforestation. Unfortunately the natural reproduction of white spruce, the most valuable tree, is not good, and it will be necessary to resort to sowing or planting if this species is to be reproduced as it should be.

The protection of the timber and the administration of the reserve will be facilitated by the removal of a number of squatters who had located on this reserve. These, to the number of 126, were induced to remove from the reserve, and that this was accomplished successfully without serious friction and leaving these people on the whole well satisfied, as many of them have attested by statements over their own signatures, reflects great credit on the inspector and forest rangers who carried out this work.

A reconnaissance survey was made of the Pines Forest reserve, a tract of 145 square miles, situated south of the North Saskatchewan river, southwest from Prince Albert. This reserve is mostly light, sandy land, with some muskeg, and was covered with a forest of jackpine, with spruce and tamarack on the lower ground. This tract has furnished a large supply of ties for railway construction; from it lumber was secured to build many of the houses in the neighbourhood, and it has supplied fuel not only to the vicinity but to the towns on the prairie farther to the south. Thirty years ago the reserve was heavily timbered. Tie contractors twenty years ago left a heavy slash ; following this fires from the railroad and settlements swept it clean until now there is not an acre left but is burned over or cut over. Scattered in patches there are 45,000 cords of fuel, 15,000 of which are dead. This supply will not last ten years. This whole tract is unsuited for agriculture, but can produce a good growth of timber, and with adequate protection from fire and reasonable care in cutting, the task would not be difficult as the jackpine produces a good seed supply which germinates readily. On some 23,000 acres there is a good reproduction of young jackpine.

North of the North Saskatchewan river, and running east to a considerable distance beyond Prince Albert, is an extension of the same sandy tract covered with jackpine forest in various stages, some mature, some covered with reproduction of various ages and some recently burned. If this tract is opened to settlement it will mean disappointment to those who attempt to make homes upon it ; it will mean the destruction of the forest, which would be of great benefit to Prince Albert and the district both for wood supply and shelter ; it will mean a waste of shifting sand useless in itself and a menace to the good land surrounding it, and will in the end require action such as is now being taken by the province of Ontario to buy back and reforest such lands. It would be a desirable policy for the Dominion government and the city of Prince Albert to unite in maintaining this tract as a municipal forest reserve.

The Spruce Woods reserve in Manitoba covers a sandy tract, and as there is a considerable area of land of similar character in the vicinity an inspection was made of it and it is proposed to increase the area in this reserve. An addition has also been proposed, after inspection, to the Beaver Hills Forest reserve.

CYPRESS HILLS.

The Cypress Hills form the most important elevation in southwestern Saskatchewan and southeastern Alberta and located, as they are, in a district where the rainfall is frequently deficient and where irrigation is generally practised, the necessity for the preservation of every favourable influence on moisture conditions is apparent. This district will be the home of the small rancher who will assist and ensure his fodder supply by means of irrigation. The greater moisture on the hills is demonstrated by the fact that while, during the dry season of the last year, there was practically no hay crop on the lowlands, the hay on the Cypress Hills was the only supply that saved the situation for many of the ranchers in the vicinity. A small forest reservation of one-half township was made in 1906 and last summer a general examination of the hills was made by Mr. A. Knechtel, inspector of forest reserves, to determine what further and other lands should be reserved. A considerable addition was recommended and these lands have been temporarily reserved pending a further inspection. There will be no difficulty in covering the greater part of the Cypress Hills with a good growth of lodgepole pine and spruce and the great advantage of a forest on these hills in the conditions which exist will more than justify every effort to restore their forest-clad condition and indeed imperatively demands that such action should be taken.

CROWSNEST PASS.

One of the most interesting investigations made during the past season was that in the Crowsnest district made by Mr. H. R. MacMillan. The eastern slope of the Rocky mountains, the source of the great river systems that water most of the western prairie country, presents one of the most interesting studies to be found in the Dominion. The forests on these great mountain slopes assist in preserving the water supply and form the reservoir for wood and lumber for the province of Alberta, one of the greatest assets for comfort and happiness that any province can have, and, moreover, on it depends largely the development of coal mining in that province, as without timber, coal mining is impossible, and the requirements for the development of the coal mines along the eastern slope of the Rocky mountains will be enormous. It is estimated that there are twenty-two and one-half billion tons of coal to be found in Alberta in the Rocky mountain district. The mining of such a quantity of coal will require 45 billion lineal feet of mining props, the product of nine million acres for sixty years.

In the Crowsnest valley the mines now in operation are using three million lineal feet of mining props and two and one-half million feet board measure of lumber and dimension timber, and in five years more this quantity will probably have doubled, then requiring the product of 66,000 acres. The total area in this valley is 135,680 acres, of which only 21,120 acres are covered by a mature unburned forest, the remainder being entirely denuded, covered with dead standing timber or with young growth. The worst fires occurred fourteen years ago, about the time the railway was built. The loss by fire was probably 570 million feet board measure of lumber worth $9,000,000. The timber for the future needs of the coal mines of the Crowsnest is not in sight in that valley as a result of this great destruction by fire, and it is necessary that the most careful attention should be given to this district and the whole eastern slope of the Rocky mountains to ensure that the forest cover so absolutely necessary from so many points of view should be preserved.

A more thorough and efficient fire patrol system is required and in order to organize and distribute it as economically as possible, and to administer the forests on an intelligent basis a timber survey and mapping of the whole eastern slope should be made with the least possible delay.

MINING CLAIMS.

As application had been made for coal lands within certain of the forest reserves, and it was not the intention in the establishment of the reserves that the working of valuable minerals which might be found located therein should be prevented, it was decided to grant mining leases under the Mining Regulations, subject to the following additional restrictions :—

1. No lease for coal mining rights within a forest reserve shall be granted until the application has been reported upon by the superintendent of forestry.

2. No lease for coal mining purposes shall entitle the lessee to purchase the surface rights, but the lessee may, upon application, be granted a lease, concurrent with that for the coal mining rights, for such portion of the surface rights thereof as the Minister of the Interior may consider necessary for the efficient and economical working of the coal mining rights granted under such lease.

3. That the lessee will do no unnecessary damage to timber and will carefully observe all the provisions of all regulations relating to forest reserves.

4. That no trees on the reserve will be cut by him without the permission of the superintendent of forestry, and that when any trees are cut by him he will carefully clear the ground of all tops and branches and other debris of such cutting, and will so dispose of them as to prevent danger from fire in accordance with the instructions of the officer in charge of the reserve. If in order to so dispose of such debris it is necessary to burn it, the lessee shall give due notice of his intention so to do to the officer in charge of the reserve, and before he proceeds to burn such debris shall obtain the consent of such officer, and shall comply with all the conditions imposed by such officer in regard to such burning.

5. That the lessee shall clear and at all times keep clear of inflammable material a space of at least one hundred feet in width surrounding his works or operations.

6. That any engine operated by the power of steam used by him in connection with his works or operations shall be fitted with efficient spark arresters which shall at all times be kept in a state of good repair.

Similar regulations were established for other classes of mining claims in forest reserves and for such claims within timber limits.

SUMMER RESORTS.

A great many people are resorting to the forest reserves for holiday outings during the summer, and it is considered that this is not only a legitimate use of the reserves, but that the presence of such people, wholly in sympathy with the purposes of the reserves, will be a great assistance in case of fire. Regulations for dealing with the use of the reserves for such purposes have been prepared and a copy is attached hereto.

FIRE RANGING.

The season of 1908 will be long remembered as one of the dry seasons, and it was only the fortunate absence of high winds that prevented its being one of the most disastrous for forest fires.

Throughout the province of British Columbia the same dry conditions prevailed and unfortunately they were accompanied at times by high winds so that the worst fires chronicled for the Dominion occurred in that province. In the northern forested districts of the prairie provinces fortunately the season was not so dry and there was less danger of fire.

The most serious fires which occurred on Dominion lands were at Salmon arm, Manson creek and White lake, due to fires set by settlers, and the latter partly due to fire from a logging engine used by a lumber company. The loss in these fires was 200,000 feet board measure of timber totally destroyed and 10 million feet damaged. It will be seen from this that the lumber companies are sometimes careless in regard to fire, and the example quoted is not by any means the only one of carelessness on their part. Some firms seem to consider that the government is entirely responsible for the protection of their timber and that they do not need to take any interest in the matter. The other two fires referred to are an example of the result of encouraging encroachment by squatters on timber berths and point to the necessity for a revision of the procedure in this respect and a proper understanding with the licensees in regard to the clearing of lands fit for settlement.

Outside of the loss of timber occasioned by these figures there was a direct expenditure of $3,122.34 in fighting them.

Another serious fire was that in the valley of the Spray river in the Rocky Mountains Park. It is supposed to have been started by a party of tourists, although it was impossible to get sufficient evidence to establish the fact, and burned about three million feet of timber. A more efficient patrol of the park is being provided for during the coming season.

The total number of rangers was 82, distributed as follows :—British Columbia, 35; Alberta, 34; Saskatchewan, 13.

The patrol was extended in the northern districts. One ranger was placed north of The Pas, the present terminus of the Hudson Bay Railway. In the country north of Prince Albert a patrol was carried on up to the Churchill river, comprising Lac la Ronge, where considerable mining excitement prevailed, with a consequent influx of prospectors. In addition to the staff on the Athabaska and Lesser Slave rivers, rangers were placed on the Peace and Great Slave rivers, thus reaching the most important routes of travel.

While this might seem to indicate that the patrol of this northern district is well provided for it will be seen on reference to the map accompanying this report that there are large tracts as yet entirely unreached, while the districts asigned to rangers cover routes of travel as much as two hundred miles in length. It must be realized that the district to be protected stretches from Hudson Bay to the Rocky mountains, a distance of 1,000 miles, with a width from 300 to 600 miles, and that a patrol of 37 men is a mere handful and utterly inadequate to the task to be accomplished. Some of the most important points and routes of travel are entirely unprotected, as for instance, the whole district surrounding and north of lake Winnipeg to Hudson Bay, the whole valley of the Churchill river and a great part of the Peace and Mackenzie river districts. If the forests of this great region, so absolutely necessary to a northern district, a great portion of which is not even provided with coal, are to be preserved, an appropriation sufficient to provide an efficient and comprehensive patrol must be given, and the interests involved would thoroughly justify the expenditure.

A special patrol was maintained during last season along the line of the Grand Trunk Pacific Railway and as a result no serious fire occurred. As provided for by the Forest Reserve Act one-half of the expenditure within five miles of the line of construction was assessed against the railway company and has been paid by it.

The projection of numerous other lines of railway into the northern districts makes it imperative that every possible precaution should be taken to prevent the destruction by fire of such forest as remains. It is unfortunately true that large areas of land in the northern country once well forested with mature timber are now but a waste as a result of fires started by human agencies, of which the railway has been one of the most destructive.

To provide for the proper protection of the forests it will be necessary also to enlist the interest of the Indians. With this purpose in view a fire notice in the Indian syllabic in both Cree and Chipewyan was obtained from some of the northern missionaries and has been printed for distribution. Facsimile of the notice in Cree with a translation in English is appended. Communication was opened with some of the missionaries to the Indians to enlist their sympathy, and it was proposed to have representatives of the department visit the principal meeting places of the Indians during the summer to discuss these questions with them. Owing to an insufficient appropriation it is unlikely that this plan can be carried out.

TREE PLANTING DIVISION.

The tree planting division is now well established and organized, and as its advantages are understood and appreciated it will require mainly development along the lines already successfully followed to meet the growing needs and increasing population of the prairie provinces.

In the distribution for the spring of 1909, 2,010 applicants were supplied, 2,570,-000 trees being provided for this purpose. The new applications received for the distribution of 1910 number 2,235.

Up to the present time no general distribution of coniferous trees has been made owing to the difficulty of handling and working up a stock. It is hoped, however, to be in a position to begin the distribution of coniferous trees in 1911. The species which will be provided in largest numbers are white spruce, jackpine, lodgepole pine and Scotch pine. The native tamarack is one of the most satisfactory of the coniferous trees and a stock of this species will be developed as soon as possible.

Other varieties of coniferous trees are being tested, including species from Europe and Japan, as well as those from the United States and native species.

DOMINION PARKS.

The Dominion parks as distinguished from the forest reserves are the following:—

Rocky Mountains Park, located on the eastern slope of the Rocky mountains, along the main line of the Canadian Pacific railway, comprises an area of 2,880,000 acres. It was first set apart by an Act of parliament passed June 23, 1887, and its area was greatly extended by an amending Act dated 1902.

Yoho Park corresponds on the western slope of the Rocky mountains to the Rocky Mountains Park on the eastern slope. It was set apart by Order in Council, dated December 14, 1901, and comprises an area of 530,000 acres.

Glacier Park is the heart of the Selkirk range. It was established by Order in Council of October 11, 1888, and extended by an order, dated November 26, 1903, and comprises an area of 368,640 acres.

Jasper Park corresponds on the line of the Grand Trunk Pacific Railway to Rocky Mountains Park on the line of the Canadian Pacific Railway. It was established by Order in Council of September 14, 1907, and comprises an area of 3,200,000 acres. This park has not yet been organized.

Elk Island Park, lying east of Edmonton, was established July 13, 1906, and comprises an area of 10,240 acres.

Buffalo Park was set apart by Order in Council, dated March 7, 1908, and comprises an area of 101,760 acres. It is located in the eastern part of Alberta in open and bluffy country specially suited for a buffalo run.

The changes that have been made in the organization of the Dominion National Parks are the removal of Mr. O. D. Hoar, Superintendent of Yoho Park, and the appointment of Mr. E. Ellis as superintendent of Buffalo Park.

The regulations governing the parks have been consolidated and amended so as to provide for more thorough administration and more complete fire and game protection. Provision was made for the appointment of fire and game guardians, whose duty it will be to see that the regulations are enforced. No person will be allowed to carry firearms in the parks unless they have been properly sealed by the superintendent or other officer, and the licensed guides as well as the game guardians will be responsible for seeing that this regulation is enforced.

The fence surrounding the Buffalo Park was satisfactorily completed. It is a substantial structure, 74 miles long, consisting of fourteen strands and nine feet in height. It is sufficiently strong to be a safe inclosure for the buffalo and the park should form an ideal place for the Canadian herd.

It was expected that the remainder of the buffalo purchased from M. Pablo of Montana would have been brought over last fall, but unfortunately the attempt to corral the herd ended in failure. It is proposed, however, to have this herd brought over during the coming season and the herd at Elk Island Park, with the exception of a small number, will also be transferred to Buffalo Park. The latter herd is reported in good condition, having come through the winter successfully. There is a gratifying increase in number which assures the perpetuation of the stock.

ST. LAWRENCE ISLAND PARK RESERVATION.

This reservation consists of eleven islands and a small peninsula on the St. Lawrence river between Brockville and Gananoque. These islands were formerly owned by the Mississagua band of Alnwick, from whom they were purchased and transferred to the Department of Interior by Order in Council in 1904 to be held for public use. Pavilions have been erected on six of these islands and they have been equipped with stoves, tables, benches, &c. The pavilions have recently been repaired and painted and furnished with additional conveniences. This reservation for public use is of great benefit and gives the opportunity for pleasant outings for thousands who would not have had access to the islands if they had been disposed of to private persons.

IRRIGATION.

During the year just closed there has been a marked decrease in the number of applications for water for irrigation purposes, and an equally notable shrinkage in the number of applicants to purchase land under the irrigation system. This is due, probably, to two main causes : first, the adoption on January 2, 1908, of new regulations which require the actual irrigation of fifty per cent of all lands purchased under the irrigation system, instead of twenty-five per cent as formerly; and second, to the provisions of the amended Dominion Lands Act permitting the acquirement by settlers of land by pre-emption or purchase, in addition to that acquired by homestead entry. A third, and perhaps equally important cause, is the fact that the valleys of the principal streams are now pretty well settled and the available water supply largely appropriated, thus making it necessary to construct larger and more expensive ditches if the remaining available water supply is to be utilized by means of reservoirs and applied to the higher lands adjoining the settled valleys. The cost of such works is usually beyond the means of the average settler.

In so far as irrigation has developed in the so-called semi-arid district, which comprises southern Alberta and southwestern Saskatchewan, the tendency has naturally been to acquire the easily-irrigable lands in the valleys, either by homestead entry or by purchase under the irrigation system, or by both means, and to secure a water right from the nearest stream. As these lands are low and fairly level, irrigation ditches can be built at moderate cost and a fair proportion of the land brought under the ditch. The result has been the settlement of the more desirable valley lands, leaving the equally productive bench lands undeveloped, owing to the higher cost of bringing water to them. Usually each irrigator owns his own system of ditches independently, but there seems to be a gradual realization by the settlers that better results can be obtained by co-operation in building larger ditches following a higher level, from which laterals or subsidiary ditches can be run to the lands of each co-owner. By this means a much larger acreage can be irrigated than by the independent system and the proportionate cost of construction and maintenance should also be less if proper care is exercised in laying out the ditches. It naturally follows that still larger areas, and a larger proportion of the land, can be irrigated and the available water supply utilized to better advantage, by co-operation on a still larger scale. The main obstacle in the way of such development is the fact that the higher lands are as yet sparsely settled and the settlers are practically strangers to one another. Co-operation under existing conditions may scarcely be looked for at present, but may come later.

As co-operative ditch construction is not likely to be extensively practised in the near future, and as there are several large tracts of land unsuitable for settlement without irrigation, the policy has been adopted of disposing of large blocks of land to persons or companies, at a low price, subject to agreements to construct works for the irrigation of not less than twenty-five per cent of the area sold and to dispose of the land and water rights to actual settlers on terms satisfactory to the Minister of the

Interior, or specified in the agreements. One such project, the canal system of the Alberta Railway and Irrigation Company, is in successful operation, and another, the Southern Alberta Land Company, has now been authorized and the contract has been let for the main diversion canal.

The Southern Alberta Land Company.

This company has been given permission to purchase some 380,000 acres between the Bow and Belly rivers and eastward from the junction of those streams towards Medicine Hat, and has been given the right to divert 2,000 cubic feet of water per second from the Bow river, during high water and flood stages of the stream only—the low water flow of the stream being already appropriated for other irrigation projects. As the diversion of water is limited to the high and flood stages of the stream it will be necessary, if the flow at low water is used by the first licensees, to divert a very large volume of water during the months of June and July of each year, and to store it for use during the later summer and autumn months and for use during the earlier part of the following spring. Fortunately the high-water flow of the Bow continues for a longer period than that of most of the rivers in the semi-arid tract, but notwithstanding this it will be necessary to construct a diversion canal of very large dimensions. This water is to be stored in a reservoir in Snake valley, to be known as Lake McGregor, so named in honour of the manager of the company. From this reservoir a canal will be built eastward to the tract to be irrigated and thence distributed by secondary canals and ditches to each farm. As a portion of the tract to be irrigated lies east of the Bow river it is the intention of the company to carry the water to the eastern tract by means of an inverted syphon.

Under the terms of the agreement the company is required to irrigate not less than twenty-five per cent of the lands purchased, or 95,000 acres. The quantity of water they are authorized to divert is sufficient, according to the present 'duty of water,' for the irrigation of 300,000 acres, if it could all be applied directly to the land. Allowance must, however, be made for seepage and evaporation and, as the water must be carried a long distance and stored in a reservoir for some time, these losses will be heavy. The loss by seepage will not be altogether wasted, as it will benefit the lands through which the canal passes, whether they are controlled by the company or not. It is the intention of the company to irrigate the largest possible percentage of the tract sold, as the larger the area irrigated the greater the profit to them from the sale of land. If the quantity of water reserved proves to be greater than the company can supply to beneficial use on the lands sold to them they will be required to dispose of the surplus to any whose lands can be served by their ditches.

Alberta Railway and Irrigation Company's Irrigation Project.

The Alberta Railway and Irrigation Company is the pioneer company in irrigation in Canada. Authorization was granted to the Alberta Irrigation Company in May, 1899, to divert water from the St. Mary river and other sources in southwestern Alberta and to construct a system of works for the irrigation of lands held by the Alberta Railway and Coal Company as part of their land grant. These lands lie between the line of the company's railway and the St. Mary river in the southern part of the province. The name of the company was subsequently changed to the Canadian Northwest Irrigation Company and, in 1904, by the amalgamation of this company with the Alberta Railway and Coal Company, the Alberta Railway and Irrigation Company was formed.

On October 22, 1902, authorization was granted to the last mentioned company to divert an additional quantity of water, and in December of the same year they were permitted to purchase a tract of 500,000 acres lying to the east of their land grant holdings. They were given a period of fifteen years from October 23, 1902, within which to complete their irrigation system. The following quantities of water have been granted to the company for irrigation purposes :—

Belly river, low water, 500 second feet.

St. Mary river, low water, total flow (about 600 second feet).

St. Mary river, high and flood, 2,000 second feet.

Milk river, low water, 500 second feet.

Milk river, high and flood, 1,500 second feet, and all the available water in certain minor streams in the vicinity of the lands to be irrigated.

The company at an early date took steps to colonize the lands tributary to their projected ditches and, as irrigation was then a new venture in Canada, they were instrumental in bringing in a number of Mormons and other settlers from the irrigation districts of the United States to settle upon and cultivate the lands. As a result of this policy several towns were established in the irrigated district and experience has proved the value of irrigation. Lands formerly used only for grazing now produce bountiful crops of many kinds and the culture of sugar beets has become a thriving industry. The towns of Raymond, Magrath and Stirling are the direct result of this irrigation enterprise and colonization scheme, and Cardston has also greatly benefited by the scheme.

Lands are sold by the company at $5 per acre, without water rights, and from $30 per acre with such rights. An annual charge of $1 per acre is made for water, in addition to the price of the water right sold with the land. The water rights are appurtenant to the lands sold but are not perpetual and may be forfeited by non-use for two consecutive years.

There is a very large, but as yet undetermined, area of irrigable land in the district to which the works might profitably be extended, if the supply of water were sufficient, but the land available is greater than the water supply. A considerable portion of the tract irrigable from the constructed or projected canal system of this company was held by the company as a part of their railway land grant and it is upon these lands, now in private ownership, that the greatest development has so far taken place. It is proposed to extend the canal system eastward and to provide for the irrigation of as much land as the available water supply will permit.

Some 231 miles of canals have already been constructed, including 57 miles of natural channels used for the same purpose. The main canal has a capacity of 1,400 cubic feet of water per second. Distributing ditches are not included in the mileage mentioned as, under this company's system, such ditches are constructed by the water users, the company only building the canals and main laterals. The amount expended by the company on their canal system is about $1,300,000.

A very profitable beet-sugar industry has been developed in the district tributary to this canal system; a factory costing in the neighbourhood of half a million dollars has been constructed and some 400,000 tons of beets are grown annually. Sugar-beets are also grown on the irrigated lands of the Canadian Pacific Railway Company, and a carload recently shipped from there to the factory at Raymond tested eighty-eight and one-tenth per cent for purity and nineteen and two-tenths of sugar in the beet. It is contended that the farther north the beet can successfully be grown the greater will be its purity and saccharine contents. The annual output of the Raymond factory is about five million pounds of sugar.

Canadian Pacific Railway Company's Irrigation Project.

The Canadian Pacific Railway Company have been given permission to consolidate a portion of their land grant and to acquire all the available lands (instead of alternate sections only) within a tract lying along the line of their railway eastward from Calgary, Alberta, and north of Bow river. This tract is approximately fifty miles wide by one hundred and fifteen miles long, and comprises some 3,000,000 acres. They have been given permission to divert water from Bow river, as follows :—

	Second feet.
At low water	3,000
At high water	13,000
At flood water	18,000

This quantity of water will be sufficient to irrigate, according to the present 'duty of water' :

	Acres.
At low water	450,000
At high water	1,950,000
At flood water	2,700,000

By means of storage reservoirs within the tract the company will probably be able to conserve and use sufficient water for the irrigation of some 2,000,000 acres, and surveys already made indicate that about this acreage is irrigable.

For convenience of operation this tract has been divided, by north and south lines, into three divisions of about equal area, but lands are at present sold in the western division only. This division lies immediately east of the city of Calgary and is being rapidly settled. The main and secondary canals have been constructed through most of this division, and work is being rapidly pushed on the laterals and distributing ditches, and no difficulty seems to be found in selling the lands when the ditches are constructed. One of the main ditches has been constructed for some distance across the second, or central, division of the tract and work is being pushed on this also.

The company have been given fifteen years from April 21, 1904, within which to complete their works and secure license for the water, but are permitted to use water during construction. Lands are sold at from $15 per acre for non-irrigable to from $25 to $30 per acre for irrigable lands in most parts of the tract now for sale. The irrigable area on each parcel is determined by survey before sale is made. The purchaser agrees to pay to the company 50 cents per acre annually as water rates for the irrigable portion. This contract is perpetual and the water right is appurtenant to the land sold and to no other land and may not be sold, or transferred separately from the land.

The land comprised in this tract is high, rolling prairie and there are few perennial streams or other permanent bodies of water that might be of use for irrigation purposes. The Bow river flows along the entire southern boundary of the tract and the Red Deer and Rosebud rivers along its northern boundary. The Bow and Red Deer rivers flow in deep valleys and are therefore of little value for irrigation purposes without the construction of extensive works involving the expenditure of sums entirely beyond the means of settlers. The annual rainfall varies from eight to thirty-four inches, with a mean of seventeen inches for the past twenty years; the greater portion of this falls in the growing season from May to July. The soil is, on most of the tract, well suited to agriculture and the climate compares favourably with that of southern Manitoba and southeastern Saskatchewan where the country is well settled and crops are successfully grown without irrigation. Before this irrigation project was undertaken this land was used almost solely for grazing purposes and supported a very sparse population. With irrigation it is believed to be capable of supporting as large a population as any similar area of farming land elsewhere in Canada, and the crops already produced will compare favourably both in quantity and quality with those grown elsewhere.

The estimated cost of these works is $5,000,000, and the total length of the canal system, including distributing ditches will be in the neighbourhood of 2,900 miles.

The Aylwin Scheme.

Mr. F. P. Aylwin has been permitted to purchase a tract of some 69,000 acres in townships 14, 15 and 16, range 17, and township 14, range 16, west of the fourth meridian, subject to the construction by him of works for the irrigation of at least one-fourth of the area purchased. Authorization has not yet been granted for the construction of the works.

The agreement for the sale of the land is similar in most respects to other agreements that have been made for the same purpose. No restriction is placed upon the price at which the lands may be sold to settlers, but the annual rates to be charged for water are subject to the approval of the department. The important difference between this and other sales of land for irrigation purposes is that the land is to be sold at the rate of one dollar per acre, that no allowance on the purchase price is to be made for the cost of the works, and that for every dollar paid on account of the purchase price two dollars shall be deposited with the department as a guarantee for the proper fulfilment by the purchaser of his obligations to construct and maintain the necessary irrigation works, and to supply water for the irrigation of the required proportion of the lands sold to him, in accordance with agreements to be entered into by him for that purpose with persons to whom he may sell any of the lands.

It is further provided in this agreement that should the grantee fail to maintain and operate the works, or should he fail to supply water for irrigation purposes in accordance with agreements entered into by him for that purpose, the minister may take over and operate the works and the said works and the guarantee fund shall be forfeited to the Crown.

In addition to these large enterprises the development of irrigated farming by individuals is shown in the following schedule :—

Smaller Irrigation Schemes.	No.	Acres to be Irrigated.
Licensed	160	40,503
Construction authorized	153	123,913
Applications	21	12,480
Total	334	176,896

While there is yet available on some of the smaller streams a portion of the ordinary low-water flow, most of the normal flow has been already appropriated and future diversions will, in most cases, be limited to high water and flood stages of the streams. This brings up an interesting question.

The unit of measurement of flowing water, as prescribed by the Irrigation Act, is the cubic foot per second, or second-foot, while the unit of quantity is the acre-foot, viz., 43,560 cubic feet, or sufficient to cover one acre to a depth of one foot. Licenses to divert water have heretofore authorized the diversion of a specified number of cubic feet per second flowing continuously throughout the irrigation season—from May 1, to September 30. This has been found satisfactory where the licenses have authorized the use of the low water, or normal, flow of the stream, which is continuous throughout the season, but where the right to divert is limited to the high water or flood period it is obvious that if sufficient water is to be obtained during such limited periods, for the irrigation of a given area, the rate of flow must be increased and a larger volume of water taken for a shorter time and stored for subsequent use.

It seems therefore that a change might advantageously be made in the form of license and the quantity of water granted expressed in acre-feet.

As an illustration two cases may be cited : 'A' is given the right to water at all stages of the stream for the irrigation of 150 acres. According to the 'duty of water' this quantity is one second foot for 153 days, and his license is made to permit the continuous diversion of one second foot.

'B' is given the right to water from the same stream at 'high and flood stages' only, for the irrigation of the same acreage. The high water period on this stream may last for only two weeks, and it is obvious that if his license limits him to the diversion of one second foot of water during this period he will not get anything like the quantity necessary to irrigate 150 acres.

While licenses for the diversion of water for domestic, industrial and other purposes should be based upon the rate of flow (the second foot), it would be advantageous to adopt the acre-foot as the basis of all licenses for irrigation purposes. If this were done the licenses in the cases cited would permit of the diversion of 303 acre-feet during the irrigation season, or sufficient to cover each irrigable acre to a depth of two feet, and the commissioner of irrigation would be empowered to prescribe when and in what order each licensee might open his headgates and take water. In all high water and flood diversions storage reservoirs should be required and these should, wherever possible, be constructed elsewhere than in the bed of the stream, as experience has shown that reservoirs formed by damming torrential streams are usually quite expensive to maintain, owing to the necessity for constructing works of sufficient strength to withstand the annual floods.

Watersheds.

One great difficulty encountered in granting licenses to divert water from streams has been the exact determination of the relationship between a main stream and its tributaries. The volume of water in any stream is the sum of its tributaries and any diversion from a tributary will affect, to some extent, the volume available below the point of diversion on the same stream or in any into which its water flows. The practice, up to the present time, has been to treat each stream independently and to grant licenses up to the full flow of each stream, without regard to the effect of such diversions upon other streams of the same system, or watershed. This has been done in all cases, except where two or more branches of a stream bear the same name, as East, West and Middle Fork of, say, Fish creek; in such cases the several branches bearing the same name were treated as one stream and licences were granted on any of the branches in order of priority. The system of treating the several branches as independent sources of supply has little to commend it, and the reason for the exception referred to is even more difficult to justify, as the name borne by a stream has obviously no bearing whatever upon the question.

The question is referred to by Inspecting Engineers R. J. Burley and P. M. Sauder in their reports for 1908, and is now receiving attention. The entire irrigation district has been divided into watersheds, or groups of streams, and careful measurements are being taken of the flow of each stream, with a view to determining the volume of water available for irrigation purposes in each and the effect of diversions from one upon the others of the same watershed. When fuller information has been obtained of the flow, and of the probable proportion of the diverted water that returns to the streams as seepage, it should be possible to devise some more satisfactory system of granting water licenses than that at present in force. The system of watersheds as defined on the map accompanying this report is doubtless imperfect in some respects; necessary corrections and changes can be made as soon as more accurate knowledge of stream flow becomes available.

Reservoir Sites.

The development of southwestern Saskatchewan and southern Alberta is dependent to a very large extent upon the quantity of water available for domestic, industrial and irrigation purposes, and the present rapid settlement of these districts, with its increased demands upon the streams, has emphasized the necessity for the construction of storage reservoirs in order to conserve and apply to beneficial use the vast quantities of water that annually run to waste during the spring freshets. Most of the principal streams of this district rise on the eastern slope of the Rocky mountains, or in the foot-hills, and are of the torrential class, carrying large volumes of water for short periods during early summer and dwindling to inconsiderable proportions during the later summer and fall months.

The losses which have been sustained during the past year in southern Alberta on account of floods in the rivers, and the annual loss by the lumbermen on the North Saskatchewan, the difficulties of navigation which result from uncontrolled floods and poorly sustained flow, the requirements of towns and villages for water supply, and of railways and other corporations for water for industrial purposes, in addition to the requirements of settlers for water for irrigation and domestic purposes, make this a question of such importance that the Dominion government, which is charged with the administration of the land and the water, may fairly be held responsible for obtaining the information necessary, to determine whether or not, or to what extent, the flow of these streams may be controlled. Whether the government should or should not construct the works that may be necessary need not at present be considered. What is necessary is that reliable data should be obtained and should be available when the necessity for undertaking the work arises. It will require careful and thorough examination for several years to secure the necessary data.

Realizing the importance of this question an effort is now being made to determine whether or not suitable sites can be found at the headwaters of the Bow and Waterton rivers, and on the southern slope of the Cypress hills for the construction of reservoirs for the storage of the water that has heretofore run to waste. It is the intention to make reconnaissance surveys during the present season with a view to the location of suitable reservoir sites, to determine the catchment area tributary to each site and the probable annual run-off. The work this season will be merely of a preliminary nature, but should give results from which to determine more accurately the possibilities of controlling the streams and the nature and approximate location of the necessary reservoirs.

Drainage.

It is provided by the Irrigation Act that the property in and the right to the use of all water in any stream, &c., within the district to which the Act applies, shall be deemed to be vested in the Crown, and that no person shall divert or use water otherwise than in accordance with the provisions of the Act.

Irrigation is not required in the northern portions of the provinces of Alberta and Saskatchewan, and in some portions of both provinces drainage is required, rather than irrigation. All drainage works are under the direct control of the provincial governments, but as the water in the lakes, sloughs, marshes, &c., is the property of the Dominion government, the resultant situation has been somewhat unsatisfactory, as no provision had been made for the acquirement of a right to drain away water from any source without complying with all the provisions of the Irrigation Act and securing a license to do so.

Realizing the importance of drainage and the desirability of simplifying the procedure for permission to drain swamps and sloughs, the Irrigation Act was amended at the session of parliament for 1908 so as to provide that the Minister of the Interior may, upon the application of the proper officer of the province, approve of the construction of any ditch or drain authorized by the provincial authorities, upon the filing with the Commissioner of Irrigation of plans of the proposed works, and upon a report by the commissioner that the said works will not injuriously affect any existing irrigation project or the future development of irrigation. Upon receipt of such a favourable report the minister may authorize the necessary diversion of water, and no further or other license shall be necessary. The present procedure is very simple and has so far worked admirably.

Accounts.

When the Irrigation Act was first passed, in 1894, surveys were undertaken, under the direction of the Surveyor General, for the purpose of determining the extent of territory that could be irrigated from the available water supply, and efforts were at the same time made to ascertain the quantity of water available for the purpose. Contour surveys were carried on for several years and bench marks were established at convenient points as bases for future operations. Owing to a variety of causes these surveys were not continued, and for several years little or no actual survey work has been done, operations being confined almost entirely to the necessary inspections of irrigation projects either under construction or proposed.

As these earlier operations were carried on under the direction of the Surveyor General, the control of the expenditure was also left in his hands. Recently, however, all matters in connection with irrigation administration have been placed under my charge and, as I am to be held responsible for the proper carrying on of the work, the control of the expenditure has also been entrusted to me.

Some changes have been made in connection with the rendering of accounts of expenditure. Accounts are in future to be rendered monthly instead of annually and advances are not to be made, as a general rule, until the previous month's accounts have been received. Estimates are to be submitted monthly for the amount required for the succeeding month's expenditure and must be approved before the proposed expenditure can be made. The permanent officers of the commissioner's staff are to be paid monthly from Ottawa instead of directly by the commissioner as formerly. In short, the office of the Commissioner of Irrigation is to be dealt with, as far as is possible, in the same manner as are the Dominion Lands and Crown Timber agencies. These changes imply no criticism of the methods followed by the commissioner in past years, but are merely part of the policy of more effectively controlling all branches of the department which are charged with the expenditure of public funds. The same rule is to be followed in dealing with expenditure for hydrographic surveys.

Hydrographic Survey.

From the date of the enactment of the 'Northwest Irrigation Act' in 1894, up to the present time, some attention has been paid to gauging streams in the semi-arid districts, but these measurements have not been made in a systematic manner nor with sufficient frequency. The result is that we have a number of measurements of the volume of water in certain streams on certain dates, from which it is possible to estimate with an approach to accuracy the volume carried by those streams at 'low,' 'high' and 'flood' stages; but we have no accurate record of the duration of the high and flood stages and consequently little real knowledge of the total flow of the streams throughout the season or of the quantity of water that may be relied upon at any season. As requests for water for irrigation and other purposes became more frequent, this lack of knowledge of stream flow seriously interfered with irrigation administration, and it became apparent that a more accurate knowledge was absolutely essential to the proper development of the country and the supply of water for its varied necessities.

In the latter part of 1907, Mr. P. M. Sauder, an inspecting engineer on the staff of the Commissioner of Irrigation, secured permission to visit the United States to look into the question of stream measurement as carried on there by the Geological Survey, with a view to the organization of a somewhat similar service in Canada. Mr. Sauder had had some experience in stream measurement during his service as an inspecting engineer and was convinced of the necessity for reorganizing the system upon which such work has previously been done in Canada in order to obtain satisfactory results. He visited the State of Montana, which was most convenient to the district in which he was then employed, and, through the courtesy of Mr. Follansbee and other officers of the United States Geological Survey, was furnished with much valuable information as to the manner in which the work was carried on there and was permitted to visit gauging stations and see the actual work performed in connection with stream measurements. Much of his report deals with technical matters, but some extracts which may be of general interest are submitted as an appendix to this report ; they show the gradual growth of the service in the United States, the general methods used and the manner in which a similar service could be organized and maintained in Canada.

An appropriation of $10,000 was made by parliament during the session of 1908 for the establishment of systematic stream measurements, but it was found impossible to organize such a service in time to be of much use during that year. Equipment was, however, purchased and steps taken for organizing the service during the present year. Only a portion of the vote for 1908 was used and a similar vote was taken for the current year.

The organization follows very closely the plan outlined by Mr. Sauder. The irrigation tract has been divided, for administration purposes, into three districts, viz., Calgary, Lethbridge and Maple Creek, and in each district there is one hydrographer and one assistant. Each party is equipped with a team and light wagon and the necessary gauging and surveying instruments, and is expected to establish gauging stations on all of the more important streams in the district and to arrange with residents to take daily readings of the height of water as shown on the gauge rods, and to forward weekly reports to the chief hydrographer at Calgary. Mr. P. M. Sauder has been placed in charge of the service and, in addition to organizing and supervising the work elsewhere, has personal charge of the Calgary district. Mr. H. C. Ritchie has charge of the Lethbridge district and Mr. H. R. Carscallen of the Maple Creek district. The last mentioned district is too large to be covered by one field party and, if funds permitted, it would be advisable to place an additional party, consisting of one hydrographer and one helper, in the southern part of the district. The amount voted for this work is very small when the extent of territory to be covered is taken into consideration. As the service is, as yet, organized on experimental lines, it was impossible to estimate accurately the cost of equipping and maintaining field parties, and already there is evidence that the most rigid economy must be practised in order to keep the expenditure within the limits of the appropriation.

Irrigation Map.

The Irrigation Act requires each applicant for water rights to file with the Commissioner of Irrigation, and in the Department of Interior, a plan showing the source of supply, the point at which water is to be diverted, the canals or ditches and the lands to be irrigated. These plans, while showing clearly enough the projects in connection with which they were filed, failed to show the connection between such projects and others in the same neighbourhood. As irrigation projects multiplied on some of the streams it became desirable to have a map at headquarters upon which each project could be plotted as soon as it became authorized so that the relationship between the various projects and the development in different portions of the country could readily be seen.

Such a map was prepared and kept constantly on the draughting table for reference purposes and it has been found so useful that other features have been added during the year, such as diversions of water for domestic and industrial purposes, the more important irrigation bench marks and the watershed divisions. Topographical features have been purposely omitted, in order that the irrigation projects might be more clearly shown. A limited edition of the map has been published in the hope that it may be of use to intending irrigators. Other useful information may be added as irrigation develops. Separate watershed maps and others showing lands sold in connection with irrigation projects are kept in the office at Ottawa for reference purposes and all these are kept constantly up to date.

Respectfully submitted,

R. H. CAMPBELL,
Superintendent of Forestry and Irrigation.

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R. H. Campbell

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(Translation.)

PRAIRIE AND FOREST FIRE LAWS FOR THIS COUNTRY.

TAKE NOTICE.

Any one who purposely or not purposely or his servant or his companion :

(1) Makes a fire and allows it to run on anybody else's land not his own, or,

(2) Allows a fire to run from his own land, or,

(3) By his doing or by his servant's doing, allows any fire to run, will have to pay $200.

About Camping.

Any one, or any one that is with him, who lights a fire in the open for camping, and leaves it without putting it out, will have to pay $100.

Those who must go and help put out a fire.

Those who are grown up and have not reached 60 years of age, being within 10 miles of a prairie fire or 15 miles of a bush fire, and being called upon to help put it out, refuse to help, will have to pay $5.

(Sgd.) R. H. CAMPBELL,
The one who is the head of this work.

Department of the Interior,
Ottawa, 1908.

Any one who tears down or destroys this notice will be put in prison.

REGULATIONS FOR CAMPING SITES IN THE FOREST RESERVES.

(1) At all places suitable for public camping sites, such as lake fronts, medicinal springs, fishing grounds, or other similar locations, such area in each case as may be considered sufficient by the officer in charge of the reserve shall be reserved and set apart for the use of the general public before any individual rights are granted.

(*b*) The use of the public area for camping or picknicking will be allowed without special permit.

(*c*) Persons making use of the public area will be subject to the regulations governing the reserve, particularly those relating to the cutting of timber, the use of fire and the protection of fish and game.

(2) Leases of lots for camping sites not exceeding one acre in area and not covering more than one hundred feet of water frontage may be granted, but no lease shall be granted which will obstruct any established trails or prevent the general public from reaching springs, lake shores, fishing grounds or points of interest.

(*b*) The location, size and shape of such lots shall be subject to the approval of the officer in charge of the reserve.

(3) All lots shall be surveyed before occupation and the boundaries shall follow the cardinal directions wherever the topography permits. The boundaries shall be marked by blazed lines and stakes, mounds or monuments shall be erected at the angles.

(4) The annual rental for a lot shall be five dollars, payable each year on or before the first day of May, and if rental is not paid within thirty days of the date when it becomes due the lease may be cancelled.

(5) Leases shall be renewable yearly for a term of ten years but may be terminated by the Minister of the Interior at any time when it is found necessary in the interests of the forest reserve.

(*b*) No transfer or sub-lease shall be made without the consent of the Minister of the Interior.

(6) Leases upon a water front shall be subject to a reservation of a public shore allowance of fifty feet in width measured from high water mark. The lessee may, subject to the approval of the officer in charge of the reserve, clear and improve such public shore allowance but no buildings, fences or other structures, which will interfere with or obstruct public passage along the shore, shall be erected.

(7) Lessees will be permitted to erect buildings upon the lands leased, but no unsightly structures will be allowed, and the premises must be kept in a sanitary condition.

(8) A lease shall not convey the right to cut or remove any trees or timber without the consent of the officer in charge of the reserve.

(9) Lessees and occupants of leaseholds shall be subject to all the regulations in force in the reserve, particularly those relating to the cutting of timber, the use of fire and the protection of fish and game, and shall be required to render assistance free of charge in fighting fires.

(10) Any lessee in occupation of a leasehold shall be allowed the privilege of grazing free, on the reserve, the stock actually used by him, not to exceed five head.

(11) No application for a lease for commercial purposes or for a larger area than one acre shall be granted.

APPENDIX No. 1.

REPORT OF THE INSPECTOR OF FOREST RESERVES.

March 3, 1909.

R. H. CAMPBELL, Esq.,
Superintendent of Forestry and Irrigation,
Ottawa.

SIR,—I have the honour to submit my first report upon the Dominion Forest Reserves, having been appointed to the office of Inspector of Forest Reserves. January 1, 1908.

It seems to me appropriate that the report should begin with the list of the reserves, showing their location and area and dates of formation, as no complete list has heretofore been published. The work on the forest reserves for the past year has included the operations incidental to grazing, protection against fire, reforesting, removal of squatters, marking reserve boundaries, forest surveys, map-making, examination of lands with view to the creation and extension of forest reserves, examinations of the shores of lakes to ascertain their suitability for pleasure resorts, granting of permits for the removal of timber, suppression of timber stealing, collection of statistics showing the timber on the reserves and the quantity removed therefrom, and various other duties connected with the care and management of the forest reserves.

LOCATION AND AREA.

The Dominion Forest Reserves all lie in the northwestern provinces. They are twenty-six in number, including the parks whose timber is managed in precisely the same way as that of the timber reserves proper. The number twenty-six does not include the eastern slope of the Rockies, however, although it also is under management similar to that of the forest reserves. Manitoba has six reserves, namely :—

	Square miles.
Riding Mountain reserve, containing	1,535
Duck Mountain reserve, containing	1,251
Porcupine No. 1 reserve, containing	322
Lake Manitoba West reserve, containing	248
Spruce Woods reserve, containing	110
Turtle Mountain reserve, containing	109¼
Total	3,575¼

Saskatchewan has four, namely :—

	Square miles.
Porcupine No. 2 reserve, containing	360
Moose Mountain reserve, containing	163
The Pines reserve, containing	145
Beaver Hills reserve, containing	72
Total	740

Alberta has six, namely :—

	Square miles.
Jasper Park reserve, containing	5,000
Rocky Mountains Park reserve, containing	4,500
Cooking Lake reserve, containing	114
Kootenay Lakes, containing	54
Cypress Hills, containing	18
Elk Island, containing	16
Total	9,702

British Columbia has ten, namely:—

	Square miles.
Yoho Park reserve, containing	828½
Glacier Park reserve, containing	576
Hat Creek reserve, containing	208
Long Lake reserve, containing	190
Tranquille reserve, containing	149
Niskonlith reserve, containing	124½
Monte Hills reserve, containing	106
Donald reserve, containing	72
Larch Hills reserve, containing	25
Martin Mountain reserve, containing	18
Total	2,297

Summarizing:—

	Sq. miles.	Acres.
Manitoba has	3,575¼	2,288,160
Saskatchewan	740	473,600
Alberta	9,707	6,209,280
British Columbia	2,297	1,470,080
Grand Total	16,314¼	10,441,120

DATES OF FORMATION.

The Dominion government awoke to the necessity of forming forest reserves in 1887, and has been constantly moving forward in that direction, thus conserving the timber, ever since that date, as appears from the following table which gives the dates when the reserves were set aside.

1887, June 23.—Rocky Mountains Park reserve, by Act of parliament.
1888, October 11.—Glacier Park reserve, by Order in Council.
1894, December 29.—Moose Mountain reserve, by departmental order.
1895, May 30.—The Kootenay Lakes reserve, by Order in Council.
1895, July 13.—Riding Mountain reserve, by departmental order.
1895, July 13.—Lake Manitoba West reserve, by departmental order.
1895, July 13.—Spruce Woods reserve, by departmental order.
1895, July 13.—Turtle Mountain reserve, by departmental order.
1899, June 5.—Cooking Lake reserve, by departmental order.
1901, December 14.—Yoho Park reserve, by Order in Council.
1901, August 29—Beaver Hills reserve, by departmental order.
1902, November 3.—Long Lake reserve, by departmental order.
1902, November 3.—Rocky Mountain reserve, extended 152 townships by Act of parliament.

1903, November 26—Glacier Park reserve, extended 16 townships by Order in Council.

1905, November 14.—The Pines reserve, by departmental order.

1906, July 13.—Duck Mt. reserve, by Act of parliament.

1906, July 13.—Duck Mountain reserve, by Act of parliament.

1906, July 13.—Porcupine No. 2 reserve, by Act of parliament.

1906, July 13.—Cypress Hills reserve, by Act of parliament.

1906, July 13.—Monte Hills reserve, by Act of parliament.

1906, July 13.—Martin Mountain reserve, by Act of parliament.

1906, July 13.—Niskonlith reserve, by Act of parliament.

1906, July 13.—Tranquille reserve, by Act of parliament.

1906, July 13.—Hat Creek reserve, by Act of parliament.

1906, July 13.—Donald reserve, by Act of parliament.

1906, July 13.—Larch Hills reserve, by Act of parliament.

1906, July 13.—Elk Island reserve, by Order in Council.

1907, September 14.—Jasper Park reserve, by Order in Council.

1907, September 17.—Yoko Park, reduced 105 square miles, by Order in Council.

The work of making forest reserves is still progressing, and will need to progress in Canada for many years. This year the region around the Waterton lakes in south-western Alberta was examined for this purpose. The forester who examined it recommended that 195 square miles be set aside. Also, territories adjacent to certain reserves have been examined with a view to ascertaining their suitability to be added. Recommendations have been made that 130 square miles be added to the Spruce Woods reserve in Manitoba, 238½ square miles to the Pines reserve in Saskatchewan, 45 square miles to the Beaver Hills reserve in Saskatchewan and 192 square miles to the Cypress Hills reserve in Alberta. Chiefly land unsuitable for agriculture or grazing has been recommended to be put into forest reserves.

GRAZING ON FOREST RESERVES.

It does not seem to me that the department, however, should exclude from the reserves all land suitable for grazing. In fact, they already include large grazing areas, and, if the recommendations made this year be sustained, such areas will be added to the Cypress Hills and Beaver Hills. These areas are among timber, and so we include them, rather than to exclude the timber. Nor should the department prevent grazing on these areas. For several reasons it is desirable that they should be grazed. The forest reserves are for the use of the people; then why should good grass be allowed to go to waste if it can be utilized? The grazing may be desirable also as a protection to the woods. In some places the ground is covered with a dense growth of long grass and peavine. This, when dry, offers much fuel for fire ; and when the fire once gets into it, it is almost impossible to check the flames. Cattle on the prairie have much the same habit as the buffalo. In going to water they follow one another and make paths which they follow day after day. These paths are fire lines where the fire may be checked, small to be sure, but there are many of them, and they give lines from which to back-fire.

Perhaps it will be objected that grazing prohibits the reproduction of timber. It seems to me, however, that the interference with reproduction from this cause is much overestimated. I know in the west many fields grazed constantly that have come into timber. There is danger from overgrazing, but from judicious grazing there is much less danger than from long grass and peavine.

PROTECTION AGAINST FIRE.

The problem of protecting the forest reserves against fire is the most difficult one we have. The fire problem is difficult even in the eastern provinces; but the conditions for fighting fire here are very favourable as compared with those prevailing in Manitoba, Saskatchewan, Alberta and eastern British Columbia. Compare, for instance, the number of rainy days for the summer months at Calgary, Alberta; Qu'Appelle, Saskatchewan; Winnipeg, Manitoba; and Toronto, Ontario. In our comparison, however, we must not only consider the number of rainy days but also the quantity of rain falling on those days; because, although a day may be considered rainy, there may not be precipitation enough to count much towards putting out a forest fire. The following table is a comparison for the four places mentioned, showing the average number of rainy days in each of the summer months and the average quantity of rain falling in those months. It is compiled from statistics furnished by the Meteorological Service published in a volume entitled 'Rain and Snowfall of Canada.'

TABLE OF RAINY DAYS.

(Average 1883 to 1902—20 Years.)

—	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Totals
Calgary, Alta..	0·20	0·06	0·33	2·93	9·40	12·93	12 00	8·66	6·93	2·79	2 66	0·26	59·15
Qu'Appelle, Sas.	0·25	0·30	0·40	4·00	8·80	12·65	11·90	8·35	8·15	4·70	0·90	0·30	60·70
Winnipeg, Man.	0·45	0·25	1·20	6·80	9·15	13·40	12 25	12·25	11·05	8·45	1·60	0·07	76·92
Toronto, Ont...	5·30	5 75	6·70	9·30	13·30	11·35	11·95	10·35	11·05	13·20	11·15	7·45	116·85

TABLE OF RAINFALL IN INCHES.

(Average 1883 to 1907—25 Years.)

—	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Totals
Calgary, Alta..	0·013	0 016	0·024	0·262	2·010	3·060	2·630	2·490	0·991	0·191	0·004	0·005	11·696
Qu'Appelle, Sas.	0·002	0·085	0·036	0·356	1·785	3·580	2·594	1·750	1·446	0·463	0·400	0·072	13·336
Winnipeg, Man.	0·005	0·003	0·160	1·142	1·858	3·319	3·003	2·209	1·253	1·290	0·728	0·013	14·983
Toronto, Ont...	1·128	0·954	1·360	1·467	2·754	2·844	2·856	2·624	2·855	2·532	2·104	1 563	25·041

It would appear from these tables that Toronto is at a slight disadvantage in the month of June. But of all the summer months, June, July and August offer the least danger to the forest. In these months the grass is green, the leaves are out on the shrubs and trees, the sap is in the bark, and the ground is moist from the shade of the trees. The chief danger periods are in the spring before June, and in the fall after September, when the woods are dry.

The eastern provinces have a great advantage also in regard to the wind. The average hourly velocity of the wind at Winnipeg for the eight summer months of 1905, as stated by the Meteorological Service, was 14.87 miles per hour, while at Toronto it was only 7.36 miles per hour; just twice as great at Winnipeg as at Toronto. The people of the east were fortunate in that respect last summer. Had the wind here been as high as in the west, quite likely there would have been twice the quantity of timber destroyed. Then, in the east the winds are moist ; there is no dry chinook

Again, in respect to population the east has the advantage. When a forest fire starts in Ontario or Quebec, you can just go out to the 100-acre farms, and to the numerous small villages and soon have a force of men to put it under control. But in the Northwest the population is scarce, railroads are not so numerous, and telephonic communication is not so good. In that country we cannot count much on putting out forest fires and so we have to be all the more diligent to see that fires do not get started.

The reserves are under constant patrol, summer and winter. During the danger periods the rangers lay aside all other duties and guard the forest against fire. In 1908, we had only two fires of any consequence, one in the Pines reserves which burned over 22 square miles, destroyed no merchantable timber, and one in the Turtle mountains, extending over 28 square miles, mostly covered with grass. In each of these fires, however, large areas of young reproduction growth were destroyed.

Last year we began a practice which we know saved the reserves several fires. It is a well known fact that, in the early spring, the fields become bare and the grass dry before the snow is all gone from the woods. While such conditions existed the forest rangers burned the meadows along the reserve boundaries. Fires, coming in from the prairie, met this wide fire line and died out for want of fuel. Around the Riding mountains the meadows were burned for ninety miles, around the Duck mountains for forty-two miles, and around the Porcupine mountains for thirty miles; all these in the most dangerous places. It is advisable to extend this practice to all the reserves wherever it is practicable, and to carry it out upon an extensive scale.

Ploughed fire guards also should be made around and across some of the reserves. The forest ranger on the Cypress Hills has instructions to plough a guard of four furrows entirely around the reserve, and outside of this four rods distant from it a second guard. Then, on calm days, with the help of two or three men he is to burn the grass between the two guards. On the Spruce Woods reserve several guards should be ploughed, one of which should run along each side of the Canadian Northern Railway which crosses the reserves.

Roads along the boundaries and through the reserves are being constructed to aid in fighting fire. One hundred and fifty miles was made this year. In certain places these roads are very much needed. For instance, I noticed in my inspection of the Turtle Mountain reserve that the roads all run north and south. There is no way of going promptly and conveniently east and west. The fires mostly come in from Dakota which lies to the south. Therefore, to facilitate the fighting of fire the forest ranger was instructed to make a road following the southern boundary. This will not only make it easier to move about on the reserve but it will serve as a fire line from which back-firing may be done.

REFORESTING.

The department is making an attempt to reforest some of the areas denuded by fire. From some experiments made last spring, it would appear that this might be accomplished by putting down a few seeds with a handful of sand over them at each place where we wish to have a forest tree. This was tried on the Turtle mountains and on the Spruce Woods reserve. In the former it was successful, in the latter unsuccessful. On the Turtle mountains the seed was thus placed under poplars and among long grass. The following species were planted : White Pine, Norway Pine, Jackpine, Bull Pine, White Spruce, Red Spruce, Colorado Blue Spruce, Engelmann Spruce and Balsam. Among the poplars the seed was evidently taken by birds, rodents or insects; but in the long grass every species germinated, and just before snowfall the trees were alive and looking well.

It is advisable to carry on a variety of such experiments next summer. For this purpose the forest ranger on the Spruce Woods reserve collected last fall 40 bushels of Spruce cones, the ranger on the Cypress Hills 40 bushels of Lodgepole Pine, and a party of foresters working on the Pines reserve 50 bushels of Jackpine. These are the species with which we hope to achieve success as they are the ones likely to prove hardy.

We shall do our best to win along this line, because the method of raising trees in nurseries until they are three or four years old and then setting them out into the field is far too slow and too expensive a method to count much towards meeting the demand for wood that will develop on this continent during the next hundred years. The nursery method is simply gardening. It is a good method for the farmer's wood-lot. Foresters should, however, seek for a method commensurate with the needs of the government lands. In the meantime, however, we are not despising the gardening method even on the reserves. We may be forced to use it, and next spring we shall start some seed beds. In fact 35,000 trees have already been planted on the Spruce Woods reserve, from stock raised at the forestry farm at Indian Head.

REMOVAL OF SQUATTERS.

A large number of people, mostly foreigners, had located and started farming operations upon the reserves, expecting some time in some way, political or otherwise, they would be permitted to make entry for the places they occupied. The department determined upon their removal. They numbered one hundred and twenty-six on the Riding mountain, and twenty-five on the Turtle Mountain reserve. The task of removing these people was a delicate one and required great judgment and courage on the part of the forest rangers. The chief ranger of the Riding mountains, W. A. Davis, devoted the entire summer to the work. All the squatters have been removed except three on the Riding mountains and two on the Turtle mountains. These remaining ones will move early next spring.

In this work the department followed a lenient policy. The squatters were taken to look over lands in wagons furnished to them free of charge. They got free entry for the lands they selected, and they received compensation for improvements they had on the forest reserves. The total cost of removing all these people was only $6,000. They have all made affidavits stating that they have been well treated and are pleased with the change.

MARKING RESERVE BOUNDARIES.

In order that the public may not unintentionally trespass upon the forest reserves thinking themselves on private property, or on other Dominion lands, the department began last year to mark the boundaries with iron posts. These are three-cornered and hence differ in shape from the regular Dominion survey posts. They are marked with the letters 'D. F. R.' (Dominion Forest Reserve), and the part that projects out of the ground is painted red so that it will be readily observable, summer and winter.

Considerable work was done in this direction last year. Mr. David Beatty, a Dominion land surveyor, was at work with a party of men on the unsurveyed portion of the boundary of the Porcupine reserve and ran fifty-one miles of the line. The forest rangers are working on the boundaries that have been surveyed and have located 140 miles.

This work was in many places difficult of accomplishment. It was about thirty years since the lines had been surveyed and some of them having been burned over, the wooden posts had been destroyed and the mounds almost obliterated. People familiar with the west know, also, that mosquitoes and flies are numerous and troublesome in the summer months. As it is the intention to have the boundary line a road from which fire can be fought it was cut out from six to eight feet wide.

Much more of this work would have been done if the rangers could have begun early in the spring, but during the early part of the summer they were all busy with the removal of squatters.

FOREST SURVEY.

In order that the department may have a thorough knowledge of the reserves and be able to form a judgment as to how the tree growth thereon should be managed, a timber and topographic survey is being conducted. Last summer Assistant Inspector MacMillan with a party of five forestry students conducted such survey of the Pines reserve. Assistant Inspector Dickson did similar work with a party of thirteen in the Riding mountains. This survey serves a double good purpose. It gives the department the knowledge it desires and gives the students the practical side of their forestry course.

The timber survey makes a thorough study of the tree growth. It gives the areas covered with mature timber and with younger timber and states the quantity of each. It considers the accretion and reproduction of timber in the forest and discovers means for their encouragement in quantity and quality. It examines areas having no tree growth, and recommends methods by which they may be afforested. It studies the effect of past management upon the forest, and advises improvements for the future. It suggests means by which dangers to the forest from fire, storms, fungi and insects may be reduced. It investigates the utilization of the forest, and seeks new uses for forest products.

The topographic survey describes the hills and valleys, the lakes, streams and trails. It studies the best routes for the removal of the mature timber and locates trails for protecting the forest against fire.

KINDS OF TIMBER.

The following species of trees exist in commercial quantity on the forest reserves:

Poplar (*Populus tremuloides* Michx.) and Balm of Gilead (*Populus balsamifera* Linn.) exist on all reserves east of the Rockies. Poplar reaches a maximum size of 32 inches at breast height. Fifteen inches, however, is the largest common size for sound trees. Balm of Gilead reaches a maximum of 34 inches, with a common large size, sound, of 18 inches.

White spruce (*Picea canadensis* [Mill.] B.S.P.) and black spruce (*Picea mariana* [Mill.] B.S.P.) exist on all reserves east of the Rockies, except Turtle mountain, Moose mountain, Beaver hills, Cooking lake, Elk island and Buffalo Park reserves. Maximum 48 inches; common large, sound, 18 inches.

Engelmann spruce (*Picea engelmanni* Engelm.) exists on the Kootenay lakes, Jasper Park, Rocky Mountains Park and all British Columbia reserves. Maximum, 30 inches ; common large, sound, 16 inches.

Jackpine (*Pinus banksiana* Lamb.) exists on all Manitoba reserves, except the Spruce Woods and Turtle mountain. In Saskatchewan it appears in the Porcupine and the Pines reserves. Maximum, 20 inches; common large, sound, 12 inches.

Lodgepole pine (*Pinus contorta, var. Murryana* [Engelm.] B. and W.) exists on the Cypress hills, Kootenay lakes, Jasper Park, Rocky Mountains Park and all British Columbia reserves. Maximum, 20 inches; common large, sound, 14 inches.

Bull pine (*Pinus ponderosa* Laws.) exists on all British Columbia reserves. Maximum, 36 inches ; common large, sound, 26 inches.

Western White pine (*Pinus monticola* Dougl.) exists on all British Columbia reserves. Maximum, 32 inches; common large, sound, 24 inches.

Tamarack (*Larix americana* Michx.) exists on all the Manitoba reserves, except Turtle mountain. It occurs on the Pines and Porcupine reserves in Saskatchewan, and on the Jasper Park in Alberta. Maximum, 24 inches; common large, sound, 14 inches.

Western larch (*Larix occidentalis* Nutt.) exists on all the British Columbia reserves. Maximum, 30 inches; common large, sound, 24 inches.

Douglas fir (*Pseudotsuga mucronata* Sudw.) exists on the Kootenay lakes, Jasper Park, Rocky Mountains Park and all British Columbia reserves. Maximum, 36 inches; common large, sound, 24 inches.

Balsam (*Abies balsamea* [Linn.] Mill.) exists on Riding mountain, Duck mountain, Porcupine and Lake Manitoba West reserves. Maximum, 17 inches; common large, sound, 10 inches.

Western cedar (*Thuja plicata* Don.) exists on all British Columbia reserves. Maximum, 84 inches; common large, sound, 40 inches.

Western hemlock (*Tsuga mertensiana,* authors) exists on the British Columbia reserves. Maximum, 35 inches; common large, sound, 10 inches.

White birch (*Betula papyrifera* Marsh.) exists on the Manitoba reserves. Maximum, 26 inches; common large, sound, 14 inches.

There are also on the Manitoba reserves small quantities of merchantable green ash (*Fraxinus lanceolata* Borkh.). Maximum, 12 inches; common large, sound, 8 inches. Bur oak (*Quercus macrocarpa* Michx.) Maximum, 27 inches; common large, sound, 10 inches. Manitoba maple (*Acer negundo* Linn.). Maximum, 11 inches; common large, sound, 7 inches.

TIMBER ESTIMATES.

As has been previously stated, the department is making a forest survey of the reserves which should give a close estimate of the timber thereon. Such estimate has been made for the Riding mountain, Turtle mountain, Moose mountain and the Pines reserves, and the following figures are probably close to the actual quantities on these reserves. For all other reserves the estimates are only tentative:—

Manitoba Reserves.

	Saw Timber. Bd. ft.	Fuel Wood. Cords.
Duck Mountain	300,000,000	3,000,000
Riding Mountain	250,000,000	2,500,000
Porcupine No. 1	50,000,000	750,000
Turtle Mountain	1,333,000	135,000
Spruce Woods	1,000,000	30,000
Lake Manitoba West	600,000	40,000
Total	602,933,000	6,250,000

Saskatchewan Reserves.

	Saw Timber. Bd. ft.	Fuel Wood. Cords.
Porcupine No. 2	50,000,000	500,000
Moose Mountain	5,000,000	130,000
The Pines		50,000
Beaver Hills		10,000
Total	55,000,000	690,000

Alberta Reserves.

	Saw Timber Bd. ft.	Fuel Wood. Cords.
Eastern Slope	3,000,000,000	50,000,000
Rocky Mountains Park	300,000,000	3,000,000
Jasper Park	100,000,000	1,000,000
Cypress Hills	2,000,000	100 000
Cooking Lake		10,000
Elk Island Park		10,000
Total	3,402,000,000	54,220,000

British Columbia Reserves.

	Saw Timber. Bd. ft.	Fuel Wood. Cords.
Railway Belt and Yoho Park.	600,000,000	6,000,000

Summary.

	Saw Timber. Bd. ft.	Fuel Wood. Cords.
Manitoba Reserves.	602,933,000	6,250,000
Saskatchewan Reserves.	55,000,000	690,000
Alberta Reserves.	3,402,000,000	54,220,000
British Columbia Reserves.	600,000,000	6,000,000
Total.	4,659,933,000	67,160,000

ESTIMATE OF ANNUAL OUTPUT.

The following table showing the quantities and kinds of timber taken from the reserves is also tentative as it is only an estimate. Heretofore, the quantities of timber cut on permits granted for the reserves have not been kept separate in the records from those granted for timber on other Dominion lands. It is the intention that in future forest reserve matters shall be kept by themselves so that accurate data in regard to them can be obtained. The receipts, however, as stated in the table, may be considered as correct. The figures may seem small considering the quantities of timber removed: but it should be borne in mind that every homesteader is entitled to one free permit.

TIMBER CUT DURING YEAR ENDING MARCH 31, 1908.

District.	Lumber. Ft. B.M.	Logs. Lineal ft.	Cordwo'd. Cords.	Fence Posts. No.	Fence Rails. No.	Poles. No.	Receipts.
							$
Manitoba Reserves.	3,789,180	17,134	3,647	31,100	22,650	8,250	7,044 41
Saskatchewan Reserves.	343,435	464,110	9,029	117,140	106,510	102,414	535 35
Alberta Reserves	1,400	332,612	1,280	52,080	247,155	48,265	56 75
British Columbia Reserves. .	8,338,000	. . . .	2,500	. . . .	. . . .	. . . .	4,794 00
Eastern slope, north as far as Brazeau River.	31,651,610	. . . .	56,037	336,860	1,336,700	. . . .	19,325 00
Totals	44,123,625	813,856	72,493	737,180	1,713,015	158,929	31,755 51

Throwing these different kinds of material into saw timber and cordwood we have saw timber about 45,751,325 board feet; cordwood, 105,943 cords. Dividing these quantities into the quantities estimated as standing on the reserves we perceive that the saw timber should last for one hundred years, and the cordwood for six hundred and thirty-four years, practically for ever, providing that the rate of consumption remains the same and that no timber be destroyed by fires or other causes. To be sure the growth has not been taken into account, but it is reasonable to suppose that fires will at least offset the growth, be we ever so vigilant.

Up to the present time permits have been granted only to actual settlers living within fifty miles of the nearest boundary of any reserve. This limitation is worthy of consideration. There is very little wood in southern Manitoba and scarcely any in Saskatchewan, and it is a question if the people all over these provinces should not be allowed the use of the mature wood of the forest reserve. It may not be quite justice to allow only the people living in the immediate vicinity of the reserves to have all the blessings.

It is a question also, if it is wise to allow only settlers to cut the timber. The average settler in taking out timber has little care for the future of the forest. His only object is to get out the timber he needs as easily as possible. If one tree has all the timber he requires, but if two will furnish it more easily, he will cut the two trees. Moreover, the settlers cut high stumps, leave large tops, and make no disposal of the brush. Millmen, knowing the loss in cutting high stumps and leaving large tops, and having regard for the future growth, treat the forest with much greater care. It therefore seems to me that mills should be permitted to enter the reserves, but they should enter under certain restrictions :—

(1) Only portable mills should be permitted.

(2) Mills should locate where the Forestry Branch directs.

(3) Permits should be granted for a definite tract not more than one mile square.

(4) Permits should be granted for one year only, but should be renewable at the discretion of the Superintendent of Forestry and should be cancellable at any time for violation of the regulations.

(5) Only such timber should be cut as is marked previously by the department for removal, and no cutting should begin before the marking is completed.

(6) In cutting down the trees the stumps left should not be more than 18 inches high.

(7) The trees should be cut down with a saw.

(8) All parts exceeding 4 inches in diameter of trees cut down should be removed by the permittee, and this should be done as the cutting progresses.

(9) Brush should be cut so as to lie flat on the ground excepting along the roads where it should be piled and burned under the immediate supervision of the department.

(10) Any unmarked trees cut down on account of the lodging of the larger trees in felling should be piled by themselves separately from the other logs, and should be considered the property of the department to be afterwards disposed of, either to the permittee or others as considered best.

(11) The dues on timber removed should be the same as those demanded of settlers.

(13) Lumber should be sold only to bona fide occupants of homesteads, or for the purpose of erecting churches and schools in rural districts.

(13) Any lumber obtained from a permittee and afterwards sold or offered for sale should be seized by the department.

(14) No settler should be permitted to receive from the mill in any one year more than 10,000 feet of lumber.

(15) The price of lumber at the mill should be fixed periodically by the department.

(16) Settlers should be permitted to draw out their lumber with their own teams.

(17) Permittees should be required to keep a mill book in which should be recorded all sales, to whom made, quantity sold, and price charged.

The department has this scheme of treating the forest already under operation. A saw-mill operating in the Cypress hills was last fall put under such restrictions, partly as an experiment, and I am glad to be able to report that the experiment is apparently a success. The owner of this mill had applied for a tract of spruce timber three-fourths of a mile square. The department stated the restrictions. They were accepted. Assistant Inspector Dickson marked the trees to be cut, and the work of cutting began. The forest ranger of the Cypress Hills reserve, who has the work under his supervision, writing on January 22, 1909, reports as follows :—'I have been down to the Grayburn mill for a few days and was all through the bush where they are cutting. They are keeping very close to the marked trees. I told them to get the brush piled along the trails and to get the poles out and they promised to do so. I will go down again soon and burn it.'

THE RESERVES AS PLEASURE RESORTS.

There are many beautiful lakes on the forest reserves and some of these are being now freely used as summer resorts. It seems to me that this should be encouraged. The campers are not a menace to the forest, in fact they are a protection, as they have personal interest in guarding the forest against fire. Besides, with campers on the lakes when a fire occurs there are people at hand to help to extinguish it. Therefore, the advisability of renting camp sites on the shores of these lakes, the leases to be made out for ten years, renewable at the discretion of the superintendent of forestry, and cancellable at any time for any misuse or menace to the forest reserve, is under consideration.

Respectfully submitted,

A. KNECHTEL,
Inspector of Forest Reserves.

APPENDIX No. 2.

REPORT OF R. H. McMILLAN.

OTTAWA, March 31, 1909.

R. H. CAMPBELL, Esq.,
Superintendent of Forestry,
Ottawa.

SIR,—I have the honour to submit herewith my report of the work which I have carried on under your instructions since June 15, 1908.

I first undertook an examination of the Pines Forest reserve, an area of 145 square miles, a short distance southwest of the town of Prince Albert, Saskatchewan. The object of the examination was to discover to what extent the reserve had suffered from fire, how much timber there was remaining, how much young growth capable of producing timber, the character of the soil around the reserve and what steps should be taken to protect the reserve from fire and put it in the best shape for the production of timber to supply the needs of the farmers on the surrounding prairie.

Four men were employed, two of them forest students, and a detailed examination and survey were made of the whole reserve. A map has since been prepared showing the location of the mature timber, the young trees and prairie and of all the trails. Where timber representative of the region could be found, measurements were taken to learn the average growth rate of jackpine in northern Saskatchewan and to discover its suitability for the production of railroad ties. A brief summary of conditions governing on the Pines Forest reserve is given below.

The Pines Forest reserve consists of an area of 145 square miles of sand ridges separated by muskegs. Where the land is sandy it is too light for agriculture. The sand is shown in railway cuts and at river banks to be in some instances 30 feet deep. If such land were cultivated it could not produce a crop, and when the sod and forest cover were removed it would be exposed to the forces of the wind and drifting sand dunes would be formed. Such land is now being artificially reforested at considerable expense by the Ontario government. There are small areas where the soil is a light sandy loam, but in such situations the drainage is so poor that a large proportion of the land is covered with muskegs and broken by sloughs. It is thus unfit for cultivation.

There is no doubt but that of the whole of the land within the reserve there is no quarter section but what is too uniformly broken by sand hills, ridges, sloughs, or muskegs to be suited for agriculture or capable of producing a living for a family, nor is the reserve sufficiently adapted for grazing to be thrown open for homesteads with that intention. Where sod exists it is very light and a large area would be required for the support of very few cattle. There are no natural hay meadows in the reserve, and the feed necessary to support stall-fed cattle through the winter would have to be grown on good land outside the reserve.

Around the immediate edge of the reserve there are settlers, most of them with very poor farms, who have depended largely upon the sale of cordwood from the reserve as a means of making a living. These people, together with a few cordwood dealers, who have profited by shipping wood to points south of the prairie, are the only ones at present interested in the sale of timber from the reserve. The majority of the people, those who are settled on the good agricultural land to the east and south of the reserve, are very much interested in having the cutting of wood limited to bona fide settlers. These farmers are at present dependent upon the Pines for building material, fencing and fuel, and they all believe that for the sake of the future, when increasing settlement will make timber still more valuable, the Pines Forest reserve should be protected from fire and managed so that it will perpetually produce timber for the use of the settlers.

Another class of people interested in the Pines Forest reserve as a source of timber supply are the residents in the prairie towns and communities farther to the south. The reserve is crossed by the railway and cordwood has been profitably shipped to Moosejaw and Regina and other towns on the prairie. Local demands must be considered first, and therefore it may not be possible from the small supply of timber now existing on the reserve, to permit the shipment of cordwood to distant points, but there is no doubt that in the future, when the whole area is under timber, there will be a surplus which can be made available for southern Saskatchewan.

Thirty years ago the greater part of the reserve was covered with dense stands of jackpine, spruce, tamarack and poplar. Altogether there were 38,400 acres of jackpine forest. Stumps and scattered trees still standing show that the average diameter over large areas was 8 to 12 inches, and that the maximum diameter was 24 inches. The contractors twenty years ago cut over a large area, taking only one tie from a tree. In the slash which they left fires were started from settlements and the railroads, and as a result there is not an acre left but has been burned over. The small patches of timber which were not completely destroyed by the fire have been gradually removed by tie contractors, cordwood shippers and the settlers. No timber now remains, excepting scattered patches of green and dead trees fit only for fuel. A detailed survey of the reserve showed that there were altogether only about 45,000 cords of fuel and of this nearly 15,000 had been killed by fire. There are about 37,000 cords cut per year from the reserve. This demand will in four years exhaust the supply of dead wood and will in ten years, with no extra consumption for building logs, and fencing, strip the reserve. It would therefore seem advisable that the remaining wood be kept for the supply of the surrounding people.

Fortunately the fire which has destroyed the mature timber has brought about conditions favourable for the growth of young timber. Jackpine, which is the tree best adapted to the light sandy soil of the Pines reserve, is a tree which is also well fitted for reclaiming burned over areas. The young pines begin to bear seed when about ten years old. The seed is encased in hard cones which hang on the tree for a number of years. The fire which destroys the timber does not always destroy the cones but only serves to open them up and liberate the seed. Jackpine seed germinates best on mineral soil where there is no shade or vegetation. These conditions are found after a forest fire and as a result a fire on jackpine land is nearly always followed by a very dense reproduction of young jackpine trees. There are now about 22,400 acres of the reserve densely covered with a thrifty growth of jackpine, varying in age from five to twenty years. Growth measurements taken of jackpine showed that at sixty years it reaches a height of 58 feet, a diameter of 11 inches at the stump and will make three ties or 32 feet of logs per tree. The young jackpine at present on the reserve will, if protected from fire, produce small fuel in ten years, and in twenty years from now will be large enough for poles and small logs.

There are on the reserve 40,000 acres of denuded land upon a portion of which there never was a forest, excepting small poplar and willow, and from the remainder of which repeated fires have removed both the original timber and any young reproduction that may have occurred. The denuded land is nearly all well suited to the growth of jackpine. A portion of it is gradually coming up with jackpine and poplar, and there is no doubt but that eventually it will all be reforested. It is probable, however, that it will be 75 or even 100 years before the whole of the denuded land is again covered with timber. It may therefore be advisable for the government to take some steps to encourage the artificial reproduction of timber on the tracts where natural reproduction seems least possible. The scheme which has been tried elsewhere with success is the sowing of seed on the snow in the winter. It seems that if jackpine seed were coated with red lead to protect it from birds and animals it could be sown broadcast upon the snow in winter and would with the melting of the snow be taken down to the soil under conditions most favourable for its germination. This method of artificial reproduction is very cheap.

The first necessity for the management of the reserve is efficient fire protection. The fire ranger should live on the reserve and should be a man who can easily secure the co-operation of the settlers in preventing and extinguishing fires.

The reserve boundaries do not at present follow the outlines of the sandy tract which the Pines Forest reserve represents. There are around the edge of the reserve several sections and quarter sections quite as unfit for agriculture as any of the lands within the reserve, some of them being very sandy, others for the greater part, covered with sloughs. This land can never be of any value to the country except by producing timber. An examination was made of all the land surrounding the reserve and such sections as are unfit for agriculture and are available were specially examined and reported upon, in order that they might be, if possible, added to the reserve, and the boundaries definitely defined.

So far as could be observed the cattle and horses which have been grazing on the reserve have done no damage, but have probably been of assistance in keeping down the grass and thus lessening the fire danger and giving seedlings a better chance to start. The grazing is of some value to the surrounding farmers, particularly those near the reserve, who have very poor land, and it would therefore seem advisable that they be allowed to secure, as cheaply as possible, grazing permits for their stock.

There has been game in the reserve, and at present moose, elk and deer are occasionally seen. There is absolutely no enforcement of the game law and as a result what little game remains will be very soon exterminated. This territory is very accessible and is a most convenient hunting ground for all the towns between Prince Albert and Regina. If the game were protected it would do much to popularize the reserve with those interested in sport.

PRINCE ALBERT FOREST RESERVE.

Acting under your instructions I made an examination of the sandy tract north of the Saskatchewan river, a portion of which had previously been set aside as the Prince Albert Forest reserve, which originally covered only about 19 square miles, although the sandy ridge upon which it is situated extended both to the east and the west and covered about 200 square miles.

The object of the examination was to locate the land which even in consideration of its proximity to Prince Albert, its possible value for market gardening and poultry farming, would nevertheless be most profitably employed in the production of timber.

Provisional boundaries were established for an area of 214 square miles of sandy land unfit for agriculture, which it seems might be most profitably set aside as a forest reserve, with the possible exceptions of a few isolated quarter sections or sections upon which local soil conditions are such that a crop can be produced. Aside from such exceptions the whole area of 214 square miles is exactly similar in topography and soil conditions to the Pines Forest reserve already described. It is if anything more uniformly sandy. Forest fires have repeatedly run over the whole tract and very little mature timber for anything but cordwood now remains. The burnt over area is everywhere covered with a dense jackpine reproduction which will in 20 to 30 years be producing valuable fuel and small timber.

If the land is now thrown open for homestead some of it will be homesteaded by people who do not know that the soil is unfit for agriculture; some of it will be homesteaded by others who are anxious to get what scattered fuel there is and who will abandon the land. The result will be that no permanent profit will come from the use of the land. The young timber will be cut and destroyed by fire and there will eventually be, between the town of Prince Albert and the fertile land a few miles north, a worthless sandy waste across which it will be expensive to maintain roads and from which no profit can be derived. It has been proved in other countries and is now being demonstrated in Ontario, that no good can come from the settlement of sandy land, and that if such land is settled it almost inevitably reverts to the government after having been productive of two or three generations of hardship for its unfortunate owners. It is surely wiser and cheaper to keep such lands under forest cover than to be forced later to adopt expensive means of reforestation.

This area of approximately 200 square miles under forest management producing a perpetual crop of fuel, ties and timber could not fail to be a source of revenue as well as pleasure to the citizens of Prince Albert. Where coal is scarce, as it is in this region, a guarantee of a perpetual supply of cheap fuel might be a consideration which would induce small manufacturers to locate in the region.

The Canadian Northern Railway will this year start the construction of their Battleford line, a part of which traverses the timber area north of Prince Albert. It is very important that extra precautions be taken to prevent fires starting from the right of way.

MOOSE MOUNTAIN FOREST RESERVE.

Acting under your instructions I visited the Moose Mountain Forest reserve to look into the question of making provision for permanent camping sites on the different lakes and to see what could be done to improve a few of the trails.

The Moose Mountain Forest reserve furnishes the only summer resort easy of access for people residing between Winnipeg and Moosejaw. Railway lines and trails which have lately been constructed have made trips to Moose mountain much more convenient. The camping season lasts from July 1 to September 1. During this time in the summer of 1908, 2,500 people are estimated to have visited the reserve for periods varying from one day to four weeks. By far the greater number go to Fish lake, which is the largest and most beautiful summer resort. Other lakes visited are Rocky lake, Gillis and Stevenson lakes within the reserve and White Bear lake in the White Bear Indian reserve. At the last mentioned lake the town of Carlyle has acquired a 99-year lease for camping purposes.

During the past year campers came to Moose mountain from the whole of Southern Saskatchewan, and from towns as far east as Brandon and Winnipeg. Some are picknickers who only wish to stay a few days and others are business men who wish to bring their families out for a month or two. The latter do not wish to tent amongst the underbrush and are anxious to secure somewhat permanent title to a small piece of land so that they may build cottages and beautify and make more convenient their surroundings. They are a class of people whom it would be advisable to interest in the reserve. They would be very ready to appreciate the great courtesy extended to them and very unlikely to do any damage by fire or otherwise.

The needs of the public could easily be provided for by reserving public camping grounds of considerable area on all important lakes or popular resorts by guarding against a monopoly of any point of interest or the obstruction of any trails. There would still remain large stretches of lake front suitable for camping purposes. These, if subdivided into small lots and leased for a term of years at a nominal rental, would enable permanent campers to build cottages and to assure themselves a summer home such as they desire. The adoption of this policy will do much to furnish the people of the prairie towns with pleasant and healthful places in which to spend their holidays, and will on the other hand be of great benefit in popularizing the forest reserves with the people. The presence of large numbers of campers in the reserve in the summer months will make available a very convenient fire fighting force.

The roads at present in the reserve are very wet and extremely hard to travel in June and July. This is an inconvenience to settlers around the reserve who are forced to cross it to avoid wide detours. It is a source of great loss of time to the fire rangers and makes it very difficult for campers who wish to drive out for a couple of days.

The bad state of the roads is due in part to their location on low land, and in part to the fact that they are so narrow the sun never gets at them to dry them. Mr. Rutherford, the forest ranger, went over them with me and together we made plans for the improvement of all the main trails, either by changing their location, widening them or building culverts.

Under the regulations which have permitted the removal of only the dead timber from the Moose mountains, the reserve has been so well cleaned up that at present there is only enough of such material to supply the demand for about one more season. There are, however, scattered in numerous patches, small areas of poplar the majority of which is steadily deteriorating. On account of the damage to which it has been subject from fire and fungi, the greater part of this wood is only fit for fuel. Practically all the mature timber in the reserve is of this class and, outside of a small strip along Fish lake which should be reserved for scenic purposes, all should be cut. It is not only becoming yearly of less value but is a source of infection, spreading the germs of the fungus destructive to poplar, and thus damaging the young growing stock. The reserve is so well stocked that none of the timber is required for seed trees and should be cut clean wherever cut. It would therefore seem that as soon as it is shown that all the available dead timber has been removed the regulations governing this reserve should be so altered that green timber could be cut. Before the season starts the ranger can select those areas upon which the stand of timber is in the worst condition and confine the cutting to such areas until everything is removed.

BEAVER HILLS FOREST RESERVE.

Mr. Willing, the Provincial Game Guardian for Saskatchewan, informed me that his department had made an examination of township 27, range 10, west second meridian, lying immediately north of the Beaver Hills Forest reserve, in order to learn its suitability as a game reserve. As a result of the examination the Saskatchewan government desired to have the township added to the Beaver Hills Forest reserve, and constituted a game reserve, in order that they might place there the beaver which they contemplated removing from the Souris river and other streams in settled districts to the game reserve, where they would do less damage and be afforded more protection.

I therefore made an examination of township 27, range 10, and the surrounding country to learn its suitability as a forest reserve. This township is exactly similar in every respect, to the townships which already constitute the Beaver Hills Forest reserve. It consists of rolling land broken by large numbers of sloughs which are the only drainage channels, which stretch almost impassably in every direction and cover about one-quarter of the total area. There are hardly any well defined streams, and those which exist have been so dammed up by beaver as to form ponds.

The soil is a heavy, impervious clay covered with very little humus or loam. It is free from boulders and gravel excepting on the ridges and knolls.

The whole area, together with four or five of the townships surrounding, forms the watershed for many small streams flowing out through the prairie country. Surrounding the hills about eight townships, of which the three townships under discussion form the centre, were originally heavily timbered with poplar. Prairie fires and fires starting from the settlements have destroyed all the timber and at present there are only small clumps of poplar left, and the whole of the remainder of the area is covered with young poplar, grass and peavine.

In spite of the fact that it will always remain quite a distance from the railroad and that it can never be well drained, a portion of the land has been homesteaded. The difficulties of the settlers have been numerous. Wherever a few acres have been broken crops have been unsuccessful every year. The land produces a very light crop of grain and almost regularly, probably on account of the elevation and the cold, wet soil, early frosts kill the crops. The peavine and rich grass furnish splendid grazing. The country is more suited for the production of cattle than of crops.

There is no doubt but that if the land is protected from fire it will rapidly produce dense stands of poplar timber. There is no other source of timber suitable for the use of the settlers within 75 miles of this region. Within this radius the land is more suited for agriculture than are the Beaver hills, is more accessible by railroad and will soon be under settlement. The necessity for preserving a public timber supply in the midst of this prairie region, together with the fact that agriculture is not a success on these hills, should furnish sufficient reason for the protection of timber in the available land in the townships reported upon.

Many of the settlers who have met with nothing but failure for two or three years are on the point of abandoning their homesteads. The settlers on the good land of the prairie are anxious that the Beaver Hills Forest reserve be extended to include as much of the sloughy district as possible.

The greatest need of this reserve at present is fire protection and game protection. There has been no fire guardian, and as a result fires have been very frequent and have every year destroyed large quantities of timber. The game regulations have not been enforced and the small quantity of game remaining is being rapidly exterminated.

KOOTENAY LAKES FOREST RESERVE.

In September I made an examination of the district surrounding the Kootenay Lakes Forest reserve to report on its suitability for a national park.

The federal government of the United States has lately set aside as a national park and perpetual reserve for the more valuable species of big game an area of 1,400 square miles, comprising the summits of the water sheds of the Flathead, Milk, St. Mary and Belly rivers in Montana. This reserve will be known as the Glacier National Park. It includes about 60 glaciers, a large number of lakes and streams, and a mountain region of unparalleled grandeur, in which there are numerous peaks ranging from 6,000 to above 10,000 feet in altitude. The park will always be a very popular resort for travellers and tourists. It is the home of mountain goats, mountain sheep, bears, deer, elk and moose, and will be a breeding ground from which they may scatter into country where they will furnish good sport and yet will not be exterminated.

The object of my examination was to discover if there was a similar area on the eastern slope of the Rockies in Alberta which could be set aside as a national park and as a refuge for game on the Canadian side of the boundary line.

The time at my disposal prevented me from continuing my examination further north than the drainage basin of the Waterton river south of Newman's peak and west of Belly river. I covered a territory of 191¼ square miles, a brief description of which is given below.

The late Dr. G. M. Dawson, in his report on the geological and physical features of the Rocky mountains, stated that the scenery in the vicinity of the Kootenay lakes was not excelled in grandeur by that in any other part of the mountains. Although the Canadian peaks are not as high as the peaks in the Glacier National Park and although there are no glaciers, the area is probably more suited as a national park for camping purposes than it would if it were more rugged. The Waterton lakes, closely surrounded by the mountains, furnish wonderful opportunities for boating, fishing and camping. Within easy access from the lakes are several beautiful valleys and many rugged mountains, from which a view may be obtained of the snow and ice-capped summits of the Flathead range in Montana. The most beautiful and the most rugged Alpine scenery is undoubtedly in the Glacier National Park of the United States, but the best place from which to visit the Glacier National Park and the most pleasing camping places which can be selected as headquarters from which to make pack trips into the mountains are found within the Kootenay Lakes Forest reserve and the territory embraced in my report.

The mountains surrounding the Kootenay lakes are frequented by the big horn sheep, mountain goats, black and grizzly bears. There are also found here the Rocky mountain grouse, ptarmigan and the prairie chicken. The lakes themselves and the streams flowing into them abound in lake and brook trout. The region is so accessible that both game and fish are at present in danger of being exterminated. If the game is protected on the United States side and not on the Canadian, it will only be a matter of a few years until the animals retreat to the mountains of the Glacier National Park, where they will be inaccessible to Canadian sportsman.

Forest fires have killed all the timber within the territory described. There is, however, a thrifty young growth of lodgepole pine which will before many years cover the region and furnish timber.

The country can be of no value for agriculture, and what little grazing there is can be made available to the settlers of the Foot hills even if the territory is reserved.

The discovery of indications of oil along some of the streams has led to extensive drilling operations in the hopes of developing oil wells. Up to the present no paying quantities of oil have been discovered and the several companies interested have to all appearances abandoned the search. They have left trails which render the territory more accessible.

This district affords the best summer resort available to the people of southwestern Alberta. It is annually visited by increasing numbers from Macleod, Lethbridge, Cardston and the intervening towns. If it is made into a national park or forest reserve no industry will be adversely affected and the people of southern Alberta will have assurance that such a park, which is the entrance to one of the most noted mountain regions of the Rockies, will be given efficient fire and game protection, and will remain always one of the best summer resorts for the people of the province.

The game protection in this region is at present inadequate. Parties have been known to take out as many as 500 trout in one afternoon and the streams are being rapidly depleted. There is no fire ranger in the district. Although there is no mature timber the value of the young timber is such that care should be taken to protect it from destruction.

THE CROWSNEST PASS, ALBERTA.

The coal mines of the Crowsnest Pass, Alberta, are even now, in the early stages of their development, experiencing some difficulty in securing a supply of the timbers necessary for the carrying on of their operations. In order to learn just what the situation was I spent a month in the Crowsnest valley studying the timber requirements of the mines in operation, the possibilities of securing timber locally, the quantity of timber available for mining purposes and endeavouring to find out just what steps should be taken by the Forestry Branch to improve the situation. Chief Forest Ranger Margach, who is thoroughly acquainted with all the details, went down to the Crowsnest Pass with me and spent some time in helping me to get acquainted with the country.

In connection with the report which I submitted I prepared a map of the region showing the area of green timber remaining unburned, the areas of the standing dead timber, of the young timber and of the burned over land upon which there are no trees.

The Crowsnest valley affords a good example of what fire has done to the timber of the eastern slope of the Rocky mountains. Of the 240 square miles included in the valley, 212 were originally covered with a fairly dense forest of spruce, pine, Douglas fir and balsam. At present only 33 square miles remain unburned, 179 square miles having been burned over. Of this latter area 60 square miles are covered with young growth, 34 square miles with dead standing timber, and 85 square miles have been so badly burned and so frequently, that only a few scattered trees remain. It must be a very long time before another forest can be produced.

The 33 square miles of green timber remaining is practically all held under license. The total stand is about 126,000,000 feet. The yearly cut is about 5,000,000 feet and is annually increasing. Twenty years probably will see the last of the present stand of mature timber in the Crowsnest valley.

The mines at present operating in the Crowsnest Pass require annually about 3,000,000 lineal feet of props and ties, and about 2,500,000 board feet of lumber and dimension timber. The props and ties require to be light and strong and are made of round timber 4 inches to 8 inches in diameter at the top. The dead timber standing after the fires of five and fourteen years ago is very suitable for this purpose. There are in the Crowsnest valley about 24,000,000 lineal feet of such timber, a supply which will be sufficient for about eight years. About three-quarters of this dead prop timber is in the hands of the timber limit holders and, under present conditions of sale, costs the mine owner more than similar prop timber purchased in Montana and British Columbia.

The young timber, which is now generally supposed to be of very little importance, will in a few years be the only source of props for the mines of the Crowsnest

Pass. There are about 60 square miles which after being burned over have come up densely to lodgepole pine. Measurements taken of the growth of timber in the Crowsnest Pass show that lodgepole pine produces prop timber at thirty years of age, but that the most profitable period at which to cut it for mining props is at sixty years. Pine will then produce about 620 8-foot props per acre. The measurements taken of the growth rate of spruce and fir, the timber which will have to be depended upon for a supply of lumber, show that spruce reaches a diameter of 12 inches in 90 years and fir reaches the same diameter in 110 years. The young growth is now 5 to 14 years old, consequently it will be producing mining props in 15 years and lumber in from 75 to 95 years.

Granting that the pine produces 620 props per acre at sixty years of age, and that the requirements of the southern Alberta coal field for 1913 are only 5,500,000 lineal feet of props, it will take 66,000 acres of pine to produce a continuous supply of props. The mines must have an assured supply of props and there are 66,000 acres of territory, immediately surrounding the mines, fit for nothing else than the growing of props.

The denuded area, 85 square miles in all, upon which there are no, or very few trees lies mostly in the valley bottoms and on the lower slope. Excepting for small meadows along the streams, the soil is a sterile gravel covered with thin dry sod. The market conditions are such that where there is a fair soil and good grazing, a comfortable living can be made by growing produce for the mines. All the locations upon which this is possible have been homesteaded. The remainder of the denuded area, nearly the whole of it, is unfit for anything but the growing of trees. If it is protected from fire it will gradually seed up. Before natural reproduction has covered the whole area with forest growth, it may be advisable to hasten the process by employing such methods of seeding as were discussed for the Pines Forest reserve.

It is very important that a forest should be maintained on the eastern slope of the Rocky mountains. The settlement of the prairie is creating a constantly increasing demand for lumber and the cheapest lumber on the southern prairie will always be that cut on the eastern slope.

Cheap mining timber is necessary for the production of cheap coal, and lumber and mining timber are the only crops possible from the greater part of the eastern slope.

The watershed of the eastern slope supplies 98 per cent of the water on the prairies. According to the highest authorities the forest on a watershed modifies violent stream fluctuation and thus prevents damage to irrigation ditches and makes available a larger supply of water during the irrigation season.

Maintaining a forest on the eastern slope does not mean an annual expense, beyond that necessary for fire protection. Unless there is fire protection there can never be any public or private revenue from the land and if there is fire protection there will always be both public revenue and private profit from the timber that will be naturally produced on land unfit for anything else.

The present system of fire ranging has been as efficient as was possible with the money at the disposal of the department. The greatest losses from fire occurred before the present system was inaugurated. The increasing value of the young timber, the increasing danger of forest fires arising from the development of coal mines, and the advance of settlement, render it necessary that more attention be devoted to the protection of the eastern slope forests from fire. If a larger force is employed on the eastern slope, as should be done, it will be necessary, in order to secure the most efficient service, to have some one in charge whose duties do not require him to leave the territory during the fire season, and who can devote all of his time to the administration and supervision of the work. The present chief ranger, Mr. Margach, has done good work by securing the co-operation of the limit holders and the mine owners, but he has been severely handicapped by other departmental duties which have required his absence from the territory.

Under the present regulations all, or nearly all, trees under 10 inches in diameter are left. Almost inevitably these are destroyed by fire or wind and the timber is lost. The loss per square mile through trees thus left is about 200,000 lineal feet of mining props and 190,000 feet, board measure, of lumber.

The idea in leaving these trees is presumably in order that they may grow to a larger size for a subsequent cutting or that they may seed up the ground. Neither of these objects is served in this particular locality. The trees are so scattered that if they are not burned they blow down or are killed by the sun which gets in and dries the soil, nor is good natural reproduction secured because the trees are left. Where the timber is all removed the cones which are left on the ground supply just as good reproduction of jackpine as is secured where seed trees are left standing.

There is a waste in logging operations in the Crowsnest Pass which seems unnecessary where the timber is so accessible and so valuable. There are left in high stumps, long tops, rollways and lodged trees, timber which brings the total loss per square mile up to 360,000 lineal feet of mining props and 400,000 feet, board measure, of lumber.

This lumber is accessible and should be taken out. In order to conserve a supply which is not too great and to secure for the government a revenue which is otherwise lost, the lumbermen should be encouraged to take it out. The governments of Quebec and the United States are, by increasing the dues on merchantable timber left in the woods, encouraging the lumbermen to remove everything that can profitably be removed. The result of such a policy is a larger production of lumber from the limits, less danger from fire and better prospects of a future crop.

Wherever it is possible for a family by industry and intelligence to make a living on a quarter section they should be encouraged to do so, but in a mining district like this, where there are very few locations where profitable homesteading is possible, care should be taken that no land is thrown open for homesteading that is unfit for agriculture, or ranching. There are always people who are ready to enter for a homestead even if there are only 25 acres of land on it, so long as there is a chance to make a living for a few months by selling what little timber there may be in the neighbourhood.

Homesteads in the mountains would be made more valuable and those owning them would be able to make a better living if the law were changed so that homesteads could be entered by legal subdivisions instead of by quarter sections. The meadows are almost the only sites suitable for homesteading. They are often so badly cut by the survey that a meadow only covering an area of 150 acres may be divided amongst three or four quarter sections. It is thus unavailable for any one family, whereas if it could be described and entered by legal subdivisions to the extent of 160 acres, the whole of it might be made available for one homestead and might be made a valuable property.

It would meet with the wishes of mine owners if all the land unfit for agriculture could be retained by the government to provide a perpetual supply of mining timber to be made available upon fair terms whenever it might be needed. The adoption of this policy would mean that no land unsuited for agriculture should be homesteaded ; that the timber limits, as fast as they are cut over or burned over so as to be valueless for the present production of timber, should revert to the government, and that the whole territory be given efficient fire protection.

North and south from the Crowsnest Pass on the eastern slope of the Rockies, are similar areas about which there is very little definite information. It would seem advisable that a reconnaissance survey should be made of districts so important for their timber and water supplies in order that definite information concerning local conditions might be obtained, and that a general plan might be outlined for the fire protection and management of the whole area.

STATISTICAL WORK.

With your permission I have discussed with Mr. Kellogg, Associate Forester of the United States Forest Service, methods of organizing an annual census of forest products in Canada, and I hope to be able, beginning with 1908, to secure complete data upon the consumption and production of all different forest productions of the country. It is likely that the publication of such information will do much to point out the necessity for provincial and national forest protection and regulation.

Your obedient servant,

H. R. MacMILLAN.

APPENDIX No. 3.

GENERAL REPORT FOR 1908 OF J. R. DICKSON, ASSISTANT INSPECTOR OF FOREST RESERVES.

Ottawa, March 25, 1909.

R. H. Campbell, Esq.,
Superintendent of Forestry,
Ottawa.

Sir,—I beg to present the following report for the season of 1908 :—

On June 1 orders reached me to take charge of a forest survey in the Riding Mountain reserve. A party of ten started in at the village of Ochre river on June 12 and proceeded up the Ochre trail to Clear lake, about forty miles, working the country on both sides. At that point we joined up with the 1906 survey, and crossing the Strathclair trail passed west through the Galician settlements bordering the south boundary of the reserve. As we moved along, three sub-camps were placed well into the reserve. Then entering the Birdtail valley I went northwest with a party of four over the Russell, Indian, Fisher and Gambler trails, completing in that way, by aid of a couple of pony trips made later south of Gilbert plains, a rapid reconnaissance survey of almost the entire 'West End.' The average number of student assistants throughout the season, was eight, and during the four months of field work we placed twelve main camps and four sub-camps. On October 16, the survey broke up and the outfit was stored at Grandview.

OBJECTS SOUGHT.

In order to decide on even a simple plan of management for any forest area, it is necessary to know its conditions of soil and climate and the general nature of the country; to survey the trails and locate the main forest types; to find out the area and quality of mature timber for immediate cutting and the nature and quantity of young growth, the basis for future crops. Finally there are large portions of burnt over and prairie lands, the area and location of which must be known before any re-foresting is attempted, and in connection with this work, a study of habits, growth rate and relative commercial and local utility of the various species available is necessary, before deciding which to favour and propagate under future plans. As in previous years, therefore, the object of the work was necessarily general in its scope, namely, to take stock of existing resources and make a study of all the conditions and factors that will influence future management.

Owing to the nature and object of the survey the area covered can only be given as an approximate figure. In whole or in part thirty townships were traversed, about 660 square miles being mapped and studied and the important trails surveyed. Of this area, 115 sections lay in the east end and 545 in the west end.

Along the Ochre trail, where there is still considerable timber, valuation survey methods were followed as in former years, but in the west end, which has been largely fire-swept, taking notes and making maps was the important work. The more important trails were surveyed and plotted as the party advanced.

The season of 1908 left little to be desired from a field work standpoint. It was so dry that many trails were available which in 1907 were entirely impassable. This not only made transportation easy but allowed the field parties to be almost constantly at work.

A sketch of the work already done in the Riding mountains by the Forestry Branch, also the general conditions prevailing, and the necessary requirements of the provisional plan of management appear in a recent bulletin on the subject. The following is a brief summary :—

FIELD WORK DONE.

During the past three seasons' work on this reserve, 1,170 square miles have been studied and mapped with that degree of completeness which the value of the timber or other conditions appeared to justify, leaving therefore 365 square miles scattered through the reserve upon which forest survey work has not been done, although on at least half of this area we have a fair knowledge of prevailing conditions.

The purpose of a working plan report for a forested area is to set forth clearly yet briefly all the facts and conditions affecting such timber tract likely in any way to prove useful or necessary in the work of laying down plans for its future management.

The Riding Mountain Forest reserve comprises 1,535 square miles of rough mountainous country in west central Manitoba. It is of great importance because of its being one of the largest of the federal timber reserves and situated in the midst of a populous community whose demand for its products has already reached large proportions. The land surface consists of two rolling plateaus some 400 and 900 feet respectively above the Dauphin plains. This entire range of hills being purely of glacial origin, the soils vary from gravels and light sandy loams to the heaviest boulder clays.

FOREST TYPES AND PRESENT TIMBER CONDITIONS.

The timber over the whole area has suffered to such an extent by fire and disease that there is comparatively little first-class saw material left. The west half of the reserve was largely swept by two great fires some 20 years ago, but a good growth of young poplar now occupies the ground. There are still several small areas of good spruce and jackpine in the east end, but most of the timber there remaining is mature poplar, which is very defective. As white spruce is the most valuable and rapidly growing timber tree of the region it should be favoured over all others in future logging and reforesting operations.

The following estimate of the saw material on the reserve is based on the knowledge obtained during the past three years, and includes the timber 8 inches and over at breast height :—

Species.	Board Feet.	Per Cent.
Aspen poplar	85,350,143	41
Balm (Balsam poplar)	27,032,691	13
White spruce	42,135,088	20
Jackpine	11,267,500	5
White birch	15,172,356	7
Larch	9,135,096	4
Black spruce	17,006,112	8
Balsam fir	3,328,000	1·5
Total	210,740,347	99·5

(Other species, ·5 per cent.)

AREA DISTRIBUTION OF RIDING MOUNTAIN FOREST RESERVE—APPROXIMATE STATEMENT.

—	Acres.	—
Water	95,000	25 per cent carrying pole stuff.
Swamp and muskeg	140,800	80 per cent carrying reproduction.
Brule	369,600	
Semi-brule	51,608	
Prairie to semi-prairie	104,073	
Timbered	221,319	
Total area	982,400	

CORDWOOD IN SAPLINGS ON RIDING MOUNTAIN FOREST RESERVE.

Cordwood.	Muskeg Type.	Cords, 87,480.	Per acre, 2·5 Cords.
Basis—All trees 4 in. to 7 in. taken at 5 cubic ft. per mean sample tree (which is 6 in. D. B. H.).	Jackpine	27,955	4·8
	Green poplar........	134,111	2·4
	Over-mature poplar....	48,576	3 0
	White spruce.........	72,098	6·7
	Mixed type	316,160	3·8
	Semi-brule poplar....	55,328	1·9
Total..........	.. . .	741,708	

MARKET AND LUMBERING CONDITIONS.

During the last ten days of October I made under your direction a study of permits in the Dauphin land office, and a report on the same was duly sent in. The number of permits issued in this land district fluctuates widely from year to year, but on the whole, 90 per cent of those granted on the reserves are in the Riding mountains, clearly proving this reserve to be at present easily the most important one in the province of Manitoba. A study of the markets and lumbering conditions about the reserve with special regard to aspen was also made at this time. Several of the large mills were visited and the owners interviewed. Up to the present, so far as I could learn, there has been no such thing as commercial poplar lumbering attempted on a large or small scale, in any part of the Riding mountains. The large mills may saw a good poplar log now and again but they only figure on the spruce log run, while the small millmen, who have no limits, are prevented by regulations from extending their operations beyond the farmers' permits. It was the decided opinion of every lumberman seen, that poplar lumbering will not pay under existing conditions.

Poplar has as yet no recognized place in the general lumber markets of the west. Poplar prices are not quoted in Winnipeg, and even in the Dauphin district one seldom finds any poplar in the local lumber yards. There is no available market as yet to which Riding mountain poplar could be shipped in commercial quantities. All the surplus spruce cut on limits in this district goes west over the Canadian Northern Railway lines to find a ready market in Kamsack and other prairie towns. Doubtless also if poplar lumber were properly seasoned and graded, in quantity sufficient for the trade, a profitable market could be created, especially for flooring and box material, but this will not occur while spruce lumber remains at present prices.

The forest of the lower plateau consists for the most part of aspen and balm poplar, with in places a large inclusion of paper birch, and in the ravines a scattering of elm, oak, ash and maple. On the upper plateau poplar is still predominant, but the forest is much more mixed in character, more or less coniferous growth being everywhere present, with considerable areas given over almost wholly to spruce, larch and balsam, or, in the drier parts, to jackpine.

Soil moisture determines three main permanent forest types: larch on the swampy areas, white spruce on the fresh to moist loams and jackpine on the dry sandy soils. But, as stated above, fire types, such as poplar and birch everywhere intervene. Owing to the slashed, diseased and burned conditions of the stands of timber on this reserve the annual balance between growth and decay is very difficult to estimate. We know, however, that the former exceeds the latter by at least 25,000 cords.

The population about the reserve, while mixed, is largely of British origin, and will be quick to recognize and approve all common sense measures looking toward its greater utility and improvement.

The market, owing to the nature of the merchantable timber, will be a local one and farmers' one in the main. A study of the market situation as affecting lumbering methods was made in October, several of the prominent lumbermen of the district being interviewed. They cut only spruce and a little larch, there being absolutely no market for poplar in commercial quantities.

DANGER TO THE FOREST.

Fire, fungi, insects, wind and frost have all been more or less destructive. Fire especially has swept away millions of dollars' worth of timber within the last 25 years, while the ravages of the hoof fungus have made large areas of standing poplar hardly worth lumbering.

To protect the timber from fire and trespass, there is now a staff on this reserve consisting of a chief fire ranger and four assistants, who have done much good work during the past two years. But more men are urgently needed for its proper safeguarding and administration.

PROVISIONAL PLAN OF MANAGEMENT.

The aim of all suggestions made or methods outlined in this provisional plan is simply to introduce a more far-sighted management of the resources on this reserve than has hitherto been attempted. Clearly, in advance of any actual regulation in a technical sense, an initial period of upbuilding and restoration will be necessary, for only after the present abnormal forest conditions have been reduced to something like normal, will it be possible with any accuracy to predict future returns or prepare a practical working plan based on annual production. The main objects now are :

(1) To provide for the wise and generous use of existing timber to meet settlers' requirements and popularize the reserve.

(2) To select and apply that silvicultural method best adapted to meet local future requirements.

(3) To introduce the best systems for protecting and administering the reserve.

The basic requirements of the situation are :

(*a*) To assure and convince public opinion that there is real utility and benefit to be gained by maintaining this reserve, the source of their supply of wood and water.

(*b*) To make the use of all the reserve products as ample and easy as possible, thus winning the confidence and support of every settler.

(*c*) To direct all cutting and refuse disposal in the woods with the object of securing a permanent and increasing yield in the forest.

(*d*) A full recognition of the enormous past losses and present dangers from fire, and the steps necessary to overcome it.

(*e*) To build up a more efficient and useful ranger service by a recognition of duties and functions, and the securing of a better-trained and more mobile personnel, devoting all their time and energies to government business. Along with this advance in methods of actual field work, the local office end of reserve management must also be made adequate to give complete control of the hay and timber sales business : the receipt and filing of all permit records and reports, and cheerful, prompt consideration of all public correspondence and inquiry.

(*f*) To consider where and in how far the work of reforstation should be prosecuted, and whether, considering the limited funds available, serious danger of fires and crude protective service justify such efforts at the present time.

(*g*) To carry on all improvement work on the reserve according to a definite plan. For instance, the whole ultimate system of trails, bridges, ranger stations, nurseries, compartments, &c., should be projected and mapped as soon as the available data bearing on these points will justify. Then all future work of the rangers is directed toward the fulfilment of this scheme.

MARKING TIMBER IN THE CYPRESS HILLS.

From November 20 to December 22 I was engaged in remarking the boundary lines of a small timber berth in the Cypress hills, Alberta, and stamping according to government regulations all the trees to be cut thereon.

All trees above a certain designated diameter at breast height, or 4½ feet from the ground, were to be distinctly marked for removal. This 'diameter cutting limit,' as it is called, is fixed in this case at 10 inches. To measure all doubtful trees a pair of calipers is necessary, and to ensure that only the desired trees shall be cut, some distinctive stamp must be used. The first marking hammer tried was found of little use, being a log-end stamp and not suited for bark. To use it, the services of a boy were required to first remove the rough bark with a hatchet. Later a stamping hatchet was tried, which instead of the three small letters 'D.F.R.,' had one large 'F.' on the back. This combination dispensed with the boy, but it is not distinctive enough, as with an ordinary cold chisel the stamp can be easily and quickly duplicated.

The above experience has shown, therefore, just what sort of tool is required to properly mark the trees most cheaply and easily, a 3-pound, cast steel hatchet with a simple but distinctive stamp on the back.

Marking in Different Species.

If marking is to be a practical operation, the problem of securing the results it aims at in the cheapest possible way, must be the forester's chief study. Such being the case, his methods vary with different species, and in a general way the following principle will hold good. With tolerant species, such as spruce, hemlock or even white pine, those which form uneven-aged stands, the trees *to be moved* should be marked, while in the case of intolerant species, which form even-aged stands, like the jackpines and poplars, the trees *to be left* should be marked, whether the latter are scattered seed trees, or the boundary trees of a cutting area.

The Work of Marking.

In the Cypress hills case, the arbitrary diameter limit was strictly held to, all doubtful trees being calipered both ways and averaged to a tenth of an inch. That is, if 9·5 inches in diameter they were left, but a diameter of 9·6 inches placed them in the ten-inch class and they were marked for removal. To make mere size the sole criterion, however, is not the best policy ; it is not flexible enough. To secure the best results the forester must be allowed discretionary power. Such exercise of judgment is necessary for various reasons, viz., where one or two trees in a vigorous clump of spruce are just over the diameter limit, as often happens, and to cut these out means destruction to the rest, the forester would not mark them, but leave the whole intact for the sake of enhanced future profits. It would be good business, good silviculture and therefore good forestry. Again, on a hillside where rigid adherence to the cutting limit would result in disastrous windfall, the forester should be empowered to use his judgment in raising that limit enough to prevent such a result.

The forester could overcome cases also where an insufficient growing stock would be left to form the next crop if permitted to reserve a few seed trees above the cutting diameter limit.

Finally, he could do the work more quickly and cheaply.

Cost of the Work.

The cost varies widely with varying conditions and the thoroughness with which it is done. Where the trees are limbed to the ground, and the country is very rough, one can only mark from 300 to 500 trees per day, especially those short days of early winter when this work is usually done. In the Cypress hills work, besides the above difficulties there was also a ragged debris over the most of the area, and the labour of climbing through and over this reduced the above figures down to about 250 trees per day on the average. Of course, the trees were calipered and each one blazed and stamped twice, once below stump height, once above. The cost of such work is very high and would make it impossible to the average lumberman. But as an experiment and because of the peculiar conditions in the Cypress hills the government undertook it.

In an ordinary virgin spruce stand in rolling country where a man could stamp 600 trees per day, the relative cost would be very much less, and if judgment were substituted for the calipers, and each tree marked only once instead of twice, all the benefits possible could be obtained at a comparatively trifling expense. Where one-foot stumps are required by the regulations, it seems to me that one stamp below stump height on each tree meets every requirement. If the snow is so deep that the mark cannot be found with comparative ease it will be quite too deep for getting one-foot stumps. And this truth will apply just as well of course to any other height of stump. Moreover, the upper mark is of no value as a check on the work, for when the logs are piled in the mill-yard only one in a hundred of these marks can be seen. That is to say, the stump will secure every object sought for, and the resultant saving of time will make the work very much cheaper.

The method of work which proved most rapid was to carry back and forth across the area a strip approximately one chain wide, and mark all trees on the same side. For instance, if work were begun on the west border of the tract, all trees would be marked on the east side. This little point is important, because it enables one, while working alone, to cover ground rapidly and not miss any trees, a compass being quite unnecessary.

Granting, then, that a forester being paid $6 a day, marks 600 trees, in timber which runs five trees to the thousand feet, board measure, we find the cost of such marking to be five cents per M.

CONCLUSION

(*a*) It is absolutely necessary in those parts of the west where the low rainfall and strong dry winds give a high evaporation co-efficient, with its concomitant, poor conditions for natural reproduction, that in spruce woods at least every tree be marked before cutting begins.

(*b*) The ten-inch cutting limit chosen for this tract proved to be just right, as it secured all the good merchantable timber while leaving the thrifty young trees of rapid taper and growth and not opening up the stand enough for the destructive entrance of wind.

(*c*) So inexpensive and yet of such immense practical utility is good marking as a means of perpetuating spruce forests (provided the presence of balsam does not render that result all but impossible), that it would seem to offer a very legitimate and promising field in the immediate future, for co-operation between the government and those lumbermen who, while anxious to operate conservatively, do not feel that their interests are extensive enough to justify the engagement of a forester.

In connection with this lumbering job at least two essential conditions for good work were made very clear :

(1) The necessity of having all parts of such an operation proceed simultaneously, thus leaving the work completed as it progresses.

Where the permittee lets all the work to a contractor who in turn sublets it to others there is grave danger of losing proper control. For instance, if the brush is not disposed of at time of lopping, it becomes so bound together by the skidding or partially buried by subsequent snowfall that it must be left *in situ* till spring, and to remedy the mistake then entails additional expense and friction to all parties.

(2) Advisory inspection while the work is under way.—This is because careful conservative methods of logging in Canada are as yet mostly in the educational stage, and mere rules carry little weight with lumberjacks and logging bosses, unless an official is on the ground to explain and enforce them.

As for the perennial problem of brush disposal, it can at least be said that no general solution of uniform applicability is possible; the question is in each case an open and relative one. Due consideration must be given to the fire danger, the best conditions for reproduction, and the cost. In the Cypress hills, where securing moisture for the desirable spruce seedling is the important factor, thorough scattering of the brush away from the logging roads and the burning of that which is piled up alongside them secure this main object in a large measure while also reducing the fire danger by changing the trails to fire lines, the whole being done at moderate cost.

Respectfully submitted,

J. R. DICKSON,
Asst. Inspector Forest Reserves.

APPENDIX No. 4.

REPORT OF C. A. WALKINSHAW, FOREST RANGER.

DEPARTMENT OF THE INTERIOR,
DOMINION LANDS AND CROWN TIMBER OFFICE,
BOISSEVAIN, MANITOBA, March 27, 1909.

R. H. CAMPBELL, Esq.,
Superintendent of Forestry,
Ottawa, Ont.

SIR,—I beg to submit herewith my annual report in regard to the conditions in the Turtle Mountain Timber reserve for the past year.

In the first place, I am sorry to say that we had bad fires in the reserve last spring. Owing to the dry and hot weather accompanied with high winds, it was impossible to get them under control, and although my assistants and myself worked day and night, the result was that a large part of the reserve was burned over, which was duly reported to you.

When all danger from fire was over, Mr. Knechtel, Inspector of Forest Reserves, supplied me with pine and spruce seed and instructed Mr. Thomas Scott, my assistant, and myself how and where to plant them. I went strictly by instructions, and when

Mr. Knechtel and I inspected them late in the fall, we found that all of those planted in the grass had germinated, looking healthy and strong, especially the bull pine. Unfortunately, a large percentage of the seed planted amongst the young trees had been eaten by mice or birds.

I am satisfied that if that had not happened at least ninety per cent of the seed planted would have germinated.

I hope that the department will supply me with a large amount of seed this spring, so that I may be enabled to reforest a good part of the reserve that was burned over.

I may say that all the squatters have left the reserve with the exception of Mulholland and Maddess. They were ordered by the county court judge last fall to leave the reserve not later than April 1, 1909. I communicated with Mr. George Paterson, of Deloraine, who represents the Department of Justice in this case, asking him to see that the judge's order was obeyed. He answered me assuring me that it would be put into effect.

As instructed by Mr. Knechtel, Mr. Scott and I staked out the international line between Dakota and Manitoba, the southern boundary of the reserve. I found this a very difficult job, especially finding the mounds, owing to the rank growth of young trees and other vegetation.

I was pleased to receive a letter during the summer from Mr. Thompson, Professor in the School of Forestry at Bottineau, North Dakota, requesting information regarding protecting Turtle mountain from fires. I gave him all the information I could ; I also visited him at Bottineau. He assured me they would do everything in their power to assist us in preserving Turtle mountain against fires. He also gave me a copy of a bill that he had presented to the legislature of North Dakota in the interest of fire protection. I mailed the copy to Mr. Knechtel at Ottawa, along with a request to assist in having it passed.

There have been issued during the past winter permits for over two thousand cords of dry wood and for over two thousand feet of logs. The wood cut was mostly dry. Any that was cut from trees burned last spring was charged twenty-five cents per cord.

Your obedient servant,

C. A. WALKINSHAW,
Forest Ranger.

APPENDIX No. 5.

REPORT OF JOHN RUTHERFORD, FOREST RANGER.

DEPARTMENT OF THE INTERIOR,
DOMINION LANDS AND CROWN TIMBER OFFICE,
CARLYLE, SASKATCHEWAN, April 7 1909.

R. H. CAMPBELL, Esq.,
Superintendent of Forestry,
Ottawa, Ont.

SIR,—I beg to submit my annual report regarding conditions in the Moose Mountain timber reserve. As a result of the favourable season there has been a splendid growth of young timber, and the damage done by fire has been practically nothing, as there was but one small fire in the scrub, which was promptly extinguished.

The supply of dry and fallen timber is now almost exhausted. The number of permits issued was hardly as large as in previous years, owing to the greater amount of coal now being used. The opening up of the trail from Fish lake to the old government road is a great convenience to the public as well as the ranger patrolling, and I would strongly recommend the widening of the trail through the Indian reserve from the Indian agency to the government road at Skeleton lake in view of the actual need of this trail as a road to Fish lake and a good fire-guard.

In conclusion I wish to say that the open season for deer should be closed for a number of years, as they are falling off in number to an alarming extent, owing to so many hunters hunting in the open season.

Your obedient servant,

JOHN RUTHERFORD,
Forest Ranger.

APPENDIX No. 6.

REPORT OF JOSEPH COXE, FOREST RANGER.

DOUGLAS, April 6, 1909.

R. H. CAMPBELL, Esq.,
Superintendent of Forestry,
Ottawa, Ont.

SIR,—I beg to herewith submit my annual report in regard to the conditions in the Spruce Woods Timber reserve.

In the first place, I would like to say that the general conditions have been very favourable during the past year, owing to the fact that there has been very little damage done by fire. We have had a few small fires, but they did very little damage, if any, owing to the fact that there was very little timber in the places where the fire ran.

We planted 10,000 Scotch pine along with the others we had already planted, which were making a good growth. We also pulled and shipped about 30,000 small tamarack trees to Indian Head station for the nursery there. We also planted a large number of seeds of various kinds in the spring, as well as sowing a quantity last fall. We also picked 40 bushels of spruce cones, and pulled and shipped a car of moss for the nursery at Indian Head. We prepared and planted an experimental bed with seeds late in the fall.

Your obedient servant,

JOSEPH COXE,
Forest Ranger.

APPENDIX No. 7.

REPORT OF NORMAN M. ROSS.

DEPARTMENT OF THE INTERIOR, FORESTRY BRANCH,
NURSERY STATION,
INDIAN HEAD, SASKATCHEWAN, March 27, 1909.

R. H. CAMPBELL, Esq.,
Superintendent of Forestry,
Ottawa, Ont.

SIR,—I have the honour to submit herewith my ninth annual report, dating from April 1, 1908.

Though the past season has been generally favourable to tree growth, unfortunately the winter of 1907-8 was the most trying since the commencement of the work, on all classes of young trees, shrubs and perennial stock. The fall of 1907, being wet and cold, was unfavourable to the early maturing of the new growth, while the winter was comparatively mild but very free from snow. The ground was very bare and exposed to strong drying winds, causing considerable damage even to a great deal of stock usually considered quite hardy. In our plantations the cottonwood suffered to the greatest extent, a considerable proportion of the new growth being killed back and in some cases the tree killed outright. In certain districts the ash and maple also suffered, though not to the same degree.

This trouble was general over the greater part of the three provinces, with the exception of southeastern Manitoba. In central Alberta the plantation suffered most. Following along the foot hills from about Olds to Cardston on the Macleod-Edmonton line there is a strip of country extending some miles east of the railroad with a comparatively high elevation, within which area experience seems to indicate that conditions for tree growth are more unfavourable than in other parts of the prairies. It will be necessary here to select most carefully the varieties for planting. In this district the Manitoba maple as a general thing has not given satisfaction, while the cottonwood frequently kills back in the most discouraging manner. The varieties which appear at present most suitable are the hardy willows and Russian poplars. The caragana seems to be hardy and could be introduced into the plantations to good advantage as a filler and nurse.

Though discouraging in many respects, such winter killing must be expected periodically, whenever the weather conditions are unfavourable to an early maturing of the new growth.

Growth during the past summer was very good. In most cases where winter killing was experienced the damage was entirely overcome by the more luxuriant growth of this season. The weather conditions in the fall of 1908 were very favourable to the early ripening of the young wood, so that we do not anticipate a repetition of the winter killing this year.

INSPECTION WORK.

In connection with the co-operative tree planting system the following were employed on inspection work :—

A. Mitchell, W. Guiton,
A. P. Stevenson, Jas. Kay,
J. Caldwell, Jas. N. B. McDonald,
A. McIntosh.

A brief report from each of these inspectors is appended, giving more detailed information as to districts covered and local conditions affecting the plantations.

As a whole the reports are most satisfactory, both regarding the success of the plantations and the greatly increased interest and general activity in tree planting all over the prairies.

Owing to the development of the work it was found necessary to appoint Mr. Arch. Mitchell as my assistant. Mr. Mitchell was, during the first few years of the operation of our tree planting system, engaged during the summer months as an inspector. He is particularly qualified for the position he now occupies, owing to his training in forestry work in Scotland and England, together with several years' experience of prairie conditions, particularly in Alberta, where since 1899 he has been actively engaged in agricultural work, devoting a large portion of his time to the subject of tree culture.

Two new inspectors, Jas. Kay and Jas. N. B. McDonald, were appointed this summer. Both have had several years' training in forestry on Scotch estates, and after considerable practical experience on the nursery station here, were considered competent to undertake inspection duties.

OFFICE WORK.

A great change was effected this season by transferring all office work in connection with the Tree Planting Division from Ottawa to Indian Head, thus centralizing the work and thereby making it more effective. This change seemed necessary for many reasons : First, large numbers of inquiries were being received at Ottawa requiring knowledge of local conditions before intelligent advice could be offered; second, considerable delays were frequently and unavoidably encountered in correspondence with applicants regarding the tree planting work, which, especially in the spring, often resulted in the necessary postponement of planting operations for another year; third, the correspondence at the nursery station was increasing so rapidly that it would, in any event, have been necessary to provide some suitable office accommodation; fourth, the inspecter's reports and sketch plans were not always so satisfactory when worked up in the office at Ottawa as they should have been. By employing in the office only men who are thoroughly conversant with our inspection work and with local prairie conditions it is hoped to greatly increase the efficiency of this work.

The office was opened in rented quarters in town during the early part of November, 1908. Though it was some time later before the necessary stationery supplies, &c., were received, the work accomplished in this office is very considerable.

The office staff at present consists of Mr. Mitchell and tree planting inspectors Guiton, Kay and McDonald. The indexing and filing is under the charge of Miss Lauder. The inspectors prepare plans for the guidance of those applicants who are to receive trees, make up the distribution lists, and later on the lists of those to be inspected during this season.

Since its opening on November 1, 1908, we have received at this office 7,723 pieces of mail matter, principally inquiries regarding our tree planting work and applications for planting material and information.

During the same time 8,431 letters have been mailed; many of these are of course circular forms, &c.

Since opening we have started 3,640 new files. With the system of book and card indexing this entails a very considerable amount of work. Owing to the great development in railroad extension and in the general settlement of the country we find it very difficult to keep the indexes up to date, as new post offices and new express offices are being opened every day. We frequently find on file three or four letters from the same correspondent, each one giving a different post office address.

When properly equipped there is no doubt that our tree planting work can be much more effectively handled from this office than was possible when all correspondence was carried on from Ottawa.

To date we have 2,235 new applicants.

In the spring of 1908 trees were furnished to 1,424 applicants: 464 in Manitoba, 659 in Saskatchewan and 301 in Alberta; the number of trees distributed being practically 1,800,000. During the winter 1,002 planting plants were prepared and sent out.

We have on the distribution list being compiled at present the names of 2,010 applicants to receive trees this spring. According to provinces there are 559 in Manitoba, 1,095 in Saskatchewan and 356 in Alberta. To furnish these applicants we have heeled in at the nursery some 2,570,000 seedlings.

The following summary will give the best idea as to the popularity of the work among the settlers : Number of applicants on inspection lists, summer of 1908, 3,734; number of applicants who received trees spring of 1908, 1,424; number of applicants to receive trees in spring of 1909, 2,010; number of new applications received to date for trees to plant in 1910, 2,235 ; number of applicants to be visited in 1909, about 4,900.

As the inspectors' lists for 1909 cannot be accurately compiled for several weeks yet the last figure, though not definite, is approximately correct.

SCOTCH PINE PLANTING ON SPRUCE WOODS RESERVE.

The experimental plantings on the reserve were not extended this spring (1908) ; 11,000 two-year Scotch pine seedlings were planted in blanks of last year's plantation as owing to unfavourable season of 1908 a considerable number of the young plants failed to become established.

These experimental plantings were started in 1904 and have annually been added to, till at the present time the area set out aggregates about 25 acres. The planting has been limited to Scotch pine. The stock used has all been grown at the Nursery Station at Indian Head. In the first two years trials were made with seed of the native jack and lodge pine and the Scotch pine, and with one and two-year seedlings of Scotch pine. The results from the two-year seedlings are the only ones at all satisfactory. The one-year stock nearly all died. The seed in most cases germinated, but at present date the seedlings from seed sown in 1904 are barely an inch high, while the two-year old stock planted in 1905 are from a foot to over two feet. The seed was sown in 1904 in spots, prepared by spade about a foot square. In 1905 the seed was sown in the bottom of a shallow furrow and lightly raked in. It is possible that the reforesting by seed may be successful in certain sections of this reserve, namely, in the more hilly parts where there is some shelter afforded by poplar and willow shrubs; but on the level open portions conditions appear most unfavourable. Here it is almost certain that planting must be resorted to if successful results are desired. The system of planting as practised during the past three seasons, which I have described in previous reports, has given most encouraging results. Using two-year stock the cost per acre is comparatively small. Two year seedlings can be grown at considerably less than $1 per 1,000 dug ready for planting. The actual planting under the system referred to, and under wages paid in 1906, was approximately $5 per acre. It is doubtful if seed could be efficiently sown at a very much less cost than this.

As stated in my last report, Scotch pine was used, not because it was considered the best variety for the situation, but for the reason that the seed was readily obtained and stock easily propagated, the object of the plantings being chiefly to ascertain the probable cost of planting and the results likely to be attained from a very rough method of planting with the use of seedling stock. The success with the two-year stock would seem to indicate the inadvisability of using comparatively expensive transplants as this would greatly increase the initial cost of planting.

EXHIBITS.

The usual exhibit was again prepared for the summer fair at Brandon.

This season, at the request of the fair board, it is proposed to prepare an exhibit at the Calgary show.

In connection with these two exhibits, which will consist mainly of enlarged photographs of prairie plantations, it is the intention to set out in a suitable portion of the grounds demonstration plantations, showing varieties hardy in the locality and suitable for prairie windbreaks and plantations. The exhibition boards at both Brandon and Calgary are most anxious that such plantings be done. It is doubtful if any trees can be set out till 1910, however, as this season will be needed to get the ground in a suitable condition for the planting.

This kind of exhibit will undoubtedly prove much more valuable from an educational standpoint than the class of exhibit as prepared heretofore, and will naturally increase in value and instructiveness year by year. In connection with this planting it is proposed also to lay out a small nursery such as any farmer might have in connection with his home garden in order to raise his own planting stock on the farm.

LECTURES, &C.

The results of the work of this division have been generally disseminated, together with information relative to the establishing of prairie plantations, by the following means :—

Farmers' Institutes.—During the whole month of February Mr. Mitchell attended farmers' meetings in Alberta. Mr. A. P. Stevenson, during the same time, lectured in Saskatchewan and I personally attended institute meetings for one week.

Special Lectures.—Mr. Mitchell gave two special lectures in Calgary before the local horticultural society and the students of the normal school, while I addressed a farmers' convention at Regina on January 20 and also delivered two addresses before the Western Horticultural Society Convention in Winnipeg, February 18 and 19. These special lectures were illustrated by lantern slides.

Bulletins and Pamphlets.—Large numbers of Bulletin No. 1 on 'Prairie Tree Planting' have been sent out, two editions having been exhausted. A special pamphlet was prepared last winter, which was published in the spring, giving a résumé of the work of this division since the commencement of the work in 1901. In addition several thousand circulars and leaflets have been sent out.

Press Articles.—From time to time articles have been prepared for publication in the western agricultural periodicals, usually supplemented by photographs.

NURSERY WORK.

The following areas were occupied during the growing season of 1908 with the various classes of stock :—

Broad Leaf.

19 acres, 1 year old Manitoba maple.
11 acres, 2 year old green ash.
16 acres, 1 year old green ash.
1½ acres, 1 year old American elm.
3 acres planted to willow cuttings for propagating stock.
1 acre planted to Russian poplar cuttings for propagating stock.

Conifers.

1 acre, transplanted native tamarack.
2 acres, transplanted evergreen conifers.
½ acre conifer seed beds.

—

55 acres, total under nursery crops.

The season was only a fair one for nursery crops. The seed germinated well and made good progress till July, when we suffered from an extremely dry hot spell; this considerably shortened the growth, the effect being more especially noticed on the ash. The two year ash are somewhat undersized. During the winter they were entirely bare of snow covering and were consequently affected by this, while the summer was not favourable to a very luxuriant growth. The plants, however, are splendidly rooted.

We have at present heeled in for distribution this spring the following :—

Manitoba maple	1,575,375
Native ash	743,000
Cottonwoods	256,000
Total	2,574,375

This number will be added to by making thousands of cuttings of the willows and Russian poplars.

Last spring over 100,000 willow cuttings were made for distribution.

As usual a portion of our maple seed was sown in the fall of 1907 and the remainder in spring of 1908. The seedlings from the fall sowing are considerably larger than those from the spring sown seed. There is always a possibility with this variety, owing to the rapid germination, for seedlings from fall sown seed to be cut down in an unfavourable spring. For this reason a considerable portion of this variety is always sown in the spring, and as a general rule we recommend that this variety be sown not earlier than the first week in May.

Elm.—This (1908) was an off seed year. With considerable difficulty we secured enough seed to sow 1½ acres. This seed is collected early in June and sown about the third week in that month. As a rule the seedlings make from 4 to 8 inches growth the first season and are left in the nursery for the following season, when they make good plants of from 18 inches to 2 feet in height.

Birch.—We have grown small quantities of this variety (native white birch) almost every year, but owing to the difficulty of obtaining seed and the comparatively great area required in propagating it has not been considered advisable to sow it at all extensively. The seed is very small and light and therefore cannot be covered deeply. We find it necessary to sow in screened beds where the seed germinates readily. When two years old the seedlings should be transplanted to nursery rows for one season in order to develop good roots for the final planting.

Ontario soft maple (*Acer Dasycarpum*).—Although this variety is not usually considered hardy in the west we have been able to secure seed from trees growing in Manitoba, near Morden, on the farm of Mr. A. P. Stevenson. We have several trees on the nursery grown from this seed which are now from six to eight feet high and have shown no sign of freezing back. In 1907 I secured some seed from Mr. Stevenson's trees and have raised some 5,000 seedlings, which came through the winter of 1907 without protection and matured up very well last fall. It is proposed to set out a test plantation with these seedlings as it is quite probable that the strain may prove hardy, at least in the more favourable districts. In this connection I might mention that seed of this same variety was secured from Pennsylvania in 1906, but each year the stock has been frozen back to the ground. The roots, however, have not been killed and last summer vigorous shoots from three to five feet long were sent up. These shoots do not appear to be so badly frozen this year.

Willow.—Three acres were this year planted to cuttings of the voronesh or Russian willow, in order to secure stock for distribution. The willow I consider as one of the most suitable varieties for the prairie, especially for formation of shelter belts. It is a rapid grower and will undoubtedly furnish fair fuel in a comparatively short time. One of the chief features in its favour is its ease of propagation by cuttings; so that any farmer owning a few plants can extend his planting almost indefinitely with no expense for nursery stock.

Russian poplar.—An acre was set out in cuttings of this variety, also for the production of propagating stock.

Though generally we have not recommended the planting of the Russian poplar it has been found of value in certain districts and under certain soil conditions. Especially in parts of southern Alberta it will prove extremely useful, where the Manitoba maple and the cottonwood do not appear altogether satisfactory.

Cottonwood.—This variety is not grown on tho nursery, stock being very cheaply secured from the natural growth along the sand bars in the rivers of North Dakota.

Caragana (*Arborescens*).—Although this cannot be classed as anything but a shrub it will undoubtedly prove very useful for mixture in planting for South Alberta. For a fast growing hedge and garden shelter it can scarcely be excelled on the prairies. It will attain a height of nearly 12 feet in about 7 years but will not exceed this much in later seasons. Growing bushy as it does from the ground it furnishes excellent shelter and is perfectly hardy anywhere on the prairies. Three acres were sown to caragana in the fall of 1908. The stock, however, will not be ready for distribution till the spring of 1911.

In the fall of 1908, 14 acres were sown to green ash and 6 acres to Manitoba maple. More maple will be sown this spring, but not so large an area as usual owing to a scarcity of seed.

COLLECTION OF SEED.

Maple and Ash.—Owing to an early spring and late spring frosts this was not a seed year for either of these varieties. As we already had on hand a large stock of ash seed we did not run short of this variety. But our supply of maple was very limited. It was impossible to secure seed in any quantity anywhere in Manitoba or Saskatchewan. We were able to get about 300 pounds of last year's crop from Brandon, which, added to a small quantity of our own, will give us enough for about ten acres. This is a considerably less area than we should have, but in future we shall be in a position to make up any deficiency in seedling stock with cuttings of willow and Russian poplar.

Elm.—It was an unfavourable seed year for this variety also though we were able to collect enough seed to plant 1½ acres.

White spruce.—About 35 bushels of cones were collected by the ranger on the Spruce Woods reserve and forwarded here. Something over 30 pounds of seed were extracted.

Jackpine.—About 45 bushels of cones were collected in the Prince Albert region and sent to the nursery for seed. As some of the cones were extremely old the seed did not turn out well. The old cones do not open as readily as the fresher ones and the seed in many cases appears to have decayed. About 22 pounds was extracted.

Lodgepole pine (*P. Murryana*).—About 40 bushels of this variety was also collected in the Cypress hills south of Maple creek. The cones of this pine seem to be the most difficult of all varieties to open, the older cones especially often remaining closed after being submitted to intense heat. If no cones older than two years could be collected there would not be much difficulty in extracting the seed and getting a fair yield to a bushel of cones, but owing to the habit of the jackpines retaining cones for several years it would be almost impossible to prevent collectors picking by the bushel from gathering a large proportion of old cones. About 29 pounds was extracted.

Pinus Ponderosa.—A small supply was obtained from seed picked in the higher altitudes of the Black hills of North Dakota. It is thought that this may prove a suitable variety for prairie planting.

Abies Concolor.—A small lot of this seed was also obtained for testing on the nursery.

CONIFERS.

We are gradually working up a stock of evergreen conifers which should be ready for distribution in 1911. The varieties which will be most extensively propagated are native white spruce, native jack and lodgepole pine and Scotch pine. Very little, comparatively, is known as to the suitability of various evergreens for prairie planting, especially under plantation conditions. Evergreens have been planted in most of the settled districts, but usually with only moderate success. The average man gets a spruce or pine, and as it is somewhat of a rarity, he plants it out in the centre of his lawn or in some other equally conspicuous and exposed position. Consequently, as a rule, the poor evergreen has to withstand the most adverse conditions of exposure to wind and sun. The failures resulting from this kind of planting do not indicate that these varieties are not hardy. If only moderate care is taken to have conditions resembling, at least as far as possible, those under which the tree thrives in its natural state, much greater success may be hoped for.

Where evergreens are planted they should be set out close together in large numbers for mutual protection, or should be protected in some manner by broad leaf varieties, shrubs or sunflowers; anything, in fact, that will hold snow in winter and keep the young plants well covered, especially during the first winter.

Though as above stated it is proposed to propagate for distribution only a few of the very hardiest varieties, there are many other conifers likely to prove suitable for prairie planting.

The following is a list of conifers at present on the nursery with the ages of the stocks :—

White Spruce.

White spruce, 1, 2 and 3 year seedlings up to 8 years old transplanted.
Colorado spruce, 2 year seedlings up to 10 years old transplanted.
Sitka spruce, 2 year seedlings.
Picea ajanesis, 1 year seedlings.
Norway spruce, 4 years transplanted.
Norway spruce (Septentrionalis), 1 and 2 year seedlings, 4 years transplanted.
Scotch pine, 1, 2 and 3 year seedlings up to 6 years transplanted.
Jackpine, 1, 2 and 3 year seedlings to 4 years transplanted.
Lodgepole pine, 1, 2 and 3 year seedlings to 4 years transplanted.
Cembra pine, 3 years transplanted to 6 years transplanted.
Flexilis pine, 3 year transplanted.
Ponderosa pine, 1 year seedlings, 3 years transplanted.
Norway pine, 3 year seedlings.
Dwarf mountain pine up to 6 years transplanted.
Douglas fir to 5 years transplanted.
Balsam fir to 5 years transplanted.
Nordman's fir, 1 year seedlings.
Concolor fir, 3 year transplanted.
Dwarf juniper up to 6 years transplanted.
Common red cedar up to 6 years transplanted.
European larch, 7 years transplanted (9 feet high).
Siberian larch, 1 year seedlings to 4 years transplanted.
Native larch or tamarack, 1 year seedlings to trees 10 feet high.
Larix leptolepis, 2 year seedlings.

Trials are also being made with a small collection of conifers, the seed of which was obtained in Japan, also with seed procured from Northern Russia and Finland.

At present date there are over 10,000 square feet of shaded seed beds on the nursery containing fall sown seed and 1, 2 and 3 year seedlings, 1 acre of transplants of Scotch pine and spruce set in 1908, and 1 acre of swamp pulled tamarack set in the same year.

Considering the somewhat unfavourable conditions for evergreen propagation which at present prevail on the nursery, owing to exposure, newness of soil, &c., the results obtained are very encouraging, and indicate that with adequate shelter the propagation of such varieties as spruce and pine may be very successfully carried on in this country.

The Native larch or tamarack has again made especially good growth in the plantations. It seems to be a very easy variety to transplant, is very hardy, and a rapid grower.

The *European larch* appears hardy and makes very strong growth, but owing to the very early date at which it buds out in the spring the time for transplanting is short. Transplanting does not seem successful after the buds have opened.

Siberian larch.—This variety matures up earlier in the fall than the European, losing its leaves eight to ten days sooner. The native larch is bare of leaves several days earlier than the Siberian. In this climate varieties maturing early in the season are the most desirable. It is probable then that the Siberian form of the larch will prove more suitable for our conditions than the common European.

PERMANENT PLANTATIONS.

We have now about 40 acres under permanent plantations, 25 acres being set out last spring (1908). These permanent or test plantations will be added to each season as new land can be prepared for planting, the object being to ascertain the best varieties and best mixtures for prairie planting for the production of fuel, fencing and other material.

The following is a list of permanent planting to date :—

Permanent Plantations.

	Feet.
In 1904—	
Main belt of Manitoba maple, cotton wood and willow.. ..	3 x 3
Plantation No 1, tamarack and white spruce..	3 x 3
In 1905—	
No. III—Tamarack, Scotch pine and White spruce..	3 x 4
No. XI—European larch..	3 x 3
No. XII.—Maple, cottonwood, elm, European larch, tamarack, white birch....	4 x 4
No. XIII—Scotch pine and white spruce under large maples and cottonwoods..	4 x 4
In 1906—	
No. II—Scotch pine and white spruce, alternate rows....	3 x 4
No. IV—Scotch pine (French stock)....	3 x 4
No. V.—Scotch pine (stock grown at Indian Head).. ..	3 x 4
No. VI—Cottonwood..	3 x 4
No. VII—Cottonwood and Manitoba maple, alternate rows	3 x 4
No. VIII—Manitoba maple and white birch, alternate rows.	3 x 4
No. IX.—American elm and green ash, alternate rows..	3 x 3
No. X—Russian poplar....	4 x 4

In 1908—

No. XIV—White willow..	3 x 3
No. XV—Golden willow..	3 x 3
No. XVI—Acute leaf willow....	3 x 3
No. VII—European larch and green ash, alternate rows..	3½ x 4
No. XVIII—Tamarack and green ash, alternate rows.. ..	3½ x 4
No. XIX—Tamarack....	3½ x 4
No. XXIII—Tamarack and Manitoba maple, alternate rows	3½ x 4
No. XXII—Scotch pine and green ash....	3½ x 3½
No. XX—Lodgepole pine....	3½ x 3½
No. XI—Lodgepole pine and green ash, alternate rows.. ..	3½ x 3½
No. XXIV—American elm....	3½ x 4
No. XXV—Cottonwood....	3 x 3
No. XXVI—Cottonwood, birch, tamarack, ash, maple and willow....	4 x 4

These plantations vary in size from ½ acre to 3 acres.

Last spring, as above stated, 25 acres were planted; about 5 acres were put in with spades, 14 acres planted directly in plough furrows, and 6 acres with iron dibbles. In all cases the ground was first marked out with cross drills to ensure the rows being straight and even both ways for horse cultivation.

	Per acre.
Planting with spades the cost averaged....	$ 9 99
Planting with dibbles the cost averaged..	6 52
Planting with plough the cost averaged..	6 33

Dibbles can only be used successfully for cuttings, as a rule, one and two year seedlings have too well developed a root system.

In planting in plough furrows we use a two-horse walking plough. The rows are five chains long. In order to keep the plough team busy a gang of five men and a boy, besides teamster are necessary. The boy sets the stakes for the plough furrows and the five men plant certain sections of the rows as soon as the plough passes. The furrow is opened up as deeply as possible running the plough twice in each furrow, throwing soil both ways. The planters only set the tree and tramp in enough soil to hold it firmly, the filling in is done by another man with a single horse cultivator.

When spade planting, the planters work in pairs, one man making the hole, the other carrying the seedlings, setting them and firmly tramping the soil. This is the method we use in planting the evergreens, as the stock being small would not be evenly covered if planted in furrows.

Plantations of maple, cottonwood, and others of the fast growing varieties, require cultivation and hoeing for at least three seasons. We find that the average annual cost per acre for hoeing is from $4.70 on new clean land to $9 on older land.

Horse cultivation averages $1.12 an acre.

These prices are arrived at from the time spent on the work and the actual wages paid on the nursery. On the average farm a few acres of trees could easily be cared for without in any way materially increasing the usual expenses, as the actual time employed is very little and special help would not be hired for this purpose.

The following table showing the percentage by actual count of dead trees in the 1908 plantations may be of interest. The count was made in September.

Permanent Plantations—1908 Planting.

Variety	No. of trees planted.	Per cent died.
Willows (cuttings)	9,832	46·4
European larch	2,406	22·02
Tamarack	12,015	2·1
Ash	13,308	5·4
Lodgepole pine	5,745	9·8
Scotch pine	3,244	4·3
Manitoba maple	3,003	3·7
Elm	5,381	1·6
Cottonwood	6,906	17·6

The soil was fresh backsetting, ploughed a third time. The willow cuttings were damaged a great deal by gophers, which cut off the young shoots as soon as they appeared above the ground. The cuttings were also set early in spring, while the ground was still very cold, some three weeks before the general planting was commenced. Had the cuttings been set later in the season it is not likely that there would have been the same percentage of failures.

It is interesting to note the difference in the death rate between the European larch and native tamarack, the latter being only 2·1 per cent.

An additional 12 acres has been prepared for planting this spring (1909).

Exhibition Plots.

Last spring several small exhibition plots were set out; these contain 100 trees each, set 4 x 4 feet. The plots are arranged side by side in order that one variety may be easily compared with another. These plots will be added to each year till a complete collection of all hardy varieties is obtained. The following plots were planted :—

Scotch pine.
Cembra pine.
Dwarf mountain pine.
Lodgepole pine.
Jackpine.
Tamarack.
European larch.
Siberian larch.
Colorado spruce.
Native white spruce.
Canada spruce (from Black hills, N.D.).
Balsam fir.
Cedar.
White birch.

Ornamental Grounds and Shrubbery.

The shrub borders have made splendid growth and now add greatly to the attractiveness of the nursery. Many of the varieties are now coming into bloom. The following are the varieties used most extensively, all of which have proved absolutely hardy during the past four seasons :—

Caragana arborescens.
Caragana pygmæa.
Flowering currant.
Red twigged dogwood.
Tartarian honeysuckle.
Albert Regel's honeysuckle.
Lilacs, common, Persian and Joseka's.
Ginnalian maple.
Spirea Van Houtii.
Spirea Billardii.
Spirea arguta.
Spirea opulifolia.
Japanese rugosa roses.
Dwarf or trailing juniper.
Dwarf mountain pine.

The Japanese rugosa rose is particularly worthy of notice. It is very hardy, has a most beautiful foliage, blooms profusely over a very long period, and after blooming produces immense hips of a bright scarlet colour which remain on the bushes well on in the winter.

All our shrubs are planted thickly and are so arranged as to be well covered with snow during winter. At present date, though the adjoining fields are perfectly bare, all the shrub borders are drifted from two to five feet deep. This winter covering is most beneficial to all flowering shrubs and herbaceous perennials.

During the summer the perennial plants gave an especially fine show of bloom, though the latter part of the season was too hot and dry for good success with annuals.

Perennials that may be particularly recommended as being specially hardy are the German iris, perennial larkspur, Iceland poppy, columbines and peonies.

This season a small lawn and some additional shrubbery planting were laid out around the new boarding house.

Ploughing and Farm Work.

Sixty acres of fresh ground was broken up and backset. About 12 acres of this was reploughed very deeply to put it in condition for permanent planting. About 20 acres was summer-fallowed for nursery work and 30 acres ploughed in fall after trees had been dug and put in shape for spring sowing. A supply of feed oats and hay was also harvested.

Buildings and Permanent Improvements.

A small building for the extraction of coniferous seeds was erected in the fall at a cost of about $500. One end of this building, 20 x 16, is equipped with a hot water heater and fitted up with suitable drawers or trays for drying and opening the cones. The other end, 16 x 18, is for the extraction and cleaning of the seed. During the early part of the winter about 120 bushels of spruce and pine cones was opened here.

Connection with the town waterworks was completed in September. The main pipe leading into town cuts across a portion of the nursery. This was tapped at a convenient point, giving a plentiful supply of splendid water under a very good pressure. This will be particularly beneficial for the growing of young coniferous stock. There is no doubt that with artificial watering the young plants can be brought to a suitable size for permanent planting at least a year sooner than if grown without any such watering.

In conclusion I would say that the results, both at the nursery and at the outside plantations, are most gratifying. The co-operative planting system is becoming well known and extremely popular through the prairie country. It is conceded on every hand that the work will prove of immense value to the country and should be developed to even greater proportions.

Your obedient servant,

NORMAN M. ROSS.

APPENDIX No. 8.

REPORT OF ARCHIBALD MITCHELL.

DEPARTMENT OF THE INTERIOR,
FORESTRY BRANCH,
NURSERY STATION,
INDIAN HEAD, SASKATCHEWAN, February 18, 1909.

R. H. CAMPBELL, Esq.,
Superintendent of Forestry,
Ottawa, Ont.

SIR,—I have the honour to submit herewith the following brief report of my work as assistant in the Tree Planting Division of the Forestry Branch.

I joined the Forestry Branch on March 1, 1908, and on that date left Edmonton to go to Indian Head to take up my duties there.

A short time before I had been requested by Mr. Bryan, the Principal of the Provincial Normal School at Calgary, to give the students there an address on tree planting, and on my way through Calgary I stopped off and did so. After the meeting was over Mr. Bryan asked me to give his students a similar lecture, any timo I happened to be in Calgary during each session of the school, and, I understand, supplemented and confirmed this request by correspondence with yourself.

The idea of giving the young teachers of Alberta some idea of prairio planting and the general principles of forestry is, I understand, the outcome of a requirement in their curriculum, and which I think reflects great credit on the Educational Department of Alberta. They thus recognize the importance of some knowledge of forestry throughout the West, and are taking what steps they can, through the public schools, to bring that knowledge to those whom it will most benefit. I regret to say that I was not able to be in Calgary during the last session of the Normal School, as my inspection work kept me in Saskatchewan during the summer and fall, but I hope in the future to be able to comply with Mr. Bryan's request as far as possible.

After assisting, at Indian Head, with the packing of the trees for distribution and the other work going forward in the nursery, on May 12 I went down to the Spruce Woods reserve east of Brandon and collected seedling tamarack from the swamps there and forwarded them to the nursery at Indian Head. While in the reserve I also planted 10,000 young Scotch pine seedlings in the fail places of the reforestry experimental plots which have been planted there in recent years. These plots have been quite successful and the plants are beginning to show well above the grass in the older plots.

The collection of elm seed was my next work, and this was done in the Qu'Appelle valley about 24 miles north of Indian Head. Seed was very scarce and several heavy gales and thunder showers at picking time made it still less, so that only a small quantity was obtainable.

After the seed gathering I went west to Alberta with Mr. J. N. B. McDonald, one of the new plantation inspectors, to go over a portion of his territory with him and give him some idea of his work. Alberta is my old inspection district and I was able to point out to him the different local conditions prevailing in that province, all of which have to be considered in the successful growing of trees in that part of the country. This took about two weeks, and on my return to Indiau Head I immediately went to Manitoba and spent a few days with Mr. A. P. Stevenson and another new inspector, Mr. Jas. Kay, looking over some of the oldest plantations in Manitoba, and getting some idea of planting conditions in that province generally.

The forestry exhibit at Brandon Summer Fair next took up my attention. This Mr. Ross and I thoroughly overhauled, and it was a souree of much interest to the visitors at the fair, hundreds of whom visited it. I was in attendance during the five days the exhibition lasted and was able to supply a good deal of information about planting on the prairies, arranging plantations, setting out gardens, and so on, in answer to inquiries.

On my return from Brandon, about July 20, I commenced inspecting plantations and continued until about October 24. The district assigned to me was the northern part of the prairie sections of Saskatchewan, chiefly along the Grand Trunk Pacific and Canadian Northern Railways to the boundaries of Manitoba and Alberta respectively.

The number of parties on my list to be visited was 406 and of these 301 were new applicants. Of the new applicants 150 were prepared to plant, while 151 had made no preparation. Many of the latter are new settlers and, while unable to undertake any preparations for planting in 1908. almost invariably requested that their names be carried over for next year's inspection.

Of the 50 per cent of new applicants who had land prepared for planting, only a little over 40 per cent had their proposed plantations arranged in an entirely satisfactory manner, that is, had their strip of prepared land wide enough and large enough for best results, and at a proper distance from their buildings. These are matters about which the farmers, as a rule, have very crude ideas, and there is no doubt that in this connection lies one of the most valuable features of the work of the inspector, for in these cases where the applicant has not made a good arrangement of his proposed plantation, or has not made a start at preparing the land, the inspector is able to go over the ground with him and point out the best arrangement his experience may suggest, and even, as is frequently done, leave a sketch plan for his guidance. It is also worthy of note in this connection that the men from Manitoba, or the older portions of the Western States, usually require little or no help in this direction. They have been through it all before and know the evil of having their buildings crowded closely round by various strips, and, as a result, you find them with wide belts, inclosing wide and long spaces within which there is plenty of room for new buildings, garden, orchard, calf or pig paddocks, and so on.

The trees planted in 1908 were as a rule well planted and cared for, and very few cases of slovenly work were met with. The necessity for thorough preparation and careful cultivation afterwards seems to be becoming quite widely recognized throughout the country, and quite an improvement in this respect is to be found compared with what it was in 1902 when I made my first inspection trip.

The older plantations are doing excellently well and I was able to take a number of photographs of some of them, so that some record of their progress might be available in the office.

It is indeed a pleasure to see some of these plantations now, five or six years old and 12 to 16 feet in height, inclosing the farmers' premises and affording shelter, no matter how the wind may blow. Such plantations are usually quite a landmark in the district and as a rule act as an encouragement and stimulus to other farmers to do likewise.

While in Alberta, in that part of it between about Nanton and Red Deer, I found many of the older plantations and especially the cottonwoods in them, badly damaged by the previous winter's frosts. This was not altogether unexpected, as in 1907 there was a severe freeze about the middle of August in these higher districts, which caught the trees while the leaves were still on and the plants in full vigour of growth. The leaves were badly blackened and consequently the trees were unable to ripen up before winter, with the result that most of them were badly damaged during the cold weather.

The cottonwoods have always been more or less susceptible to frost-hurt in these districts, and it will probably be better to send fewer of them for a few years and try Russian poplar and perhaps the acute-leafed willow instead. Russian poplar, as is well known, has certain disadvantages which do not make it advisable for planting in certain situations, but I think that this case is exceptional.

One of the reasons why the Russian poplar is not to be recommended for general planting is the fact that its roots spread wherever possible into cultivated land adjoining and there send up a multitude of suckers, which, in time, may become very objectionable. In the middle of a good wide belt, however, it should not give so much trouble in this respect.

Another objection to the Russian poplar has been found in its liability to sunscald and disease, but it would appear that certain varieties of it are not so easily affected in this way as others. It seems that the varieties with spreading branches and thick leaves are more exempt from trouble of this sort than those with upright branches and thin leaves. The bark is thicker and the set of the branches is such that they seem to afford a better shade and protection from the sun's rays. In the Porcupine Hills, about 9 miles west of Staveley, at the Oxley ranch, there are other Russian poplars of this wide spreading variety which are about 35 feet high and about 16 years old, and which are quite sound and in good order. West of Saskatoon this summer I also saw a number of Russian poplar plantations seemingly of the same variety which were about 15 years old and about 32 feet high, from 4 to 5 inches in diameter 4 feet up, and remarkably free from disease. The parent tree was also quite sound and it is interesting to note that it was obtained as a cutting from Dr. Saunders, of the Central Experimental Farm, Ottawa, 17 years ago.

From these examples I should judge that the Russian poplar might, with advantage, be introduced into our plantations in the higher altitudes where the cottonwood is inclined to be tender. Some one of the fast growing poplars is desirable as a mixture in the plantations in order to obtain rapid height, growth and shelter, and even although the Russian poplar might not be a very long lived tree, if judiciously mixed, it could be cut out when its usefulness as a rapid shelter was past, without detriment to the plantation.

I may mention that Mr. Ross takes a similar view of this question and that arrangements are being made to send a number of Russian poplar cuttings into these higher districts in spring.

The acute-leaved willow is also proving pretty hardy in these districts, and at the Oxley ranch there is a specimen about 30 feet high and 16 years of age.

After returning to Indian Head from my inspection tour I was engaged for a short time in the nursery and latterly in the office revising the work of the summer and arranging in detail the quantities of trees to be shipped in spring and preparing plans and other office work. On February 1 I started for Alberta to carry out a month's series of institute meetings.

Perhaps it may not be out of place to mention that, after my being away from any connection with the Forestry Branch for two years, I find on my return to it all over the several districts I have been in this past summer, quite an improvement in the attitude with which the work of prairie planting is viewed by the farmers. Men look at it now with confidence instead of almost suspicion as they were often inclined to do at first, and the community is coming more and more to recognize the value of the assistance rendered them. The *need* of the trees never was questioned at any time, but there seemed in many cases to be a feeling as if they were afraid of compromising themselves in some way by signing the Tree Planting Agreement. Now, as a rule, the men seem to understand the conditions and frankly and with alacrity accept them, and it is seldom necessary, on the inspector's visit, to explain the agreement so fully in detail as it used to be. They know it already and recognize it as a protection for their plantations and necessary for their success in growing them.

To the men from Ontario and eastern Canada generally, who have been somewhat used to government assistance in agriculture, the tree planting movement, while highly appreciated, is not so striking a thing as it is to the settler from the old country and the continent of Europe. These, coming from the wooded countries, recognize at once the need for trees, and appreciate highly the efforts of the government of Canada in attempting to supply their need, the more so, as such assistance is unknown where they come from.

The new comer from the States has been used to assistance in various directions in his farming operations, and also, in some cases, in tree planting, but he also, nevertheless, seems to value very highly the opportunity he finds in this country for obtaining a quantity of planting material grown in the country, and adapted to its requirements, with instructions as to the disposal of it, free of charge.

Altogether, it would appear to be becoming well recognized on all hands that the tree planting movement is a very worthy one, and one readily finds, in conversation with the farmer, that nearly every one of them intends to take advantage of it as soon as he finds himself firmly enough established, and able to undertake the work of planting.

I am, sir, your obedient servant,

ARCH. MITCHELL.

APPENDIX No. 9.

REPORT OF A. P. STEVENSON.

DEPARTMENT OF THE INTERIOR,
FORESTRY BRANCH,
DUNSTAN, MANITOBA, NURSERY STATION, February 26, 1909.

R. H. CAMPBELL, Esq.,
Superintendent of Forestry,
Ottawa, Ont.

SIR,—I have the honour to submit the following brief report on the work done by me as tree planting inspector in connection with the work carried on in this province (Manitoba) by the Forestry Branch of the Department of the Interior, during the summer of 1908.

I began inspection work on the 15th of June. It was soon noticed that the previous winter had done some damage to the young growth of the previous year. The evidence of this injury was not so great in the Red River valley, but in the western part of the province it was noticed and the previous year's growth had got considerably killed back. The cottonwood and Manitoba maple were the chief sufferers. The ash, elm and Russian willow came out all right.

I might note that the winter of 1907-8 was a very trying one on our own grounds, the injury from what is known as winter killing being the greatest in many years. This was especially noticeable among the young trees that had made strong, vigorous growth during the previous summer. I believe the trouble was caused by a very late spring followed by a summer of excessive growth. An early frost caught the young immature growth full of sap, with the above mentioned result. This is the only explanation I can give; it was not excessive cold, as the winter of 1907-8 was a comparatively mild one.

I do not anticipate any unfavourable results this spring, the young growth ripening up its wood well in the fall, the soil also being full of moisture at the close of the season, which is of great assistance to trees of all kinds wintering well in this country.

On June 30, Mr. Arch. Mitchell, assistant in Tree Planting Division, Indian Head, arrived in Morden to examine some of the plantations in that locality. He was accompanied by Mr. Kay, of the Forest Nursery Staff, who was later to take part in the inspection of tree plantations. Various plantations were examined in the Morden, Dunstan and Clegg districts. A day was also spent in the Baldur district. On leaving for Indian Head on July 3rd Mr. Mitchell expressed himself as being highly pleased with the growth and appearance the young plantations had made in so few years.

Mr. Kay accompanied me on inspection work until July 11, when he left to take up inspection work on the main line of the Canadian Pacific Railway and its northern tributaries, including the Glenboro' branch from St. Claude to Sinclair. The district covered by myself was the Red River valley and westward to the western boundary of the province, taking in all the country south of the Glenboro' branch of the Canadian Pacific Railway and also the main line of the Canadian Northern Railway from Winnipeg northwest to Roblin.

The spring of 1908 was a very favourable one for the growth of all tree and plant material of any variety, the rainfall being well up to the average. The percentage of young trees growing that were set out in the spring of 1908 is fully 85 per cent. The older trees also, that had lost some of their last year's wood, quickly recovered from their slight setback, the vigorous growth made being good evidence that their vitality was not in any way weakened.

About the beginning of July the weather set in dry and very hot, the drought lasting till after harvest, but little or no damage was noticed among the young plantations, the trees having a good start and being well established before the dry weather set in. This, together with the thorough preparation of the land before planting, made all the difference between success and failure; for without doubt, had the land not been thoroughly prepared previous to planting, few trees would have survived through the dry heated term that was experienced in southern Manitoba.

It is with pleasure I again note the continued good behaviour of the ash tree and its growing popularity with the farmers.

The Russian willow is being much sought after. Inquiries for this hardy, quick-growing tree are very much on the increase, its general good behaviour under almost all conditions being the cause. One year old rooted cuttings only, if possible, should be sent out to planters.

A few of the first farmers to take advantage of the government co-operative scheme to secure a shelter belt are now turning their attention to the growing of a wood lot for the purpose of raising their own fuel. They find that the work of attending to a block of an acre or two of trees is not such a difficult undertaking as they anticipated when the land is clear of weeds to begin with, and as a horse and cultivator can be used both ways to advantage very little hoeing is required.

In June a visit was paid to the Forest Nursery Station at Indian Head. To the man in the street it is difficult to realize that only four years ago this place was a piece of bare, raw prairie. The transformation that trees, rightly placed, can give to a piece of bare prairie is here realized. It is a great object lesson, and the doubting Thomas goes home strengthened and encouraged to plant trees, convinced that no ideal home can be had without them.

The valuable tests being made with the various kinds of coniferous trees in order to find out their adaptability for prairie planting were also noted. This is a line of work of which practically nothing is known at the present time. The results of these tests will in a few years be of great value to the people of the west. The demand for information on this subject is yearly on the increase, and without doubt it is the desire and ambition of all tree planters to grow successfully a few evergreen trees.

Your obedient servant,

A. P. STEVENSON.

APPENDIX No. 10.

REPORT OF ANGUS MACKINTOSH.

DEPARTMENT OF THE INTERIOR,
FORESTRY BRANCH,
HEADLANDS, NURSERY STATION, SASKATCHEWAN, December 11, 1908.

R. H. CAMPBELL, Esq.,
Superintendent of Forestry,
Ottawa, Ont.

SIR,—I beg to send you herewith a brief report upon the tree planting inspection work with which you entrusted me this year (1908).

I began work on the 15th June at Lipton, and from there zigzagged the country as far as Lanigan. Then turning back I worked from Lipton to Kirkella; and after from Lumsden to Saskatoon on the Prince Albert Railway.

I found the plantations that I inspected on the whole in a satisfactory state. There were of course a few exceptions, where the keeping down of weeds and cultivation had been neglected.

The plantations made three or four years ago are now showing up well, the trees in many places are from 10 to 13 feet in height and shading the ground thoroughly. These plantations need no further soil cultivation.

The plantations set out last spring, and the spring before that, are also doing well, and taking them all over the average failures do not exceed 7 per cent.

There is not so much cutting back among the cottonwoods noticeable this year as there was last year. Most of the trees injured last year have now recovered, and have this year made good growth. This year's shoots seem to have matured well, and look as if they would stand the winter unscathed. As I have remarked in previous reports, there is always more cutting back on soils that have been heavily manured than on unmanured ground. I always tell the tree planters not to manure, as the prairie soil is generally rich enough for forest trees without any artificial fattening.

You will notice on my books, some applicants who wish their applications cancelled, and others who did not have their ground properly prepared. That is mainly owing to the bad seasons we have been having lately, and the discouraging effects they have upon homesteaders who, to begin, had very little capital, and are now deeply in debt. Tree-planting is not of much interest to a person who can hardly secure the necessaries of life. This year on account of bad times I found more empty shacks in my travels than in previous seasons. Quite a number of applicants, mainly bachelors, were away from home trying to earn a little money. Their neighbours often do not know where they are, and thus long drives at times produce no effects.

I find there is a growing desire among those who have plantations three or four years of age for more ash than maple, and that their first impression regarding ash as a slow grower is getting gradually dispelled. They find that when the other trees close in upon the ash it shoots upward, gives a good account of itself, and keeps pace with its neighbours; also that it does not run so much into straggling branches as the maple, and promises to make more useful timber.

Quite a number of people who with care have made their shelter belts a success, ask from time to time if there is any likelihood of conifers being distributed in the near future.

I think it would be advisable to increase the number of trees granted to those who have shown, by the care they have taken of the first lot sent them, that they are worthy of more; to give them, if they have ground well prepared, from 2,000 to 2,700 as a second grant.

I this year visited for the first time some places far back from railways, where trees were sent without the ground having been inspected, and I am glad to say that the statements made by the applicants, as to the state and situation of their ground, were in most cases correct, and that the trees have been well planted and well cared for. Those outlying places take up a good deal of the inspector's time, but they should be visited once in two years at least.

Your obedient servant,

ANGUS MACKINTOSH.

APPENDIX No. 11.

REPORT OF JOHN CALDWELL.

VIRDEN, MANITOBA, February 6, 1909.

R. H. CAMPBELL, Esq.,
Superintendent of Forestry,
Ottawa, Ont.

SIR,—I beg to submit to you herewith my report for the summer of 1908. I began work on June 15, and ended November 30. I had more names than usual on my list, and to finish properly I should have started on June 1.

My territory was the Canadian Pacific Railway main line from the Manitoba boundary west to Regina, from Regina back east to Manitoba on the Arcola line, the Reston and Wolseley line, and the Canadian Northern Railway from the Manitoba boundary to Regina.

During my first two or three years' work among the farmers I found considerable prejudice, partly political, and helped on by tree agents who would like the farmers to believe that signing the agreement presented was almost like placing a mortgage on the farm.

This feeling on the part of the farmers had almost entirely disappeared. They realize that the splendid work that is being done is just what is wanted in wide open prairie country where farmers are settling down by thousands, and to live in a home probably not within miles of a tree, is dreariness and desolation. In order to make a home anything near homelike, it is absolutely necessary to plant trees, and to plant a good many.

There are so many rich plantations springing up here and there all over my territory, that it has become a matter of course for the farmer to get his name on the list, and to take government trees as soon as he is ready.

Of course, we are working in a new country where most of the farmers are more or less hard up, and where so many improvements have to be made, and it is sometimes hard for them to do things just as well as they themselves would like, so it is up to the inspectors to impress upon them the importance of having their land well prepared, and to take no more than they can care for properly.

My instructions this season were to give no man more than 1,500 for the first time. I gave quite a few less than that ; but once in a while I come across a man who, I feel sure, is quite capable of caring for at least 3,000, and who may be anxious to plant them all at once. In that case I book him for what I think he should have, and make a note to that effect on the margin. However, our motto should be, 'What we do, do it well.'

We are bound to meet with a few failures or partial failures, and I believe as time goes on when one farmer has a splendid plantation and his neighbour's trees are only middling or worse, then is a good time to become even more strict, as they can see that the growing of a fine grove is entirely in their own hands, and is simply a question of good or bad management.

The stock sent out from the forest nursery at Indian Head is the very best for the purpose, and generally reaches the farmers well packed and in good order. The cottonwood is the only variety which, I believe, has sometimes reached the farmer a little out of condition. There may be a little danger of them being dried or heated on the road up from Dakota, or being tied too tightly when being buried for the winter.

This last winter was a splendid try as to the hardiness of the different varieties. The previous summer being cold and wet, the growth had a very poor chance to mature, which left them in poor shape to stand the winter, and a light snowfall made it worse. The cottonwood suffered by far the worst, most of them being badly frozen back, and a few frozen dead.

The elm, ash, maple, willows and Russian poplar all stood the test well. I noticed a few maple, ash and elm killed, but in each case the cause was shallow planting, which is a fatal mistake. These young trees stand a poor chance of living with half an inch or more of the root above ground.

The cottonwood in Saskatchewan seems to do well, and those that were frozen back made great growth this last summer.

The willow cuttings which have been sent out have done well, and are a splendid mixture in a plantation. Few Russian poplar have been sent out lately, but Mr. Ross is getting quite a stock at the nursery, and I would say to send out some. I would not advise planting many on good land, but where the land is sandy or a gravelly bottom, then Russian poplar is one of the best.

The elm has done only middling. It seems to grow slowly, and is liable to be chewed off by rabbits, but when they once come up to six or eight feet they do better, and in the long run elm and ash should be the best. The ash has given pretty good satisfaction right from the start.

The native maple, as usual, is doing well.

I sent a bunch of Russian red willows to Mr. Ross last spring; that is a fast grower and extremely hardy. It grows well on high, dry land, and on low ground it does better than most of the other varieties.

About eighty-five per cent of the trees in my district are doing well. The demand is growing each year, and is likely to increase pretty fast.

I think it is well to leave most of the names on the list, and to make a special effort to call on the new men and to send a return circular to all we do not see.

A few are talking of planting for fuel and posts, but that will not become general till the farmers are in a better position to give the plantations the necessary care.

Quite a few are asking for evergreens, and when we are in a position to send out a few they will indeed be very acceptable.

I still carry my dibble, and give a good many object lessons, which are always appreciated. Most of the young trees sent out are easily planted with a dibble, and as I find new men imagine it quite a contract to put out even a small plantation, I want to show them what an easy matter it really is.

I think we have reason to be pretty well pleased with our progress so far, but I believe we should be a little more strict as to cultivation both before and after planting, as failure or partial failures can generally be traced to poor cultivation.

Twice during the season I had the pleasure of visiting the nursery at Indian Head, and to spend a day there is a real pleasure. The nursery there is a great credit to our efforts in helping to make the thousands of farm homes in the west.

Your obedient servant,

JOHN CALDWELL.

APPENDIX No. 12.

REPORT OF WALTER GUITON.

DEPARTMENT OF THE INTERIOR,
FORESTRY BRANCH, NURSERY STATION,
INDIAN HEAD, SASKATCHEWAN, December 26, 1908.

R. H. CAMPBELL, Esq.,
Superintendent of Forestry,
Ottawa, Ont.

SIR,—I have the honour to submit to you my second annual report on tree planting inspection work as carried on through the co-operation of the Forestry Branch, Department of the Interior. The districts assigned to me were:

Main line of the Canadian Pacific Railway, Grand Coulee to Moosejaw.

Soo line, Moosejaw to North Portal,

Estevan line, Estevan to Gainsboro'.

Main line of Canadian Pacific Railway, Moosejaw to Lethbridge.

Crowsnest, Lethbridge to Pincher Creek and Cowley.

Alberta irrigation line, Lethbridge to Cardston.

There were 640 applicants on my books, 317 of whom were new applicants. Of these 210 are to receive trees in the spring (1909), while the other 107 will be visited next year, when they will have had more time to cultivate.

The total number of trees recommended by me this year will be 452,520 to old and new applicants, numbering 415.

On April 1 I commenced work at the Forest Nursery Station, making cuttings, planting and assisting with the usual spring distribution of trees, until the 15th of June, when I left Indian Head to inspect plantations on the main line of the Canadian Pacific Railway from Grand Coulee to Moosejaw, also the Soo line. During the whole of this time I found trees making a splendid growth. The tops of the cottonwoods were badly killed back last year, from too late a growth, largely due in many cases to cultivation being carried on later than the third week in August.

On the Estevan line, where planting has been carried on for a number of years, I found the trees, which are from 10 to 15 feet high, shading the ground sufficiently to keep down the weeds and cultivation no longer necessary.

From Gainsboro' I returned to Moosejaw, continuing my way west towards southern Alberta at Swift Current, where we have a large number of plantations. I found the trees doing very well, also well protected from stock. While there I inspected the land at the Mennonite village, twenty-three miles southeast of the town, where the settlers have prepared a sixteen-acre strip running the full length of the village on the west side. This will be, when completed, the largest solid block of trees set out under the co-operation of the Forestry Branch, which will demonstrate to the settlers the advantage of shelter. Care has been taken by the department that the trees on this strip are at a sufficient distance from the buildings (360 feet) so that in the future the enlarging of the present buildings would not disturb the trees.

The plantations planted around Maple creek are doing remarkably well considering the small amount of rain which fell during the summer, but by following the rules given by the inspectors as regards cultivation which is carried on during the dry spell, thus retaining what moisture there is in the ground, this disadvantage is greatly lessened.

I also visited the Cypress hills, about twenty-three miles south of the town, to pick jackpine cones, Murrayana variety, which were shipped to Mr. Norman M. Ross at Indian Head.

Leaving Maple creek, I continued my way inspecting along the Crowsnest Railway till I reached Lethbridge, where the trees are grown under two systems. The trees grown under the irrigation system are doing very well. The best results seem to be when the water is turned off the second week in July, so that the trees may have sufficient time to ripen before the frost comes. A good plan, which has shown good results, is to irrigate the ground the last thing in the fall, so that the ground when frozen may be thoroughly moist, thereby having a tendency to check the trees from budding out too early in the spring.

To cultivate trees we all know that a sufficient amount of time and labour is required to be spent upon them to keep the weeds from growing, which takes the moisture from the trees. The soil should always be kept in a loose state so that evaporation does not become too rapid. In dry weather evaporation is effectively diminished by frequently stirring the soil which forms a loose, dry, protecting covering for the deeper layers.

The country southwest of Lethbridge is known as the Mormon district. Here tree planting has been carried on for the past eight years. The killing back of the cottonwood was not noticeable here on account of splendid growth this year. The willow cuttings given out by the Department would have attained a bigger and stronger growth if the rules had been more closely followed in regard to planting, not leaving so much of the young cutting exposed.

The percentages of trees living, set out this year are: elm 98, ash 95, cottonwood 90, maple 95, willow 90.

The increase in the number of new applicants is encouraging, as it shows the interest taken by the farmers in the planting of the prairies.

I arrived in Indian Head the middle of October, assisted with the heeling in of the trees for spring distribution, after which I went into the office at Indian Head, making plans and assisting in the general routine of office work.

Your obedient servant,

WALTER GUITON,

Tree Planting Inspector.

APPENDIX No. 13.

REPORT OF JAS. KAY.

DEPARTMENT OF THE INTERIOR,
FORESTRY BRANCH, NURSERY STATION,
INDIAN HEAD, SASKATCHEWAN, December 26, 1908.

R. H. CAMPBELL, Esq.,
Superintendent of Forestry,
Ottawa, Ont.

SIR,—I have the honour to submit the following brief report on my work as Inspector of Plantations set out under the co-operative system of the Forestry Branch.

I commenced work at Indian Head about the beginning of April, assisting in the distribution of trees and other nursery work, and left Indian Head at the end of June to commence regular inspection work.

The district assigned to me by Mr. Ross was in the northern parts of Manitoba, viz., Glenboro' branch of the Canadian Pacific Railway from St. Claude to Sinclair, the Yorkton branch up to and around Foam lake, the Miniota, Lenore and Brookdale branches and the main line from Rosser to Kirkella.

There were 450 applicants to be visited on my list, 115 being new; of these new applicants 92 were promised trees, 23 not receiving trees for various reasons, such as, land not in fit shape to plant trees, being too rough, that is, backsetting not well done, land in grain crops, others having plenty of natural bluff and therefore not requiring trees, &c. In all, 266 applicants were promised trees to the number of 229,100 for the spring of 1909.

With a few exceptions I found the trees set out under the co-operative system making satisfactory progress, the exceptions being due mostly to want of time, help, sickness, or some other unavoidable circumstance.

The following is an approximate percentage of trees living: Ash, 98 per cent; elm, 98 per cent; maple, 95 per cent; cottonwood, 85 per cent; willow, 80 per cent; giving an average of 90 per cent, which I consider very satisfactory.

Many farmers at first are not in favour of ash and elm, owing chiefly to their slower growth, but those that have a larger experience of them prefer to have a good percentage of both ash and elm in the mixture, as they are beginning to realize the fact that these two trees will become useful about the farm later on, and when properly mixed with the maple and cottonwood are quite able to hold their own.

The Manitoba maple and cottonwood are general favourites and have done fairly well in most of the districts I travelled over. They are hardy and give good shelter in a very short time when given proper care and cultivation, both of which are necessary to obtain the best results.

Willows are also giving satisfaction, and when properly planted make a quick, bushy growth and make an excellent hedge for wind or snowbreak, and are also quite hardy.

There were a good many trees damaged by frost last winter (1907) even among the older trees, this being probably due to the late short spring and wet summer, keeping the trees growing late in the fall, with the consequence that the new growth was not properly ripened, therefore was killed back when frost set in, some trees being killed outright, the roots of the latter being probably not so well protected by snow or other covering. The periderm or outer covering on roots is thinner than on stems and consequently the former are less protected, and besides growth is generally active for a longer period on roots, where it frequently continues till well on in winter, so that when frost occurs the tissues are not in the inert condition which assists them to resist cold. Such plants burst their buds in spring, but wither whenever transpiration from the tender young shoots has exhausted the supply of water stored up in the plant.

On the Yorkton branch of the Canadian Pacific Railway, north of Binscarth, the ash were nipped back by a 9th of June frost; the 1908 plants only lost their leaves, but the 1907 growths on older plants were killed back, but afterwards recovered and put on a good growth.

These two examples would tend to show that the condition of vegetation in regard to the season of the year has great influence in the power of a plant to resist frost. It is well known what low temperature a plant can stand during the period of winter rest, whereas in spring after the beginning of vegetative activity, and before it ceases in autumn, it is killed by a few degrees of frost.

There should not be much cutting back by frost this winter, as owing to the dry nature of the summer and fall the trees composing the plantations began to lose their leaves early, thus giving them time to ripen the new wood before severe frost set in.

In some cases the 1907 cottonwoods were disfigured by a rough growth in the twigs, this growth being due to plant lice, viz., vagabond gall (*pemphigus vagabundis*). The galls were not noticeable till they had lost their green colour, turning black in the fall, they were then easily seen. There were a few galls this year, 1908, but not in such quantity as in 1907. Farmers were advised to cut off and burn them while still green, thus destroying the insects inside the galls.

Pruning seems to be a vexed question with a good many planters, but many of them who have pruned find that it has given them years of extra labour to keep down weeds, and that they would have had better windbreaks and plantations if they had kept their knives off the trees. Pruning the trees of these plantations should be quite unnecessary, as the trees are planted close enough, so that after a few years growth the low branches are shaded, cut off from the light, die and drop off, leaving the stems clean and free from branches. The shade also helps to keep down weeds, and also prevents radiation and consequent evaporation of soil moisture, thus rendering cultivation no longer necessary. Any one can see this for himself in the natural bluffs; the straightest, cleanest and best trees are where they grow thickest.

Pruning is only advisable in the case of ornamental and avenue trees where the lower branches would be in the way. When pruning a branch, care should be taken to cut the branches off as close to the main stem as possible, so that the wound will heal over quickly. If snags are left sticking out they decay, the rot spreads into the interior of the tree, making it of little or no value for anything.

In the districts I travelled over the earlier set out plantations are already affording good protection to buildings, and have enabled farmers to lay out nice gardens and lawns in their shelter, in which gardens they can grow quite a large variety of vegetables, flowers and small fruits. Many farmers are also planting out some of the larger fruit trees, and these when carefully selected, give every prospect of success.

The majority of farmers who are planting take quite an interest in the work, which is demonstrated in the time and work and care they have given the trees received from the Forestry Branch.

Your obedient servant,

JAS. KAY.

APPENDIX No. 14.

REPORT OF N. B. McDONALD.

DEPARTMENT OF THE INTERIOR,
FORESTRY BRANCH,
INDIAN HEAD, SASKATCHEWAN, January 12, 1909.

R. H. CAMPBELL, Esq.,
Superintendent of Forestry,
Ottawa, Ont.

SIR,—I have the honour to submit the following report of my work as Tree Planting Inspector in connection with the co-operative tree planting of the Forestry Branch. The district assigned to me was in Alberta, the country along the Canadian Northern line from Islay to Edmonton, the Canadian Pacific Railway line from Edmonton to Calgary, including both Wetaskiwin and Lacombe branches, the Calgary-Macleod line as far south as Granum, and the main line from Cochrane to Medicine Hat.

The number of places to visit on my list was 568. To 261 of these trees will be sent, 220 were new applicants, of whom 130 receive trees next spring.

After spending two months and a half in the nursery station at Indian Head assisting with the distribution of trees, spring planting and other work, I started out on inspection work on June 15 via Calgary and visited first the district round Airdrie, Crossfield and Wetaskiwin to note the results at different elevations of some of the older plantations and to see how the cottonwoods had stood last winter.

The plantations along the Canadian Northern line had not been inspected before, and it was evident that many of the people did not understand the amount of cultivation necessary as a preparation for tree planting, as about fifty per cent of the new applicants had to be deferred for a year, and much of the ground planted in 1908 would have been better for another year's cultivation. In this newly settled country I found a potato crop usually a much better preparation for planting than summer-fallow, as the farmer must have his potatoes anyway and generally gives them good cultivation; while the land to be summer-fallowed is often allowed to stand in the press of work till late in the summer, when the growth of grass and weeds is so great that the main object of summer-fallow, the conservation of the moisture, is entirely defeated.

Conditions were much better in the districts along both the Wetaskiwin and Lacombe branches of the Canadian Pacific Railway. The country here is open and the want of native timber is felt very much. The few bluffs that have escaped the fires are being rapidly cut out, and I even heard of cases where people came twenty miles to cut poles at night on other peoples' farms; so that the owners in self-defence had finally to cut what was left that they might have a little for their own use. The plantations out in these districts are doing well, and as people realize this and their material conditions improve, I have no doubt that there will be a great increase in the demand for trees to plant.

From about Red Deer south, as far as Staveley, and east to about range 25, west of the 4th meridian, I was sorry to find many of the plantations not so satisfactory, having been badly damaged by the frosts of last and preceding winters; the cottonwood, indeed, may be said to be a complete failure. This district is higher than the rest of the country and on this account seems to be subject to occasional early frosts in the fall, and the soil being generally of a rich black loam, the growth seems to be carried on so late that the new wood is not ripe when the frost comes, and more or less damage is the result. This seems to be particularly true of the cottonwood, though in many of the plantations it must be said that the elm, ash and maple have also suffered badly. This season, however, has been more favourable, the wood being fairly well ripened before the first frost and likely to stand the winter.

Russian poplar and native trees, such as the balm of gilead, balsam and spruce, do well in this district, but few of the people are within reach of the native plants and those who are frequently lift and plant them badly, the roots often being allowed to dry out on the journey from the bush to the farm, and many of the trees never make a start after being planted.

From about Staveley, south and east, all the trees, including cottonwood, are doing well and making good growth.

In the Gleichen and Medicine Hat districts conditions are very favourable. The trees are growing rapidly and ripening early where the soil is lighter.

With a good many people the ash is not a favourite on account of its slow growth for the first two or three years, but its qualities as a tree suitable for planting on the prairie are being well shown in the older plantations; most of the trees being already as high as the maples and making a yearly growth of from eighteen inches to two feet.

The percentage of deaths in the plantations is small, and this should improve as people understand the planting better. Most of the blanks were amongst the willows, caused no doubt by either loose or shallow planting of the cuttings, and in some cases where the outside row was planted too close to the sod the spreading grass roots getting most of the moisture and the plants suffering accordingly.

Your obedient servant,

N. B. McDONALD.

APPENDIX No. 15.

REPORT OF JAMES LEAMY.

DEPARTMENT OF THE INTERIOR,
DOMINION LANDS OFFICE,
NEW WESTMINSTER, B.C., January 16, 1909.

R. H. CAMPBELL, Esq.,
Superintendent of Forestry,
Ottawa, Ont.

SIR,—I beg to submit the following report in connection with the preservation of the forests from fire and the work done by the forest fire rangers in the employ of the Department of the Interior, for this purpose, in the railway belt in the province of British Columbia, during the season of 1908, which was an excessively dry one and numerous fires occurred, the suppression of which necessitated the employment of a large number of temporary men, and consequently the expenditure of a considerable amount of money, also constant vigilance on the part of the regularly appointed fire rangers in the various districts.

A fire occurred on Timber Berth No. 29 in Yoho park, which, while causing some anxiety, did not do any damage, being subdued by Ranger Buttwell and some men employed under him. This fire was caused by a survey party who were engaged in surveying this berth.

In Mr. Fisher's district, which extends up the Beaver river, and from Donald to Surprise rapids, on the north boundary of the railway belt, a fire occurred which was supposed to have been caused by lightning, there being no person in that neighbourhood; no damage, however, was done thereby.

In Mr. Ashdown's beat, extending along the Columbia river on both sides from the south boundary of the Railway Belt north to Donald, a number of small fires occurred, and some money was expended in fighting them, but no timber was lost.

A fierce fire raged on provincial land in this vicinity for some time, but did not reach the railway belt, owing to the watchfulness of Ranger Ashdown.

Numerous small fires started along the line of the Canadian Pacific Railway between Glacier and Revelstoke and were attended to by Ranger Kennedy. Up the Loop, near Glacier, a bad fire occurred and did considerable damage by burning a snow-shed on the Loop and extending across the mountain near to the Glacier hotel; a large number of men in the employ of the Canadian Pacific Railway, working under the direction of Ranger Kennedy, succeeded in preventing this fire from doing any further damage than as before mentioned.

Along the branch of the Canadian Pacific Railway running from Revelstoke to Arrowhead a number of small fires occurred, being chiefly caused by sparks from locomotives and by settlers clearing land, but were promptly looked after by the Rangers, Messrs. McRae and Morris, also by the Canadian Pacific Railway sectionmen, therefore no damage was done by them; they principally occurred in old logging works and other debris left from clearing the line of railway.

Through the valley of the Eagle Pass river several large fires occurred, notably one on Limit No. 363, held under license by the Eagle River Lumber Company; this fire it is claimed was ignited by sparks from a logging engine operated by the licensees, and burned over an area of 1½ square miles, which had, however, been logged off by the company some years ago; it destroyed two logging camps belonging to the company and some logs on skid-ways amounting to 50,000 feet board measure.

The only other fire that caused any trouble in this valley was one which started about one mile south of Malakwa on the Canadian Pacific Railway line. It was attended to by Ranger Lidstone, who got it under control and prevented it from doing damage.

The largest and most destructive fire that took place in the Railway Belt in British Columbia occurred in the Shuswap Lake district, in the vicinity of Carlin and White lake; it burned over an area of 2 square miles, partly in a logged out section, on Limit No. 239, under license to the Columbia River Lumber Co.; it is calculated that at least six million feet has been affected by this fire and unless logged out within the next two years, will be lost. This fire is supposed to have been partly caused by sparks from a locomotive operated by the Columbia River Lumber Company in hauling lumber from their Carlin mill to the main line of the Canadian Pacific Railway in the immediate vicinity of White lake; the fire was also set maliciously by some person, as the Fire Ranger, Mr. Peacock, discovered that the fire was started in some six or seven places, evidently with the intention of burning up that entire district. This fire was looked after by Mr. D. J. McDonald, Assistant Crown Timber Agent, and Mr. W. R. Peacock, fire ranger in charge of this district, and it is due to their combined efforts that the whole of the peninsula situated between the main Shuswap lake on the north and the Salmon Arm on the south, was not completely burned over and all the timber thereon destroyed. A glance at the map of the Shuswap lake will show this; both of the gentlemen were untiring in their efforts, working day and night supervising the work of fighting this fire.

The fire on Manson creek, in Limit No. 240, on the north shore of Shuswap lake, held under license by the Arrow Lake Lumber Company, was caused by squatters clearing and burning brush; this was likewise a very serious fire, affecting about four million feet of good merchantable timber. A bad feature in connection with this fire is that while the men were fighting and quenching the fire it was constantly being reset by malicious persons, who evidently desired to burn up all the timber in that country. I may say that this fire was also overlooked by Messrs. McDonald and Peacock, assisted by the foreman of the Arrow Lake Lumber Company, the company having sent a force of men from Kamloops to look after it.

Another fire, of no consequence, took place on Limit No. 242, on the north shore of the Little Shuswap lake. I may add further that several small fires occurred on the Big Shuswap lake, which were probably set by Indian campers or others, but they were promptly extinguished by the patrol men stationed along the lake and did no damage.

On the Shuswap and Okanagan branch of the Canadian Pacific Railway small fires occurred in many places but did no damage; one occurred about one mile west of Armstrong on some deeded lands, which was attended to by Mr. Johnstone, Fire Ranger, who succeeded in preventing it from spreading into valuable timber along the Salmon River valley; no loss was occasioned by this fire.

A very large fire took place on Deep creek, which fire was caused by settlers clearing land, and extended over some nine hundred acres of bush; it was looked after by Mr. J. D. McQuire, Fire Ranger, who succeeded in preventing it from extending into the Larch Hill reserve and into Limits Nos. 386 and 402, which would have happened if it had not been properly looked after.

A fire occurred up the Salmon river at Silver creek, which was properly attended to by Mr. J. D. McQuire and assistants; it did no harm, as it ran through timber grass and did not destroy any timber, only requiring constant watching.

In the Skemeekin valley a fire occurred which at one time threatened to destroy the timber on Berths Nos. 428 and 451, but was prevented from doing so by the prompt action of the Ranger, Mr. Peacock.

In China valley a fire started which threatened to destroy timber not yet leased, but nevertheless valuable; this fire was prevented from doing any damage.

In the district covered by Mr. Angus McGillivray, around Ashcroft and along the Nicola valley, several small fires occurred but did not do any damage to standing timber. Along the line of the Canadian Pacific Railway in the vicinity of Hope and Yale some fires started which were attended to by Mr. Teague, whom I engaged to look after this district, as it was practically impossible for Mr. Fadden and Mr. Hughes to give proper attention to the large districts in their charge.

On Harrison lake two fires of considerable importance took place, one at Twenty-mile Point on Timber Berth No. 281 started in the month of May; this did no damage but another fire occurred in the same place later in the season, which destroyed about fifty thousand feet board measure of timber. The other fire referred to took place on Timber Berth No. 445, and considerable expense was incurred in fighting it; about sixty thousand feet of saw-logs which were cut and lying in the path of the fire, were destroyed thereby; operations were being conducted on both of these berths at the time the fires took place, and the fires are supposed to have originated from sparks from their logging engines.

In the Cultus Lake district only two fires took place, one of them on a steep mountain side, destroying about 10,000 feet of merchantable timber; the other fire did no damage.

At Abbotsford, in the district covered by Mr. John Ball, a fire of considerable proportions took place, but with the assistance of a number of men Mr. Ball was able to prevent its doing any damage.

At Stave river a fire started on Timber Berth No. 268, under license to the Bank of Hamilton, but operated by Messrs. E. H. Heaps & Company; the cause of this fire is unknown, but with the assistance of a number of men the Rangers, Messrs. Martyn and Gilchrist, were able to prevent its doing very much damage; about two hundred cords of shingle bolts were destroyed by this fire.

Another fire occurred in this district on lands on Timber Berth No. 106, presumably started by a party who was living on land which forms a part of this berth; no damage, however, resulted therefrom.

Along the Coquitlam and Pitt Lake rivers, some small fires occurred, but were promptly attended to by Mr. Marshall, the ranger of this district.

On the North Arm of Burrard Inlet only one fire took place, on a small island on which there was no timber, and I consider that the Ranger, Mr. Jeffrey, must have attended strictly to his duties, this being considered a very dangerous district, owing to the many campers who spend the warm months of the summer in this vicinity.

On the south side of the Fraser river a number of fires took place in the vicinity of Timber Berths Nos. 'B,' 'K,' 'H,' 'R' and 293, but owing to the prompt attention of Messrs. Johnson, Gairns and Jameson, the fire rangers in this district, with the assistance of other men, no timber can be said to have been destroyed.

In the whole Railway Belt, in my opinion, not more than 200,000 feet of merchantable timber was actually destroyed during the season, and I consider this small loss is due to the faithfulness and efficiency of the various fire rangers, who were untiring in their efforts, and who have at all times shown a willingness to perform their duties.

Your obedient servant,

JAMES LEAMY,
Crown Timber Agent.

APPENDIX No. 16.

REPORT OF W. R. McLEOD, CHIEF FOREST FIRE RANGER.

DEPARTMENT OF THE INTERIOR,
DOMINION LANDS AND CROWN TIMBER OFFICE,
PRINCE ALBERT, SASKATCHEWAN, Nov. 19, 1908.

R. H. CAMPBELL, Esq.,
Superintendent of Forestry,
Ottawa, Ont.

SIR.—Attached herewith you will please find report filled in as requested in yours of the 5th instant.

In further reference to this report I may add that we have had a lot of fires to contend with with during the months of May and June principally caused through carelessness on the part of travellers and hunters, in leaving camp fires and lighting pipes, as the grass was very dry and did not require a big spark to start burning; however, with the number of fires I consider that the service was very good and saved many times the amount of expense incurred in checking the fires.

We had two bad fires to contend with, viz., the Shrimp lake fire and another near Mistatim on the Canadian Northern Railway branch. These were practically the only fires where any great assistance was required and any amount of extra expense was incurred.

The last mentioned fire at Mistatim must have been caused by lightning, as there was no person near the starting point.

I believe great assistance could be had from the provincial government if they enforced their laws respecting prairie fires, as I understand all officials of the provincial government are fire guardians, but they will let the prairie fires run unnoticed, and nearly all our fires in timber land came from the prairie.

I believe I am safe in saying that the only damage caused in this district has been to second growth pine, and the total amount damaged would not exceed 1,800 acres. Of course, all the second growth pine was not damaged in this above mentioned radius.

Our timber land is broken with poplar bluffs, and these bluffs assist us greatly in fighting fires, as the fire will not run so fast in the poplar as in spruce and pine.

The system we have found most satisfactory in fighting fires is to work at night when the air is heavy and moist, and dig a trench in suitable places where the fire has too far to jump so as to make it a ground fire. The ordinary garden hoe and wet sacks where water can be had we find to be the most effective.

Your obedient servant,

W. R. McLEOD,
Chief Forest Fire Ranger.

9-10 EDWARD VII., A. 1910

APPENDIX No. 17.

REPORT OF INSPECTOR W. CONROY.

DEPARTMENT OF INDIAN AFFAIRS,
OTTAWA, March 31, 1909.

R. H. CAMPBELL, Esq.,
Superintendent of Forestry,
Ottawa.

SIR,—In compliance with your request I beg to report upon the work done by the fire guardians in northern Alberta for the past year. I might be permitted to state that the work done by them in forest protection has been very satisfactory and a great many fires of long burning were extinguished.

Mr. Samuel Cunningham, who was appointed last spring for Lesser Slave lake, has a very large country to travel over and I was informed by very good authority that he extinguished a number of fires north and south of Lesser Slave lake that had been running for a year or more.

Mr. Duncan McDonald, of Dunvegan, has about 200 miles of the Upper Peace river. He also did a great amount of fire fightiug.

I would strongly recommend that the department appoint another guardian from Peace River crossing to Wolverine point, as there is considerable timber fringed along the river which is very valuable. Wolverine point is about 150 miles down the river and would be sufficient for one man to attend to.

If the department would appoint another guardian from Wolverine point to Lachute I think it would be a good thing for the country as the timber is all very valuable. I might say that the Lower Athabaska is well attended to but a man might be appointed for the Upper Athabaska for a hundred miles or more from the mouth of the Little Slave river. Another should be appointed at Grande Prairie, a large tract of country with many bluffs. Big Smoky river would also come within that district.

Your obedient servant,

W. CONROY,
Inspector Treaty 8.

APPENDIX No. 18.

CANADIAN IRRIGATION SURVEYS.

REPORT OF JOHN STEWART, D. L. S., C. E.,

Commissioner and Chief Engineer of Irrigation.

In the spring of 1908 I sent two engineering parties into the field, one in charge of Mr. R. J. Burley, in Saskatchewan, and the other in charge of Mr. P. M. Sauder, in Alberta. Both these men had instructions to make inspections of all ditches authorized, gauge all streams and make surveys of lands to be purchased under the terms of the irrigation system. Under these instructions Mr. Burley made 101 inspections of schemes authorized, 28 inspections of licensed schemes, 36 surveys of lands to be purchased, 11 transit surveys of ditches and made 66 gaugings of streams in his territory and sent in to this office 160 reports. Not having the new meters until late in the season, he was unable to gauge all streams but made a number of weir measurements of small streams before the meters arrived. Mr. Burley had one assistant for the purpose of gauging streams who also helped in making surveys; outside of the other surveys mentioned above be made measurements of earth removed and an estimate of the cost of the Enright and Strong irrigation scheme, in all 14 miles of ditches.

The second party in charge of Mr. Sauder in Alberta made 26 inspections of ditches authorized, 5 inspections for domestic purposes, inspected 19 applications for water, made 2 surveys of Tide lake and Trout creek, and gauged 37 streams, a total number of gaugiugs of 152, and set 11 gauge rods and erected 3 cable stations for gauging streams, 5 bridge stations and 3 wading stations. He also inspected 5 licensed schemes. Mr. Sauder had two assistants for gauging streams.

In the past season I have personally inspected the Southern Alberta Land Company's property for the exchange of lands, made a survey of the Canadian Pacific Railway Company's reservoir on Thomas Winter's land at Fleming Station, also inspected the Canadian Pacific Railway reservoir at Moosomin Station, the Indian Head waterworks, Enright & Strong's irrigation scheme, and made a survey of Andrew Gordon's and J. W. Imes' irrigation schemes on the Red Deer river. I inspected the Canadian Pacific Railway works at Elkwater lake, inspected some dry lakes southwest of Saskatoon, for Davidson & McRae, of Winnipeg, the Moosejaw waterworks from Snowdy's springs, Maple creek waterworks from Saunder's springs and gauged Milk river at highwater for Dr. King. I also went over the St. Mary lakes and Milk river schemes with Dr. King and the United States officials.

With reference to the inside work of this office during the past year there have been the following number of communications received and sent out, viz.:

Letters received	4,235
Letters sent out	4,162
Agreements for water received, in triplicate	31
Applications for water received, in duplicate	43
Plans with applications for water	86
Right of way easements	38
Agreements for supply and use of water	1
Agreements for construction and maintenance	3
Transfers of applications	4
Transfers of land	2
Gauge rod reading (monthly)	149
Gauge rod (weekly cards)	567
Right of way plans recorded	37
Notice of cancellation of water agreements	6

Notice of transfers of water agreements....	38
Applications to cross-road allowances....	40
Applications for right of way over Crown lands....	31
Notice of applications prepared for publication....	39
Number of certificates under section 20 of the Act..	52
Number of certificates under section 33 of the Act....	26
Number of final licenses recorded, in triplicate....	38
Number of reports received from Mr. R. J. Burley..	160
Number of reports received from Mr. P. M. Saunders.. ..	52
Number of cards of discharge of streams....	207

In a great many of the letters received there were inclosures which had to be recorded in the books of this office and do not show in the number of letters received. and in connection with right of way plans, which are in triplicate, they all have to be compared and checked before registration, which means a lot of work that does not show, also a large amount of blue printing that has to be done and does not show.

APPENDIX No. 19.

REPORT OF RALPH J. BURLEY.

CALGARY, ALBERTA, March 31, 1909.

JOHN STEWART, Esq.,
Commissioner of Irrigation,
Calgary, Alta.

SIR,—I beg to submit the following report upon the work performed by me, and general remarks regarding the progress of irrigation development in the Cypress Hills district during the past season :—

Camp was set up in Maple creek on May 2, and, as soon as possible thereafter the work of inspection and stream gauging was commenced. This work was carried out on practically the same lines as last year, all inspections and surveys in the neighbourhood of Maple creek being made first, then moving the outfit in an easterly and southerly direction to east end, inspecting all schemes on the north side of the hills and then moving west, covering the territory along the south side as far as Eagle Butte and Medicine Hat. Owing to the heavy snowstorm on October 21 and 22, it was impossible to make any inspections north of Tenmile Police Detachment and west of Maple creek, excepting those made in the spring and summer on special trips.

In connection with this inspection work some eleven of the longest ditches were traversed by transit with the idea of carrying on this work in future in such a way that it will not take too much time from the actual work of inspection until the department has in its possession accurate maps of all schemes licensed or authorized. While such work takes considerable time, it will, I think, save much trouble in the future regarding right of way, and many difficulties between the settlers themselves will be avoided if each man's rights are definitely known.

During the past season, progress, in many instances, has been slow owing to various causes, such as a misunderstanding regarding the dipping regulations, and the dry season, causing great difficulty in working the ground and necessitating such long hauls for hay and so unduly prolonging the time necessary to put up sufficient feed for stock.

The question of obtaining hay and fodder for stock is being brought to the attention of the ranchers more forcibly every year as the district becomes more closely settled, because the government lands bearing hay are becoming, in many places, very inadequate to supply the demand and it seems that irrigation, used to increase the yield of grass, is the only remedy. The effect of irrigation was strikingly illustrated at Messrs. Enright and Strong's last summer, where, on the upper side of the ditch there was a sparse growth of grass perhaps three inches long and on the irrigated land the bluejoint grass, timothy, alfalfa, &c., were very thick and reached a height of two to three feet. Where such results can be obtained in a dry season like last summer by use of irrigation it must be apparent that it is to the interest of the rancher to complete his works at the earliest possible date.

The conditions of climate and soil in many portions of the Cypress Hills district appear to make it particularly adaptable to irrigation and, although still in its infancy, as regards actual work accomplished, enough has been done to show that under intelligent management the best results may be anticipated. Mr. H. H. Fauquier, near Maple creek, who has been working out his irrigation system for some thirteen years, has demonstrated, year after year, that practically all garden products which can be grown in Ontario can be brought to perfection here, and there are other men who are experimenting along different lines, whose work is beginning to show the possibilities of irrigation in this portion of the semi-arid belt. The long hot days and warm nights appear to produce a condition extremely favourable to growth when the necessary water can be applied.

HYDROGRAPHIC WORK.

This work was carried out in conjunction with the inspections, but as there was practically no snow in the hills during the preceding winter and very little rain during the summer the majority of the creeks went dry during the month of August and part of July. All creeks were measured where possible and eight gauging stations established on some of the more important streams. Several more stations should have been established but owing to the lack of cables and chain gauges and to the fact that most of these other streams were dry last fall it did not appear advisable to expend the time obtaining and transporting such supplies until next season's work commenced, and as there were a great number of inspections pressing for attention this work had to be deferred. My assistant, Mr. Fletcher, started out on a second round of the hills, in October, with instructions to make gaugings of all the streams but was unable to proceed further than Bear creek on account of the heavy snowstorms on the 21st and 22nd.

This work in the Cypress hills is very important, but is rather difficult to carry out owing to the fact that practically all streams over a very large area are in flood at once and rise and fall very rapidly, making necessary the selection of stations where the cross-section is as nearly as possible constant and taking observations for an extended period of years, as it is impossible for any man to cover more than a very small portion of the district during high water.

This work should be greatly extended and carried on systematically over a long period of years as, with the present information on file, it is often very difficult to report on the feasibility of an irrigation scheme, for, although the drainage area may be estimated, practically nothing is known regarding the run-off per square mile, amount of rainfall, slopes of watersheds and amount of timber on watersheds, all of which factors materially affected the flow of water, and this information can only be obtained by careful observation and surveys carried on over a long period. While this work is important in any district it is of special interest in the Cypress hills, where the peculiar conditions of stream flow and the necessity of utilizing all available water for irrigation purposes make it imperative that all available information should be obtained as quickly as possible so that this department will be in a position to advise irrigators as to the best method of conserving and using the water. A condition which is very noticeable on many of the streams is the sinking of the water in the gravel and its reappearance at a point miles down the stream bed, leaving a long stretch dry excepting during flood seasons. Unless this condition is pretty thoroughly investigated it may cause trouble regarding the use of water in case an applicant on the dry portion of the stream holds a prior right to one above him and should demand that his amount of water be allowed to pass. Such action would be very unfair, as the water would not reach him in any case and the applicant with the second right would be deprived of the use of the water, which would merely be wasted.

An important factor which must be taken into consideration in the near future is the issuing of licenses against the various sources of supply. As at present carried on it means that when the total flow of the tributaries has been granted no water will be left in the main stream for the applicants along that portion of the stream. A careful definition of the watersheds of the main named creeks and the granting of licenses against the watershed, rather than against the stream would appear to overcome the difficulty, but unless each watershed were very clearly defined it would probably result in considerable confusion.

Another matter which has, so far, attracted no attention but which may be the source of considerable trouble in the future is the granting of licenses against high and flood water. At present licenses are granted for flood water on the same lines as for low water, viz., one second foot for each 150 acres to be irrigated. This gives no chance for reservoiring water during flood periods, and if this amount of water is necessary when the stream flows all the time it would appear that the license should be granted on such a basis as to allow for a steady flow of this amount of water during the irrigation season. This must be arrived at by careful determination of the average duration of high water as well as its amount. There is very little doubt that this matter must be taken up in this district before long on account of the large number of flood schemes being constructed.

Another subject which may have to be considered is the diversion of water from one watershed to another. At the present time I know of only one case where this is being done and this is only a small scheme, but I am informed that it has been a matter for serious consideration in the United States and that it is not allowed in many places. The difficulty appears to be that the seepage from the irrigated land does not return to its own watershed and this water, which otherwise would be of use lower down the creek, is lost to the other residents.

RESERVOIRS.

The question of reservoirs is one which is already attracting a great deal of attention and which, from the nature of the water supply, must be of increasing importance as settlement increases throughout this district. Almost all the creeks flowing north from the Cypress hills empty into lakes and sloughs between the railway and the Sand hills, and as these are too low to be of any practical use for storage purposes from an irrigation standpoint the flood water is wasted. In the season of 1902, Mr. C. H. Ellacott, C.E., made very careful contour surveys of reservoir sites on the following locations :—

Sections 4, 5 and 9, 11, 22, 3 to supply Skull creek,
Sections 4, 8 and 9, 10, 25, 3 to supply Hay creek,
Sections 18, 10, 25, 3 and 3, 10, 26, 3 to supply Maple creek,
Sections 7, 8, 17 and 18, 10, 26, 3 to supply Maple creek.

But no further action was taken regarding them and it is probable that most of the lands included have been otherwise disposed of before the present date. The work of constructing dams, ditches, &c., in these cases was usually too great to be performed by individuals without considerable monetary loss, and although it would be of great benefit to all residents on the creeks no efforts have been made to carry on the work, owing probably to lack of organization amongst the settlers.

Further surveys of this nature would undoubtedly demonstrate the feasibility of storage reservoirs along almost every creek flowing north from the hills, while on the south side, there appears to be a very fine natural reservoir in Cypress lake. A careful survey of this lake should be made in the near future to demonstrate its usefulness as a reservoir, taking into consideration the feasibility of diverting water from Battle creek at flood water and using this water to supply both Battle creek and the Frenchman river. It will also, probably, be found when further surveys have been carried out that several small reservoir sites can be obtained to the north and west of this lake, which could be used as feeders, but their utility may be doubtful because of the fact that most of this water must ultimately reach Cypress lake in any case.

Along Middle Fork creek there are several good reservoir sites but there is only one undisposed of, which appears upon casual inspection to be easily constructed. This site is situated in township 5, range 1, west of the 4th meridian and could be made to supply the majority of the irrigation schemes along this creek.

Along Lodge creek I do not know of any suitable site, but there is very little doubt that a survey for this purpose would prove that there are several suitable locations for reservoirs, which will be very necessary for successful irrigation along this creek.

Along the other creeks flowing south from the hills it is doubtful if any large sites could be obtained owing to the rapid fall in the country and it is probable that most of the reservoirs must be constructed by individual irrigators to supply themselves, but a system of surveys would demonstrate to them the possibility of such storage scheme.

Attached hereto is a schedule showing the inspections, surveys and traverses made during the past season.*

Your obedient servant,

RALPH J. BURLEY.

* Not printed

APPENDIX No. 20.

REPORT OF P. M. SAUDER.

March 31, 1909.

JOHN STEWART, Esq.,
Commissioner of Irrigation,
Calgary, Alta.

SIR,—I beg to submit the following report of work performed by me during the season of 1908 :—

As almost all the ditches in my district had been inspected during the latter part of the season of 1907, I did not spend much time on inspections, except those in connection with the purchase of land under the irrigation regulations, until after midsummer.

The measurement of the discharge of streams completed during the previous years served to give a fair approximate idea of the volume of discharge in the different streams in southern Alberta, at the different stages, and it was quite evident in beginning operations this season, that isolated measurements would add little to the information already obtained. Special effort was therefore directed to establishing gauging stations, and in making systematic and continued measurements of the more important streams.

Towards the end of April, a camp was organized at Calgary and Messrs. H. R. Carscallen and H. C. Ritchie engaged as field assistants. Gaugings were first made in the vicinity of Calgary and gauging stations established on the Bow river, Elbow river and Jumpingpound creek. Early in May we moved southward and made discharge measurements of Fish creek, Sheep creek, Highwood river and their branches.

Bridge stations were established on the north branches of Sheep river, near Millarville, and on the south branch of Sheep river near Black Diamond. Arriving at Nanton on May 30, we were unable to proceed further by trail on account of the heavy rains, so Mr. Carscallen and myself returned to Calgary by train and gauged the Bow, Elbow and Highwood rivers in flood, and afterwards accompanied you to Milk river. In the meantime the camp proceeded to Macleod, where a short delay was necessitated owing to the damage done to the bridge by the floods. I joined camp at Macleod and finding that the floods had changed the gauging station there and so damaged it that reliable results could not be obtained, proceeded to the station on the Belly river, near the Royal Northwest Mounted Police detachment at Big Bend, and found that that station had also been seriously damaged by the floods. The camp was then moved on to Kimbal on the St. Mary river, while Mr. Carscallen and myself made a trip to Milk river and gauged the main stream and the two branches, at points near the junction of the two branches. After gauging St. Mary river, Lee creek and Belly river, we returned to Macleod.

At Cardston we received the new meter and on reaching Macleod I started Mr. Carscallen out with a team, democrat, instruments and one helper to make discharge measurements of the various streams between Macleod and Calgary and in the vicinity of Calgary. I myself proceeded to Brooks station, where I organized a small camp and ran levels from Tilley station to Tide lake to ascertain the elevation of the latter.

In the meantime Mr. Ritchie took charge of the main camp and, moving to the South Fork river, made discharge measurements of the various streams in that locality.

About the middle of July, I again joined the main camp and, after making some inspections in the vicinity of Pincher creek and Cowley, moved camp to Macleod and thence to Willow creek and Nanton. After establishing gauging stations on Muddypound creek, Trout creek, Mosquito creek and Willow creek and making some inspections, we moved camp to the Waterton lakes.

A cable station was established on the Waterton river, near the outlet of the Waterton lakes, and some inspections and gauging made in the vicinity of the lakes. Completing the work in the vicinity of the Waterton lakes about the end of August, we again moved camp to Kimbal on the St. Mary river and made gaugings of Lee creek, St. Mary river, North Branch of Milk river and the Alberta Railway and Irrigation Company's canal.

On September 1, having completed the work in the vicinity of Kimbal, Mr. Ritchie again took charge of the camp and proceeded to a point on the Oldman river, north of Cowley, where he erected a cable station and made various gaugings in the vicinity. In the meantime I made a trip down Milk river to Pendant d'Oreille and across to Pakowki lake, and made various inspections in that locality. I again joined camp near Cowley on September 16 and after completing the inspectors and gaugings in that locality moved camp to Macleod and thence to Calgary, reaching here on the 30th. Camp was disbanded and the men paid off on October 3.

After leaving camp at Macleod on July 8, Mr. Carscallen made regular discharge measurements at the gauging stations between Calgary and Macleod and in the vicinity of Calgary until the season's work was ended on October 3. In August, he made a trip up the Crowsnest Pass as far as Coleman, where he made a number of isolated measurements on the Crowsnest river and its tributaries. He also made a round of the gauging stations on the Waterton and St. Mary rivers in September.

After making an inspection of the dam erected by the Blindman River Power Company in the outlet of Gull lake early in October, I went to Saskatchewan and made several examinations of applications for water rights and to purchase lands under the irrigation regulations in the vicinity of Gull lake, Swift Current and Herbert.

During the month of November I made a number of inspections in that part of my district lying between Calgary and Claresholm and west of the Calgary and Edmonton Railway.

The past year has been a very prosperous one in southern Alberta. Crops have been good and the stock has done well. The water used in irrigation has been largely devoted to the growth of fodder crops, hay being the chief consideration in connection with stock raising, in which a large number of the ditch owners are engaged.

Much of the success of future irrigation development will depend upon a correct estimate of the water supply available for irrigation and the permanency of this supply. Frequently applications to purchase lands under the irrigation regulations cannot be dealt with for a considerable time, and, sometimes, not at all, owing to insufficient information as to the water supply. In dealing with schemes which will have to depend entirely on high water and flood stages, it is very important that some definite knowledge of both the quantity of water at those stages and the probable duration of those stages, should be known.

On the information furnished by the government on the water supply, will depend to a very great extent, the development of water-power in Canada. It only takes a few days to locate a good power site and determine the amount of power which can be developed when the water supply is known. Very often the engineer has to spend a year or more making observations of the discharge of a stream before he can make any estimate of the water-power.

While our irrigation laws in general have some very excellent and superior features, the present method of recording licenses is unsatisfactory and if continued will make an adjudication of the water rights on the different streams necessary. This is most undesirable and should, if possible, be avoided. It is evident to any one looking into it, that the granting of a license on a tributary affects the main stream. Following the present practice, water rights will ultimately be granted for the total flow of all the tributaries of certain streams and licensees on the main stream itself will have no protection. Recording the water rights against the catchment basin, or drainage area, rather than against the streams comprising it, would, I think, be the better practice.

Under the present method of granting water rights, the holder of a highwater or flood license does not get the same quantity of water per acre as the holder of a low water license. He is permitted to divert water at the same rate per second as the holder of a low water license, but the period during which he may divert it is only a short one, whereas the holder of a low water license may divert during the whole season. If the holders of high water or flood licenses were permitted to divert water at a higher rate per second, they could store the extra amount of water diverted in reservoirs and use it during low water stages of the stream when they cannot divert from it.

Your obedient servant,

P. M. SAUDER.

APPENDIX No. 21.

HYDROGRAPHIC SURVEYS.

(Appendix to report of Superintendent of Forestry.)

EXTRACTS FROM A REPORT OF P. M. SAUDER, ON THE HYDROGRAPHIC WORK OF THE UNITED STATES GEOLOGICAL SURVEY AND THE NECESSITY FOR THE ORGANIZATION OF SIMILAR WORK IN CANADA (JANUARY, 1908).

ORGANIZATION AND SCOPE OF WORK.

The hydrographic work of the United States Geological Survey includes the collection of facts concerning and the study of the conditions affecting the behaviour of water from the time it reaches the earth as rain or snow until it joins the oceans or the great navigable rivers. These investigations became a distinct feature of the work of the survey in the fall of 1888, when an instruction camp was established at Embudo, New Mexico. The first specific appropriation for gauging streams was made by the Act of August 18, 1894, which contained an item of $12,500 'for gauging the streams and determining the water supply of the United States, including the investigation of underground currents and artesian wells in the arid and semi-arid sections.'

Since that time the appropriations have been gradually increased, as shown by the following tables :—

1895	$ 12,500
1896	30,000
1897	50,000
1898	50,000
1899	50,000
1900	50,000
1901	100,000
1902	100,000
1903	200,000
1904	200,000
1905	200,000
1906	200,000

As a result of the increased appropriations the work has been greatly extended and at the same time it has been more thoroughly systematized by the adoption of standard methods and by grouping the States in districts, in each of which a district hydrographer and a corps of assistants carry on a comprehensive study of the hydrographic resources.

The chief features of the hydrographic work are the collection of data relating to the flow of the surface waters and the study of the conditions affecting this flow. Information is also collected concerning the river profiles, duration and magnitude of floods, water-power, &c., which may be of use in hydrographic studies. This work includes the study of the hydrography of every important river basin in the United States and is of direct value in the commercial and agricultural development of the country.

In order to collect the material from which estimates of daily flow are made, gauging stations are established. The selection of a site for a gauging station and the length of time it is maintained depend largely on the physical features and the needs of each locality. If the water is to be used for power, special effort is made to obtain information concerning the minimum flow ; if water is to be stored, the maximum flow receives special attention. In all sections of the country permanent gauging stations are maintained for general statistical purposes, to show the conditions existing through long periods. They are also used as primary stations, and their records in connection with short series of measurements serve as bases for estimating the flow at other points in the drainage basin.

Owing to the broad scope of these hydrographic investigations and the length of time they should cover in order that the records may be of greatest value, it is in general impossible for private individuals to collect the necessary data, and as many of the streams traverse more than one state this work does not properly fall within the province of the state authorities. The United States Geological Survey has, therefore, by means of the appropriations of Congress, for several years systematically made records of stream flow, with the view of ultimately determining all the important features governing the flow of the principal streams of the country. In carrying out this plan stations are established on the streams and maintained for a period long enough to show their regimen or general behaviour. When a record that is sufficient for this purpose has been obtained for any stream the work on that stream is discontinued. The order in which the streams are measured is determined by the degree of their importance.

During 1906 the regimen of flow was studied at about 700 stations distributed along the various rivers throughout the United States. In addition to these records data in regard to precipitation, evaporation, water-power and river profiles, were obtained in many sections of the country.

These data have been assembled by drainage areas, and are published in a series of water-supply and irrigation papers, each of which pertains to the surface water resources of a group of adjacent areas. In these papers are embodied not only the data collected in the field, but also the results of computations based on these data, and other information that has a direct bearing on the subject, such as descriptions of basins and the streams draining them, utility of the water resources, &c. The records at most of the stations discussed extend over a serious of years.

FIELD METHODS OF MEASURING STREAM FLOW.

Streams may be divided with respect to their physical conditions into three classes: (1) Those with permanent beds; (2) Those with beds which change only during extreme low or high water; (3) Those with constantly shifting beds. In determining the daily flow special methods are necessary for each class. The data upon which these determinations are based and the methods of collecting them are, however, in general the same. * * * * * * * * * *

VELOCITY METHOD OF CALCULATING STREAM FLOW.

The determination of the quantity of water flowing past a certain section of a stream at a given time is termed a discharge measurement. This quantity is the product of two factors, the mean velocity and the area of the cross-section. The mean velocity is a function of surface slope, wetted perimeter, roughness of bed, and the channel conditions at, above and below the gauging section. The area depends upon the contour of the bed and the fluctuations of the water surface. The principal way of measuring the velocity of a stream is by current meters.

Great care is taken in the selection and equipment of gauging stations for determining discharge by velocity measurements in order that the data may have the required degrees of accuracy. They are located as far as possible where the channel is straight both above and below the gauging station; where there are no cross-currents, backwater or boils; where the bed of the stream is reasonably free from large projections of a permanent character; and where the banks are high and subject to overflow only at flood stages. The station must be so far removed from the effects of tributary streams and of dams or other artificial obstructions that the gauge height shall be an index of the discharge.

Certain permanent or semi-permanent structures usually referred to as equipment are generally pertinent to a gauging station. These are a gauge for determining the fluctuations of the water surface, bench marks to which the datum of the gauge is referred, permanent marks on a bridge or a tagged line indicating the points of measurement, and, where the current is swift, some appliance (generally a secondary cable) to hold the meter in position in the water. As a rule, the stations are located at bridges if the channel conditions are satisfactory, as from them the observations can more readily be made and the cost of the equipment is small.

Many kinds of current meters have been constructed; they may, however, be classed in two general types, those in which the wheel is made up of a series of cups, as the Price, and those having a screw propeller wheel, as the Haskell. Each meter has been developed for use under some special condition. In the case of the small Price meter, which has been extensively used by the United States Geological Survey, an attempt has been made to get an instrument which could be used under practically all conditions.

Current meter measurements may be made from a bridge, a cable, a boat or by wading, and gauging stations may be classified in accordance with such use.

In making the measurement an arbitrary number of points are laid off at which the velocity and depth are known as measuring points, and are usually fixed at regular intervals, varying from 2 to 20 feet, depending upon the size and condition of the stream. Perpendiculars dropped from the measuring points divide the gauge section into strips. For each strip or pair of strips the mean velocity, area and discharge are determined independently, so that conditions existing in one part of the stream may not be extended to parts where they do not apply. Three classes of methods of measuring velocity with current meters are in general use—multiple-point, single-point and integration. * * * * * *

OFFICE METHODS OF COMPUTING RUN-OFF.

There are two principal methods of determining run-off, depending upon whether or not the bed of the stream is permanent.

For stations on streams with permanent beds, the first step in computing the run-off is the construction of the rating table, which shows the discharge corresponding to any stage of the stream. This rating table is applied to the record of stage to determine the amount of water flowing. The construction of the rating table depends upon the method used in measuring the flow.

For a station at a weir or dam, the basis for the rating table is some standard weir formula. The coefficient to be used in its application depends upon the type of dam and other conditions near its crest. After inserting in the weir formula the measured length of crest and assumed coefficient, the discharge is computed for various heads and the rating table constructed.

The data necessary for the construction of a rating table for a velocity-area station are the results of the discharge measurements, which include the record of stage of the river at the time of measurement, the area of the cross-section, the mean velocity of the current, and the quantity of water flowing. A thorough knowledge of the conditions at and in the vicinity of the station is also necessary.

The construction of the rating table depends upon the following law of flow for open, permanent channels: (1) The discharge will remain constant so long as conditions at or near the gauging stations remain constant; (2) The discharge will be the same whenever the stream is at a given stage if the change of slope due to the rise and fall of the stream be neglected; the discharge is a function of and increases gradually with the stage.

The plotting of results of the various discharge measurements using gauge heights as ordinates, and discharges, mean velocity and area as abscissas, will define curves, which show the discharge, mean velocity and area corresponding to any gauge height. For the development of these curves there should be therefore a sufficient number of discharge measurements to cover the range of the stage of the stream.

As the discharge is the product of two factors, the area and the mean velocity, any change in either factor will produce corresponding change in the discharge. Their curves are therefore constructed in order to study each independently of the other.

The area curve can be definitely determined from accurate soundings extending to the limits of high water. It is always concave toward the horizontal axis or on a straight line, unless the banks of the stream are overhanging.

The form of the mean velocity curve depends chiefly upon surface slope, the roughness of the bed and the cross-section of the stream. Of these the slope is the principal factor. In accordance with the relative changes of these factors the curves may be either a straight line, convex or concave toward either axis, or a combination of the three. From a careful study of the conditions at any gauging station, the form which the vertical velocity curve will take can be predicted, and it may be extended with reasonable certainty to stages beyond the limits of actual measurements. Its principal use is in connection with the area curve in locating errors in discharge measurements and in constructing the rating table.

The discharge curve is defined primarily by the measurements of discharge, which are studied and weighed in accordance with the local conditions existing at the time of each measurement. The curve may, however, best be located between and beyond the measurements by means of curves of area and mean velocity. The discharge curve under normal conditions is concave toward the horizontal and is generally parabolic in form.

In the preparation of the rating table the discharge for each tenth or half-tenth on the gauge is taken from the curve. The differences between successive discharges are then taken and adjusted according to the law that they shall either be constant or increasing.

The determination of daily discharge of streams with changeable beds is a difficult problem. In case there is a weir or dam available, a condition which seldom exists on streams of this class, the discharge can be determined by its use. In case of velocity-area stations frequent discharge measurements must be made if the determinations of flow are to be other than rough approximations. For stations with beds which shift slowly or are materially changed only during floods, rating tables can be prepared for periods between such changes and satisfactory results obtained with a limited number of measurements, provided that some of them are taken soon after the change occurs. For streams with continually shifting beds, discharge measurements should be made every two or three days and the discharge for intervening days obtained either by interpolation modified by gauge height or by Professor Stouts' method, which has been described in full in the nineteenth annual report of the United States Geological Survey, Part IV., page 323, and in the *Engineering News* of April 21, 1904. This method, or a graphical application of it, is also much used in determining the flow at stations where the bed shifts but slowly.

EXPLANATION AND USE OF TABLES.

For each regular gauging station are given as far as available the following data:—

1. Description of station.
2. List of discharge measurements.
3. Gauge-height table.
4. Rating table.
5. Table of estimated monthly and yearly discharges and run-off, based upon all the facts obtained to date.

The descriptions of stations give such general information about the locality and equipment as would enable the reader to find and use the station, and they also give, as far as possible, a complete history of all the changes that have occurred since the establishment of the station that would be factors in using the data collected.

The discharge measurement table gives the results of the discharge measurements made during the year, including the date, the name of the hydrographer, the gauge height, the area of cross-section, the mean velocity and the discharge in second feet.

The table of daily gauge heights gives the daily fluctuations of the surface of the river as found from the mean of the gauge readings taken each day. The gauge height given in the table represents the elevation of the surface of the water above zero of the gauge. At most stations the gauge is read in the morning and in the evening.

The discharge measurements and gauge heights are the base data from which the other tables are computed. In case of extensive development, it is expected that engineers will use these original data in making their calculations, as the computations made by the Survey are based on the data available at the time they are made and should be reviewed and, if necessary, revised when additional data are available.

The rating table gives the discharge in second feet, corresponding to various stages of the river, as given by the gauge heights. It is published to enable engineers to determine the daily discharge in case this information is desired.

The values in the table of monthly discharge are intended to give only a general idea of the conditions of flow at the station, and it is not expected that they will be used for other than preliminary estimates.

DISTRICT HYDROGRAPHER.

As above intimated the work has been systematized by the adoption of standard methods and by grouping the States in districts, in each of which a district hydrographer and a corps of assistants carry on a comprehensive study of the hydrographic resources. Mr. Follansbee, with whom I spent a week, has in his district about seventy gauging stations, scattered over Montana, and the northern part of Wyoming.

His office is located in Helena, where he receives regularly reports from the gauge height observers and his assistant hydrographers and has a record of all the data and facts collected in his district. Recent information is always available at his office even before it appears in the departmental reports.

The gauge height observer is required to mail weekly reports and to enter his observations in a book which he sends in every three months. The book is examined and if satisfactory the amount due the observer is forwarded to him and the book filed for reference.

Mr. Follansbee has two assistant hydrographers, one of whom makes the gaugings in the northern part and the other in the southern part of his district. Each assistant hydrographer makes regular discharge measurements, at each of the gauging stations assigned to him. While making the gauging he checks the gauge height and makes a memorandum of any data which may be useful or interesting to the Hydrographic Survey. As soon as convenient after the gauging has been made, he computes the discharge and forwards a 'Report of Discharge Measurement' to Mr. Follansbee. As soon as the assistant hydrographer has filled his current meter note-book and has made the computations, he sends it to Mr. Follansbee, who checks it and files it for reference.

Mr. Follansbee plots a gauge height-discharge curve, a gauge height-mean velocity curve and a gauge height-area curve for each station, and when an assistant hydrographer sends in his report of a discharge measurement, he plots the data on these curve sheets.

If the points do not plot in the old established curves he at once endeavours to ascertain the cause. When the cross-section changes, the point will not plot on the established curve on the gauge height-area sheet; when the slope changes, the point will not plot on the established curve on the gauge height-mean velocity sheet; and when the current meter is out of order, the point will not plot on the established curve on the gauge height-discharge sheet. When the point does not fall on the established gauge height-discharge curves for several stations and the points on the gauge height-area sheets fall on the established curves, it is evident that the meter is not in order and requires rerating. If it is found that the slope or cross-section at a gauging station has changed, new curves must be plotted for that station.

When making a discharge measurement the hydrographer always checks the gauge-height, and if he finds it has shifted he corrects it and reports the particulars. Mr. Follansbee then corrects the gauge-height observations over the period between the last two discharge measurements, accordingly.

Mr. Follansbee visits as many of the gauging stations himself as he can during the year, inspects the gauge height and equipment and makes a discharge measurement himself. He also spends considerable time in locating and installing new stations.

During the winter when gauge height observations and discharge measurements are discontinued at many stations he prepares the gauge height tables, rating tables, the tables of monthly and yearly discharges and run-off, and in some cases tables showing discharge and horse-power and the number of days during the year when the same is available. These tables he sends to Washington to be embodied in the annual report of the survey.

Realizing the importance of the hydrographic work in the advancement of the country, the railways are assisting the work to a great extent by the provision of free transportation for each hydrographer and his helper.

I found Mr. Follansbee and the other United States officials whom I met very courteous and obliging, giving me as much information as they could and demonstrating their methods as far as possible. With Mr. Follansbee I visited several gauging stations, and by assisting in making discharge measurements got a good insight into the work.

HYDROGRAPHIC WORK IN ALBERTA AND SASKATCHEWAN.

In accordance with instructions to gauge streams in my district, this work has been done as far as possible, but as the gaugings made give the discharge for one day only the information obtained is not of much value for practical purposes. Gauging stations should be established and discharge measurements made at the different stages of the streams in order that gauge height-discharge, gauge height-mean velocity and gauge height-area curves can be plotted, and rating and discharge tables prepared.

The department's irrigation report for 1902 includes twenty-four diagrams showing rise and fall of certain streams in Alberta and Saskatchewan. These diagrams would be useful if they could be applied to gauge height-discharge curves or to a rating-table, but there is no information given as to the discharge of any of these streams at any given gauge height. They give no information whatever as to the quantity of water in the stream at any given time. The same report gives a statement of the quantity of water available, the quantity recorded and the quantity still available for irrigation purposes for many streams. The information in that statement was obtained from a few miscellaneous discharge measurements and cannot be relied upon. Systematic gaugings must be carried on continuously for a period of eight or ten years in order to get reliable information about any stream.

Hydrographic work has from time to time been taken up in a desultory manner, with the result that the information and data obtained have not been as reliable and beneficial as they should have been had a satisfactory system been commenced and followed up.

In order to carry on the hydrographic survey properly, a special appropriation should be made for it and one man with a small staff should devote all his time to the work. If the irrigation belt were divided into three hydrographic districts, namely : Maple Creek, Macleod and Calgary, with one hydrographer operating in each district, the work could be carried on systematically and thoroughly.

The Maple Creek district would include the following streams :—

Battle creek, east and west branches of Bear creek, Belanger creek, Maple creek, Piapot creek, Ross creek, Skull creek, Seven Persons creek, north and south branches of Swift Current creek, Big Plume creek, Little Plume creek, Miry creek, Boxalder creek, Frenchman river, north fork of Frenchman river, Gap (or Fish) creek, McKay creek, Lodge creek, Middle creek, Fairwell creek, Bridge creek, Cottonwood creek, Hay creek and the South Saskatchewan river.

The Macleod district would include the following streams :—

Beaver creek, Belly river, Boundary creek, Callum creek, Connelly creek, Heath creek, Indian Farm creek, Lee creek, Mahmee creek, Muddypound creek, Milk river, Oldman river, north fork or Oldman river, South Fork river, Crowsnest river, Pincher creek, St. Mary river, Trout creek, Todd creek, Cow creek, Willow creek and Waterton river.

The Calgary district would include the following streams: —

Bow river, Elbow river, Fish creek, north fork of Fish creek, south fork of Fish creek, Highwood river, Jumpingpound creek, Little Bow river, Mosquito creek, Nanton creek, Nose creek, Pine creek, Rosebud river, Sheep river, north fork of Sheep river, south fork of Sheep river, Kananaskis river, Pekisko creek, Stimson creek and Red Deer river.

The chief hydrographer could be stationed at Calgary, and his duties would be similar to those of Mr. Follansbee at Helena. He could see that the gauge height observers reported regularly, plot the returns from his assistants in the gauge height-discharge, gauge height-mean velocity and gauge height-area curves and direct the operations of his assistants.

As the office work would not be very heavy, and the Calgary district is not very large and easy to work, he could do the gauging in that district himself.

During the winter months when most of the gauge-height observations and discharge measurements would be abandoned, rating and discharge tables could be prepared, the data and information compiled to be embodied in the annual report.

Each hydrographer should be provided with a Price Patent Electric Current Meter for ordinary streams, a small Price Acoustic Meter for small streams, an engineer's level, a levelling rod, a compass, a steel tape, a team and democrat. An engineer on hydrographic work only rquires one helper and as the country is becoming fairly well settled he does not require a camp. There is no difficulty in getting accommodation for two men almost anywhere. A camp means travelling with a wagon, which of course cannot cover as much ground as a team and democrat. The running expenses of a camp, which include the wages of a cook and a teamster, are greater than the expenses of two men and a team putting up at stopping houses. Then when it is considered that two men without a camp can cover more ground than a party with a camp it is evident that the camp is not economical.

The district hydrographers need not be graduated engineers but capable men with two or three years' experience in engineering and surveying. As the season advanced it is likely the helpers could be dispensed with and during the winter the services of at least one of the district hydrographers could be dispensed with.

As you are aware, the following resolution was submitted and carried at the recent irrigation convention in Calgary :—

'Whereas the permanency of all irrigation development is dependent upon an accurate knowledge of the location and quantity of water supply available ; and,

'Whereas, the matter of the topographical and hydrographical surveys to determine the location and quantity of such water supply and the proper methods of conserving it must be undertaken by the governments administering the law relating to the use of such water ;

'Therefore be it resolved, That this convention, while recognizing the work already done, urges strongly upon the Dominion government and the government of British Columbia the importance of making the necessary appropriations and providing the necessary staff to undertake in an intelligent and systematic manner, the gauging of all streams of water supply and the location and survey of all sites suitable for reservoirs for the storage of water.'

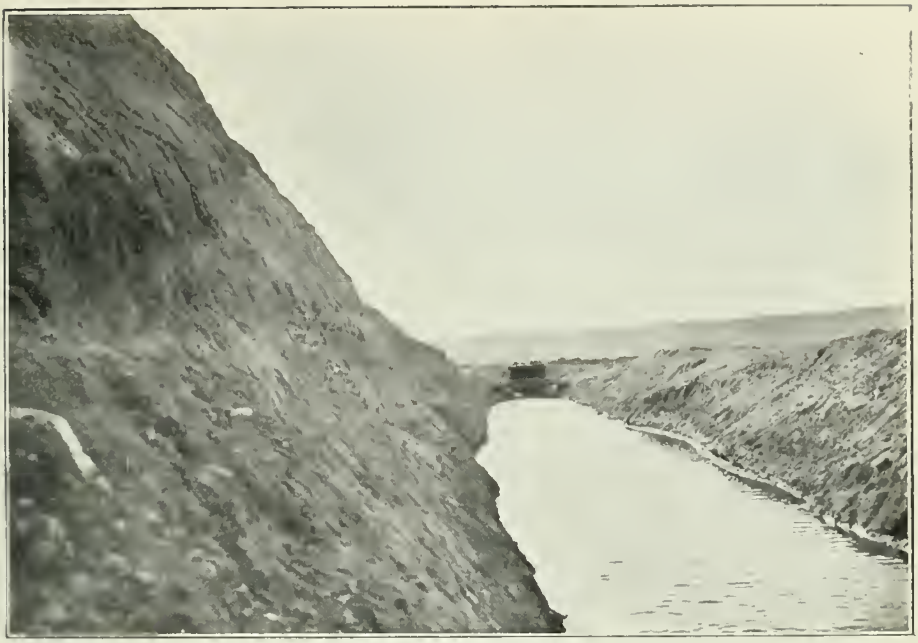
The results of stream measurements would prove many irrigation and power schemes feasible which at present will not be touched on account of lack of information. There would be many more storage schemes for irrigation if the people knew the amount of water going to waste during the flood stages of the streams.

Engineers in the hydrographic survey in the United States claim that many industries have sprung up as a direct result of the information supplied by the hydrographic survey and there are doubtless many power schemes in Canada which will eventually be developed, but at the present time capitalists are slow to invest in such schemes owing to so little information as to the quantity and the permanancy of the water supply. This information would also settle any questions arising in connection with water supply and sewage disposal in towns and cities.

The hydrographic work need not be confined to southern Alberta and Saskatchewan but might with advantage be extended over the greater part of Canada. Owing to the extensive surveys for irrigation in British Columbia, information will soon be required there as to the quantity and permanency of the water supply.

Buffalo at Banff.

25—vii 7



Thirty-five-foot cut for Ditch, East End, Sask.

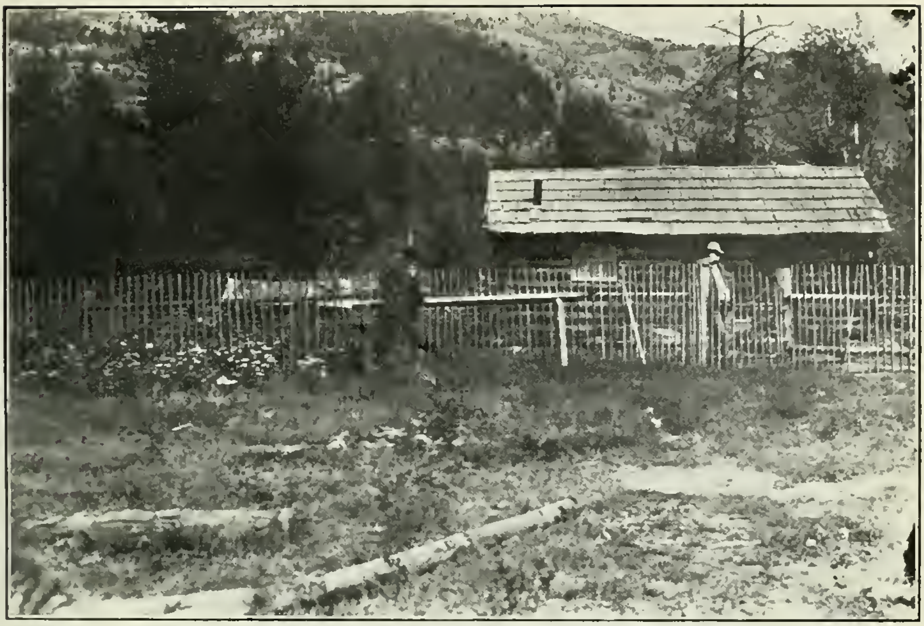
A Forest Fire in British Columbia

Town of Banff from Tunnel Mountain.

Women pulling and bundling young trees in autumn. Forest Nursery Station, Indian Head, Sask.

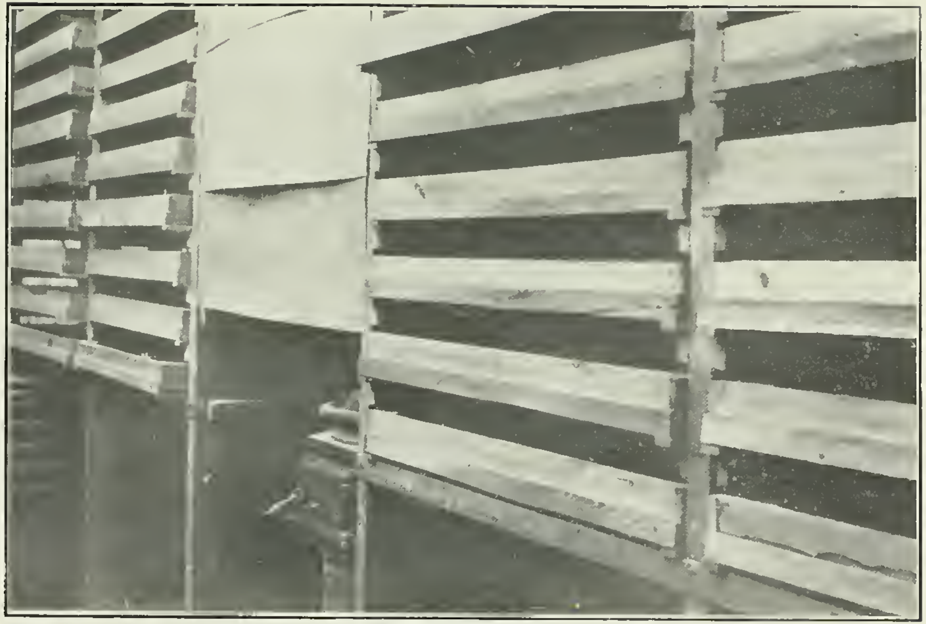
Fire Ranger Gladstone putting up fire notice.

Wheat on Irrigated ground, East End, Sask.—Enright & Strong Irrigation scheme.

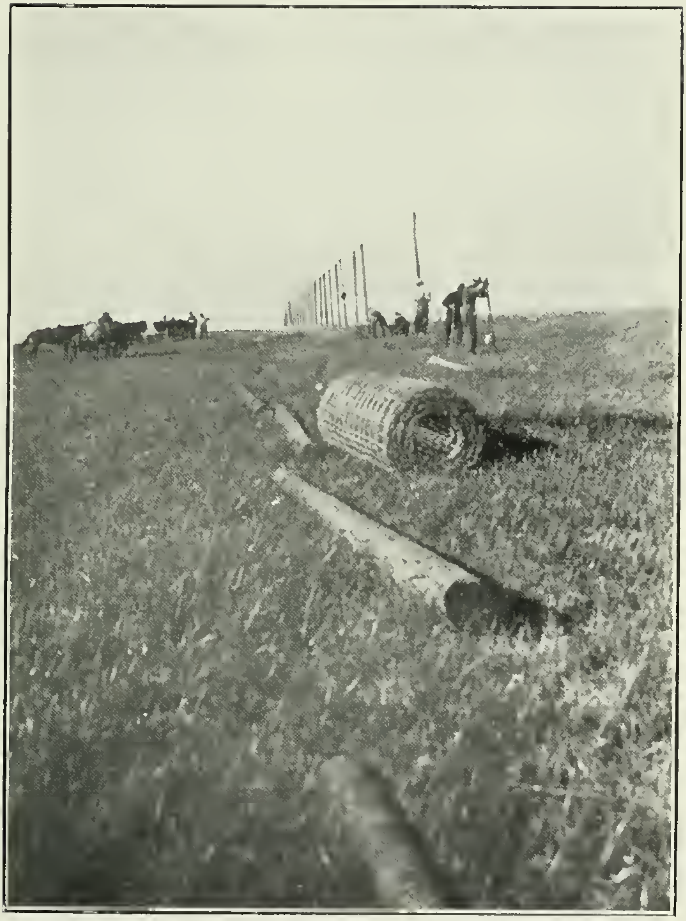


Squatter's Cabin on a British Columbia Forest Reserve.

"Heeling in" young trees in autumn, Forest Nursery Station, Indian Head, Sask.



Interior of Seed House, Forest Nursery Station, Indian Head, Sask.

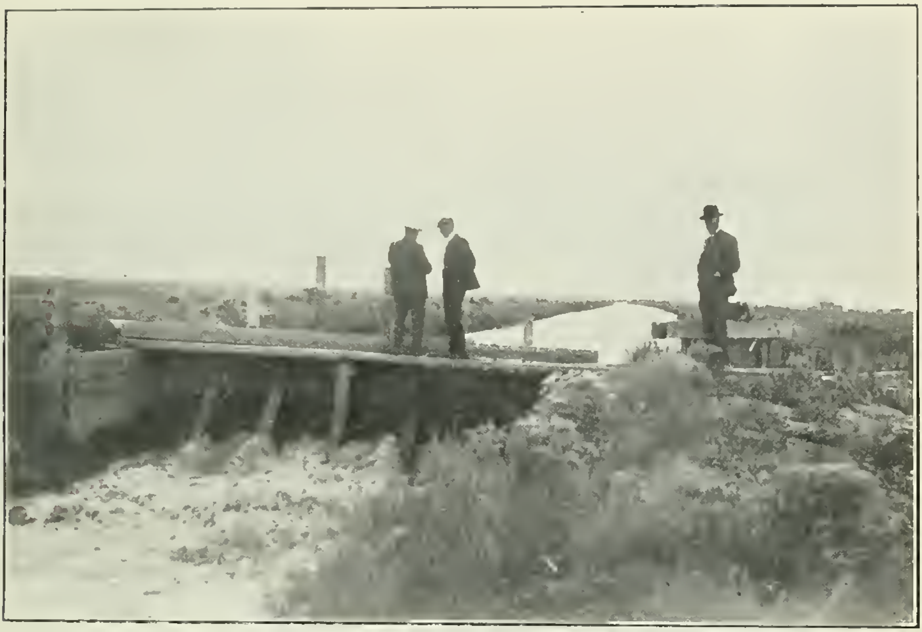


Erecting Fence around Buffalo Park.

25—vii—8

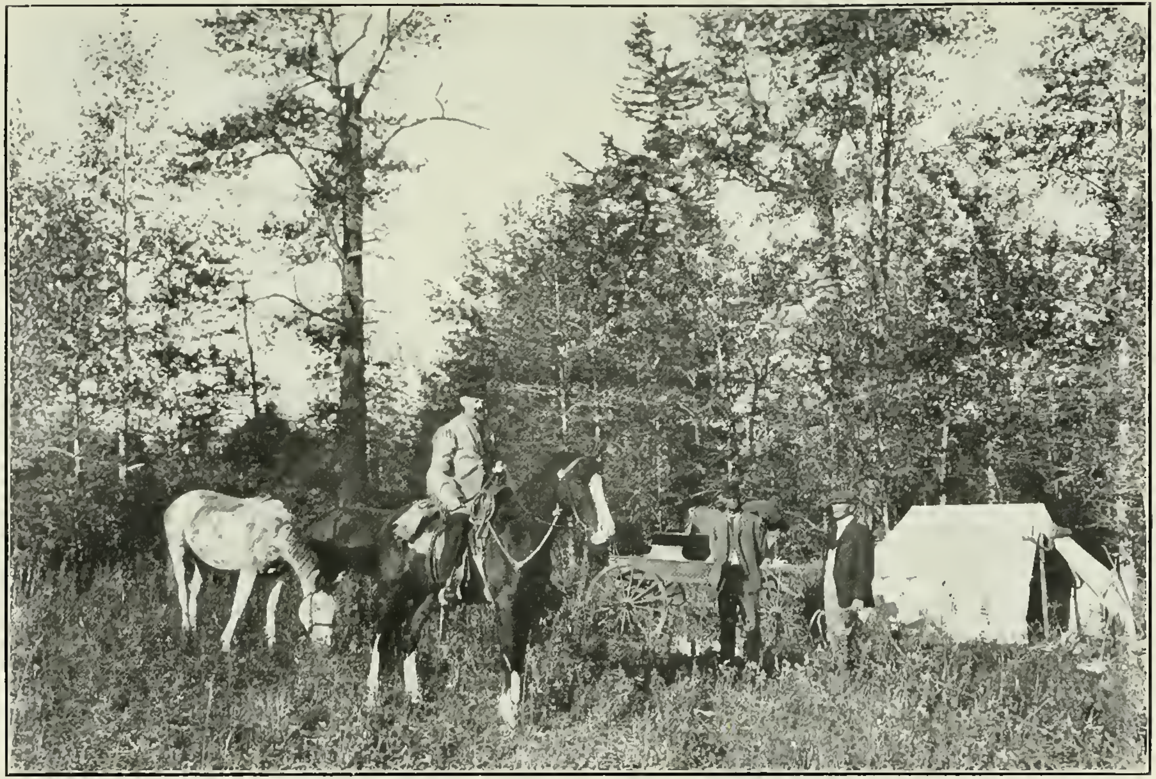
Forest Fire in British Columbia.

Fish Lake in Long Lake Forest Reserve.



Head-gate on Irrigation Ditch, Alberta Railway and Irrigation Company's scheme.

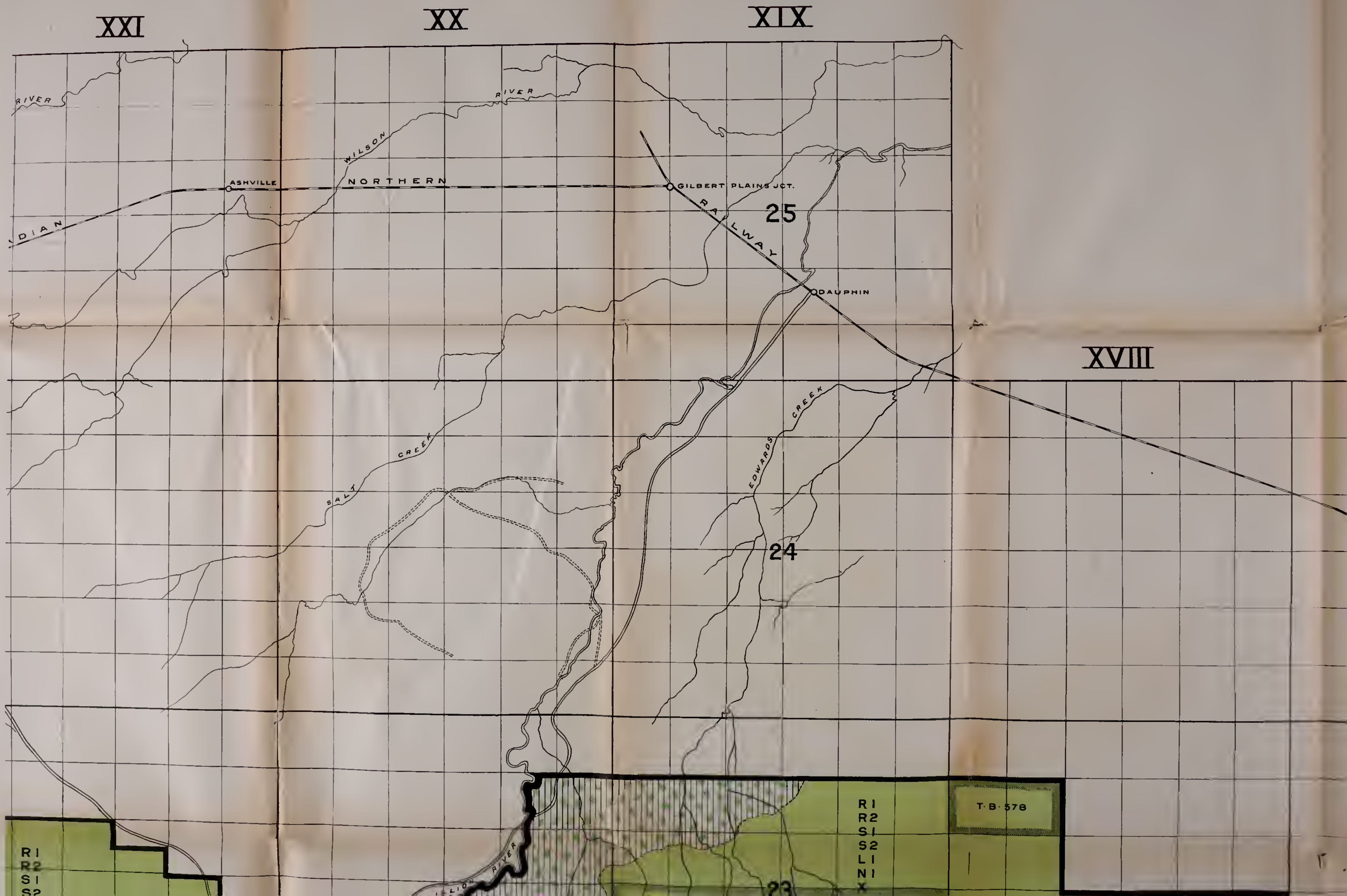
Cylindrical Screen for shaking out seed, Seedhouse at Forest Nursery Station, Indian Head, Sask.



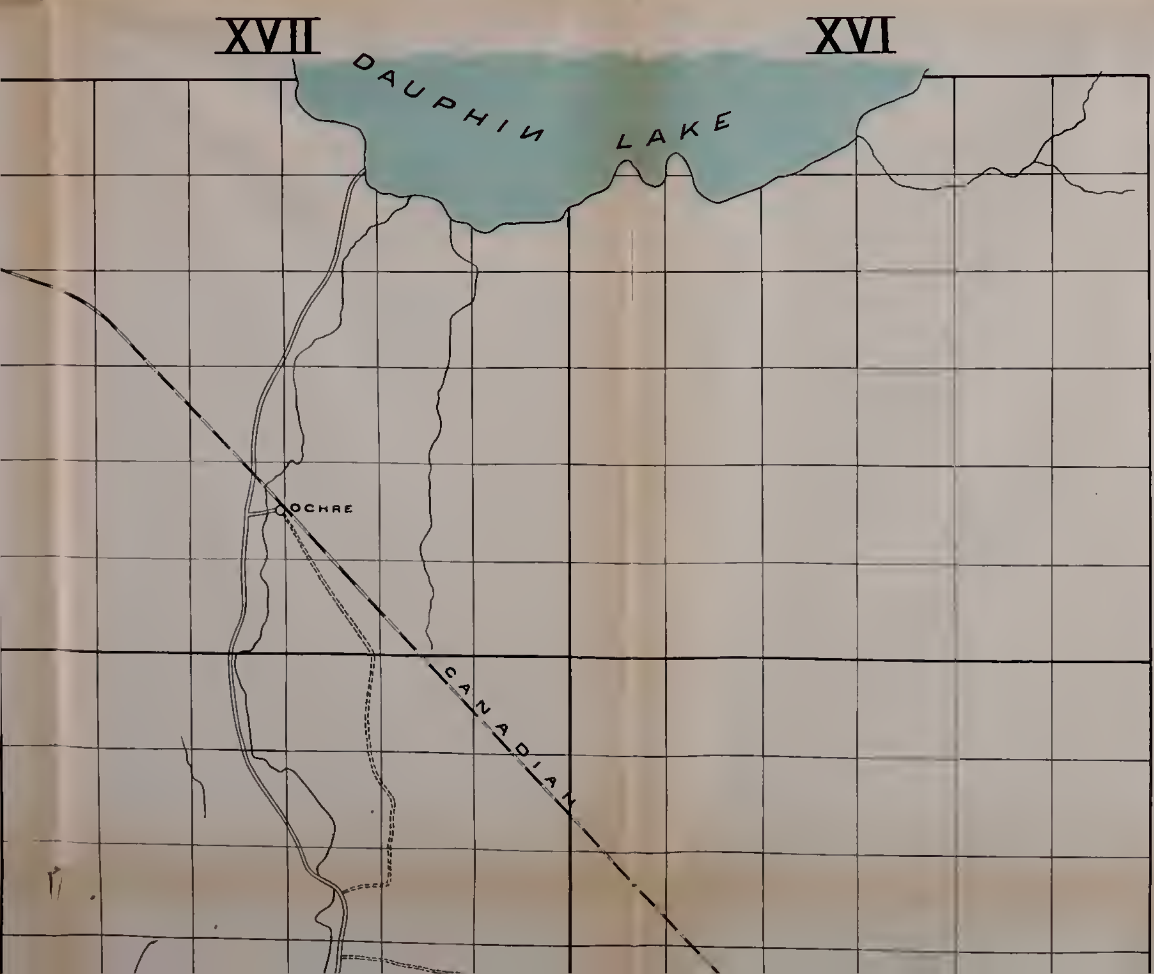
Forest Ranger interviewing Campers. Cypress Hills Reserve Alberta.

Forest Survey Party, Summer 1908,
Riding Mountain Reserve, Manitoba.

Grazing, Riding Mountain Reserve. Manitoba.



XXI
XX
XIX
XVIII
RIVER
RIVER
WILSON
ASHVILLE
NORTHERN
GILBERT PLAINS JCT.
25
DAUPHIN
SALT CREEK
EDWARDS CREEK
24
T·B·578
R1
R2
S1
S2
L1
N1
X
RIVER



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DAUPHIN LAKE
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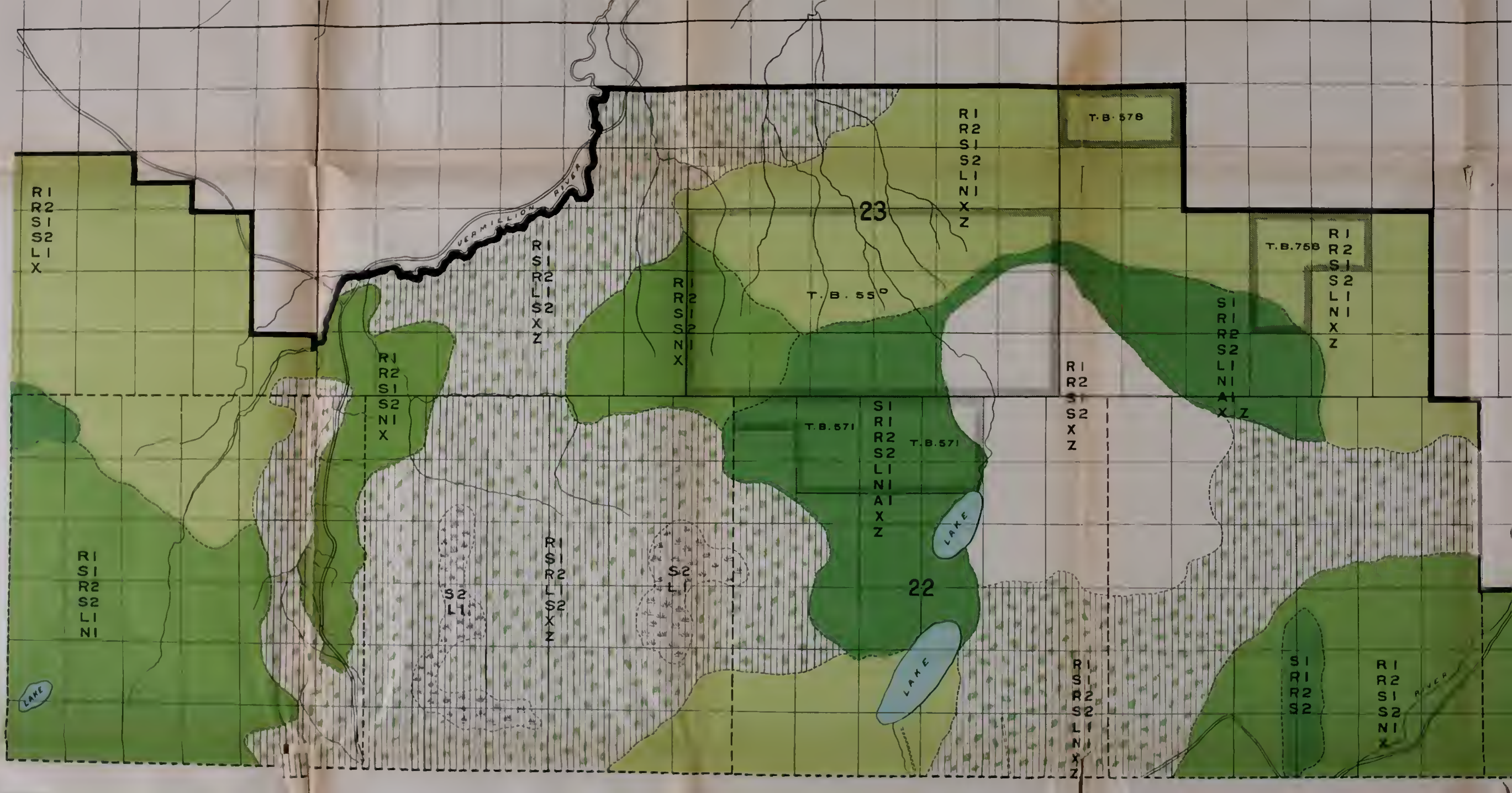
CANADIAN



VERMILLION RIVER
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T.B. 578
T.B. 758
T.B. 55D
T.B. 571
T.B. 571
LAKE
LAKE
LAKE
LAKE
RIVER
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R1 R2 S1 S2 N1 X
R1 R2 S1 S2 L1 N1 X Z
R1 R2 S1 S2 L1 N1 X Z
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R1 R2 S1 S2 X Z
S1 R1 R2 S2 L1 N1 A1 X Z
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R1 S1 R2 L1 S2 X Z
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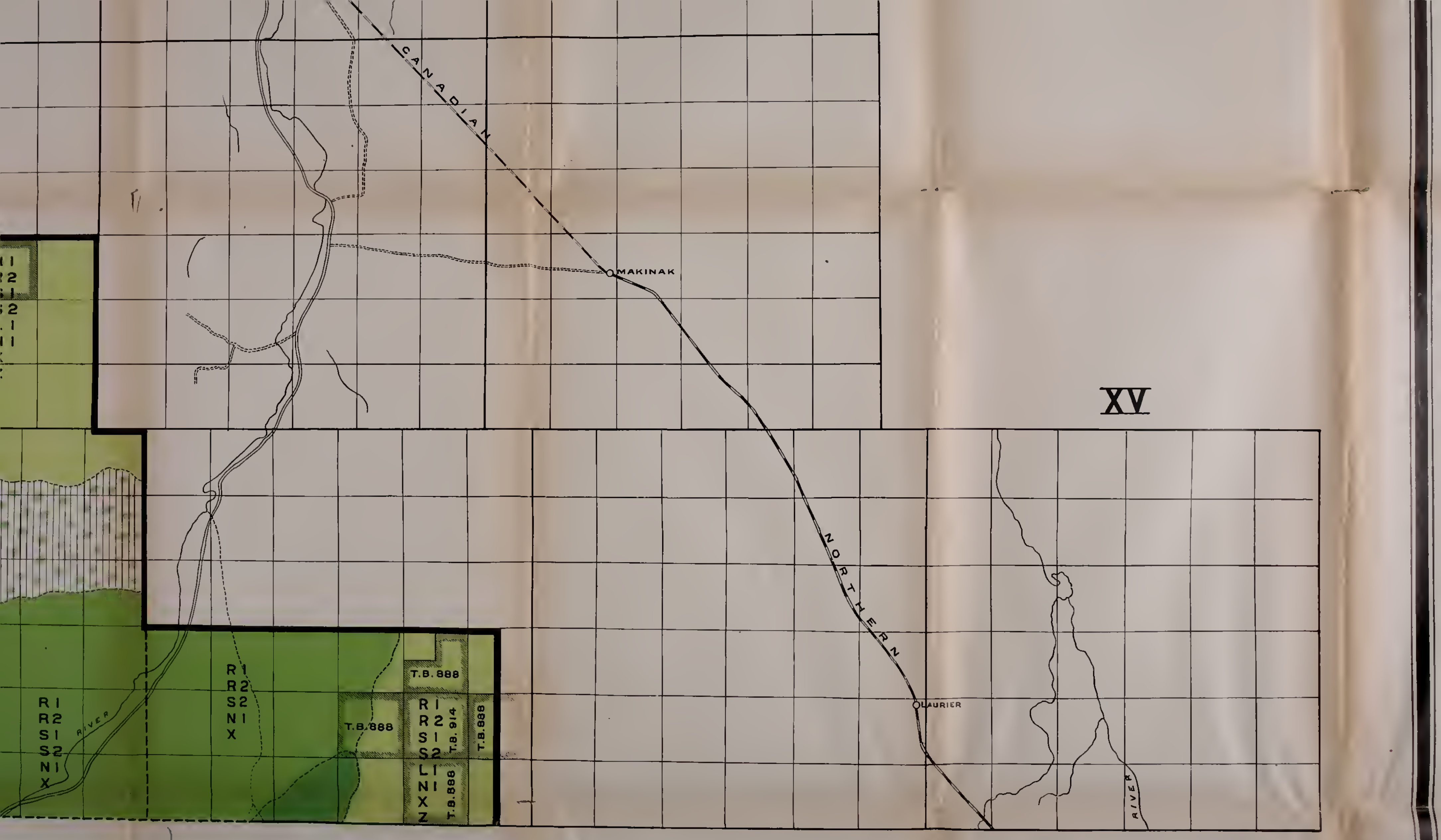
CANADIAN
MAKINAK
NORTHERN
LAURIER
XV
RIVER
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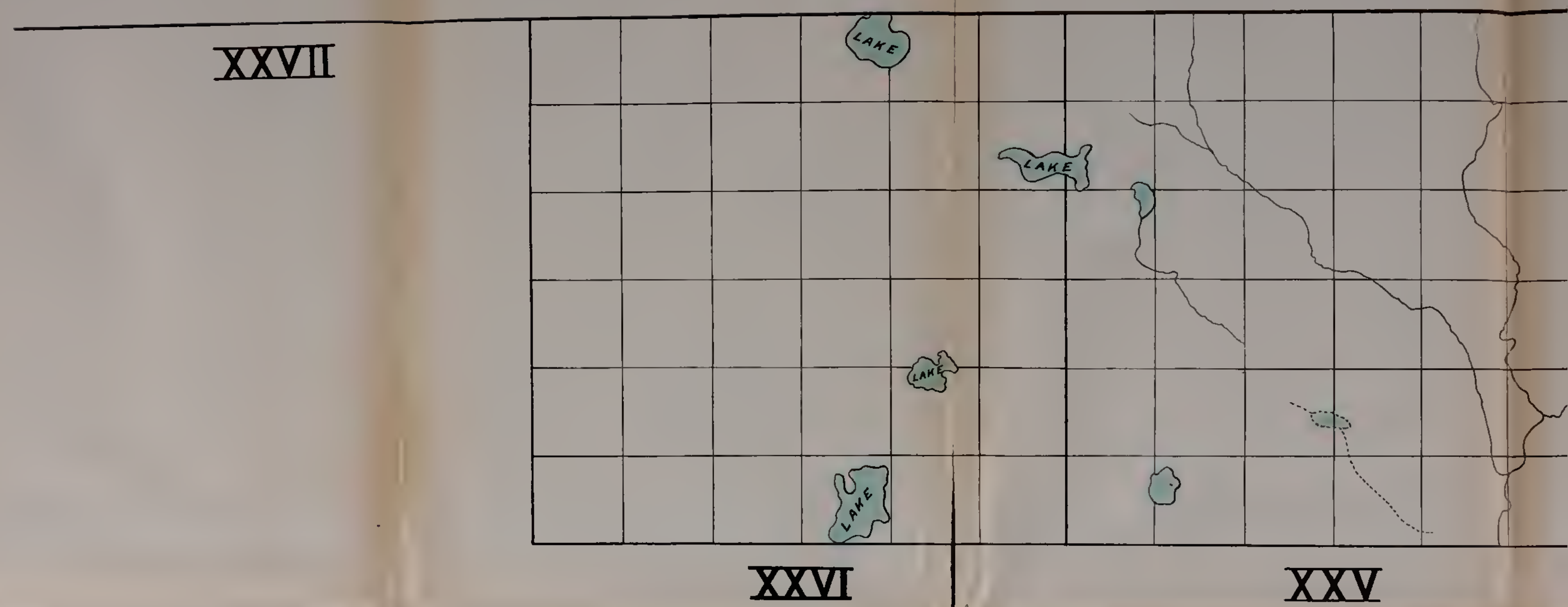


Department of the Interior
Canada

HONOURABLE FRANK OLIVER, MINISTER
W. W. CORY, DEPUTY MINISTER

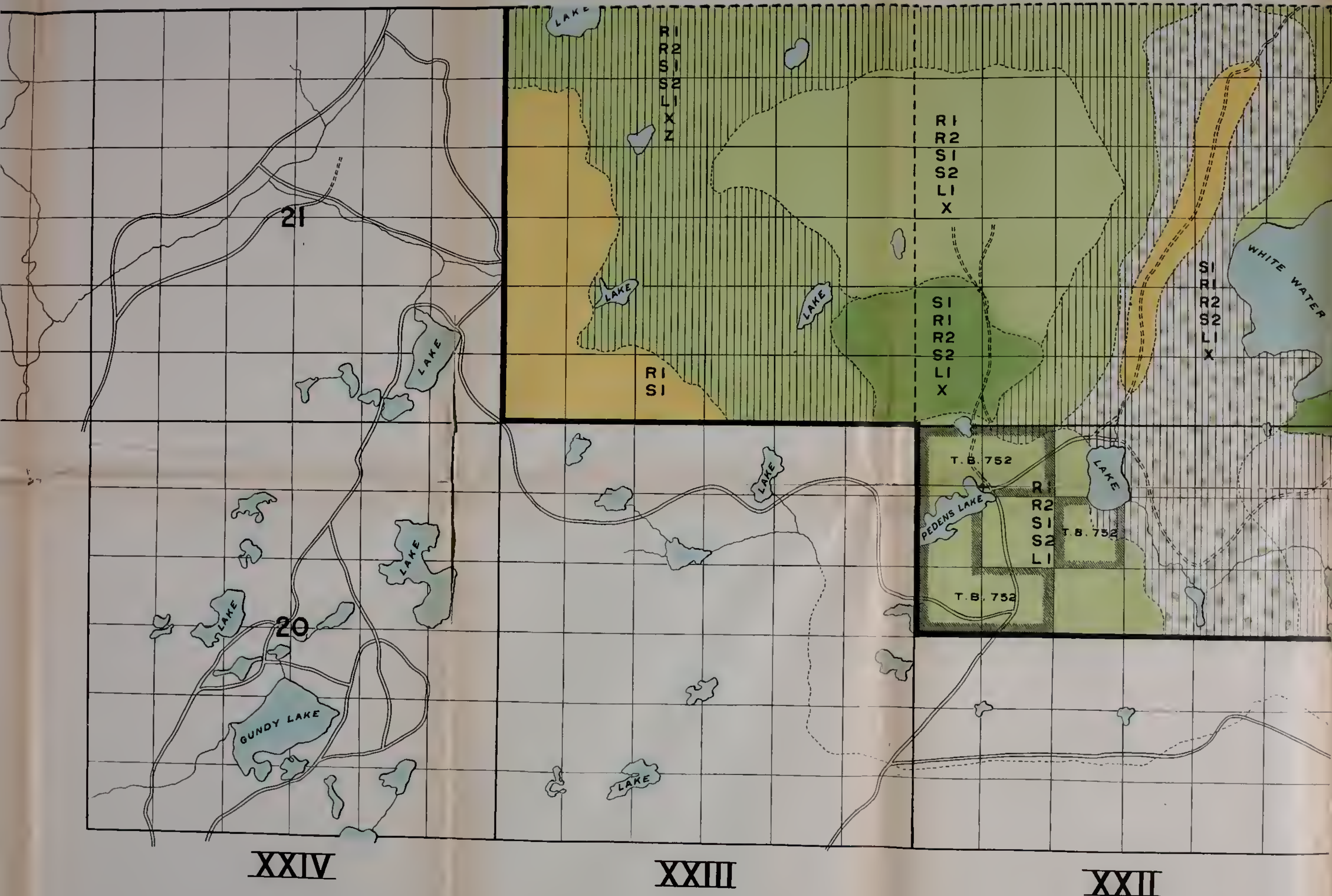
FORESTRY BRANCH

R. H. CAMPBELL, SUPERINTENDENT

RIDING MOUNTAIN FOREST RESERVE

PROVINCE OF MANITOBA

SCALE: ONE MILE TO AN INCH



LAKE
R1 R2 S1 S2 L1 X Z
R1 R2 S1 S2 L1 X
S1 R1 R2 S2 L1 X
S1 R1 R2 S2 L1 X
WHITE WATER
R1 S1
LAKE
LAKE
LAKE
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T.B. 752
R1 R2 S1 S2 L1
T.B. 752
T.B. 752
PEDENS LAKE
LAKE
LAKE
LAKE
LAKE
LAKE
20
GUNDY LAKE
LAKE
XXIV
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Department of the Interior
Canada

Honourable Frank Oliver, Minister
W. W. Cory, Deputy Minister

FORESTRY BRANCH

R. H. Campbell, Superintendent

RIDING MOUNTAIN FOREST RESERVE

PROVINCE OF MANITOBA

SCALE: ONE MILE TO AN INCH

1909

Surveyed by J.R. Dickson, B.S.F.

Compiled by Geo. S. Proctor

LEGEND

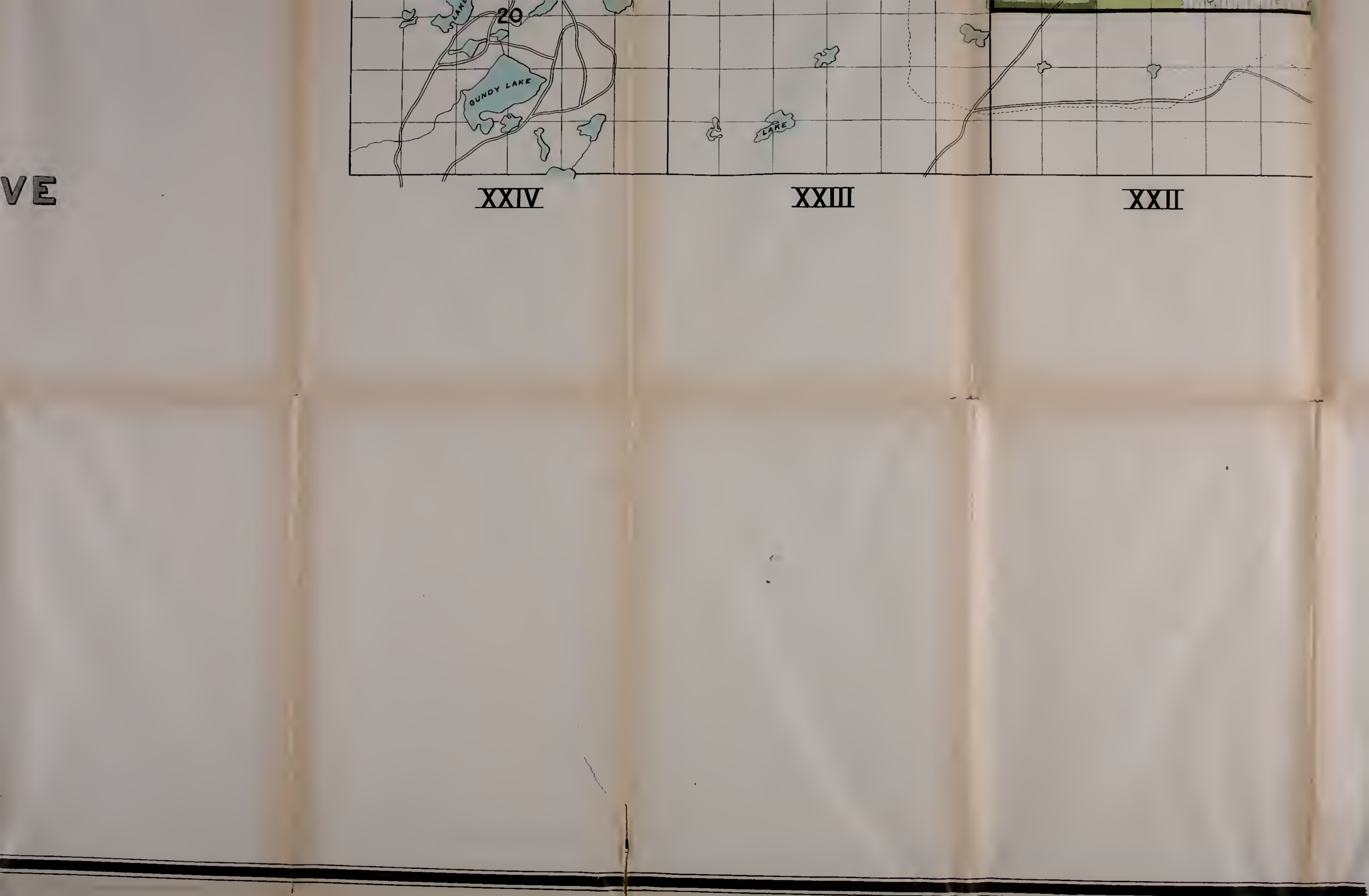
- Less than 2,000 B.F. per acre
- 2,000 to 5,000 B.F. per acre
- Woodland, cordwood, poles, etc.
- Scattered merchantable timber
- Burn forest cover established
- Burn scattered trees
- Burn not restocking
- Grassland, parks, etc.
- Timber berths

SYMBOLS OF TREE SPECIES

R.1.	Populus Tremuloides	Aspen Poplar
R.2.	Populus Balsamifera	Balsam Poplar
S.1.	Picea Canadensis	White Spruce
S.2.	Picea Mariana	Black Spruce
N.1.	Betula Alba var Papyrifera	Canoe Birch
L.1.	Larix Americana	Tamarack
P.1.	Pinus Banksiana	Jackpine
X.	Salix	Willow
Z.	Alnus	Alder

CONVENTIONAL SIGNS

- Fence
- Bridge
- Ferry
- Ford
- Nursery
- Corral
- Supervisor's headquarters
- Ranger's headquarters
- House
- Railroad station
- Hotel
- Store
- School
- Church
- Telegraph office
- Cabin
- Logging camp
- Sawmill, portable
- Sawmill, stationary
- Grist mill
- Grist and sawmill
- Boundary line for classifications
- Railroad
- Wagon road
- Secondary or private road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GUNDY LAKE
LAKE
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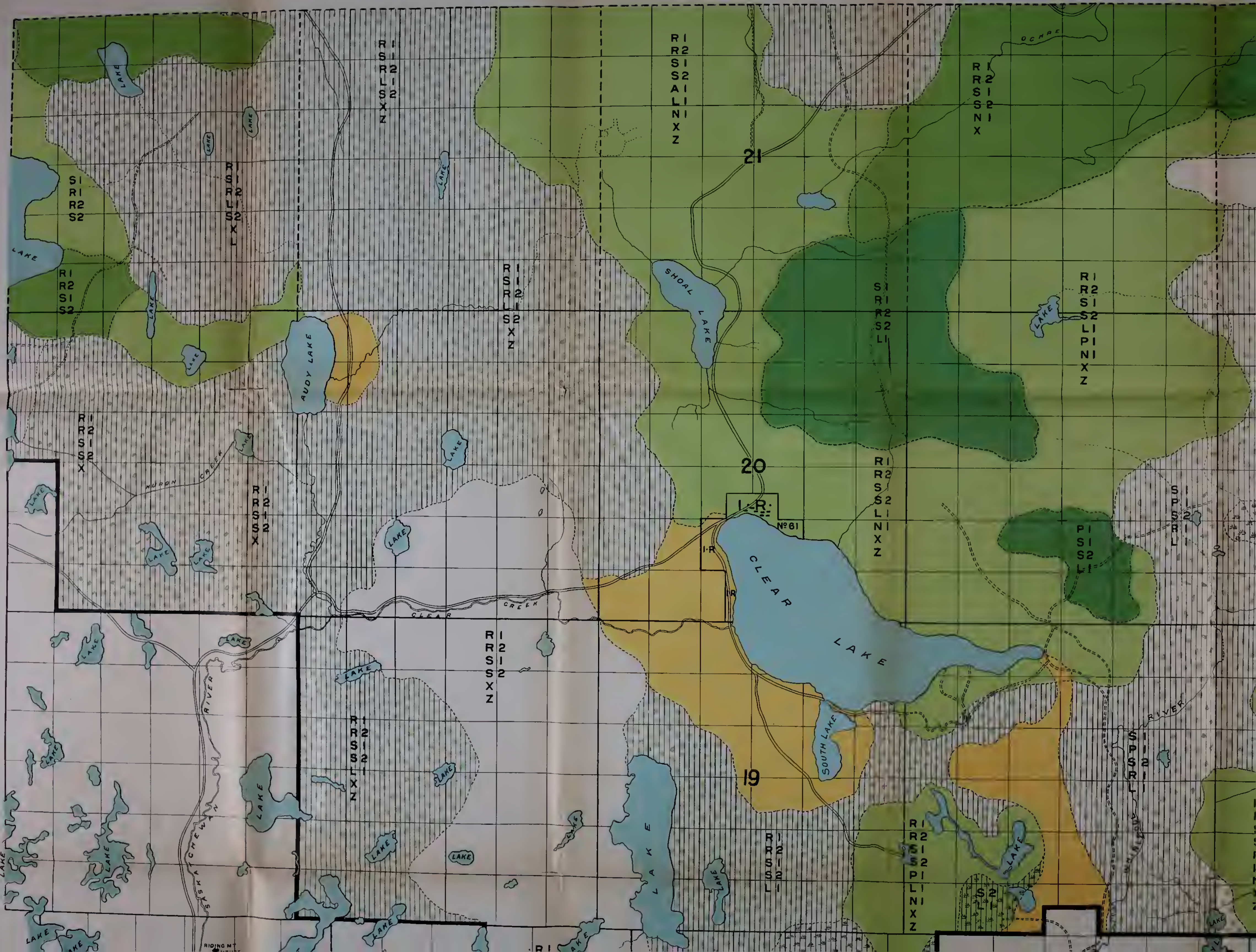
21
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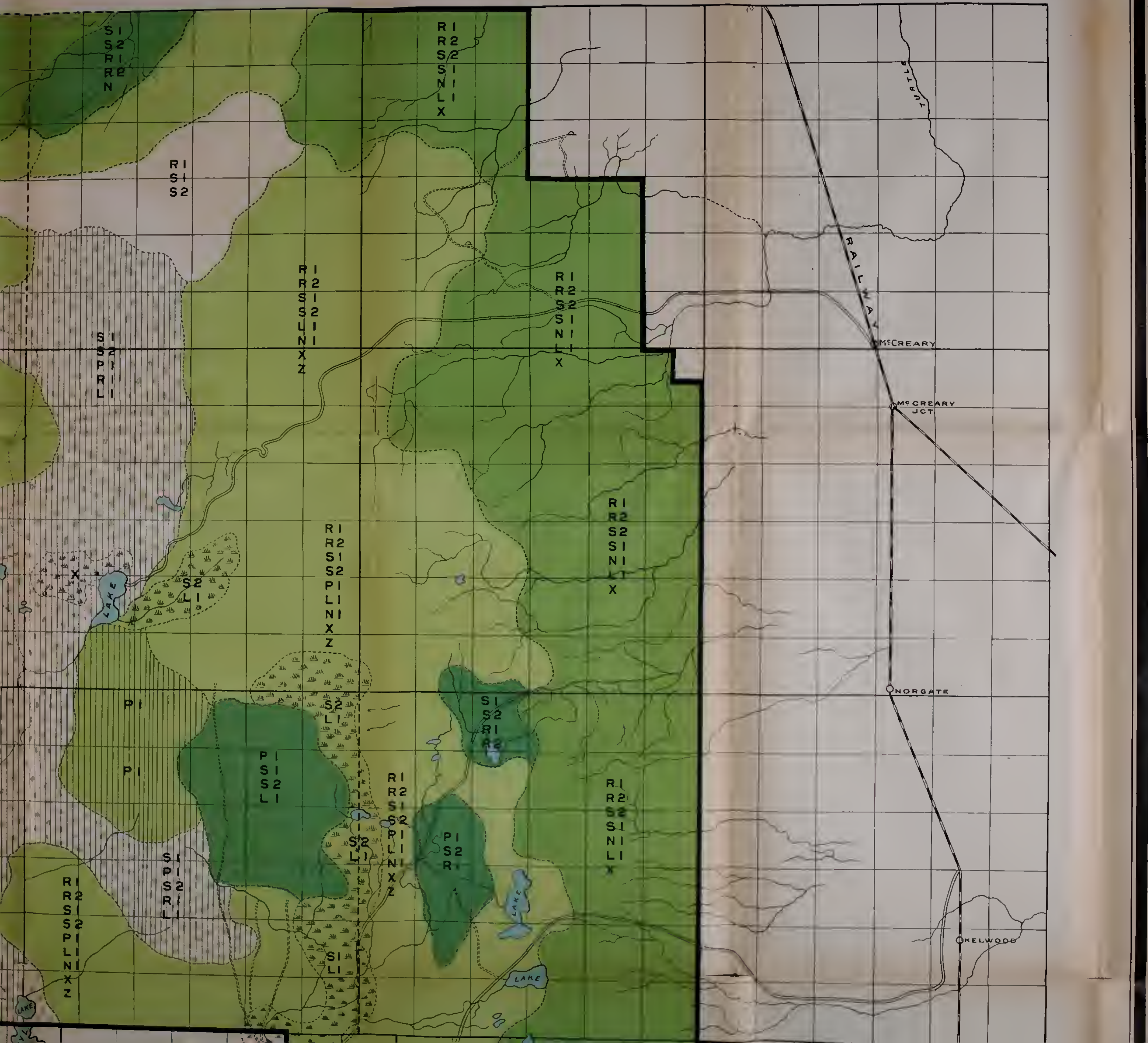
SHOAL LAKE
AUDY LAKE
CLEAR LAKE
SOUTH LAKE
HURON CREEK
CLEAR CREEK
SASKATCHEWAN RIVER
OCHRE
I.R.
No 61
I.R
LAKE
RIVER


TURTLE
RAILWAY
McCREARY
McCREARY JCT
NORGATE
KELWOOD
LAKE
LAKE
LAKE
LAKE


CLEAR LAKE
SOUTH LAKE
CLEAR CREEK
HURON CREEK
SASKATCHEWAN RIVER
LITTLE
WHIRLPOOL
RIVER
ROLLING
LONG LAKE
OTTER LAKE
LAKE JOSEPH
RIDING MT HOUSE
ELPHINSTONE
I·R· Nº 61
I·R
Nº61
CANADIAN NORTHERN RAILWAY
19
18
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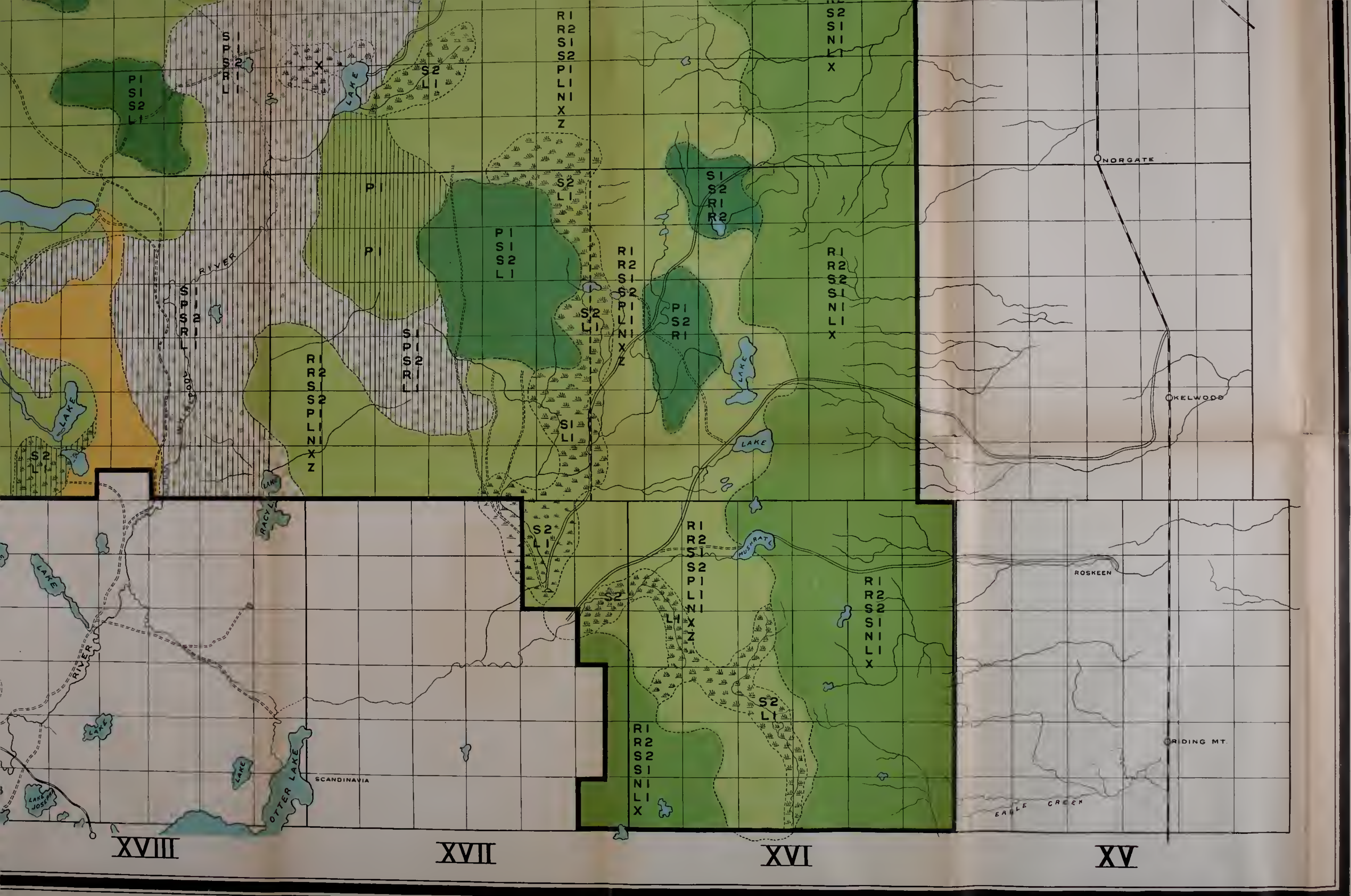
XIX
XVIII



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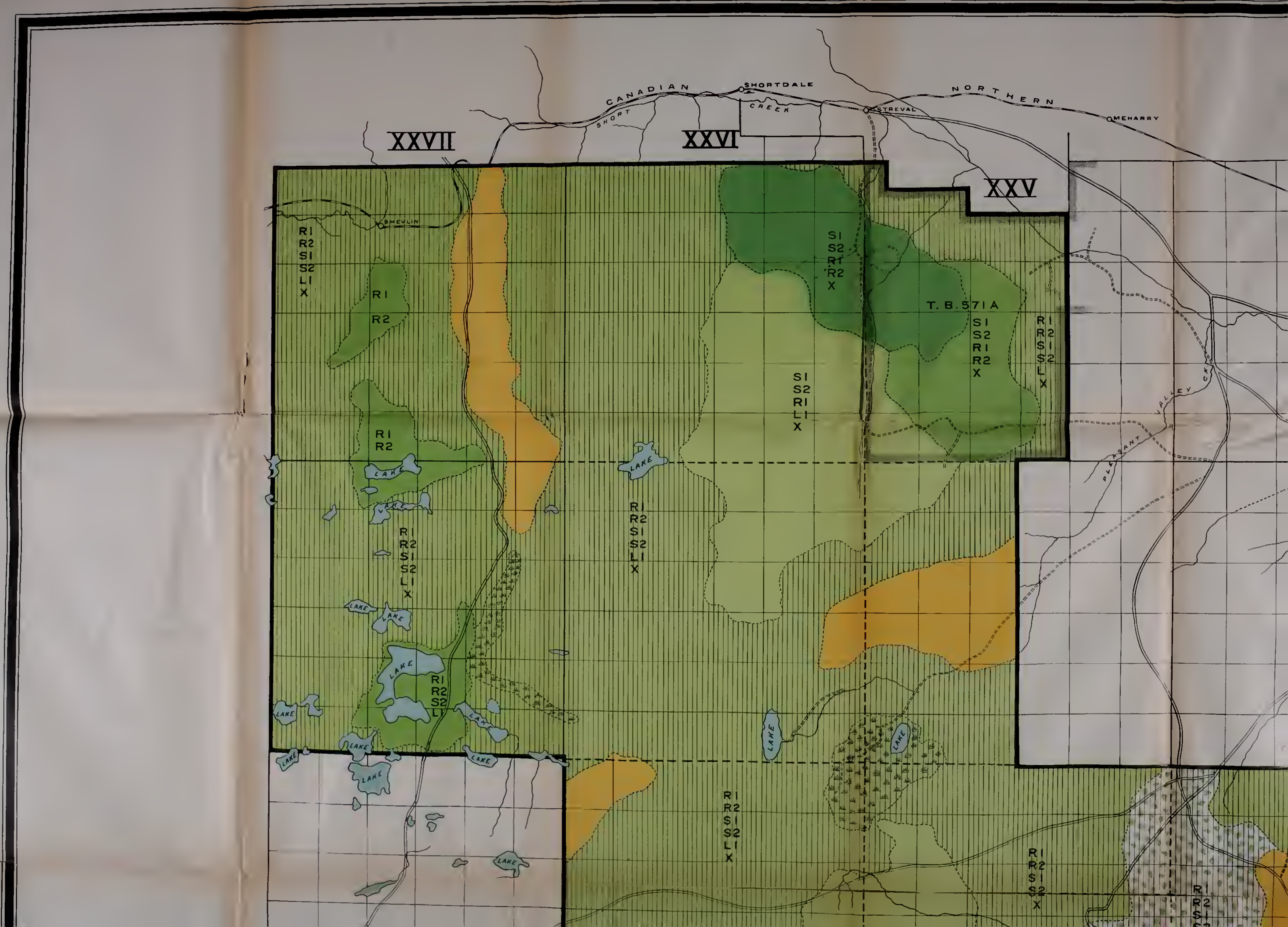
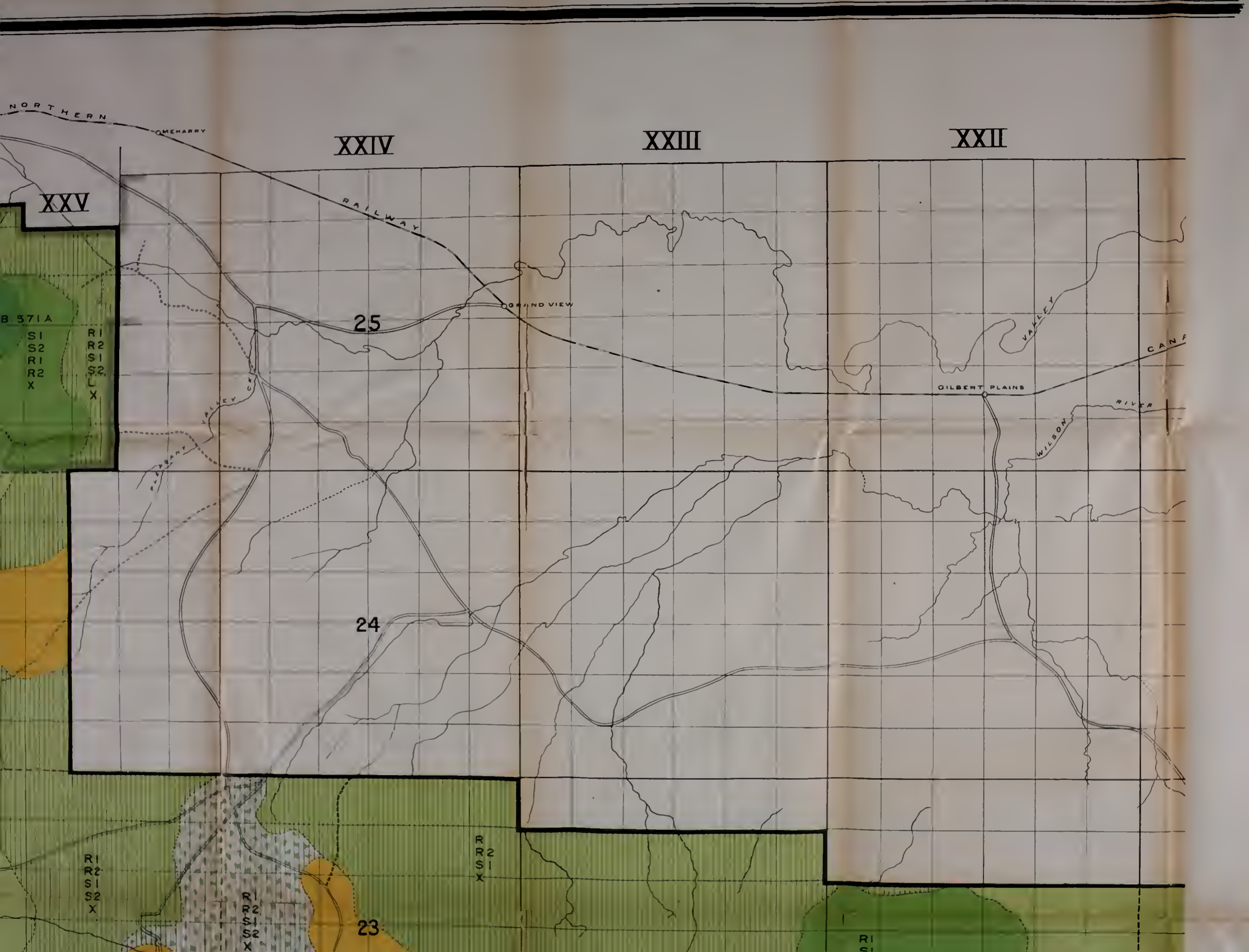
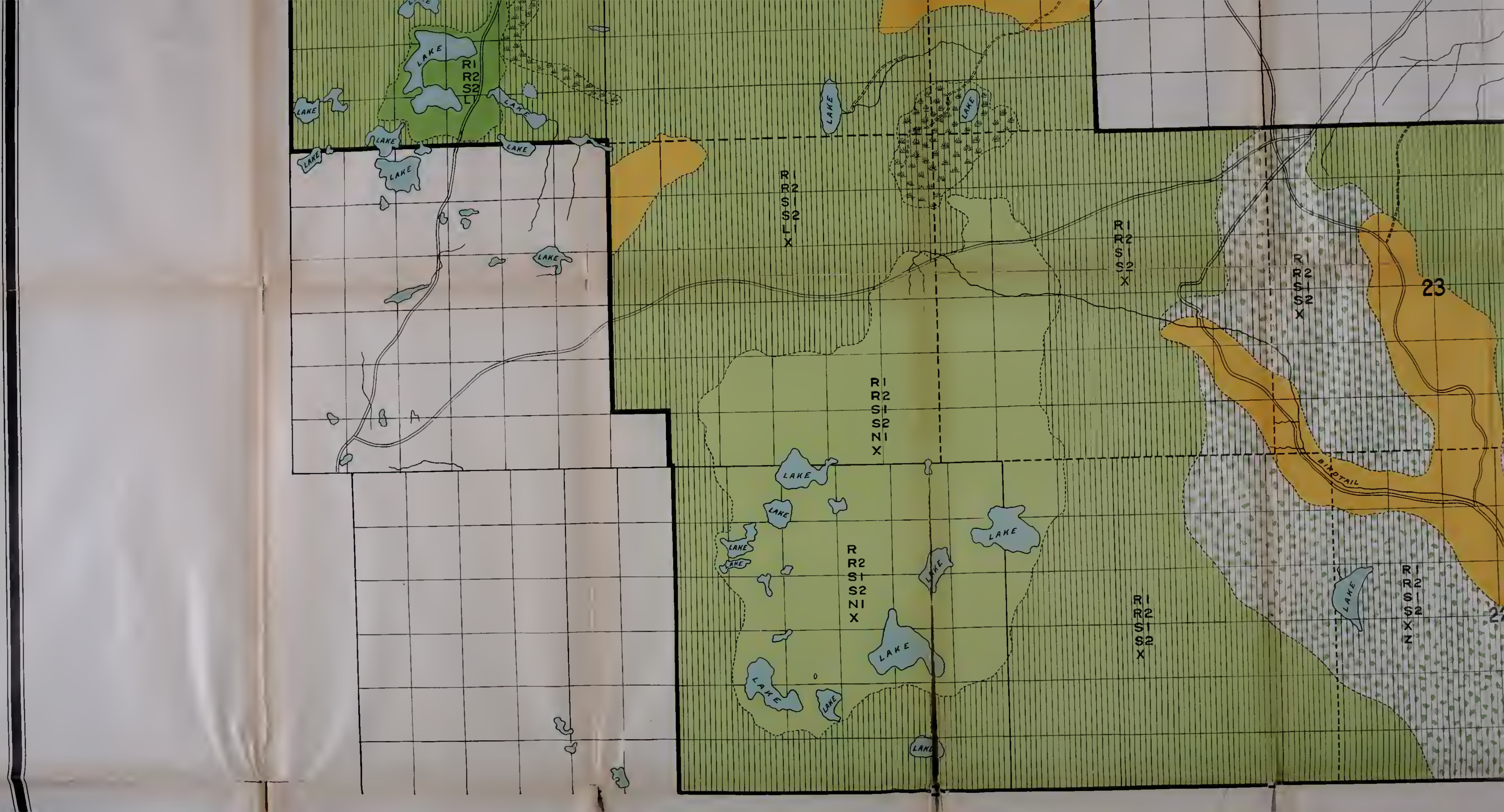
KELWOOD
ROSKEEN
RIDING MT.
SCANDINAVIA
OTTER LAKE
LAKE JOSEPH
MUSKRAT
EAGLE CREEK
RIVER
LAKE
XVIII
XVII
XVI
XV



CANADIAN
NORTHERN
SHORTDALE
SHORT CREEK
STREVAL
MEHARRY
XXVII
XXVI
XXV
SHEVLIN
T. B. 571 A
PLEASANT VALLEY CK.
LAKE
R1 R2 S1 S2 L1 X
R1 R2
S1 S2 R1 R2 X
S1 S2 R1 L1 X
S1 S2 R1 R2 X
R1 R2 S1 S2 L X
R1 R2 S1 S2 L1 X
R1 R2 S2 L1
R1 R2 S1 S2 L X
R1 R2 S1 S2 X



NORTHERN
MEHARRY
RAILWAY
XXIV
XXIII
XXII
XXV
GRAND VIEW
25
B 571 A
S1
S2
R1
R2
X
R1
R2
S1
S2
L
X
VALLEY CR.
PLEASANT
VALLEY
CAN
GILBERT PLAINS
RIVER
WILSON
24
R1
R2
S1
S2
X
R
R2
S1
X
23



LAKE
R1
R2
S2
L
LAKE
LAKE
LAKE
LAKE
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LAKE
LAKE
LAKE
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S1
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R2
S1
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R1
R2
S1
S2
X
23
R1
R2
S1
S2
N1
X
LAKE
LAKE
LAKE
LAKE
LAKE
R1
R2
S1
S2
N1
X
LAKE
LAKE
BIRDTAIL
LAKE
R1
R2
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S2
X
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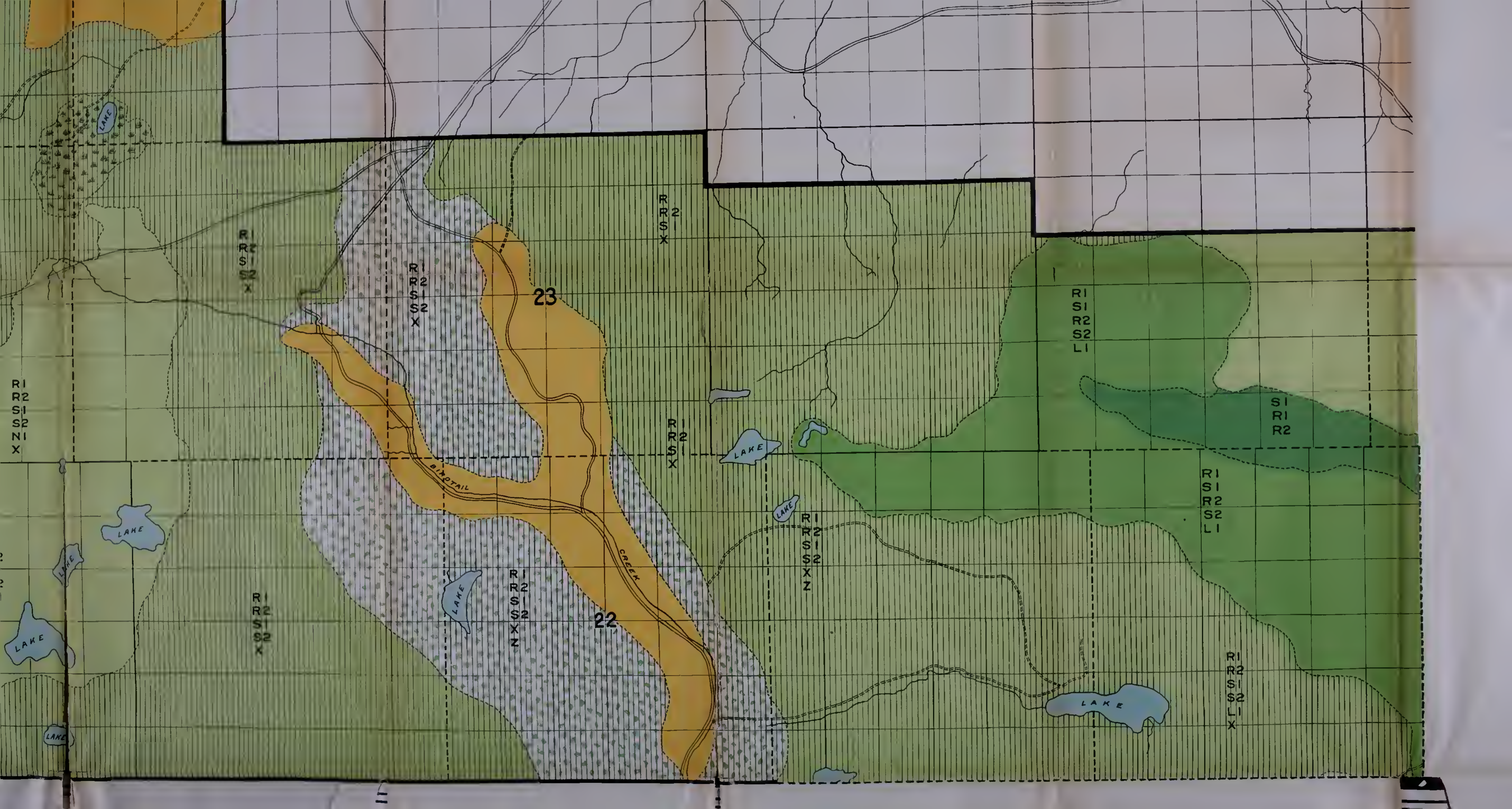
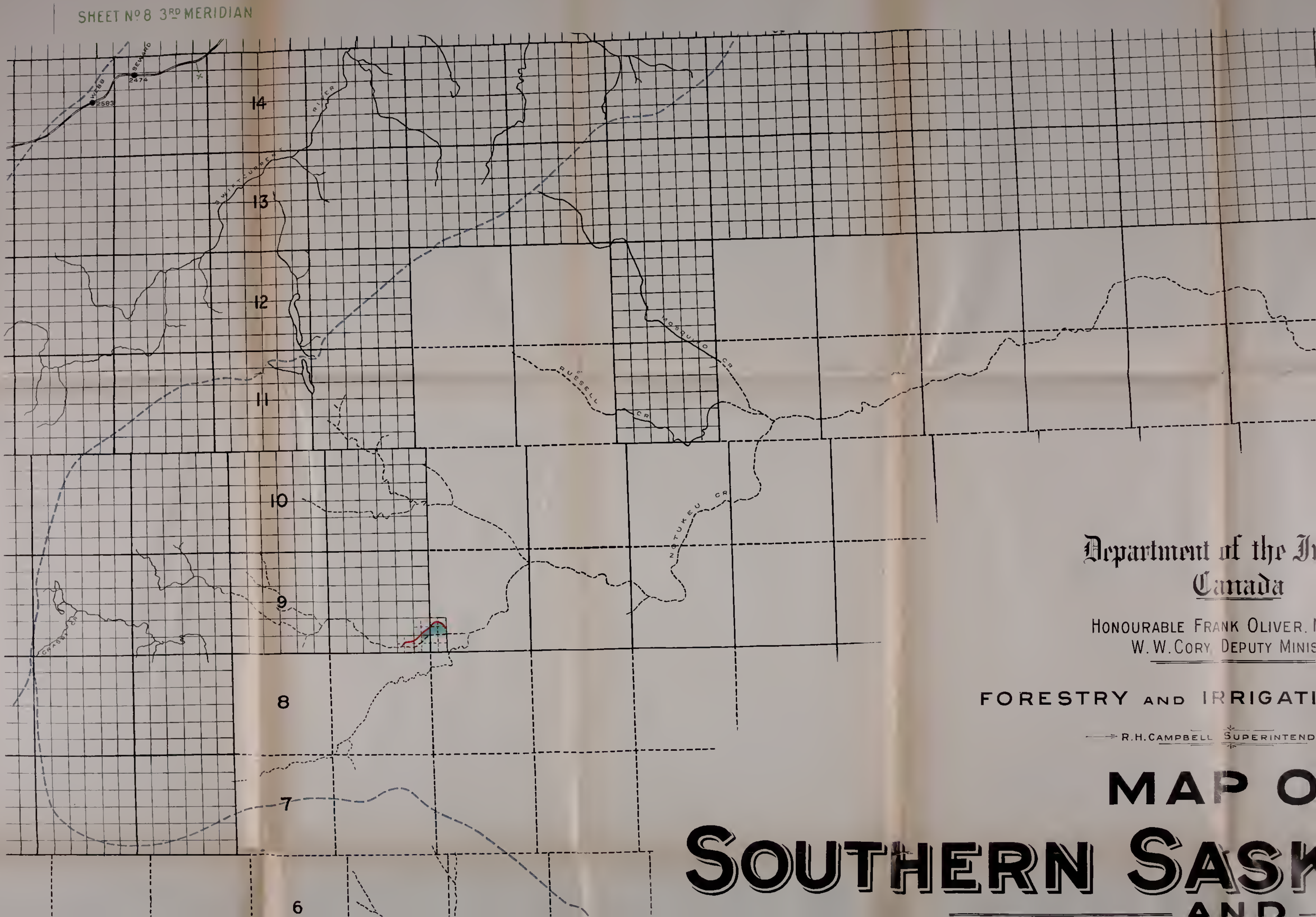
S2
X
LAKE
LAKE
LAKE
LAKE
2



23
22
BIRDTAIL
CREEK
LAKE
R1 R2 S1 S2 X
R R2 S1 S2 X
R R2 S X
R1 R2 S1 S2 N1 X
R1 R2 S1 S2 XZ
R1 R2 S X
R1 R2 S S2 XZ
R1 S1 R2 S2 L1
S1 R1 R2
R1 S1 R2 S2 L1
R1 R2 S1 S2 L1 X


SHEET No 8 3RD MERIDIAN
WEBB
2583
SEWARD
2474
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13
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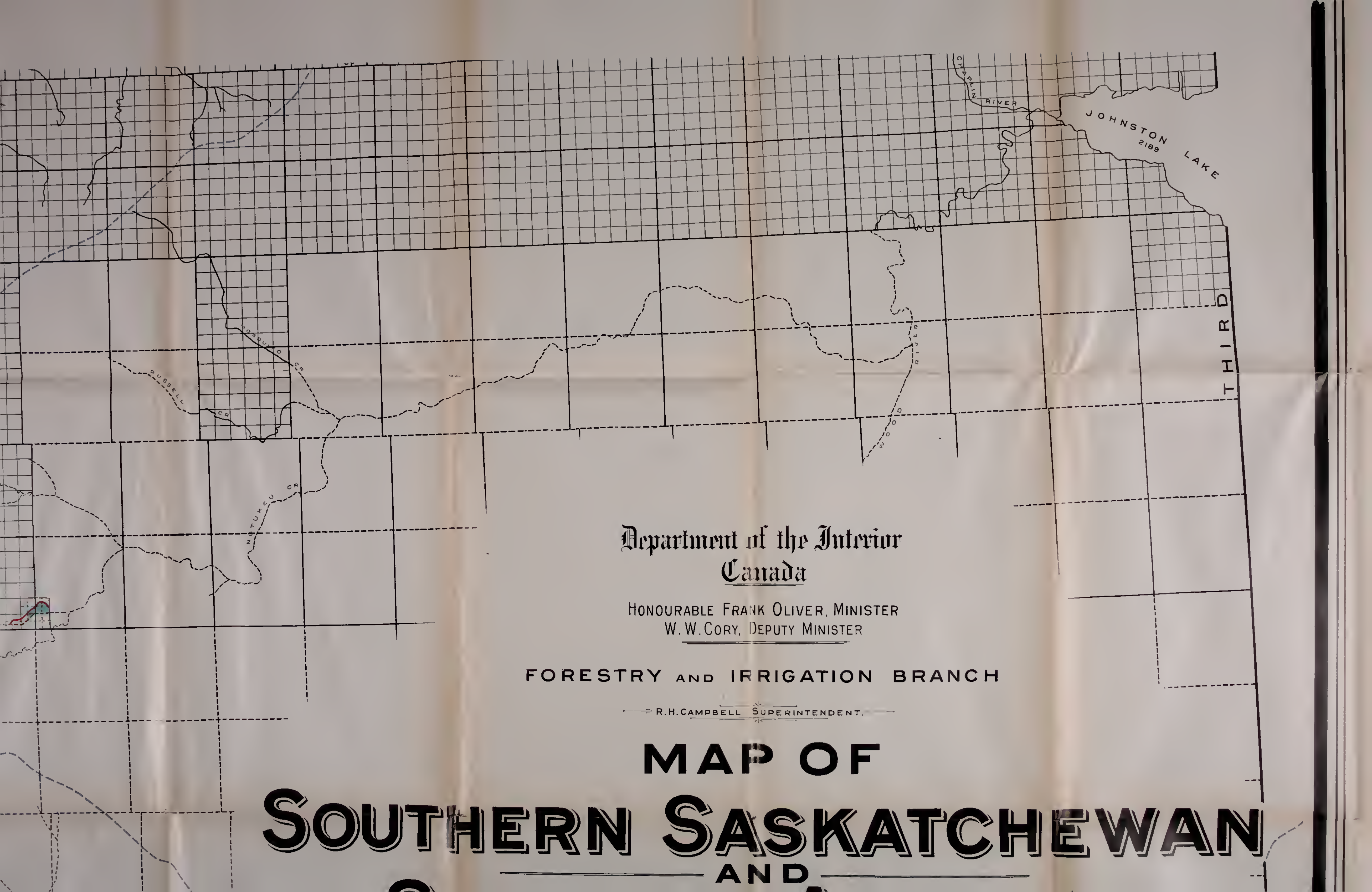
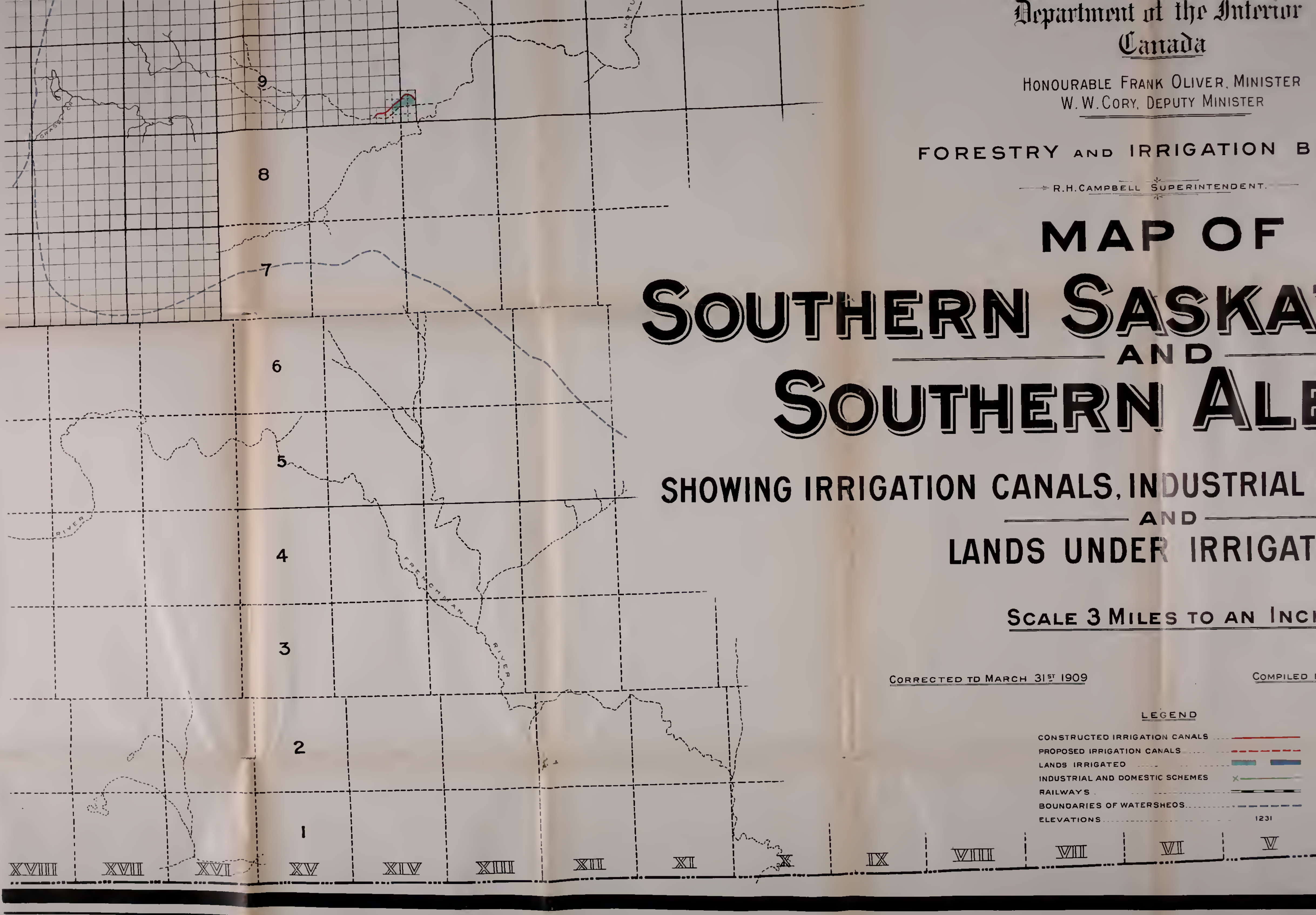
SWIFTCURRENT
RIVER
RUSSELL
CR
MOSQUITO
CR
NOTUKEU
CR
GRASSY CR
Department of the I
Canada
HONOURABLE FRANK OLIVER, M
W. W. CORY, DEPUTY MINIS
FORESTRY AND IRRIGATI
R.H. CAMPBELL SUPERINTEND
MAP O
SOUTHERN SASK
AND


CHAPLIN RIVER
JOHNSTON 2189 LAKE
MOSQUITO CR
RUSSELL CR
NOTUKEU CR
WOOD RIVER
THIRD
Department of the Interior
Canada
Honourable Frank Oliver, Minister
W. W. Cory, Deputy Minister
FORESTRY AND IRRIGATION BRANCH
R.H. CAMPBELL SUPERINTENDENT.
MAP OF
SOUTHERN SASKATCHEWAN
AND


Department of the Interior
Canada
Honourable Frank Oliver, Minister
W. W. Cory, Deputy Minister
FORESTRY AND IRRIGATION BR
R.H. CAMPBELL SUPERINTENDENT.
MAP OF
SOUTHERN SASKAT
AND
SOUTHERN ALE
SHOWING IRRIGATION CANALS, INDUSTRIAL
AND
LANDS UNDER IRRIGATI
SCALE 3 MILES TO AN INCH
CORRECTED TO MARCH 31ST 1909
COMPILED BY
LEGEND
CONSTRUCTED IRRIGATION CANALS
PROPOSED IRRIGATION CANALS
LANDS IRRIGATED
INDUSTRIAL AND DOMESTIC SCHEMES
RAILWAYS
BOUNDARIES OF WATERSHEDS
ELEVATIONS
1231
9
8
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6
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4
3
2
1
FRENCHMAN RIVER
RIVER
XVIII
XVII
XVI
XV
XIV
XIII
XII
XI
X
IX
VIII
VII
VI
V


Department of the Interior
Canada
Honourable Frank Oliver, Minister
W. W. Cory, Deputy Minister
FORESTRY AND IRRIGATION BRANCH
R.H. CAMPBELL SUPERINTENDENT.
MAP OF
SOUTHERN SASKATCHEWAN
AND
SOUTHERN ALBERTA
SHOWING IRRIGATION CANALS, INDUSTRIAL AND DOMESTIC SCHEMES
AND
LANDS UNDER IRRIGATION.
Scale 3 Miles to an Inch
Corrected to March 31st 1909
Compiled by George S. Proctor.
LEGEND
CONSTRUCTED IRRIGATION CANALS
PROPOSED IRRIGATION CANALS
LANDS IRRIGATED
INDUSTRIAL AND DOMESTIC SCHEMES
RAILWAYS
BOUNDARIES OF WATERSHEDS
ELEVATIONS
1231
RIVER
XIII
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XI
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VIII
VII
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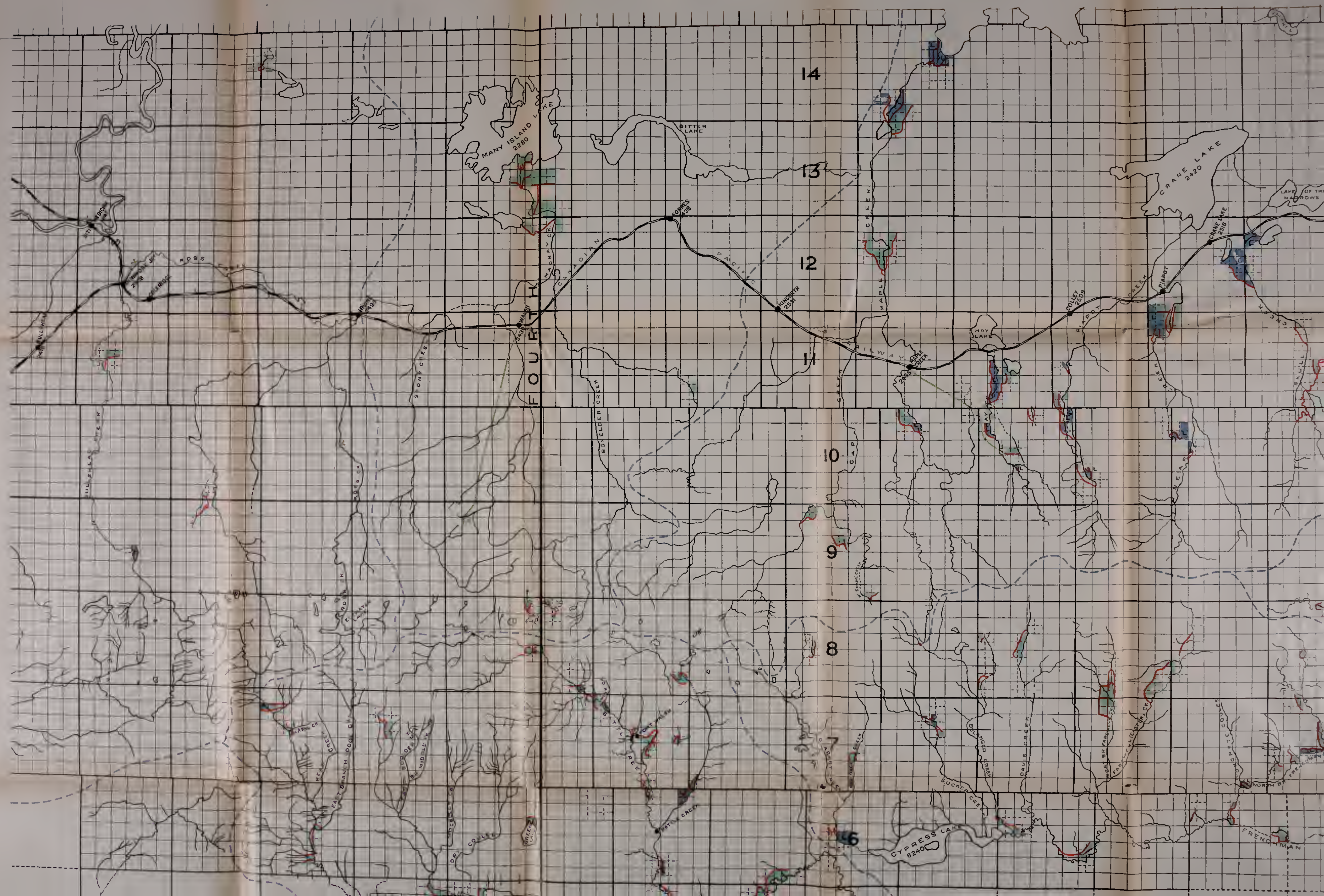

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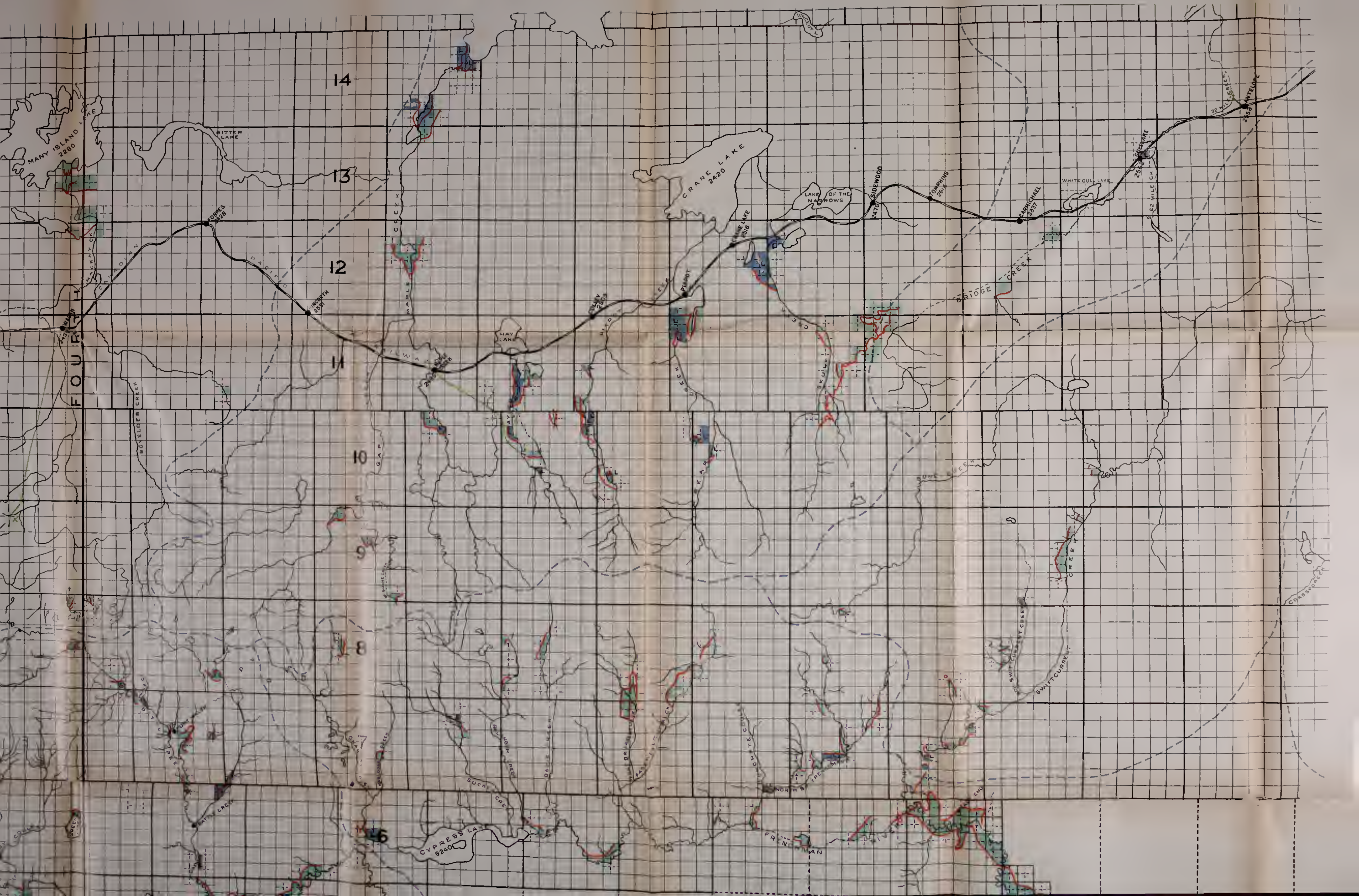
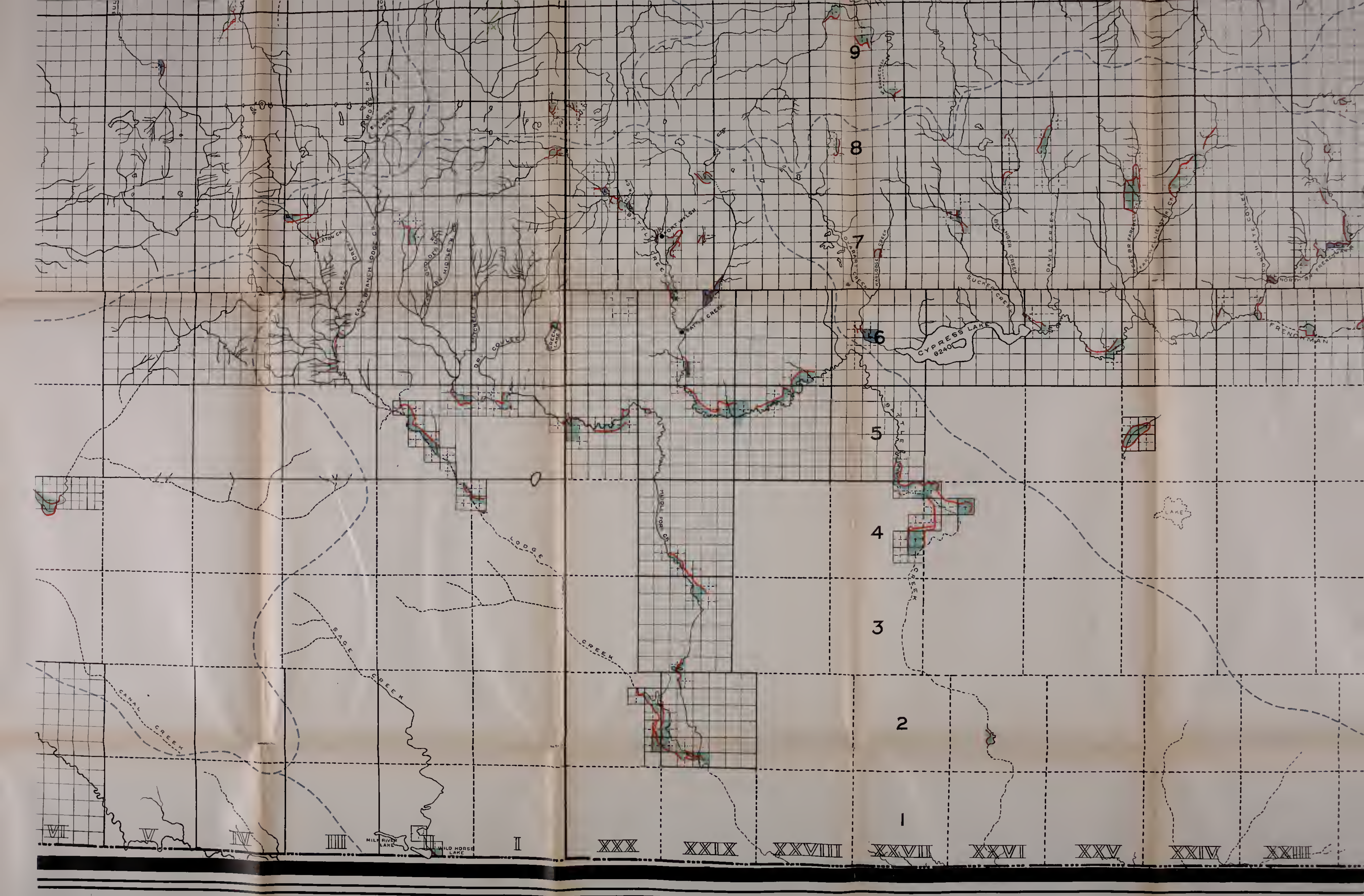
6
MANY ISLAND LAKE
2280
BITTER LAKE
CRANE LAKE
2420
FORRES
KINCORTH
2531
MAPLE CREEK
PIAPOT
CRANE LAKE
HAY LAKE
ROSS CREEK
FOURTH
CANADIAN
PACIFIC
RAILWAY
MACKAY CR
STONY CREEK
BOXELDER CREEK
GAP CREEK
MAPLE CREEK
BEAR CREEK
SKULL CREEK
PIAPOT CREEK
SUCKER CREEK
DAVIS CREEK
BELANGER CREEK
BATTLE CREEK
CYPRESS LAKE
FRENCHMAN

SHEET No 7 3RD & 4TH MERIDIAN




9
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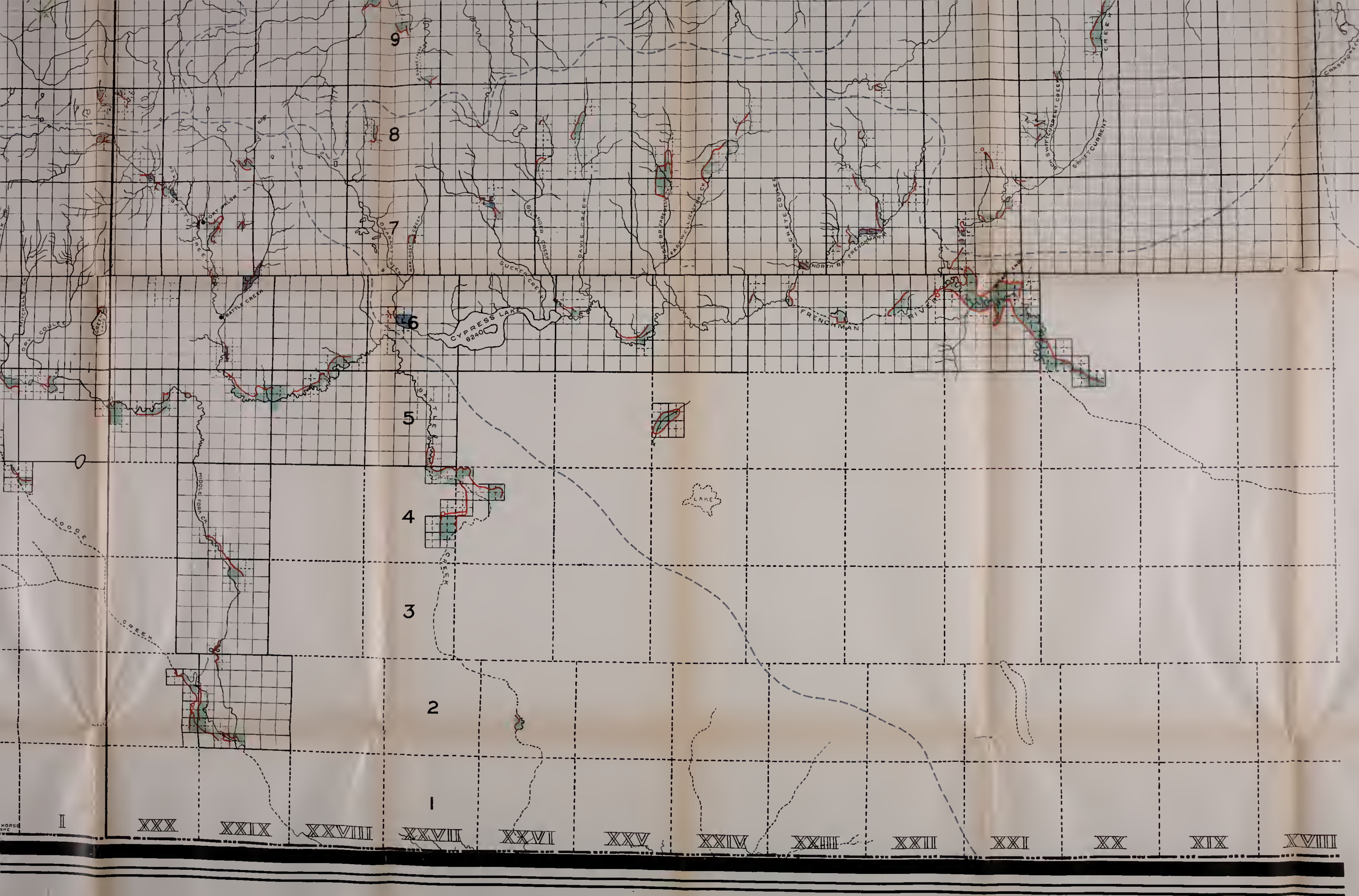
VII
V
IV
IIII
I
XXX
XXIX
XXVIII
XXVII
XXVI
XXV
XXIV
XXIII
CYPRESS LAKE
FORT WALSH
BATTLE CREEK
LODGE
CREEK
SAGE
CREEK
CANAL
CREEK
MIDDLE FORK CK.
MILK RIVER LAKE
WILD HORSE LAKE
FRENCHMAN
DAVIS CREEK
BELANGER CREEK
SUCKER CREEK
LAKE


9
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1
CYPRESS LAKE
BATTLE CREEK
MIDDLE FORK CR.
DAVIS CREEK
SUCKER CREEK
FRENCHMAN
RIVER
SWIFTCURRENT
LAKE
I
XXX
XXIX
XXVIII
XXVII
XXVI
XXV
XXIV
XXIII
XXII
XXI
XX
XIX
XVIII

14
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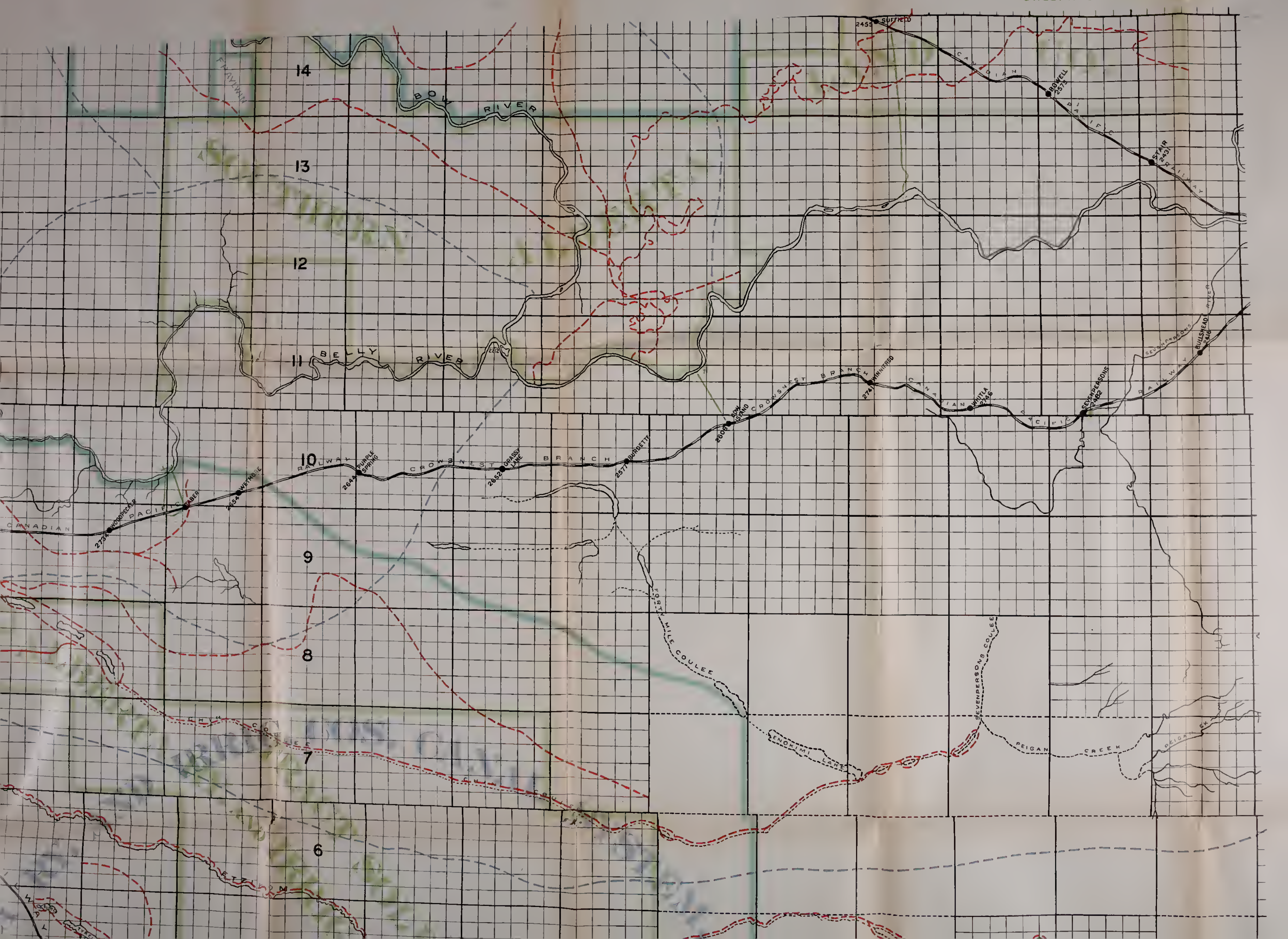
6
BOW RIVER
BELLY RIVER
BELLY RIVER
CANADIAN PACIFIC RAILWAY CROWSNEST BRANCH
2644 PURPLE SPRING
2652 GRASSY LAKE
2577 BURDETTE
TABER
2724 WOODPECKER
2826 COALDALE
LETHBRIDGE
3238 KIPP
2956.9
2765
WHOOPUP
RESERVE
FORTY MILE COULEE
RIVER
2996


14
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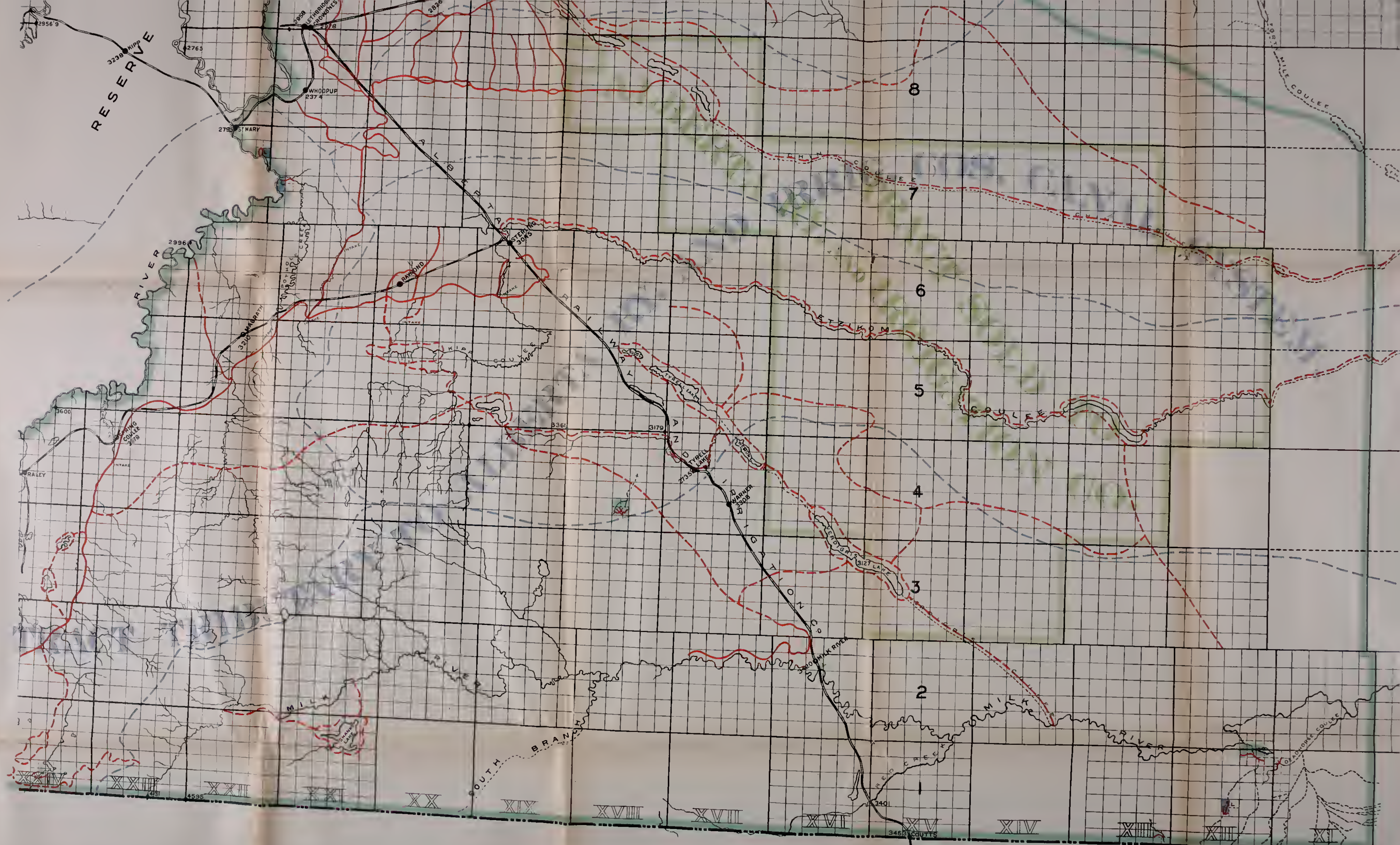
BOW RIVER
BELLY RIVER
2455 SUFFIELD
BOWELL 2575
STAIR 2431
CANADIAN PACIFIC RAILWAY
CROWSNEST BRANCH
WINNIFRED 2741
WHITLA 2746
SEVENPERSONS 2462
BULLSHEAD
SEVENPERSONS RIVER
BOW ISLAND 2606
BURDETTE 2577
GRASSY LAKE 2652
PURPLE SPRING 2644
WETMORE 2654
TABER
WOODPECKER 2734
2212
FORTY MILE COULEE
SEVENPERSONS COULEE
PEIGAN CREEK
ENOKIMI LAKE



RESERVE
KIPP
3238
2956.9
2765
LETHBRIDGE
2778
WHOOPUP
2374
2795 ST MARY
RIVER
2996
MAGRATH
RAYMOND
STERLING
3045
ALBERTA RAILWAY AND IRRIGATION CO.
INTAKE
KIPP COULEE
CHIN COULEE
ETZIKOM COULEE
TYRELL LAKE
3179
3361
WARNER
3308
3127 LAKE
3600
SPRING COULEE
RALEY
MILK RIVER
SOUTH BRANCH
RED CREEK
3401
3450 COUTTS
FORTY MILE COULEE
TRACT
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XXIV
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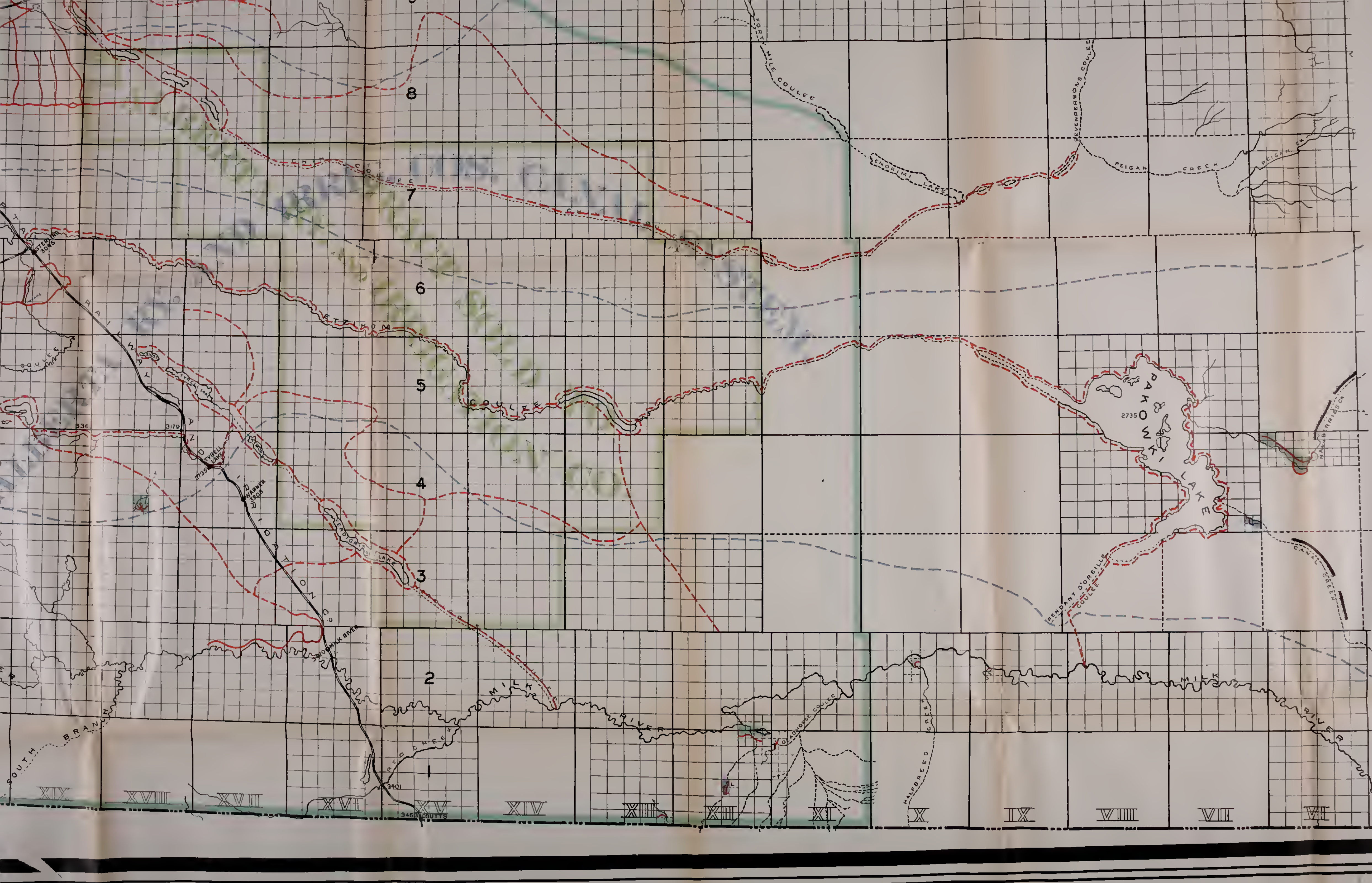
XII
XI
4595



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FORTY MILE COULEE
SEVENPERSONS COULEE
PEIGAN CREEK
ENOKIMI LAKE
STERLING
3045
RAILWAY
TYRELL LAKE
WARNER
3308
IRRIGATION CO.
VERDIGRIS LAKE
ETZIKOM COULEE
PAKOWKI LAKE
2735
PENDANT D'OREILLE COULEE
CANAL CREEK
MILK RIVER
RED CREEK
HALFBREED CREEK
SOUTH BRANCH
3401
3468
COUTTS
XIX
XVIII
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XI
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BRITISH COLUMB
13
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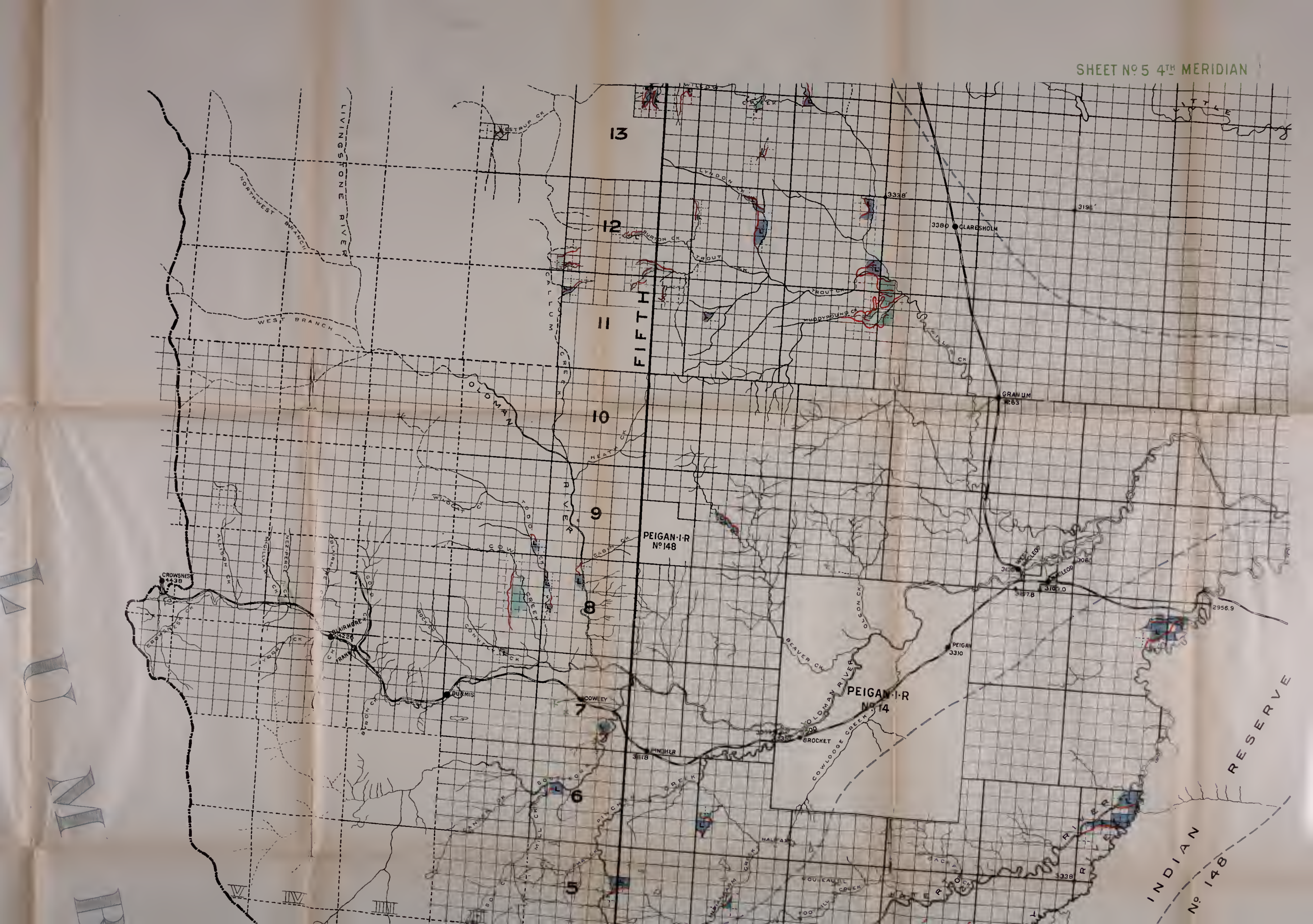
FIFTH
LIVINGSTONE RIVER
NORTHWEST BRANCH
WEST BRANCH
OLDMAN RIVER
CALLUM CREEK
PEIGAN I.R
Nº 148
CROWSNEST
4438
BLAIRMORE
4226
COWLEY
PINCHER
WILDCAT CK
COW CREEK
ALLISON CK
McGILLIVRAY CK
NEZ PERCE CK
BLAIRMORE CK
GOLD CK
ROCK CK
LYON CK
V
IV



SHEET Nº 5 4TH MERIDIAN
13
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FIFTH
LIVINGSTONE RIVER
NORTHWEST BRANCH
WEST BRANCH
CALLUM CREEK
OLDMAN RIVER
PEIGAN I.R Nº 148
PEIGAN I.R Nº 14
CLARESHOLM
GRANUM
PEIGAN
BROCKET
COWLEY
PINCHER
BURMIS
FRANK
BLAIRMORE
CROWSNEST
WILLOW CREEK
TROUT CK
MUDDYPOUND CK
BEAVER CK
OLSON CK
COWLODGE CREEK
INDIAN RESERVE
Nº 148
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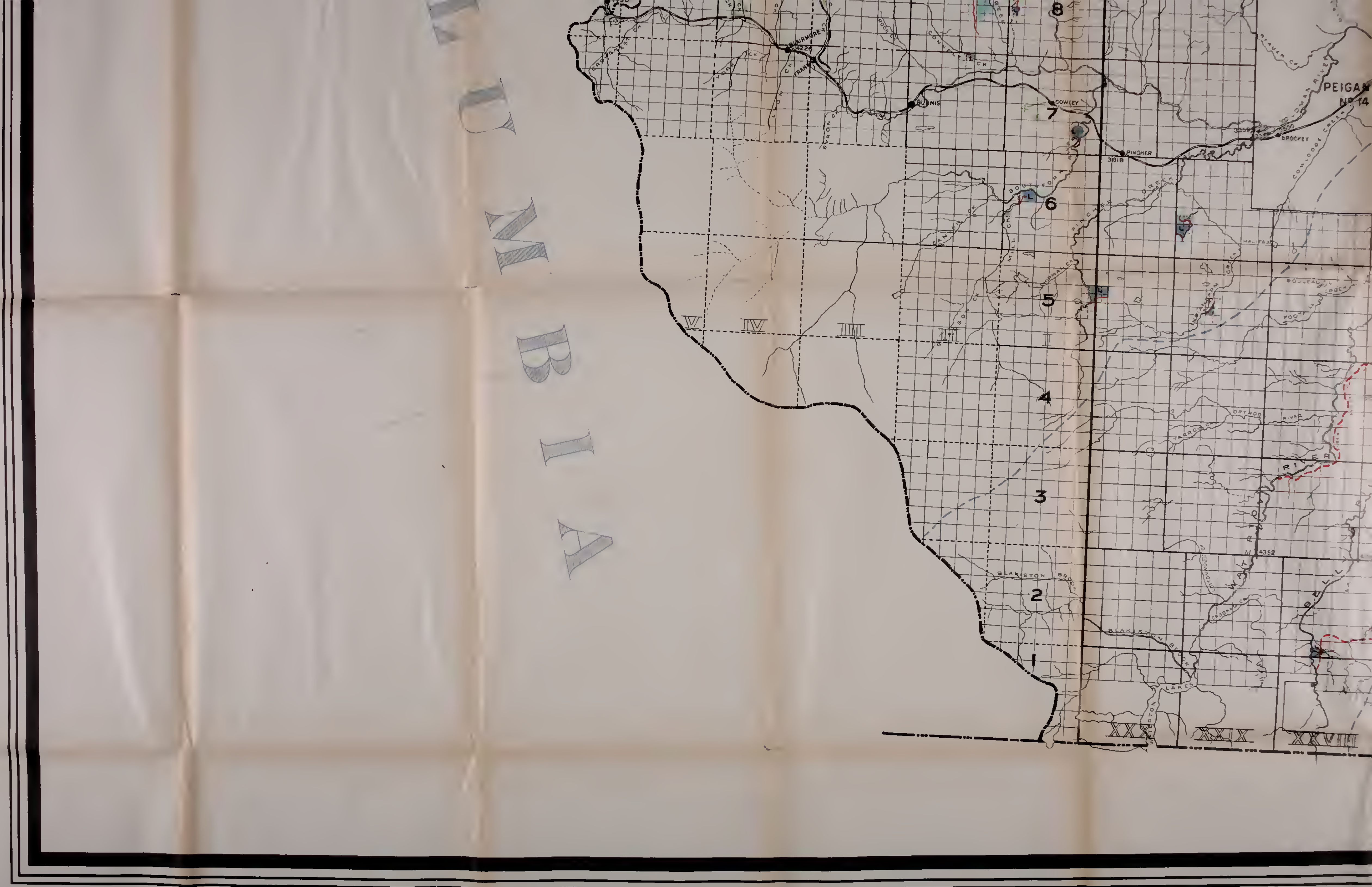
3380
3310



M B I A
BLAIRMORE
BURMIS
COWLEY
PINCHER
3818
PEIGAN
No 14
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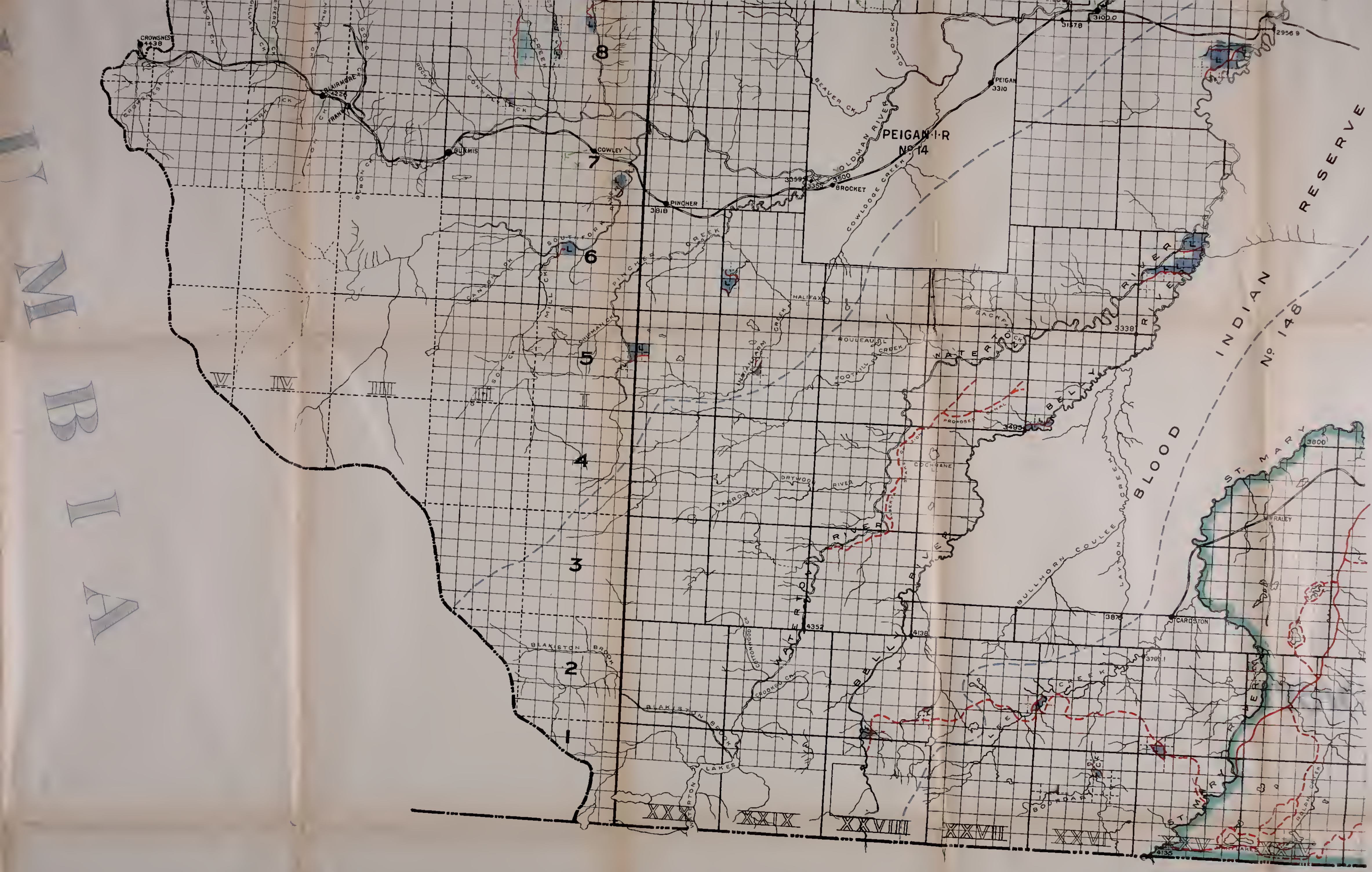
XXIX
XXVIII
BLAKISTON BROOK
4352



CROWSNEST
4438
BLAIRMORE
FRANK
BURMIS
COWLEY
PINCHER
3818
BROCKET
3500
PEIGAN I.R
No 14
PEIGAN
3310
OLDMAN RIVER
BEAVER CK
COWLODGE CREEK
BLOOD INDIAN RESERVE
No 148
HALIFAX
ROULEAU L
FOOTHILL CREEK
WATERTON RIVER
BELLY RIVER
DRYWOOD RIVER
YARROW CK
PINCHER CREEK
SOUTH FORK
MILL CK
INDIAN FARM CREEK
BULLHORN COULEE
LAYTON CREEK
ST. MARY RIVER
CARDSTON
3876
4352
4136
4135
3800
RALEY
BLAKISTON BROOK
COTTONWOOD CK
CROOKED CK
LAKES
BOUNDARY
3338
3493
COCHRANE L
PROPOSED CANAL
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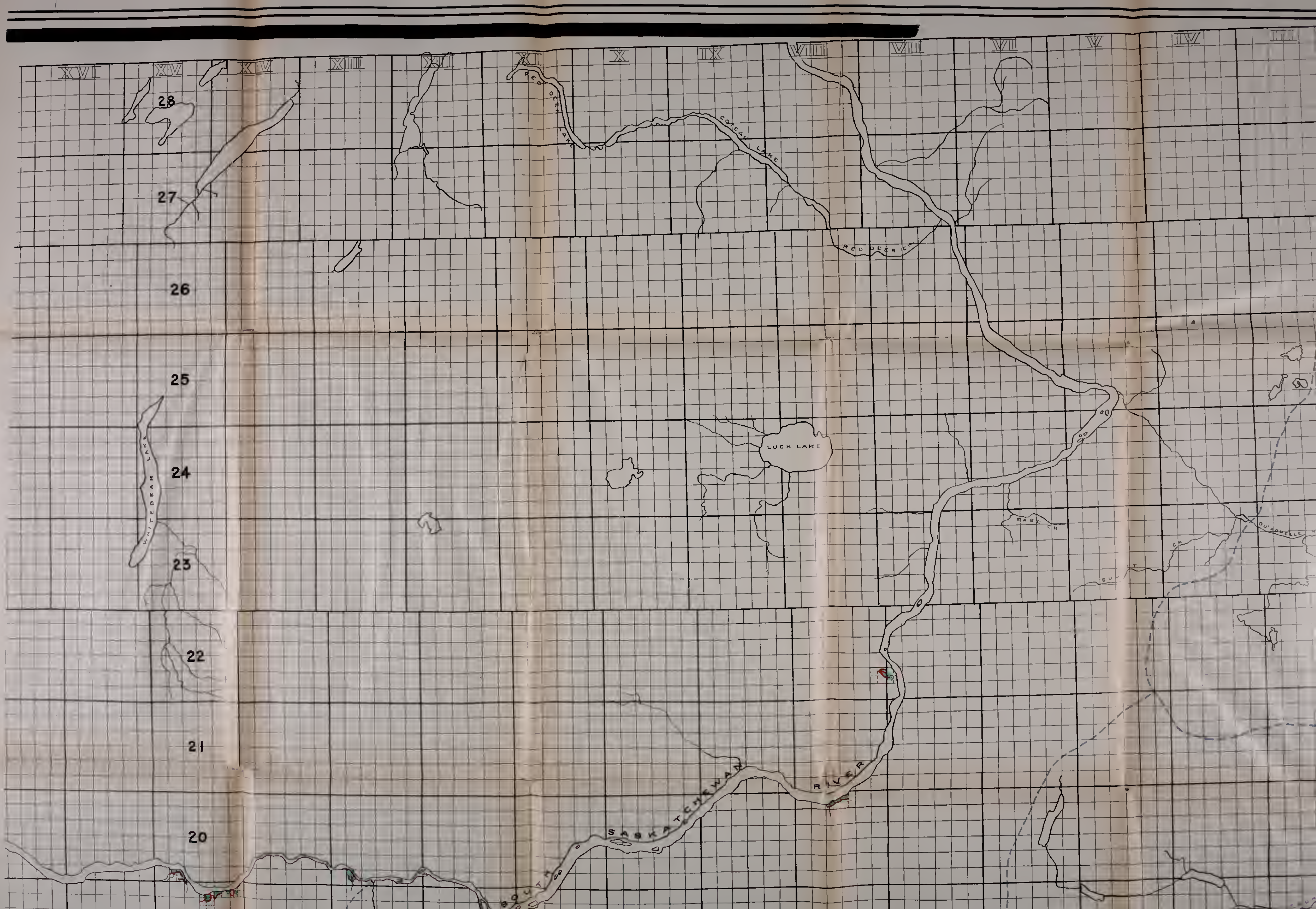

XVI
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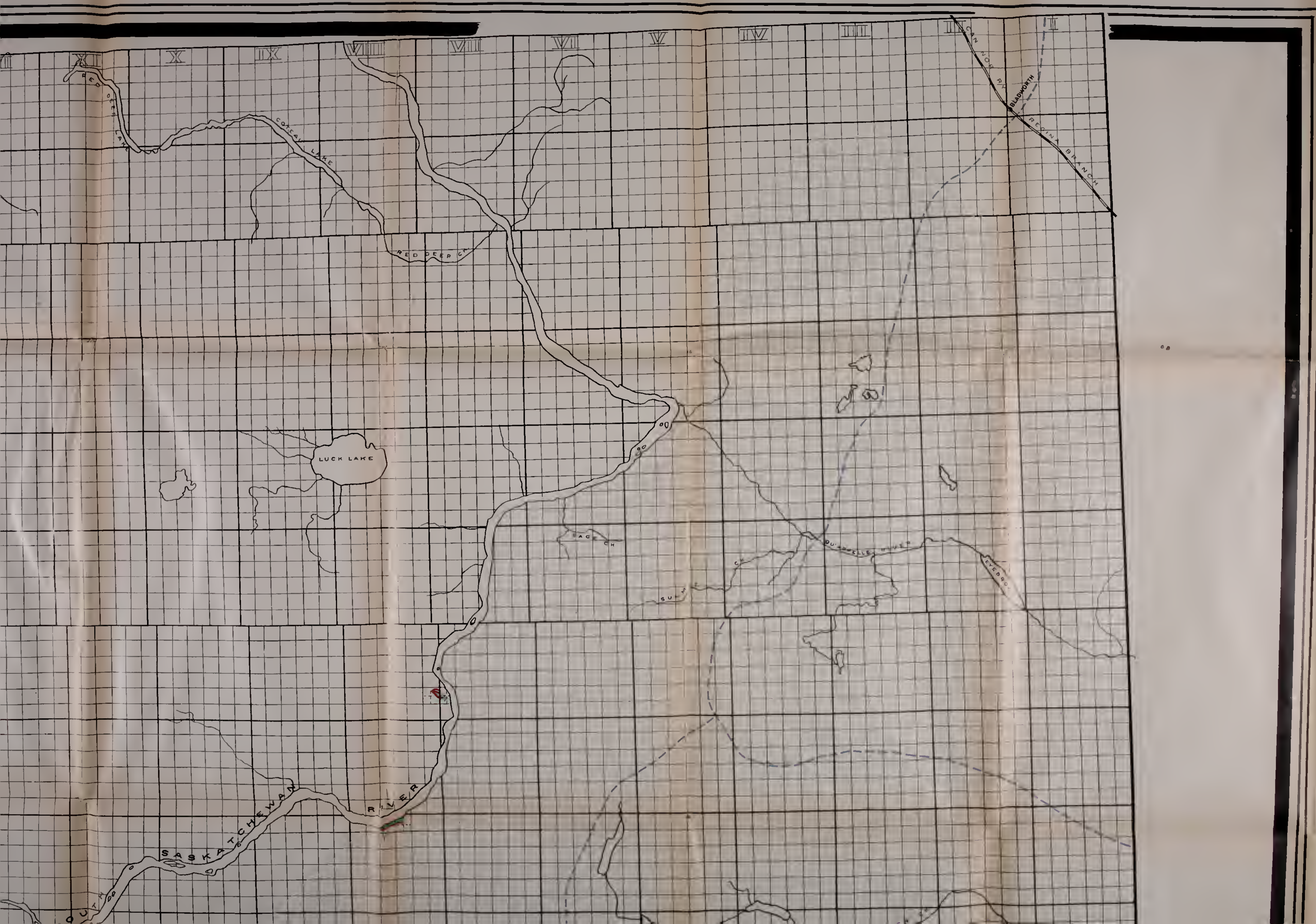
RED DEER LAKE
COTEAU LAKE
RED DEER CR.
WHITEBEAR LAKE
LUCK LAKE
SAGE CR.
QU'APPELLE
SOUTH SASKATCHEWAN RIVER


XI
X
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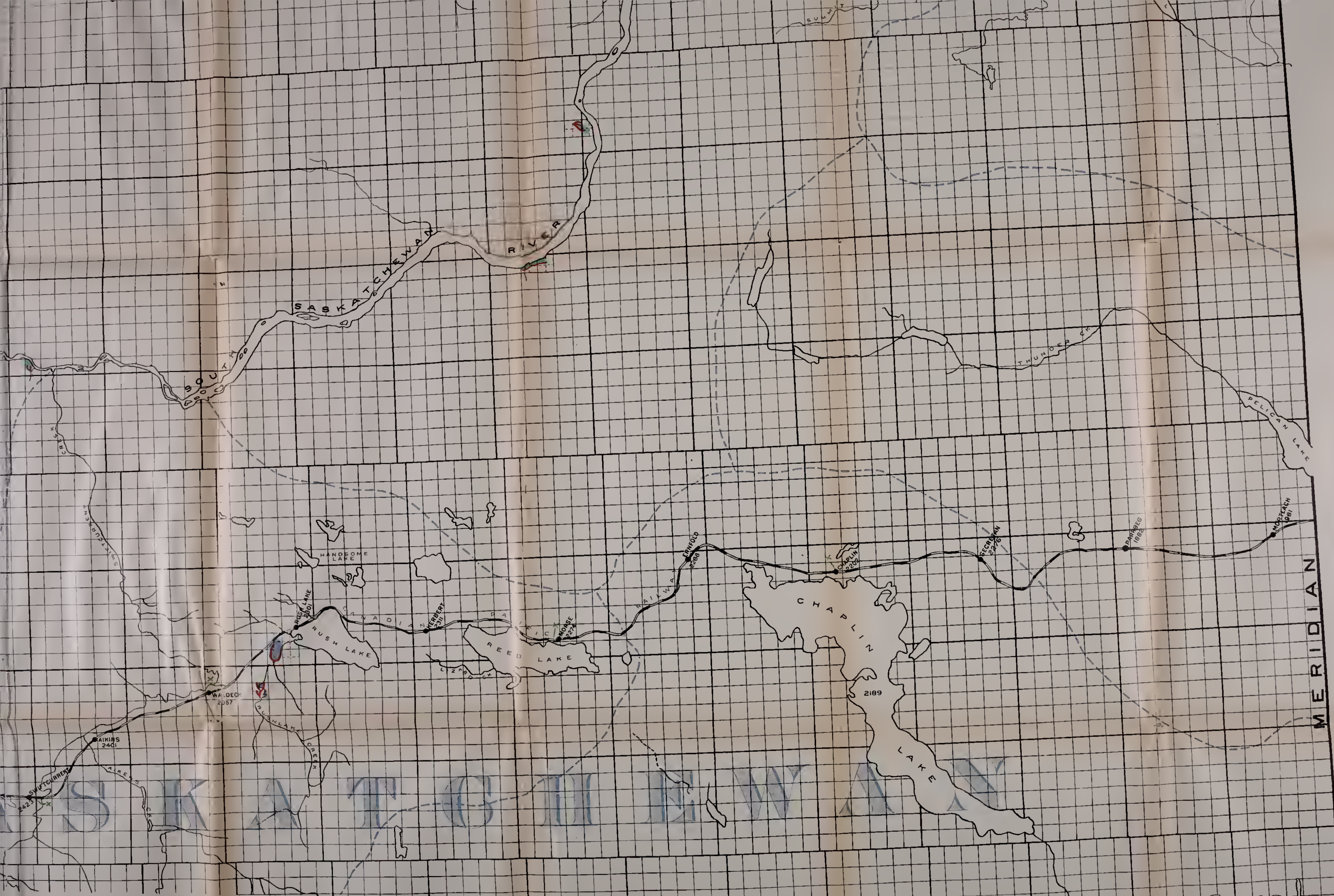
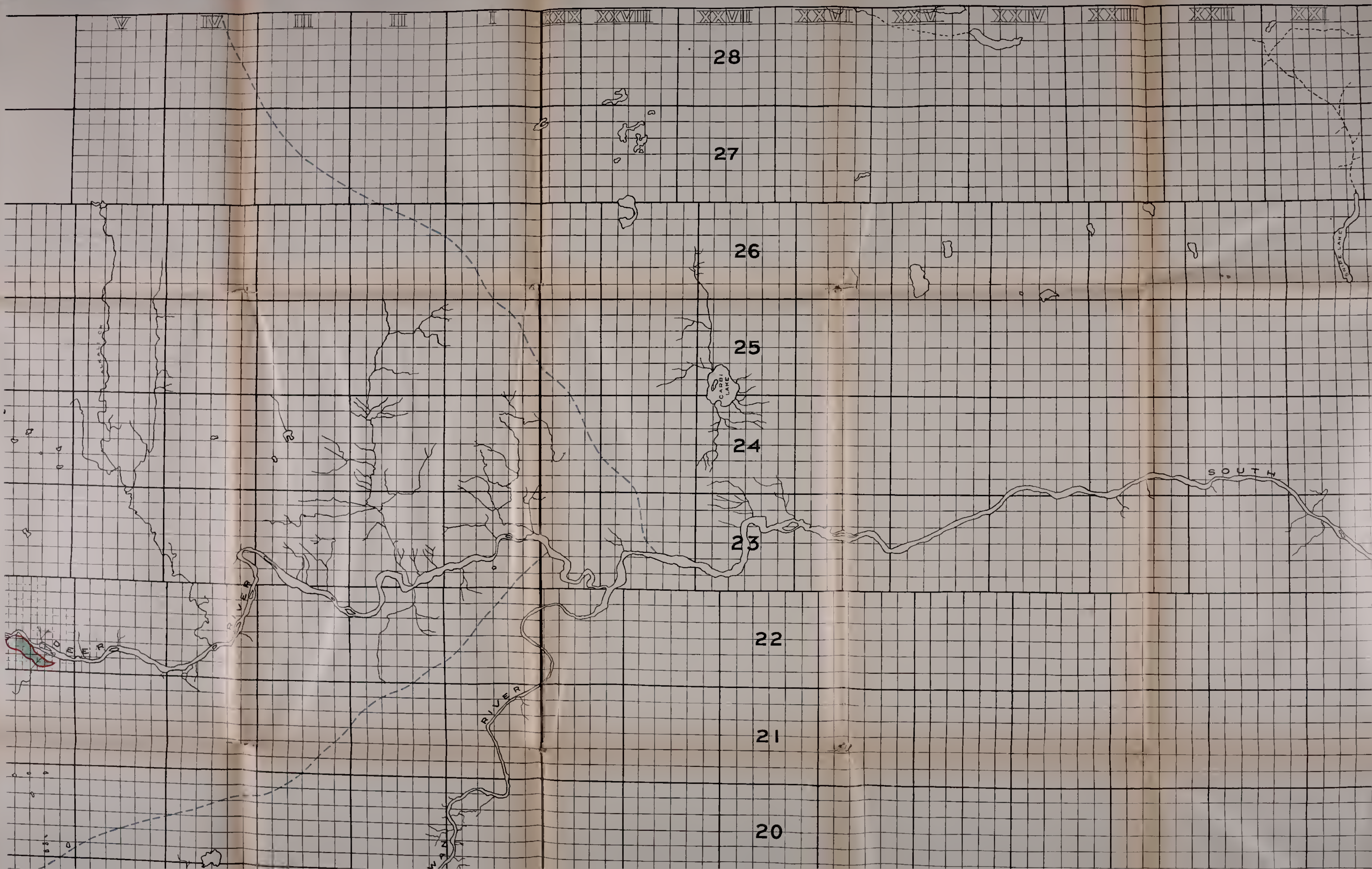
II
I
CAN NOR RY
BLADWORTH
REGINA BRANCH
RED DEER LAKE
COTEAU LAKE
RED DEER CK
LUCK LAKE
SAGE CK
QU'APPELLE RIVER
SASKATCHEWAN
RIVER

SHEET No 4 3RD MERIDIAN


SOUTH SASKATCHEWAN RIVER
SWIFT CURRENT CREEK
HANDSOME LAKE
RUSH LAKE
REED LAKE
LIZARD CK
RUSHLAKE CREEK
AIKENS CK
CHAPLIN LAKE
2189
THUNDER CK
PELICAN LAKE
CANADIAN PACIFIC RAILWAY
SWIFTCURRENT 2423
AIKINS 2401
WALDECK 2357
RUSH LAKE 2301
HERBERT 2311
MORSE 2274
ERNFOLD 2288
CHAPLIN 2202
SECRETAN 2276
PARKBEG 1882
MORTLACH 1961
MERIDIAN
SASKATCHEWAN



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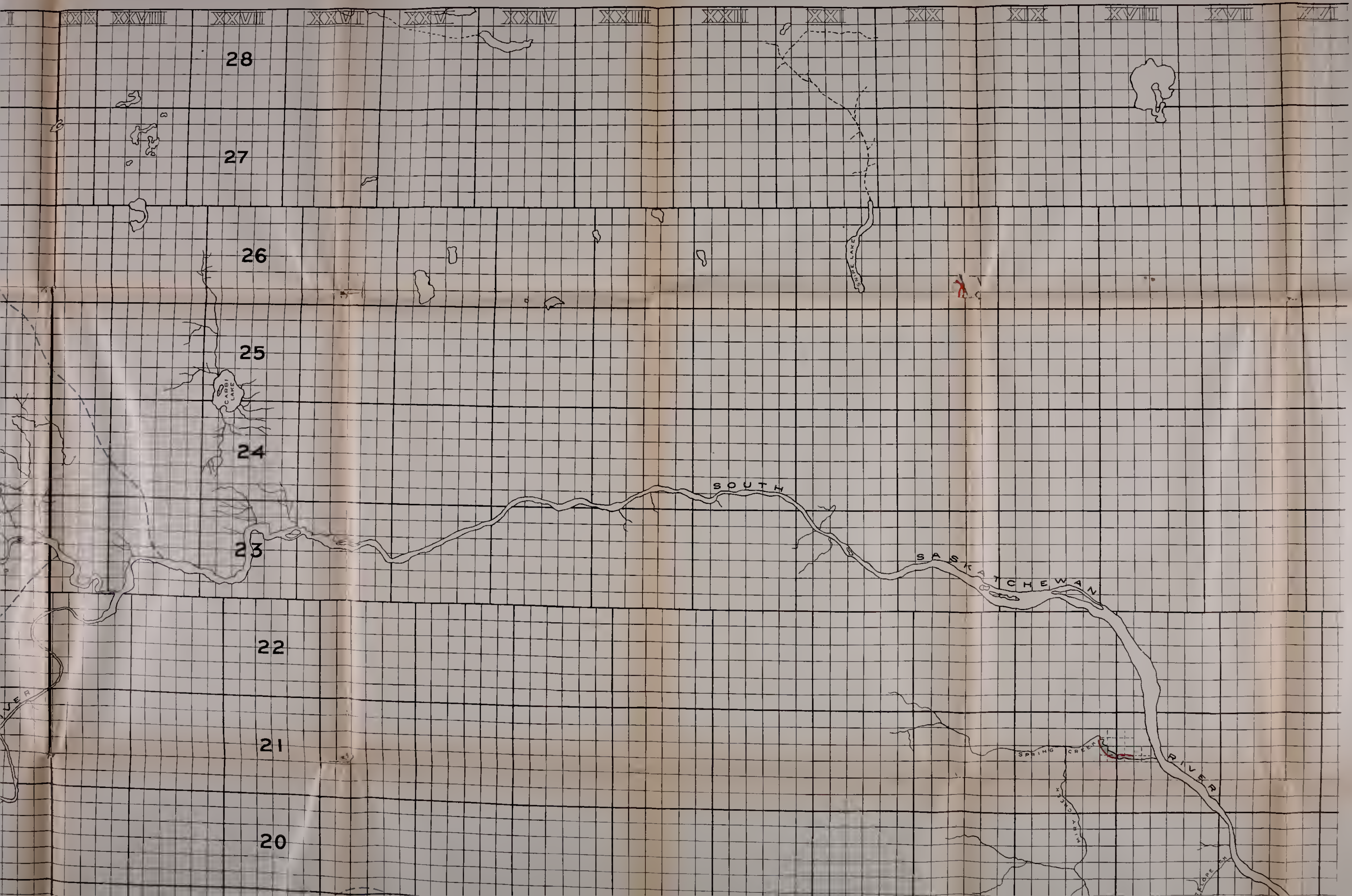
CARBI LAKE
SOUTH
DEER
RIVER
RIVER



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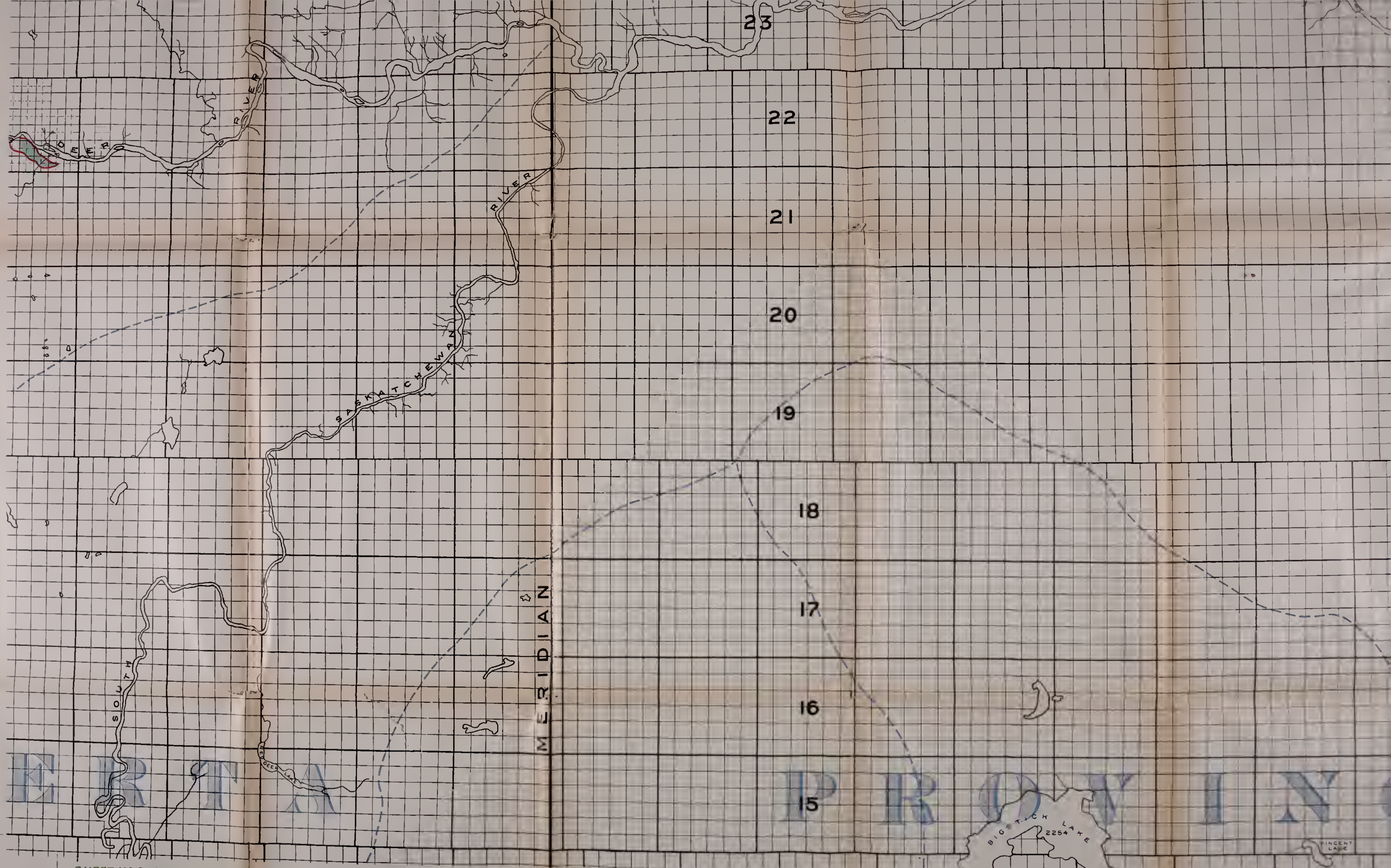
CARBI LAKE
SNIPE LAKE
SOUTH
SASKATCHEWAN
RIVER
SPRING CREEK



SHEET No 3 4TH MERIDIAN

23
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SASKATCHEWAN
RIVER
SPRING CREEK
MERIDIAN
PROVINCE OF
BIGSTICK LAKE
2254
VINCENT LAKE
2304


X
IX
VIII
VII
VI
V
IV
III
II
LAKE MINNEWANKA
GHOST RIVER
SOUTH FORK
NORTH BR
GHOST RIVER
DOGPOUND CK
SALTER LAKE
CARROT CK
STONY I.R.
BOW RIVER
CHINIKI CK
CANMORE
KANANASKIS 4220
MORLEY
RADNOR
COCHRANE
JUMPINGPOUND CREEK
ELBOW RIVER
ELBOW
SARCEE I.R. No 142
KANANASKIS RIVER
FISHER CREEK
THREEPOINT CR
NORTH BR
WARE CREEK
LINEHAM CK
SHEEP RIVER
3839.0
3821.25
3608.5
4214.4
3871.2
3842.3
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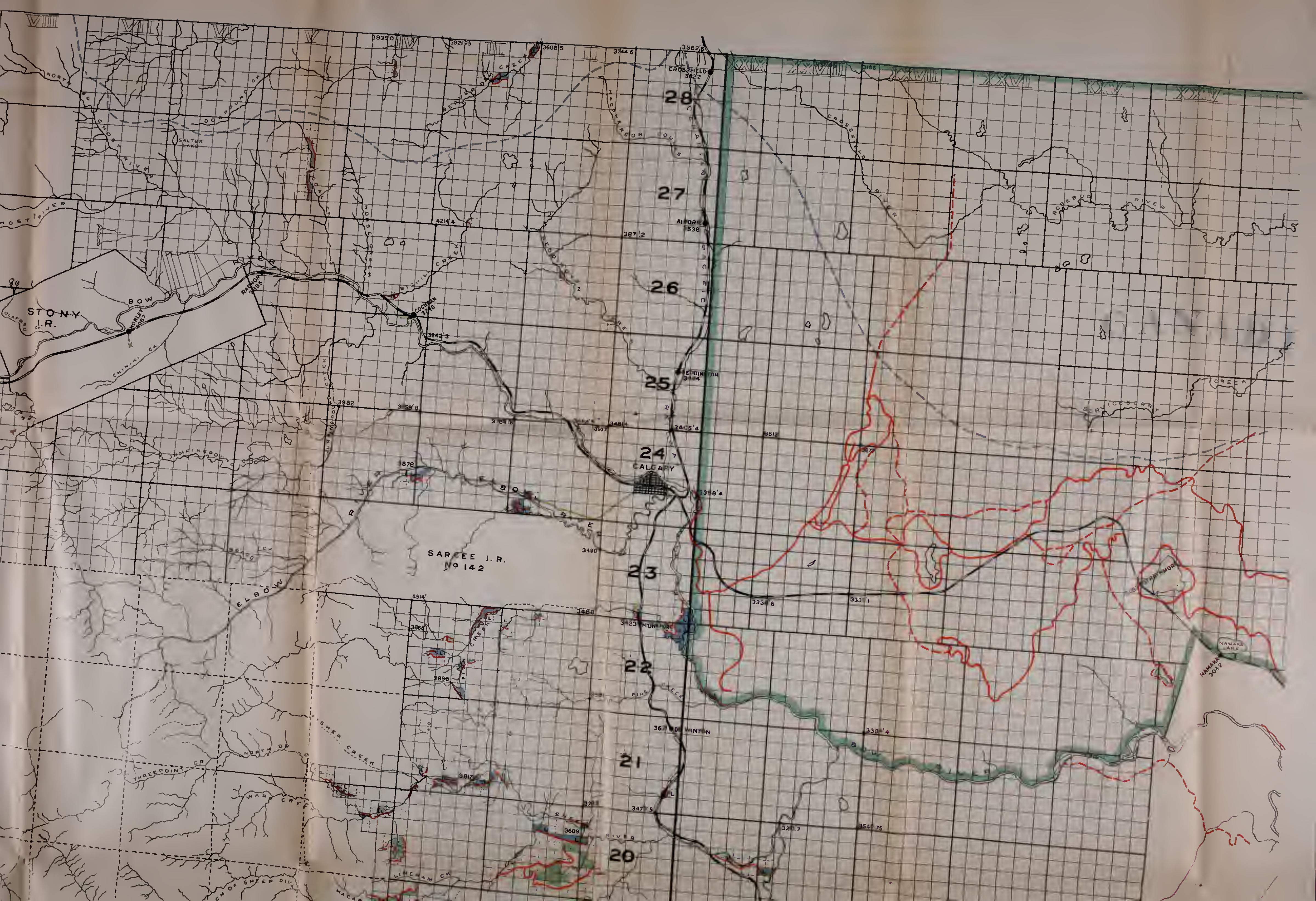

STONY I.R.
BOW
MORLEY
CHINIKI CK
RADNOR
COCHRAN
SALTER LAKE
GHOST RIVER
CROSSFIELD
28
27
AIRDRIE
26
25
24
CALGARY
SARCEE I.R.
No 142
ELBOW
23
MIDNAPORE
22
PINE CREEK
DE WINTON
21
20
THREEPOINT CR
WAR CREEK
SHEEP RIVER
ROSEBUD RIVER
SERVICEBERRY
CREEK
BOW RIVER
NAMAKA
NAMAKA LAKE


BRITISH
MERIDIAN
21
20
19
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17
16
15
14
WINTON
BOW
SHEEP RIVER
NORTH BR.
FISHER CREEK
THREEPOINT CR.
WARE CREEK
LINEHAM CK.
MACABEE CR.
SOUTH BRANCH OF SHEEP RIVER
KANANASKIS RIVER
KANANASKIS LAKE
TONGUEFLAG CREEK
HIGHWOOD RIVER
BULL CK.
SULLIVAN CR.
TRAP CREEK
WALDIE CK.
MIST CREEK
CATARACT CREEK
SHEPPARD CK.
WILLOW CREEK
LANGFORD CREEK
MACLEOD BR.
3304.4
3548.75
3267.8
3399.65
3479.5
3789
3609
3817
3890
3732.7
4405

SHEET No 1 4TH & 5TH MERIDIAN


XXIII
XXII
XXI
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XIX
XVIII
XVII
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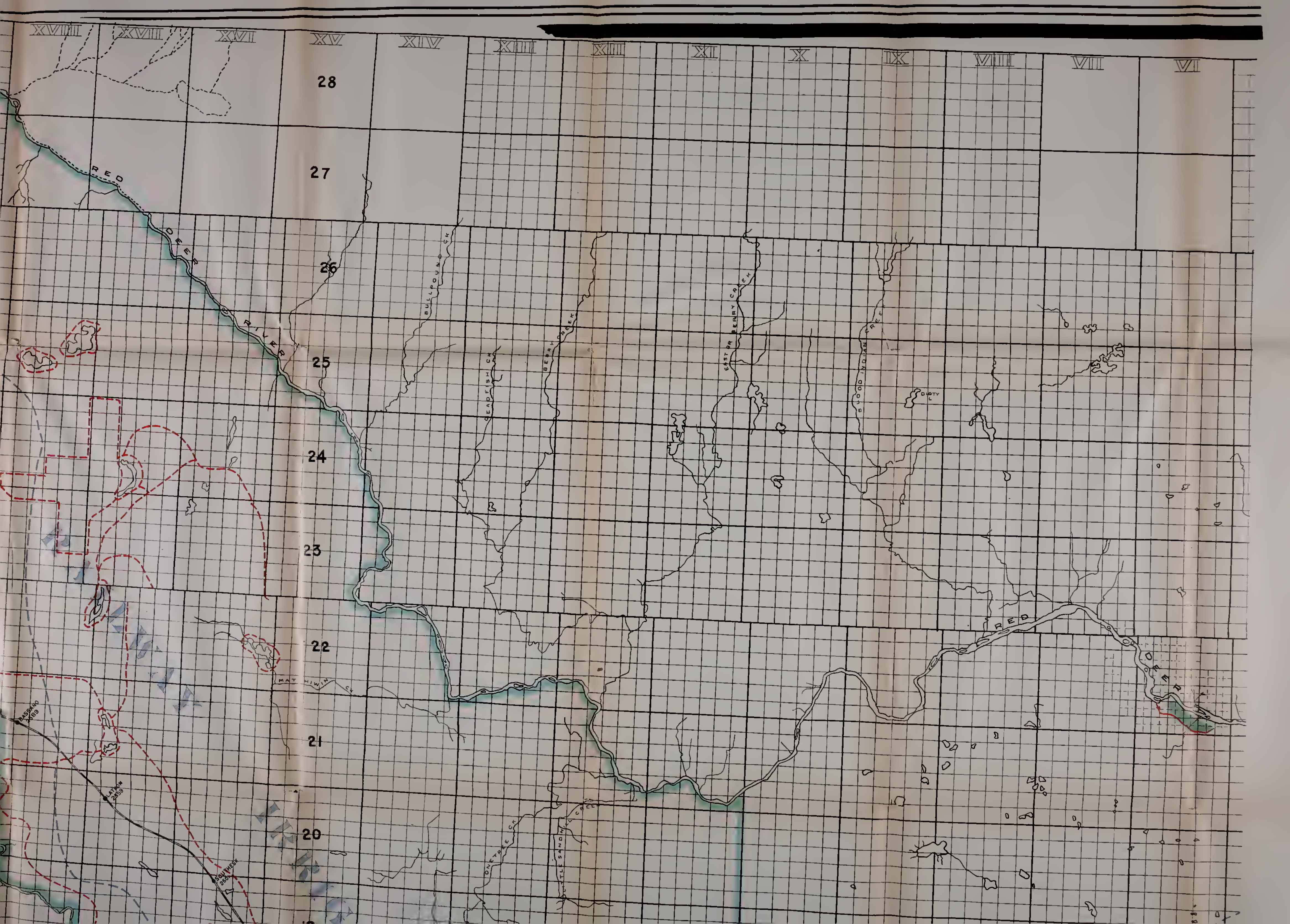
Nº 146



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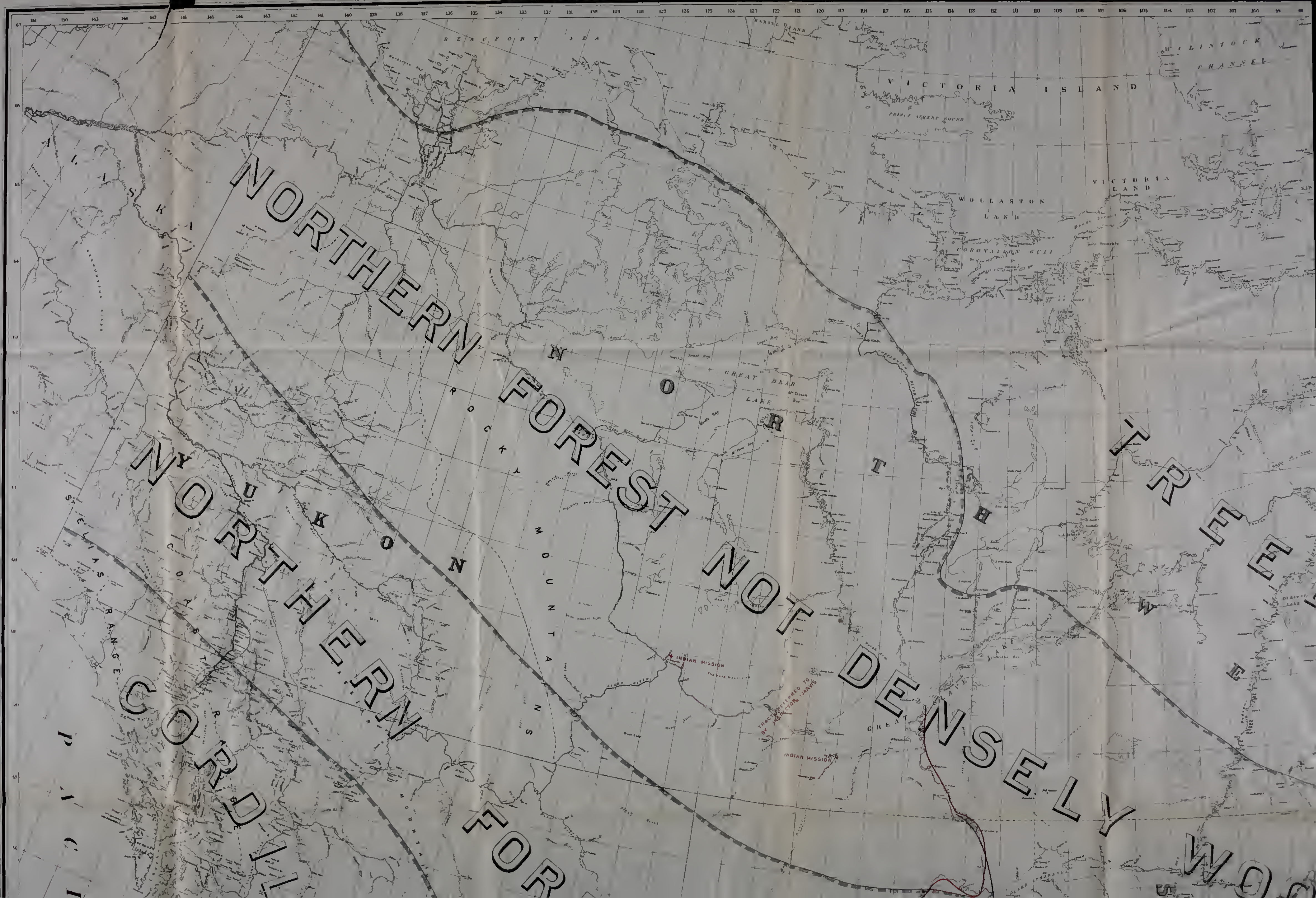
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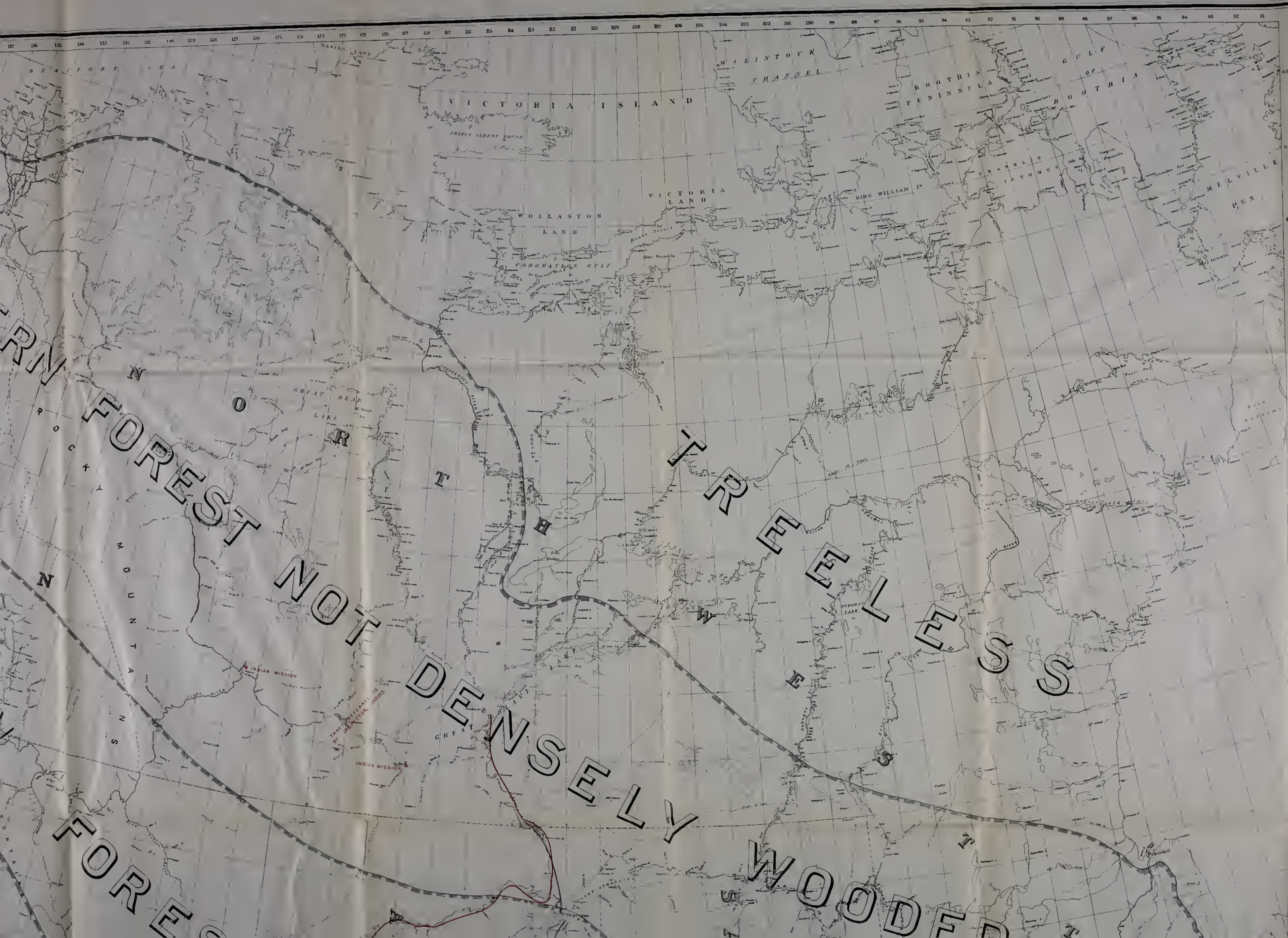

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INDIAN MISSION
DUBAWNT LAKE


SKETCH PLAN
Showing fire patrols in the Northern forest districts.
Principal routes at present, coloured blue.
Principal routes proposed, coloured red.
Indian Missions designated by red star.
Scale 50 miles to an inch
NORTHERN FOREST
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BRITISH COLUMBIA
PACIFIC OCEAN
YUKON
ROCKY MTS.
SASKATCHEWAN
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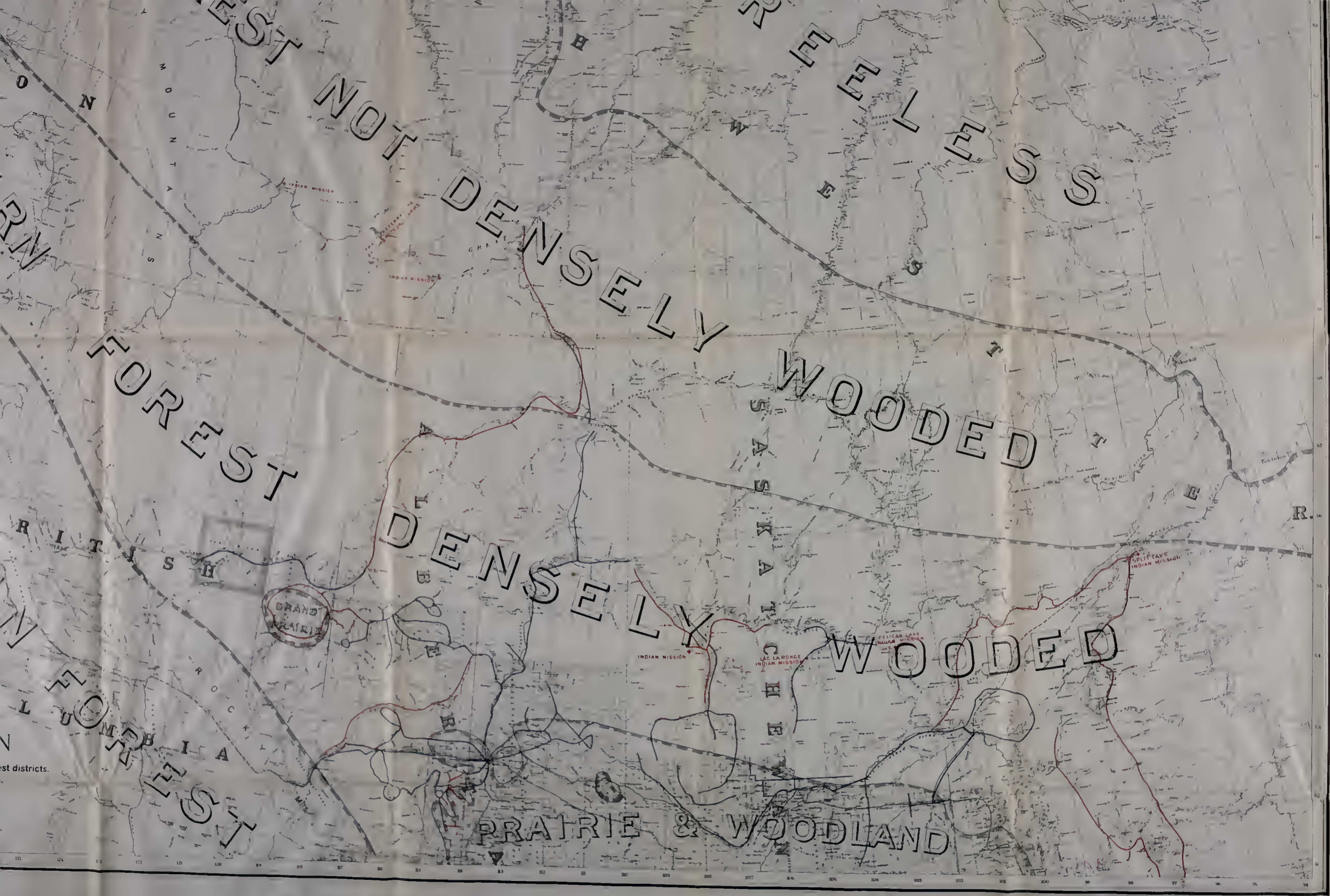
QUEEN CHARLOTTE ISLANDS



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DEPARTMENT OF THE INTERIOR

REPORT

OF THE

CHIEF ASTRONOMER

FOR THE

YEAR ENDING MARCH 31

1909

PRINTED BY ORDER OF PARLIAMENT

OTTAWA
PRINTED BY C. H. PARMELEE, PRINTER TO THE KING'S MOST
EXCELLENT MAJESTY
1910

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Appendix B.

Appendix C.

Appendix D.

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REPORT

OF THE

CHIEF ASTRONOMER AND INTERNATIONAL BOUNDARY COMMISSIONER.

DEPARTMENT OF THE INTERIOR.
DOMINION ASTRONOMICAL OBSERVATORY,
OTTAWA, CANADA, May 1, 1909.

W. W. CORY, Esq.,
Deputy Minister of the Interior,
Ottawa.

SIR,—I have the honour to present the report of the Astronomical Branch of the Department of the Interior for the year ending 31st March, 1909.

The correspondence in the twelve months was:—

Letters received	1,841
Letters sent	2,997
Accounts examined	815

The work of the photographer was as follows:—

Survey plates (developed),		8 x 10	360	
"	"	11 x 14	40	
"	"	16 x 20	161	
"	"	4¾ x 6½	1,158	
				1,719
Films	"	3¼ x 5½	180	
"	"	5 x 7	1,104	
"	"	4¾ x 6½	120	
				1,404
Bromide prints	"	4 x 14	24	
"	"	11 x 14	1,208	
"	"	16 x 20	527	
"	"	9 x 36	469	
"	"	12 x 30	61	
"	"	24 x 36	69	
"	"	20 x 24	23	
				2,381
Blue prints	"	24 x 36	10	10
Contact prints	"	4 x 6	531	
"	"	5 x 7	3,338	
"	"	8 x 10	189	
				4,058
Transparencies	"	4 x 5	137	137
Total				9,709

The Library on March 31st last contained 3,400 volumes and 260 pamphlets. It increases by several hundred volumes each year, principally by exchanges with other observatories and by the binding into volumes of the scientific periodicals, so that additional shelf space will be needed before very long. A card index of subjects and authors has been installed which has proved a great convenience.

The mechanical parts of a single-prism spectrograph designed by Mr. Plaskett for the avoidance of flexure, and of the solar spectrograph, of 23 feet focus, to be used in connection with the coelostat, have been constructed in the workshop.

The pivots of the meridian circle, as received from the makers, having been found to be of too soft metal, rings of hardened steel were shrunk upon them, and turned to proper form. This was a very difficult piece of work on account of the extreme accuracy of figure which was required.

There were besides numerous small pieces of work for the Observatory, and many repairs and minor alterations to field instruments for the Boundary and Geodetic Surveys, keeping two mechanics constantly employed.

The equipment of the shop has been increased by a second lathe, avoiding thereby a considerable loss of the men's time. The workshop, which is in the basement of the building, is insufficiently lighted for the fine work which we require. It is also rather inconveniently small.

The practice of opening the Observatory to the public every Saturday evening has been continued, and is much appreciated. An astronomer is always present on that evening to exhibit the large telescope. There are also many day-time visitors to the Observatory who have then an opportunity of seeing the other instruments.

The number of visitors registering in the book from April 1, 1908, to March 31, 1909, is 2,646.

In this connection may be mentioned the meetings of the Royal Astronomical Society of Canada which are held monthly during the winter in the Normal School Hall or in the Public Library, when lectures on astronomical subjects are presented. The majority of these lectures have been given by officers of the Observatory. Lectures are also given in the Observatory in the afternoon, alternating with the evening lectures in the city. These afternoon meetings serve a very useful purpose in the exchange of ideas among members of the staff.

TIME SERVICE.

The ordinary work in connection with the time service has consisted, as in the past, of the necessary attention to the up-town service, the sending out of time signals to the telegraph company, dropping of the time-ball on Parliament Hill, supplying of mean and sidereal time by telephone to those requiring it, occasional rating of chronometers, testing of aneroid barometers, &c., together with the maintenance of the clocks and apparatus at the Observatory. The city service has been extended by the installation of electric dials in the Mint and the Archives Building, which are operated by a master clock in the Mint controlled directly from the Observatory. The dials were started at noon on September 19, though the master clock was not put under control for some time subsequently. It was decided by the Public Works Department, contrary to the original intention, not to instal clocks in the Printing Bureau at present. There were also, as usual, changes and additions in the other Government Buildings. Below is a list of the number of clocks in operation:—

MINUTE DIALS.

	March 31, 1909.	March 31, 1908.
Parliament Building	49	46
East Block	36	35
West Block	63	61
Langevin Block	48	48
Post Office	20	20
Thistle Block	2	2
Ottawa Electric Company	1	1
Mint	16	..
Archives	7	..
Observatory	28	28
	270	241
Program clock	1	1
Seconds dials	3	2
Tower clocks	2	2
Total electrically driven clocks	276	246
Secondary master clocks	8	7
Primary clocks	4	4
Total	288	257

TRANSIT OBSERVATIONS.

Observations with the portable transits were taken on 142 nights, involving 281 determinations of clock error, as well as some observations for other purposes; on a number of nights two, and sometimes three, observers worked simultaneously, for determination of personal equation.

The relative personal equation of the Ottawa observers was in addition determined from the clock-curve, which was regular. The method of observation for clock-error was that described in last year's report, Appendix No. 3; the increase in accuracy over previous years was in the neighbourhood of 50 per cent. There were 156 exchanges for longitude, occupying 116 nights; exchanges were had irrespective of the weather at Ottawa, the clock error being when necessary interpolated from adjacent nights. An analysis was made of the rate of the Sidereal Standard as shown by the observations; the probable variation of daily rate appears to be between ·01 sec. and ·02 sec. per day; the advantage of having a completely uniform temperature is markedly shown. An approximate investigation was made, by observations suited to the purpose, of the causes underlying personal equation in micrometer observations. Mr. Stewart found in his own case a tendency to set the movable wire always to the same side (the left) of the star, by a quantity in the neighbourhood of a second of arc, depending on the magnitude of the star; north stars at upper culmination would thus be observed too soon, others too late. This affects the observed clock-error, and more markedly the azimuth. It was found that this would approximately explain the difference in personal equation of two of the observers, but not completely that of the third.

MERIDIAN CIRCLE.

The piers in the meridian circle room and the transit room have been rebuilt, their bases being sunk deeper into the earth and a system of drainage into a specially prepared cistern being installed, the cistern being pumped out from time to time. During wet periods there has proved to be a great accumulation of water in the cistern;

though the latter holds in the neighbourhood of 1,200 gallons it has on a number of occasions been filled to overflowing in a single night, apparently by surface water entering under the foundation walls of the building. This is very undesirable, as in that case the water becomes backed up around the footings of the piers. The only remedy would seem to be a proper drain surrounding the outside walls to carry off the surface water.

Provision has been made in the collimator piers for underground lenses to serve as permanent marks, over which may be adjusted the long-focus collimating lenses for the azimuth marks; pits have also been provided to allow access to the underground marks. The positions for the azimuth marks have been accurately determined and marked.

The mechanism for opening the roof shutters has been installed and works satisfactorily; the iron wall shutters have been replaced by wooden ones; wire frames have been made for the louvres in the walls to exclude snow, and have been in place during the past winter; the piers have been encased in felt and wood, with an air-space, to avoid sudden changes in temperature; an extension was made to the main instrument pier to provide for observations by reflection.

The meridian circle itself was in the beginning very unsatisfactory in almost all respects. When the graduated circles were received from the makers after having been repaired it was found that owing to irregularities in the bearings on axis and circles, the plane of the graduations was not perpendicular to the axis, nor was the distance from graduations to end of axis the same for both circles. While the adjustment of these errors was in progress it was found that the pivots were soft; it was therefore necessary to turn down the pivots and fasten upon them hardened steel bushings. Owing to the lack of lathes and grinders of the size requisite to handle the axis this proved a most arduous undertaking, but has at length been successfully accomplished. In this connection I wish to express my appreciation of the very great kindness of Mr. A. H. W. Cleave, of the Royal Mint, who was good enough to offer us the use of his workshop and even to have alterations made in his machines which made it possible to handle the work. Had it not been for his kindness the work could hardly have been done in Canada. There is still a great deal of work to be done on the instrument before it will be in a condition to do effective work. The counterpoises are unsatisfactory, and will require to be replaced by new ones; the bearings of the vertical circle require to be scraped and polished; alterations are necessary in the micrometers of the circle microscopes; the double spider lines in right ascension and declination micrometers and circle microscopes are at unsuitable and varying distances; in addition there is a multitude of small details that require alterations. When these have all been completed, however, the instrument will probably do efficient work. It is hoped that it may be ready for systematic work in both right ascension and declination by the beginning of the year.

For further details reference may be had to Mr. R. M. Stewart's report, in Appendix No. 3.

WORK OF THE ASTROPHYSICAL DIVISION.

The principal work in this division has been observation by the spectroscope of the radial velocities of spectroscopic binaries for the determination of the elements of their orbits. Five orbits have been thus determined: η Bootis, θ Aquilæ, α Coronæ Borealis, ϵ Herculis, β Orionis. In only the first of these have the observations been well satisfied by a velocity curve due to simple elliptic orbits. In two of the others irregularities show which are explained fairly well on the hypothesis of the presence of a third body. Four stars with early type spectra δ Herculis, γ Aquarii, ι Andromedæ, and ξ Persei, have been examined and their velocities found to be variable, but not enough observations have been made to determine the law of variation. Twelve other binary systems are under observation.

Considerable time has been spent in testing and adjusting the instruments and in experimenting on the best methods of observation. Mr. Plaskett investigated the fields given by different types of camera objectives for spectrographs, and the effect of increased slit width upon the accuracy of radial velocity work. Dr. DeLury examined the errors of the plane grating of the spectrograph of the coelostat. Mr Motherwell investigated the aberration of the eight-inch doublet of the stellar camera, and proved that the halos which the lens gives around the images of stars are due to spherical aberration, which may be corrected by slight refiguring of the lens.

Other work in this division has been micrometric measurements of double stars, comet photographs, observations of occultations of stars, and solar photography. This work as well as all the other astronomical work has greatly suffered from the dense smoke from forest fires which prevailed during a great part of last summer.

Fuller details of this work will be found in Mr. Plaskett's report, Appendix No. 2.

DIVISION OF GEOPHYSICS.

Continuous records have been obtained by the Bosch seismograph of earth movements. Some forty-nine earthquakes were recorded during the twelve months from April 1, 1908, to April 1, 1909, including five of some severity. Ordinarily the record of an earthquake shows that waves of three kinds are received. These are called the first preliminary, the second preliminary, and the long waves. They are distinguished from one another on the seismograph sheet by differences in form and amplitude, and the times of first arrival of the waves of each type may be measured off from the sheet very nearly.

It is supposed that the three waves have their origin at the same instant of time at the centre of disturbance, and that the difference in time of arrival is due to a difference in the mode of transmission through the earth's crust, whether by longitudinal or transverse vibrations through the depths of the earth, or near the surface, and that corresponding to the different modes or paths of transmission are different but definite velocities.

These velocities have been found by many observations within pretty close limits. Hence the difference of time between the first arrival of the different waves gives immediately the distance of the origin of disturbance. The actual position of the origin may often be determined by drawing a circle on a terrestrial globe with centre at the place of observation and radius equal to the distance of the origin. Where this circle passes through a region of known seismic activity, the probable origin of the disturbance may be placed.

Besides the records of earthquakes, numerous minor tremors, called microseisms, have been registered. An account of these, with an inquiry into their probable causes will be found in the report of Dr. Klotz, which forms Appendix No. 1 to this report.

Dr. Klotz concludes that the microseismic vibrations of the pendulums of the seismograph are closely connected with the gradients of barometric pressure, and that their amplitudes increase with the steepness of the gradient.

Microseisms are not due to the dynamical effect of the movement across the continent of areas of high or low pressure, nor to the direct dynamical effect of winds.

Microseisms registered at Ottawa almost invariably co-exist with 'lows' over the Gulf of St. Lawrence with steep gradients over the St. Lawrence valley.

They arise from movements of large areas of the earth's crust, and are related to the geological structure by which probably their period is determined.

The meteorological conditions on which they appear to depend are not local; the variations of local barometric pressure shown by the micro-barograph cause local bendings of the earth's crust which are exhibited on the seismograms by deflection of the zero of the instrument, but the irregularities thus caused are easily distinguished by their irregularity from the real microseisms.

It has been suggested that the fact that the period of most of the microseisms nearly agrees with that of the pendulums, indicates that the record is due to air currents within the instrument or to other instrumental cause. This explanation, however, cannot stand, in view of the evidence adduced by Dr. Klotz, of co-incident occurrence with the 'lows' on the eastern coast.

AUXILIARY BUILDINGS OF THE OBSERVATORY.

During the past year the coelostat house has been completed, and the coelostat installed, with its spectrograph. As stated above a careful examination has been made of the plane grating of this instrument, by which certain defects have been indicated. The making of this necessary examination has delayed the making of the observations on the sun which were contemplated.

The building for the standardizing of tapes and other measures of length has been completed, but the apparatus for making comparisons has not yet been installed. Means will be provided for tests of measures up to 50 metres in length.

Ground was broken for the residence of the Chief Astronomer about the middle of March last. This building will stand a short distance to the east of the Observatory.

Work was begun last summer on the grading of the grounds surrounding the Observatory, a much needed improvement. Owing to the excessive dryness of the latter part of the summer it was not thought advisable to do any sodding, which has been postponed until this season.

FIELD ASTRONOMICAL WORK.

Latitudes and longitudes were determined at twenty-seven stations during the season of 1908.

Two stations on the southern boundary of British Columbia, one near the southern boundary of Manitoba in the neighbourhood of Lake of the Woods, and three on the Ontario-Minnesota border, were observed for purposes of the boundary surveys. The other points were observed for geographical purposes, and comprise three points in Ontario, eight in Quebec, eight in New Brunswick, and two in Nova Scotia. The longitudes of the two most westerly stations were determined by telegraphic signals from Seattle, a point of known longitude; that of the others by signals from this Observatory.

Observations of the magnetic elements were made at seventeen points in British Columbia and at Winnipeg, Ottawa and Agincourt. The instruments used were the Tesdorpf magnetometer and the Dover dip-circle.

INTERNATIONAL BOUNDARY SURVEYS.

On June 3, 1908, a treaty between His Majesty and the United States was ratified, which provides for the survey of the whole of the boundary line from the Atlantic to the Pacific.

The treaty divides the boundary line into eight sections, and prescribes the manner in which the survey of each section shall be carried out, and placed the carrying out of the work, except as regards the fourth section, in the hands of two commissioners who shall be 'expert geographers or surveyors.'

The several sections are as follows:—

1. In Passamaquoddy bay, from the open waters of the Bay of Fundy to the mouth of St. Croix river (at Joe's Point near St. Andrews, N.B.).

By the treaty of 1783, the boundaries of the United States were defined as beginning at the mouth of St. Croix river and ascending that river to its source. Then the description proceeds with the northeastern, northern, western and southern boundaries of the United States, terminating on the Atlantic ocean at the northern boundary of Florida. The territory of the United States was also to include 'all the islands within twenty leagues of the coast except such as have heretofore belonged to His Majesty's province of Nova Scotia.' ('Nova Scotia' then included the present province of New Brunswick.)

Soon afterwards question arose as to which river was the St. Croix, mentioned in the treaty; it appears that three or more rivers bore that name. Commissioners were appointed under a special provision by treaty (1794) to decide which river was intended and to determine its mouth and its source.

The Commissioners in due course reported (1798) their decision identifying the St. Croix river of the treaty with the river which now bears the name, and placed its mouth opposite Joe's Point, the point at the southwestern extremity of St Andrews peninsula, opposite to the town of Robbinston, in Maine.

South and east of this point lies Passamaquoddy bay, being the western part of the Bay of Fundy, and including an extensive archipelago.

It will be observed that the decision of the Commissioners, placing the mouth of St. Croix river at Joe's Point, left the jurisdiction over the islands of this archipelago, which are within twenty leagues of the United States shores, to be determined by the fact whether they had previously belonged to the United States or to Nova Scotia.

Under the fourth article of the treaty of Ghent, 1814. Commissioners were appointed to determine to which of the High Contracting Parties the several islands belonged. These Commissioners rendered their decision in 1817 to the effect that Moose, Dudley and Frederick islands belonged to the United States, and that all the other islands in Passamaquoddy bay, and the island of Grand Manan, in the Bay of Fundy, belonged to His Britannic Majesty. This decision, however, did not determine the locality of the boundary line in the narrow waters between Campobello island and the islands allotted to the United States, and subsequently difficulties arose in regard both to smuggling and to fishery rights.

It was not until 1892 that provision was made by treaty for the determination of the boundary line in these waters, and commissioners were appointed to determine and mark the line.

This the Commissioners did in part but not wholly, since they failed to agree as regards the ownership of a certain island and of certain fishing grounds.

By the treaty of 1908, provision was made for the preparation on the behalf of each government of a 'case' to be submitted to the other, and in the event of their not arriving at an agreement within one year of the date of ratification of the treaty, for a reference of the question to arbitration. The cases of the two governments were duly presented on December 3 last, six months after ratification of the treaty.

These negotiations, or the arbitration which will result, if they do not result in an agreement, have reference only to the two specific points on which the Commissioners of 1892 differed. Their marking of other parts of the line is confirmed by the treaty. The present Commissioners are to renew the marks when necessary, and to lay out the remainder of the line when a decision of the disputed questions has been arrived at. Pending such decision no work has yet been done on this section.

2. The second section of the line is that along St. Croix river from its mouth to its source.

As already stated the Commissioners of 1798 determined the source of this river as well as its mouth. This was sufficient to obviate disputes involving any large extent of territory, and no serious question is known ever to have risen. For this reason doubtless no survey of the river as an international boundary has been made, or indeed provided for, by any previous treaty. In its course the river expands into several large lakes in which as well as in the river itself islands exist, which may become of importance in the future. The treaty provides that the boundary line shall follow the thalweg, or middle of the main channel as naturally existing, except where such would conflict with the recognized national character of an island. The boundary line is to be marked where possible by permanent monuments, and is to be shown by the Commissioners on accurate modern charts. Like provisions apply to all the sections of the boundary line.

It is proposed to send out two survey parties, an American and a Canadian party this summer to make the preliminary survey necessary for the setting out of the permanent reference marks. They will operate in the navigable part of the river below the international bridge connecting St. Stephen and Calais.

3. The third section extends from the source of the St. Croix to the St. Lawrence river. An approximate description of this section of the boundary line is: along the meridian of the source of St. Croix river to St. John river, up the latter and one of its branches, St. Francis river, to a certain point; in a straight line to the southwest branch of St. John river; up the last to its source in the highlands (of the St. Lawrence); along the highlands to the source of Hall's stream (a branch of Connecticut river); down the last to the 45th parallel; and along the 45th parallel to the St. Lawrence.

By the treaty of 1783, the boundary line was to follow the due north line from the source of St. Croix river to the highlands dividing the waters flowing into the St. Lawrence from those flowing into the Atlantic ocean, and thence to follow the highlands to the source of Connecticut river; and follow the river to the 45th parallel, and the parallel as far as the St. Lawrence.

Dispute arising as to the location of these highlands, this section of the boundary line remained undetermined for many years, the question about the year 1840 assuming a very serious phase, though more than one attempt had previously been made to settle it. By the treaty of 1842 the matter was finally disposed of, the definition adopted for the boundary, being a compromise between widely differing claims. The line was surveyed and marked with cast-iron monuments in the years 1843 to 1846, by a joint Commission.

For brevity in the above description of the boundary line, I have spoken of the meridian line of the source of the St. Croix and of the 45th parallel. The boundary line does not accurately follow these astronomical lines, but follows the lines of old surveys, originally intended to coincide with them, but which show in places very large deviations from them. The perpetuating in this manner of the errors of the old surveys was dictated by reasons of convenience arising out of the fact that in many instances the country had been settled on either side up to the old survey, and the lands were in private hands.

As a result of complaints which had from time to time been received, that some of the original monuments had been destroyed and that there was difficulty in places in finding the line, in 1890 an inspection, jointly with representatives of the state of New York was made of the line from Richelieu river to the St. Lawrence. This inspection indicated that it was necessary to renew the original monuments, as well as to place new ones where the line had been in the first instance insufficiently marked.

Nothing, however, was done until 1902, when an agreement for co-operation in the work of renewal was made with the government of the state of New York with the concurrence of the Washington government and a joint re-survey of the line was made, and new monuments of granite were erected.

In 1906 an agreement was made with the United States government for a joint re-survey of the rest of the line from Richelieu river to the St. Croix, and the work has since been actively prosecuted. The re-survey and renewal of monuments has been completed from Richelieu river to Hall's stream (covering the northern boundary of the state of Vermont) and along the meridian of the St. Croix river to the St. John. This has been done by a joint survey party representing both governments. The work so done will of course be available for the use of the Commissioners appointed under the new treaty.

It is proposed this year to proceed with the survey along the River St. John.

4. The fourth section covers the River St. Lawrence, the Great Lakes and their connecting waters, from the intersection of the 45th parallel by the River St. Lawrence to the mouth of Pigeon river in Lake Superior.

A general and rather vague description of this part of the line was contained in the treaty of 1783. The sixth article of the treaty of Ghent, 1814, provided for the appointment of Commissioners to determine the actual course of the line through the rivers and lakes, from the initial point in the St. Lawrence as far as the water communication between Lake Huron and Lake Superior. The seventh article of the treaty provided that the same Commissioners should determine the line from the said water communication to the North West Angle of the Lake of the Woods.

The Commissioners made the necessary surveys and laid down the line on their maps, reporting in 1822 their agreement so far as their work under the sixth article of the treaty was concerned. They, however, were unable to come to a full agreement under the seventh article, and that part of the line remained undetermined until settled by the treaty of 1842.

Owing to the imperfections of the maps upon which the Commissioners under the treaty of Ghent drew their line, difficulty is found in accurately transferring it to modern charts. The present treaty provides for the ascertainment and accurate re-establishment of the line, for the laying of it down on modern charts, and for the marking so far as practicable of the course of the line by buoys, monuments and range marks.

The carrying out of these provisions with respect to the fourth section of the boundary line is placed in the hands of the International Waterways Commission, which is composed of three Commissioners on the part of the Dominion of Canada and three Commissioners on the part of the United States.

5. The fifth section extends from the mouth of Pigeon river, up that river and through various lakes and rivers to the North West Angle of the Lake of the Woods.

The North West Angle of the Lake of the Woods was one of the governing points in the description of the boundaries of the United States in the treaty of 1783. Its location was ascertained without difficulty, but from the want of good maps when the treaty of 1783 was framed the line between the Lake of the Woods and Lake Superior was so vaguely defined as to leave room for widely different interpretations. Thus one contention was that the boundary line should ascend the St. Louis river at the head of Lake Superior, where Duluth now stands; another, that it should ascend the Kaministikwia. The Commissioners under the treaty of Ghent narrowed the question down to a choice between two water routes, both leading from Pigeon river to Rainy lake, and thence by Rainy river to Lake of the Woods. These two routes diverged a short distance up Pigeon river, passing one north and the other south of a considerable area almost surrounded by a series of lakes and rivers, now known as Hunter's island. By the treaty of 1842 the southern route was adopted.

No survey of the international boundary has been made along this section of the line. The Commissioners under the treaty of Ghent prepared maps to illustrate their report, but their surveys were imperfect.

The Commissioners under the present treaty having the duty of exhibiting the boundary line on modern charts will have to make a topographical survey over the whole distance.

6. From the North West Angle of the Lake of the Woods to the Rocky Mountains.

The treaty of 1783 described the northern boundary of the United States after reaching the North West Angle as proceeding thence west along the 49th parallel of north latitude to the Mississippi river.

It was afterwards ascertained, however, that the North West Angle lay about twenty-five miles north of the 49th parallel, and that the Mississippi river did not extend so far north as the parallel by a considerably greater distance.

The treaty of 1818 provided that the boundary line should follow the 49th parallel west to the Rocky Mountains. To provide for the difficulty as to the latitude of the North West Angle, it was agreed that the boundary line should be drawn due south from the angle of the lake to the 49th parallel. Thus occurred the peculiar 'jog' which the maps show in the boundary line at Lake of the Woods.

An interesting point in this connection is that the Commissioners who surveyed the meridian south from the North West Angle in 1872 found that their line starting from the old monument marking the North West Angle crossed the line of boundary which had been drawn by the Commissioners under the treaty of Ghent along the inlet of the lake at the head of which the monument stands.

This meridian line and the 49th parallel west as far as the Rocky Mountains were surveyed by a joint Commission in the years 1872 to 1874. The line was marked by iron posts one mile apart so far as the old boundary of the province of Manitoba extended (from longitude 96° to longitude 99°). On the remainder of the line the monuments were farther apart, averaging about three miles, and consisted of large mounds of earth or stones.

The re-survey of the line has the purpose of re-locating and repairing lost or damaged monuments, and establishing additional monuments wherever necessary to meet the requirements of modern conditions.

The doing of this was provided for in an administrative agreement between the governments, entered into in 1902. This agreement provided for a survey of the whole line from Lake Superior to the Gulf of Georgia, on the Pacific coast, but the completion of the portion west of the Rocky Mountains being more immediately pressing, operations were begun at that end, and the section east of the Rocky Mountains was not reached until last year. A Canadian party under Mr. J. J. McArthur began operations at Coutts, Alberta, which lies about one hundred miles east of the Rocky Mountains. The operations of the survey during the season covered one hundred miles east from Coutts, the section west of that place being left to an American party, under an agreement between the Commissioners by which the line was divided into alternate sections of one hundred miles.

7. From the Rocky Mountains to the Gulf of Georgia.

By the treaty of 1846, the boundary line here also lies on the 49th parallel. It was surveyed and monumented by a joint Commission in the years 1859 to 1863. The monuments generally consisted of mounds of stones, though along a certain part of the line cast-iron monuments were placed. Owing to the exceedingly mountainous character of the country the survey was not a continuous one; the position of the parallel was determined by astronomical observation in some of the principal valleys, and the line was cut out east and west from the astronomical stations as far as possible in the circumstances.

The survey made under the agreement of 1902 is continuous, from the summit of the mountains to Point Roberts in the Gulf of Georgia. Monuments of alluminium bronze, set in concrete bases, have been placed at average distances of two miles along the whole length of the line, and a wide vista has been cut through the forest from monument to monument. The field work was completed in 1907, with the exception of a short piece of triangulation in the Cascade Mountains, which was finished last year. The plans and other records of the survey have yet to be put into final shape for publication.

8. The eighth section is the water boundary from the 49th parallel to the Pacific ocean.

By the treaty of 1846 the boundary line was to follow the 49th parallel to the middle of the strait between Vancouver island and the mainland, and of the strait of Fuca to the Pacific ocean.

East of the southern extremity of Vancouver island and lying between it and the mainland lies an archipelago of considerable extent. Not many years after the treaty of 1846 the question arose to which country these islands belonged.

The principal island in the group is the island of San Juan, and the question which arose is commonly referred to as the San Juan question. The group is separated from Vancouver island and the islands adjacent thereto by Haro strait, and is separated from the Washington shore and its adjacent islands by Rosario strait. Both countries claimed ownership of the group of islands between these straits and for several years there was joint occupation of San Juan island by military forces.

By the treaty of Washington, 1871, it was agreed to refer the question to the decision of the Emperor of Germany, who decided in favour of the United States, that the boundary line should follow Haro strait.

In 1873 at a conference held at Washington by representatives of both countries an agreement was reached as to the actual course of the line, in accordance with the Emperor's decision, and the boundary line was defined by a line drawn upon a chart, accompanied by a written description.

The present treaty in providing for the survey of this line follows accurately the wording of the protocol of the conference of 1873, excepting at one point only, where a short curved line is replaced by a straight line.

It is proposed during the present season to send two survey parties to make the necessary surveys for the placing of reference monuments to perpetuate the points named in the treaty.

Mr. O. H. Tittmann, Superintendent of the United States Coast and Geodetic Survey, and the writer were appointed in June last commissioners, representing respectively the United States and His Majesty, for the carrying out of this treaty (excepting as regards the fourth section of the line).

Canada-Alaska Boundary Line

This boundary is in two sections, the most northerly following the 141st meridian of west longitude from a point near the summit of Mt. St. Elias to the Arctic ocean, the other starting from Cape Muzon on Prince of Wales island in about latitude 54° 40′, crossing the sea to the entrance of Portland channel, ascending the channel to a certain point, and then following certain mountains.

This boundary was first defined by the treaty of 1825, between Great Britain and Russia. The treaty described the line from its point of commencement, the southernmost point of Prince of Wales island, up Portland canal, and thence in a direction generally parallel to the coast to the 141st meridian of longitude west from Greenwich; thence along that meridian to the Arctic ocean. This definition of the boundary was of course not affected by the transfer of Alaska to the United States in 1867.

No demarcation had been attempted during the Russian occupation, but a few years after the transfer attention became directed to the boundary question. It was seen that the interpretation of the treaty as regards the southern part of the boundary, from Prince of Wales island to the 141st meridian, presented great difficulties, while the description of the remaining portion, following a definite astronomical line, the 141st meridian, was clear and unambiguous, and has never been the subject of controversy.

Hence in subsequent discussions the boundary line has been divided into two parts, which have been dealt with separately.

It is not my intention here to go into detail concerning the points of the controversy over the line from Prince of Wales to the 141st meridian. In 1892 a treaty was entered into between Great Britain and the United States, the first article of which provided for the appointment of commissioners to make a survey of the region adjacent to the line with a view to the ascertainment of the facts and data necessary for the permanent delimitation of the line in accordance with the spirit and intent of the then existing treaties.

The Commissioners made extensive topographical surveys of the mountains adjacent to the coast, and rendered a joint report to the two governments on December 31, 1895.

Although the treaty provided for the consideration of the boundary question, as soon as the report of the Commissioners had been received, the matter was not taken up until three years later, when it was discussed by the Joint High Commission, but without any action being determined upon.

In 1903, by treaty, the matter was referred in the form of five questions to a tribunal of six jurists, who held their sittings in London in September and October, 1903.

By their decision the line was to be drawn from Cape Muzon, on Prince of Wales island, in a straight line to a certain point off the mouth of Portland canal; up the canal to a certain point; then following certain mountain summits (which they marked out on the maps prepared by the survey made under the treaty of 1892) to Mt. St. Elias, which is near the 141st meridian.

The series of mountain summits selected by the tribunal was incomplete, in that between a certain summit north of Frederick sound and another north of Taku inlet a gap was left, some 120 miles in extent. In this gap the tribunal found the available topographical information not sufficiently complete to enable them to decide which were the mountains referred to in the treaty of 1825, and the line as regards that portion was left undetermined.

In the following year a conference between the Commissioners charged with the duty of the demarcation was held, at which a recommendation was made as to the course which the line should follow across the gap, and in March, 1905, this recommendation was formally approved by both governments.

By this agreement the line follows southward from the peak north of Taku inlet, from summit to summit of seven intervisible mountains, till a point near Whiting river is reached. Another peak was selected near the southern end of the gap. These eight peaks lie nearly in a straight line between the two terminal peaks of the Award. Between the seventh and eighth of them a gap remains about 50 miles in length in which the agreement leaves the selection of peaks in the hands of the Commissioners, after necessary surveys are made, the peaks selected to be intervisible and none of them more than 2,500 metres distant from the straight line joining the terminal peaks.

Survey of the Boundary of the Coast Strip of Alaska.

The demarcation of the Award line was begun in 1904 and has been continued since as rapidly as possible.

The work of the season of 1908 comprised the marking of the line at Alsek river, on the southern branch of the Iskut river (a tributary of the Stikine) and on the Unuk river and its tributaries, besides the topographical survey necessary for the carrying out of the agreement of 1905.

The Iskut work was carried on by Mr. J. D. Craig, D.L.S., and that of the topographical survey by Mr. W. F. Ratz, D.L.S., while Mr. White-Fraser, D.T.S., and Mr. F. H. Mackie, D.L.S., worked on the Alsek and Unuk rivers respectively, in conjunction with American parties.

The topographical survey of the region between the peak above referred to near Whiting river and the mountains north of Frederick sound was begun by Mr Ratz in 1907, and completed by him last year, so that the Commissioners have been able to make a selection of summits which accord with the conditions of the agreement of 1905, and it is hoped that the demarcation of this part of the line will be completed during the coming summer.

When this has been done little of the boundary of the coast strip of Alaska will be left for demarcation except a fifty-mile stretch near Mt. St. Elias and two or three uncompleted portions of a few miles each.

I regret to have to record the death of Mr. Ratz which occurred in Ottawa on February 6. Mr. Ratz had been employed on the Alaska survey since 1905. He carried out the demarcation of the line at Salmon river (Chilkat district), and in part between Taku inlet and Whiting river. During the last two years he was engaged, as already stated, on the topographical survey between Whiting and Stikine rivers, not the least difficult section of a very difficult survey. His success in carrying this to completion in a relatively short time is a testimony of his capability as a surveyor as well as to his personal energy. His death, at the early age of 25, is a serious loss to the profession and to the public service.

Survey of the 141st Meridian.

This survey and demarcation is carried on in pursuance of the treaty of 1906.

This treaty does not alter in any way the boundary line as defined by the treaty of 1825, but provides for the manner of making the survey and the demarcation merely.

Operations were begun in 1906 by ascertaining the position of the meridian at the crossing of the Yukon river by astronomical observations for longitude, using the telegraph for comparison of time.

The survey of the line south from the Yukon crossing was begun in 1907, and in 1908 continued southward to a point south of White river, a distance from the Yukon crossing of 225 miles. The placing of the permanent monuments on the line made good progress, as also the triangulation and topographical survey which is being made along the line.

Mr. A. J. Brabazon, D.L.S., was in charge of the Canadian parties engaged in this work.

THE GEODETIC SURVEY OF CANADA.

The work accomplished by the Geodetic Survey staff during the season of 1908 is briefly as follows:—

Two observing parties, measuring horizontal angles, were in the field during the whole season, but on account of the prevalence of dense smoke very little work was accomplished. The district covered lies between Brockville and Toronto.

Reconnaissance surveys were conducted in the maritime provinces, in the province of Quebec, in western Ontario and along the international boundary west of Lake Superior. This latter reconnaissance was for the purpose of making a primary triangulation to control the survey of the international boundary along Pigeon river. The reconnaissance in the province of Quebec, which embraced all of that part of the province lying southeast of the St. Lawrence river from Montreal to a point some thirty miles below the city of Quebec, and also one row of triangulation stations to the northwest of the St. Lawrence river a sufficient distance back therefrom to secure high enough points to control the country to the southeast was most gratifying in its results; it was successful in securing an excellent system of quadrilaterals and large five and six sided figures with central points.

The work of signal building was continued west of Toronto as far as Woodstock or thereabouts. In the maritime provinces reconnaissance has been satisfactory. The stations for a tringulation extend from Chamcook mountain in the southwest corner of New Brunswick, to the northerly extremity of Cape Breton island, embracing a district about fifty miles wide between those points, including the easterly portion of Prince Edward island. Chamcook mountain is one of the primary triangulation stations of the United States Coast and Geodetic Survey and in conjunction with Trescott Rock—another primary station of the same survey—direct connection is made with the Geodetic Survey of the United States.

In 1905 two Geodetic levelling parties were employed and a line of levels was carried from Coteau Junction—thirty-eight miles southwest of Montreal—to Fort Erie via Hamilton, and also from Hamilton to London. The computations are now in progress and are sufficiently advanced to show that the results are of a high order of precision. The work has been carried on by a double line of levels running forward and backward directions, the forward and backward levelling being independent of each other in every respect, and when possible, performed under different atmospheric conditions. The standard of accuracy adopted requires that the backward levelling shall correspond with the forward levelling within $0'{\cdot}017\sqrt{M}$, '*M*' being the distance in miles covered by the section. The dense smoke, so prevalent during the season of 1908 and which interfered so materially with the trigonometrical work, was found to be an assistance in precise levelling, inasmuch as the usual steadiness of the atmosphere—no doubt caused by smoke—made the observing of the graduations on the levelling rod much easier than in former seasons.

Consequent upon a discussion in parliament, in which was apparent a concurrence of opinion that an accurate survey of the better settled parts of Canada would be of practical benefit, the government, by order in council of April 20 last, formally instituted the 'Geodetic Survey of Canada,' and appointed the writer superintendent.

The following appendices are attached to this report:—

Appendix 1.—Report by Otto Klotz, LL.D., on seismological and magnetic work.
Appendix 2.—Report by J. S. Plaskett, B.A., on the astrophysical work.
Appendix 3.—Report by R. M. Stewart, M.A., on meridian work and time service.
Appendix 4.—Report on observations for latitude and longitude by J. Macara.

I have the honour to be, sir,
Your obedient servant,

W. F. KING,
Chief Astronomer and Boundary Commissioner.

APPENDIX 1.

REPORT OF THE CHIEF ASTRONOMER, 1909.

SEISMOLOGY, TERRESTRIAL MAGNETISM AND GRAVITY

BY

OTTO KLOTZ, LL.D.

CONTENTS.

ILLUSTRATIONS.

APPENDIX I.

SEISMOLOGY, TERRESTRIAL MAGNETISM AND GRAVITY, BY OTTO KLOTZ, LL.D.

OTTAWA, ONT., July 1, 1909.

W. F. KING, LL.D., C.M.G.,
Chief Astronomer,
Department of the Interior,
Ottawa.

SIR,—I have the honour to make the following report of the work carried out under my charge, and which is classified under the three headings—Seismology, Terrestrial Magnetism and Gravity.

SEISMOLOGY.

Instruments.—The instruments which are in service are: two Bosch photographic seismographs, described in the report for 1906; a Callendar electric recorder; a Negretti and Zambra barograph; a Shaw-Dines micro-barograph, besides wet and dry bulb thermometers.

The Callendar electric recorder is from the Cambridge Scientific Instrument Company, England. It was installed in August 10, 1908, and has given satisfaction. It records the outside temperature. It is similar to the one used in connection with our standard sidereal Riefler clock for temperature control. In the report for 1907 Mr. R. M. Stewart gives an illustration of the recorder, together with a detailed description, so it is unnecessary to describe the other one. It may be mentioned, however, that the extreme possible range of outside temperature is confined within the range of the galvanometer wire along which the sliding contact balances the resistance of the platinum wire thermometer, wound on a mica frame. The thermometer is housed in a louvred shelter 2 feet 6 inches by 1 foot 8 inches and 2 feet 6 inches high with slanting double top, the whole being painted white; it is mounted on four posts and the bottom is 4 feet above the ground in an open space with free circulation of air. It is 46 feet from the northwest corner of the transit house of the observatory. The lead-covered double leads are led from the thermometer in an iron $\frac{3}{8}$-inch pipe under ground, then through the wall of the Observatory and finally into my room to the recorder. The range of resistance on the galvanometer wire and covering the sheet which is daily renewed, is equivalent to 100°, that is, the readings extend from − 50°C. to + 50°C. or from − 58°F. to + 122°F., and this is represented in linear measure on the sheet by 20 cm., so that 1°C. is equivalent to 2mm. The temperature records are very satisfactory, and the rapid oscillations of temperature on bright cloudless days is very marked. These fluctuations amount to several degrees within a few minutes, showing that the atmosphere is far from being homogeneous as far as temperature is concerned, but instead is permeated by thermal and density 'schlieren,' continuously shifting. The scale of the bridge-wire was determined by readings of several standard mercurial thermometers placed within the thermometer shelter.

Last March another platinum wire thermometer was installed; it is in the well at the bottom of the south collimator pier of the meridian circle. The leads of this thermometer are led to a special switch beside the recorder, and every morning before taking off the sheet a reading is taken of this latter thermometer, which is subject, of course, to a very slow change of temperature.

Of the aneroid barograph with its weekly recording sheet nothing further need be said. Beside it hangs the Greene standard mercurial barometer and by which the readings of the former are checked.

In connection with the study of the seismograms, especially of the microseisms and other records, such as movements of the position of the pendulum zero not attributable to earthquakes, a Shaw-Dines micro-barograph was installed last July (1908), also a Richard Frères statoscope. Although the latter works very well, its time-scale is too large (one revolution of the cylinder in less than an hour) for continuous use. The former is 'an apparatus designed to magnify and record the minor and sudden fluctuations of the atmosphere as opposed to the general atmospheric surges. It records the small variations on a scale magnified twenty fold, the general surges being practically obliterated through the operation of a small leak. It thus records comparatively rapid oscillations, and no others. The instrument consists of a small, closed vessel containing air, which communicates with a mahogany box containing mercury, on the surface of which floats, mouth downwards, a light hollow cylindrical bell. The air is enclosed in a large japanned metal chamber, the space between the two being filled with a non-conducting material. The movements of the bell are transmitted to the chart by means of a delicate system of leverage. The chart is wound round a drum actuated by clock-work, and making one revolution in twenty-four hours.'

This instrument (micro-barograph) has given efficient service for the purpose for which it was desired, viz., in the first place to give a record of very rapid barometric fluctuations with the accompanying gusty winds, and secondly to enable one to make a comparison of such record with the seismogram to determine the relationship, if any, between the micro-barogram and seismogram. This has now been clearly and unequivocally established by simple ocular demonstrations. Whenever a closely serrated line with amplitudes of a sixteenth to quarter of an inch (about the maximum for very rapid oscillations) is found on the micro-barogram, the seismogram will show for the same time invariably an irregular record, not microseisms, which appear as a combination of tilting and horizontal movements, probably vertical movements too. They can never be mistaken for any phase of earthquake effects nor for microseisms, about which more will be said hereafter. The service of this instrument has been wholly confined to interpretation of some of the disturbances recorded by the seismograph and not for other meteorological purposes, as that is outside of our field.

The electric light 16 c.p., 104 v., continues to serve for the seismograph, and is efficient although slightly reduced in brightness when the machinery using the motor, and the lights of the observatory are on. A 'detector' was installed in my room, on the wall opposite to my desk. The object is to show when, by accident, the filament of the seismograph lamp should break, or otherwise the light circuit be interrupted. This is effected by having two small 1-candle power lamps in series, with the main lamp in the basement, and being themselves in parallel. The idea of having the two small lamps in parallel is that if one of them should give out, the circuit would not be interrupted, but would show by the other small lamp burning much brighter. The scheme works very well.

In last year's report I spoke of the trouble that some of the electric lamps, necessarily with single filament, gave by the vibrations set up in the filament and produced by the electric current alone. This has been nearly eliminated by the use of new lamps with shorter filaments. Occasionally spots of a widened line are shown on the seismogram when the filament has oscillated for a few seconds. It is a rather peculiar phenomenon and was discussed in detail last year.

The two horizontal pendulums have remained in their respective positions N.-S. and E.-W. during the year. The steel point of the N.-S. pendulum bearing against the lower support was found to have become somewhat blunted, so it was replaced by a spare point supplied by Bosch when the instrument was purchased. The effect of this was well shown in the record of microseisms whose amplitude although always small was distinctly increased by the decrease of friction at the point of lower support. For this same pendulum, as noted last year, the air-damping had been replaced by oil-damping, in the belief that the oil would be very much more efficient for the purpose of damping. Neither the damping by the oil nor the surface tension manifested themselves as conspicuously as anticipated. The experimental test was made with an immersion of 3mm. by the aluminum vane of the aluminum rod which extends from the 'bob,' or mass. The damping co-efficient was practically the same as with the air damping. The oil used was ordinary bicycle oil with some clock oil.

As in previous years a record has been kept of the hygrometric condition immediately without and within the seismograph room. The humidity although subject to small oscillations is in general dependent upon the season and the artificial heating of the building during the colder months. The least humidity is during the winter, and the greatest during the summer, ranging from an average of 36 per cent in January to 75 per cent in July. Since the construction of an additional drain below the seismograph cement floor there has been no occasion to use chloride of calcium for the absorption of moisture. The following are the bi-monthly means:—

Months.	Humidity.		Months.	Humidity.	
	Basement.	Seismograph Room.		Basement.	Seismograph Room.
1908					
April 1 to 15	48·6	45·7	October 1 to 15	61·7	57·9
" 16 to end	49·2	47·2	" 16 to end	72·2	54·7
May 1 to 15	58·7	60·7	November 1 to 15	81·3	48·2
" 16 to end	72·4	73·4	" 16 to end	44·5	43·2
June 1 to 15	69·3	72·5	December 1 to 15	40·9	38·6
" 16 to end	76·5	74·7	" 16 to end	37·7	36·0
			1909		
July 1 to 15	65·1	73·3	January 1 to 15	39·0	36·3
" 16 to end	71·2	75·6	" 16 to end	38·2	37·0
Aug. 1 to 15	67·9	73·8	February 1 to 15	37·5	38·1
" 16 to end	64·5	71·8	" 16 to end	36·1	34·0
Sept. 1 to 15	60·9	71·4	March 1 to 15	38·0	33·5
" 16 to end	67·6	71·5	" 16 to end	40·7	38·2

During the construction of the large dam across the Ottawa river above the Chaudière falls considerable blasting was done for the foundation in the limestone rock. It was desired to ascertain whether the shocks would be recorded by the seismograph. By request the engineer-in-charge, Mr. J. B. McCrae, kindly noted the time of discharge as given below:—

	h.	m.	s.	No. of holes.	Dynamite Sticks.
No. 1	12	15	00	3	3
2	12	17	30	5	5
3	12	24	30	4	4
4	12	29	00	11	11
5	12	48	00	8	8
6	12	52	30	16	16

The holes were 3 feet apart and about 15 inches deep; one stick of dynamite per hole, and the dynamite 50 per cent. The firing was electric. The nature of the limestone rock is more or less shaly. The distance from the Observatory to the dam is in round numbers 10,000 feet, or 3,050 km. The seismogram for the noon hour was carefully examined for any effect of the above blasts, but it failed to reveal the slightest trace. If there was any it was masked by the very small microseisms that were present on that day. Beside the presence of the minute microseisms two other causes militated against obtaining a record; one, the lack of compactness of the rock over that distance, and the other the very rapid oscillations that would be set up to which the seismograph could not well respond.

EARTHQUAKES RECORDED.

In the following table are given the earthquakes recorded here from January 1, 1908, to March 31, 1909, the end of the fiscal year. On April 1, 1909, began the publication of monthly bulletins of earthquakes and the Göttinger nomenclature adopted by most earthquake stations was also adopted. The preceding three months for 1908 are added in order to have a complete list for that year. Before the adoption of the above nomenclature fewer data were taken from the seismograms than subsequently, which is obvious in the table.

Göttinger Nomenclature or Designations.

Character of the earthquake—

I = noticeable. II = conspicuous. III = strong.
d = (terræ motus domesticus) = local earthquake (sensible or felt).
v = (" " vicinus) = near " (under 1000 km.)
r = (" " remotus) = distant " (1000 to 5000 km.)
u = (" " ultimus) = very distant earthquake (over 5000 km.)

Phases—

P = (undæ primæ) first preliminary tremors.
S = (" secundæ) second preliminary tremors.
L = (" longæ) long waves (principal portion).
M = (" maximæ) greatest motion in principal portion.
C = (coda) = trailers.
F = (finis) = end of visible disturbance.

Nature of the motion—

i = (impetus) = beginning.
e = (emersio) = appearance.
T = period = twice time of oscillation.
A = amplitude of earth movement, reckoned from zero line.
A_E = E-W component of A } measured in microns (μ).
A_N = N-S " A }

SESSIONAL PAPER No. 25a

Record of the Earthquake Station, Dominion Astronomical Observatory, Ottawa, Canada. Latitude 45° 23′ 38″, Longitude 75° 42′ 57″ or 5^h 02^m $51^s.8$ W. Greenwich. Elev. 83^m. Time: Mean Greenwich, midnight to midnight. Instruments: Two Bosch photographic horizontal pendulums. Nomenclature: Göttinger. From January 1, 1908, to March 31, 1909.

No.	Date.	Char.	Phase.	Time.	Period.	Amplitude.		Remarks.
						A_E	A_N	
	1908.	—	—	h. m. s.	s.	μ.	μ.	—
1	Feb. 1.....	I	P	23 25 20				
			L	23 33 16				
			F	24 09				
2	" 9. ...	I	P	3 28 12				
			L	3 35				
			F	4 06				
3	" 9...	I	P	9 15 08				
			L	9 27				
			F	9 42				
4	" 11 ..	I	P	13 09 48				
			F	13 25				
5	" 14	I	P	9 01 04				
			S	9 08 18				
			L	9 14				
			F	9 40				
6	" 14.....	I	P	11 44 28				
			S	11 47 08				
			F	12 00				
7	Mar. 3....	I	P	23 47 48				
			F	24 10				
8	" 5	I	P	2 36 48				
			L	3 20	20			
			F	4 00				
9	" 5.....	I	L	14 46				
			F	15 03				
10	" 25.. ..	I	P	17 02 00				
			S	17 07 34				
			L	17 15				
			F	18 17				
11	" 26	II	P	23 10 12				
			S	23 15 50	.. ..	.. ....	....	Chilapa, Mexico, destroyed
			M_E	23 28 40	....	.. ....	175	
			M_N	23 29 40	....	87		
	" 27...		F	2 55				
12	" 27.....	II	P	3 54 12				
			S	3 59 44	....	....	....	Same epicentre as above.
			L	4 05 28				
			M	4 11	....	70	83	
			F	6 00				
13	April 19 ..	I	eP	8 – 16 – 09	5	....	5	Well-marked microseisms mask the *P*.
			iS	8 – 24 – 14	8	25	10	
			F	9 – 00 – ..	....	....	....	
14	April 23....	I	S ?	0 – 07 – 36	8	7	2	Microseisms mask the *P*.
			eL	0 – 52 – ..	20	....	....	
			F	2 – 16 – ..	....	....	....	
15	May 3 .	I	S	1 – 11 – 20	8	3	2	*P* unrecognizable in the small microseisms. The *L* of 22^s continue for 10 min.
			L	1 – 35 – ..	22	....	....	
			F	2 – 30 – ..	....	....	....	

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No.	Date.	Char.	Phase	Time.	Period.	Amplitude. A_E	Amplitude. A_N	Remarks.
	1908.			h. m. s.	s.	μ	μ	
16	May 5	*I*	*P*	6 - 40 14	5	6	8	Microseisms throughout sheet.
			L	7 - 19 - ..	27	. .	......	*L* not conspicuous till 7^h 19^m
			F	8 - 30 - ..	....	...	.....	and continue then for 15 minutes.
17	May 15	*IIr*	*iP*	8 - 39 - 22	12	3	2	On N-S. component for *iP*
			Pr	8 - 41 - 00	10	...	.....	period 3^s to 4^s.
			iS	8 - 45 - 32	10	......	..	
			eL	8 - 50 - 48	33	.. ..	. .	Shorter periods of 5^s·5 super-
			M	8 - 53 - 30	....	140	110	imposed on *L* of 33^s.
			F	11 - 10 - ..	....	......	...	Epicentral distance 4400 km.
18	June 14	*I*	*eN*	6 - 07 - 36	2·6	.... .	6	Phases unrecognizable.
			eE	6 - 09 - 38	7	8	......	
			F	6 - 33 - ..	....	.	......	
19	June 16........	*Id*	*e*	20 - 41 - 52	2	8	8	Some windows rattled. Felt in
			F	20 42 - 04	....	....	.....	the Observatory and in many places in the city.
20	June 18	*I*	*iP*	10 - 46 - 38	4·8	2	2	Epicentral distance 3800 km.
			iS	10 - 52 - 16	6·6	4	4	
			L	11 - 01 - 28	8·5	....	......	
			M	11 - 08 - ..	....	6	7	
			F	12 - 00 - ..	....	.....	....	
21	June 30.	*I*	*e*	17 - 51 - 30	6	....	....	
			M	17 - 57 - ..	11	8	6	
			F	18 - 20 - ..	....	.....	. . .	
22	July 2..... ..	*I*	*e*	13 - 07 - 22	....	...	.....	
			ME	13 - 15 - ..	5	2	......	
			MN	13 - 16 - ..	8	... .	4	
			F	13 - 28 - ..	....	......	...	
23	July 8..........	*I*	*P*	12 - 58 - 16	6	.....	......	*L* not well marked. Distance
			S	13 - 04 - 52	10	. .	....	of epicentre 4900 km.
			M	13 - 20 - ..	10	12	4	
			F	14 - 11 - ..	....	. . ..	....	
24	July 16...	I*u*	*P*	17 - 00 - 30	5	......	.....	Epicentre 6800 km. Severe
			S	17 - 08 - 52	7	.....	......	earthquake reported from
			M	17 - 11 - ..	....	7	2	Arica, Chile, but no time
			M	17 - 54 - ..	6	....	10	stated.
			F	18 - 00 - ..	....	. ....	.....	
25	July 19	*I*	*e*	14 - 13 - 40	5·3	......	......	
			F	14 - 19 - ..	..... .	......	.....	
26	July 26.... ..	.....	..	....	....	... .	.... .	The first well-marked "saw-
								tooth" microseisms, period
27	August 14.....	*II*	*iP*	0 49 48	5·7	2	2	5^s.2, since May 10.
			iS	0 - 55 - 40	8	10	6	
			iL	1 - 00 - 08	.. ..	... .	....	
			L	1 - 02 - 16	22	......	....	Superimposed by shorter period
			MN	1 - 03 - 52	... .	....	41	waves.
			ME	1 - 08 - 16	....	71	....	
			C	....	7·6	......	...	Distance to epicentre 3900 km.
			F	2 - 25 - .	....	...	...	
28	Aug. 17	II	*iP*	10 - 56 - 00	4·6	.... .	...	
			iS	11 - 03 - 07	7	.....	....	
			L	11 - 12 - ..	... .	.....		
			M	11 - 12 12	. . . ..	8	10	
			LE	11 - 30 - ..	32	. ..	....	*LN* *LE* well-marked undulatory.
			LN	11 - 36 - ..	29	.....	......	
			LE	11 - 37 - ..	20	......	8	
			LN	11 - 41 - ..	21	8	.....	Distance to epicentre 5400 km.
			F	13 30 - ..	....	... .	... .	

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No.	Date.	Char.	Phase	Time.	Period.	Amplitude. A_E	Amplitude. A_N	Remarks.
	1908.			h. m. s.	s.	μ	μ	
29	Aug. 18........	*I*	*e*	11 – 16 – 08	....	......	......	Press despatches report an earthquake at Eureka, California,
			M	11 – 20 – 40	7	4	..	at about 11^h = 3 a.m. Pacific
			F	11 – 40 – ..	....	......	....	Standard, for which the adjoining is apparently the record. Distance to Eureka 3800 km.
30	Aug. 19........	*I*	*cP?*	23 – 42 – ..	6	......	.....	
			eS?	23 – 47 – ..	8	......	.....	
			M	23 – 47 – 48	....	7	6	
			F	24 – 00 – ..	....	......	.....	
31	Aug. 20........	*I*	*e*	10 – 21 – ..	....	......	......	Phases not distinguishable.
			L	10 – 43 – ..	16-20	4	2	E–W component the better
			F	11 – 33 – ..	....	.. .	.....	shown.
32	Aug. 22........	*I*	*e*	19 – 31 – ..	....	.....	.....	
			S?	19 – 36 – 22	....	.. ..	.....	
			M	19 – 42 – 00	8	6	.....	
			F	20 – 15 – ..	....	......	.....	
33	Aug. 23........	*I*	*e*	19 – 22 – 28	5-7	......	.....	
			F	19 – 26 – ..	....	......	.....	
34	Aug. 29........	*I*	*e*	18 – 15 – 18	5–6	.....	.....	
			M	18 – 24 – 10	....	6	.....	
			L	18 – 25 – ..	20	....	....	
			F	19 – 00 – ..	....	......	.....	
35	Sept. 21........	I_u	*e*	6 – 43 – ?	....	......	......	The microseisms mask the *P* and
			S	6 – 55 – 47	8	......	8	interfere with the other phases.
			L_N	7 – 07 – 40	10	.....	......	
			M_{1N}	7 – 09 – 32	10	......	16	
			M_{2N}	. – 12 – 16	9·5	....	16	
			M_{3N}	.. – 14 – 44	8	......	12	
			M_{1E}	.. – 14 – 40	10	50	.....	
			M_{2E}	.. – 16 – 08	8	37	......	
			M_{3E}	.. – 18 – 14	8	25	....	
			F	9 – 00 – ..	....	.. ..	....	
36	Sept. 24........	*I*	*e*	1 – 05 – ..	....	....	......	
			eL	1 – 09 – 40	16	3	2	
			F	1 – 21 – ..	....	......	....	
37	Oct. 13........	*I*	*iP*	5 – 13 – 26	....	.....	......	*iL* uncertain.
			iS	5 – 19 – 02	8.5	29	14	
			M_N	5 – 35 – 50	8	.....	35	Epicentre 3700 km.
			M_E	5 – 38 – 00	8·3	50	.....	
			e	6 – 52 – 38	8	12	6	A second shock appeared before
			M_E	7 – 03 – 52	....	14	.....	the other had wholly died out.
			"	.. – 6 – 24	....	......	......	
			"	.. – 9 – 24	....	... .	....	
			"	.. – 12 – 40	....	.....	....	
			F	8 – 00 – ..	....	....	....	
38	Nov. 2........	*I*	*P*	5 – 37 – 56	....	......	......	N.-S. component unreadable due
			S	.. – . – ..	......	.....	.....	to stray microseisms.
			L	5 – 54 – 20	20	6	......	Some *L* of 32s
			M	6 – 43 – ..	20	14	.....	Epicentre 6300 km.
			F	7 – 40 – ..	....	....	..	
39	Nov. 4........	*I*	*e*	8 – 54 – ..	12	.. .. ..	......	
			F	9 – 20 – ..	....	......	....	
40	Nov. 6........	*I*	*P*	7 – 31 – 50	6	14	7	Strong microseisms prevailed
			S?	7 – 38 – 16	....	......	...	and partly mask N-S component.
			L	7 – 46 – 35	20	......	.....	
			M	8 – 02 – 20	16	29	12	
			F	10 – 30 – ..	....	......	....	Epicentre 5900 km.

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No.	Date.	Char.	Phase	Time.	Period.	Amplitude. A_E	Amplitude. A_N	Remarks.
	1908.			h. m. s.	s.	μ	μ	
41	Nov. 6	I	*e*	23-02-?				Very strong microseisms prevailed, 10 μ, and almost mask N-S component.
			L	23-14-?				
			ME	23-16-50	10	17		
			MN	23-16-50	6		10	
			F	23-45-..				
42	Nov. 9	I	*iP*	15 27 00	9	6		Small microseisms mask N-S component except *P*. No *M* distinguishable. Epicentre probably 6,500 km.
			L	15 44 ?	19			
			F	17 00 ..				
43	Nov. 11	I	*e*	13-39-10	5	...	2	
			L?	13-44-40				
			M	13-56-.	14	7		
			F	15-25-..				
44	Nov. 12	I	*e*	13-51-.	4·3	1		Very weak: phases unrecognizable.
			F	15-00 ..				
45	Nov. 19	I	*e*	5-46 ..	15			No phases recognizable.
			ME		15	6		
			F	6-26-..				
46	Nov. 22	I	*e*	6-45-36	8	1	..	Not recognizable in N-S component.
			L	6-55-12	16	2	..	
			L	8-09-24	20	2		
			F	8-30-.				
47	Nov. 23	I	*e*	13-04-20	6	2		
			M	13-54-..	22	6		
			F	15-00-..				
48	Nov. 30	I	*P?*	21-49-48				
			L	21-56 ..				
			MN	21-57-30	6		75	
			ME	21-59-30	10	125		
			F	23-30-..				
49	Dec. 12	I	*eL*	13-43-40				Microseisms present.
			LE	13-46-..	32	4		
			L	13-57-..	20	4	4	
			F	14—26-..				
50	Dec. 28	I	*iP*	4 31-04	5-6	8	4	Strong microseisms, but materially decreased after quake.
			L	4-39-42	20			
			MN	4-56-30	16		10	
			ME	5-00-..	16	18		Epicentre 7,100 km.
			FN	6-10 ..				Postscripts:
			FN	9—20-..				Calabrian quake. 7,300 km
	Dec. 28	I	*P*	23-22-05			6	No other phases recognizable. E-W component not recorded.
	1909.		*F*	24-00-..				
51	Jan. 12	I	*P*	0-04-36	4	3	4	Earthquake reported from Vancouver, B.C.
			F	0-22-..				
52	Jan. 12	I	*e*	10-26-..				
			F	10-37-..				
53	Jan. 12	I	*e*	12-30-..				
			M	12-35-..	12-16	4	2	
			F	12-55-..				
54	Jan. 21	I	*e*	21 43-..				No phases recognizable.
			MN	21-47-30	6·1		5	
			ME	21-48-40	6·7	6		
			F	22-05-..				

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No.	Date.	Char.	Phase	Time.	Period.	Amplitude. A_N	Amplitude. A_E	Remarks.
	1909.			h. m. s.	s.	μ.	μ.	—
55	Jan. 23	*I*	*P*	3 – 01 – 13				
			S	3 – 11 – 42				Epicentre estimated at 9,400 km.
			L	3 – 28 – ?				
			L	3 – 32 – ..	24			
			M_N	3 – 35 – ..	24		6	
			M_E	3 – 37 – ..	22	8		
			F	4 – 50 – ..				
56	Feb. 9	*I*	*e*	12 – 01 – ..				Well-marked microseisms prevail.
			L	12 – 06 – ..	20			
			F	12 – 21 – ..				
57	Feb. 16	*I*	*P*	16 – 31 – 20?				
			L	16 – 54 – 20	6			
			M_N	16 – 55 – 00	6		30	Epicentre 8,400 km.
			M_E	16 – 55 – 40	7	40		
			F	17 – 35 – ..				
58	Feb. 22	*I*	*P*	9 – 40 – 00				Microseisms present.
			S	9 – 45 – 06				
			L_E	9 – 48 – 29	7			Epicentre 3,500 km.
			M	9 – 52 – 40?	7	20		
			F	11 – 20 – ..				
59	Feb. 26	*I*	*P*	16 – 53 – 35				Well-marked microseisms.
			S	16 – 59 – 16				
			L	17 – 01 – 23				Epicentre 3,900 km.
			M	17 – 05 – 12	12	50		
			F	17 – 38 – ..				
60	Mar. 12/13	*I*	*e*	23 – 42 – ..				
			L	0 – 07 – ..				
			M_E	0 – 14 – ..	20	6		
			F	1 – 38 – ..				
61	Mar. 13	*I*	*P*	14 – 42 – 20				
			S	14 – 52 – 40				
			L	15 – 16 – 32	20			
			M	15 – 19 – 30	27	6		
			F	17 – 00 – ..				
62	Mar. 18	*I*	*eL*	0 – 03 – 40	24			
			F	0 – 20 – ..				Irregularities due to winds and microseisms mask the phases.

During this period of fifteen months sixty-two earthquakes were recorded and but one of them of Canadian origin, and that one in the vicinity of Ottawa. Popularly the severity of an earthquake is measured by the destruction of life and property, which is however by no means the criterion for the seismologist when considering it as a tectonic movement. There were three earthquakes by which much destruction was done: the two shocks of March 26-27 by which Chilapa, on the Pacific slope of Mexico was destroyed; then the great disaster of Messina, also spoken of as the Calabrian earthquake; and the Persian one of January 23, 1909.

Most of the other quakes probably occurred at sea and hence give us no evidence from the epicentre or central area of disturbance unless it be through the breaking of submarine cables. However, with the great improvement of earthquake instruments in recent years, with increased sensitiveness and more accurate time-scale, it will now be possible to locate with a fair degree of accuracy every earthquake that is recorded at a number of widely separated stations. There is yet room for improvement in sensitiveness, especially for recording the first preliminary tremors, and also in the time record; the clock correction, if any, should be within a second of time. The time-scale on our photographic seismogram is made by a shutter, actuated electrically by our normal standard mean time clock, and so far has never required a correction of a second. The light is cut off every minute for two seconds and the 60th minute is omitted in order to identify the hour.

With well marked phases on a seismogram and good time-scale, the distance to the epicentre of a tectonic quake can be obtained within say 100 km. or 60 miles. The direction of the seat of disturbance, however, can not be so well deduced. Were the matter through which the earthquake waves are propagated homogeneous, then the components of the two pendulums placed generally in the N.-S. E.-W. directions at each station would furnish some indication of the direction sought, and thus enable each station to obtain at least an approximate position for the epicentre. The complete analysis of the seismograms is yet remote.

That the velocity of the first and second preliminary tremors or longitudinal and transverse waves respectively is a function of the distance is well illustrated in the accompanying table which has been compiled of the Messina earthquake. Time of occurrence at Messina is taken as $4^h\ 20^m$ Greenwich mean time (Professor Rizzo). The seismogram records were obtained from the various subjoined stations, and the distances were directly taken from our 30-inch globe with a flexible steel tape especially graduated to represent 10,000 km. for the quadrant. A globe of this size with such a graduated tape is of great service in the study of earthquakes and their epicentres.

P, S, L, represent respectively the time of arrival of the first preliminary, the second preliminary, and the long waves.

MESSINA EARTHQUAKE.

Place.	Distance.	Middle ordinate to Chord.	*P*	*S*	*L*	Velocity per Minute.			$\frac{S}{P}$
						P	*S*	*L*	
	km.	km.	h m s	h m s	h m s	km.	km.	km.	
Ottawa	7200	992	4 31 04	4 39 42	.. .. ..	651	365	.. ...	·56
Washington	7650	1116	4 31 23	4 40 30	.. .. ..	672	373	....	·56
Tiflis	2550	128	4 25 33	4 29 50	4 35 20	458	259	166	·57
Cartuja	1700	56	4 23 35	4 26 40	4 27 50	474	255	217	·54
Sarajevo	700	10	4 21 51	4 23 09	4 23 54	378	222	180	·59
Belgrade	850	14	4 22 09	4 23 11	4 24 12	395	267	202	·68
Laibach	900	16	4 22 18	4 23 33	4 24 16	391	254	211	·65
Vienna	1100	24	4 22 55	4 25 17	4 26 16	377	208	175	·55
Cracow	1400	38	4 23 23	4 25 59	4 26 48	413	234	206	·56
Hamburg	1750	60	4 24 16	4 27 18	4 28 12	410	240	213	·58
Aachen	1600	50	4 23 53	4 26 38	.. .. ..	412	241	....	·58
Toronto	7500	1073	4 31 12	4 39 48	5 00 00	670	379	187	·57
Victoria	9550	1709	4 33 12	4 43 36	5 06 36	723	405	205	·56
					Mean			196·2	
					Per second			3·27	

The ratio $\frac{S}{P}$ is pretty constant, with the exception of the three stations, Sarajevo, Belgrade and Laibach, which are all less than 1,000 km. from the epicentre, and for which the ordinates to the chords are small, from 10 to 16 km., not reaching to the supposed layer of isostatic adjustment.

The degree of accuracy of the time element in the records for deducing velocities is of far more consequence for close stations than for very distant ones. However in the above, which comprise all the data available at the time, there does not appear to be any serious discrepancy in the reading of the various seismograms. The *L* waves show themselves conspicuously as being propagated over the same medium for all stations, that is, along the surface, by having the same velocity. Thus the velocity from origin to Cracow is the same as to Victoria, seven times as distant. Although there are some variations in the velocity of the surface waves, they are wholly independent of the distance, and most likely attributable to the difficulty of sometimes identifying the arrival of the long waves in the medley of the other waves and their reflections which precede.

As the time of the occurrence of the severe earthquake in Persia of January 23, 1909, was not reported, and the time service in those regions is in any case probably very unsatisfactory with reference to Standard or Greenwich time, an attempt has been made to determine the time of the occurrence at the epicentre, based on the press despatch that the epicentre was at Bahrein, and on the times of arrival of the first and second preliminary tremors (*P* and *S*) at various stations of which the records had been received. The geographical position of Bahrein is taken from Stieler's *Hand Atlas*, $\varphi = 33° \ 30'$, $\lambda = 49° \ 30'$ E. Greenwich. The distances are taken from our 30-inch globe.

In the following table the computed transmission times V_1, V_2 for the *P* and *S* are interpolated from the Wiechert-Zœppritz values compounded from the Indian earthquake of 1905, the Calabrian one of 1905, and the San Francisco one of 1906. For *L* the velocity is taken at 4 km. per second.

EARTHQUAKE OF JANUARY 23, 1909.

BAHREIN, PERSIA.

$\phi = 33° \ 30'$, $\lambda = 49° \ 30'$ E. OF GR.

GREENWICH TIME.

Station.	Distance.	Ordinate.	Seismograms.			Computed.			Deduced time at Epicentre.		
	km.	km.	*P*	*S*	*L*	V_1	V_2	*B*	$P-V_1$	$S-V_2$	$L-B$
			h m s	h m s	h m s	m s	m s	m s	h m s	h m s	h m s
Ottawa	9750	1778	3 01 13	3 11 42	3 28 ..	12 54	23 38	40 37	2 48 19	2 48 04	2 47 23
Hamburg	3830	287	2 55 14	3 00 36	3 03 12	7 07	12 40	15 57	.. 48 07	.. 47 56	.. 47 15
Aachen	4020	315	2 55 33	3 01 05	3 04 56	7 21	13 06	16 45	.. 48 12	.. 47 59	.. 48 11
Trieste	3330	217	2 54 42	2 59 42	3 04 41	6 22	11 22	13 52	.. 48 20	.. 48 20	.. 50 49
*Sarajevo	2920	168	2 55 30	3 00 09	3 03 36	5 52	10 24	12 10	.. 48 38	.. 48 45	.. 50 26
Cracow	3060	183	2 54 08	2 58 59	.. .. ..	6 00	10 43	.. ..	.. 48 08	.. 48 16	.. .. ..
Vienna	3200	200	2 54 18	2 59 10	3 00 56	6 13	11 07	13 20	.. 48 05	.. 48 03	.. 47 36
Tiflis	1030	21	2 50 40	.. .. ..	.. .. ..	2 19	4 04	.. ..	.. 48 21	.. .. ..	.. .. ..
Strassburg	3850	290	2 55 09	3 00 26	3 05 26	7 09	12 40	16 02	.. 48 00	.. 47 46	.. 49 24
Laibach	3300	213	2 54 20	2 59 15	3 04 17	6 21	11 16	13 45	.. 47 59	.. 47 59	.. 50 32
Belgrade	2650	137	2 53 26	2 57 53	3 01 42	5 27	9 42	11 02	.. 47 59	.. 48 11	.. 50 40
Cartuja	4820	450	2 56 33	3 03 05	3 07 30	8 20	14 48	20 05	. 48 13	.. 48 17	.. 47 25
Washington	10300	1972	3 01 22	3 12 05	3 30 ..	13 18	24 28	42 55	.. 48 04	.. 47 37	.. 47 05
Mean									2 48 11	2 48 06	2 48 48

It will be observed from the above table that the mean time deduced from the *P* agrees within 5 seconds of the mean of the deduced time from the *S*, so that one feels justified in giving for the time of the occurrence of the quake in Persia $2^h \ 48^m \ 8^s$

* Times evidently one minute too late.

Greenwich time. The agreement between the two independent values $P - V_1$ and $S - V_2$ for any station is satisfactory too; in several cases the times are absolutely co-incident. However, we cannot always be sure of individual seconds in reading P and S on the seismogram.

A greater difficulty we encounter when trying to read on the seismogram the arrival of the long waves, L, and this is manifested in the last column, which in the ideal condition we should expect to agreo with the other two. The discordances in the last column of individual values from the general mean ($2^h\ 48^m\ 08^s$) of the other two columns is not attributable to the assumption of 4 km. as the velocity of the long waves per second, but rather to the reading of the various seismograms. For, taking $T = 2^h\ 48^m\ 08^s$ as the time of the occurrence of the quake and solving by least squares for the velocity of the long waves we get 238 km. per minute, which is practically the same as 4 km. per second, the quantity used.

If we arrange $L - T$ in the order of magnitude and divide the resulting time into the respective distance of the station from the epicentre it will be found that there is a tendency for the greater distance to give the greater velocity; the extreme values being Hamburg 4·24 km., and Belgrade 3·26 km. per second.

We may recall the table of the Calabrian or Messina quake, which gave for Belgrade 3·36 km., and for Hamburg 3·55 km., and the general mean 3·27 km. In no case for that quake was a velocity obtained as high as 4 km., the highest being for Cartuja 3·61 km. per second.

Judging from our seismograms here, it is believed that the discordances obtained for the velocity of the long waves are mostly or wholly attributable to the uncertainty of identifying, midst the complexity of longitudinal and transverse waves and their reflections which precede, the arrival of the surface or long waves.

Some of the stations on this continent failed to get a record of the first preliminary tremors, due to lack of sensitiveness of the instrument. For distant quakes not only the diminished force of the longitudinal impulse comes into play, but also the horizontal component of that impulse, so that distance very materially militates against the recording of the first preliminary tremors.

The following table is a compilation of the two preceding ones, and arranged in order of distance with the corresponding middle ordinate to the chord, and the mean velocity of the first preliminary tremors, P, or longitudinal waves in kilometres per minute.

FOR MESSINA AND BAHREIN EARTHQUAKES.

Place.	Distance.	Ordinate.	Velocity P.	Place.	Distance.	Ordinate.	Velocity P.
	km.	km.	km.		km.	km.	km.
Sarajevo	700	10	378	Vienna	3,200	200	519
Belgrade	850	14	395	Laibach	3,300	213	532
Laibach	900	16	391	Trieste	3,330	217	507
Tiflis	1,030	21	407	Hamburg	3,830	287	540
Vienna	1,100	24	377	Strassburg	3,850	290	519
Cracow	1,400	38	413	Aachen	4,020	315	542
Aachen	1,600	50	412	Cartuja	4,820	450	573
Cartuja	1,700	56	474	Ottawa	7,200	992	651
Hamburg	1,750	60	410	Toronto	7,500	1,073	670
Tiflis	2,550	128	458	Washington	7,650	1,116	672
Belgrade	2,650	137	500	Victoria	9,550	1,709	723
Sarajevo	2,920	168	396	Ottawa	9,750	1,778	745
Cracow	3,060	183	510	Washington	10,300	1.972	778

There are some discrepancies in the table, notably the one for Sarajevo. From information received it would appear that it is mostly due to an error or inaccuracy in time scale. If the phenomenal progress that seismology has made in recent years continues, such discrepancies will disappear and data of a high order of precision will be obtained, upon which a permanent structure can be raised.

There are now some 200 earthquake stations distributed over the earth, and the seismograms furnished by them are far from homogeneous, and are far from equal merit and value for studying the geophysical problems for which they are obtained. The first order of precision to be aimed at is that of time. Seismology demands now that the time recorded should be accurate within at least one second. As standard time is now so widely distributed by telegraph, there seems no reason why the time of every earthquake station should not be controlled by the time from some astronomical observatory. In order to be able to read to one second on the seismogram the time scale should be about 90cm. to the hour, or 15mm. to the minute; *i.e.,* 1mm. would represent 4 seconds. There is a limit to the speed of the revolving cylinder, for if it is too great, although the time could then be more accurately read, yet, waves with small amplitudes would become so flattened as to be scarcely recognizable. A further demand for precision, is that the instrument be highly sensitive in order that the first impulse of the first preliminary tremors is recorded, and that damping co-efficient should approach the limit of aperiodicity for the pendulum, in order that the seismogram may represent fairly well the earth movements and free from those of the pendulum itself.

CANADIAN EARTHQUAKES.

Looking at a geological map of Canada one is immediately impressed with the fact that the greater part of the Dominion, running from the Gulf of St. Lawrence past Hudson bay and on to Great Bear lake and the Arctic ocean, is composed essentially of archæan rock, that is, of the oldest formation on the earth. This is probably the largest area of archæan rock on the earth, being closely followed by the Scandinavian peninsula and Finland. As earthquakes are intimately associated with the age of rock formation, the more recent being more subject to disturbances than the older ones, we may say that broadly speaking the vast area above referred to will always be fairly free from earthquakes, for its compact and more or less homogeneous nature is not so well adapted to the adjustment of the strains of the earth's crust, which is the cause of earthquakes, as the newer formations are, which are intersected by dikes and faults, and which exhibit stratification and folding with, consequently, lines and surfaces of weakness.

In the St. Lawrence valley, westward from Quebec to Lake Huron, we have formations of the Palæozoic age, and also to the south of the St. Lawrence covering New Brunswick and Nova Scotia. In the whole of eastern Canada from Nova Scotia to near the mouth of the Mackenzie river, a distance of nearly 3,000 miles, no formations more recent than those of the Palæozoic age are found. In western Canada the newer formations occur; the Great Plains being represented by the Cretaceous and Tertiary eras. The mainland Pacific coast of British Columbia is almost wholly 'coast granite,' while the interior is largely represented by the Miocene period of the Tertiary era. The nature, composition and structure of the formation itself may, *per se,* directly lead through gravitational effect to earthquakes. While on the other hand such formation may lend itself to the adjustment of stresses imposed upon it from neighbouring regions, *e.g.* the sea or ocean. So much is obvious, that whatever reason we may assign as the contributory cause of an earthquake, where it occurs is necessarily the weak spot for the area under strain. From historic records and of late years from instrumental records the seismic areas of the earth are fairly well known, but why the degree of seismicity should vary in different regions is open to considerably more elucidation. The Indo-Pacific archipelago, including Sumatra, Java, New Guinea and the Philippines is the most seismic region of the earth for the larger quakes, while the eastern coast of Canada is fairly immune.

The more or less severe, but not destructive, earthquakes that have visited eastern Canada are all associated more or less directly with the 'Great Champlain and St. Lawrence fault,' running from the gulf up the river to Quebec and then curving southwesterly to Lake Champlain. Of these the quakes of 1663, 1791, 1860 and 1870 are the most noted. The first one has gained a certain celebrity from its exaggerated description. This earthquake, which lasted about six months, occurred during the French occupation. We may regard the record of this as the beginning of our literature on seismology, and hence give it a place here, although its scientific value is rather circumscribed.

From a manuscript in the Jesuits' College at Quebec the editor of 'Hochelaga Depicta' took the following account of this quake:—

'On the 5th of February, 1663, about half past five in the evening a great rushing noise was heard throughout the whole extent of Canada. This noise caused the people to run out of their houses into the streets, as if their habitations had been on fire; but instead of flames or smoke, they were surprised to see the walls reeling backwards and forwards, and the stones moving, as if they were detached from each other. The bells sounded by the repeated shocks. The roofs of the buildings bent down, first on one side and then on the other. The timbers, rafters and planks cracked. The earth trembled violently, and caused the stakes of the palisades and palings to dance in a manner that would have been incredible had we not actually seen it in many places. It was at this moment every one ran out of doors. There were to be seen animals flying in every direction, children crying and screaming in the streets; men and women seized with affright, stood horror-struck with the dreadful scene before them, unable to move, and ignorant where to fly for refuge from the tottering walls and trembling earth, which threatened every instant to crush them to death, or to sink them into a profound and unmeasurable abyss. Some threw themselves on their knees in the snow, crossing their breasts and calling on their saints to relieve them from the dangers with which they were surrounded. Others passed the rest of this dreadful night in prayer, for the earthquake ceased not, but continued at short intervals, with a certain undulating impulse, resembling the waves of the ocean, and the same qualmish sensations, or sickness of the stomach, was felt during the shocks as is experienced on a vessel at sea. . . . The violence of the earthquake was greatest in the forests, where it appeared as if there was a battle raging between the trees; for not only their branches were destroyed, but even their trunks are said to have been detached from their places and dashed against each other with inconceivable violence and confusion, so much so, that the Indians in their figurative manner of speaking, declared that all the forests were drunk. The war also seemed to be carried on between the mountains, some of which were torn from their beds and thrown upon others, leaving immense chasms in the places from whence they had issued, and the very trees with which they were covered sunk down, leaving only their tops above the surface of the earth; others were completely overturned, their branches buried in the earth and the roots only remained above ground. During this general wreck of nature the ice, upwards of six feet thick, was rent and thrown up in large pieces, and from the openings in many parts, there issued thick clouds of smoke, or fountains of dirt and mud, which spurted up to a very considerable height. The springs were either choked up or impregnated with sulphur,—many rivers were totally lost, others were diverted from their course and their waters entirely corrupted. Some of them became yellow, others red, and the great River of St. Lawrence appeared entirely white as far down as Tadousac. This extraordinary phenomenon must astonish those who know the size of the river, and the immense body of water in various parts, which must have required such an abundance of matter to whiten it. They write from Montreal that during the earthquake they plainly saw the stakes of the picketing or palisades jump up as if they had been dancing; and that of two doors in the same room, one opened and the other shut of their own accord; that the chimneys and tops of the houses bent like branches of trees agitated with the wind; that when they went to walk they felt the earth following them and rising at every step they took, sometimes sticking against the soles of their feet and other things in a very forcible and surprising manner. . . . From Three Rivers they write that the first shock was the most violent, and commenced with a noise resembling thunder. The houses were agitated in the same manner as the tops of trees during a tempest, with a noise as if fire was crackling in the garrets. The shock lasted half an hour, or rather better, though the greatest force was properly not more than a quarter of an hour; we believe there was not a single shock which did not cause the earth to open either more or less. As for the rest, we have remarked that, though this earthquake continued almost without intermission, yet it was not always of an equal violence. Sometimes it was like the pitching of a large vessel which dragged heavily at her anchors; and it was this motion that caused many to have a giddiness in their heads and qualmishness at their stomachs. At other times the motion was hurried and irregular, creating sudden jerks, some of which were extremely violent; but the most common was a slight tremulous motion, which occurred frequently with little noise. Many of the French inhabitants and Indians, who were eye-witnesses to the scene, state that a great way up the river of Trois Rivières, about 18 miles below Quebec, the hills which bordered the river on either side, and which were of a prodigious height, were torn from their foundations and plunged into the river, causing it to change its course and spread itself over a large tract of land recently cleared; the broken earth mixed with the waters, and for several months changed the colour of the great River St. Lawrence, into which that of Trois Rivières disembogues itself. In the course of this violent convulsion of nature, lakes appeared where none ever existed before; mountains were overthrown, swallowed up by the gaping, or precipitated into adjacent rivers, leaving in their places frightful chasms or level plains; falls and rapids were changed into gentle streams, and gentle streams into falls and rapids. Rivers in many parts of the country sought other beds or totally disappeared. The earth and the mountains were entirely split and rent in innumerable places, creating chasms and precipices whose depths have never yet been ascertained. Such devastation was also occasioned in the woods, that more than a thousand acres in one neighbourhood were completely overturned, and where but a short time before nothing met the eye but one immense forest of trees, now were to be seen extensive cleared lands apparently cut up by the plough . . At Tadousac, about 150 miles below Quebec on the north side, the effect of the earthquake was not less violent than at other places; and such a heavy shower of volcanic ashes fell in that neighbourhood, particularly in the River St. Lawrence, that the waters were as violently agitated as during a tempest. Near St. Paul's bay, about 50 miles below Quebec on the north side, a mountain about a quarter of a league in circumference, situated on the shore of the St. Lawrence, was precipitated into the river, but, as if it had only made a plunge, it rose from the bottom and became a small island, forming with the shore a convenient harbour, well sheltered from all winds. Lower down the river, towards Point Alouettes, an entire forest of considerable extent was loosened from the main bank and slid into the River St. Lawrence, where the trees took fresh root.

'There are three circumstances, however, which have rendered this extraordinary earthquake particularly remarkable: the first is its duration, it having continued from February to August, that is to say, more than six months almost without intermission. It is true, the shocks were not always equally violent. In several places, as towards the mountain behind Quebec, the thundering noise and trembling motion continued successively for a considerable time. In others, as towards Tadousac, the shock continued generally for two or three days at a time with much violence. . . . The second circumstance relates to the extent of this earthquake, which we believe was universal throughout the whole of New France, for we learn that it was felt from l'Isle Percée and Gaspé, which are situate at the mouth of the St. Lawrence to beyond Montreal, as also in New England, Acadia and other places more remote. As far as it has come to our knowledge, this earthquake extended more than 600 miles in length and about 300 in breadth. Hence 180,000 square miles of land were convulsed in the same day and at the same moment.

'The third circumstance, which appears the most remarkable of all, regards the extraordinary protection of Divine Providence which has been extended to us and our habitations; for we have seen near us the large openings and chasms which the earthquake occasioned, and the prodigious extent of country which has either been totally lost or hideously convulsed, without our losing either man, woman or child, or even having a hair of their heads touched.'

We might add a fourth circumstance, and that is, that the narrators of the above anticipated the sensationalism of our 'yellow' journals by two and a half centuries.

The following is a list of the slight local shocks occurring in Canada from January 1, 1908, to April 30, 1909. The items were gathered from the daily press:—

1908.

May 12.—A very perceptible shock of earthquake was felt in Yarmouth, N.S., and vicinity a few minutes before 12 on Wednesday night. Houses shook and trembled and there was a loud report as of heavy thunder. No damage has been reported. It was bright moonlight and calm at the time. It was likewise felt in Digby, Annapolis and Shelburne counties.

June 16.—A distinct shock occurred at Ottawa, and was recorded by the seismograph at 3^h 41^m 52^s p.m., the pulsations lasting 16 seconds. It was generally felt: windows rattled, and some heard a loud rumbling sound. On the Rossi-Forel scale the intensity would be designated by IV. It was felt over an area about 60 miles in diameter.

July 17.—Quite a distinct shock was felt at Arnprior at 2^h 10^m a.m. A great many citizens felt it. The quake was accompanied by a noise similar to that of a large building falling.

August 8.—Despatches from the up-river section of New Brunswick report earthquake shocks in several places this morning. At Hartland there were three shocks at 1, 4 and 7 a.m. Plaster fell from the ceiling in one building. In Fredericton and vicinity there was a shock felt about 7 o'clock. Thunder and lightning and very heavy rain were experienced during the night.

November 30.—An earthquake travelling apparently from north to south threw the inhabitants of the town of Skidegate, Queen Charlotte islands, into a state of nervous apprehension in the afternoon of November 30, according to news brought south by the fishing steamer *Celestial Empire*, which reached Vancouver yesterday morning (December 9) from the northern halibut banks. It was estimated that the shock lasted fully seven seconds. No other tremors were felt, greatly to the relief of the people of the town, who became somewhat alarmed on observing that two Indian shacks had been thrown to the ground. The buildings knocked down were old, half-tumbled-down affairs.

1909.

January 11.—Nearly all parts of southern British Columbia and Washington Territory, across the international boundary, were shaken by an earthquake at 3.45 p.m., Pacific standard time of January 11, the quake lasting from 10 to 20 seconds. No damage was done but the alarm was very great. Beyond the breaking of some crockery in a few homes in Victoria, there was little damage caused. Comox, Alberni, Pachena, Bamfield and other points report having felt the shock, Bamfield stating that two tremors were felt, while Estevan reports that no shock was experienced there. At Port Townsend, across the boundary line, in many places where water pipes lay in the frozen ground, the earthquake broke the pipes and flooded houses.

January 31-February 1.—Three distinct earthquake shocks were felt in Montreal last night. The first shock was felt at $11^h\ 30^m$ p.m., the second at $11^h\ 45^m$, and the third and most severe at $3^h\ 20^m$ a.m. People were awakened all over the city. The rattling of glassware and crockery was heard distinctly. A peculiar feature was the howling of dogs all over the city. Loud cracking as though houses were being severely strained was noticed everywhere. A number of houses are cracked as the result of the quakes, also some sidewalks.

February 3.—At about 4 a.m. quite a number of people in Montreal were aroused by an unusual sound and a slight sense of vibration, which lasted only a very short time and was not repeated. It was less severe than the preceding one of two days ago.

Examining the geological areas for the above places it is not difficult to understand that local shocks may occur there. The complexity of the formations; the differences in composition, in density, in elasticity; the many faults and dikes; the numerous surfaces of contact; the constant gravitational effect, all conspire towards the interruption of a continuous gradual adjustment of stresses and strains, so that at times these adjustments, though very minute, are abrupt and manifest themselves as local shocks. That these adjustments are very small is shown by the very small acceleration produced. Acceleration is the measure of intensity of an earthquake.

In the above local shocks there is only one, that for Ottawa, for which direct measures were obtained. We find from them that the acceleration produced was 2·4 millegals.

The unit of acceleration in the C. G. S system is called a 'gal', *i.e.*, the acceleration of 1cm per second, per second; hence for gravity at latitude 45° we have 980·60 gals. A millegal is the thousandth of a gal.

Small local shocks like the above may occur almost anywhere, at least in many localities over the southern part of Canada from Nova Scotia to British Columbia.

It may be remarked, however, that when we reach the Pacific coast we enter upon ground adapted to tectonic or the larger quakes. Vancouver island, Queen Charlotte islands and the smaller islands all lie in comparatively shallow water, but immediately to the west lies the deep trough of the Pacific, adapted for breeding seismic disturbances on a large scale.

MICROSEISMS.

In order to treat this subject as fully as the data and records here warrant, some of the matter published last year is here incorporated for the sake of completeness.

Under the designation microseisms, are included all pulsations not directly attributable to what are generally known as earthquakes, which give abrupt, more or less violent, and momentary movements of the earth's crust, the effect of which may, however, continue for some hours. Attempts have been made to classify these microseisms according to their cause, but so far without complete success. During the past year the writer has paid considerable attention to these disturbances, and in doing so has studied and compared the daily seismograms with our daily micro-barograms, our weekly aneroid barograms and also with the daily weather maps, which give the isobars at 8 a.m. for Canada and the United States, roughly between latitudes 25° and 55°, and the Atlantic and Pacific oceans. The micro-barogram exhibits particularly well very rapid fluctuations of pressure as manifested by local and often gusty winds, the counterpart of which is always represented on the seismogram by irregular movements and not by microseisms The average time of the beginning of the seismogram sheet is about 10 a.m., so that the above isobars and gradients dependent upon them are for a time preceding the former by two hours. From the examination of the local barogram alone not much information can be gathered as to the behaviour of the seismograph except when very rapid and marked fluctuations, say a millimetre or more, take place in the pressure, comparable with the 'pumping' of a mercurial barometer at sea. The barometer may show little or no change in pressure at a given place, yet areas of 'High' and 'Low' (barometer) may be rushing along to the north and south of it, setting up vibrations or pulsations of the earth's surface that may be markedly felt at a given place by the seismograph. Similarly from a large rise or fall of the barometer during 24 hours at a given place alone, we can draw no gradients to determine the atmospheric movements; the position of the isobars and 'Highs' and 'Lows' being unknown. We have simply the record of the vertical movement of pressure at one point. The isobars on the Weather Map are drawn at intervals of one-tenth inch difference of pressure. The normal to the isobars is called the gradient, and when spoken of, generally refers to the gradient between a 'High' and a 'Low' passing through Ottawa. An examination has been made during the year of the daily seismograms and the daily Weather Maps, including the isobars or position of 'Highs' or 'Lows' and the forecast for the Ottawa regions with reference to winds and storms. This examination furnishes the data upon which the conclusions depend. As the Observatory is not yet supplied with an anemometer and pressure gauge for camparison of the dynamical conditions, we are at present dependent upon the daily forecast.

It may be stated at the outset, before discussing the preceding data, that there is never a day in the year on which some trace of microseisms can not be seen on a seismogram from a Bosch photographic seismograph. It is all a matter of degree. That microseisms should be ever present is but natural, for the earth is in a continual state of stress and strain, many varied and different causes contributing thereto. The term microseisms as here used excludes any deviations of the vertical or movements of the zero position of the pendulum. Some writers have divided microseisms into 'earth tremors' or 'pulsations,' and 'earth pulsations' or 'pulsatory oscillations.' The writer, however, from the seismograms at this station sees no reason for this division, as it is not at all evident from them that the contributory causes, whatever they may be, manifest themselves in such a manner as clearly to differentiate themselves. Furthermore, from the examination of the seismograms the oscillations of the pendulum are excluded; on the one hand, from the frequent change of period on the same seismogram, which would be inadmissible for a pendulum, and on the other hand, if the pendulum were made to oscillate we should expect to see the damping effect in the decrease of amplitude, and a more or less sudden beginning, unless the oscillations of the earth particles themselves were of a period commensurable with that of the pendulum, which, of course, is sometimes the case. It is evident that a photographic registering apparatus with high magnification will record microseisms when a seismograph with mechanical registration will draw only a straight line.

Of the contributing causes to stresses and strains and manifesting themselves as microseisms, we may consider: secular cooling of the earth; unequal heating and the radiation during the day and night; statical effect of atmospheric pressure, areal or local; dynamical effect of atmospheric pressure, areal or local; precipitation, as rain or snow.

The vanishingly small effect of secular cooling, whatever its constants may be, becomes evident from the fact, that, although it is ever present, and its manifestations would be of a constant nature, the recorded microseisms are of the most fluctuating character both in time and magnitude, completely masking the effect of secular cooling. The daily alternations of unequal heating and radiation during the 24 hours are not shown by their effect on microseisms. The case of precipitation is similar in regard to microseisms to the preceding. It may be noted that the stresses set up over large areas, hundreds of miles in extent, by differential loading of rain, is small compared with that of barometric pressure. Taking an area, say of a thousand miles with a rainfall of an inch, which is a pretty heavy rain, and decreasingly distributed, we would have a maximum pressure of a little over one-thirtieth of a pound per square inch, and the rain-pressure diminishing to zero for the edge of the area. An average barometric gradient, on the other hand, over such an area would be several times as great, due to a differential atmospheric pressure equivalent to about three-tenths of an inch of the mercurial barometer. The rain-pressure may, however, make itself felt locally, as has been recorded at some stations. The result of a heavy rainfall soon fills the valleys and streams much beyond the direct precipation on them, so that this loading and bending of the surface may become a measurable quantity by an observing station in the neighbourhood. This effect is, however, one of tilting, of change of vertical or change of pendulum zero and not microseisms, the subject at the moment under discussion.

The effect of difference of atmospheric pressure and of change of atmospheric pressure may be manifested in two ways by the seismograph. We are here dealing with large areas, say 1,000 miles in extent, for local barometric conditions have little or nothing in common with microseisms. In the one case, considering the earth as having an elastic crust, the pier is tilted towards the area of greatest pressure, in consequence of which the pendulum will move in that direction, *i.e.,* its zero line will be displaced. Besides this effect of statical loading, there appears to be no doubt, based on the records here, that vibrations are set up by this statical loading, quite apart from the dynamical effect of change of pressure. In the other case, by change of pressure over a wide area vibrations are set up on the earth's surface, and these may be produced by two allied causes. The one of these is the passage of Highs' and 'Lows' over the surface, equivalent to the dragging of a weighted meniscus over the surface, and the other is the winds set up or resulting from the atmospheric gradient due to difference of pressure. The winds would operate more probably by frictional resistance along the surface of the earth rather than by impact or uneven surface or obstructions. In studying various phenomena collectively in an investigation for correlation, considerable restraint must be exercised not to draw conclusions as to cause and effect from a limited number of coincidences, for a conclusion once drawn is apt to become an obsession to the investigator, and he is more or less blinded to facts that do not fit his theory.

In examining the records of microseisms the first question that presents itself is whether the recorded motion is that of the ground or of the pendulum; in the first case the pendulum acts as a steady mass or point, while in the latter case it is set oscillating either by impulses from the ground or by an undulatory movement of the ground. Let us consider the case of microseismic record of the 'sawtooth' type, where we see regular and almost wholly uniform oscillations kept up for hours and longer. If in this case the pendulum actually oscillates it will do so with the period inherent to it. After receiving the first impulse or impact let us suppose it to oscillate. If no further impact were received the oscillations would soon die out and the amplitudes would decrease in the known ratio of the damping coefficient. When a second impulse is given the pendulum will continue its uniform swings, provided the time interval from the preceding impulse is that of the period of the pendulum or a multiple thereof. Were this not the case, interference would occur and would be shown on the record. But such interference is not present in the microseismic records referred to and we must conclude, even admitting that the diagram is a record of the oscillations of the pendulum, that it is in reality only a counterpart of the actual movements of the ground, that is, of horizontal to-and-fro motions of the earth particles. The pendulum can be kept swinging uniformly only by some force acting at intervals of the period of the pendulum. This may occur through the periodic oscillating movements of the earth particles; or the same effect may be produced by rythmic undulatory movements of the ground. Now, the period of microseisms recorded here lies usually between 5 and 6 seconds, which is also approximately the period of the two pendulums, and the period of the undulatory movements manifested in the 'principal portion' of tectonic earthquakes is 20 seconds or more, so that if we adopt the hypothesis that the microseismic motions are undulatory and not horizontal displacements, we have to explain a period only one-quarter of the general period of the earth's crust. The shorter period might perhaps be accounted for by the supposition that a thinner part of the crust of the earth is affected in the microseisms than is involved in the undulatory motion connected with macroseisms. As an analogy we may give the short period of the ripples in water from a breeze, and the much longer one of waves from a storm when a greater depth of water is involved in the motion.

This reasoning does not appear to furnish a conclusive reply to the question whether the microseisms are attributable to the horizontal or to the undulatory movements. However, the consideration of the simultaneous occurrence of microseisms, together with certain atmospheric or barometric conditions leads to the conclusion that microseisms are mostly attributable to horizontal displacements.

Having made daily comparisons with the seismograms, local barograms and weather maps, the following conclusions have been deduced:—It is believed that identical atmospheric conditions prevailing over different parts of the earth's surface will not necessarily produce similar microseisms, as these are affected by the elasticity of the particular area under consideration, also by the geological formation, the presence of well-marked dykes, faults, and by the proximity of large sheets of water or the ocean. One effect of the proximity of the ocean caused by barometric pressure is the change of the level of the water, quite apart from the tides, and this change through loading or unloading along the coast produces a displacement of the pendulum zero, referred to in another place. In the sea, then, we have the dual effect of the direct barometric pressure and the correlated one of displacement of the water, while on land we have only the former. Barometric gradients over the ocean necessarily produce a motion of the water, quite apart from that produced by the winds resulting from the gradients. However, the pressure effect on the ocean bottom remains constant, for any displacement of the water is exactly balanced by the change of atmospheric pressure. Different of course it is on land which suffers the change of barometric pressure.

The feature to strike one most in the above comparisons is that when marked microseisms are present we are almost certain to find that the daily weather map for the morning of the day of record gives for the following 24 hours an area of 'Low' about the Gulf of St. Lawrence. That is, the condition of 'Low' in the gulf precedes the record of marked microseisms. The greater part of the gulf is less than 150 fathoms deep. Through it runs a 'deep' from the mouth of the St. Lawrence (Matane) along the south of Anticosti, passing between Cape Breton and Newfoundland, reaching a depth of 250 fathoms before joining the Atlantic ocean. This deep is over the eastern part of the great St. Lawrence and Champlain Fault, shown on the geological maps, for nearly 700 miles. The waters about Nova Scotia and Newfoundland are all within the 150 fathom line, so that the 'Lows' over the gulf and Sable island are over waters, the greater part of which are less than 150 fathoms deep. The distance from Ottawa to the gulf is about 700 miles, direction east-north-east; and from Ottawa to the nearest broad waters of the Atlantic, off the state of Maine, 300 miles, direction east-south-east.

Next to the presence of a 'Low' in the gulf in importance as a phenomenon accompanying microseisms, we find the isobars which cut the valley of the St. Lawrence (in which lies the great fault) at right angles, so that the gradient is along the St. Lawrence valley, or in general parallel to the Atlantic coast, and to the line of the Alleghany mountains.

Furthermore, it is found that if a 'High' prevails along the south Atlantic coast, northward from Florida the microseisms are intensified.

The passing of 'Highs' and 'Lows' across the coast-line, *i.e.*, from land to water, is not found to be marked by the occurrence of microseisms. As the whole atmospheric movement is, for Canada and the United States, from west to east, it is uncommon for a 'High' or 'Low' to cross the coast-line *from* the Atlantic *to* the continent.

It appears that the reversal of the position of 'Low' and 'High' with reference to the gulf for the former is not so closely associated with the subsequent appearance of microseisms as obtains in the case first stated.

When there is a persistence of 'Low' in the gulf and 'High' on the Atlantic coast to the south as indicated, the microseisms set up in the first instance become intensified in amplitude, so that the maximum microseisms are not necessarily coincident with the greatest difference of pressure, or the steepest gradients. It appears that the difference of barometric pressure is in the first instance responsible for the microseisms, and when favourable conditions continue the microseisms will increase in amplitude, although the pressure difference may have decreased. Furthermore, another condition is that the line of 'High'-'Low' preserves its direction along the St. Lawrence valley.

When a 'Low' with even very steep gradients is to the west, say over the lakes, and 'High' on the lower St. Lawrence or gulf, microseisms are generally weak or even absent altogether, although there are exceptions. This is not the case when the 'Low' is to the east, especially when over the gulf. When the 'Low' with steep gradients moves up to Lake Erie by 8 a.m. of the day of the seismogram we may expect to see the beginning of marked microseisms, which increase as the 'Low' moves down the St. Lawrence towards the gulf. From the immediately preceding it is seen that the microseisms give no indication of the approach of a 'Low' or storm centre, but on the contrary, are the result of the passage of a 'Low' and especially of its presence in the gulf. Some investigators believe the microseisms may be the forerunner of coming weather conditions, and hope that this may assist in making forecasts. The seismograms examined here are not very encouraging on that point, the microseisms indicating rather 'that we have had weather, than that we are going to have weather.'

The preceding remarks refer to the microseisms and not to the effect of bending or displacement of the pendulum zero, brought about by unequal pressure over a large area. The writer is not as yet prepared to say whether the approach of a 'Low,' with the consequent lifting or rising of the earth's surface, is a distinctly measurable quantity as registered by our seismograph, for the measurements of the two components of the change of pendulum zero for the year have not yet been tabulated and critically compared with the movements of 'Highs' and 'Lows' in the eastern part of the continent.

By far the large majority of microseisms show themselves by a serrated record, 'sawtooth' type, as I designate them; more rarely are they of the 'spindle' type, where the oscillations or rather the amplitudes rise and fall, increase and decrease, with certain cadence, as in the vibrations of a string between two fixed points. The interval between the maximum amplitudes is very variable, varying from one to several minutes. The rate of increase and decrease of the amplitudes is less than that produced by the damping of the pendulum, so that we can scarcely attribute it to the latter on the supposition that the pendulum itself is set in motion and the oscillation dies down by damping, to be renewed by a fresh impulse. This, however, would preclude a gentle increase; instead there should be a more or less abrupt beginning, which is not the case. Intermittent rhythmic vibrations of the ground, nearly synchronizing with the period of the pendulum, setting the pendulum in motion could produce the phenomenon.

The validity of a supposed relationship between different phenomena, as cause and effect, is tested by predicting the effect when given the cause. This has been done with reference to the existence of a 'Low' in the gulf and a 'High' over the Atlantic coast to the south, or in general by taking the daily weather map with its isobars and from it predicting the resulting microseisms. The result has so far been satisfactory that in the large majority of cases the microseisms have fairly well answered in presence and magnitude the prediction. There are, however, still important outstanding differences that require further explanation. Just why the 'Low' about the gulf should have such an influence in the production of microseisms is by no means apparent. The two main physical features are the shallow gulf and the St. Lawrence valley in which lies the great St. Lawrence and Champlain Fault, 700 miles long, already referred to. Also there is the generally parallel trend of the Atlantic coast, and that of the Alleghany mountains.

On frequent occasions there is a 'Low' over the gulf, another 'Low' over Arkansas, while one 'High' rests north of Lake Superior and another over Bermuda. When these conditions obtain with steep gradients we are pretty sure to have marked microseisms. The line joining the 'Lows,' then, lies in the St. Lawrence valley, while that of the 'Highs' is at right angles to the former. In this case the maximum strain is along the valley of the St. Lawrence, along the Great Fault, so that from *a priori* reasoning marked microseisms might be expected.

In concluding the present investigation of the well-marked microseisms recorded here, we will repeat, that the presence of a 'Low' over the gulf surrounded by steep or fairly steep gradients on a given morning is indicative of more or less well-marked microseisms following at Ottawa that day.

It has already been stated that the large majority of microseisms have a period of about 5^s with small fluctuations. The cause of the fluctuations is by no means apparent unless it be the varying depth of the earth's surface involved.

On some occasions the period changes to one of about one-half, or about 3^s, showing, however, a transition time during which there is an irregularity and interference, so that their period is unrecognizable. At present no explanation can be offered for this change. When the period is so short, the amplitudes are very minute, although visible on the sheet to the naked eye.

It is found that, broadly speaking, the microseisms are more numerous during the colder season than during the warmer one, and some have sought therein a relationship of cause and effect. In our climate here we have a large range of temperature, during the year 1907-1908, of 127°F. (96° and − 31°F.). During February, when the thermometer reached its lowest and we had some continuously very cold weather, the seismograph showed no evidence thereof. More frequent microseisms might be expected during winter from the fact that the frozen ground better transmits pulsations, and that the act of freezing itself sets up stresses and consequent oscillations. From extreme cold it does not necessarily follow that the ground is frozen to any great depth. During the past winter there was very little frost in the ground, because an early and heavy snowfall, subsequently accumulating to many feet, covered the earth with a mantle that cold could not penetrate.

From examination it is found that the strongest and most numerous microseisms were recorded during the months of January and February last (1909), while during the period September, 1907, to April, 1908, October had the strongest, and the fewest and weakest were during the summer months of July and August, when the atmospheric barometric gradients were very long.

We are led to conclude that strong winds have little effect in causing microseisms by setting up pulsations over large areas of the earth's surface or crust, *i.e.,* the dynamical effect by friction or impact is not the governing factor in the production of microseisms. We are dealing here with the larger effect of strong winds upon large areas and not the local effect upon buildings, which, as is well known, are set in oscillation, and these in turn are communicated to the ground. When the building within which the seismograph is housed is large, the oscillations of the former will be recorded.

When we compare the occurrence of microseisms with the predicted strong winds of the daily forecasts, we find little or no connection between the two phenomena. Considering the two phenomena as independent events, we see that the probability of the simultaneous occurrence of the two events is as great as the actual happening.

i.e., as far as the observations go there is very little to show any causal relationship between the two.

On the other hand we do find that the winds recorded here by the micro-barograph invariably show themselves on the seismograms, not by microseisms, but by irregular movements, including deviations of the zero line. Microseisms and these latter movements can never be mistaken for earthquake records.

RECORD of Microseisms for the period January 1, 1908, to March 31, 1909. Two Bosch photographic seismographs, mounted N.-S., E.-W. Magnification, 120. Sheet put on each day at about 10. a.m. Standard Time = 15^h G.M.T.

Date.	N-S. Comp.		E-W. Comp.		Remarks.
	Period.	Max. Amp.	Period.	Max. Amp.	
1908.	s.	μ	s.	μ	——
Jan. 1	5·7	8	5·8	8	Decreasing towards following morning.
" 2	......	......	......	......	Almost wholly quiescent.
" 3	......	......	......	......	Almost quiescent.
" 4	......	......	......	......	" "
" 5	5·5	7	5·4	8	Increase gradually, reach a maximum about midnight, then decrease.
" 6	5·5	4	5·5	4	
" 7	5·5	4	5·5	4	Maximum about 8 a.m., Jan. 8.
" 8	5·5	4	5·5	4	
" 9	5·5	4	5·5	4	
" 10	5·6	......	5·6	......	Small.
" 11	5·5	2	5·5	2	
" 12	5·5	4	5·5	4	
" 13	5·5	3	5·5	4	
" 14	5·5	4	5·1	4	Increase about midnight.
" 15	......	......	......	......	Present but weak.
" 16	......	......	......	......	Slight microseisms scattered throughout.
" 17	......	2	......	2	
" 18	......	......	......	......	Scarcely any.
" 19	......	......	......	......	" "
" 20	5·5	2	5·5	2	
" 21	5·5	2	5·5	2	
" 22	3·0				
" 23	5–3	4	5·5	4	
" 24	5·5	7	5·5	7	Two hours at beginning and end of sheet weakest.
" 25	5·5	......	5·7	......	Decreasing.
" 26	......	......	......	......	Small, of usual saw-tooth type, not so well expressed by N-S component.
" 27	5·5	4	5·5	4	
" 28	......	......	......	......	Present throughout.
" 29	......	......	......	......	" "
" 30	......	2	......	2	
" 31	......	......	......	......	Slight throughout.
Feb. 1	......	6	......	6	Earthquake occurs, microseisms after quake.
" 2	5·7	6	6·3	6	
" 3	......	......	......	......	Not so strong as yesterday.
" 4	......	......	......	......	Scarcely any.
" 5	......	......	......	......	Weak.
" 6	......	......	......	......	"
" 7	5·5	2	6·0	2	
" 8	......	......	......	......	Small.
" 9	......	......	......	......	Very slight.
" 10	......	......	......	......	Scarcely any.
" 11	......	......	......	......	" "
" 12	......	......	......	......	Very few and weak.
" 13	......	......	......	......	Small and fairly evenly distributed.
" 14	......	......	......	......	Very few.
" 15	5·4	3	6·3	4	
" 16	5·3	3	6·6	5	
" 17	5·5	3	6·3	3	
" 18	......	......	......	......	Scarcely any.

RECORD of Microseisms for the period January 1, 1908, to March 31, 1909. Two Bosch photographic seismographs, mounted N.-S., E.-W. Magnification, 120. Sheet put on each day at about 10 a.m. Standard Time = 15^h G.M.T.—*Con.*

Date.	N-S Comp.		E-W. Comp.		Remarks.
	Period.	Max. Amp.	Period.	Max. Amp.	
1908.	s.	μ	s.	μ	—
Feb. 19					Very minute, increase after 3 a.m.
" 20	5·7		6·4	4	Fairly strong by E-W component.
" 21	6·0		6·8	6	
" 22	6·0	3	6·5	4	
23					Very weak.
" 24					Weak.
" 25					Practically quiescent.
" 26					Very minute.
" 27					Small.
" 28					Very weak.
" 29					Slight traces.
March 1					" "
" 2					Very slight traces.
" 3	3·0		3·0		Very weak.
" 4					Apparently quiescent.
" 5					Almost perfectly quiescent.
" 6	5·5	3	6·0	5	Decrease after 6 p.m.
" 7					Very slight.
" 8					" "
" 9					Almost quiescent till about 3 a.m., when micros. set in, reading 3μ.
" 10	5·7	1	6·9	4	
" 11		1		2	
" 12		1		1	
" 13					Very slight.
" 14					" "
" 15					" "
" 16					Practically quiescent.
" 17					Quiescent.
" 18					Very minute.
" 19					" "
" 20					Minute.
" 21	5·7	2	6·3	2	Small.
" 22					Very slight.
" 23					" "
" 24					Small.
" 25		4		4	Decrease after 7 p.m.
" 26					Small. Continue between the two earthquake records of Chilapa, Mexico.
" 27					Very minute.
" 28		2		2	Minute.
" 29					"
" 30	4·0	2			
" 31				3	Strongest during night.
April 1	4·6	4	4·8	2	Increase after 6 p.m.
" 2					Less strong.
" 3	5·2	5	5·0	5	
" 4	5·7	6	7·5	6	
5		3		3	Gradually decreasing.
" 6					Minute.
" 7					Very minute.
" 8					Minute.
" 9	3–5	2	3·5	2	
" 10	5·2	4	6·3	2	
" 11	5·5	4	5·0	3	
" 12	5·7	6	6·2	4	
" 13	5·7	7	6·0	5	
" 14	5·3	4	6·0	3	Decreasing.
" 15	5·3		7·5		By following morning period for both $3^s.7$.
" 16	4·2	3	4·1	2	Decrease.
" 17	5·5	4	5·5	4	
" 18	6·0	4	7·3	5	

RECORD of Microseisms for the period January 1, 1908, to March 31, 1909. Two Bosch photographic seismographs, mounted N.-S., E.-W. Magnification, 120. Sheet put on each day at about 10 am. Standard Time = 15^h G.M.T.—*Con.*

Date.	N.-S. Comp. Period.	N.-S. Comp. Max. Amp.	E.-W. Comp. Period.	E.-W. Comp. Max. Amp.	Remarks.
1908.	s.	μ	s.	μ	
Apr. 19					Minute, increase after 6 a.m.
" 20		4		3	
" 21	5·3	4	5·4	3	
" 22	5·2	3	5·7	2	
" 23	5·5		5·5		Very minute, and decreasing.
" 24	5·0	2	5·0	2	Quiescent after noon.
" 25					Almost quiescent.
" 26		1		1	Small.
" 27		2		2	Stronger after 6 a. m.
" 28	6·3	4	7·5	5	
" 29	6·6	5	7·5	6	
" 30		2		3	
May 1		2		2	
" 2	5·3	3	6·0	2	
" 3	5·3	5	6·3	4	
" 4		5		4	Strongest during night.
" 5	5·7	6	6·0	5	Decrease after 1 a. m.
" 6	5·5	2	6·0	2	
" 7	5·5	3	6·0	2	
" 8	4·3		5·0		Minute.
" 9	5·5	3	6·0	2	
" 10	5·5	4	5·7	3	
" 11		2		1	Decreasing.
" 12	3·5	1	7·0	4	
" 13	4·0				Very minute.
" 14	4·3				"
" 15					"
" 16	5·2	1			Very small.
" 17					Almost quiescent.
" 18					" "
" 19					" "
" 20					" "
" 21					Almost wholly quiescent.
" 22					Practically quiescent.
" 23			7·0		Almost quiescent.
" 24					Quiescent.
" 25					Almost quiescent.
" 26					Quiescent.
" 27					Slight traces.
" 28					Quiescent.
" 29	2·7		4·6		Very minute.
" 30	2·7		4·3		"
" 31					Apparently quiescent, but shows very minute and rapid oscillations
June 1					" " " "
" 2					Practically quiescent.
" 3			7·0	2	
" 4					Very small.
" 5					Practically quiescent.
" 6					" "
" 7					Faintest traces.
" 8					"
" 9					"
" 10					Practically quiescent.
" 11					Perfectly quiescent.
" 12					Quiescent.
" 13					Practically quiescent.
" 14					Quiescent.
" 15					Small, scattered.
" 16					Small.
" 17					Very minute.
" 18	5·5	1			Decrease after midnight.

RECORD of Microseisms for the period January 1, 1908, to March 31, 1909. Two Bosch photographic seismographs, mounted N.-S., E.-W. Magnification, 120. Sheet put on each day at about 10 a.m. Standard Time = 15ʰ G.M.T.—*Con.*

Date.	N-S. Comp. Period.	N-S. Comp. Max. Amp.	E-W. Comp. Period.	E-W. Comp. Max. Amp.	Remarks.
1908.	s.	μ	s.	μ	
June 19	......	......	......	......	Small.
" 20	......	......	......	......	Nearly quiescent.
" 21	......	......	......	......	Very minute.
" 22	......	......	......	......	A few very minute shown by N-S component.
" 23	......	......	......	......	A few scattered shown by N-S component.
" 24	4 4	1	......	......	Strongest about 4 p. m.
" 25	......	......	......	......	Practically quiescent.
" 26	......	......	......	......	" "
" 27	......	......	......	......	" "
" 28	......	......	......	......	Practically quiescent.
" 29	......	......	......	......	" "
" 30	......	......	......	......	Very minute by N-S component.
July 1	......	......	......	......	Practically quiescent.
" 2	......	......	......	......	" "
" 3	......	......	......	......	Quiescent.
" 4	......	......	......	......	"
" 5	......	......	......	......	Minute.
" 6	......	......	......	......	Quiescent.
" 7	......	......		......	Almost quiescent, some minute between 2 and 4 a.m. (July 8).
" 8	......	......	......	......	Quiescent.
" 9	......	......	......	......	Very minute, mostly shown by N-S component.
" 10	......	......	......	......	Practically quiescent.
" 11	......	......	......	......	Quiescent.
" 12	......	......	......	......	"
" 13	......	......	......	......	"
" 14	......	......	......	......	"
" 15	......	......	......	......	"
" 16	......	......	......	......	" , a few very minute.
" 17				......	Very minute throughout, more distinct by N-S component.
" 18	......	......	......	......	Very minute.
" 19	......	......	......	......	Practically quiescent.
" 20	......	......	......	......	Quiescent.
" 21	......	......	......	......	"
" 22	......	......	......	......	"
" 23	......	......	......	......	"
" 24	......	......	......	......	"
" 25	......	......	......	......	" until about 8 a. m. (July 26) when minute micros. appear and increase.
" 26	5·2	4	5·2	4	First typical "sawtooth" micros. for months. Strongest between 9 p.m. and 3 a.m. Period N-S component pendulum 6ˢ.1, E-W component pendulum 10ˢ·1.
" 27	5·5	3	6·0	3	Decrease, disappear after 12 p.m.
" 28	......	......	......	......	Practically quiescent.
" 29	......	......	......	......	Quiescent.
" 30	......	... 1	......	... 1	Very minute.
" 31	......	......	......	......	Almost quiescent.
Aug. 1	5·0	4	5·0	4	Low moving up Atlantic coast from Hatteras.
" 2	5·0	4	5·0	4	Little stronger than yesterday. Maximum about midnight.
" 3	5·0	3	5·0	3	
" 4	......	2	......	2	
" 5	......	......	......	......	Practically quiescent.
" 6	......	......	......	......	Quiescent.
" 7	......	......	......	......	"
" 8	......	......	......	......	"
" 9	......	1	......	1	Very minute.
" 10	......	......	......	......	"
" 11	......	......	......	......	" , shown best by N-S. component.

RECORD of Microseisms for the period January 1, 1908, to March 31, 1909. Two Bosch photographic seismographs, mounted N.-S., E.-W. Magnification, 120. Sheet put on each day at about 10 a.m. Standard Time = 15^h G.M.T.—*Con.*

Date.	N-S. Comp.		E-W Comp.		Remarks.
	Period.	Max. Amp.	Period.	Max. Amp.	
1908.	s.	μ	s.	μ	
Aug. 12	....	....	....	....	Practically quiescent.
" 13	....	....	....	....	Quiescent.
" 14	....	....	....	....	"
" 15	....	1	....	1	
" 16	....	1	....	1	Not continuous.
" 17	....	....	....	....	Almost quiescent.
" 18	4·5	....	....	....	Very minute.
" 19	....	....	....	....	"
" 20	....	1	....	1	
" 21	....	2	....	2	
" 22	....	2	....	2	Strongest in forenoon.
" 23	....	2	....	2	" about 3 a.m. (Aug. 24).
" 24	....	....	....	....	Very small.
" 25	....	....	....	....	Minute.
" 26	3·7	1	3·7	1	Quiescent till about 2 a.m. (Aug. 27), then small. Low moving up Atlantic coast from Hatteras.
" 27	5·1	5	5·1	4	Decrease after 8 p.m.
" 28	5·0	1	5·0	1	
" 29	....	....	....	....	Very minute, and decrease.
" 30	....	....	....	....	Practically quiescent.
" 31	....	....	....	....	" "
Sep. 1	....	....	....	....	Almost quiescent.
" 2	3·8	1	3·8	1	Minute.
" 3	5·0	....	5·0	....	A little stronger than yesterday.
" 4	....	....	....	....	Practically quiescent.
" 5	....	....	....	....	" "
" 6	....	....	....	....	Practically quiescent, save for fluctuations, not micros. caused by gusty wind.
" 7	5·5	2	6·0	1	
" 8	5·0	....	5·0	....	
" 9	5·0	1	5·0	1	Decreasing after midnight.
" 10	5·0	1	5·0	1	
" 11	5·0	....	5·0	....	Very small.
" 12	6·0	1	7·5	2	Towards evening micros. appear, increase to midnight, then decrease.
" 13	....	....	....	....	Minute.
" 14	4·7	1	4·9	1	Minute, increase.
" 15	5·5	2	5·5	2	
" 16	5·6	3	6·4	4	Maximum about 10 p.m.
" 17	4-5	2	5–8	3	
" 18	5·7	3	6·3	4	
" 19	5·9	4	6·6	5	
" 20	4·7	3	5·5	4	
" 21	5·4	2	6·8	3	
" 22	6·1	1	6·8	2	
" 23	5·0	1	5-7	1	
" 24	....	....	7·5	1	Almost wholly quiescent, here and there micros.
" 25	....	....	7·0	1	
" 26	5-6	1	7·5	1	
" 27	5·5	....	5·7	....	Small; N-S component the stronger, being reverse of what it has been lately.
" 28	5·5	1	5·7	1	
" 29	5·0	2	5·0	1	
" 30	5·1	2	6·2	1	
Oct. 1	5·3	1	5·1	1	
" 2	4·0	1	4-10	3	After 1 a.m. (Oct. 3) periods lengthen, and intensity increases.
" 3	4·5	4	7·5 4·7	4	Increase after 9 p.m. Period of E-W component becomes shorter.
" 4	5·3	3	5·5	2	Decreasing.
" 5	5·4	2	5·5	1	
" 6	....	....	....	....	Minute.

RECORD of Microseisms for the period January 1, 1908, to March 31, 1909. Two Bosch photographic seismographs, mounted N.-S., E.-W. Magnification, 120. Sheet put on each day at about 10 a.m. Standard Time = 15^h G.M.T.—*Con.*

Date.	N-S. Comp. Period.	N-S. Comp. Max. Amp.	E-W. Comp. Period.	E-W. Comp. Max. Amp.	Remarks.
1908.	s.	μ	s.	μ	
Oct. 7	4·9	1	4·9	1	
" 8	4·8	2	5·1	2	Strongest about 8 p.m.
" 9	5·2	2	5·4	2	Strongest about midnight.
" 10	5·3	2	5·8	2	Strongest between 8 p.m. and 2 a.m.
" 11	4·6	....	5·0	....	Very small, better expressed by N-S component.
" 12	....	....	....	....	Small and well marked.
" 13	5·3	2	5·2	2	
" 14	5·6	3	5·7	3	Strongest about 9 p.m.
" 15	5·2	1	6·8	1	Almost disappear by following morning.
" 16	....	....	....	....	Almost quiescent.
" 17	6·4	1	6·7	2	Almost quiescent till about 9 p.m. then become pretty well marked.
" 18	6·5	1	7·0	1	
" 19	....	....	....	....	Very minute.
" 20	4·9	1	6·7	1	Almost quiescent.
" 21	6·0	3	6·6	4	Minute till 9 p.m., then increase.
" 22	6·3	3	6·8	5	Decrease after 8 p.m.
" 23	5·1	1	7·8	1	
" 24	5·1	2	6·9	2	
" 25	5·4	2	5·5	2	
" 26	5·3	1	5·6	1	Decrease after 2 a.m., (Oct. 27).
" 27	5·4	1	6·1	1	
" 28	5·1	1	6·0	1	Scattered throughout, not continuous.
" 29	4·6	4	4·3	3	Increase after 2 a.m., (Oct. 30).
" 30	4·7	3	4·5	2	
" 31	5·4	6	5·4	3	Begin small. After 5 a.m., (Nov. 1st), become very marked.
Nov. 1	5·6	6	5·8	4	"Sawtooth" type, very few of spindle form.
" 2	5·5	4	5·4	3	
" 3	5·4	5	5·8	3	
" 4	5·4	4	5·5	2	
" 5	5·0	4	4·9	2	Strongest during the night.
" 6	5·8	10	6·6	6	
" 7	5·8	6	5·9	4	
" 8	5·7	3	5·8	2	
" 9	5·3	2	5·3	1	
" 10	5·0	1	5·9	1	
" 11	4·8	1	6·9	1	
" 12	4·9	5	5·4	3	Fairly quiescent till midnight, when micros set in and increase in intensity.
" 13	5·2	5	5·7	4	
" 14	5·4	2	5·8	2	After 2 a.m., period changes markedly by decreasing to 4^s.
" 15	4·8	2	4·6	2	
" 16	4·8	3	5·3	2	
" 17	4·5	1	5·5	1	
" 18	4·8	4	5·0	3	Increase after 7 p.m.
" 19	4·3	4	4·4	3	Maximum about 7 p.m.
" 20	5·0	2	8·3	1	
" 21	5·0	2	5·0	1	
" 22	4·0	2	4·0	1	
" 23	....	....	....	....	Scarcely a trace.
" 24	5·0	1	....	....	Almost quiescent.
" 25	5·0	1	....	....	"
" 26	5·7	1	7·0	1	
" 27	5·2	2	7·2	1	
" 28	5·0	3	5·0	2	
" 29	5·6	3	5·6	2	Decrease.
" 30	5·2	2	5·3	1	
Dec. 1	....	....	....	....	Very windy, shown by irregularity of zero line. New steel point for E-W component.
" 2	5·1	3	4·5	3	Begin small, become well-marked by following morning.

Record of Microseisms for the period January 1, 1908, to March 31, 1909. Two Bosch photographic seismographs, mounted N.-S., E.-W. Magnification, 120. Sheet put on each day at about 10 a.m. Standard Time = 15h G.M.T.—*Con.*

Date.	N.-S. Comp.		E.-W. Comp.		Remarks.
	Period.	Max. Amp.	Period.	Max. Amp.	
1908.	s.	μ	s.	μ	
Dec. 3	5·4	3	4·3	4	
" 4	5·1	2	4·5	2	
" 5	5·1	3	4·5	5	Begin small.
" 6	5·1	4	4·5	6	
" 7	5·1	3	4·3	8	
" 8	5·2	5	4·6	9	
" 9	5·1	3	4·3	4	
" 10	5·3	3	4·6	4	
" 11	5·8	3	4·5	4	Strongest about 7 p.m.
" 12	5·6	4	4·6	5	
" 13	5·5	5	4·4	5	
" 14	5·3	3	4·6	5	
" 15	5·6	4	4·7	4	
" 16	5·3	3	4·6	4	
" 17	5·3	3	4·5	5	
" 18	5·1	3	4·4	5	
" 19	5·2	3	6·5	6	
" 20	6·2	2	6·6	5	
" 21	4·9	1	6·6	2	
" 22	5·1	1	5·6	4	
" 23	5·5	4	6·6	7	
" 24	5·6	2	6·3	4	
" 25	5·6	1	6·3	3	
" 26	5·5	4	6·8	7	Strongest between 5 and 12 p.m.
" 27	5·4	4	6·1	7	
" 28	5·6	1	6·2	5	No difference of micros. before and after the earthquake (Messina).
" 29	4·3	2	4·7	4	
" 30	5·4	1	6·4	2	
" 31	.....	.....	.....	.....	Small to minute.
1909.					
Jan. 1	5·5	2	5·9	3	
" 2	5·1	1	5·8	2	
" 3	5·0	1	5·4	1	Almost quiescent.
" 4	5·0	1	6·3	1	" "
" 5	5·3	1	6·5	2	
" 6	5·3	2	6·0	3	Increasing.
" 7	4·9	2	6·6	4	
" 8	4·9	–	6·4	1	Almost quiescent.
" 9	.....	.....	.....	.....	" perfectly quiescent.
" 10	5·3	1	6·5	2	
" 11	5·0	1	6·5	2	
" 12	5·3	1	8·6	2	
" 13	5·1	1	6·6	2	
" 14	5·4	.....	6·6	.....	Almost perfectly quiescent.
" 15	4·7	1	5·7	2	
" 16	5·3	2	6·7	5	
" 17	.....	.....	7·0	5	Wind effect shown by irregularities of zero line. N-S component off.
" 18	.....	.....	6·6	8	Maximum between 5 and 9 a.m. (January 19). N-S component off.
" 19	6·0	7	6·4	12	Strongest in a long time.
" 20	5·9	4	6·9	7	
" 21	5·4	2	6·0	3	Almost cease after 5 p.m.
" 22	5·8	1	6·7	1	Fairly quiescent.
" 23	5·7	1	5·9	1	Scattered, not continuous.
" 24	6·0	2	6·1	2	
" 25	6·0	1	6·0	1	Wind makes zero line irregular.
" 26	4·5	3	4·5	3	
" 27	5·6	5	6·5	6	

RECORD of Microseisms for the period January 1, 1908, to March 31, 1909. Two Bosch photographic seismographs, mounted N.-S., E.-W. Magnification, 120. Sheet put on each day at about 10 a.m. Standard Time = 15ʰ G.M.T.—*Con.*

Date.	N-S. Comp. Period.	N-S. Comp. Max. Amp.	E-W. Comp. Period.	E-W. Comp. Max. Amp.	Remarks.
1909.	s.	μ	s.	μ	
Jan. 28	5·8	5	6·8	7	
" 29	6·6	5	6·8	8	
" 30	6·0	5	6·7	6	
" 31	5·3	2	6·6	3	
Feb. 1	5·5	2	6·4	4	
" 2	5·4	1	6·2	2	Decreasing.
" 3	5·2	1	5·8	1	Almost quiescent.
" 4	5·2	1	5·2	1	" "
" 5	5·2	1	5·4	1	Minute.
" 6	3–5	1	4–6	1	
" 7	5·1	2	5·1	2	
" 8	5·4	5	5·6	5	Decrease after 8 p.m.
" 9	5·5	6	6·2	8	Increasing.
" 10	......	....	....	.....	No light.
" 11	5·7	2	6·7	2	Small.
" 12	5·4	1	5·9	1	
" 13	4–5	1	4–5	1	Minute.
" 14	4–5	1	4–5	1	Very small.
" 15	6·2	1	6·8	2	Decreasing.
" 16	3·7	1	3·7	1	Periods decrease after 7 p. m.
" 17	4·4	2	6·6	2	
" 18	5·4	2	6·5	3	Begin small, but increase, particularly after 5 a. m. (Feb. 19).
" 19	5·9	3	6·8	5	
" 20	5·1	2	6·4	3	
" 21	5·7	2	6·4	4	In general not as strong as yesterday.
" 22	5·7	2	6·2	3	
" 23	5·6	1	6·2	1	Small.
" 24	5·3	1	6·2	1	Wind effect shown by irregularity of zero line.
" 25	5·6	5	6·3	6	Wind effect shown by irregularity of zero line. After 4·30 p. m., micros. well-marked.
" 26	5·8	5	6·7	7	
" 27	6·1	4	6·9	8	Decrease after 6 p. m.
" 28	5·6	2	6·3	3	Decreasing.
March 1	5·3	1	5·9	2	
" 2	5·5	1	6·5	2	
" 3	4·8	6	4·6	4	Small but after 5 a. m. (March 4) strong set in.
" 4	4·9	4	5·0	3	
" 5	5·4	4	5·7	4	
" 6	5·4	2	6·2	2	Gradual decrease.
" 7	5·8	2	6·4	4	" increase.
" 8	5·7	3	6·3	6	
" 9	5·8	2	6·3	4	Decrease to small and minute.
" 10	5·3	1	5·5	1	
" 11	5·2	1	5·8	1	Wind effect shown as heretofore.
" 12	5·6	1	6·0	1	
" 13	5·3	1	6·2	1	
" 14	5·2	1	6·4	1	
" 15	5·2	1	6·4	1	
" 16	5·4	2	6·1	2	
" 17	5·7	2	6·4	3	
" 18	5·5	3	6·6	5	Increases to well marked.
" 19	5·8	3	6·5	5	Maximum between 8 & 12 p. m.
" 20	5·9	4	7·0	6	Decreasing.
" 21	5·7	3	6·7	4	
" 22	5·8	3	6·6	5	
" 23	5·5	3	6·8	4	Strongest between 6 & 9 p. m.
" 24	5·3	2	6·4	2	
" 25	5·3	1	5·8	1	Snow storm shows irregularity of zero line.
" 26	5·4	2	6·6	3	
" 27	5·5	3	6·5	4	
" 28	5·4	3	6·5	3	
" 29	5·2	3	6·2	3	
" 30	5·3	2	6·2	2	
" 31	5·4	1	6·4	1	

A table was compiled for the official year April 1, 1908, to April 1, 1909, in which were given day by day for every twelve hours, 8 a.m. and 8 p.m eastern standard time, the position and pressure of the Low, as shown by the charts of the 'Tracks of Centres of Low Areas' published in the United States Monthly Weather Review. In an adjoining column was entered the occurrence and intensity of microseisms on the respective date. The object was to determine if possible the relationship between the existing Low at any particular time and place with the prevailing microseisms at Ottawa. Unfortunately for the purpose in hand the published track of Lows ends generally at the gulf, sometimes near its west coast, and less frequently in Newfoundland, so that the presence of a Low immediately east of the gulf, and which probably is the cause of many of the microseisms, is not noted, with the result that the Low in the west with which the microseisms are bracketed, being the only Low on the chart, is asked, so to speak, to account for the microseisms, when in reality they have nothing to do with it, but are due to the uncharted Low of the vicinity of the gulf or Newfoundland. The comparison between Lows and microseisms as above was consequently very misleading. It resulted in frequently having strong microseisms associated with a Low in the gulf, which is generally the case, but the next day the microseisms would probably persist, while the Low moved eastward beyond the sphere of the chart, yet they would in the table appear opposite to a Low far in the west, with which it could not possibly be related. I have therefore omitted this tabulation.

The following table has been compiled from the charts 'Tracks of centres of Low Areas.' published in the Washington 'Monthly Weather Review.' The object was to see whether the dynamical effect of the daily movement of the Lows across the continent was manifested by microseisms, that is, whether the apparent velocity of translation of the Low produced microseisms, and whether the intensity of the latter was a function of the velocity. The consideration here is independent of the steepness of gradients accompanying a Low. We may have a Low persistent or stationary for some time and this would hence not belong to the above investigation. That same Low may however be surrounded by steep gradients, which, in turn, as shown elsewhere, will be conducive to the appearance of microseisms. The rapidity with which a Low travels across the continent, from west to east, is quite independent of the gradients or isobars that accompany it. In the table, the first column gives the number of the Low for the respective month; the next column headed 'Beginning' gives the day of the month, forenoon—a—(at 8 a.m.) or afternoon—p—(8 p.m.) with barometer reading, when the Low began its course; the third column 'Ending' gives the date, forenoon or afternoon, with pressure when the Low ended or rather left the continent. The fourth column, 'Duration,' is the difference between the second and third, expressed in days. The fifth column, 'Distance,' gives the length of the track or path followed by the Low, and was obtained by following on the map with a graduated measuring wheel, adapted for the purpose, the path of the Low from beginning to end across the continent. The odd miles in the distances must not be taken too seriously, they simply show the multiplication of a constant factor by the revolutions and part of a revolution of the wheel measuring the track. The sixth column which gives the division of 'Distance' by 'Duration,' expresses the apparent average daily velocity of the Low across the continent. Finally, the last column shows where the Low was lost to observation or ended as far as the continent is concerned. 'Gulf' refers to the waters and surroundings of the Gulf of St. Lawrence, while 'Atlantic' refers to the ocean along the continent from Maine to Florida. 'Interior' indicates that either the Low disappeared as such in the interior, or was lost to observation in northeastern Canada:—

APRIL, 1908.

No.	Beginning.		Ending.		Duration	Distance.	Apparent average daily velocity.	Disappearance.
		in.		in.	days.	miles.	miles.	
I	1a	29.70	3a	29.04	2.0	1,700	850	Gulf.
II	3a	29.32	6a	29.64	3.0	2,480	827	"
III	6p	29.56	9a	29.18	2.5	2,340	936	"
IV	8p	29.60	12a	28.88	3.5	2,340	668	"
V	13a	29.64	16a	29.58	3.0	2,560	853	"
VI	15p	29.68	19p	29.14	4.0	3,024	756	"
VII	17a	29.44	19p	29.14	2.5	2,832	1,133	"
VIII	20p	29.58	29a	29.72	8.5	4,576	538	"
IX	21p	29.46	29a	29.72	7.5	4,016	535	"
X	21p	29.90	23p	29.78	2.0	896	448	Atlantic.
XI	25p	29.42	29a	29.72	3.5	2,128	608	Gulf.
XII	25p	29.36	29a	29.72	3.5	2,048	586	"
XIII	27p	29.70	30p	29.24	3.0	2,704	901	Atlantic.
						Mean ..	742	

MAY, 1908.

No.	Beginning.		Ending.		Duration	Distance.	Apparent average daily velocity.	Disappearance.
I	1a	29.08	1p	29.40	0.5	160	320	Gulf.
II	1a	29.64	3a	29.36	2.0	1,168	584	"
III	2a	29.35	10a	29.32	8.0	3,536	442	"
IV	6p	29.54	9a	29.80	2.5	656	262	Interior.
V	7a	29.60	8p	29.60	1.5	976	651	Gulf.
VI	8a	29.53	13a	29.62	5.0	3,840	768	"
VII	9p	29.66	13a	29.62	3.5	2,784	795	"
VIII	11a	29.64	18a	29.92	7.0	3,376	482	"
IX	14p	29.66	20p	29.76	6.0	2,960	493	Atlantic.
X	18a	29.46	19a	29.58	1.0	880	880	Interior.
XI	19a	29.56	24a	29.98	5.0	3,264	653	Gulf.
XII	23p	29.64	25a	29.74	1.5	928	619	Interior.
XIII	24a	29.92	31a	29.44	7.0	2,128	304	Gulf.
XIV	24p	29.58	27a	29.64	2.5	2,144	858	"
XV	25a	29.78	31a	29.44	6.0	3,104	517	"
XVI	25a	29.70	27p	29.54	2.5	976	390	Interior.
						Mean .	564	

JUNE, 1908.

No.	Beginning.		Ending.		Duration	Distance.	Apparent average daily velocity.	Disappearance.
I	1a	29·76	3a	......	2·0	992	496	Gulf.
II	2a	29·48	4p	29·52	2·5	1,450	580	Interior.
III	4a	29·54	11p	29·86	7·5	3,392	452	Gulf.
IV	8p	29·70	17a	......	8·5	2,720	320	"
V	17a	29·52	22a	29·70	5·0	3,200	640	"
VI	22p	29·56	26a	29·66	3·5	3,120	891	"
VII	24p	29·68	27p	29·62	3·0	1,680	560	Interior.
VIII	27p	29·62	30a	29·82	2·5	1,840	736	Gulf.
						Mean...	584	

JULY, 1908.

No.	Beginning.		Ending.		Duration.	Distance.	Apparent average daily velocity.	Disappearance.
		in.		in.	days.	miles.	miles.	
I	2p	29·72	9a	..	6·5	2,880	413	Gulf.
II	7p	29·78	12p	..	5.0	2,720	544	"
III	9a	29·88	11a		2·0	496	248	Atlantic.
IV	12a	29·88	15p	29·56	3·5	2,701	772	Gulf.
V	14a	29·80	20a	.....	6·0	3,232	539	Atlantic.
VI	18p	29·86	23a	....	4·5	2.784	619	Gulf.
VII	19p	29·90	22a	30·04	2·5	1,408	563	Atlantic.
VIII	23a	29·68	26p	29·88	3·5	1,216	347	Interior.
IX	29p	....	31p	29·32	2·0	688	344	Atlantic.
X	27a	29·84	30a	30·02	3.0	1,456	485	
						Mean...	491	

AUGUST, 1908.

No.	Beginning.		Ending.		Duration.	Distance.	Apparent average daily velocity.	Disappearance.
I	1a	29·66	3a	....	2·0	960	480	Gulf.
II	1p	29·44	10a	29·80	8·5	2,928	344	"
III	10p	29·56	14p	29·80	4·0	2,240	560	"
IV	15a	29·80	19a	29·60	4·0	2,528	632	"
V	20a	29·70	24a	29·98	4·0	2,440	610	"
						Mean...	525	

SEPTEMBER, 1908.

No.	Beginning.		Ending.		Duration.	Distance.	Apparent average daily velocity.	Disappearance.
I	1a	29·90	3a	....	2·0	1,424	712	Gulf.
II	4p	....	7a	....	2·5	1,960	784	"
III	6a	29·84	7a	....	1·0	1,024	1,024	"
IV	8a	29·86	9a	29·02	1·0	736	736	Interior.
V	11a	....	18a	....	7·0	2,320	331	Gulf.
VI	14p	29·66	19a	29·78	4·5	2,080	462	Interior.
VII	23a	29·82	29a	....	6·0	3,040	507	Gulf.
VIII	28p	....	30p	29·68	2·0	1,680	840	Interior.
						Mean...	674	

OCTOBER, 1908.

No.	Beginning.		Ending.		Duration.	Distance.	Apparent average daily velocity.	Disappearance.
I	1p	29·90	2p	.....	1·0	704	704	Gulf.
II	2a	29·28	3p	29·56	1·5	560	373	Interior.
III	8a	....	11p	29·68	3·5	2,240	640	Gulf.
IV	8p	29·72	11p	29·68	3·0	2,544	848	"
V	14a	29·36	15a	29·30	1·0	1,200	1,200	Interior.
VI	14p	29·56	17p	....	3·0	1,888	629	"
VII	15p	29·46	17p	29·90	2·0	960	480	"
VIII	17p	29·68	21p	....	4·0	2,099	525	"
IX	20p	29·58	27a	29·90	6·5	2,144	329	"
X	26a	......	27p	....	1·5	1,056	704	Gulf.
XI	27p	....	30p	29·06	3·0	2,120	707	"
						Mean.....	649	

NOVEMBER, 1908.

No.	Beginning.		Ending.		Duration.	Distance.	Apparent average daily velocity.	Disappearance.
		in.		in.	days.	miles.	miles.	
I	1p	29·66	4p	29·20	3·0	2,944	981	Gulf.
II	5a	29·72	6p	29·16	1·5	1,480	987	"
III	8p	29·66	12a	29·46	3·5	2,400	686	"
IV	14a	29·96	15a	29·60	1·0	1,480	1,480	"
V	16p	29·54	18p	29·60	2·0	2,304	1,152	"
VI	17p	29·50	20a	29·88	2·5	2,336	934	"
VII	21a	29·88	25a	29·52	4·0	1,424	356	Interior.
VIII	23a	29·64	25a	29·52	2·0	1,000	500	"
IX	23p	29·70	26a	29·06	2·5	2,048	819	"
X	27a	29·84	30p	29·04	3·5	1,936	553	"
XI	28a	29·90	30p	29·04	2·5	1,984	793	"
XII	29a	29·52	30p	29·04	1·5	1,408	938	"
						Mean.....	848	

DECEMBER, 1908.

No.	Beginning.		Ending.		Duration.	Distance.	Apparent average daily velocity.	Disappearance.
I	2p	30·06	4p	29·62	2·0	2,176	1,088	Gulf.
IIa	5a	29.82	7a	29·86	2·0	2,128	1,064	"
IIb	5a	29·82	7p	29·28	2·5	2,656	1,062	"
III	9a	29·68	12p	29·04	3·5	2,640	754	"
IV	11a	29·50	14a	29·48	3·0	2,720	907	"
V	12p	29·06	16a	29·72	3·5	2,944	841	"
VI	14a	29·72	17p	......	3·5	640	183	Interior.
VII	16a	......	18p	29·42	2·5	1,504	602	Atlantic.
VIII	18a	29·86	19a	29·94	1·0	1,280	1,280	"
IX	21a	30·00	23a	......	2·0	1,520	760	"
X	23a	29·78	26a	29·28	3·0	2,240	747	Gulf.
XI	25a	29·62	28a	29·66	3·0	2,880	960	"
XII	28a	29·40	31a	29·58	3·0	2,560	853	"
						Mean.....	854	

JANUARY, 1909.

No.	Beginning.		Ending.		Duration.	Distance.	Apparent average daily velocity.	Disappearance.
I	2a	29·70	6a	29·36	4·0	2,000	500	Gulf.
II	3a	29·60	5p	29·84	2·5	1,824	730	Interior.
III	3p	29·58	6a	29·36	2·5	3,008	1,203	Gulf.
IV	7a	29·66	10p	29·86	3·5	1,328	379	Interior.
V	10a	29·92	11a	29·80	1·0	1,088	1,088	Gulf.
VI	12p	29·60	15a	29·66	2·5	2,944	1,177	"
VII	15a	30·00	18a	29·70	3·0	2,608	869	"
VIII	19a	29·18	21a	29·70	2·0	1,640	820	Interior.
IX	21p	28·90	26a	29·56	4·5	3,344	743	Gulf.
X	25p	29·74	27p	29·30	2·0	2,016	1,008	"
XI	27p	29·72	31a	29·12	3·5	2,240	640	"
						Mean.....	832	

FEBRUARY, 1909.

No.	Beginning.		Ending.		Duration.	Distance.	Apparent average daily velocity.	Disappearance.
		in.		in.	days.	miles.	miles.	
I	3a	29·64	6p	28·98	3·5	2,528	722	Gulf.
II	4a	29·48	6p	28·98	2·5	2,208	883	"
III	5a	29·36	7p	29·70	2·5	2,600	1,040	Atlantic.
IV	5p	29·60	7p	29·70	2·0	1,800	900	"
V	7a	29·42	10p	29·30	3·5	2,760	789	Interior.
VI	11p	29·68	17a	29·40	5·5	3,059	556	Gulf.
VII	13a	29·58	17a	29.40	4·0	3,136	784	"
VIII	16p	29·44	20p	28·94	4·0	3,536	884	"
IX	20a	29·66	25p	29·02	5·5	4,200	764	"
X	21a	29·66	27p	29·58	3·5	3,168	905	"
						Mean.....	825	

MARCH, 1909.

No.	Beginning.		Ending.		Duration.	Distance.	Apparent average daily velocity.	Disappearance.
I	28p Feb...	....	2p	29·78	2·0	1,664	832	Atlantic.
II	28p Feb.....	......	2p	29·74	2·0	1,664	832	"
III	1a	29·38	5a	29·00	4·0	3,744	936	Gulf.
IV	4p	29·60	7p	29·62	3·0	2,880	960	"
V	5a	29·65	7p	29·62	2·5	2,016	806	"
VI	5p	29·78	10p	29·42	5·0	3,840	768	"
VII	12a	29·98	14p	29·62	2·5	2,560	1,024	"
VIII	15a	30·22	18a	29·48	3·0	1,920	640	Atlantic.
IX	16a	29·88	20a	29·58	4·0	3,040	760	"
X	18a	29·64	21p	29·72	3·5	2,240	640	"
XI	19p	29·72	22a	29·92	2·5	1,216	486	Interior.
XII	22p	29·76	26a	29·10	3·5	2,720	777	"
XIII	22p	29·68	26a	29·10	3·5	2,624	750	"
XIV	24p	29·54	29a	29·08	4·5	2,432	540	Gulf.
XV	26a	29·70	29a	29·08	3·0	2,720	907	"
						Mean	777	

The result of the comparison of the preceding table with the microseisms prevailing at corresponding dates may be briefly stated. There is a general relationship between the movements of Lows and microseisms, that is, that during the winter months when the average movement is greater than during the summer months, the microseisms are more frequent and stronger during the former period than during the latter, but when we look for an increase of microseisms with an increase of movement of Lows, we find that the two phenomena are by no means always synchronous. We are therefore obliged to deny the relationship of cause and effect between these two phenomena.

As is shown elsewhere the true relationship lies between the isobars and gradients, their geographic position, the ocean and the microseisms.

MAREOGRAMS.

Very recently through the kindness of Dr. W. Bell Dawson, Superintendent of the Tidal Survey, I had an opportunity of examining the mareograms of St. Paul island for the year 1904, and those for May-December, 1908, the latter, the latest received.

St. Paul is a small rocky island in Cabot strait, the main entrance to the Gulf of St. Lawrence, between Cape North in Cape Breton Island and Cape Ray in Newfoundland, but near to the former. It is almost surrounded by the 100-fathom (183 meters) line and lies just outside and westward of the St. Lawrence Deep running from the Atlantic ocean (1,000-fathom-line) to the mouth of the St. Lawrence, opposite Matane, a distance of about 630 miles (1,014km.). Cabot strait, 65 miles wide, 250 fathoms deep, is the main entrance to the gulf; the other, the Strait of Belle Isle, is only 11 miles wide at its narrowest part and has less than 50 fathoms of water. The gulf itself is about 450 miles long in a N.W.-S.E. direction, and 350 miles in a N.E.-S.W. direction. The greater part of the gulf is less than 100 fathoms deep.

The object of the scrutiny of these mareograms was to examine the secondary oscillations, which are superposed on the regular tidal movements, and to see if any relationship exists between the occurrence and intensity of these secondary oscillations and the microseisms registered at Ottawa. For the study of the oscillations in the gulf, the mareograms of St. Paul seemed the most suitable.

Secondary oscillations have received considerable attention by various investigators, but so far without conclusive proof of their cause. Last year the Earthquake Investigation Committee of Japan issued a report on 'The secondary oscillations of Ocean Tides.' In the investigation 'Professor Omori was led to the conclusion that the bays or inlets oscillate like fluid pendulums with periods peculiar to their own.'

Records were obtained from many bays about the Japanese coast by specially designed portable tide-gauges and the results tabulated. The period of oscillation was computed by the formula $t = \frac{4\,l}{\sqrt{g\,h}}$ where $l =$ length of bay, $h =$ mean depth, and $g =$ acceleration. The denominator represents the velocity of the long waves.

The observed and calculated periods, although ranging for different bays very widely, from 9^{m} to 363^{m}, agree pretty well throughout. This part of the investigation seems to show conclusively that each bay has its own inherent period or note like a tuning fork, and will oscillate with its own period 'if it be excited by waves in the external sea having the synchronizing component.' From this it would follow that we can get little or no information about the period of the microseisms as dependent upon the periods of the bays, for microseisms with the same period obtain or prevail over very large areas, tens or hundreds of thousands of square kilometres in extent. However, 'as to the cause of the long waves which manifest themselves as secondary undulations,' the above report says, 'we may mention the wind, the cyclone, the earthquake, &c.' In short, the report does not show that the change of atmospheric pressure is the direct cause of these secondary oscillations and is indicated by them.

Coming now to the mareograms of St. Paul island, it is found that:

(1) Secondary oscillations are always present throughout the year.

(2) The range or double amplitude varies, being greater in winter than in summer. The range running from 1cm. to 30cm.

(3) The period is practically constant throughout the year and years (1904 and 1908), being about 4·6 min., deviating from this by only one or two-tenths of a minute, and this deviation may be partly due to difficulty in measuring the period accurately.

(4) Small oscillations in amplitude show less interference phenomena than do the larger ones.

(5) There is a fair correspondence between the occurrence of Lows with steep gradients in or about the gulf and large amplitudes for the secondary oscillations; but this coincidence is not nearly so well marked as in the relation between such Lows and microseisms.

(6) The cause of these secondary oscillations is in the main due to changes of barometric pressure.

(7) As the period of the oscillations is practically constant, and the disturbing cause variable, the period must be a function of the topography and hydrography, that is, the depth of water and extent of basin.

Although the 100-fathom line almost surrounds the island, yet one would not be justified in using its dimensions for computing the period for the oscillations there. Such would give about 31 minutes.

The following table gives the period and range (double amplitude) of mareograms at St. Paul island. The dates are taken more or less at random, but always of such records where the pencil tracings were still clear, as in some cases they were somewhat obliterated by inking in a smooth tidal curve:—

SECONDARY OSCILLATIONS on mareograms recorded at St. Paul island, Cabot strait. The tide-sheets cover alternately 3 and 4 days. Time scale, $1^h = \frac{3}{4}$ inch. Vertical scale, 1 in. = 1 ft.

Date.	Period.	Range Units of 1/20 ft.	Date.	Period.	Range Units of 1/20 ft.	Date.	Period.	Range Units of 1/20 ft.
1901.	min.		1908.	min.		1908.	min.	
Jan. 3	4·0	15	May 18	4·5	4	Sept. 11	4·6	12
" 9	4·0	20	" 29	4·8	11	" 18	4·8	5
" 14	3·2	17	June 2	5·0	2	" 21	4·5	3
" 27	4·0	5	" 7	4·6	2	" 25	4·8	3
Feb. 7	4·5	4	" 17	4·6	7	" 29	4·8	2
Mar. 1	4·6	6	" 21	4·6	4	Oct. 2	4·6	6
" 23	4·3	9	" 23	4·5	4	" 6	4·8	2
" 24	4·3	3	" 26	4·6	3	" 9	4·5	3
Apl. 16	4·5	7	" 30	4·5	2	" 14	4·3	3
" 18	4·4	9	July 3	4·6	1	" 20	4·5	4
May 2	4·8	3	" 7	4·5	2	" 24	4·8	3
" 8	4·6	2	" 12	4·6	3	" 26	4·6	2
" 18	4·6	2	" 14	4·5	2	" 31	4·6	7
June 30	4·6	2	" 17	4·6	2	Nov. 9	4·6	3
July 3	4·3	2	" 20	4·8	2	" 12	4·8	8
" 7	4·3	3	" 24	5·0	2	" 16	4·5	7
Aug. 8	4·6	2	" 31	4·6	2	" 19	4·6	8
" 26	4·8	4	Aug. 3	4·4	2	" 24	4·6	5
Sept. 1	4·3	5	" 7	4·6	2	" 27	4·4	5
" 12	4·6	3	" 14	4·3	2	Dec. 1	4·6	5
Oct. 1	4·3	5	" 22	4·6	2	" 3	4·6	8
" 8	4·3	3	" 26	4·3	2			
Nov. 13	4·5	4	" 29	4·6	8			
" 15	4·3	8	Sept. 1	4·3	2			
" 25	4·5	5	" 4	4·5	2			

Another examination of mareograms was made, and that for Trepassey, near Cape Race, Newfoundland, the extreme point jutting into the broad Atlantic It showed very marked secondary oscillations, exceeding both in period and in amplitude those of St. Paul island greatly. While the mean period of the latter is 4·6 minutes, that of the former is 67·6 minutes, about 15 times as large; and the range reaches over three and a half feet, while for the other it seldom reaches half a foot. The distance apart of these two stations is about 300 miles, but the tidal movement coming from the southeast reaches them about simultaneously. The general movement of the atmosphere or areas of Lows and Highs is easterly, and the barometric conditions prevailing at the two stations are, allowing for time interval in passing from one to the other, fairly similar, yet we find these great differences in the secondary oscillations. We must hence again conclude that their period as well as amplitude must be dependent upon surroundings of the station, *i.e.*, topography-hydrography, or depth of water and extent of basin. Land-locked basins, as shown by the mareograms of Halifax and other places, show little of secondary oscillations, and those shown are generally irregular, which is an experience quite different from that cited for the Japanese coast.

Taking the above two stations which are exposed to the Atlantic, and noting their very different periods, there does not appear to be any very obvious connection between them and the microseisms.

Some investigators believe that the breaking of the waves on the shore sets up tremors in the earth's crust, which may manifest themselves to great distances. To this I am not at present prepared to give assent. My investigations have established more or less synchronous phenomena, but how they are related—as cause and effect—is not yet fully determined.

The following table from the mareograms for Trepassey is similar to the preceding one for St. Paul island. It may be noted that at Trepassey there was at times a tertiary oscillation of a period of 2 minutes or less superimposed on the secondary oscillations. The selection of dates is more or less at random. The mean for each of the four months available is given, and it will be seen that the periods are about the same:—

SECONDARY OSCILLATIONS on mareograms recorded at Trepassey, Newfoundland. Time scale $1^h = \frac{1}{2}$ inch. Vertical scale 1 in. = 6 ft.

Date.	Period.	Range.	Date.	Period.	Range.
1902.	min.	ft.	1902.	min.	ft.
Aug. 22	64	3·	Oct. 9	68	3·0
" 25	77	2·5	" 13	71	3·5
" 26	74	3·	" 15	65	3·0
" 27	63	1·5	" 25	66	3·0
Mean	69·5	....	" 31	64	3·0
			Mean	66·8	....
Sept. 1	65	2·5			
" 2	65	3·0	Nov. 3	67	1·5
" 5	76	2·0	" 5	64	2·0
" 6	68	2·5	" 6	71	3·0
" 24	68	3·5	" 11	63	3·0
" 26	67	2·0	" 17	64	2·0
Mean	68·2	....	Mean	65·8	....
			Grand mean	67·6	....

After these various examinations we arrive at the following conclusions:—

(1) Microseisms are essentially due to meteorological phenomena, that is, to barometric pressure and the accompanying gradients.

(2) The amplitude of microseisms is largely a function of the steepness of the barometric gradient.

(3) Areas of low barometer with steep gradients, but west of Ottawa, have little effect in producing microseisms.

(4) Strong microseisms are almost invariably accompanied by steep gradients in the gulf, with the St. Lawrence valley, containing the Great Champlain fault, on a line of steep gradients.

(5) A well-marked Low sweeping up the Atlantic coast from Florida to Newfoundland is almost invariably accompanied by marked microseisms.

(6) Microseisms are but slightly, if at all, influenced by the movement of Lows across the continent.

(7) Microseisms are not produced by local winds, frictional excitation of the earth's surface.

(8) Microseisms represent movements in vast blocks of the earth's crust, covering tens of thousands of square miles; and the period is possibly dependent on or modified by marked geological configuration and depth.

(9) Microseisms once produced may continue for a day or two when the immediate cause has passed.

ACCELERATION.

The acceleration produced here by earthquakes for the period of the report, April 1, 1908, to March 31, 1909, has in all cases been small. The destructiveness of an earthquake is dependent upon the acceleration and this is measured by the absolute displacement of the earth particles and the period of the oscillation. The absolute displacement is obtained from the seismogram on which the magnified movement is read in terms of millimetres. This latter is converted into absolute measure by application of the magnification factor.

The general expression for the oscillation of a pendulum is $T_0 = 2\pi\sqrt{\frac{L}{g}}$ where T_0 = period, *i.e.*, the oscillation to and fro, L = length of the pendulum (in metres), g = acceleration for the particular latitude, being for latitude 45°, 9,806 metres, and $\pi = 3{\cdot}1416$, or the ratio of the semi-circumference of a circle to the radius.

If in a horizontal pendulum we have observed its period, T_0, without damping of the pendulum, the deduced L is called the 'equivalent length,' being that of a simple pendulum having the same period.

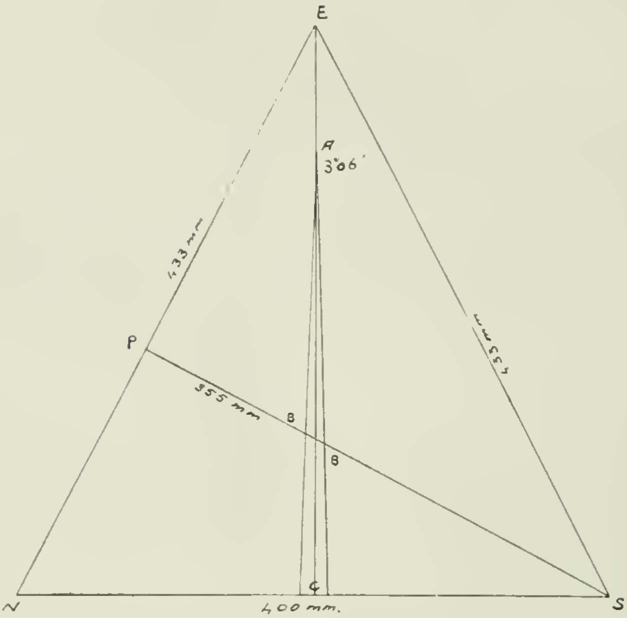
As the square root of g (9·81) is approximately the value of π, we obtain the approximate relation

$$T_0 = 2\sqrt{L}, \text{ or } L = \left(\frac{T_0}{2}\right)^2$$

The magnification of the actual movement of the pendulum is effected in seismographs either by a system of levers or by means of a mirror attached to the pendulum. The former method is adopted where there is mechanical registration by a stylus on smoked paper, or by a light glass tube drawn to a fine point and filled with ink, and the latter method for photographic registration as is the case for our seismograph. The magnification in the latter case is simply double the ratio of the actual length of the pendulum to the distance of the recording cylinder from the axis of oscillation of the pendulum.

We may regard the magnification to be produced by the extension of our simple pendulum of the above length L to the length J, which is called the 'equivalent indicator length,' so that the magnification or $V = \frac{J}{L}$. The determination of V for our Bosch photographic seismograph was made directly from measurements of the parts composing the horizontal pendulum and therefrom computing the length of the simple pendulum that would have the same period as the horizontal pendulum when the latter swung in a vertical plane. This deduced length divided into twice the distance of the recording cylinder gave $V = 120$. Some of the heavy astatic Wiechert pendulums, weight 17,000 kgm. (ours is 200 gms.!) have a lever magnification of upwards of 2,000.

As stated in a previous report, the period of the horizontal pendulum is simply a matter of adjustment of the axis about which it swings with reference to the vertical. We may here give an investigation that I made during the past year for tilting and period of the east-west pendulum, *i.e.*, of the one giving the north-south component.



In the accompanying diagram *E, N, S* represent the three footscrews of the pendulum stand. *E, N* the axis of rotation with reference to tilting done by footscrew *S*.

A is the vertical projection of the lower point of pendulum support.

B is the vertical projection of the upper point of pendulum support, when arc on footscrew *S* reads 0°.

B′ similarly when arc on footscrew *S* reads 90°.

(*Note.*—In linear measure the triangle *A, B, B′* is much exaggerated in scale: the angles are however to scale.)

The top of the base-plate is 92 mm. above the pier.
Lower support above top of base-plate, 27·5 mm.
Centre of bob above top of base-plate, 25 mm.
Distance between supports of pendulum, 166·7 mm.
Thread of footscrew very nearly 1/40 inch, say $\frac{5}{8}$ mm.

The tilting was done with the south footscrew by turning it through 90°. A special brass arm, graduated through 90° into half-degree spaces and attached concentrically with the footscrew, together with a fixed pointer, opposite the graduations, securely placed on the pier, were used in the experiments.

We have then in linear measure for 90° turn of the footscrew $\frac{1}{4} \times \frac{5}{8} = \frac{5}{32}$ mm., and the angular measure will be θ, where $\sin \theta = \frac{5}{32} \div 355 = \cdot 0004401$, hence $\theta = 90'' \cdot 8$.

Four measurements of raising and lowering by a quarter turn, or 90°, by south footscrew gave displacements of image at cylinder by pendulum mirror over point of lower support, respectively: 1′ 4¾″, 1′ 5″, 1′ 6″, 1′ 5⅜″, mean 1′ 5¼″ = 438mm.

Distance of image from mirror, 4,060 mm. Hence angle swept over by image $= a$, and $\tan\frac{a}{2} = \frac{219}{4060} = \cdot 054$, $a = 6° 12'$ and the angle swept over by the pendulum $= \frac{a}{2} = 3° 06'$.

The upper point of support is 166·7 mm. vertically above the lower one. By the quarter turn of the footscrew we have an angular motion of 90″·8, hence the *relative* displacement of the upper point of support to the lower one will be x, where $\frac{x}{166\cdot 7} = \tan 90''\cdot 8$, therefore $x = \cdot 073382$mm. $= B\ B'$.

This displacement is in a plane, perpendicular to the axis of rotation $E\ N$. Reducing to the perpendicular of $A\ C$ this becomes ·06509 mm.

Remembering that $A\ C$ is the normal position of the pendulum, we have in the triangle formed by the two positions of the upper point of support and the lower one due to readings of 0° and 90° on the footscrew, the angle at the apex 3° 06′ from above, and the reduced opposite side ·06509 mm., hence the horizontal distance between the two points is d, where $\cdot 06509 \div d = \sin 3°\ 06'$, therefore $d = 1\cdot 2036$mm.

It follows that the angle between the points of support and the vertical is γ, where $\tan\gamma = \frac{1\cdot 2036}{166\cdot 7} = 24'\ 49''\cdot 25$.

By previous determination we have the distance from the centre of oscillation to the axis of rotation of the pendulum 66·774 mm., hence the length of the equivalent pendulum is $L = \frac{66\cdot 774}{\sin 24'\ 49''\cdot 25} = 9248\cdot 4$ mm., therefore the period $= 2\pi\sqrt{\frac{L}{g}} = 6^s\cdot 10$ (g for 45° = 9806 mm.)

By direct observation on the day of the above investigation, the period was found to be $6^s\cdot 15$, being in satisfactory agreement with the above value.

The method of deflection of image is more accurate for the determination of the period than direct observation.

For the above adjustment of pendulum 1″ tilting was equivalent to a displacement of the image of 5·42 mm., or 1 mm. deflection of image $=$ ″·184 tilting north-south. Similar experiments were carried out with the other pendulum, the N–S one, giving the east-west component. The instrument is identical with the other; it is mounted on the same pier, but its adjustment was different at the time.

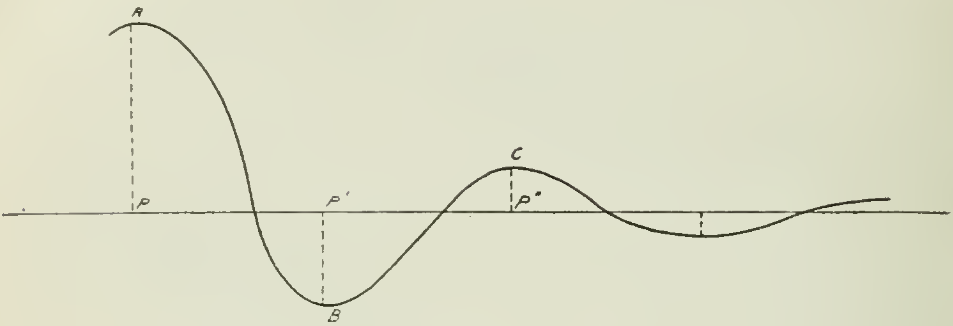
For it was found a period of $12^s\cdot 56$, and 1 mm. deflection of the image represented a tilt of ″·0444. As one can read to a tenth of a millimetre, we see that for the adjustment of the latter pendulum one can detect tilting of ″·0044, which is equivalent to about 1 inch in 710 miles.

Without damping, a horizontal pendulum set in motion would continue to oscillate for an indefinite time and with equal amplitudes, leaving out of consideration for the moment the effect of friction at the points of support. This latter would effect a reduction in amplitude in arithmetical progression.

As the principal function of the seismograph is to record the true movements of the earth, both in time and magnitude, it is essential that its own personality regarding swing should be obliterated as much as possible, that is, that it should subside unless acted on by the earth movements. This is effected to a greater or less degree by air, oil or electro-magnetic damping. In our Bosch instrument an air chamber forms a cushion within which a vane of the pendulum moves.

The effect of damping is to reduce the amplitudes in geometrical progression instead of arithmetical, as in the case with friction. Friction will ultimately stop a pendulum, but with damping the amplitude curve is asymptotic, and hence the time infinite.

The 'damping ratio' is understood to be the ratio of the amplitude of a swing from the zero line to the next amplitude on the opposite side, as shown by the accompanying diagram.



Damping ratio $= \frac{A\ P}{B\ P'} = \frac{B\ P'}{C\ P''} = 1 : f$; hence in time $\frac{T}{2}$, where T = period of damped pendulum we have the ratio $1 : f$.

In time $2\left(\frac{T}{2}\right)$ the ratio $1 : f^2$, and in general for $n\left(\frac{T}{2}\right)$ the ratio is $1 : f^n$.

If we call $x\left(\frac{T}{2}\right)$ the time in which the amplitude is reduced $\left(\frac{1}{e}\right)^{th}$ of its value, where e is the base of the natural or Napierian logarithms, then for time $x\left(\frac{T}{2}\right)$ we have $1 : f^x = 1 : e^{-1}$.

Let $\tau = x\left(\frac{T}{2}\right)$, $\therefore x = \frac{2\tau}{T}$, hence $1 : f = 1 : e^{-\frac{1}{x}} = 1 : e^{-\frac{T}{2\tau}} = e^{\frac{T}{2\tau}} : 1.$

The quantity $e^{\frac{T}{2\tau}}$ is generally designated by ϵ.

The effect of damping changes the period of the pendulum when swinging freely, and the relation between the two is expressed by

$$T_0 = \frac{T}{\sqrt{1 + \left(\frac{T}{2\pi\tau}\right)^2}}$$

in which T is the damped period.

The magnification of the earth movement of earthquakes, as recorded on the seismogram by the damped pendulum, is dependent upon the period of such earth movement, hence the magnification is not a constant quantity for interpreting the amplitudes. Professor Wiechert in his 'Theorie der automatischen Seismographen,' gives the following formula for the derivation of the magnification:—

$$\mathfrak{V} = \frac{V}{\sqrt{\left\{1 - \left(\frac{T_e}{T_0}\right)^2\right\}^2 + 4\left(\frac{T_0}{2\pi\tau}\right)^2\left(\frac{T_e}{T_0}\right)^2}}$$

From relations we have found before, this may be put in the form

$$\mathfrak{M} = \frac{V}{\sqrt{\left\{1 - \left(\frac{T_e}{T_o}\right)^2\right\}^2 + 4\,\frac{(\text{nat. log }\epsilon)^2}{\pi^2 + (\text{nat. log }\epsilon)^2}\left(\frac{T_e}{T_o}\right)^2}}$$

or using the common logarithms we have

$$\mathfrak{M} = \frac{V}{\sqrt{\left\{1 - \left(\frac{T_e}{T_o}\right)^2\right\}^2 + \frac{4\,(\cdot 733 \log \epsilon)^2}{1 + (\cdot 733 \log \epsilon)^2}\left(\frac{T_e}{T_o}\right)^2}}$$

in which T_e is the period of the earth particles; T_0 is the period of undamped pendulum; and the other symbols as previously designated.

It will be observed that this gives wide variations in the magnification, dependent upon the relative values of T_e and T_0, and also upon the damping co-efficient. The value best suited for ϵ lies between 3 and 8.

We now come to the evaluation of the acceleration from the amplitude and period of the recorded earth movements. We have the general expression for normal acceleration $= \frac{v^2}{r}$, in which $v = \frac{2\pi r}{T_e}$, and r is the amplitude, or half range of the oscillation measured on the seismogram, and expressed in microns or 1/1000 millimetres. The value of r is obtained by dividing the linear measure on the seismogram by the appropriate $\mathfrak{M}$ for the particular period of T_e. The result is expressed in milligals, where 1 gal is the acceleration of 1 cm. = 10 mm. = 10,000 μ per second, per second, and a milligal is 1/1000 of a gal. Gravity would therefore be represented by 980·6 gal (for $\varphi = 45°$), so that approximately a milligal is the one millionth of gravity.

The acceleration Δg in milligals is given by the approximate formula $\Delta g = \frac{4\ A}{T_e^{\,2}}$, where A is the amplitude ($\frac{1}{2}$ range) expressed in microns, and T_e the period in seconds.

As Ottawa is several thousand miles from the nearest seismic area—the West Indies, Mexico or California—the acceleration produced here is always very small, and of course the destructive earthquakes which have occurred there in recent years were not felt here.

During the year, April 1, 1908, to March 31, 1909, the greatest acceleration was produced by the earthquake of November 30, where the period was 10^s, and the amplitude 125μ. This gives an acceleration of 4·9 milligals or about the 1/200,000 that of gravity.

For the disastrous Messina earthquake of last December the following accelerations have been computed. Most of the weekly or monthly earthquake reports received from other stations do not give sufficient data to compute the acceleration:—

—	Distance.	T_e	A	Δg
	km.	s	μ	
Ottawa	7,200	16	18	·3
Granada	1,700	12	750	21
Graz	1,000	20	1,100	11
Jena	1,400	19	3,000	33

In closing this part of my report, on seismology, I desire to express the hope that at no distant day, quarters will be erected for the machine shop; for the operation of the machinery in the basement of the Observatory, as at present, is a menace to the satisfactory functioning of the seismograph.

TERRESTRIAL MAGNETISM.

In continuation of the systematic magnetic survey of Canada begun last year, stations were occupied during the past summer, mostly in British Columbia, and the observations were made by Mr. C. A. French. The stations occupied were: Ottawa, Agincourt, Winnipeg, Banff, Golden, Revelstoke, Sicamous, Clinton, Barkerville, Quesnel, Alexandria, Williams Lake, Bridge Creek, Ashcroft, Spence's Bridge, Nicola, North Bend, Agassiz, Vancouver, Victoria and Nanaimo. The magnetic observations were all made in a tent, carried along for the purpose. Instruments used were: Tesdorpf magnetometer 1977, Dover Dip circle 145, Dent Mean Time chronometer 511, and a six-inch Troughton-Simms theodolite for azimuth, latitude and time observations.

In order that the observations of the elements of terrestrial magnetism in different parts of the earth may be strictly inter-comparable, it is essential that the constants of the instruments employed be referred to standard instruments, preferably at basal stations. By such comparisons, repeated from time to time, say at the beginning and end of the season of field work, one is enabled to give a homogeneity and confidence to the results which would otherwise be lacking, and would militate against their value for incorporation in the general discussion of the difficult problems presented by terrestrial magnetism.

There are several departments of physical investigation in which little progress has been made during the last fifty years in getting at the fundamentals underlying the elements involved. One of them is terrestrial magnetism. In 1904 the Carnegie Institution of Washington undertook to attack the problem in a comprehensive manner, especially in supplying magnetic data for the accessible regions of the world not before occupied, and more particularly to make a systematic magnetic survey of the various oceans, for which purpose a specially built non-magnetic vessel, the *Carnegie*, has been built and which was recently launched at Brooklyn. This work, combined with the Solar Research at Mt. Wilson, also under the auspices of the Carnegie Institution, should in the near future unravel some of the mysteries that have hitherto enshrouded that subtle force or energy—Terrestrial Magnetism.

Toronto is and has been one of the principal magnetic stations in the world, although the location of the instruments now, is not where the original ones were mounted. This change in 1898 to Agincourt, some 10 miles distant, was necessitated through the introduction of the electric cars in Toronto. Since beginning our systematic magnetic survey of Canada complete sets of magnetic observations—declination, inclination and horizontal intensity—have always been made with our field instruments at Agincourt and compared with the results of the standard instruments there, thereby standardizing the former. A similar comparison was made with our Tesdorpf magnetometer 1977 through the kindness of Dr. L. A. Bauer, Director of the Department of Terrestrial Magnetism, Carnegie Institution, at Washington, in April, 1908, with results practically identical with those at Agincourt.

For further comparisons, and more particularly for the comparison of different magnetic instruments, there has been erected during the past year on the Observatory grounds here, a magnetic hut, an illustration No. 1, thereof, accompanying this report. Its dimensions are 10 x 15 feet. It is scarcely necessary to say that no iron or steel of any description was used in the construction. The nails are all copper; hinges, &c., of brass, all tested for non-magnetism before use. The two pillars for mounting the instruments are solid cedar posts surmounted by brass plates 11¼ inches in diameter, which are grooved with three diameters, dividing the surface into sectors of 60°, for the footscrews of the instruments. When observations are made at night, petroleum is used for illumination. There is a permanent azimuth mark about a quarter of a mile distant. The Observatory grounds are just outside of the city limits and the vicinity is fairly free from traffic. The nearest approach of an electric car line to the magnetic hut is 1,492 feet (455 m.). The cars run from 6 a.m. to 12 p.m. on this line. In order to test whether the current of the line exercised a magnetic influence at the hut, observations were made for three days during the 24 hours for declination. There was no effect noticeable during the day-time when the cars were running, and for different positions of the cars on the line with reference to the hut and power station; nor for the time after midnight. The change in declination for each 24 hours followed the general daily curve of eastern and western elongation. Further on will be found the record of these observations. In the future, observations will be made here with the field instruments at the beginning and close of the season's work.

The following 'Memorandum for Magnetic Observations, 1908,' was issued to the observer:—

'In the selection of new stations regard should be had for future occupation for the same points.

The vicinity of trolley lines should be avoided; the magnetic station should be at least a mile from the line.

The station selected is to be connected by linear measure with established corners of lots or intersections of streets, so that it may be accurately re-established at any future time. The azimuth of two or more well recognized objects from the station is to be obtained, either by observation on the sun at about 9 a.m. or 3 p.m., or on Polaris, the former by observing the altitude, circle right and circle left, and the latter by noting the sidereal time when sighting on Polaris, circle right and circle left.

The nature of the ground, whether there are any rock exposures, and surrounding topographic features are to be noted.

A sketch is to be made for each station, showing its relative position, and that of the astronomic meridian.

The order of the observations in general are:—

1. Azimuth.
2. Declination.
3. Dip.
4. Oscillation.
5. Deflection.
6. Deflection.
7. Oscillation.
8. Dip.
9. Declination.

Suspension of weight and removal of torsion for fibre declinometer require particular attention.

The mean of the times for dip, oscillations and deflections will be approximately the same when observing in the above order.

The observations are to be entered on the forms supplied.

Before leaving a station all the observations are to be reduced, with a sufficient degree of accuracy to ensure their reliability.

On your way west you will go via Toronto, and at Agincourt (the Magnetic Observatory) take a full set of observations with both the Tesdorpf and Dover, for the latter especially to obtain the value of A, not forgetting to note temperatures throughout all the observations. Particular attention will be paid to the determination of the declination and the constant of correction for the declination magnet, 10.

After all the observations have been satisfactorily made, you will proceed to Winnipeg and re-occupy the Carnegie Institution station in the park, the description of the station is hereto attached, also the former magnetic values. The azimuths given will be re-determined, and a full set of satisfactory magnetic observations taken.

Similarily Banff will be occupied, the necessary data are also attached.

The names of the other stations to be occupied are appended:—Golden, Revelstoke, Sicamous, Ashcroft, Clinton, Bridge Creek, Williams Lake, Alexandria, Quesnel, Barkerville, Spence's Bridge, Nicola, North Bend, Agassiz, Vancouver, Victoria, Nanaimo (Departure Bay).'

Description of Stations occupied.

Ottawa.—The station (not the magnetic hut) was situated in the southeastern part of the observatory grounds; it was 81 feet from the easterly limit and 53 feet from the southerly limit of the grounds. This station was occupied by the Carnegie Institution in October, 1906, and in 1907-1908 by our observers. It is now abandoned owing to the erection of the Director's house nearby. The reference object was the flag-staff on the central tower of the Parliament Buildings. True bearing, N. 16° 59′·0 W.

Agincourt.—The magnetic observatory.

Winnipeg.—Same station as occupied by the Carnegie Institution in 1906. It is in River Park, about half a mile east of park entrance, in the first cleared space beyond the grove of small trees that surround the entrance. It is about 15 paces from the top of the north bank of the Red river and in line of the fence bounding the buffalo pasture on the side adjacent to the river. It is about 330 feet southwest of the south corner of the pasture. Two grain elevators in the distance, and a small red barn in the pasture are seen nearly in line from the station. A red water tank is seen near the elevators and a little to the west of the barn. The following true bearings were determined:—

Smokestack near International Elevator C.. ..	39° 18′·8 E. of N.
Pole on the red water tank..	23° 40′·0 E. of N.
West gable of a large white house..	47° 28′·6 E. of N.

Banff.—The station is the same as that occupied by the Carnegie Institution in 1907. It is in the grounds of the National Park Museum, 292 feet south-southwest of the southwest corner of the museum building, midway between, and in line with, the two small spruce trees near the north bank of Bow river and nearest to a pen used at present for ducks. The point was marked by a round pine stake (about two inches in diameter and about eight inches long) driven flush with the surface. The stake is 67½ feet from the northeast corner of the duck pen and 93½ feet from the southeast corner, and is about 10 feet north of bank of river, and furthermore about in line with the west side of a one-story building in the rear of the Canadian Pacific Railway Museum on the north bank of the Bow river. The bearings of the following objects were obtained:—

Meteorological Observatory, Sulphur Mt. anemometer pole,	8° 07′·2 W. of S.
Sanitarium hotel, bottom of flagstaff, east tower..	27° 19′·2 E. of S.

Golden.—The station (1908) is on the property of Mr. Alexander, in a clearing on the south bank of the Kicking Horse river. It is about 200 feet east of the roadbed of the proposed Kootenay railway, and is midway between the ends of that portion of the bank along which is a breakwater consisting of a layer of small trees. From the station the top of the Columbia hotel is visible above the wooden bridge over the Kicking Horse river, and the front of the Queens hotel is seen to the east of the fire-hall.

The point is marked by a round wooden peg 2 inches in diameter, and projects about an inch above the ground. It is distant 190 feet 3 inches from the northeast corner of a vacant log house; 261 feet 9 inches northeast from the southeast corner of a lot, one side of which is on Calgary street and the other parallel to the Kootenay Railway road-bed, and 234 feet southeast from the northeast corner of a lot adjacent to the first mentioned one. True bearings of the following reference objects were obtained:—

Bottom of pole on C. P. R. water tank..	N. 36° 51′·1 W.
Bottom of flagpole on Columbia hotel..	N. 49° 35′·8 W.
Bottom of flagpole on Parson's store..........	N. 80° 03′·9 W.

The magnetic observations were taken 13 feet 3 inches southeast from station and in line with pole on tank. The soil is gravel.

Revelstoke.—The station is located on the Athletic grounds in the southwest part of the town. It is about 45 paces east of the bank of the Columbia river. The top of the Catholic church may be seen a little to the left of the line joining the station with the Canadian Pacific Railway water tank. The station is marked by a peg 2″ x 1½″ driven flush with the ground, and is 71 feet 8 inches from the northeast corner of the grand stand and 68 feet from the southeast corner. The true bearings of the following reference objects were obtained:—

Bottom of pole on west water tank on mountain side.	N. 33° 28′·1 E.
Top of belfry on school....................	N. 6° 03′·8 W.
Bottom of pole on Court House..............	N. 18° 53′·7 W.

The magnetic observations were taken at a point 8 feet 3 inches southwest from station and in line with water tank.

Sicamous.—The station is located in a clearing on the south side of the Canadian Pacific Railway, and on the east side of the narrow part of Shuswap lake. The Canadian Pacific Railway hotel may be seen between the pump-house and the first telegraph pole to the west of the semaphore. It is almost directly in line with the north end of the Bellevue hotel. The spot is marked by a round post about 2 inches in diameter, driven so as to project 3 inches above ground. It is 18 feet 9 inches from a large poplar tree and southeast of it, and is 14 feet from another round post about 1½ inches in diameter, which is in line with the station and tree. It is 172 feet from the east end of the Canadian Pacific Railway bridge.

The true bearings of the following points were obtained:—

Top of pyramid over east bay window, C.P.R. hotel.	S. 67° 56′·7 W.
North end of peak of Bellevue hotel..	S. 39° 39′·0 W.

The magnetic observations were taken 9 feet southeast from station and in line with Canadian Pacific Railway hotel.

Clinton.—The station is in the southeast part of the town in a field owned by Mr. Smith. It is on a slight elevation about 30 paces to the south of the road leading to the cemetery. It is marked by a brass nail in a fir stake 2″ x 4″, driven 18 inches into the ground and projects 7 inches. It is 143½ feet northwest of the post which marks the northwest corner of the cemetery, and 144 feet southwest from the south large gate-post.

The true bearings of the following reference objects were obtained:—

Top of church tower, Indian reservation..	S. 70° 07′·3 W.
Pole on cottage, rear of Provincial Land Office..	N. 88° 18′·7 W.
Pole on cottage (Dr. Sanson's)...............	N. 69° 30′·5 W.

The magnetic observations were taken 25 feet northeast from station and in line with spire on Catholic church.

Barkerville.—The station is in a small clearing on the west side of the road which leads from the south of the town. It is about 336 feet (by way of road) from the bridge which crosses the ditch constructed for conveying water used for mining purposes, which is about 45 paces from the south end of the bridge which crosses the river (now dug). The station is marked by a brass tack in the top of a fir post 3″ x 4″ which projects 3 inches above the ground. It is 39 feet from the middle of the road and 37 feet from a spruce tree which is to the south of it, and in line with a point slightly to the east of the Presbyterian church.

The following true bearings were determined:—

Pole on Fire Hall	S. 72° 08′·7 W.
Pole on Masonic Hall	N. 80° 32′·3 W.
West gable on belfry Presbyterian church	N. 44° 59′·5 W.

The magnetic observations were taken 12 feet east from the station and in line with the pole on the Fire Hall.

Quesnel.—The station is on government property, north of the town. It is about 318 paces from the ferry cable, and is marked by a brass tack in a fir post 2″ x 4″, driven so as to project 8 inches above ground. It is 15 feet from the bank of the Fraser river, and 76 feet 8 inches northwest from the corner post of the fence around a small field which is adjacent to the post office property. There are three clumps of spruce trees about 75 feet south, and are so situated that the Catholic church and post office may be seen between the easterly pair; the pole of Reid's store between the westerly pair; and the grist mill to the right of the westernmost one.

The following true bearings of reference objects were obtained:—

Bottom of cross on church	S. 28° 10′·7 E.
Gable of wing of post office	S. 22° 54′·4 E.
Pole on Reid's store	S. 14° 47′·4 E.
Gable of ventilator on grist mill	S. 2° 06′·9 E.

The magnetic observations were taken 8 feet northwest from station and in line with pole on Reid's store.

Alexandria.—The station is on a waste piece of land in the northwest corner of a field belonging to Mr. Anders. The field is on the west side of the government road opposite the post office and farm buildings, and borders on the Fraser river. It is marked by a brass tack in a fir post 5 inches in diameter, which projects 8 inches above ground. It is about 95 feet northeast from the end of the trail which leads to the post office landing; 56 feet from the bank, and 57 feet southeast from a forked tree. The soil is a layer of sandy loam over gravel.

The following true bearings of reference objects were obtained:—

West chimney on Mr. Anders' house	S. 73° 20′·7 E.
Spire, Catholic church, Indian reservation	S. 3° 30′·0 W.

The magnetic observations were taken 12 feet northwest from station and in line with west chimney on Mr. Anders' house.

Williams Lake.—The station is southwest of the town on property belonging to the Cariboo Trading Company. The point is marked by a brass nail in a fir post 4″ x 4″, which projects 7 inches above ground. It is about 132 paces west of the Government Road, and a line joining it with the centre of the school passes over the entire length of a fairly large irrigation ditch. A telegraph pole obscures the lower part of the pole on the top of the school. The station is 87 feet from the point where the ditch branches into two, one taking a northwest direction and the other a southwest one. The ground is covered with stones and bowlders. The soil is of a soft, black nature.

The following true bearings of reference objects were obtained:—

Top of north chimney on large frame house. . . .	S. 22° 12′·0 E.
Top of small pole on school.	N. 88° 20′·5 E.
Bottom of pole on ventilator C. T. Co.'s barn. . . .	N. 7° 52′·5 E.
Bottom of pole over bay-window, white house W. of hotel.	N. 6° 38′·1 W.

The magnetic observations were taken 25 feet northwest from station and in line with chimney on large frame house.

Bridge Creek.—The station is located on property belonging to Stephenson Bros., and is on the south edge of a fir grove which is in a field to the northwest of the ranch buildings, being 145 feet from the point where the irrigation ditch passes under the fence adjacent to the Cariboo road, and about at right angles to it. It is marked by a brass nail in a fir post 4½″ x 4″, which projects 7 inches above ground.

The true bearings of the following reference objects were obtained:—

N.W. corner of chimney on N. of dwelling house. .	S. 28° 30′·1 E.
Gable of house situated to S.W. of dwelling house. .	S 14° 38′·9 E.
Chimney on machine shop in open field.	S. 14° 16′·4 W.

The magnetic observations were taken 12 feet northwest from station and in line with the central reference object.

Ashcroft.—The station is the same as that occupied by the Carnegie Institution in 1907. The station is in a field in the southern part of the town, owned by the British Columbia Express Company. It is 100 feet east of the bank of the Thompson river, about 1,000 feet from the Canadian Pacific Railway track, and about 500 feet from the nearest building. The station is marked by a brass screw in the top of a fir post 3½″ x 3½″ x 30″, set so as to project 11 inches above the ground.

The following true bearings were determined:—

Presbyterian church spire.	0° 17′·8 W. of N.
English church spire.	14° 36′·4 E. of N.
Corner of red house on hill.	45° 41′·5 E. of N.
Telegraph pole marked 48.	3° 19′·6 E. of S.
Vertical edge of rock pinnacle on opposite bank of river.	12° 50′·2 W. of S.

The magnetic observations were taken 14 feet west from the station and in line with the Presbyterian church spire.

Spence's Bridge.—The station is a little less than half a mile west of the railway station, in a field belonging to Mr. Clemes. It is marked by a brass nail in a fir post 4″ x 4″ projecting 12 inches above ground, and is 61 feet 5 inches from the north corner post of the cemetery and almost in line with the diagonally opposite post, and is 110 feet 7 inches from the east corner post and 115 feet from the west corner post. (The diagonals of the cemetery are almost N.-S. and E.-W.)

The following true bearings of reference objects were obtained:—

Corner of post of water tank on mountain side. .	N. 42° 21′·8 W.
Centre of circle on white cross (being headstone on grave in cemetery on opposite side of river.	N. 11° 27′·4 W.
Pole on C. P. R. water tank.	N. 64° 31′·6 E.
Bottom of post marked 'Yard Limit' on C.P.R.	S. 27° 47′·6 W.

The magnetic observations were taken at a point 25 feet west from station, and in line with pole on Canadian Pacific Railway water tank. Soil, loose sand and gravel.

Nicola.—The station is opposite the Canadian Pacific Railway station in a field owned by Mr. House. It is marked by a brass nail in a fir post 2″ x 4″, projecting 7 inches above ground. The point is about 165 paces southwest of the end of the 'Y.' 62 feet east of a small irrigation ditch and 22 feet north of a line joining the bottom of the north row of stakes in the fence along the south boundary of the field.

The following true bearings of reference objects were obtained:—

Gable end C. P. R. station..	N. 33° 35′·7 E.
Gable end C. P. R. engine shed..	N. 49° 54′·4 E.
Vertical edge of large boulder on mountain side..	N. 86° 03′·0 E.
Chimney on south wing of house (this wing painted red)..	S. 2° 55′·8 W.
Gable of large red barn, about a mile distant..	S. 34° 30′·5 W.

The magnetic observations were taken 12 feet northeast from station, and in line with chimney on house. Soil, fine gravel.

North Bend.—The station is southwest of the town on the property of Mr. Phinister. It is on a waste piece of land beyond the first enclosure at the rear of the post office, and is about 650 feet from the Canadian Pacific Railway tracks. It is marked by a brass nail in a fir post 4″ x 4″, projecting 12 inches above ground. The point where the line through the station and the pole on the Canadian Pacific Railway water tank, intersects the continued line of the straight rail fence running northwesterly from the northwest corner of the post office is 38 feet from the station, and 86 feet from the end of the fence.

The following true bearings of reference objects were obtained:—

Pole on C. P. R. water tank..	N. 25° 46′·2 E.
Small pole on south end of Mountain View hotel.	N. 46° 39′·9 E.
Small pole on west end of C. P. R. hotel..	N. 58° 36′·9 E.
Bottom of cross on Catholic church..	N. 88° 57′·1 E.

The magnetic observations were taken 8 feet southwest from the station and in line with the pole on the water tank.

Agassiz.—The station is on the grounds of the Agassiz Agricultural Association. It is marked by a fir stake 2″ x 4″ driven flush with the ground. It is about 9 feet inside the race-track and is 165 feet 10 inches from the point in the east fence which is 167 feet from the northeast corner of the grounds, and 173 feet 10 inches from the point in the west fence which is 165 feet from the northwest corner of the grounds; the above distances to the east and west fences are in the same straight line.

The following true bearings of the reference objects were obtained:—

Gable of porch in front of Presbyterian church..	S. 27° 42′·0 W.
Gable of building in southwest corner of grounds.	S. 60° 49′·1 W.
Top of ventilator on hop barn..	N. 56° 17′·8 W.

The magnetic observations were taken 31 feet northeast from the station and in line with the Presbyterian church. Soil, sandy loam.

Vancouver—Brockton Point.—The station is on the Government Lighthouse Reserve, on which is also the small Dominion Astronomical Observatory, used as a reference station for longitudes in British Columbia. It is 43 feet southerly from the southwest corner of the observatory building (office part), and eight feet due west from the produced line of the west end of building.

The following true bearing of the distant reference object was obtained:—

Steeple Catholic Indian mission church, North Vancouver, N. 50° 22′·6 E.

The magnetic observations were taken at the above point.

Victoria.—The Coast and Geodetic Survey station of 1903, as described in the C. & G. S. report of 1903, p. 1003, is as follows:—'On the southeastern edge of the city, about 500 feet in a southwesterly direction from the flagpole in Dr. Millin's yard (Dallas road and Dallas ave.) and 12 feet from the edge of the bluff overlooking the beach, between Holland point and Finlayson point. The station is marked by a 2″ x 4″ fir stub set flush with the ground. The flagpole in Dr. Millin's yard bears 65° 03′·3 east of true north; Race Rocks lighthouse bears 43° 18′·8 west of true south.'

The following was received from the Carnegie Institution:—'L. A. Bauer, of the Carnegie Institution, re-occupied this station in August, 1907, having found a fir stub projecting about 2 inches in the locality described above. However, two sets of azimuth observations gave for the azimuth of the first mark 64° 53′·1 E. of N., and the second mark 43° 12′·3 W. of S. Apparently there are two stubs in close proximity which it will be well to investigate if the station is re-occupied.'

A stub or peg was found projecting slightly above ground, evidently the one found by Dr. Bauer, of the Carnegie Institution. This peg, being badly decayed and broken, was replaced by one 4″ x 4″, set flush with the ground.

The following true bearings of reference objects were obtained:—

Flagpole in Dr. Millin's yard..	N. 64° 51′·0 E.
Race Rocks lighthouse..	S. 43° 13′·7 W.
Buoy on Brotchy ledge..	S. 72° 20′·9 W.

The magnetic observations were taken 12 feet northeast from the station and in line with the lighthouse.

Nanaimo.—The station is on the side of Jesse island, which faces south and west. It is marked by a fir post which projects 18 inches above ground, and has a mound of earth and stones around it one foot in height. It is about 45 paces from the edge of the bank, and 160 paces from the cliff near the northwestern part of the island.

The following true bearings of reference objects were obtained:—

Pole on water tank at Breckin mine..	S. 8° 16′·7 W.
Chimney on west end of large white house at northwest part of bay..	S. 86° 01′·0 W.

The magnetic observations were taken 12 feet north from the station and in line with the pole on the water tank.

To occupy the stations between Ashcroft and Barkerville required a stage-drive of fully 500 miles.

On September 4, 1908, a magnetic storm manifested itself at Williams lake, as shown by the following readings for declination, magnet erect. The observations began at $16^h\ 30^m$ Pacific Standard Time; this would be equivalent to $0^h\ 30^m$ (a.m.) Greenwich Mean Time of September 5.

Vernier A.	Time.	Vernier A.	Time.	Remarks.
	h. m.		h. m.	
177° 04'.8	16 30	177° 22'.5	17 10	Reference object A = 307° 36'.1.
6.3	32	26.3	12	B = 127° 36'.0.
4.5	37	26.7	14	Azimuth R. O., S 22° 11'.2 E.
6.2	40	22.7	16	
6.7	41	14.7	24	
10.1	42	2.0	30	
10.2	44	176° 56'.6	32	
4.2	46	44.1	33	
0.5	48	38.0	34	
4.5	50	177° 10'.6	38	
8.9	52	176° 36'.1	43	
16.2	54	177° 00'.0	46	
16.2	56	176° 52'.8	50	
12.6	58	177° 10'.0	52	
6.2	17 00	8.0	18 00	
8.9	2	18.0	10	
12.0	4			
8.3	6			
14.0	8			

The needle was very unsteady also on the following day (5th). On September 11 and 12, while at Ashcroft, the needle showed unsteadiness. There was a fine auroral display on the evening and night of September 11.

The following readings of the declination magnet show the disturbances at Ashcroft on September 11, 1908.

Time—Pacific Standard—eight hours slow on Greenwich.

Vernier A.	Time.	Remarks.
	h. m.	
243° 24'.8	14 01	Reference object A = 215° 14'.3.
28.5	3	B = 35° 14'.2.
22.0	12	Az. of R. O. = N. 0° 17'.8 W.
28.0	16	
18.0	22	
14.3	28	
242° 54.6	43	
58.5	46	
243° 12.3	49	
22.3	54	
16.1	15 03	
10.4	07	

The range of declination at Williams lake on September 4, during the 1^h 40^m of observation, was 50'·6; and at Ashcroft on September 11, during 1^h 04^m, was 33'·9. On the afternoon of September 12, at Ashcroft, the magnet was quite steady. The observations at neither place were sufficiently continuous to obtain the extreme range, east and west, that the magnet attained.

The magnetic storms of those days were undoubtedly world-wide. Dr. C. Chree, of Kew, makes note of them in 'Nature,' of September 24, 1908. Referring to the declination, he says: 'The extreme easterly position was reached at about 2.53 a.m., and the extreme westerly position at about 5.14 a.m. on September 12, the total range of declination being about 1° 27′. The movements on September 12 were the most rapid. Between 1.24 a.m. and 1.46 a.m. there was a westerly movement of about 51′, followed in the course of the next eight minutes by an easterly movement of about 35′, while between 2.58 a.m. and 3.28 a.m. there was a westerly movement of about 53′. There were no large movements after 6 a.m.

TABLE I.

Stations occupied during 1908. The declinations are all reduced to 10.30 a.m. local time for the position of the average meridian for the day and place.

Place.	Latitude.		Longitude.		Year.	Month & Day.	Hour & Minute.	Declination.		Month & Day.	Hour & Minute.	Dip.		Month & Day.	Hor. intensity C.G.S. Units.
	°	′	°	′				°	′			°	′		
**Winnipeg, Man.	49	52	97	09	1908	July 16	10 30	13	61·2	July 16	10 30	.....	.....	July 16	·13128
						" 17			58·8	" 17		78	15·0	" 17	
						" 18			56·2	" 18			12·0	" 18	·13113
						" 20			57·1	" 20			11·9	" 20	
								13	58·6			78	13·0		·13121
Banff, Alta.	51	10	115	37	1908	July 22		26	6·8	July 22		.....	.....	July 22	·15922
						" 23			5·7	" 23		75	0·3	" 23	·15978
						" 24			4·2	" 24		74	55·9	" 24	·15966
								26	5·6			74	58·1		·15955
Golden, B.C.	51	18	116	57	1908	July 27		26	3·8	July 27		74	43·3	July 27	·16152
						" 28			7·4	" 28		.....	.....	" 28	
						" 29			1·6	" 29		74	42·2	" 29	·16167
						" 30			1·2	" 30		.....	.....	" 30	
								26	3·5			74	42·8		·16160
Revelstoke, B.C.	51	0	118	12	1908	.....			....	Aug. 1		74	13·6	Aug. 1	·16499
						Aug. 3		25	48·6	" 3			17·5	" 3	·16521
						" 4			47·6	" 4			17·2	" 4	16483
						" 5			49·5	" 5		.....	.....	" 5	
								25	48·6			74	16·1		·16501
Sicamous, B.C.	50	50	118	59	1908	Aug. 6		25	51·7	Aug. 6		73	51·0	Aug. 6	·16779
						" 7			55·3	" 7			52·0	" 7	
						" 8			54·7	" 8			52·0	" 8	

						" 9....		53·0	" 9....			" 9...	16771
						" 10....		49·3	" 10....			" 10....	
							25	52·8		73	51·8		·16775
Clinton, B.C.	51		121	35	1908	Aug. 13....	26	25·3	Aug. 13....			Aug. 13....	
						" 14....	..	25·8	" 14....	73	28·9	" 14....	·17040
						" 15....	..	28·0	" 15....		26·3	" 15....	·17043
						" 16....	..	26·6	" 16....			" 16....	
							26	26·4		73	27·6		·17042
Barkerville, B.C.	53	4	121	30	1908	Aug. 22....	28	5·8	Aug. 22....	74	57·5	Aug. 22....	·15707
						" 23....		8·9	" 23....		58·5	" 23....	·15710
						" 24....		7·3	" 24....			" 24....	
							28	7·3		74	58·0		·15708
Quesnel, B.C.	52	59	122	32	1908	Aug. 26....	28	18·1	Aug. 26....	74	51·3	Aug. 26....	·15869
						" 27....		19·1	" 27....		50·8	" 27....	·15857
						" 28....		19·9	" 28....			" 28....	
							28	19·0		74	51·1		·15863
Alexandria, B.C.	52	35	122	28	1908	Aug. 30....	28	15·5	Aug. 30....	74	21·7	Aug. 30....	·16401
						" 31....		15·4	" 31....		20·1	" 31....	·16375
						Sept. 1....		17·7	Sept. 1....			Sept. 1....	
							28	16·2		74	20·9		16388
*Williams Lake, B.C.	52	6	121	56	1908	Sept. 3....	28	54·1	Sept. 3....	74	12·5	Sept. 3....	·16524
						" 4....		50·3	" 4....			" 4....	
						" 5....		52·6	" 5....		12·1	" 5....	·16515
						" 6....		54·2	" 6....			" 6....	
							28	52·8		74	12·3		·16518
Bridge Creek, B.C.	51	39	121	27	1908	Sept. 8....	26	49·0	Sept. 8....	73	35·0	Sept. 8....	·17202
						" 9....		45·8	" 9....		35·2	" 9....	·17142
							26	47·4		73	35·1		·17172

* Magnetic storm on afternoon of Sept. 4th.
** Observations for Dip were taken with Dover Dip Circle 145. The standards on Tesdorpf Magnetometer 1977 prevented a reading being taken.

TABLE 1—*Continued.*

Place.	Latitude. °	Latitude. ′	Longitude. °	Longitude. ′	Year.	Month & day.	Hour & minute.	Declination. °	Declination. ′	Month & day.	Hour & minute.	Dip. °	Dip. ′	Month & day.	Hor. Intensity C. G. S. Units.
*Ashcroft, B.C.	50	44	121	17	1908	Sept. 11	10 30	.....	.....	Sept. 11	10 30	73	{25·6 24·9	Sept. 11	....
						" 12		.....	.....	" 12			26·2	" 12	....
						" 14		27	46·8	" 14			{28·4 25·6	" 14	·17214
						" 15			47·0	" 15		.	....	" 15	·17229
								27	46·9			73	26·1		·17222
Spence's Bridge, B.C.	50	25	121	21	1908	Sept. 16		.....	....	Sept. 16		.....	.....	Sept. 16	·17379
						" 17		26	38·1	" 17		72	59·3	" 17	·17361
						" 18			40·6	" 18			58·5	" 18	... .
								26	39·4			72	58·9		·17270
Nicola, B.C.	50	9	120	40	1908	Sept. 19		25	1·4	Sept. 19		72	54·7	Sept. 19	·17546
						" 20			4·1	" 20			53 3	" 20	·17546
						" 21			3·4	" 21		...	......	" 21	....
								25	3·0			72	54·0		·17546
North Bend, B.C.	49	52	121	27	1908	Sept. 23		25	48·6	Sept. 23		72	33·4	Sept. 23	....
						" 24			48·9	" 24			31·1	" 24	·17964
						" 25			47·3	" 25			31·9	" 25	·17980
						" 26			47·2	" 26		....	......	" 26	....
								25	48·0			72	32·1		·17972
**Agassiz, B.C.	49	15	121	45	1908	Sept. 28		....	......	Sept. 28		71	34·9	Sept. 28	....
						Oct. 1		25	24·0	Oct. 1		..	34·9	Oct. 1	·18923
						" 2			23·2	" 2		.....	34·9	" 2	·18915
								25	23·6			71	34·9		·18919

Vancouver, (Brockton Point) B.C.	49	18	123	7	1908	Oct. 5....	25	21·0	Oct. 5...	...	......	Oct. 5...	.....
						" 6....		23·3	" 6...	71	39·5 / 41·4	" 6....	....
						" 7....		24·3	" 7...		44·0	" 7....	18782
						" 8....		24·4	" 8...		42·8 / 41·7	" 8...	18781
							25	23·3		71	42·4		·18782
Victoria, B.C.... (C.I.S.)	48	25	123	21	1908	Oct. 12....	....	.....	Oct. 12..	71	18·3	Oct. 12....	....
						" 13....	24	34·0	" 13....		19·8 / 20·0	" 13....	·18757
						" 14....		33·9	" 14....		19·9 / 18·3	" 14...	18769
							24	34·0		71	19·3		·18763
Nanaimo, B.C...... (Jesse Island)	49	13	123	52	1908	Oct. 17....	25	15·4	Oct. 17..	71	19·3	Oct. 17 .	18827
						" 18....		15·1	" 18.		20·9	....	....
							25	15·3		71	20·2		18827
Ottawa, Ont .... (C.I.S.)	45	24	75	43	1908	Nov. 2....	12	49·1W	Nov. 2....	75	41·9	Nov. 2....	15150
						" 5....		47·5	....	....	......	" 5....	·15169
						" 26....		48·9	....	.....	......	" 26....	....
							12	48·5W		75	41·9		·15156
Ottawa, Ont........ (Hut.)	45	24	75	43	1908	Nov. 20 ...	12	50·3	... ...	....	....	Nov. 20....	....
						" 23....		50·2	....	......	......	" 23....	·15165
						" 26....		51·0	....	....	....	" 26....	.....
						" 27....	.....	...	....	......	.....	" 27....	·15149
							12	50·5W		.....			·15157

* Magnetic storm Sept. 11th and 12th. Aurora Sept. 11th.
** Magnetic storm Sept. 29th and 30th. Aurora Sept. 29th.

TABLE II.

This table gives a resume of Table I, together with the values of the horizontal intensity observed with Dover 145.

1977—Tesdorpf Magnetometer.
145—Dover Dip Circle.

Place.	Latitude.		Longitude.		Year.	Month & day.	Declination.		Month & day.	Dip.		Month & day.	Hor. force C.G.S. Units.	Instrument.
	°	′	°	′			°	′						
**Winnipeg, Man., Carnegie Instit't'n Stn	49	52	97	9	1908	July 16–20	13	58·6	July 17-18-20 " 17	78	13·0 13·0	July 16–18 " 17	·13121 ·13060	1977 145
Banff, Alta., Carnegie Institution Stn	51	10	115	37	.....	" 22–24	26	5·6	" 23–24 " 25	74	58·1 59·3	" 22–21 " 25	·15955 ·15942	1977 145
Golden, B.C.	51	18	116	57	.....	" 27–30	26	3·5	" 27–29 " 28	74	42·8 40·1	" 27–29 " 28	·16160 ·16142	1977 145
Revelstoke, B.C.	51	0	118	12	.....	Aug. 3-4-5	25	48·6	Aug. 1-3-4 " 5	74	16·1 16·6	Aug. 1-3-4 " 5	·16501 ·16458	1977 145
Sicamous, B.C.	50	50	118	59	.....	" 6–10	25	52·8	" 6–7–8 " 10	73	51·8 55·4	" 6–9	·16775 ·16785	1977 145
Clinton, B.C.	51	6	121	35	.....	" 13–16	26	26·1	" 14–15 " 13	73	27·6 25·1	" 14–15 " 13	·17042 ·17223	1977 145
Barkerville, B.C.	53	4	121	30	.....	" 22–24	28	7·3	" 22–23 " 21	74	58·0 57·6	" 22–23 " 21	15708 ·15694	1977 145
Quesnel, B.C.	52	59	122	32	.....	" 26–28	28	19·0	" 26–27	74	51·1 49·0	" 26–27 " 28	·15863 ·15913	1977 145
Alexandria, B.C.	52	35	122	28	.....	Aug. 30– ept. 1	28	16·2	" 30–31 Sept. 1	74	20·9 18·4	" 30–31 Sept. 1	·16388 ·16468	1977 145
*Williams Lake, (150 mile post) B.C.	52	6	121	56	.....	Sept. 3–5	28	52·8	" 3–5 " 5	74	12·3 12·4	" 3–5 " 5	·16518 16507	1977 145
Bridge Creek, (100 mile post) B.C.	51	39	121	27	.....	" 8–9	26	47·4	" 8–9	73	35·1	" 8–9	·17172	1977

Ashcroft, B.C., Carnegie Institution Stn	50	41	121	17	.....	" 11 15..	27	16 9	" 11-12-14 " 12..	73	26 1 26·8	" 11-15 . " 12.	·17222 ·17208	1977 145
Spence's Bridge, B.C.	50	25	121	21	.....	" 17-18..	26	39 4	" 17-18.. " 18..	72	58·9 57·6	" 16-17. " 18..	·17370 ·17414	1977 145
Nicola, B.C.	50	9	120	40	....	" 19-21..	25	3·0	" 19-20.. " 21..	72	54·0 53·4	" 19-20.. " 21..	·17546 17529	1977 145
North Bend, B.C.	49	52	121	27	....	" 25-26..	25	48 0	" 23-25.. " 26..	72	32·1 31·2	" 24-25..	17972 ·17946	1977 145
‡Agassiz, B.C.	49	15	121	45	....	Oct. 1-2..	25	23 6	Sept. 28 Oct. 1, 2 " 28..	71	34 9 36·1	Oct. 1 2.. Sept. 28 .	·18919 ·18902	1977 145
Vancouver, B.C., (Brockton Point).....	49	18	123	7	....	" 5-8..	25	23·3	Oct. 6 8.. " 3..	71	42·4 43·7	Oct. 7-8.. " 3..	·18782 ·18669.	1977 145
Victoria, B.C., Carnegie Institution Stn.	48	25	123	21	....	" 13 14..	24	34·0	" 12-14 . " 10..	71	19·3 17·0	" 13-14 . " 10..	·18763 ·18779	1977 145
Nanaimo, B.C., (Jesse Island)	49	13	123	52	....	" 17-18..	25	15·3	" 17-18. " 18..	71	20·2 21·5	" 17. " 18..	·18827 .18786	1977 145
Ottawa, Ont., Carnegie Institution Stn..	45	24	75	43	....	Nov. 2-5 26	12	48·5W	Nov. 2..	75	41·9	" 2-5..	·15156	1977
Ottawa, Ont., (Hut)............	45	24	75	43	....	" 20-23-26	12	50·5W	....	....		Nov. 23-27..	·15157	1977

* Magnetic storm Sept. 4th., p.m.
† " " Sept. 11th and 12th., Aurora, Sept. 11th.
‡ " " " 29th and 30th., " " 29th.
** The "Dip" at Winnipeg was obtained with Dover Dip Circle 145.

In the report of 1898 the Department of the Interior published the magnetic data that had been obtained in connection with the survey and exploration of Dominion lands between the years 1881 and 1890. The declination was generally obtained by means of a long compass needle attached to the lower plate of a transit-theodolite within a narrow box, fitting into a groove, while inclination and total force (intensity) were obtained by a Kew Dip Circle, the constants of which had been determined at the Toronto Magnetic Observatory.

The observations extended in latitude from Port Arthur 48° 26′ to Lake Lindeman 59° 47′ near the head waters of the Yukon, and in longitude from Eastmain, 78° 29′, to Lake Lindeman, 135° 05′. The number of stations distributed over this vast area was 204, but by no means uniformly distributed, the most of them lying along exploratory routes.

In 1883 Sir J. H. Lefroy published his observations in Canada made in 1843-44, covering 314 stations.

These two publications are the only ones up to the present of extended magnetic observations in Canada, except the publications of the United States Coast and Geodetic Survey, which are partly based on the above data and partly on the observations by officers of that survey.

It is thought desirable to bring together the whole of the magnetic data available in our office and publish it.

For the present it is considered more desirable to publish the actual observations than to defer until a reduction has been made to a uniform epoch. The data for most of the stations and many areas, are far too limited to justify such a reduction by themselves. The principal difficulty encountered in reducing to a common epoch, or in reducing from one epoch to another is that of secular variation. Although the existence of secular variation has been known since the days of Gellibrand, 275 years ago, yet its explanation is still unknown. Here is a case where nature absolutely refuses to allow itself to be put in a straight jacket of mathematical formulæ, but instead, pursues its apparently erratic course to the dismay of investigators. As Huxley has well said, that 'our mathematical skill is no guarantee of the quality of the grist,' adding that, 'as the grandest mill will not extract wheat flour from peascods, so pages of formulæ will not get a definite result out of loose data.'

The element, for which for practical purposes, information is from time to time required is the declination, due to the fact that nearly all the older surveys were made with chain and compass, so that in re-tracing or re-establishing an old survey line it is frequently necessary to know the amount of change of the position of the needle, in short, the secular variation for the interval of time. It is impossible to give a general formula from which to deduce the information desired. However, as the original compass survey was at best but an approximation, the secular variation deduced from some empirical formula covering the area under consideration will furnish data for the re-establishment of old survey lines run by compass with a degree of accuracy quite in keeping with the bearing of the original line. The application of secular variation is most applicable in the re-survey of 'timber limits,' where seldom a definite line of reference is available, of which the magnetic bearing at the time of the timber limit survey is given. Such limits generally border a stream or river, the direction of the other sides was mostly made dependent upon the general course or trend of the river. What was accepted at the time by the surveyor as the general course of the river it is impossible subsequently to determine, so that laying off angles with a transit from the river is out of the question, and we fall back on the compass line as corrected for secular variation for re-determining the boundaries of an old timber limit.

For the re-establishment of lot lines in eastern Canada, which was originally almost completely wooded, and where the original surveys were all made by chain and compass, the case is somewhat different. Here 'concessions' and 'side-roads' were the governing factors for the directions of the lot lines, and these former ones were the ones to be opened up first, before the blazes and marks of the original survey were lost and obliterated. Hence in re-running a lot line at present with a compass, one would need only observe the actual magnetic bearing of the governing concession line and apply the difference between it and its original bearing, to the original bearing of the lot line for obtaining its present magnetic direction. Nowadays, however, no surveyor's outfit in Canada is confined to a compass, in fact this instrument on Jacob's staff is obsolete, and the transit-theodolite is used, with which the proper angle would be turned off from the governing line for the lot line irrespective of the magnetic bearing of either.

There are other cases besides those of timber limits and original lot lines. These refer to subdivision lines abutting on original lot lines or other subdivision lines, all run at different periods, the maps thereof showing the magnetic bearing for each line *when* surveyed, which for a closed figure is, on the face of it, a mathematical impossibility. Such cases, personally well known to the writer, tax the ingenuity and skill of the surveyor, armed with theodolite, compass, secular variation, 'deeds' and plans, to do justice to all parties and lines concerned. It may be noted that while the secular variation in general is but a few minutes per year, the daily or diurnal variation is several times that amount. This indicates the importance of noting the time of day when an observation for declination is taken. A disregard of this precaution is equivalent to probably several years displacement theoretically of the year of observation. Conversely, most of our old survey data do not include the time of day when the direction of a line had a certain magnetic bearing, hence with meagre data with reference to different periods or years for a given place, as is the case for many of the stations hereafter given, it is obvious that in the attempt to deduce secular variation therefrom or a general expression for the declination at a given time, we cannot hope to attain more than a rude approximation; much more so when we wish to carry the determination beyond the limits of observation, that is, when we extrapolate instead of interpolate.

The diurnal variation reaches its extreme value eastward at about 8 a.m. and westward at about 1.30 p.m., crossing the average magnetic meridian for the place at about 10.30 a.m. This applies to the southerly part of Canada; in the higher latitudes, the time interval of elongation from the magnetic meridian is increased.

Stations.

In the grouping of our stations, lying between the Atlantic and Pacific oceans and extending to Hudson bay and the Arctic ocean, it was considered more desirable to group them by political divisions as far as possible, *i.e.*, by provinces, than to bound the groups by parallels of latitude and meridians of longitude. In any case we will have contiguous stations falling into different groups. To the general public, to the surveyor, the engineer, the grouping by provinces will be more acceptable than any other scheme.

Canada has hence been divided into the following groups:—

Quebec and Labrador; Nova Scotia, including Cape Breton and Prince Edward Island; Ontario; Hudson bay and surrounding territory; Manitoba; Saskatchewan and Alberta; British Columbia; and Yukon and Northwest Territories, these latter extending from the 60th parallel to the Arctic ocean and west of Hudson bay.

In each of these groups the stations have been arranged in order of longitude, so that, in general, the tabulation will show, considering west declination positive and east declination negative, an algebraic decrease of declination with an increase of longitude.

The agonic line, or line 'without an angle,' *i.e.*, the line joining the points at which the direction of the magnetic meridian is coincident with that of the astronomic meridian, passes at the present time somewhat to the west of Schreiber on the Canadian Pacific Railway, and west of Windsor. Places to the east of it have west declination, and those to the west have east declination.

In the table of compiled magnetic elements,—declination, inclination, horizontal and total intensities,—the column 'Observer' gives the source of the information, indicated by abbreviation, when the observer himself is not given.

The data opposite to the abbreviations C.I., C.S. and L.S., are taken from

TABLE

MAGNETIC

NOVA

C. I.—Carnegie Institution.

Place.	Latitude.	Longitude.	Year.	Month and day.	Hour and minute.	Declination.
	° ′	° ′				° ′
Louisburg.	45 53·0	60 00·0	1862	....	....	....
Cape Breton	46 16·0	60 08·0	1862	....	....	....
Sydney, Cape Breton.	46 09·0	60 11·0	1905·5	....	....	24 48 W
" "	46 08·6	60 11·6	1881	Oct. 21, 22..	....	25 11·8 "
" "	46 08·5	60 11·8	1896	July 11, 13..	....	24 53·4
" "	46 06·7	60 12·0	1907	Oct. 30, 31.. Nov. 1, 2...	....	25 27 9
" "	46 09·0	60 15·0	1905·7	....	....	25 09.6 "
Arichat, Isle Madame	45 30·5	61 01·3	1881	Oct. 26	....	23 25·9 "
Isle Madame, Cape Breton	45 28·0	61 03·0	1862	....	....	....
Mulgrave	45 35·1	61 22·5	1907	Nov. 5,6....	....	24 13·2
Antigonish	45 35·6	61 59·2	1907	" 8,9....	....	23 25·4
Pictou	45 38·0	62 43·5	1907	Oct. 25,26,28	....	23 01·9
Truro.	45 20·2	63 15·0	1907	" 22,23,24	....	21 50·7
Point Pleasant	44 37·0	63 31·0	1904·7	....	....	21 02·0 "
"	"	"	1905·7	....	....	20 47·3 "
Halifax	44 40·0	63 35·0	1834	....	....	....
"	"	"	1837	....	....	....
"	"	"	1838·5	....	....	....
"	"	"	1847·5	....	....	....
"	"	"	1873	....	....	....
"	"	"	1879	Sept. 8-10..	....	20 43·3 "
"	"	"	1881	....	....	....
"	44 39·5	63 35·0	1896	July 6, 7...	....	20 38·6 "
Pugwash	45 50·2	63 40·5	1907	Oct. 19,20,21	....	22 39·0
Black Point	44 38·0	64 01·0	1905·7	....	....	21 01·0 "
Windsor	44 59·6	64 08·4	1847	....	....	....
"	44 59·6	64 08 4	1881	Nov. 22. ...	....	20 42·3 "
Kentville	45 12·0	64 46·0	1847	....	....	....
Annapolis	44 44·5	65 31·1	1881	Nov.14,15.16	....	19 26·8 "
Weymouth	44 24·4	65 59·8	1881	" 11.....	....	18 43·4 "
Yarmouth	43 49·9	66 07·2	1881	" 7, 8 ..	....	17 49·4 "

'United States Magnetic Tables and Magnetic Charts for 1905,' by L. A. Bauer, and published by the United States Coast and Geodetic Survey, 1908.

C.I. refers to observations made by officers of the Carnegie Institution.

C.S. refers to observations made or published by the United States Coast and Geodetic Survey.

L.S. refers to observations by the United States Lake Survey.

III.

RESULTS.

SCOTIA.

Month and day.	Hour and minute.	Dip.	Month and day.	Hour and minute.	Hor. intens.	Total intens.	Temperature.	Observer.
		° '						
...	...	76 00·0	...	...	...	...	...	Shadwell.
...	...	76 03·0	...	...	...	...	...	"
...	...	74 25·0	...	...	·1560	...	...	French Navy.
Oct. 21, 22..	...	75 10·0	Oct. 21, 22..	...	...	·5918	...	S. W. Very.
...	...	74 38·6	...	...	·1547	·5842	...	G. R. Putnam.
...	...	74 16·8	...	...	·1563	·5768	...	White-Fraser.
...	...	74 23·7	...	...	·1566	...	...	C. I.
Oct. 26....	...	74 43·0	Oct. 26....	...	...	·6007	...	S. W. Very.
...	...	75 31·0	...	...	...	...	...	Shadwell.
...	...	73 53·6	...	...	·1611	·5807	...	White-Fraser.
...	...	74 17·9	...	...	·1596	·5899	...	"
...	...	74 31·2	...	...	·1577	·5910	...	"
...	...	73 52·5	...	...	·1618	·5827	...	"
...	...	73 58·0	...	...	·1624	...	...	N. S. Instit. Science
...	...	73 59·6	...	...	·1619	...	...	C. I.
...	...	75 33·0	...	...	...	·5966	...	E. Home.
...	...	74 58·0	...	...	...	...	...	"
...	...	74 45·0	...	...	...	...	...	Estcourt.
...	...	75 37·0	...	...	...	·6026	...	Keily.
May 13, 15, 16	...	74 48·2	May 13, 15, 16	...	...	·5954	...	Maclean & Bromley
Sept. 8-10...	...	74 39·2	Sept. 8-10...	...	...	·6013	...	J. B. Baylor.
Nov. 2.. ...	...	74 29·0	Nov. 2...	...	...	·5962	...	S. W. Very.
...	...	73 54·0	...	...	·1632	·5885	...	G. R. Putnam.
...	...	74 48·8	...	...	·1544	·5895	...	White-Fraser.
...	...	73 59·9	...	...	·1617	...	...	C. I.
...	...	75 41·0	...	...	...	...	...	G. W. Keily.
Nov. 21, 22..	...	74 49·0	Nov. 21, 22..	...	...	·6026	...	S. W. Very.
...	...	75 46·0	...	...	...	...	...	G. W. Keily.
...	...	74 53·0	Nov. 14, 15..	...	...	·6059	...	S. W. Very.
Nov. 10...	...	74 45·0	Nov. 10....	...	...	·6068	...	"
" 7	...	74 35·0	Nov. 8...	...	...	·6026	...	"

TABLE

MAGNETIC

QUEBEC—

C. I.—Carnegie Institution.
C. S.—Coast Survey.

Place.	Latitude.	Longitude.	Year.	Month and day.	Hour and minute.	Declination.
	° ′	° ′				° ′
Battle Harbour, Caribou island, Labrador	52 16·3	55 34·5	1881	Sept. 5,6,7,8.		37 12·7W
Grady, Labrador	53 48·2	56 25·3	1881	Aug. 3,4		39 03·8 "
Turnavik, Labrador	55 14·9	59 19·0	1881	July 28,29		40 22·8 "
" "	55 14·6	59 20·3	1896	July 20		38 26·4
Nain, Labrador	56 32·7	61 40·7	1881	Aug. 11 to 18		44 50·2 "
Gaspé Basin	48 50·0	64 30·0	1832			
Rivière du Loup	47 51·0	69 25·0	1876			
"	47 50·0	69 33·0	1906·7			20 38·7W
Brandypot island	47 53·0	69 42·0	1830			
St. Thomas, Montmagny	46 59·0	70 33·0	1876	Aug. 24,25		17 50·1W
Megantic	45 34·4	70 53·2	1907	Sept. 20,21, 23, 24		16 33·2
Alphonse	48 21·0	70 54·0	1906·7			21 54·0 "
Tring Jct	46 15·5	71 00·0	1907	Sept. 26, 27		17 22·2
Chicoutimi	48 25·0	71 03·0	1906·7			20 17·1 "
Quebec	46 48·6	71 13·3	1845			
"	"	"	"			
"	46 48·0	71 14·0	1906·2			17 53·0W
"	46 49·5	71 14·2	1842	Sept. 1		14 12·0 "
"	46 48·4	71 14·5	1859	July 19		16 17·0 "
"	"	"	1879	Sept. 16, 19		17 13·7 "
Bécancour	46 22·0	71 33·0	1876	Aug. 17,18		15 43·5 "
Sherbrooke	45 23·9	71 56·2	1907	Sept. 14,16, 17, 18		15 59·9
Richmond Jct	45 41·0	72 03·0	1876	Aug. 15		16 59·6 "
Peribonka	48 46·0	72 05·0	1906·7			20 55·7 "
Stanstead	45 02·0	72 07·0	1842			
Kingsey	45 46·0	72 12·0	1842			
Roberval	48 31·0	72 14·0	1906·7			19 44·5W
Mistassini	48 54·0	72 14·0	1906·7			19 20·5 "
Lake Mempbremagog	45 01·0	72 15·0	1845			
Lake Edward	47 40·0	72 15·0	1906·7			19 34·4W
Three Rivers	46 21·0	72 32·0	1842			
"	46 21·0	72 33·0	1906·7			15 26·1W
Farnham	45 16·1	73 01·5	1907	Sept. 9,10,11		15 12·4 "
Sorel	46 02·0	73 03·0	1842			
"	"	"	"			
St. Johns	45 17·0	73 15·0	1842			
Montreal	45 31·0	73 30·0	1833			
St. Helens island, Montreal	45 31·1	73 31·7	1842	Sept. 19	8 31a	8 57·6W
" " "	"	"	1843			
" " "	"	"	"			
" " "	"	"	"			
Montreal, The Mountain	45 31·0	73 33·3	1845			}
Montreal	45 31·0	73 32·0	1843			
"	45 30·0	73 33·0	1838			
"	45 30·3	73 34·9	1859	July 20		12 21·0W
"	"	"	1879	Sept. 25		13 40·5 "
"	"	73 35·0	1896·8			14 19·0 "
"	"	"	1905·7			14 40·1 "
"	"	"	1906·7			

IV.

RESULTS.

Labrador.

Month and day.	Hour and minute.	Dip.	Month and day.	Hour and minute.	Hor. intens.	Total intens.	Temperature.	Observer.
		° ′						
Sept. 6,7,8,9		77 16·0	Sept. 6, 7, 8.			·5794		S. W. Very.
Aug. 3,4,5..		77 49·0	Aug. 3, 4...			·6060		"
July 28,29		79 56·0	July 28, 29..			·5916		"
		79 30·8			·1074	·5901		G. R. Putnam.
Aug. 11, 14, 19		78 22·0	Aug. 11, 15, 19			·5961		S. W. Very.
		78 50·0						Capt. Bayfield.
Aug. 28, 30..		77 31·6				·5952		F. E. Hilgard.
		76 34·1			·1408			C. I.
								Capt. Bayfield.
Aug 24, 25..		77 11·7				·5952		F. E. Hilgard.
		75 40·6			·1498	·6056		White-Fraser.
		77 56·1			·1279			C. I.
		76 06·7			·1462	·6094		White-Fraser.
		77 36·9			·1334			C. I.
		77 08·8	June 23			·6286		C. Younghusband.
			" 23			·6284		"
		76 01·1			·1477			C. I.
Sept. 1		77 15·3	Sept. 1			·6383		J. H. Lefroy.
July 18.		77 17·5	July 19			·6271		Schott.
Sept. 16, 19.		76 45·1	Sept. 16, 19.			·6243		Baylor.
Aug. 17, 18..		76 54·5	Aug. 17, 18..			·6005		F. E. Hilgard.
		75 26·7			1512	·6018		White-Fraser.
Aug. 15		75 47·7	Aug. 15			·6009		F. E. Hilgard.
		77 27·4			·1328			C. I.
Sept. 12		77 19·2	Sept. 12			·6282		J. H. Lefroy.
Sept. 10		77 14·0	" 10			·6311		"
		77 33·5			·1329			C. I.
		78 19·4			·1250			"
		76 08·6						A. W. Whipple.
		76 54·2			·1389			C. I.
Sept. 6		77 10·7	Sept. 6			·6383		J. H. Lefroy.
		75 57·1			·1482			C. I.
		75 20·1			·1540	·6095		White-Fraser.
Sept. 8		77 16·4	Sept. 8			·6340		J. H. Lefroy.
" 8.		77 16·5						"
" 14		77 00·1						"
		77 06·0						Back.
Sept. 16		77 13·1				·6326		J. H. Lefroy.
April 25		77 15·7	April 25			·6362		"
" 28		77 02·1	" 28			·6356		"
" 29		77 08·6	" 29			·6317		"
June 20		77 06·7	June 20			·6248		C. Younghusband.
" 20		77 10·3	" 23			·6234		"
			August			·6280		A. D. Bache.
		76 19·0						Estcourt.
July 20		76 51·4	July 20			·6308		Schott.
Sept. 25		76 25·7	Sept. 25			·6271		Baylor.
		75 40·2			·1507			C. S.
		75 38·2			·1512			C. I.
		75 38·1						"

TABLE

MAGNETIC

QUEBEC—

C. I.—Carnegie Institution.
C. S.—Coast Survey.

Place.	Latitude.	Longitude.	Year.	Month and day.	Hour and minute.	Declination.
	° ′	° ′				° ′
*Isle Dorval	45 25 0	73 44 0	1843			
"	"	"	"			
"	"	"	"			
St. Jérôme	45 46 0	73 59 0	1906·7			15 49·2W
Lacombe farm	55 33·0	74 09 0	1843·3			8 26·0 "
Labelle	46 16·0	74 33·0	1906·7			15 24·6 "
*Pointe du Chêne	45 37 0	74 50·0	1843	May 3	6 40p	7 28·0 "
"	"	"	"			
*Mishomis	47 13·0	75 38·0	1906·8			18 15·3W
Baskatong	46 49·0	75 52·0	1906·8			12 16·2 "
Aylmer	45 15·0	75 58 0	1843			
Maniwaki	46 23·0	75 59·0	1906·7			12 20·0W
*Portage des Chats	45 26·0	76 32·0	1843			
"	"	"	"			
Portage du Grand Calumet	45 45·0	76 40·0	1843			
Fort Coulonge	45 54·9	76 45·0	1843			
"	"	"	"			
"	"	"	"			
Pointe Baptême	46 05·0	77 26·0	1843			
Portage des Deux-Joachims	46 12·1	77 40·0	1843			
"	"	"	"			
Trou portage	46 15·0	78 16 0	1843			
"	"	"	"			
Kipawa	46 47 0	78 59 0	1906·8			9 44 9W

* Local disturbance.

IV—*Con.*

RESULTS—*Con.*

LABRADOR—*Con.*

Month and day.	Hour and minute.	Dip.	Month and day.	Hour and minute.	Hor. intens.	Total intens.	Temperature	Observer.
		° ′						
April 30. ..	p. m.	77 03·1	April 30....	... .	....	·6302	....	J. H. Lefroy.
....	....	.. ..	" 30....	....	....	·6297	....	"
....	... .	.. ..	" 30 . .	....	.. ..	·6261	....	"
....	....	76 08·2	....	....	·1487	....	....	C. I.
....	....	76 50·6	....	....	·1454	....	....	J. H. Lefroy.
....	....	76 29·8	....	....	·1432	......	....	C. I.
May 3......	. ...	76 55·4	May 3..	....	....	·6273	....	J. H. Lefroy.
....	....	....	" 3......	....	....	·6302	.. ....	"
....	....	77 04·2	....	....	·1392	....	....	C. I.
.. ..	....	76 38·5	....	....	·1417	.. ....	......	"
May 5......	....	76 41·0	May 5......	....	....	·6380	....	J. H. Lefroy.
....	....	76 29·5	....	....	·1441	.. ...	....	C. I.
May 6.. ...	Noon.	75 07·0	May 6.....	....	.... .	·6450	... ...	J. H. Lefroy.
....	....	....	" 6.. ..	....	.. ..	·6399	....	"
May 7......	p. m.	76 44·4	" 7.....	....	.. ..	·6378	......	"
" 8......	p. m.	77 29·7	" 8.....	....	.. .. ..	·6418	....	"
" 8......	... .	77 16·7	" 8.....	....	....	·6415	....	"
....	....	. ...	" 8.....	... .	... . ..	·6433	....	"
May 9......	3 00p	77 19 1	" 9. ..	....	....	·6351	....	"
" 10.. ...	11 00a	77 03·8	" 10.....	....	....	·6374	....	"
....	....	... . .	" 10.....	....	....	·6383	....	"
May 11.....	p. m.	77 24·4	" 11	....	....	·6429	.... ..	"
....	....	....	" 11.....	....	....	·6403	....	"
.. ..	....	76 41.8	....	....	·1430	..... .	....	C. I.

TABLE

MAGNETIC

ONTA

C. I.—Carnegie Institution.
L.S.—Lake Survey.
C.S.—Coast Survey.

Place.	Latitude.	Longitude.	Year.	Month and day.	Hour and minute.	Declination.
	° ′	° ′				° ′
Hawkesbury	45 36·0	74 37·0	1906·7			11 51·3 W
Cornwall	45 02·0	74 50·0	1845			
"	"	"	"			
Williamsburg	44 55·0	75 07 0	1843			
"	"	"	"			
Fox Point, Ottawa river	45 32·0	75 22·0	1843			
" "	"	"	"			
Prescott	44 35·0	75 30 0	1843			
Brockville	44 35·9	75 40·7	1907	Sept. 2, 3, 4.		10 34.2
"	44 32·0	75 41·0	1845			
"	"	"	"			
Ottawa	45 21·0	75 42·0	1856			
"	45 23 6	75 42·9	1907	June 3		12 36·5
" (C.I.S.)	45 24·0	75 43·0	1908	Nov. 2, 5, 26		12 48·5 W
" (Magnetic hut)	"	"	"	" 20, 23, 26		12 50 5 "
Kingston Jct	44 15·2	76 28·0	1907	Aug. 27, 28.		14 16·9
" (R. M. College*)	44 13·8	76 28·2	"	" 20, 21		36 46·4
" (Artillery Barracks*)	44 13·0	76 28·6	1842			
"	"	"	"			
"	"	"	1843			
"	"	"	"			
"	"	"	1845			
"	"	"	"			
Kingston (Stewart point)	44 12·0	76 29·0	"			
" "	"	"	"			
Kingston (Barracks)	44 13 0	76 29·2	1907	Aug. 25		*30 07·4
Kingston Junction	44 15·0	76 29·0	1906·7			13 26·0 W
Kingston (The Common)	44 13·0	76 30·0	1845			
" "	"	"	"			
Renfrew	45 29·0	76 40·0	1906·7			11 13·6 W
Sharbot lake	44 46·4	76 41·2	1907			11 28·7
Pembroke	45 49·3	77 07·5	"			10 16·7
Belleville	44 09·0	77 25·0	1843			
Chalk river	46 00 0	77 26·0	1906·8			10 20·2 W
Barry bay	45 28·8	77 40·3	1907	Aug. 9		08 46·3
Madawaska	45 30·0	77 59·0	1906·7			9 05·2 "
Cobourg	43 56 0	78 10 0	1843			
Peterborough	44 18·0	78 18·0	1906·7			8 16·1 "
Kinmount	44 48·0	78 39·0	1906·7			8 22·7 "
Mattawa	46 19·7	78 41·0	1907	July 23, 24		8 44·3
Little river	46 15·4	78 44·0	1843			
"	"	"	"			
Joe lake	45 35·2	78 46·5	1907	Aug. 6, 7		7 30·6
Niagara village	43 15·0	79 04·0	1843			
Niagara Falls	43 04·0	79 05·0	1841			
"	"	"	1845			
"	"	"	"			
South side of Trout lake	46 18 5	79 13·0	1843			
"	"	"	"			
Agincourt (Mag. Obsy.)	43 47 0	79 16·0	1905			5 40·3 "
"	"	"	1906·8			5 47·0 "
"	"	"	1908	July 9, 11		6 2·2 "
"	"	"	"	" 9, 11		5 59·0 "
Emsdale	45 32·0	79 18·0	1906·7			7 52.2 "

* Local disturbance.

V.

RESULTS.

RIO.

Month and day.	Hour and minute.	Dip.	Month and day.	Hour and minute.	Hor. intens.	Total intens.	Temperature	Observer.
		° ′						
		76 03·1			·1500			C. I.
June 16		76 16·5	June 16			·6355		C. Younghusband.
" 16		76 16·3	" 16			·6361		"
April 20		76 31·8	April 20			·6425		J. H. Lefroy.
" 20		76 29·8	" 20			·6452		"
May 4		76 35·3	May 4			·6410		"
			" 4			·6370		"
April 19		78 42·5						"
		75 03·6			·1577	·6118		White Fraser.
June 13		76 19·8	June 13			·6320		C. Younghusband.
" 13		76 18·0	" 13			·6324		"
August		76 42·9						K. Friesack.
		75 41·2			·1505	6086		White-Fraser.
Nov. 2		75 41 9			1516			C. A. French.
			Nov. 23, 27		·1516			"
		74 57·8			·1613	·6219		White-Fraser.
		73 27·3			1708	·5998		"
Nov. 11		77 18·8	Nov. 11			·6816		J. H. Lefroy.
" 11		77 19 1	" 11			·6990		"
April 18		77 18·1	April 18			·6921		"
			" 18			·6967		"
June 10		77 14·2	June 10			·6965		C. Younghusband.
" 10		77 14·7	" 10			.6969		"
			" 11			·6672		"
			" 11			·6652		"
		74 37·3						White-Fraser.
		74 57·3			·1621			C. I.
			June 11			·7137		C. Younghusband.
			" 11			·7125		"
		75 46·7			·1513			C. I.
		74 54·6			·1608	6173		White-Fraser.
		76 11·2			1476	·6182		"
April 17		77 01·0						J. H. Lefroy.
		76 23·5			·1461			C. I.
		75 53·9			·1501	·6197		White-Fraser.
		75 54·0			·1503			C. I.
April 16		75 27·2						Corporal Henry.
		74 42·9			·1647			C. I.
		75 18·2			·1558			C. I.
		76 41·2			·1429	·6205		White-Fraser.
May 12		77 28 5	May 12			·6448		J. H. Lefroy.
			" 12			·6406		"
		75 56·0			·1525	·6281		White-Fraser.
Mar. 11		74 45·6	Mar. 11			·6387		J. H. Lefroy.
Sept.		74 54·7						J. M. Nicollet.
Oct. 18		74 46·8	Oct. 18			·6342		J. H. Lefroy.
			" 18			·6345		"
May 13		77 21·7	May 13			·6430		"
			" 13			·6437		"
		74 33·8			·1643			Observatory.
		74 35 6			·1638			C. I.
July 9		74 32·1	July 10, 11		·1638			C. A. French.
			" 10, 11		·1637			Observatory.
		75 48·7			·1520			C. I.

TABLE

MAGNETIC

ONTA

Place.	Latitude.	Longitude.	Year.	Month and day.	Hour and minute.	Declination.
	° ′	° ′				° ′
Toronto, Magnetic Observatory	43 39·4	79 23·3	1841	12 months..	....	1 14·3W
" "	"	"	1842	" ..	....	1 19·1 "
" "	"	"	1843	....	....	....
" "	"	"	1844	....	....	....
" "	"	"	1845	12 months..	....	1 29·1 "
" "	"	"	1846	" ..	....	1 30·8 "
" "	"	"	1847	" ..	....	1 33·2 "
" "	"	"	1848	" ..	....	1 35·4 "
" "	"	"	1849	" ..	....	1 36·9 "
" "	"	"	1850	" ..	....	1 38·6 "
" "	"	"	1851	" ..	....	1 40·9 "
" "	"	"	1852	" ..	....	....
" "	"	"	1853	July & Aug.	Cor. for year.	1 46·1 "
" "	"	"	1854	Feb. to June		1 48·0 "
" "	"	"	1855	Aug. to Dec.		1 52·3 "
" "	"	"	1856	12 months..	....	1 56 3 "
" "	"	"	1857	" ..	....	2 00·5 "
" "	"	"	1858	" ..	....	2 04·5 "
" "	"	"	1859	" ..	....	2 07·4 "
" "	"	"	1860	" ..	....	2 10·6 "
" "	"	"	1861	" ..	....	2 14·4 "
" "	"	"	1862	" ..	....	2 15·7 "
" "	"	"	1863	" ..	....	2 19·1 "
" "	"	"	1864	" ..	....	2 21·9 "
" "	"	"	1865	" ..	....	2 24·8 "
" "	"	"	1866	" ..	....	2 27·6 "
" "	"	"	1867	" ..	....	2 29·8 "
" "	"	"	1868	" ..	....	2 33·2 "
" "	"	"	1869	" ..	....	2 37·1 "
" "	"	"	1870	" ..	....	2 41·9 "
" "	"	"	1871	" ..	....	2 47·9 "
" "	"	"	1872	" ..	....	2 53·3 "
" "	"	"	1873	" ..	....	2 56·9 "
" "	"	"	1874	" ..	....	3 01·5 "
" "	"	"	1875	" ..	....	3 06·4 "
" "	"	"	1876	" ..	....	3 12·5 "
" "	"	"	1877	" ..	....	3 22·6 "
" "	"	"	1878	" ..	....	3 31·3 "
" "	"	"	1879	" ..	....	3 36·0 "
" "	"	"	1880	" ..	....	3 40·0 "
" "	"	"	1881	" ..	....	3 46·6 "
" "	"	"	1882	" ..	....	3 50·5 "
" "	"	"	1883	" ..	....	3 54·3 "
" "	"	"	1884	" ..	....	3 57·7 "
" "	"	"	1885	" ..	....	3 59·8 "
" "	"	"	1886	" ..	....	4 02 1 "
" "	"	"	1887	" ..	....	4 04·8 "
" "	"	"	1888	" ..	....	4 08·3 "
" "	"	"	1889	" ..	....	4 12·0 "
" "	"	"	1890	" ..	....	4 18 2 "
" "	"	"	1891	" ..	....	4 23·3 "
" "	"	"	1892	" ..	....	4 29·2 "
" "	"	"	1893	" ..	....	4 36·4 "
" "	"	"	1894	" ..	....	4 42·2 "
" "	"	"	1895	" ..	....	4 44·7 "
" "	"	"	1896	" ..	....	4 48·9 "
" "	"	"	1897	" ..	....	4 52·8 "
" "	"	"	1898	*6 " ..	....	4 55·0 "

* Observatory moved to Agincourt in September 1898. The mean is interpolated from 6 months.
** For January-July, October-December ; 9 months.

V—*Con.*

RESULTS—*Con.*

RIO—*Con.*

Month and day.	Hour and minute.	Dip.	Month and day.	Hour and minute.	Hor. intens.	Total intens.	Temperature.	Observer.
		° ′						
12 months..		75 16·6						
"		16·4						
"		14·7						
"		14·8						
"		15·5	12 months..			·64284		
"		15·1	"			·64153		
"		15·3	"			·64094		
"		18·3	"			·64234		
"		18·8	"			·64331		
"		20·0	"			·64323		
"		20·4	"			·64311		
		20·5	"			·64054		
10 months..		22·2						
12 "		23·0						
"		23·5	Sept. to Dec.			·64276		
"		24·1	12 months..			·64115		
"		24.3	"			·63830		
"		24·4	"			·63871		
"		25·0	"			·63745		
"		24·6	"			·63680		
"		23·8	"			·63709		
"		23·2	"			·63695		
"		21·5	"			·63642		
"		20·9	"			·63680		
"		21·0	"			·63675		
"		19·2	"			·63550		
"		18·8	"			·63610		
"		20·1	"			·63706		
"		16·7	"			·63625		
"		16·3	"			·63451		
"		16·8	"			·63520		
"		15·5						
"		16·2						
"		13·9						
"		14·0						
"		13·3						
"		6·6						
"		2·4						
"		0·5						
"		74 57·3						
"		59·2						
"		55·2						
"		54·1						
"		53·2						
"		51·6						
"		49·0						
"		48·0						
"		46·5						
"		44·7						
"		42·2						
"		37·5						
"		37·0						
"		35·7						
"		34·2						
"		34·2						
"		34·7						
"		36·1						
**9 "		37·0						

observations for the year.

TABLE

MAGNETIC

ONTA

C. I.—Carnegie Institution.
L. S.—Lake Survey.
C. S.—Coast Survey.

Place.	Latitude.	Longitude.	Year.	Month and day.	Hour and minute.	Declination.
	° ′	° ′				° ′
Toronto, Agincourt	43 47	79 16	1899	12 months		5 26·5 W.
" "	"	"	1900	"		5 27·8 "
" "	"	"	1901	"		5 29·4 "
" "	"	"	1902	"		5 31·7 "
" "	"	"	1903	"		5 33·7 "
" "	"	"	1904	10 "		5 36·4 "
" "	"	"	1905	12 "		5 42·2 "
" "	"	"	1906	"		5 45·6 "
" "		"	1907	"		5 50·6 "
North Bay	46 18·3	79 24·7	1907	July, 18,19,20		08 55·6 "
"	46 19·0	79 26·0	1906·8			8 44·2 "
Barrie	44 21·0	79 41·0	1843			
New Liskeard	47 31·0	79 42·0	1906·8			8 50·0 "
Timagami sta	47 04·0	79 47·0	1906·8			11 54·4 "
Lake Nipissing	46 11·0	79 48·0	1843			
Hamilton, in yard of Farmers inn	43 16·0	79 50·0	1842			
" " "	"	"	1845			
Englehart	47 50·0	79 52·0	1906·8			9 05·8 "
Penetanguishene	44 47·0	79 55·0	1906·7			6 58·9 "
"	"	79 58·0	1843			
"	"	"	1825			
"	"	"	1844			
"	"	"	"			
"	"	"	"			
"	"	"	"			
Timagami inn	46 58·0	80 02·0	1906·8			11 26·8 "
Rose point	45 19·1	80 02·3	1907	July 31, Aug. 1,2,3,4		6 49·1
Twin lake	48 16·0	80 17·0	1906·8			7 47·5 "
Simcoe	42 51·0	80 18·0	1906·8			4 39·7 "
*Ricollet falls	45 57·0	80 30·0	1843			
"	"	"	"			
Berlin	43 27·0	80 31·0	1906·8			5 27·9 "
Owen Sound	44 35·0	80 57·0	1906·7			5 45·8 "
Sudbury	46 30·0	81 00·0	1906·7			6 26·8 "
"	46 29·0	81 00·0	1907	July 15,16,17		6 54·9 "
Small island, Lake Huron	45 55·5	81 02·0	1843			
" "	"	"	"			
" "	"	"	"			
Hyde Park Jc	42 59·0	81 19·0	1906·8			3 26·8 "
Stokes bay	44 59·0	81 22·0	1905·8			6 14·8 "
Southampton	44 30·0	81 23·0	1905·8			6 04·5 "
Kincardine	44 11·0	81 38·0	1905·8			5 12·4 "
Frazer bay, Lake Huron	46 00·0	81 40·0	1843			
" "	"	"	"			
Goderich, in garden foot of hill	43 45·0	81 41·0	1845			
" " "	"	"	"			
" " "	"	"	"			
" " "	"	"	"			
"	43 46·0	81 42·0	1906·7			4 15·5 "
" ¼ mile S. of Town Hall	43 44·0	81 43·0	1860			
Cove island	45 20·0	81 43·0	1860·7			3 58·6 "
"	"	81 44·0	1905·7			7 02·4 "
Goderich	43 44·0	81 44·0	1905·8			4 20·7 "
Cape Ipperwash, Lake Huron	43 13·0	82 00·0	1860			
Kettle point	43 13·0	82 01·0	1905·8			3 43·6 "
Fort La Cloche, Lake Huron	46 07·0	82 03·0	1843	May 18	8 33a	2 10·0 "
" "	"	"	1844			

* Local disturbance.

SESSIONAL PAPER No. 25a

V—*Con.*

RESULTS—*Con.*

RIO—*Con.*

Month and day.	Hour and minute.	Dip.	Month and day.	Hour and minute.	Hor. intens.	Total intens.	Temperature	Observer.
		° ′						
12 months.		74 35·9						
″		32·5						
″		32·1						
″		32·0						
″		32·6						
″		33·2						
″								
″								
″								
		76 35·7			·1433	·6182		White-Fraser.
		76 37·4			·1442			C. I.
Jan. 24		75 49·9						J. H. Lefroy.
		77 34·7			·1348			C. I.
		76 05·9			·1521			C. I.
May 14	p.m.	77 09·5	May 14			·6391		J. H. Lefroy.
Dec. 29		74 56·7	Dec. 29			·6374		″
″ 31		74 54·1						J. H. Lefroy.
		77 49·6			·1320			C. I.
		75 27·9			·1556			C. I.
Jan. 26		76 04·2						J. H. Lefroy.
April 18		76 16·0						Franklin.
Nov. 11		76 19·2	Nov. 11			·6491		J. H. Lefroy.
″ 11		76 21·0	″ 15			·6483		″
			″ 15			·6483		″
			″ 15			·6506		″
		76 47·4			·1428			C. I.
		75 36·1			·1525	·6588		White-Fraser.
		77 39·4			·1365			C. I.
		74 04·6			·1701			C. I.
May 15	2 00p	76 45·4	May 15			·6531		J. H. Lefroy.
			″ 15			·6406		″
		74 23·3			·1666			C. I.
		75 10·7			·1590			C. I.
		76 22·0			·1477	·6254		C. I.
		76 35·2			·1451			White-Fraser.
May 16		76 31·3	May 16			·6422		J. H. Lefroy.
			″ 16			·6394		″
			″ 16			·6448		″
		73 56·6			·1704			C. I.
		75 32·0			·1538			L. S.
		75 00·0			·1584			L. S.
		74 36·0			·1641			L. S.
May 17	2 00p	77 05·6	May 17	2 00p		·6412		J. H. Lefroy.
			″ 17			·6411		″
Oct. 28		75 04·4	Oct. 28			·6380		″
			″ 28			·6374		″
Oct. 28		75 05·3	″ 28			·6376		″
			″ 28			·6383		″
		74 26·5			·1660			C. I.
July 19		75 02·0				6383		W. P. Smith
		76 32·0			·1506			L. S.
		75 44·0			·1553			L. S.
		74 29·0			·1645			L. S.
May 8		74 46·0	May 28			·6427		W. P. Smith.
		74 03·0			·1680			L. S.
								J. H. Lefroy.
Nov. 8		76 50·2						″

TABLE

MAGNETIC

ONTA

C. I.—Carnegie Institution.
L. S.—Lake Survey.
C. S.—Coast "

Place.	Latitude.	Longitude.	Year.	Month and day.	Hour and minute.	Declination.
	° ′	° ′				° ′
Biscotasing	47 18·0	82 08·0	1906·7			3 07·2 "
Chatham	42 24·0	82 10·0	1906·8			2 13·8 "
Providence bay	45 40·0	82 17·0	1905·7			4 26·4 "
Sarnia, garden near the ferry	45 58·0	82 22·0	1845			
" "	"	"	"			
" "	45 58 0	82 22·0	1845			
" "	"	"	"			
Snake island, Lake Huron	46 10·0	82 40·0	1843			
" "	"	"	"			
Algoma	46 11·0	82 50·0	1906·8			4 35·4 W.
Great Duck island	45 38·0	82 56·0	1905·7			2 22·8
Amherstburg	42 06·0	83 03·0	1845			
"	"	"	"			
Missisagi straits	45 54·0	83 14·0	1905·7			4 06·4 "
*Cockburn island	45 52 0	83 21·0	1905·7			2 11·3 E.
Chapleau	47 50·0	83 27·0	1906·8			4 04·0 W.
"	47 49·6	83 27·0	1907	July 11, 12, 13		3 47·0
Thessalon point, Lake Huron	46 17·0	83 33 0	1843	May 19	3–26p	0 11·4 "
" "	"	"	"			
Missinaibi	48 20·0	84 07·0	1906·7			5 39·1 "
Sault Ste. Marie	46 30·9	84 21·5	1844	Nov. 4	9–56a	1 14·1 E.
"			"	" 4	10–05a	0 51·1 "
"			"	" 4	11–05a	1 08·2 "
"			1845			
Pointe aux Pins, Lake Superior	46 29·9	84 29 0	1843			
" " "	"	"	"			
" " "	"	"	"			
Sinclair harbour	47 22·0	84 42·0	1906·6			2 41·4 W.
Parisian island	46 39·0	84 42·0	1906·6			2 37·6 "
Gros Cap	46 32·0	84 43·0	1841			
Pointe aux Crêpes, Lake Super'r	46 58·0	84 44·0	1843	May 21	5–08p	3 02·8 E.
Mamainse point	47 02·0	84 47·0	1906·6			0 34·7 "
Michipicoten, Lake Superior	47 56 0	84 50 6	1880	J'ly 21, Sep. 9		1 20·5 W.
" "	47 56·2	84 54·0	1843	May 23	9–55a	0 20·3 E.
" "	"	"	"			
" "	"	"	1844			
" "	"	"	"			
" "	"	"	"			
" "	"	"	1845			
Gargantua I.	47 34·0	84 58·0	1906·7			2 26·3 W.
*Cape Gargantua, L. Superior	47 36·9	85 05·0	1843	May 21	2–15p	0 38·0 E.
" " "	"	"	"			
" " "	"	"	"			
White river	48 36·0	85 18·0	1906·7			3 00·6 W.
Michipicoten I.	47 42·0	85 46·0	1906·7			1 49·2 E.
Caribou I. No 1	47 20·0	85 50·0	1906·7			1 16·6 W.
Otter island	48 06·0	86 03·0	1906·7			4 07·3 "
*S.E. of Otter I., Lake Superior	48 07·0	86 07·0	1843			
" "	"	"	"			
Tip-Top	48 15·0	86 08·0	1871			
Oiseaux bay	48 22·0	86 10·0	1906·7			1 41·4 "
Rivière Blanche, Lake Superior	48 31·7	86 14·0	1844	Oct. 21	3–51p	2 15·2 E.
" " "	"	"	"			
" " "	"	"	"			
Pic, Lake Superior	48 35·3	86 15·0	1843			
" "	"	"	"			
" "	"	"	1844	Oct. 18	10–38a	5 13·3 E.
" "	"	"	"	" 18	11–06a	5 52·5 "
" "	"	"	"			

* Local disturbance.

V—*Con.*

RESULTS—*Con.*

RIO—*Con.*

Month and day.	Hour and minute.	Dip.	Month and day.	Hour and minute.	Hor. intens.	Total intens.	Temperature	Observer.
		° ′						
		77 09·4			·1384			C. I.
		73 33·4			·1749			C. I.
		76 00·0			·1513			L. S.
Oct. 25		74 18·6				·6366		J. H. Lefroy.
						·6370		”
Oct. 27		74 12·9				·6370		”
						·6362		”
May 18		77 05·5	May 18			·6383		”
			” 18			·6393		”
		76 24·0			·1467			C. I.
		76 24·0			·1461			L. S.
Oct. 22		73 32·7	Oct. 22			·6347		J. H. Lefroy.
” 22		73 27·2	” 22			·6342		”
		76 40·0			·1421			L. S.
		77 00·0			·1421			L. S.
		77 50·6			·1329			C. I.
		77 54·1			·1321	·6304		White-Fraser.
May 19		76 59·3	May 19			·6484		J. H. Lefroy.
” 19		77 04·8	” 19			·6418		”
		77 51·6			·1330			C. I.
Nov. 4		77 46·2	Nov. 4			·6365		J. H. Lefroy.
” 4		77 45·6	” 4			·6369		”
			” 4			·6386		”
May		77 19·5						Dr. J. Rae.
” 20		77 13·4	May 20			·6510		J. H. Lefroy.
” 20		77 12·1	” 20			6462		”
			” 20			·6481		”
		77 26·0			·1411			L. S.
		76 44·0			·1478			L. S.
Aug		77 05·3						E. Loomis.
May 21		77 11·5	May 21			·6436		J. H. Lefroy.
		77 18·0			·1444			L. S.
								S. W. Very.
May 23		78 06·3	May 23			·6460		J. H. Lefroy.
” 23		78 04·4	” 23			·6496		”
Oct. 30		78 08·1	Oct. 30			·6435		”
” 30		78 08·5	” 30			·6462		”
			” 30			·6417		”
		75 05·2						Dr. J. Rae.
		77 54·0			·1374			L. S.
May 21		77 56·1	May 21			·7019		J. H. Lefroy.
			” 21			·7050		”
			” 21			·7042		”
		78 15·9			·1291			C. I.
		77 36·0			·1379			L. S.
		77 02·0			·1451			L. S.
		78 42·0			·1253			L. S.
May 24	1-30p	79 43·6	May 24			·6226		J. H. Lefroy.
” 24		79 32·8	” 24			·6330		”
Aug. 26		78 56·0	Aug. 26			6358		C. B. Coomstock.
		78 04·0			·1319			L. S.
Oct. 21	2-00p	78 33·7	Oct. 21			·6509		J. H. Lefroy.
” 21		78 32·5	” 21			·6524		”
			” 21			·6494		”
May 25	a.m.	78 45·8	May 25			·6412		”
” 25	a.m.	78 40·8	” 25			·6460		”
Oct. 17	a.m.	78 32·8	Oct. 17			·6359		”
” 17	a.m.	78 29·9	” 17			·6387		”
			” 17			·6349		”

TABLE

MAGNETIC

ONTA

C. I.—Carnegie Institution.
L. S.—Lake Survey.
C. S.—Coast "

Place.	Latitude.		Longitude.		Year.	Month and day.	Hour and minute.	Declination.	
	°	′	°	′				°	′
Pic, Lake Superior	48	35·3	86	15·0	1845				
Peninsula harbor	48	42·0	86	20·0	1906·7			4	53·7W
"	48	44·0	86	28·0	1824				
*Black Rock	48	41·0	86	30·0	1906·7			19	26·4W
Pic island	48	42·0	86	34·0	1906·7			2	45·8 "
Sunday harbor	48	37·0	86	59·0	1906·7			1	21·0 "
Schreiber	48	49·0	87	18·0	1906·7			0	22·4 "
*Battle island, Lake Superior	48	45·0	87	33·0	1843				
" "	48	45·0	87	33·0	1843				
" "	48	45·0	87	33·0	1843				
" "	48	45·0	87	33·0	1906·7			1	57·6W
Simpson island, L. Superior	48	49·0	87	45·0	1843	May 27	6–30a	5	44·8 E
" "	48	49·0	87	45·0	1843				
Isle St. Ignace	48	46·0	87	48·0	1906·7			4	58·1 "
Spar Point island	48	38·0	88	06·0	1906·7			2	00·2 "
Lamb island	48	36·0	88	08·0	1906·7			6	12·0 "
*Porcupine island	48	38·0	88	09·0	1906·7			21	30·1W
Nipigon	49	01·0	88	16·0	1906·7			1	17·5 E
Roche de Bout ids.	48	31·0	88	21·0	1906·7			0	29·4W
Big Edward island	48	22·0	88	38·0	1906·8			3	28·4 E
Porphyry point	48	21·0	88	38·0	1906·8			3	16·2 "
Five miles east of Thunder cape	48	20·0	88	52·0	1843				
" "	48	20·0	88	52·0	1843				
Thunder harbor	48	19·0	88	53·0	1906·8			2	14·0 E
Port Arthur	48	26·0	89	12·6	1884				
Fort William	48	23·5	89	13·5	1843	May 29	5–32p	6	14·3 E
"	48	23·5	89	13·5	1843	" 30	4–12p	6	41·9 "
"	48	23·5	89	13·5	1843	" 30	4–17p	6	56·6 "
"	48	23·5	89	13·5	1843	" 31	9–11a	6	46·1 "
"	48	23·5	89	13·5	1824			9	05·0 "
"	48	23·5	89	13·5	1825	May 12		7	17·5 "
"	48	23·5	89	13·5	1844	Oct. 11		5	01·4 "
"	48	23·5	89	13·5	1844				
"	48	23·5	89	13·5	1844				
"	48	23·5	89	13·5	1845				
Fort William school	48	24·0	89	14·0	1902·8			3	49·9E
Fort William mission	48	24·0	89	14·0	1902·8			3	32·9 "
Fort William	48	24·0	89	14·0	1906·7			3	37·2 "
Sturgeon bay	48	11·0	89	18·0	1906·8			2	18·1 "
*Victoria island	48	05·0	89	21·0	1906·8			0	31·3 "
Dog portage	48	39·0	89	30·0	1843				
"	48	39·0	89	30·0	1843				
"	48	39·0	89	30·0	1844				
"	48	39·0	89	30·0	1844				
"	48	39·0	89	30·0	1844				
Pigeon river	48	00·0	89	34·0	1906·8			2	44·8E
*Portage Ecarté	48	25·0	89	44·0	1843				
"	48	25·0	89	44·0	1843				
Prairie portage	48	57·5	90	01·5	1843				
"	48	57·5	90	01·5	1843				
"	48	57·5	90	01·5	1844				
"	48	57·5	90	01·5	1844				
"	48	57·5	90	01·5	1844				
S. W. of Savanne portage	48	53·0	90	03·3	1825	May 21		9	23·9 E
" "		"		"	1843	June 6	7–52a	8	06·3 "
" "		"		"	1844	Oct. 6	7–12p	7	23·1 "

* Local disturbance.

V—*Con.*

RESULTS—*Con.*

RIO—*Con.*

Month and day.	Hour and minute.	Dip.	Month and day.	Hour and minute.	Hor. intens.	Total intens.	Temperature	Observer.
		° ′						
May..		78 34·0						Dr. J. Rae.
		77 47·0			·1419			L. S.
		78 34·0						Bayfield.
		81 50·0			·1016			L. S.
		78 08·0			·1320			L. S.
		78 18·0			·1298			L. S.
		78 24·8			·1271			C. I.
May 26		76 24·0	May 26			·6294		J. H. Lefroy.
			" 26			·6309		"
			" 26			·6291		"
		79 04·0			·1234			L. S.
May 27	8-00a	78 53·6	May 27			·6468		J. H. Lefroy.
" 27		78 46·2	" 27			·6457		"
		78 10 0			·1298			L. S.
		78 26·0			·1021			L. S.
		79 20·0			·1164			L. S.
		68 48·0			·1983			L. S.
		78 28·6			·1274			C. I.
		78 55·0			·1251			L. S.
		78 21·0			·1294			L. S.
		78 06·0			1315			L. S.
May 28		78 23·2	May 28			·6587		J. H. Lefroy.
" 28		78 30·0	" 28			·6480		"
		78 00·0			·1305			L. S.
July 14	2-40 to 3-20p	78 09·0	July 14	3-45 to 5-30p		·6402		E. Deville.
May 29		78 09·7	May 29			·6528		J. H. Lefroy.
" 29		78 10·2	" 29			·6509		"
			" 29			·6500		"
			" 31			·6452 / ·6457		"
								Bayfield.
May 11		78 20 0						Franklin.
Oct. 11		78 07·5	Oct. 11			·6428		J. H. Lefroy.
" 11		77 55·5	" 11			·6423		"
" 11		77 55·5	" 11			·6387		"
		78 11·0						Dr. J. Rae.
		77 54·6			·1332			C. S.
		77 54·9			·1331			C. S.
		77 48·0			·1341			C. I.
		77 29·0			·1349			L. S.
		77 51·0			·1348			L. S.
June 3	4-30p	78 26·8	June 3			·6518		J. H. Lefroy.
" 3		78 25 0	" 3			·6480		"
			Oct. 9			·6507		"
			" 9			·6533		"
			" 9			·6547		"
		78 07·0			·1295			L. S.
June 2		77 13·5	June 2			·6463		J. H. Lefroy.
			" 2			6442		"
June 5		78 26·1	" 5			·6486		"
" 5		78 28·2	" 5			·6446		"
			Oct. 7			·6515		"
			" 7			·6560		"
			" 7			·6543		"
May 20		78 39·1						Franklin.
								J. H. Lefroy.
Oct. 6	11-00a	78 21·8	Oct. 6			·6507		"

TABLE

MAGNETIC

ONTA

C. I.—Carnegie Institution.
L. S.—Lake Survey.
C. S.—Coast Survey.

Place.	Latitude.	Longitude.	Year.	Month and Day.	Hour and Minute.	Declination.
	° ′	° ′				° ′
S. W. of Savanne portage	48 53·0	90 03 3	1844	Oct. 6	7–50a	7 25·6 E
" "	"	"	1857			6 53·0 "
Savanne	48 58·0	90 14·0	1906·7			4 33·8 "
French portage	48 35·0	91 08·4	1843			
"	"	"	"			
End of the portage of the Two Rivers	48 35·0	91 23 0	1843	June 9	9–56a	10 57·6 "
" "	"	"	"			
" "	"	"	1844			
" "	"	"	"			
" "	"	"	"			
Ignace	49 25 0	91 40·0	1906·7			6 14·6 "
E. end of Lac à la Crosse	48 24·0	92 04 0	1843	June 10	7–44a	7 52·5 "
" "	"	"	"			
2nd portage, Lac à la Crosse	48 14·2	92 25·0	"	June 11	7–41a	10 40·3 "
" "	"	"	"	"	8-13a	10 01 0 "
Sturgeon lake	48 27·5	92 38·0	"			
"	"	"	"			
Farrington	48 46·0	92 48·0	1906·8			7 39·2 "
S. side, Lac à la Pluie	48 33·4	92 50·0	1843	June 13	9–30a	10 53·6 "
" "	"	"	"			
Eagle river	49 48·0	93 11 0	1906·7			6 39·7 "
Fort Frances	48 36·6	93 26·7	1825	May 28		10 42·6 "
"	"	"	1843	June 14	6–25p	10 33·3 "
"	"	"	"	"	6–52p	10 36.7 "
"	"	"	"	"	6–00	
"	"	"	"			
"	"	"	"			
"	"	"	1844	Sept. 30	9–26a	8 36·7 "
"	"	"	"	"	3–17p	8 34·1 "
"	"	"	"			
"	"	"	1845			
"	"	"	1857			9 31·0 "
Kenora	49 46 0	94 26·0	1906·7			9 54·1 "
Near Rat portage, Winnipeg river	49 46·3	94 29·4	1885	June 22	10–30a	11 55·7 "
" "	"	"	"			
" "	"	"	"			
On N. bank of Rainy river	48 41·0	94 31 0	1843	June 16	7–48a	13 04.5 "
" "	"	"	"			
" "	"	"	"			
*Rainy river	48 43·0	94 31·0	1906·8			9 33·8 "
Rat portage	49 45·9	94 33·3	1843	June 20	10–11a	9 38·0 "
"	"	"	"			
"	"	"	"			
"	"	"	1844			
"	"	"	"			
"	"	"	"			
Winnipeg river	49 53·1	94 34·2	1885	June 25	10–00a	10 09.1 "
Island in Lake of the Woods	49 25·0	94 37·0	1843	June 18	3–14p	12 26·0 "
" "	"	"	"			
" "	49 19·0	94 40·0	"	June 17	7–58a	13 42·6 "
" "	"	"	"			
Sand lake, Winnipeg river	50 02·5	94 41·9	1885	June 28	10–45a	10 53·2 "
Settlement, mouth of White Dog river	50 08·2	94 54·4	1885	July 1	5–45p	9 41·0 "

*Local disturbance.

V—*Con.*

RESULTS—*Con.*

RIO—*Con.*

Month and Day.	Hour and Minute.	Dip.	Month and Day.	Hour and Minute.	Hor. Intens.	Total. Intens.	Temperature.	Observer.
		° '					°	
Oct. 6		78 14·4	Oct. 6			.6499		J. H. Lefroy.
								Palliser.
		78 09·9			.1304			C. I.
June 8		78 20·4	June 8			.6494		J. H. Lefroy.
"		78 05·5	"			.6471		"
June 9		77 49·4	June 9			.6508		"
"		77 53·2	"			.6473		"
			Oct. 4			.6384		"
			"			.6422		"
			"			.6407		"
		78 27·4			.1279			C. I.
June 10	10-00a	77 51·0	June 10			.6488		J. H. Lefroy.
			"			.6474		"
June 11		77 40·1	June 11			.6473		"
			"			.6453		"
June 12	1-00p	77 44·8	June 12			.6503		"
			"			.6462		"
		77 42·4			.1349			C. I.
June 13		77 47·9	June 13			.6515		"
"		77 28·7	"			.6461		"
		78 07·8			.1313			"
May 28		77 18·1						Franklin.
June 14		77 28·0	June 14			.6467		J. H. Lefroy.
"		77 22·8	"			.6480		"
			"			.6420		"
			"			.6471		"
			"			.6475		"
			Sept. 29			.6456		"
			"			.6487		"
			"			.6488		"
		77 32·0						Dr. J. Rae.
								Palliser.
		77 58·9			.1318			C. I.
June 22	10-25a to 10-45p	78 31·3	June 22	1-23 to 2-10p		.6444	87	Th. Fawcett.
Oct. 19	8-38 to 9-00a	78 36·1	Oct. 19	9-40 to 10-11a		.6445	34	"
"	9-03 to 9-35a	78 38·5	"	10-11 to 10-50a		.6403	37	"
June 16	9-00a	77 57·4	June 16			.6593		J. H. Lefroy.
"		78 14·9	"			.6633		"
			"			.6575		"
		77 27·2			.1376			C. I.
June 20		78 07·5	June 20			.6480		J. H. Lefroy.
"		78 07·1	"			.6463		"
"		78 00·5						"
			Sept. 25			.6417		"
			"			.6452		"
			"			.6446		"
June 25	10-10 to 11-30a	78 28·3	June 25	2-00 to 2-45p		.6504	79	Th. Fawcett.
June 18	1-00p	78 16·7	June 18			.6503		J. H. Lefroy.
"		78 15·2	"			.6413		"
June 17	9-20a	78 03·7	June 17			.6516		"
"		78 01·7	"			.6482		"
June 28	11-20 to 12-45a	78 31·4	June 28	1-20 to 1-43p		.6538	82	Th. Fawcett.
July 1	6-17 to 7-00p	78 28·2	July 1	7-02 to 8-00p		.6518	72	"

TABLE

MAGNETIC

HUDSON BAY AND

Place.	Latitude.	Longitude.	Year.	Month and day.	Hour and minute.	Declination.
	° ′	° ′				° ′
Eastmain	52 14·7	78 29·3	1890	Sept. 11	5-25 to 5-45p	15 01 6W
"	"	"	"	Oct. 2	4-25 to 4-41p	14 51·5 "
"	"	"	"			
"	"	"	"			
Rupert House	51 29 5	78 43·4	1890	Aug. 13.	5-14 to 5-38p	14 15·1 "
"	"	"	"			
"	"	"	"			
At sea, Hudson bay	63 17·0	78 55·0	1846			58 15·0 "
"	60 10 0	80 10·0	1846			
"	62 10·0	80 10 0	"			
"	52 20·0	80 17·0	"			
"	51 32·0	80 34·0	"			10 41·0 "
"	53 24·0	81 06·0	"			
"	53 42 0	81 09·0	"			12 48·0 "
"	60 20·0	81 12·0	"			
"	62 20·0	81 12·0	"			
"	53 57·0	81 30·0	"			
"	54 43·0	81 32·0	"			13 30·0 "
"	56 24·0	81 50·0	"			
"	56 40·0	81 57 0	"			
"	60 26·0	82 0·80	"			
"	55 25·0	82 14·0	"			11 53·0 "
"	55 29·0	82 24·0	"			
"	57 15·0	82 33·0	"			15 57·0 "
"	57 04·0	82 37·0	"			
"	57 32·0	82 37·0	"			16 15·0 "
"	57 09·0	82 42·0	"			17 16·0 "
"	60 25·0	82 42·0	"			
"	59 11·0	82 45·0	"			
"	60 45·0	82 45·0	"			
"	61 07·0	82 50·0	"			
"	58 53·0	82 52·0	"			20 52·0 "
"	57 15·0	82 53·0	"			15 57·0 "
On shore, Hudson bay	51 08·0	80 44·0	"			10 55·0 "
Moose Factory	51 15·0	80 56·0	"			12 40·0 "
"	51 15 4	80 40·5	1880	Aug. 14, 17, 20		15 27·5 "
"	51 14·5	80 56·0	1890	July 24	4-15 to 4-48p	15 14·7 "
"	"	"	"			
Fort Albany, Hudson bay	51 22·0	82 38·0	1775			
Fort Hope	66 32·0	86 56·0	1846			
"	"	"	"			
"	"	"	1847			
"	"	"	"			

VI.

RESULTS.

Surrounding Territory.

Month and day.	Hour and minute.	Dip.	Month and day.	Hour and minute.	Hor. Intens.	Total Intens.	Temperature	Observer.
Sept. 11	3-20 to 3-46p	80 43·4						Wm. Ogilvie.
" 11	4-16 to 4-30p	80 46·7						"
Oct. 2	2-28 to 2-57p	80 47·4						"
" 2	3-35 to 3-56p	80 42·6						"
Aug. 13	10-58 to 11-22a	80 26·6						"
" 13	11-57 to 12-18a	80 34·2						"
Oct. 5	3-47 to 4 09p	80 33·8						"
		86 35·0				·6248		T. E. L. Moore.
		87 01·0				·6160		"
		87 01·0				·6160		"
		81 49·0						"
		80 59·0						"
		82 20·0						"
						·6401		"
		86 07·0						"
		86 07·0						"
		83 02·0				·6358		"
		83 47·0				·6381		"
		84 10·0						"
		84 42·0				·6248		"
		85 20·0				·6257		"
		84 00·0				·6266		"
		83 48·0				·6114		"
		84 30·0				·6266		"
		84 31·0						"
		85 15·0				·6123		"
		84 36·0						"
		86 36·0				·6095		"
		86 30·0				·6289		"
		86 41·0				·6261		"
		87 00·0				·6082		"
		85 48·0						"
		84 34·0				·6238		"
		81 02·0				·6487		"
		81 30·0				·6510		"
								S. W. Very.
July 22	10-20 to 10-48a	80 48·5						Wm. Ogilvie.
" 23	11-30 to 11-57a	80 52·0						"
		79 20·0						Hutchins.
November		88 03·8						Dr. J. Rae.
December		88 14·0						"
January		88 17·5						"
February		88 12·2						"

TABLE

MAGNETIC

HUDSON BAY AND

Place.	Latitude.	Longitude.	Year.	Month and day.	Hour and minute.	Declination.
	° ′	° ′				° ′
Repulse bay	66 32·0	86 55·0	1846			
Near Wager river	65 10·0	87 30·0	"			
Three miles N. W. of cape Lady Pelly	64 30·0	88 00·0	"			
Knapp bay	64 06·0	88 00·0	"			
"	61 09·7		"			
Mouth of Albany R., Lake St. Joseph	51 12·7	90 09·8	1885	Sept. 10	3-50p	6 09·0 E
" "	"	"	"	" 11	8-30a	5 33·4 "
Lake St. Joseph	51 11·2	90 37·0	1885	Sept. 6	9-30a	5 22·0 "
"	"	"	"	" 6	4-10p	5 18·8 "
" *	50 58·8	91 08·0	"	Aug. 29	5-50p	24 27·2 "
" *	"	"	"	" 30	10-17a	23 43·9 "
On a portage, Root river	50 49·7	91 22·7	1885	Aug. 23	8-00a	7 20·3 E
" "	"	"	"	" 23	4-10p	7 07·5 "
Cat river	51 05·7	91 24·2	"	Sept. 20	10-15a	5 35·3 "
"	"	"	"	" 20	3-33p	5 35·0 "
Root river	50 41·2	91 35·8	"	Aug. 16	10-00a	6 55·7 "
"	"	"	"	" 16	3-15p	6 50·6 "
H. B. Co.'s post, Cat lake	51 44·3	91 46·2	"	Sept. 30	4-00p	4 50·1 "
" "	"	"	"	Oct. 1	6-40a	4 31·1 "
Cat river	51 30·0	91 49·7	"	Sept. 27	9-39a	5 12·3 "
"	"	"	"	" 27	4-13p	4 43·2 "
Cat lake	51 46·3	91 51·1	"			
"	"	"	"			
Lac Seul	50 23·7	92 04·8	"	Aug. 9	9-20a	8 22·4 E
"	"	"	"	" 9	4-40p	8 09·1 "
H. B. Co.'s post, Lac Seul	50 19·5	92 14·4	"	" 6	4-30p	7 03·9 "
" "	"	"	"	" 7	10-00a	7 09·4 "
At a creek	58 02·0	92 20·0	1846			
York Factory	56 59·9	92 26·0	1843	July 24	6-07p	9 37·8 E
"	"	"	"	" 24	6-40p	9 07·8 "
"	"	"	"	" 26	7-21a	8 16·2 "
"	"	"	"	" 26	7-36a	9 00·8 "
"	"	"	"			
"	"	"	"			
"	"	"	"			
"	"	"	1845			

* Local disturbance.

VI—*Con.*

RESULTS—*Con.*

SURROUNDING TERRITORY—*Con.*

Month and day.	Hour and minute.	Dip.	Month and day.	Hour and minute.	Hor. intens.	Total intens.	Temperature	Observer.
		° ′					°	
July 27		88 16·7						Dr. J. Rae.
		87 10·6						"
Aug. 3		88 27·1						"
		86 36·5						"
July 8		86 47·3						"
Sept. 10	4-12 to 4-55p	80 18·3	Sept. 10	5-00 to 5-25p		·6481	60	Th. Fawcett.
" 11	9-00 to 9-30a	80 21·4	" 11	9-35 to 10-00a		·6484	56	"
" 6	10-00 to 10-30a	80 25·3	" 6	10-35 to 11-00a		·6450	52	"
" 6	4-35 to 5-00p	80 19·0	" 6	5-55 to 6-20p		·6463	48	"
Aug. 29	6-10 to 6-38p	81 46·6	Aug. 29	6-40 to 7-04p		·6435	55	"
" 30	10-20 to 10-40a	81 48·8	" 30	11-56 to 12-15a		·6413	61	"
" 23	8-27 to 8-55a	79 42·1	Aug. 23	9-00 to 9-26a		·6513	51	"
" 23	4-26 to 4-54p	79 39·4	" 23	4-56 to 5-15p		·6500	48	"
Sept. 20	10-15 to 11-08a	80 05·7	Sept. 20	11-10 to 11-40a		·6491	70	"
" 20	4-03 to 4-30p	80 04·5	" 20	4-35 to 5-00p		·6493	60	"
Aug. 16	0-08 to 0-33p	79 27·1	Aug. 16	0-35 to 1-00p		·6526	67	"
" 16	3-28 to 3-52p	79 26·1	" 16	3-54 to 4-10p		6516	70	"
Sept. 30	4-00 to 4-30p	80 29·0	Sept. 30	4-32 to 5-00p		·6497	46	"
Oct. 1	7-40 to 8-10a	80 29·0	Oct. 1	8-18 to 8-42a		.6475	47	"
Sept. 27	10-02 to 10-24a	80 11·6	Sept. 27	10-26 to 11-00a		·6533	67	"
" 27	4-35 to 5-07p	80 07·0	" 27	5-09 to 5-25p		·6548	61	"
Oct. 1	3-26 to 4-15p	80 24·6	Oct. 1	4-20 to 5-07p		·6538	55	"
1	4-17p	80 21·8	" 1	5-08 to 5-30p		·6523	55	"
Aug. 9	4-40 to 5-35p	79 03·9	Aug. 9	5-38 to 6-00p		.6557	72	"
" 9	6-07 to 6-30p	79 04·9	" 9	10-36 to 11-00		·6539	70	"
" 6	4-43 to 5-12p	79 35·3	" 6	5-18 to 5-40p		·6534	70	"
" 7	10-00 to 10-33a	79 34·4	" 7	10-35 to 11-00a		·6537	69	"
June 20		84 46·4						Dr. J. Rae.
July 24	11-00a	83 50·5	July 24			·6492		J. H. Lefroy.
" 24	3-00p	83 44·0	" 24			·6481		"
			" 25			·6500		"
			" 25			·6433		"
			" 25			·6460		"
			" 26			·6495		"
			" 26			·6494		"
Dec. 3		83 54·2						Dr. J. Rae.

TABLE

MAGNETIC

HUDSON BAY AND

Place.	Latitude.	Longitude.	Year.	Month and day.	Hour and minute.	Declination.
	° ′	° ′				° ′
York Factory	56 59·9	92 26·0	1846	...	...	...
"	"	"	"	...	...	...
"	"	"	1847	...	...	...
"	"	"	1857	...	...	...
"	"	"	"	...	...	...
"	"	"	1884	Sept. 12	10–15 to 11–53a	6 45·0 E
"	"	"	"	" 13	9–20 to 9–46a	6 32·0 "
Shanty narrows, Lac Seul	50 29·3	92 51·57	1885	Aug. 1	5–33p	6 54·7 "
" "	"	"	"	" 2	7–47a	7 15·7 "
Jct. of the Shamattawa and Hayes rivers	56 21·0	93 00·0	1843	July 22	6–15p	10 00·0 "
" "	"	"	"	" 28	4–03p	12 19·6 "
" "	"	"	"	...	...	...
" "	"	"	"	...	...	...
English river	50 38·9	93 10·2	1885	July 29	5–30p	9 21·0 E
"	"	"	"	...	...	...
Camping lake, English river	50 38·1	93 24·1	"	July 26	9–40a	8 20·0 "
" "	"	"	"	...	...	...
White Mud portage	55 33·0	93 44·6	1843	July 31	7–19a	10 51·0 E
" "	"	"	"	...	...	...
" "	"	"	"	...	...	...
" "	"	"	"	...	...	...
Tide lake, English river	50 20·6	93 57·0	1885	July 18	6–15p	9 24·8 E
" "	"	"	"	" 19	5–30a	9 23·8 "
Devils Landing Place	54 24·0	94 00·0	1844	Aug. 1	8–24a	11 49·4 "
" "	"	"	"	...	...	...
Grassy narrows, English river	50 10·7	94 02·2	1885	July 15	5–00p	9 28·0 "
" "	"	"	"	...	...	...
Fort Churchill	58 43·8	94 14·0	1846	June 29	a.m.	12 43·0 E.
"	"	"	"	July 1	p.m.	11 29·0 "
"	"	"	"	...	...	...
"	"	"	"	...	...	...
"	"	"	"	...	...	...
Long portage	55 14·0	94 22·0	1819	Sept.	...	11 10·4 E.
"	"	"	1843	July 20	5–42a	12 59·4 "
"	"	"	"	Aug. 2	6–29a	12 13·5 "
"	"	"	"	...	...	...
"	"	"	"	...	...	...
"	"	"	"	...	...	...
English river	50 16·0	94 30·6	1885	July 12	8–10a	9 44·7 E.
"	"	"	"	...	...	...
"	50 21·8	94 39·3	"	" 9	6–00p	10 21·2 E.
"	"	"	"	...	...	...
"	50 14·5	94 59·3	"	July 5	9–50a	9 07·0 E.

VI—*Con.*

RESULTS—*Con.*

SURROUNDING TERRITORY—*Con.*

Month and day.	Hour and minute.	Dip. °	Dip. '	Month and day.	Hour and minute.	Hor. intens.	Total intens.	Temperature °	Observer.
Feb. 9		83	42·9						Dr. J. Rae.
April 25		83	35·5						"
Sept. 18		83	47·0						"
Aug. 9		83	53·0				·6466		Blakiston.
							·6463		"
Sept. 11	3-05 to 3-40p	83	47·2	Sept. 11	3-45 to 4-10p		·6419		Otto Klotz.
" 11	4-18 to 4-56p	83	46·7	" 11	3-45 to 4-10p		·6423		"
Aug. 1	5-35 to 6-20p	79	16·3	Aug. 1	6-25 to 6-50p		·6557	59	Th. Fawcett.
" 2	8-00 to 8-55a	79	14·9	" 2	9-00 to 9-32a		·6520	78	"
July 28	4-00p	83	36·2	July 22			.6508		J. H. Lefroy.
" 22		83	41·6	" 28			·6534		"
" 28		83	30·2	" 22			·6504		"
				" 28			·6496		"
July 29	5-50 to 6-30p	79	10·8	" 29	6-40 to 7-06p		·6486	74	Th. Fawcett.
" 29	7-36 to 8-10p	79	13·0	" 29	7-36 to 8-10p		·6474	71	"
" 26	9-40 to 11-00a	79	16·1	" 26	11-05 to 11-48a		·6477	75	"
" 26	4-00 to 4-28p	79	18·2	" 26	4-30 to 5-05p		·6463	67	"
" 21	1-00p	83	02·9	" 21			·6552		J. H. Lefroy.
" 21		83	11·6	" 31			·6511		"
" 31		83	00·0	" 21			·6484		"
				" 31			·6472		"
July 18	6-15 to 7-25p	79	20·0	" 18	7-30 to 8-05p		·6460	60	Th. Fawcett.
" 19	9-30 to 10-35a	79	22·9	" 19	10-40 to 11-25a		·6486	63	"
Aug. 1		82	55·0	Aug. 1			.6576		J. H. Lefroy.
				" 1			·6512		"
July 15	5-00 to 5-50p	79	09·3	July 15	6-00 to 6-30p		·6429	74	Th. Fawcett.
" 15	7-30 to 8-00p	79	02·5	" 15	8-15 to 8-50p		·6471	65	"
June 29		84	57·5						Dr. J. Rae.
" 29		84	44·2						"
July 1		84	33·9						"
" 1		84	53·8						"
" 4		84	44·5						"
									Franklin.
July 19	4-30p	82	13·9	July 20			·6543		J. H. Lefroy.
" 20		82	21·3	Aug. 2			·6566		"
Aug. 2		82	32·2	" 2			·6540		"
				July 20			·6568		"
				Aug. 2			·6534		"
July 12	9-06 to 9-45a	79	19·0	July 12	10-25 to 10-46		·6405	83	Th. Fawcett.
" 12	10-50 to 11-52a	79	13·6	" 12	0-00 to 0-35p		·6414	75	"
" 9	6-00 to 7-00p	79	25·9	" 9	7-30 to 7-55p		·6435	54	"
" 9	8-00 to 8-40p	79	18·7	" 10	7-00 to 7-20a		·6457	64	"
" 5	9-15 to 11-10a	79	08·0	" 5	0-10 to 0-32p		·6464	89	"

TABLE

MAGNETIC

HUDSON BAY AND

Place.	Latitude.	Longitude.	Year.	Month and day.	Hour and minute.	Declination.
	° ′	° ′				° ′
*Oxford House	54 56·0	95 30·0	1843	Aug. 3	5–10p	10 31·5 E.
"	"	"	"			
"	"	"	"			
Hell Gate, Upper portage	54 42·0	96 10·0	"			
" "	"	"	"			
" "	"	"	"			
" "	"	"	"			
East end Split lake, Nelson river	56 13·3	96 18·8	1884			
South end of White Fall portage	54 23·3	96 31·0	1843	Aug. 5	3–36p	17 32·0 E.
South end of White Fall portage	"	"	"			
Nelson river	55 20·8	97 06·3	1884			
Hairy lake, mouth of R. Echimamish	54 20·0	97 28·0	1843	July 15	4–00p	18 43·7 E.
Hairy lake, mouth of R. Echimamish	"	"	"			
Nelson river, on an island of granite	54 16·8	97 46·4	1884	July 27	5–40p	16 11·0 E.
Nelson river	54 50·1	98 11·8	1884			
Duck Nest, Lake Winnipeg	53 15·5	97 33·5	1886	Aug. 3	8–45a	16 41·6 E.
" "	"	"	"			
Old Norway House	53 41·6	98 01·4	1819			
"	"	"	1843			
"	"	"	"			
"	"	"	"			
Norway House	53 59·6	98 03·9	1843	July 13	6–45p	16 21·9 E.
"	"	"	"	" 13	7–04p	16 00·0 "
"	"	"	"	" 13	7–10p	15 58·6 "
"	"	"	"	" 13	7–30p	15 12·1 "
"	"	"	"			
"	"	"	"			
"	"	"	1844	Sept. 6	5–22p	14 51·0 E.
"	"	"	"	" 7	9–12a	15 22·0 "
"	"	"	"			
"	"	"	"			
"	"	"	"			
"	"	"	1884	July 22	4–30p	14 55·0 E.
"	"	"	"	" 24	4–30p	14 59·0 "
"	"	"	"	Oct. 4	3–15p	15 00·0 "
"	"	"	"			

* Local disturbance.

VI—*Con.*

RESULTS—*Con.*

SURROUNDING TERRITORY—*Con.*

Month and day.	Hour and minute.	Dip.	Month and day.	Hour and minute.	Hor. intens.	Total intens.	Temperature	Observer.
		° ′						
Aug. 3....	5-30p	82 38·8	Aug. 3 ..	......	....	·6568	....	J. H. Lefroy.
" 3....	....	82 43·4	" 3....	....	....	·6542	....	"
....	....	....	" 3....	....	....	·6548	....	"
Aug. 4....	1-30p	81 57·0	" 4....	....	....	·6557	....	"
" 4	....	81 53·5	" 4....	....	....	·6540	....	"
....	....	....	" 4....	....	....	·6544	....	"
....	....	....	" 4....	....	....	·6509	....	"
Aug. 17....	4-10 to 4-55p	82 49·9	" 17....	5-05 to 5-39p	....	·6453	61	Otto Klotz.
" 5..	1-00p	81 47·9	" 5....	....	....	·6557	....	J. H. Lefroy.
" 5....	....	81 51·6	" 5 ...	....	....	·6524	....	"
" 10....	4-45 to 5-25p	81 58·1	" 10....	5-30 to 5-55p	....	·6593	68	Otto Klotz.
July 15....	4-30p	81 20·9	July 15....	....	....	·6487	....	J. H. Lefroy.
....	....	....	" 15..	....	....	·6483	....	"
July 27....	3-45 to 4-35p	81 23·8	" 27 ...	4-45 to 5-15p	....	·6512	69	Otto Klotz.
Aug 3....	5-34 to 6-13p	82 24·3	Aug. 3....	6-17 to 6-44p	....	·6428	67	"
" 3....	9-00 to 10-00a	80 50·8	" 3....	10-30 to 11-30a	....	·5996	....	F. W. Wilkins.
" 3....	1-30 to 2-30p	80 46·8	" 3 ...	2-45 to 3-30p	....	·6026	....	"
Oct. 7....	....	83 40·0	....	....	....	....	....	Franklin.
Aug. 12 ...	....	80 45·4	Aug. 12....	....	....	·6506	....	J. H. Lefroy.
" 12....	....	80 49·4	" 12 ...	....	....	·6552	....	"
....	....	....	" 12....	....	....	6551	....	"
July 12 ...	....	81 11·0	July 13 ...	....	....	·6536	....	"
" 13..	....	81 06·2	Aug. 8....	....	....	·6522	....	"
Aug. 9....	....	81 09·4	" 8....	....	....	·6531	....	"
....	....	....	" 9 ...	....	....	·6503	....	"
....	....	....	July 14....	....	....	·6514	....	"
....	....	....	" 14 ...	....	....	·6513	....	"
Sept. 7 ..	a.m.	81 11·1	Sept. 6 ..	....	....	·6475	....	"
" 7....	....	81 11·4	" 6....	....	....	·6515	....	"
....	....	....	" 6....	....	....	·6540	....	"
....	....	....	" 6....	....	....	·6530	....	"
....	....	....	" 6...	....	....	·6560	....	"
July 23....	2-43 to 3-32p	81 05·4	July 23....	3-40 to 4-06p	....	·6525	80	Otto Klotz.
" 23....	4-12 to 4-59p	81 12·0	" 23....	5-02 to 5-19p	....	·6489	70	"
Oct. 4....	9-30 to 10-45a	81 18·0	Oct. 4....	10-50 to 11-15a	....	·6459	52	"
" 4....	0-00 to 0-50p	81 15·8	" 4 ..	1-00 to 1-20p	....	·6463	53	"

TABLE

MAGNETIC

C.I.—Carnegie Institution.

MANI

Place.	Latitude. ° ′	Longitude. ° ′	Year.	Month and day.	Hour and minute.	Declination. ° ′
Winnipeg river	50 10·2	95 12·0	1843	June 21	5-12p	12 28·7 E
"	"	"	"			
Slave falls	50 14·7	95 40·0	1843			
"	"	"	"			
Badger	49 12·0	95 56·0	1906·8			11 05·0 "
Fort Alexander	50 36·9	96 22·0	1825	June 5		15 15·7 "
"	"	"	1834			
"	"	"	1843	June 25	6-37p	13 29·0 "
"	"	"	"	" 26	4-49a	14 25·3 "
"	"	"	1844	Sept. 20	7-39a	14 03·4 "
"	"	"	"	" 20	8-26a	14 04·2 "
"	"	"	"			
*Big island, Lake Winnipeg	51 04·0	96 26·0	1844			
" "	"	"	"			
" "	"	"	"			
Bay of Winnipeg river, Lake Winnipeg	50 41·7	96 31·4	1886	June 23	9-00a	12 40·2 "
" " "	"	"	"			
Lake Winnipeg	50 35·0	96 35·6	1843	June 26	6-06p	13 41·0 "
"	50 33·4	96 36·0	1843			
About six miles N. of Loon creek, Lake Winnipeg	51 36·9	96 37·3	1886	July 9	8 45a	14 41·6 "
" " "	"	"	"			
*Lake Winnipeg, on an island.	51 34·0	96 43·0	1844	Sept. 17	9-36a	15 06·7 "
" " "	"	"	"			
" " "	"	"	"			
Selkirk	50 09·2	96 51·8	1886			
"	"	"	"			
On Red river	50 18·2	96 52·0	1843			
"	"	"	"			
West Selkirk	50 10·0	96 52·0	1907·8			13 16·8 "
*Opposite Bull's Head, Lake Winnipeg	51 36·7	96 53·0	1843	July 6	7-59a	16 25·1 "
" " "	"	"	"			
On Red river	51 36·0	96 56·0	1843	July 5	6-53p	13 40·9 "
"	"	"	"	" 5	7-05p	13 10·5 "
"	"	"	"	July 5	7-19p	14 04·2 "
Island east of Bear island, Lake Winnipeg	51 46·0	97 00·0	1843			
" " "	"	"	"			
" " "	"	"	"			
*Lake Winnipeg	51 44·5	97 02·0	1844	Sept. 16	9-05a	15 24·2 "
"	"	"	"			
"	"	"	"			
Winnipeg	49 52·0	97 09·0	1906·7			13 56·1 "
Lake Winnipeg	52 20·9	97 10·0	1844	Sept. 14	3-48p	16 54·6 "
"	"	"	"			
"	"	"	"			

* Local disturbance.

VII.

RESULTS.

TOBA.

Month and day.	Hour and minute.	Dip.	Month and day.	Hour and minute.	Hor. intens.	Total intens.	Temperature	Observer.
							°	
June 21.	......	79 10·0	June 21.	......	......	·6549	......	J. H. Lefroy.
" 21.	......	79 11·3	......	......	......	......	......	"
June 23.	......	78 57·1	June 23.	......	......	·6498	......	"
" 23. ...	......	78 56·0	......	......	......	......	......	"
......	......	77 36·4	......	......	·1369	......	......	C. I.
June 5. ...	......	78 47·1	......	......	......	......	......	Franklin.
......	......	78 54·0	......	......	......	......	......	Back.
June 25.	......	78 51·8	June 25.	......	......	·6477	......	J. H. Lefroy.
" 25.	......	78 55·8	......	......	......	......	......	"
Sept. 30.	......	79 03 4	Sept. 19. ...	......	......	·6561	......	"
" 30.	......	79 02 5	" 19.	......	......	·6564	......	"
......	......	......	" 19.	......	......	·6527	......	"
Sept. 18. ...	a. m.	79 31·5	Sept. 18.	......	......	.6685	......	"
......	......	......	" 18.	......	......	.6688	......	"
......	......	......	" 18.	......	......	.6705	......	"
June 23. ...	9-30 to 10-30a	78 59·4	June 23.	10-45 to 11-45a	......	·5999	71	F. W. Wilkins.
" 23. ..	1-30 to 2-20p	78 58·2	" 23.	2-45 to 3-45p	......	·5964	70	"
June 26.	7-00p	78 34·4	June 26.	......	......	·6514	......	J. H. Lefroy.
" 27.	......	79 05·1	......	......	......	......	......	"
July 9.	0-15 to 1-30p	78 49·5	July 9. ...	1-45 to 2-30p	......	·5981	78	F. W. Wilkins.
" 9.	9-00 to 10-00a	78 48·9	" 9.	10-30 to 11-15a	......	·6004	72	"
Sept. 17.	......	79 06·1	Sept. 17.	......	......	·6646	......	J. H. Lefroy.
......	......	......	" 17.	......	......	.6623	......	"
......	......	......	" 17.	......	......	.6639	......	"
June 7.	12-00 to 1-15p	78 22·8	June 7.	1-30 to 3-00p	......	·6008	69	F. W. Wilkins.
" 8.	9-00 to 10-40a	78 20·6	" 8.	11-00 to 12-00a	......	·6025	70	"
July 4.	......	78 34·0	July 4.	......	......	·6492	......	J. H. Lefroy.
......	......	......	" 4.	......	......	·6515	......	"
......	......	78 45 6	......	......	·1256	......	......	C. I.
July 6. ..	6-30p	79 38·0	July 6.	......	......	·6660	......	J. H. Lefroy.
......	......	......	" 6.	......	......	·6687	......	"
July 5. ...	8-00p	79 11·8	July 5.	......	......	·6490	......	"
" 5.	......	79 01·2	" 5. ..	......	......	·6514	......	"
......	......	......	......	......	......	......	......	"
July 7.	1-00p	79 28·3	July 7.	......	......	·6638	......	"
" 7.	......	79 28·8	" 7.	......	......	·6658	......	"
" 7.	......	79 32·2	" 7. ...	......	......	·6649	......	"
Sept. 16.	......	79 39·0	Sept. 16.	......	......	·7074	......	"
......	......	......	" 16. ...	......	......	·7091	......	"
......	......	......	" 16. ...	......	......	·7112	......	"
......	......	78 10·3	......	......	·1304	......	......	C. I.
Sept. 14.	......	80 24·4	Sept. 14.	......	......	·6633	......	J. H. Lefroy.
......	......	......	" 14. ...	......	......	·6655	......	"
......	......	......	" 14.	......	......	·6625	......	"

TABLE

MAGNETIC

C. I.—Carnegie Institution.

MANI

Place.	Latitude.	Longitude.	Year.	Month and day.	Hour and minute.	Declination.
	° ′	° ′				° ′
Wesleyan Mission, Berens riv..	52 22·6	97 12·0	1843	July 8.....	6–52p	14 13·3 E
" " ..	"	"	"	" 8.....	7–04p	14 20·7 "
Fort Garry.............. ...	49 53·2	97 15·6	1843	June 29.....	5-11p	15 27·6 "
"	"	"	"	" 30.....	7-18p	16 42·1 "
"	"	"	"	....	....	....
"	"	"	"	....	....	....
"	"	"	"	....	....	....
"	"	"	"	....	....	....
"	"	"	"	....	....	....
"	"	"	"	....	....	....
Winnipeg, C.P.R. station.....	49 53·5	97 08·0	1882	....	....	....
" "	"	"	"	....	....	....
Winnipeg...............	49 52·0	97 09·0	1908	July 16, 17, 18, 20.....	10-30a	13 58.6
Near Leaf river, Lake Winnipeg..	52 31·6	97 18·0	1843	July 10.....	8-03a	19 12·2 E
" " "	"	"	"	....	....	....
" " "	"	"	"	....	....	....
" " "	"	"	"	....	....	....
" " "	"	"	"	....	....	....
Four miles south of War Path river, Lake Winnipeg.......	52 18·3	98 14·6	1886	Sept. 22. ..	9-00a	15 48·4 "
" " "	"	"	"	....	....	....
End of Long point, Lake Winnipeg......	53 02·5	98 27·5	1886	Sept. 9. ..	8-45a	15 39·1 "
" " "	"	"	"	....	....	....
North side of Long point, Lake Winnipeg.	53 04·2	98 44·5	1886	Sept. 6.....	8-45a	17 31·8 "
" " "	"	"	"	....	....	....
North end of Limestone bay, Lake Winnipeg............	53 53·8	98 48·7	1886	Aug. 19....	8-15a	15 13·8 "
" " "	"	"	"	....	....	....
Lake Winnipeg.	53 31·9	99 12·0	1843	Aug. 14 ..	8-14a	17 07·3 "
"	"	"	"	....	....	....
"	"	"	"	....	....	....
"	"	"	"	....	....	....
Grand Rapids, east end......	53 08·4	99 27·0	1843	Aug. 15....	4-14p	19 12·9 "
" "	"	"	"	....	....	....
" "	"	"	1844	Sept. 2. ...	9-43a	17 25·0 "
" " ...	"	"	"	....	....	....
" "	"	"	"	....	....	....
" "	"	"	"	....	....	....
H. B. Co's. post, Grand Rapids	53 13·4	99 29·0	1884	July 17.....	6-15p	15 38·0 "
Cross lake	53 10·1	99 34·0	1843	Aug. 16....	9-34a	18 03·7 "
"	"	"	"	....	....	....
"	"	"	"	....	....	....
"	"	"	"	....	....	....
"	"	"	"	....	....	....
"	"	"	"	....	....	....
"	"	"	"	....	....	....
Brandon.	49 50·0	99 57·0	1884	July 18. ..	5-42p	14 46·5 "
"	"	"	"	" 19.....	9-02a	15 06·8 "
"	"	"	"	" 19....	11-32a	14 47·0 "
"	49 52·0	99 58·0	1906·7	....	....	15 00·2 "

V I I—*Con.*

RESULTS—*Con.*

TOBA—*Con.*

Month and day.	Hour and minute.	Dip.	Month and day.	Hour and minute.	Hor. Intens.	Total Intens.	Temperature	Observer.
							°	
July 8	7-00p	80 39·2	July 8			·6524		J. H. Lefroy.
〃 8		80 28·9						〃
July 3		78 19·4	June 29			·6498		〃
〃 3		78 16·3	〃 29			·6492		〃
June 29		78 17·0	〃 29			·6466		〃
〃 29		78 10·0	〃 29			·6465		〃
July 3		78 10·7	〃 29			·6462		〃
			〃 29			·6486		〃
			〃 30			6457		〃
			July 1			·6459		〃
May		79 50·7						Wm. Ogilvie.
〃		79 49·9						〃
July 16, 17, 18, 20		78 13·0	July 16, 17, 18, 20		·13121			C. A. French.
July 10		80 03·7	July 10			·6510		J. H. Lefroy.
〃 10	2-03p	80 07·2	〃 10			·6509		〃
〃 10		80 08·2	〃 10			·6534		〃
			〃 10			·6485		〃
			〃 10			·6524		〃
Sept. 22	9-10 to 10-00a	79 43·9	Sept. 22	10-15 to 11-00a		·5996	50	F. W. Wilkins.
〃 22	11-15 to 12-15a	79 47·4	〃 22	0-45 to 1-30p		·5953	55	〃
Sept. 9	9 00 to 10-00a	80 26·5	Sept. 9	10-15 to 11-00a		·5986	61	〃
〃 9	10-15 to 11-15a	80 23·4	〃 9	11-13 to 12-15p		·5992	62	〃
Sept. 6	9-00 to 10-00a	81 01·5	Sept. 6	10-30 to 11-15a		·5983	68	〃
〃 6	10-30 to 12-15a	80 58·9	〃 6	0-45 to 1-30p		·5988	70	〃
Aug. 19	8-30 to 9-30a	81 03·4	Aug. 19	9-45 to 10 30a		·5941	68	〃
〃 19	10-45 to 11-30a	80 58·1	〃 19	11-40 to 12-15a		·5984	69	〃
Aug. 14	5-00a	80 16·8	Aug. 14			·6533		J. H. Lefroy.
〃 14	5-00a	80 19·7	〃 14			·6483		〃
〃 14		80 30·0	〃 14			·6486		〃
			〃 14			·6500		〃
Aug. 15	6-30p	80 21·5	Aug. 15			·6540		〃
			〃 15			6494		〃
Sept. 2	6-30a	80 31·6	Sept. 2			6547		〃
			〃 2			·6517		〃
			〃 2			·6496		〃
			〃 2			·6494		〃
July 19	4-25 to 5-05p	80 24·9	July 19	5-05 to 5 25p		·6503		O. Klotz.
Aug. 16	p.m.	80 28·2	Aug. 16			·6546		J. H. Lefroy.
			〃 16			·6474		〃
			〃 16			·6549		〃
			〃 16			·6537		〃
			〃 16			·6541		〃
			〃 16			·6537		〃
			〃 16			·6573		〃
July 18	3-20 to 4-20p	77 34·9	July 18	4-45 to 5-55p		·6459	72	E. Deville.
〃 19	10-00 to 11-00a	77 37·0	〃 19	11-15 to 12-00a		·6453	82	〃
								〃
		77 28·7			·1381			C. I.

TABLE

MAGNETIC

C. I.—Carnegie Institution.

MANI

Place.	Latitude.		Longitude.		Year.	Month and day.	Hour and minute.	Declination.	
	°	′	°	′				°	′
Hare island, Cedar lake.......	53	12·2	100	00·0	1843	....	....	....	
Chemahawin, Saskatchewan river......................	53	20·4	100	32·2	1884	July 5......	8-00p	17	36·0 „
Devil's Drum island, Saskatchewan R................	53	19·5	100	36·0	1843	Aug. 9	7-30p	17	32·2 „
" " "		"		"	"	....	....	....	
" " "		"		"	"	....	....	....	
Lauder......................	49	24·0	100	43·0	1906·7	....	....	16	09·5 „
On bank of Saskatchewan river	53	52·6	101	11·0	1884	....	....	....	
Kirkella	50	02·0	101	22·0	1906·7	....	....	16	02·4 „
Round Turn, Saskatchewan river..........................	53	48·8	101	23·0	1844	Aug. 31....	10-39a	19	56·8 „
" " "		"		"	"	....	....	....	
" " "		"		"	"	....	....	....	
On bank of Saskatchewan river	54	02·2	101	34·9	1844	June 22.....	7-00p	19	22·0 „
Sturgeon Weir river..........	54	20·9	101	42·9	1888	Oct. 7......	9-50a	18	27·3 „
At Swan River Barracks......	51	54·4	101	57·3	1880	June 12.....	1-00p	19	37·3 „
" " "		"		"	"	....	....	....	
" " "		"		"	"	....	....	....	

VII—*Con.*

RESULTS—*Con.*

TOBA—*Con.*

Month and day.	Hour and minute.	Dip.	Month and day.	Hour and minute.	Hor. intens.	Total intens.	Temperature	Observer.
		° ′					°	
Aug. 18....		80 07·1	Aug. 18....			·6484		J. H. Lefroy.
July 7....	1-25 to 2-19p	80 04·4	July 7....	2-25 to 2-48p		·6487		O. Klotz.
Aug. 19....		80 00·0	Aug. 19....			·6393		J. H. Lefroy.
			" 19....			·6356		"
			" 19....			·6358		"
		76 53·7			·1433			C. I.
June 28 ...	6-08 to 6-50p	80 20·2	June 28 ...	6-54 to 7-20p		·6463	56	O. Klotz.
		77 17·0			·1400			C. I.
Aug. 31 ...		80 24·4	Aug. 31....			·6600		J. H. Lefroy.
			" 31....			·6592		"
			" 31....			·6614		"
June 22....	5-30 to 6-13p	80 20·3	June 22....	6-20 to 6-50p		·6466	81	O. Klotz.
Oct. 7....	10-30 to 10-55a	80 16·3	Oct. 7....	11-27 to 11-45a		·6170	60	Th. Fawcett.
June 12....	11-15 to 11-50a	78 33·4						W. F. King.
June 7 & 8..	7-30 to 8-15p, 2-00 to 2-30p	78 38·4						"
" 13....	9-45 to 10-30a	78 36·0						"

TABLE

MAGNETIC

C. I—Carnegie Institution.

SASKATCHEWAN

Place.	Latitude.	Longitude.	Year.	Month and day.	Hour and minute.	Declination.
	° ′	° ′				° ′
On Ellice and Touchwood trail	50 42·5	102 00·0	1880	May 22.....	11-00a	18 51·0 E.
" " ..	"	"	"	" 22.....	2-00p	18 56·0 "
" " ..	"	"	"	" 27.....	4-00p	18 48·0 "
" " ..	"	"	"	" 31	11-00a	18 48·0 "
On Pelly and Qu'Appelle trail.	51 44·8	102 00·8	"	June 16.....	7-00p	20 10·0 "
" " ..	"	"	"	" 17. .	6-00p	20 15·0 "
Limestone point, Beaver lake..	54 26·0	102 10·0	1843	....	....	....
" " ..	"	"	"	....	....	....
" " ..	"	"	"	....	....	....
" " ..	"	"	"	....	....	....
" " ..	"	"	"	....	....	....
Cumberland House........	53 56·7	102 19·2	1819	Nov. 19..	....	17 17·5 E.
"	"	"	1825	May 22..	....	19 14·3 "
"	"	"	1843	Aug. 23....	7-30a	19 52·4 "
"	"	"	"	" 23....	7-58a	19 43·8 "
"	"	"	"	....	....	....
"	"	"	"	....	....	....
"	"	"	"	....	....	....
"	"	"	"	....	....	....
"	"	"	"	....	....	....
"	"	"	"	....	....	....
"	"	"	"	....	....	....
"	"	"	"	....	....	....
"	"	"	"	....	....	....
"	"	"	1844	Aug. 29....	5-39p	19 16·7 E.
"	"	"	"	....	....	....
"	"	"	"	....	....	....
"	"	"	1884	June 17.....	6-00p	20 09·0 E.
"	"	"	"	....	....	....
"	"	"	1888	Oct. 14.....	2-30p	19 19·1 E.
"	"	"	"	" 14.....	2-40p	19 37·9 "
Broadview................	50 24·0	102 35·0	1906·7	....	....	17 05·7 "
Carp portage, Great river.....	54 47·2	102 39·5	1843	Aug. 27....	2-23p	24 08·6 "
Pine portage..............	55 04·0	102 42·0	1843	....	....	....
"	"	"	"	....	....	....
"	"	"	"	....	....	....
"	"	"	"	....	....	....
"	"	"	"	....	....	....
Estevan....................	49 09·0	102 58·0	1906·7	....	....	17 29·4 E.
Northeast of Beaver hills.....	51 38·7	103 08·0	1880	June 21....	5-30p	19 30·0 "
" "	"	"	"	" 22.....	4-30p	19 30·0 "
" "	"	"	"	" 25.....	7-30p	19 41·0 "
Frog portage............	55 24·1	103 15·2	1888	Sept. 21. ..	1-55p	21 10·8 "
"	"	"	"	" 21.....	2-10p	20 30·4 "
On an island, Saskatchewan riv.	53 38·2	103 41·9	1884	June 8. ...	8-00a	20 25·0 "
Northwest of Beaver hills.....	51 32·0	103 42·6	1880	" 27...	6-30p	19 45·0 "

VIII.

RESULTS.

AND ALBERTA.

Month and day.	Hour and minute.	Dip.	Month and day.	Hour and minute.	Hor. intens.	Total intens.	Temperature	Observer.
		° ′					°	
May 23.....	11-00 to 12-00a	78 00·5	...	...	...	...	...	W. F. King.
" 24.....	7-00 to 7-45p	77 51·6	...	...	...	...	...	"
" 27....	5-00 to 6-00p	77 42·5	...	...	...	...	...	"
...	...	...	...	...	...	...	...	"
June 16	7-15 to 7-45p	78 34·8	...	...	...	...	...	"
...	...	...	...	...	...	...	...	"
Aug. 26.....	2-00 to 3-00p	80 34·2	Aug. 26	...	...	·6501	...	J. H. Lefroy.
...	...	...	" 26....	...	...	·6421	...	"
...	...	...	" 26. ..	...	...	·6501	...	"
...	...	...	" 26. ...	...	...	·6436	...	"
...	...	...	" 26....	...	...	·6408	...	"
...	...	...	...	...	...	...	...	Franklin.
June 28....	...	80 21·1	...	...	...	...	...	"
Aug, 23	7-00a	80 28·2	Aug. 23.. .	...	...	·6504	...	J. H. Lefroy.
" 23....	...	80 31·8	" 23....	...	...	·6535	...	"
...	...	...	" 23....	...	...	·6460	...	"
...	...	...	" 24. ...	...	...	·6532	...	"
...	...	...	" 24....	...	...	·6534	...	"
...	...	...	" 24....	...	...	·6522	...	"
...	...	...	" 24....	...	...	·6519	...	"
...	...	...	" 24....	...	...	·6527	...	"
...	...	...	" 23....	...	...	·6552	...	"
...	...	...	" 23....	...	...	·6551	...	"
...	...	...	" 23....	...	...	·6530	...	"
...	...	...	" 23....	...	...	·6528	...	"
Aug. 29....	p.m.	80 20·5	" 29....	...	...	·6530	...	"
" 29....	p.m.	80 19·5	" 29....	...	...	·6543	...	"
...	...	...	" 29....	...	...	·6470	...	"
June 17.....	9-43 to 10-29a	80 24·3	June 17. ...	10-40 to 11-05a	...	·6383	84	Otto Klotz.
" 17.....	4-07 to 4-44p	80 28·4	" 17....	4-48 to 5-11p	...	·6457	80	"
Oct. 14 ...	2-44 to 3-10p	80 26·4	Oct. 14....	3-10 to 4-00p	...	·6476	...	Th. Fawcett.
" 14.....	3-12 to 3-33p	80 21·4	" 14.....	4-00 to 4-15p	...	·6454	...	"
...	...	77 37·5	...	...	·1359	...	...	C. I.
Aug. 27....	1-30p	80 39·6	...	...	...	...	...	J. H. Lefroy.
" 28	11-00a	80 52·7	Aug. 28.....	...	...	·6532	...	"
...	...	...	" 28.....	...	...	·6473	...	"
...	...	...	" 28.....	...	...	·6518	...	"
...	...	...	" 28.....	...	...	·6501	...	"
...	...	...	" 28.....	...	...	·6465	...	"
...	...	76 18·3	...	...	·1490	...	...	C. I.
June 23 ...	5-00 to 5-30p	78 21·4	...	...	...	...	...	W. F. King.
" 24.....	8-30 to 9-10p	78 21·1	...	...	...	...	...	"
...	...	...	...	...	...	...	...	"
Sept. 21....	2-37 to 3-00p	81 00·7	Sept. 21....	3-09 to 3-23p	...	·6451	60	Th. Fawcett.
" 21.....	3-44 to 4-10p	80 59·1	" 21.....	3·25 to 3-36p	...	·6447	60	"
June 8.....	5-55 to 6-29p	79 49·7	June 8.....	6-35 to 6-57p	...	·6474	66	Otto Klotz.
" 26.....	0-00 to 1-00p	78 18 7	...	...	...	...	...	W. F. King.

TABLE

MAGNETIC

C. I.—Carnegie Institution.

SASKATCHEWAN

Place.	Latitude.	Longitude.	Year.	Month and day.	Hour and minute.	Declination.
	° ′	° ′				° ′
Northwest of Beaver hills...	51 32 0	103 42·6	1880	June 28.....	7-00a	20 00·0 E.
" " ..	"	"	"	....	......	....
Fort Qu'Appelle......	50 46·3	103 48·1	"	July 5......	3-00p	19 30·0 "
"	"	"	"	" 10.....	7-30a	19 40·0 "
On Touchwood and Qu'Appelle trail..	51 12 5	103 53·8	"	June 30....	7-30p	19 50·0 "
" " ..	"	"	"	July 1......	5-00a	19 50·0 "
Touchwood hills, H. B. Co's post.....	51 21 6	104 00 0	"	June 28	6-00p	18 33·6 "
On bank, Saskatchewan river..	53 18·7	104 04·7	1884	....	....	....
H. B. Co's post, Stanley......	55 25·4	104 18 9	1888	Sept. 15 ..	8-10a	23 38·2 E.
" "	"	"	"	" 15...	8-30a	22 53·9 "
Mountain portage............	55 33·4	104 19·2	"	" 13....	3-40p	20 10 7 "
" "	55 33·4	104 19·2	"	" 13 ...	3-50p	21 04·1 "
* Little Rock Portage.........	55 30·0	104 34 0	1843	Aug. 31....	4-18p	16 35·0 "
" "	"	"	"	" 31....	4-51p	15 16·3 "
" "	"	"	"	" 31.. .	5-10p	17 01·4 "
Regina.	50 27 4	104 35·0	1884	July 21....	9-07a	18 44·8 "
"	"	"	"	" 21....	9-07p	18 32 3 "
"	"	"	"	" 21.. .	3-52p	18 40·5 "
"	"	"	"	" 21....	6-30p	18 41·8 "
"	50 26·0	104 36·0	1906·7	....	....	19 12 0 "
East end of Great Devil's portage.....	55 40·0	104 47·8	1843	Sept. 1....	9-27a	24 48·5 "
" "	"	"	"	....	....	....
" "	"	"	"	....	....	....
" "	"	"	"	....	....	....
West of Fort à la Corne.. .	53 09 7	104 50·3	1884	May 26....	3-45p	21 50·0 E.
2½ miles below forks of Saskatchewan river............	53 13·0	104 51·6	1844	Aug. 27....	4-44p	24 45·0 "
" "	"	"	"	....	....	....
" "	"	"	"	....	....	....
" "	"	"	1859	....	....	22 30·0 E.
Trout Falls portage........ ..	55 42·9	104 58·8	1888	Sept. 7....	3 30p	21 48·7 "
" "	"	"	"	" 7....	3-50p	22 52 0 "
Black Bear Island lake........	55 42·5	105 35·5	"	" 2....	9-15a	21 14·0 "
" "	"	"	"	" 2 ..	1-20p	21 32 0 "
Pine portage........	55 43·0	106 00·0	1843	....	....	....
"	"	"	"	....	....	....
"	"	"	"	....	....	....
Carlton House..	52 50·8	106 32·0	1844	Aug. 26....	9-00a	22 55·6 E.
"	"	"	"	....	....	....
"	"	"	"	....	....	....
Knee lake.......	55 50·8	106 33 4	1888	Aug. 26....	9-30a	27 19·6 E.

* Local disturbance.

SESSIONAL PAPER No. 25a

VIII—*Con.*

RESULTS—*Con.*

AND ALBERTA—*Con.*

Month and day.	Hour and minute.	Dip. ° ′	Month and day.	Hour and minute.	Hor. intens.	Total intens.	Temperature. °	Observer.
June 26.....	3-20 to 4-15p	78 11·4	....	....	....	....	....	W. F. King.
" 26....	4-45 to 5-25p	78 05·7	....	....	....	....	....	"
July 5......	6-30 to 7-10p	77 21·0	....	....	....	....	....	"
" 5	5-45 to 6-20p	77 25·5	....	....	....	....	....	"
June 30.....	6-15 to 6-30p	77 51·6	....	....	....	....	....	"
....	....	....	....	....	....	....	....	"
June 29.....	11-15 to 12-00a	77 53·2	....	....	....	....	....	"
June 2....	3-00 to 3-50p	79 09·7	June 2 ...	4-00 to 4-20p	....	6544	80	Otto Klotz.
Sept. 15....	0-10 to 0-40p	80 45·0	Sept. 15....	9-50 to 10-10a	....	·6408	70	Th. Fawcett.
" 15....	0-45 to 1-14p	80 45·1	" 15....	10-10 to 10-32a	....	·6408	70	"
" 13....	4-25 to 4-37p	80 33·4	" 13....	4-40 to 4-58p	....	·6389	55 to 60	"
" 13....	5-15 to 5-30p	80 35·3	" 13....	5-00 to 5-13p	....	·6373	55	"
Aug. 31....	3-30p	80 16·4	Aug. 31....	....	....	·6966	....	J. H. Lefroy.
....	....	....	" 31....	....	....	·6925	......	"
....	....	....	....	....	....	....	....	"
July 21....	9-30 to 10-50a	77 06·2	July 21....	11-05 to 12-00a	....	·6401	76	E. Deville.
" 21....	4-15 to 5-05a	77 04.0	" 21 ..	5-15 to 6-15p	....	·6403	....	"
....	....	....	....	....	....	....	....	"
....	....	76 57·2	....	....	·1427	....	....	C. I.
Sept. 1....	10-00a	80 30·9	Sept. 1....	....	....	·6516	....	J. H. Lefroy.
....	....	....	" 1 ..	....	....	·6514	....	"
....	....	....	" 1....	....	....	·6460	....	"
....	....	....	" 1...	....	....	·6464	....	"
May 26 ...	4-05 to 5-05p	78 59·3	May 26 ...	5-30 to 6-00p	....	·6443	64	Otto Klotz.
Aug. 27....	....	79 11·2	Aug. 27....	....	....	·6422	....	J. H. Lefroy.
....	....	....	" 27. ..	....	....	·6404	....	"
....	....	....	" 27....	....	....	·6434	....	"
....	....	....	....	....	....	....	....	H. Y. Hind.
Sept. 7....	4-02 to 4-22p	80 37·1	Sept. 7....	4-24 to 4-40p	....	·6422	60	Th. Fawcett.
" 7....	5 00 to 5-30p	80 38·1	" 7....	4-42 to 4-58p	....	·6407	60	"
" 2....	10-35 to 11-00a	80 43·2	" 2....	11-45 to 12-00a	....	·6512	60	"
" 2....	11-00 to 11-30a	80 37·1	" 2 ...	0 02 to 0-18p	....	·6480	60	"
" 3....	4-30p	80 40·3	" 3 ...	....	....	·6491	....	J. H. Lefroy.
....	....	....	" 3...	....	....	·6463	....	"
....	....	....	" 3...	....	....	·6450	....	"
Aug. 26....	....	78 30·2	Aug. 26 ...	....	....	·6350	....	"
" 26....	....	78 31·2	" 26....	....	....	·6366	....	"
....	....	....	" 26....	....	....	·6339	....	"
Aug. 26....	10-30 to 10-57a	80 48·2	" 26 ...	11-00 to 11-17a	....	·6505	70	Th. Fawcett.

TABLE

MAGNETIC

SASKATCHEWAN

Place.	Latitude.	Longitude.	Year.	Month and day.	Hour and minute.	Declination.
	° ′	° ′				° ′
Knee lake	55 50·8	106 33·4	1888	Aug. 26	2-00p	27 53·7 E.
Snake rapid	55 44·1	106 35·0	1843			
"	"	"	"			
"	"	"	"			
Near Elbow, South Saskatchewan river	51 04·8	106 37·0	1880	July 17	8-00p	21 21·0 E.
" "	"	"	"	" 18	6-00p	21 17·0 "
Near the N. W. end of Old Wives lake	50 28·9	106 46·7	"	" 20	7-00p	21 18·7 "
Narrow Rapids lake	55 56·5	107 22·1	1888	Aug. 19	1-50p	24 03·9 "
"	"	"	"			
*Saskatchewan, near Elbow	52 21·4	107 23·0	1844	Aug. 24	2-30p	25 21·4 E.
Portage Sonnaute	55 54·0	107 36·0	1843	Sept. 7	4-13p	26 43·4 "
"	"	"	"			
"	"	"	"			
"	"	"	"			
Ile à la Crosse	55 25·6	107 37·0	1888	Aug. 11	3-00p	25 02·9 E.
"	"	"	"			
South Saskatchewan river	50 39·6	107 47·9	1884			
Fort à la Crosse	55 26·8	107 54·0	1843	Sept. 9	8-26a	24 57·5 E.
"	"	"	"	" 9	8-54a	24 35·0 "
"	"	"	"	" 9	5-30p	25 11·7 "
"	"	"	"			
"	"	"	"			
"	"	"	"			
"	"	"	"			
"	"	"	"			
"	"	"	"			
"	"	"	"			
"	"	"	1819	February		22 15·8 E.
"	"	"	1825	June 27		23 19·3 "
Narrows of Buffalo lake	55 37·9	108 13·5	1888	Aug. 5	0-50p	25 15·9 "
"	"	"	"			
Battleford	52 42·7	108 18·8	1880			
"	"	"	"			
"	"	"	1884	July 28	10-00a	22 12·7 E.
"	"	"	"	" 28	3-00p	21 57·2 "
"	"	"	"	" 28	6-00p	21 59·9 "
"	"	"	"	" 29	7-40a	22 15·4 "
"	"	"	"	" 29	9-10a	22 06·2 "
"	"	"	"	" 29	0-35p	21 58·2 "
*Willow hills	53 00·1	108 30·0	1844	Aug. 23	p.m.	28 24·1 "
"	"	"	"			
"	"	"	"			
Northern end of Buffalo lake	56 04·0	108 40·0	1843			
"	"	"	"			
"	"	"	"			
"	"	"	"			
Sidewood, on Cypress trail	50 02·6	108 51·4	1880	July 24	7-00p	22 00·0 E.

* Local disturbance.

VIII—*Con.*

RESULTS—*Con*

AND ALBERTA—*Con.*

Month and day.	Hour and minute.	Dip.	Month and day.	Hour and minute.	Hor. intens.	Total intens.	Temperature	Observer.
		° ′					°	
Aug. 26	11-20 to 11-43a	80 45·8	Aug. 26	11-48 to 12-06a		·6529	65	Th. Fawcett.
Sept. 4	1-30p	80 38·8	Sept. 4			·6537		J. H. Lefroy.
			" 4			·6505		"
			" 4			·6477		"
July 18	7-20 to 7-50p	77 05·5						W. F. King.
" 18	6-50 to 7-30p	77 02·3						"
" 20	5-50 to 6-35p	76 51·3						"
Aug. 19	2-30 to 3-00p	80 39·8	Aug. 19	3-00 to 3-30p		·6419	76	Th. Fawcett.
" 19	3-35 to 4-00p	80 34·2	" 19	5-15 to 5-40p		·6426	73	"
" 24		78 16·6	" 24			·6495		J. H. Lefroy.
Sept. 7	p. m.	80 11·2	Sept. 7			·6481		"
			" 7			·6482		"
			" 7			·6438		"
			" 7			·6499		"
Aug. 11	5-45 to 6-35	79 56·1	Aug. 11	4-15 to 4-35p		·6371	75	Th. Fawcett.
" 11		79 58·1	" 11	6-40 to 7-04p		·6371	66	"
May 8	4-00 to 5-30p	76 32·5	May 8	5-35 to 6-30p		·6132	58	Otto Klotz.
Sept. 9	6-30	80 09·1	Sept. 9			·6476		J. H. Lefroy.
" 9	7-30	80 10·5	" 9			·6471		"
			" 9			·6454		"
			" 9			·6449		"
			" 9			·6442		"
			" 9			·6442		"
			" 9			·6440		"
			" 9			·6469		"
			" 9			·6442		"
			" 9			·6439		"
								J. Franklin.
July 11		79 55·0						"
Aug. 5	1-40 to 2-06p	80 11·9	Aug. 5	2-13 to 2-36p		·6427	68	Th. Fawcett.
" 5	2-42 to 3-08p	80 13·3	" 5	3-10 to 3-35p		·6429	60	"
Nov. 1	9-45 to 10-10a	77 52·3						W. F. King.
" 2	11-15 to 11-40a	77 46·4						"
								E. Deville.
								"
								"
								"
								"
								"
Aug. 23	p.m.	78 28·1	Aug. 23			·6569		J. H. Lefroy.
			" 23			·6548		"
			" 23			·6585		"
Sept. 13	7-00a	80 37·0	Sept. 13			·6472		"
			" 13			·6470		"
			" 13			·6457		"
			" 13			·6420		"
July 25	1-20 to 1-55p	75 50·1						W. F. King.

TABLE

MAGNETIC

SASKATCHEWAN

Place.	Latitude.	Longitude.	Year.	Month and day.	Hour and minute.	Declination.
	° ′	° ′				° ′
River La Loche....	56 11·6	108 57·5	1888	July 29....	2–10p	28 10·0 E.
"	"	"	"	....	....	....
La Loche lake.........	56 26·6	109 12·8	1888	July 22 ..	2–10p	25 49·0 E.
"	"	"	"	....	....	....
North end of Long portage.....	56 14·7	109 18·0	1843	Sept. 14....	9–35a	28 40·6 E.
"	"	"	"	" 14....	9–43a	28 27·5 "
"	"	"	"	....	....	....
"	"	"	"	....	....	....
Portage La Loche...........	56 35·2	109 30·2	1888	July 18....	10–00a	26 37·3 E.
"	"	"	"	....	....	....
Great Methye portage	56 35·0	109 37·0	1843	Sept. 16....	8–38a	26 15·0 E.
"	"	"	"	" 16....	9–30a	26 59·7 "
"	"	"	"	....	....	....
"	"	"	"	....	....	....
Fort Pitt.......	53 34·1	109 47·2	1844	Aug. 22....	6–50a	23 07·3 E.
"	"	"	"	" 22....	7–57a	23 11·2 "
"	'	"	"	....	....	....
At the gap of Cypress hills....	49 37·7	109 51·4	1880	July 31....	7–00p	21 43 7 E.
Great Methye p'tge, N.W. end	56 43·7	109 52·3	1820	"	.. ... .	25 02·5 "
"	"	"	1843	Sept. 17....	7–09a	28 30·3 "
"	"	"	"	" 17....	7–22a	28 25·0 "
"	"	"	"	" 17....	7–30a	28 30·6 "
Clear Water river.............	56 42·7	110 03·9	1888	July 8....	10–00a	26 53·5 "
"	"	"	"	....	....	....
Land survey station	51 05·0	110 15·0	1882	....	....	... .
Clear Water river.............	56 39·4	110 46·6	1888	July 1....	10–40a	28 54·3 E.
"	"	"	"	" 1....	2–00p	28 56·9 "
Two miles below mouth of Pembina river...............	59 39 0	110 55·0	1843	....	.... ..	....
" " ..	"	"	"	....	... ...	....
" " ..	"	"	"	. .. .	....	....
" " ..	"	"	·	... .	.. ..., .	....
Saskatchewan river near Moose Hill creek...........	53 50·0	110 59·0	1844	Aug. 21....	8–08a	24 26·6 E.
" " ..	"	"	"	....	....	....
" " ..	"	"	"	....	....	....
Fort McMurray.............	56 43·9	111 13·6	1888	June 23....	9–00a	29 02·4 E.
" " ..	"	"	"	....	....	....
Fort Chipewyan, L. Athabaska	58 43·0	111 18·7	1843	Sept. 23....	3–50p	28 09·1 E.
" " ..	"	"	"	" 23....	3–59p	27 08·4 "
" " ..	"	"	"	Oct. 16 ..	....	28 30·8 "
" " ..	"	"	"	....	....	....
" " ..	"	"	"	....	....	....
" " ..	"	"	"	....	....	....
" " ..	"	"	1820	March	... .	22 49·6 E.
" " ..	"	"	1825	July 11.....	....	25 29·0 "
" " ..	"	"	1843	....	....	....

VIII—*Con.*

RESULTS—*Con.*

AND ALBERTA—*Con.*

Month and day.	Hour and minute.	Dip.	Month and day.	Hour and minute.	Hor. intens.	Total intens.	Temperature	Observer.
		° ′					°	
July 29....	3-00 to 3-22p	80 34·0	July 29....	3-24 to 3-43p	....	·6456	61	Th. Fawcett.
" 29....	3-45 to 4-20p	80 33·1	" 29....	4-25 to 4-45p	....	·6435	59	"
" 22....	2-45 to 3-20p	80 31·9	" 22....	4-32 to 5-02p	....	·6409	76	"
" 22....	3-47 to 4-25p	80 35·5	" 22....	3-22 to 3-45p	....	·6352	86	"
Sept. 14....	10-15a	80 19·7	Sept. 14 ...	....	....	·6380	....	J. H. Lefroy.
....	....	....	" 14....	....	....	·6425	....	"
....	....	....	" 14 ...	....	....	·6401	....	"
....	....	....	" 14....	....	....	·6432	....	"
July 18....	10-40 to 11-10a	80 29·3	July 18....	11-14 to 11-35a	....	·6397	88	Th. Fawcett.
" 18....	11-45a to 0-13p	80 28·3	" 18 ...	0-15 to 0-40p	....	·6417	81	"
Sept. 16....	9-00a	80 36·4	Sept. 16....	....	....	·6444	....	J. H. Lefroy.
....	....	....	" 16....	....	....	·6457	....	"
....	....	....	" 16....	....	....	·6426	....	"
....	....	....	" 16 ...	....	....	·6467	....	"
Aug. 22...	a. m.	78 43·0	Aug. 22....	....	....	·6533	....	"
" 22....	"	78 39·1	" 22....	....	....	·6520	....	"
....	....	....	" 22....	....	....	·6526	....	"
July 28....	0-15 to 0-45p	75 20·4	....	....	....	....	....	W. F. King.
....	....	....	....	....	....	....	....	Franklin.
Sept. 17....	6-00a	80 38·3	....	....	....	....	....	J. H. Lefroy.
....	....	....	....	....	....	....	....	"
....	....	....	....	....	....	....	....	"
July 8....	11-15 to 11-45a	80 27·4	July 8....	11-50a to 0-15p	....	·6377	76	Th. Fawcett.
" 8....	0·20 to 0·50p	80 25·5	" 8....	0-55 to 1-20p	....	·6425	65	"
" 15....	....	76 14·1	....	....	....	....	....	Wm. Ogilvie.
" 1....	11·10 to 11-40a	80 09·1	July 1....	11-40 to 12-00a	....	·6419	66	Th. Fawcett.
" 1 ...	3-40 to 4-00p	80 12·1	" 1....	4-04 to 4-50p	....	·6460	68	"
Sept. 19....	8-30a	80 36·2	Sept. 19....	....	....	·6456	....	J. H. Lefroy.
....	....	....	" 19....	....	....	·6414	....	"
....	....	....	" 19....	....	....	·6364	....	"
....	....	....	" 19....	....	....	·6419	....	"
Aug. 21....	....	78 33·5	Aug. 21 ...	....	....	·6410	....	"
....	....	....	" 21....	....	....	·6350	....	"
....	....	....	" 21....	....	....	·6391	....	"
June 23....	9-30 to 10-00a	80 07·8	June 23....	10-04 to 10-35a	....	·6334	57·	Th. Fawcett.
" 23 ...	10-40 to 11-04a	80 09·8	" 23....	11-04 to 11-30a	....	·6371	59·	"
Sept. 30....	9-00a	81 37·7	Sept. 25...	....	....	·6374	....	J. H. Lefroy.
" 30....	11-00a	81 37·5	" 25....	....	....	·6413	....	"
....	....	....	Oct. 9 ...	....	....	·6383	....	"
....	....	....	Sept. 30....	....	....	·6449	....	"
....	....	....	Oct. 6....	....	....	·6446	....	"
....	....	....	" 10....	....	....	·6456	....	"
....	....	....	....	....	....	....	....	J. Franklin.
July 24....	....	81 26·1	....	....	....	....	....	"
....	....	....	Oct. 13....	....	....	·6419	....	J. H. Lefroy.

TABLE

MAGNETIC

SASKATCHEWAN

Place.	Latitude.	Longitude.	Year.	Month and day.	Hour and minute.	Declination.
	° ′	° ′				° ′
Fort Chipewyan, L Athabaska	58 43·0	111 18·7	1843	....	... ...	....
" " ..	"	"	"	....	... .	....
" " ..	"	"	"	....	......	....
" " ..	"	"	"	....	....	. ...
" " ..	"	"	"	....	....	. . ..
" " ..	"	"	"	. .. .	... .	....
" " ..	"	"	"	. ...	.. ....	.. . .
" " ..	"	"	1844	....	... .	.. ..
" " ..	"	"	"	....	... .	....
" " ..	"	"	"	....	.... ..	....
" " ..	"	"	"	July 2.....	9-34a	29 52·0 E.
" " ..	"	"	"	....	....	. ...
" " ..	"	"	"	... .	....	....
" " ..	"	"	1884	....	... .	... .
" " ..	"	"	1888	Nov. 22....	3-20p	27 15·3 E.
" " ..	"	"	"	" 23 ...	3-30p	27 09·5 "
" " ..	"	"	"	" 24....	10-15a	27 17·9 "
" " ..	"	"	"	....	... .	... .
In the valley of Vermilion river..	53 35·9	111 24·0	1880	Oct. 17....	10-30a	25 46·4 E.
Point Brulé, Athabaska river..	58 07·0	111 25·0	1843	....	....	....
" " ..	"	"	"	.. ....	... .	....
" " ..	"	"	"	....	. ...	....
" " ..	"	"	"	....	....	....
*Pierre au Calumet..........	57 24·0	111 35·0	"	Sept. 20 ...	5-03p	26 35·1 E.
" " ..	"	"	"	" 20....	5-15p	25 24·9 "
" " ..	"	"	"	....	....	....
" " ..	"	"	"	....	. ....	....
Land survey station	51 00·5	111 40·5	1882	....	.. ..	.. ..
" "	"	"	"	.. ..	....	....
Pelican portage	59 58·0	111 51·0	1844	June 27.....	6-24p	36 15 0 E.
Point Providence............	58 58·0	112 10·0	"	July 5.. .	3-11p	30 35·0 "
On Saskatchewan river.... .	54 04·5	112 19·5	"	Aug. 20 ..	9 20a	23 55·0 "
" "	"	"	"	" 20....	9-33a	24 56·0 "
" "	"	"	"	....	....	....
On Peace river	58 58·0	112 56·1	"	July 7 ...	7-19a	32 24·0 E.
Willow creek	49 45·3	113 24·0	1880	Aug. 17....	6-00p	22 32·0 "
"	"	"	"	" 18...	9-00a	22 43·0 "
"	"	"	"	" 18....	9-10a	22 39·0 "
Athabaska river.............	54 51·0	113 25·0	1888	May 27. ..	4-00p	24 33·3 E
" . .. .:....	"	"	"	" 28.....	6-50a	24 16·4 "
Fort Edmonton............	53 32·0	113 30·1	1844	Aug. 16.....	7-31a	23 47·0 "
"	"	"	"	... .	....	....
"	"	"	"	....	....	....
"	"	"	"	....	....	....
"	"	"	"	....	....	....
"	"	"	1880	Oct. 6	2-00p	26 43·2 "
"	"	"	"	....	....	....

*Local disturbance.

VIII—*Con.*

RESULTS—*Con.*

AND ALBERTA—*Con.*

Month and day.	Hour and minute.	Dip.	Month and day.	Hour and minute.	Hor. intens.	Total intens.	Temperature	Observer.
							°	
			Oct. 13			·6399		J. H. Lefroy.
			" 13			·6428		"
			" 13			·6418		"
			" 13			·6411		"
			" 14			·6386		"
			" 14			·6453		"
			" 14			·6425		"
			Mar. 1			·6384		"
			" 1			·6363		"
			" 1			·6331		"
			" 1			·6368		"
Feb. 27	1-04p	81 35·4	July 2			·6431		"
			" 2			·6433		"
			" 2			·6426		"
Sept. 17		81 26·6						H. P. Dawson.
Nov. 22	1-50 to 2-21p	81 22·2	Nov. 22	2-25 to 2-45p		·6335	17·5	Wm. Ogilvie.
" 22	3-06 to 3-24p	81 21·4	" 22	2-48 to 3-04p		·6306	17·5	"
" 23	1-45 to 2-07p	81 23·3	" 23	2 05 to 2·20p		·6348	18·	"
" 23	3-05 to 3-25p	81 21·7	" 23	2-40 to 3-01p		·6355	16·	"
Oct. 17	2-45 to 3-05p	77 56·8						W. F. King.
Sept. 21	4-00p	81 30·6	Sept. 21			·6402		J. H. Lefroy.
			" 21			·6475		"
			" 21			·6438		"
			" 21			·6493		"
Sept. 20	2-30p	81 16·8	Sept. 20			·6739		"
			" 20			·6615		"
			" 20			·6597		"
			" 20			·6631		"
Aug. 6		76 16·5						Wm. Ogilvie.
" 6		76 09·7						"
June 27		82 26·8						J. H. Lefroy.
July 5		81 46·1						"
Aug. 20		78 05·2	Aug. 20			·6330		"
			" 20			·6311		"
			" 20			·6316		"
July 7		81 36·9						"
Aug. 17	3-50 to 4-20p	74 44·8						W. F. King.
" 17	5-25 to 5-40p	74 47·9						"
								"
May 27	4-26 to 5-05p	78 08·3	May 27	5-07 to 5-40p		·6351	70	Th. Fawcett.
" 28	7-35 to 8-28a	78 07·2	" 28	7-40 to 8-28a		·6415	51	"
Aug. 17		77 53·4	Aug. 17			·6476		J. H. Lefroy.
" 17		77 55·1	" 17			·6418		"
			" 17			·6474		"
			" 17			·6499		"
			" 17			·6468		"
Oct. 6	4-40 to 5-00p	77 31·6						W. F. King.
" 7	10-20 to 10-40a	77 29·4						"

TABLE

MAGNETIC

C. I.—Carnegie Institution.

SASKATCHEWAN

Place.	Latitude. ° ′	Longitude. ° ′	Year.	Month and day.	Hour and minute.	Declination. ° ′
Fort Edmonton	53 32·0	113 30·1	1888	May 17	1-30p	25 28·7 E
"	"	"	"	...	...	...
At north branch, Pipestone creek	53 04·3	113 35·5	1880	Sept. 25	6-00p	25 14·4 "
Mosquito creek	50 22·4	113 48·8	"	Aug. 20	7-00p	22 03·0 "
"	"	"	"	...	...	...
Forks of the Athabaska	55 13·0	113 53·2	1844	Aug 7	4-44p	26 28·0 "
Fourth base on 5th meridian	50 02·9	114 00·0	1887	July 19	1-50p	23 53·7 "
Land survey station	54 21·3	114 00·0	1883	...	...	...
Athabaska river	54 43·0	114 00·2	1844	Aug. 9	9-10a	26 29·1 "
Crossing of Pembina river	54 03·2	114 00·2	"	" 14	9-42a	22 23·0 "
Mouth of Lesser Slave lake	55 29·0	114 03·5	1888	June 4	noon.	27 22·5 "
" "	"	"	"	" 4	3-15p	27 25·3 "
Land survey station	55 10·0	114 03·5	1883	May 9	...	27 45·4 "
"	"	"	"	...	...	...
"	"	"	"	...	...	...
Near Fort Calgary	51 03·0	114 04·0	1880	...	...	...
Poplar island	58 39·0	114 10·7	1844	July 9	9-30a	26 29·8 "
Morleyville, Rocky Mt.	51 10·5	114 18·5	1880	...	...	...
" "	"	"	"	...	...	...
Fort Assiniboine	54 21·7	114 28·4	1844	Aug. 11	7-02a	24 39·0 "
"	"	"	"	...	...	...
Falls of the Peace river	58 24·2	114 51·1	"	July 10	10-38a	30 22·0 "
Swan point, Lesser Slave lake	55 26·0	115 03·1	"	Aug. 6	10-00a	26 19·0 "
Sulphur mountain	51 09·0	115 34·0	1907·5	...	...	25 53·5 "
Banff	"	"	"	...	...	25 59·3 "
Tunnel mountain	51 11·0	"	"	...	...	25 57·4 "
Banff (C.I.S.)	51 10·0	115 37·0	1908	July 22-24	...	26 5·6 "
Fort Vermilion	58 24·5	115 58·6	1844	July 11	6-31p	32 40·0 "
"	"	"	"	...	...	...
"	"	"	"	...	...	...
"	"	"	"	...	...	...
"	"	"	"	...	...	...
Fort of Lesser Slave lake	58 32·6	116 00·0	"	Aug. 3	5-37p	26 52·5 "
" "	"	"	"	...	...	...
" "	"	"	"	...	...	...
Land survey station	55 32·5	116 08·6	1883	...	...	...
On Peace river	57 19·0	117 01·7	1844	July 17	8-39a	28 53·0 "
Opposite River Cadotte	56 47·0	117 01·7	"	" 19	9-17a	27 03·0 "
Island opposite Baril river	57 57·0	117 04·7	"	" 15	8-22a	29 56·0 "
Land survey station	56 08·0	117 50·6	1883	...	...	...
"	"	"	"	...	...	...
Fort Dunvegan	55 55·6	118 28·5	1844	July 23	10-05a	27 09·0 "
"	"	"	"	" 25	5-49p	27 24·0 "
"	"	"	"	...	...	...
"	"	"	"	...	...	...
"	"	"	"	...	...	...

VIII—*Con.*

RESULTS—*Con.*

AND ALBERTA—*Con.*

Month and day.	Hour and minute.	Dip.	Month and day.	Hour and minute.	Hor. intens.	Total intens.	Temperature	Observer.
							°	
May 17	1-50 to 3-05p	77 30·4	May 17	4-11 to 5-00p		·6391		Th. Fawcett.
" 17	3-21 to 3-53p	77 30·9						"
Sept. 26	6-30 to 6-50a	77 03·2						W. F. King.
Aug. 20	5-45 to 6-10p	74 40·1						"
" 21	6-15 to 6-30a	74 48·2						"
Aug. 7		78 55·2						J. H. Lefroy.
July 19		74 37·5						J. S. Dennis.
Jan. 1		77 58·1						Wm. Ogilvie.
Aug. 9		78 34·1						J. H. Lefroy.
" 14		77 54·0						"
June 4	1-00 to 1-30p	78 31·7	June 4	1-38 to 2-05p		·6308		Th. Fawcett.
" 4	1-38 to 2-40p	78 33·3	" 4	2-07 to 2-40p		·6323		"
May 10		78 24·1						Wm. Ogilvie.
" 11		78 28·2						"
" 11		78 29·9						"
Sept. 11	1-00 to 1-20p	75 23·4						W. F. King.
July 9		81 04·8						J. H. Lefroy.
Sept. 16	0-25 to 0-45p	75 14·3						W. F. King.
" 16	3-00 to 3-15p	75 19·7						"
Aug. 11		78 16·9						J. H. Lefroy.
" 11		78 13·5						"
July 10		80 50·8						"
Aug. 6		78 29·9						"
		74 54·0			·1590			C.I.
		74 56·3			·1593			C.I.
		74 57·6			·1593			C.I.
July 23, 24		74 58·1	July 22-24		·15955			C. A. French.
July 11		80 48·4	July 11			·6505		J. H. Lefroy.
" 11		80 47·6	" 11			·6409		"
			" 11			·6472		"
			" 11			·6515		"
			" 11			·6463		"
Aug. 3		78 36·2	Aug. 5			·6422		"
" 3		78 41·8	" 5			.6397		"
			" 5			·6369		"
Oct. 3		{78 18·1 / 78 12·4}						Wm. Ogilvie.
July 17		79 27·0						J. H. Lefroy.
" 19		79 20·7						"
" 15		80 00·7						"
Sept. 22		78 14·3						Wm. Ogilvie.
" 22		78 20·2						"
July 22		78 45·7	July 23			·6477		J. H. Lefroy.
" 22		78 46·8	" 23			·6439		"
			" 23			·6445		"
			" 23			·6452		"
			" 23			·6452		"

TABLE

MAGNETIC

C.I.—Carnegie Institution.

BRITISH

Place.	Latitude.		Longitude.		Year.	Month and day.	Hour and minute.	Declination.	
	°	′	°	′				°	′
Akamina station........ ...	49	01·0	114	04·0	1861	Aug. 2....	.. ..	23	12·0 E
*Wigwam river section........	49	00·0	114	45·0	"	July 15, Aug. 14	....	23	52·0 "
Camp No. 11............... ..	49	07·0	115	16·0	"	....	....	......	......
Joseph's prairie, Camp No. 14.	49	31·0	115	35·0	"	....	.. ....	......	......
Stephen, Rocky mountains ...	51	27·0	116	17·7	1886	May 14....	4-00p	23	55·0 "
Near Leanchoil, along C.P.R..	51	13·8	116	37·9	"	" 28...	4-45p	23	33·0 "
Between Palliser and Golden, C.P.R....................	51	17·9	116	51·7	"	June 4....	11-00a	25	40·0 "
Golden......	51	18·0	116	57·0	1908	July 27-30..	....	26	03·5
"	"		"		"	...	.. ..	....	.. .
One mile north of Golden... .	51	18·8	116	58·5	1886	June 9....	5-54p	25	37·0 E
Keefe and Clarke siding	51	30·9	117	20·4	"	" 18...	9-21a	26	34·0 "
Glacier......	51	16·0	117	28·0	1907·8	.. .. . .	....	25	57·1 "
Near Rogers pass, along C.P.R.	51	17·6	117	31·0	1886	June 30....	2-45p	25	27·5 "
Near Revelstoke, along C.P.R.	51	00·1	118	11·9	"	Aug. 15....	4-23p	27	17·5 "
Revelstoke	51	00·0	118	12·0	1908	Aug. 3, 4, 5.	....	25	48·6
"	"		"		"	....	....	......	......
Inchwointum station	49	00·0	118	28·0	1860	Nov. 13....	....	20	17·0
Sicamous	50	50·0	118	59·0	1908	Aug. 6-10..	....	25	52·8
Sicamous narrows......	50	49·7	118	59·6	1885	Oct. 21....	11-20a	24	46·2 "
"	"		"		"	....	....	.....	....
120 yds. west of station 1569 of traverse.	50	44·7	119	14·5	"	" 4 ...	4-50p	24	37·5 "
" .	"		"		"	....	....	......	......
Lake Shuswap, Blind bay	50	51·0	119	19·5	"	....	....	......	....
" "	"		"		"	.. ..	....	......	....
Southwest end of Salmon Arm, Lake Shuswap...	50	45·9	119	19·9	"	Sept. 25...	5-10p	24	55·9 E
" "	"		"		"	" 27.. .	5-15p	24	46·9 "
" .	"		"		"	....	....	....	... ...
" "	"		"		"	....	....	......	......
Little Shuswap...	50	48·6	119	41·2	"	Sept. 13..	4-45p	25	07·5 E
"	"		"		"	.. ..	....	....	....
Ashtnolaon station...........	49	00·0	120	00·0	1860	Aug. 17, 18.	....	22	44·0 "
On Ashtnolaon river.....	49	10·0	120	00·0	"	July .. .	....	22	10·0 "
350 yds. south of station 1289 traverse................ ..	50	38·9	120	06·9	1885	Sept. 6. ..	4-00p	24	59·4 "
" "	"		"		"	.. ..	....	....	.....

* Local disturbance.

IX.

RESULTS.

COLUMBIA.

Month and day.	Hour and minute.	Dip.	Month and day.	Hour and minute.	Hor. intens.	Total intens.	Temperature	Observer.
		° ′					°	
Aug. 2		73 42·7	Aug. 2			·6265		R. W. Haig.
July 15, Aug. 14		73 30·8	July 15, Aug. 14			·6223		do
		73 37·8						J. L. Harris.
		73 50·4				·6226		do
May 14	4-45 to 5-25p	75 04·6	May 14	5-30 to 5-55p		·6177	47	O. Klotz.
" 28	5-00 to 5-35	74 49 5	" 28	5-43 to 6-10p		·6174	59	do
June 4	11-30 to 0-05p	74 54·2	June 4	0-07 to 0-50p		·6168	85	do
July 27-29		74 42·8	July 27-29		·16160			C. A. French.
" 28		74 40 1			·16142			do
June 9	4-11 to 4-36p	74 50·4	June 9	4-40 to 5-14p		·6171	72	O. Klotz.
June 18	9-40 to 10-03a	74 52·5	June 18			·6166	59	do
		74 29·9			·1625			C. I.
June 30	3-01 to 3-22p	74 41·6	June 30	3-25 to 3-44p		·6167	61	O. Klotz.
Aug. 15	4-52 to 5-36p	74 26·4	Aug. 15	5-50 to 6-44p		·6144	70	do
Aug. 1, 3, 4		74 16·1	Aug. 1, 3, 4		·16501			C. A. French.
" 5		74 16·6	" 5		·16458			do
Nov. 13		72 48·8	Nov. 13			·6119		R. W. Haig.
Aug. 6, 7, 8		73 51·8	Aug. 6, 9		·16775			C. A. French.
Oct. 21	9-45 to 10-02a	74 06·1	Oct. 21	10-08 to 10-27a		·6141	44	W. Ogilvie.
" 21	10-51 to 11-10a	74 07·8	" 21	10-33 to 10-46a		·6123	45	do
" 4	3-08 to 3-27p	73 58·9	" 4	3-32 to 3-48p		·6139	65	do
" 4	4-18 to 4-40p	73 58·2	" 4	3-51 to 4-11p		·6146	62	do
Sept. 20	2-55 to 3-20p	73 58·0	Sept. 20	3-25 to 3-45p		·6169	66	do
" 20	4-20 to 4-45p	73 59·0	" 20	3-50 to 4-13p		·6164	65	do
" 25	3-25 to 3-41p	73 59·0	" 25	3-45 to 4-06p		·6164	62	do
" 25	4-33 to 4-59p	73 57·1	" 25	4-10 to 4-27p		·6143	62	do
" 27	2-48 to 3-11p	73 58·8	" 27	3-18 to 3-34p		·6139	59	do
" 27	4-10 to 4-30p	74 00·4	" 27	3-45 to 4-04p		·6144	59	do
Sept. 13	2-30 to 2-50p	73 55·2	" 13	2-55 to 3-20p		·6143	64	do
" 13	4-05 to 4-25	73 48·0	" 13	3-30 to 3-56p		·6170	63	do
Aug. 17, 18		72 27·0	Aug. 17, 18			·6142		R. W. Haig.
July		72 37·0	July			·6098		do
Sept. 6	2-15 to 2-35p	73 41·4	Sept. 6	2-40 to 3-03p		·6098	84	W. Ogilvie.
" 6	3-30 to 3-32p	73 41·0	" 6	3-08 to 3-23p		·6096	84	do

TABLE

MAGNETIC

C. I.—Carnegie Institution.

BRITISH

Place.	Latitude.	Longitude.	Year.	Month and day.	Hour and minute.	Declination.
	° ′	° ′				° ′
Thompson river	50 41·0	120 11·0	1833			
Kamloops	50 39·9	120 20·2	1885	Sept. 2	3-50p	24 20·5 E
"	"	"	"	" 3	5-30p	23 35·5 "
"	"	"	"			
"	"	"	"			
Nicola	50 09·0	120 40·0	1908	Sept. 19-21		25 03·0
"	"	"	"			
Van Horne	50 44·4	120 50·3	1885			
St. Cloud	50 45·9	121 07·8	"	Aug. 16	4-55p	23 51·5 E
"	"	"	"			
Ashcroft (C. I. S.)	50 44·6	121 17·0	1908	Sept. 14, 15		27 46·9 E
"	"	"	"			
"	"	"	1907·7			27 36·1 E
Near Black canyon	50 39·6	121 17·9	1885	Aug. 9	4-55p	27 22·5 "
"	"	"	"			
Spence's bridge	50 24·3	121 20·7	"	" 2	Noon	23 43·8 E
"	"	"	"			
"	50 25·0	121 21·0	1908	Sept. 17, 18		26 39·4
"	"	"	"			
Chilukweyuk	49 02·0	121 23·0	1859			
Chilukweyuk camp	49 06·0	121 23·0	"			
Bridge creek (100-mile)	51 39·0	121 27·0	1908	Sept. 8, 9		26 47·4
North Bend	49 52·0	121 27·0	"	" 23-26		25 48·0
"	"	"	"			
Barkerville	53 04·0	121 30·0	1908	Aug. 22-24		28 07·3 E.
"	"	"	"			
Salmon river	49 58·3	121 30·6	1885	July 12	5-00p	24 59·0 "
"	"	"	"			
Cisco station	50 07·4	121 34·4	"			
"	"	"	"			
Clinton	51 06·0	121 35·0	1908	Aug. 13-16		26 26·4
"	"	"	"			
Agassiz	49 15·0	121 45·0	"	Oct. 1, 2		25 23·6
"	"	"	"			
Williams lake (150 mile)	52 06·0	121 56·0	"	Sept. 3-5		28 52·8 E.
"	"	"	"			
Harrison river	49 13·4	121 56·0	1885	June 14	6-20p	22 21·3 "
"	"	"	"	" 14	6-25p	22 25·4 "
Schweltza lake station	49 02·0	122 00·0	1859	July 4, 5		21 37·0 "
Sumas prairie	49 01·0	122 12·0	1858	Oct. 4, 5 / Nov. 10		21 30·0 "

IX—*Con.*

RESULTS—*Con.*

COLUMBIA—*Con.*

Month and day.	Hour and minute.	Dip.	Month and day.	Hour and minute.	Hor. intens.	Total intens.	Temperature	Observer.
		° ′					°	
April	....	73 43·0	....	....	....	·5939	......	D. Douglas.
Sept. 2....	2-00 to 2-23p	73 35·8	Sept. 2 ...	2-27 to 2-42p	....	·6071	75	Wm. Ogilvie
" 2....	3-25 to 3-48p	73 34·2	" 2....	2-53 to 3-18p	....	·6065	75	do
" 3...	3-48 to 4-10p	73 37·5	" 3....	4-15 to 4-30p	....	·6054	79	do
" 3....	5-00 to 5-20p	73 39·0	" 3....	4-35 to 4-54p	....	·6085	79	do
Sept. 19, 20.	....	72 54·0	Sept. 19, 20.	....	·1755	....	....	C. A. French.
" 21....	....	72 53·4	" 21....	....	·1753	....	....	do
Aug. 23....	2-50 to 3-15p	73 28·0	Aug. 23....	3-20 to 3-43p	....	·6037	71	Wm. Ogilvie.
Aug. 16....	2-45 to 3-10p	74 00·8	Aug. 16....	3-18 to 3-40p	....	·6166	94	do
" 16 ..	4-22 to 4-47p	74 02·6	" 16....	3-50 to 4-10p	....	·6157	96	do
Sept. 11, 12, 14.... ..	....	73 26·1	Sept. 14, 15.	....	·1722	....	....	C. A. French.
" 12 ...	....	73 26·8	" 12....	....	·1721	....	....	do
....	....	73 22·2	....	....	·1725	....	....	C. I.
Aug. 9....	2-48 to 3-06p	73 37·5	Aug. 9....	3-10 to 3-32p	....	·6123	88	Wm. Ogilvie.
" 9....	4-08 to 4-38	73 40·3	" 9....	3-42 to 4-02p	....	·6111	88	do
" 2....	9-45 to 10-20a	73 26·8	" 2....	10-25 to 10 55a	....	·6048	85	do
" 2....	11-47 to 12-17a	73 27·2	" 2...	11-05 to 11-35a	....	·6072	85	do
Sept. 17....	....	72 58·9	Sept. 16, 17.	....	·1737	....	....	C. A. French.
" 18 ...	....	72 57·6	" 18 ...	....	·1741	....	....	do
" 7....	....	72 31·0	Sept. 7....	....	....	·6077	....	R. W. Haig.
....	....	72 22·2	....	....	....	·6125	....	J. S. Harris.
Sept. 8, 9...	....	73 35·1	Sept. 8, 9...	....	·1717	....	....	C. A. French.
" 23-25..	....	72 32·1	Sept. 24-25.	....	·1797	....	....	do
" 26....	....	72 31·2	....	....	·1795	....	....	do
Aug. 22, 23.	....	74 58·0	Aug. 22, 23.	....	·1571	....	....	do
" 21	....	74 57·6	" 21.....	....	·1569	....	....	do
July 12.. .	3-20 to 3-48p	72 39·4	July 12.....	3-50 to 4-15p	....	·6063	85	W. Ogilvie.
" 12....	5-18 to 5-38p	72 40·7	" 12 ...	4-22 to 4-41p	....	·6052	82	do
" 19.....	1-50 to 2-16p	72 44·7	" 19.....	2-20 to 2-44p	....	·6066	84	do
" 19....	3-16 to 3-40p	72 41·1	" 19.....	2-50 to 3-10p	....	·6067	80	do
Aug. 14, 15.	....	73 27·6	Aug. 14, 15.	....	·1704	....	....	C. A. French.
" 13....	....	73 25·1	" 13.....	....	·1722	....	....	do
Sept. 28, Oct. 1, 2	....	71 34·9	Oct. 1, 2 ...	....	·1892	....	....	do
Sept. 28 ...	....	71 36·1	Sept. 28 ...	....	·1890	....	....	do
Sept. 3, 5...	....	74 12·3	" 3, 5 . .	....	·1652	....	....	do
" 5	....	74 12·4	" 5 . . .	....	·1651	....	....	do
June 14....	4-00 to 4-30p	72 28·3	June 14.....	4-35 to 5-00p	....	·5994	75	W. Ogilvie.
" 14. ...	5-33 to 5-54p	72 28·0	" 14.....	5-05 to 5-25p	....	·6011	73	do
July 4, 5....	....	72 04·0	July 4, 5 ...	....	....	·6125	....	R. W. Haig.
Oct. 4, 5, Nov. 10	....	72 22·0	Oct. 4, 5, Nov. 10	....	....	·6163	....	do

TABLE

MAGNETIC

C. I.—Carnegie Institution.
C. S.—Coast Survey.

BRITISH

Place.	Latitude.	Longitude.	Year.	Month and day.	Hour and minute.	Declination.
	° ′	° ′				° ′
Alexandria	52 35·0	122 28·0	1908	Aug. 30 – Sept. 1		28 16·2
"	"	"	"			
Fort Alexandria	52 33·0	122 29·0	1833			
Quesnel	52 59·0	122 32·0	1908	Aug. 26-28		28 19·0
"	"	"	"			
Port Hammond	49 12·1	122 38·9	1885	May 26	6-38p	22 46·2 E.
"	"	"	"			
Camp Semiamu	49 01·0	122 46·0	1857			
Station Semiamu	49 00·7	122 46·2	1857			
Port Moody	49 17·0	122 52·6	1885	June 3	4-45p	22 45·8 E.
"	"	"	"	" 3	4-55p	22 46·3 "
New Westminster	49 13·0	122 53·0	1862			
Vancouver	49 18·0	123 07·0	1898·4			24 30·0 E.
Vancouver (Brockton Pt.)	49 18·0	123 07·0	1908	Oct. 5-8		25 23·3
"	"	"	"			
Burrard inlet	49 16·0	123 10·0	1859			
Victoria (C. I. station)	48 25·0	123 21·0	1908	Oct. 13, 14		24 34·0
" "	"	"	"			
"	48 25·0	123 21·0	1907·7			24 15·2 E.
"	48 26·0	123 25·0	1858			
"	48 25·8	123 22·2	1880			
Victoria, Laurel point	48 25·4	123 22·5	1862			
Esquimalt	48 25·0	123 26·0	1881·8			22 55·6 "
"	48 26·0	123 27·0	1859			
"	"	"	1862			
"	"	"	1892·7			
"	"	123 28·0	1898·3			23 42·9 E.
Nanaimo (Jesse island)	49 13·0	123 52·0	1908	Oct. 17, 18		25 15·3
"	"	"	"			
Departure bay, Vancouver I.	49 12·6	123 57·0	1881	Oct. 7		23 55·6 E.
" "	49 12·6	123 58·5	1880			
Nanaimo	49 10·0	124 00·0	1862			
Stuart lake	54 27·0	124 20·0	1833			
Fraser lake	54 03·0	124 40·0	1833			
Bayne sound (Maple spit)	49 28·0	124 45·0	1898·4			24 25·7 E.
" (Beak point)	49 36·0	124 51·0	1898·6			24 14·1 "
Union	49 36·0	124 54·0	1900·8			25 55·6 "
"	"	"	1904·3			26 05·6 "
Union (1)	49 36·0	124 54·0	1906·5			26 00·9 E.
Union (2)	"	"	"			26 17·4 "
Waddington harbour	50 54·0	124 49·5	1881	July 30		25 22·0 "
Henry bay, Vancouver island	49 36·0	124 51·0	1860			
Hecate bay, "	49 15·0	125 56·0	1861			
Port Neville	50 31·0	126 04·0	1860			
Anchorage cove, Kingcome inlet	50 52·8	126 11·7	1881	Aug. 3		25 42·7 "
Nootka sound, Vanc'ver island	49 36·0	126 37·0	1778			
" "	"	"	1791			
" "	"	"	1792			
Friendly cove, "	49 35·5	126 37·5	1881	Sept. 27		23 36·2 "
Beaver harbour	50 43·0	127 25·0	1860			
North harbour, Quatsino sound	50 29·4	128 03·6	1881	Sept. 24, 25		24 53·7 "
Port McLoughlin	52 08·4	128 10·3	"	Aug. 7		26 42·9 "

1 X—*Con.*

RESULTS—*Con.*

COLUMBIA—*Con.*

Month and day.	Hour and minute.	Dip. ° ′	Month and day.	Hour and minute.	Hor. intens.	Total intens.	Temperature.	Observer.
Aug. 30, 31		74 20·9	Aug. 30, 31.		·1639			C. A. French.
Sept. 1		74 18·4	Sept. 1		·1647			"
May		74 50·0				·5985		D. Douglas.
Aug. 26, 27		74 51·1	Aug. 26, 27		·1586			C. A. French.
		74 49·0	" 28		1591			"
May 26	3-10 to 3-43p	71 58·6	May 26	3-48 to 4-15p		·6030	68	W. Ogilvie.
" 26	5-00 to 5-38p	71 59·0	" 26	4 20 to 4-48p		6064	66	"
Sept.		72 02·0	Sept.			6114		J. S. Harris.
Sept. 8, 9 / Oct. 18		71 57·0	Sept. 8, 9 / Oct. 18			·6106		J. S. Harris.
June 3	2-15 to 2·52p	72 13·0	June 3	2-55 to 3-30p		·6118	70	W. Ogilvie.
" 3	4-12 to 4-35p	72 10·5	" 3	3-36 to 3-50p		·6102	70	"
		72 15·0						Richards.
		71 51·5			·1870			British Navy.
Oct. 6-8		71 42·4	Oct. 7, 8		·1878			C. A. French.
" 3		71 43·7	" 3		·1867			"
		72 14·0						Richards.
Oct. 12-14		71 19·3	Oct. 13, 14		·1876			C. A. French.
" 10		71 17·0	" 10		·1878			"
		71 18·1			·1881			C. I.
		71 39·0						K. Friesach.
May 4		71 22·1	May 4			·5925		W. H. Dall & Baker
		71 39·0						Richards.
		71 30·3			·1881			C. S.
		71 34·1	Jan. 24 / Mar. 22			·6042		R. W. Haig.
		71 52·0						Richards
		71 27·4			·1905			French Navy.
		71 32·4			·1868			British Navy.
Oct. 17, 18		71 20·2	Oct 17		·1883			C. A. French.
" 18		71 21·5	" 18		·1879			"
" 6		71 42·2	Oct. 7			·5973		H. E. Nichols.
May 6		71 29·2						W. H. Dall & Baker
		71 54·0						Richards.
June		76 09·0	June			6090		D. Douglas.
"		75 48·0	June			·6059		"
		71 53·6			·1844			British Navy.
		71 56·5			·1854			"
		71 30·2						C S.
		71 26·4			·1898			C S.
		71 24·2			·1901			C. S.
		71 25·3			·1910			"
July 30		71 58·6	July 30			·5969		H. E. Nichols.
		72 25·0						Richards.
		72 37·0						"
		72 19·0						"
Aug. 3		72 46·1	Aug. 3			·5928		H. E. Nichols.
April		72 29·0						J. Cook.
Aug. 16, 17		70 20·7						Don. A. Malespina.
Oct.		73 56·0						G. Vancouver.
Sept. 26		71 33·0	Sept. 27			·5950		H. E. Nichols.
		72 37·0						Richards.
Sept. 22		71 41·3	Sept. 24, 25			·5942		H. E. Nichols.
Aug. 5, 6		73 12·1	Aug. 7			6038		"

TABLE

MAGNETIC

BRITISH

Place.	Latitude.	Longitude.	Year.	Month and day.	Hour and minute.	Declination.
						° '
Salmon cove, Observatory inlet	55 15·6	129 52·0	1793	Between July 27 and August 12	....	25 18·0 "
Port Simpson..............	54 33·6	130 22·8	1881	Aug. 10, 12..	... .	27 54·1 "
"	54 33·5	130 23·8	1862	....	....	....
Rose harbour, Queen Charlotte island....................	52 09·1	131 15·0	1881	Sept. 20....	....	26 00·6 "
Lake Lindeman......	59 47·2	135 04·8	1887	June 25...	1-00p	32 16·8 "
"	"	"	"	.. ... .	.. ....	....

I X.—*Con.*

RESULTS.—*Con.*

COLUMBIA—*Con.*

Month and day.	Hour and minute.	Dip	Month and day.	Hour and minute.	Hor. intens.	Total intens.	Temperature.	Observer.
		° ′						
Between July 27 and August 12.	....	75 54·5	....	....	....	....	....	Vancouver.
Aug. 9....	....	74 21·0	Aug. 10, 12..	....	....	·5987	....	H. E. Nichols.
....	....	74 53·0	....	....	....	....	....	Richards.
Sept. 19....	....	72 30·2	Sept. 20....	....	....	·5957	....	H. E. Nichols.
June 25....	10-55 to 11-19a	77 03·9	June 25 ...	11-23 to 11-50a	....	·5987	56	Wm. Ogilvie.
" 25....	0-19 to 0-47p	77 06·5	" 25....	11-52a to 0-13p	....	·5973	56	"

TABLE
MAGNETIC
YUKON AND
(North of

Place.	Latitude.	Longitude.	Year.	Month and day.	Hour and minute.	Declination.
	° ′	° ′				° ′
Portage du Grand Detour....	60 22·0	113 00·0	1844	June 25....	5-58p	35 15·0 E.
Fort Resolution	60 10·7	113 46·0	1825	....	....	29 15·6 "
"	"	"	1844	June 22....	10-20a	37 12·5 "
"	"	"	"	....	....	....
"	"	"	"	....	....	....
"	"	"	1888	Sept. 20....	4-45p	38 20 2 E.
"	"	"	"	....	....	....
Fishing station, Little lake....	61 11·7	116 38·0	1844	June 20.....	6-02a	35 28·0 E.
" " ..	"	"	"	....	....	....
Fort Confidence..............	66 54·0	118 49·0	1839	....	....	....
"	"	"	1849	....	....	....
"	"	"	"	....	....	....
"	"	"	"	....	....	....
"	"	"	"	....	....	....
"	"	"	"	....	....	....
"	"	"	"	....	....	....
"	"	"	1850	....	....	....
"	"	"	"	....	....	....
"	"	"	"	....	....	....
"	"	"	"	....	....	....
"	"	"	"	....	....	....
Fort Simpson	61 51·7	121 25 3	1825	....	....	....
"	"	"	1844	Mar. 30 ..	7-58a	37 52·0 E.
"	"	"	"	" 30....	9-13a	38 43·0 "
"	"	"	"	" 30....	3-46p	37 28 0 "
"	"	"	"	" 30....	4-56p	38 02 0 "
"	"	"	"	May 8....	9-00a	37 57·0 "
"	"	"	"	....	....	....
"	"	"	"	....	....	....
"	"	"	"	....	....	....
"	"	"	"	....	....	....
"	"	"	"	....	....	....
"	"	"	1888	Aug. 27....	8-20a	37 42·4 E.
"	"	"	"	....	....	....
"	"	"	"	....	....	....
Fort Norman.	64 40 6	124 44·8	1844	....	....	....
"	"	"	"	....	....	....
"	"	"	"	....	....	....
"	"	"	"	....	....	....
"	64 54·3	125 43·1	1888	July 29.....	8-15p	33 39 0 E.
"	"	"	"	....	....	....
Mackenzie river............	64 26·7	125 03·8	"	Aug. 5.....	7-17p	41 34·6 "
"	"	"	"	....	....	....
Fort Good Hope..........	66 16 0	128 31·0	1844	....	....	....
"	"	"	"	....	....	....
"	"	"	"	....	....	....
"	"	"	"	....	....	....
"	"	"	"	....	....	....

X.

RESULTS.

Northwest Territories.

Latitude 60°).

Month and day.	Hour and minute.	Dip. ° ′	Month and day.	Hour and minute.	Hor. intens.	Total intens.	Temperature °	Observer.
June 25		82 33·6						J. H. Lefroy.
								J. Franklin.
June 22	a.m.	82 43·5	June 22			·6428		J. H. Lefroy.
" 22	a.m.	82 45·4	" 22			·6439		"
			" 22			·6437		"
Sept. 19	4-00 to 4-23p	82 10·1	Sept. 19	4-34 to 4-49p		·6308	60	Wm. Ogilvie.
" 19	5-15 to 5-32p	82 08·0	" 19	4-51 to 5-08p		·6307	60	"
Mar. 18		82 08·7	June 20			·6390		J. H. Lefroy.
			" 20			·6369		"
June		84 48·0						T. Simpson.
October		84 49·4	October			·6289		J. Rae & J. Richardson.
November		84 51·1	"			·6179		"
December		84 50·0	November			·6101		"
						·6454		"
			December			·5994		"
			"			·6567		"
January		84 48·8	January			·6467		"
February		84 53·9	February			·6162		"
March		84 50·4	"			·6406		"
			March			·6101		"
			"			·6363		"
Aug. 5		81 53·1						J. Franklin.
Mar. 28	4-05p	81 53·8	May 2			·6314		J. H. Lefroy.
May 12	12-00a	81 50·7	" 2			·6394		"
			" 2			·6344		"
			" 2			·6411		"
			" 2			·6388		"
			June 12			·6373		"
			" 12			·6334		"
			" 12			·6373		"
			" 12			·6427		"
			" 12			·6350		"
Aug. 25	6-00 to 6-20p	81 17·2	Aug. 25	6-23 to 6-44p		·6249	66	Wm. Ogilvie.
" 27	5-41 to 6-03a	81 20·9	" 27	6-06 to 6-26a		·6230	46	"
" 27	6-56 to 7-16a	81 17·4	" 27	6-30 to 6-47a		·6225	46	"
May 28		82 34·3	May 28			·6250		J. H. Lefroy
			June 2			·6235		"
			" 2			·6304		"
			" 2			·6385		"
July 29	5-15 to 5-35p	81 59·1	July 29	5-40 to 6-00p		·6154	76	Wm. Ogilvie.
" 29	7-38 to 8-00p	82 01·9	" 29	6-03 to 6-40p		·6156	74	"
Aug. 5	4-48 to 5-06p	81 58·2	Aug. 5	5-12 to 5-30p		·6142	68	"
" 5	6-35 to 6-55p	81 54·0	" 5	5-35 to 6-00p		·6176	66	"
May 29	10-40p	82 55·8	May 29			6268		J. H. Lefroy.
" 29	10-40p	82 56·1	" 29			·6277		"
			" 29			·6297		"
			" 29			·6297		"
			" 29			·6409		"

TABLE

MAGNETIC

YUKON AND

(North of

Place.	Latitude.	Longitude.	Year.	Month and day.	Hour and minute.	Declination.
	° ′	° ′				° ′
Fort Good Hope..............	66 16·0	128 50·0	1888	July 13...	6-10p	41 30·9 E.
"	"	"	"	....	....	....
Marsh lake, Yukon river......	60 21·1	134 17·2	1887	July 17....	6-15p	32 46·1 E.
" "	"	"	"	....	....	....
Fort McPherson..	67 26·0	134 57·0	1888	June 22....	4-25p	46 00·8 E.
"	"	"	"	....	.. ..	....
Lewes river	60 42·3	135 04·1	1887	June 24....	6-40p	30 55·7 E.
"	"	"	"	....	....	.. . .
"	62 04·4	136 04·0	"	Aug. 7....	7-20p	33 54·8 E.
"	"	"	"	....	....	......
Fort Selkirk.	62 47·6	137 24·9	"	Aug. 18....	6-00p	34 18·0 E.
"	"	"	"	....	. ...	....
Richardsons Chain...........	69 01·0	137 25·0	1826	....	....	....
La Pierre's House............	67 23·0	136 54.0	1888	... .	....	... .
"	"	"	"	....	... ..	....
Yukon river	63 20·3	139 28·5	1887	Aug. 27 ...	5-40p	33 52·8 E.
"	"	"	"	....	....	....
Mouth of White river.........	63 11·9	139 37·8	"	Aug. 26 ...	9-45a	34 27·0 E.
"	"	"	"	....	....	.. ..
Porcupine river	65 43·0	139 40·0	1888	May 16....	11-45a	37 44·3 E.
"	"	"	"	" 20....	7-02p	37 24·2 "
"	"	"	"	... .	. .. .	... .
"	"	"	"	....	....	.. ..
Yukon river	64 25·5	140 31·7	1887	Sept. 12. ..	10-15a	35 01·1 E.
"	"	"	"	....	....	. ...
Clarence bay, Arctic ocean....	69 38·0	140 51·0	1826	....	....	....
Boundary, Observatory.	64 41·0	140 54·0	1888	Feb. 27....	4-15p	35 45·3 E.
"	"	"	"	" 28....	11-45a	35 47·5 "
"	"	"	"	....	....	....
"	"	"	"	....	....	....
"	"	"	"	....	.. . .	.. ..
"	"	"	"	....	....	....

X—*Con.*

RESULTS—*Con.*

NORTHWEST T… RIES—*Con.*

Latitude 60°).

Month and day.	Hour and minute.	Dip. ° ′	Month and day.	Hour and minute.	Hor. intens.	Total intens.	Temperature °	Observer.
July 13. ..	4-05 to 4-26p	82 17·9	July 13....	4-33 to 4-54p	....	·6123	72	Wm. Ogilvie.
" 13.....	5-20 to 5-44p	82 18·9	" 13....	4-58 to 5-17p	....	·6117	72	"
July 17.....	4-39 to 5-05p	77 31·1	" 17....	5-41 to 6-01p	....	·6035	....	"
" 17.....	6-08 to 6-31p	77 33·7	" 17....	5-08 to 5-35p	....	·6009	....	"
June 22.....	2-15 to 2-35p	81 51·8	June 22....	2-38 to 2-55p	....	·6089	72	"
" 22.....	3-44 to 4-06p	81 45·9	" 22....	2-58 to 3-18p	....	·6085	73	"
July 24....	4-22 to 4-50p	77 42·8	July 24....	4-55 to 5-14p	....	·5948	76	Wm. Ogilvie.
" 24....	6-05 to 6-35p	77 45·2	" 24 ...	5-18 to 5-36p	....	·5935	76	"
Aug. 7....	5-02 to 5-24p	78 16·4	Aug. 7 ...	5-30 to 5-52p	....	·6026	72	"
" 7 ...	6-40 to 7-00p	78 16·4	" 7....	5-55 to 6-13p	....	·6023	70	"
" 18....	4-00 to 4-22p	79 08·2	" 18....	4-28 to 4-50p	....	·6019	81	"
" 18 ..	5-14 to 5-40p	79 08·4	" 18....	4-53 to 5-09p	....	·6012	78	"
....	....	82 22·0	....	....	....	....	....	J. Franklin.
June 7....	8-12 to 8-32p	81 23·7	June 7....	8-36 to 8-55p	....	·5989	48	Wm. Ogilvie.
" 7....	9-22 to 9-40p	81 25·7	" 7....	9-00 to 9-18p	....	·5995	48	"
Aug. 27....	3-25 to 3-45p	78 35·2	Aug. 27....	3-50 to 4-10p	....	·5960	67	"
" 27....	4-48 to 5-12p	78 38·3	" 27....	4-22 to 4-44p	....	·5965	64	"
" 26....	8-00 to 8-25a	78 20·3	" 26....	8-28 to 8-50a	....	·5966	54	"
" 26....	9-15 to 9-40a	78 18·6	" 26 ...	8-55 to 9-12a	....	·5971	55	"
May 16....	9-45 to 10-07a	79 57·6	May 16....	10-15 to 10-33a	....	·6023	44	"
" 16....	11-00 to 11-18a	79 57·1	" 16....	10-39 to 10-45a	....	·6012	44	"
" 20....	4-24 to 4-45p	79 51·5	" 20....	4-50 to 5-06p	....	·5949	41	"
" 20....	5-30 to 5-55p	79 53·2	" 20....	5-08 to 5-26p	....	·6004	41	"
Sept. 12....	7-12 to 8-20a	78 45·5	Sept. 12....	8-25 to 8-40a	....	·5942	46	"
" 12....	9-15 to 9-35a	78 46·9	" 12....	8-47 to 9-10a	....	·5930	48	"
....	....	83 27·0	....	....	....	....	....	J. Franklin.
Jan. 3....	0-40 to 1-22p	78 49·7	Jan. 3....	1-40 to 1-50p	....	·5994	10	Wm. Ogilvie.
" 3....	2-25 to 2-50p	78 50·1	" 3....	1-55 to 2-20p	....	·5995	9·5	"
Feb. 27....	1-40 to 2-01p	78 50·0	Feb. 27....	2-12 to 2-30p	....	·6004	12	"
" 27....	3-10 to 3-29p	78 48·9	" 27. ..	2-45 to 3-00p	....	·5993	12	"
" 28....	9-25 to 9-43p	78 48·6	" 28 ..	9-55 to 10-09a	....	·6005	7	"
" 28....	10-53 to 11-10a	78 50·1	" 28....	10-20 to 10-34a	....	·6004	9	

Comparison at Agincourt.

On July 9, 1908, a series of readings were taken with magnet 10, Tesdorpf magnetometer 1977, magnet erect, and magnet inverted.

The resulting declination July 9, at 14^h 33^m was.. ..	6° 01′·4 W
Observatory standard magnetometer..	5° 57′·6
Similarly on July 11 at 14^h 05^m, Tesdorpf..	6° 03′·1
Observatory..	6° 00′·4
Mean difference O – T..	— 3′·2

Hence west declinations as observed with the Tesdorpf instrument must be numerically decreased by 3′·2, and east declinations increased numerically by the same amount.

For horizontal intensity the following comparisons were obtained:—

July 10 at 14^h 05^m, Tesdorpf..	·16400	in C.G.S. units.
" 14^h 05^m, Observatory..	·16387	"
" 16^h 33^m, Tesdorpf..	·16391	"
" 16^h 33^m, Observatory..	·16379	"
July 11 at 10^h 23^m, Tesdorpf..	·16356	"
" 10^h 23^m, Observatory..	·16349	"
" 11^h 44^m, Tesdorpf..	·16365	"
" 11^h 44^m, Observatory..	·16357	"
Mean difference, O – T..	·00010	

This is equivalent to ·00061 *H*, which is the quantity to be deducted from observed values of *H*. In figures 2, 3, 4, are shown the observations made for ascertaining the effect, if any, of the electric car service already referred to. The smooth curves drawn exhibit the diurnal variation clearly, showing the hours of the day when it changes most rapidly.

It will be seen that for April 24, 1909, the range was nearly 17 minutes of arc.

In figure 5, is shown a curve based upon the one of the preceding date. This curve represents the actual line that would be run by a surveyor with a compass in trying to lay down a true N.-S. line, starting at 7 a.m, of that day, getting half-mile sights, then resetting at hour intervals, always with the same magnetic reading of the compass without getting back-sights on the preceding station. The scale of offsets is much exaggerated in the figure.

The result would be that after running six miles by evening, he would be 104 links or about 69 feet west of the line on which he started in the morning.

This shows the theoretical inaccuracy of a compass line due to diurnal variation alone. Of course with the ordinary surveyor's compass it is not possible to read to single minutes, far less to fractions thereof such as enter into the above curve. But the point is, one cannot get away from the important effect of diurnal variation, though it be masked by larger errors of reading. When compass lines are, or were, run in the open a fairly straight line could be run by using back-sights or simply 'picketing' the line, but this condition was rarely the case; the most of the compass lines were run through the woods, the trees being 'blazed' along the line, those on the line were 'notched' and left standing, and the compass simply put on the other side of the obstruction and the line continued on the same bearing as near as it was possible to read the needle.

The actual magnetic bearings of the astronomic north and south line at Ottawa on that day were:

Hour.	Bearing.	Offset at end of each course from true N.-S. line of first course.
7h (a.m.)	12° 52′·4 W	0·0 links.
8	51 ·2	1·4 "
9	51 ·0	3·0 "
10	54 ·8	0·2 "
11	59 ·0	7·7 "
12	13° 03′·0	19·8 "
13	6 ·0	35·5 "
14	7 ·4	52·8 "
15	6 ·4	69·5 "
16	4 ·4	83·2 "
17	2 ·4	95·0 "
18	0 ·5	104·4 "

For the coming season it is intended to send the observer along the northern shore of the St. Lawrence from Quebec eastward to Blanc Sablon, near the western entrance of the strait of Belle Isle. The data from this territory are very meagre, so that the magnetic elements to be derived on this stretch of about 750 miles will be of particular value.

The accompanying map shows the position of the various stations given in the table, and the direction of the magnetic meridians at the respective stations or places.

GRAVITY.

During the past season no member of the staff was available for making gravity observations.

I have the honour to be, sir,

Your obedient servant

OTTO KLOTZ.

FIG. 1 Magnetic Hut, Ottawa.

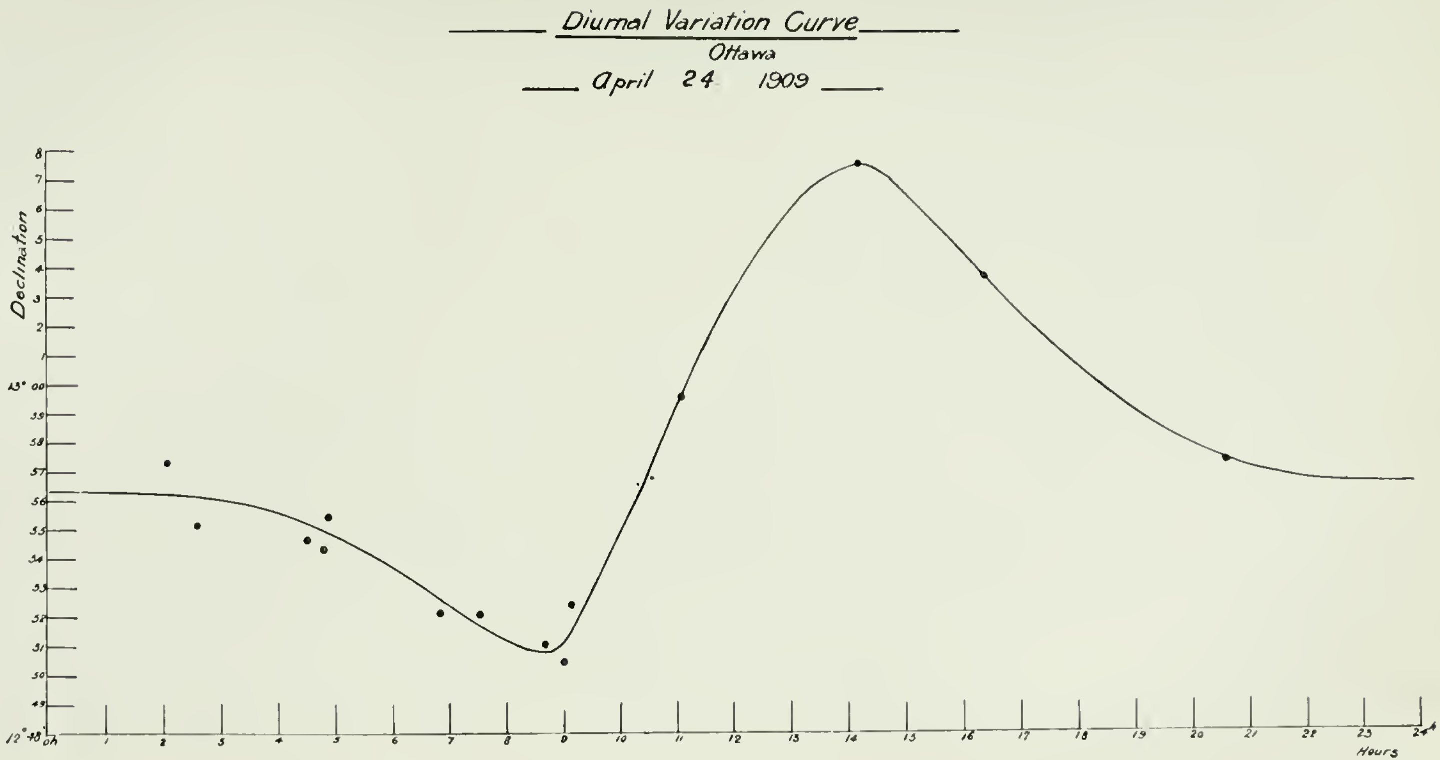

Diurnal Variation Curve
Ottawa
April 24 1909
Declination
8
7
6
5
4
3
2
1
13° 00
59
58
57
56
55
54
53
52
51
50
49
12° 48
0h
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24h
Hours

FIG. 2.

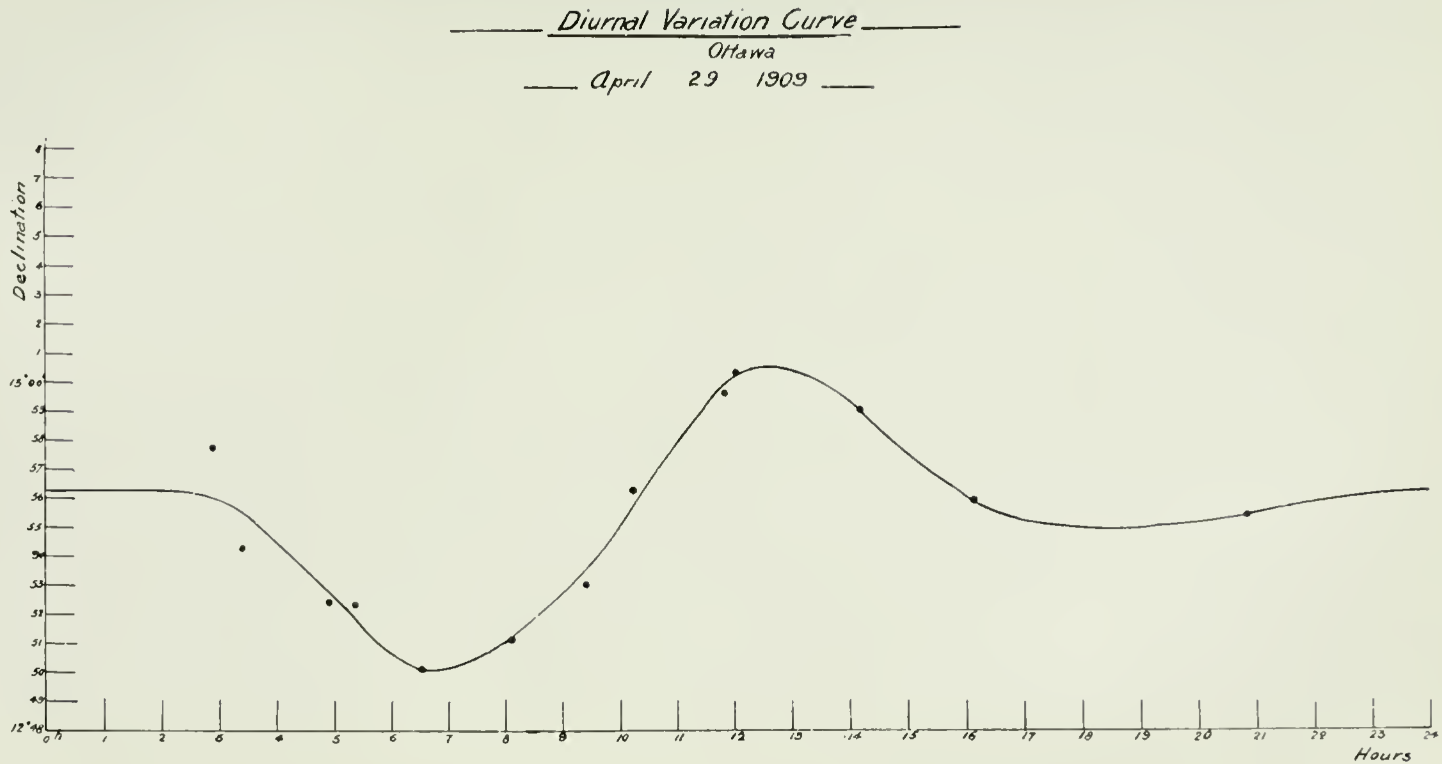

Diurnal Variation Curve
Ottawa
April 29 1909
Declination
15°00'
12°48'
Hours

FIG. 3.

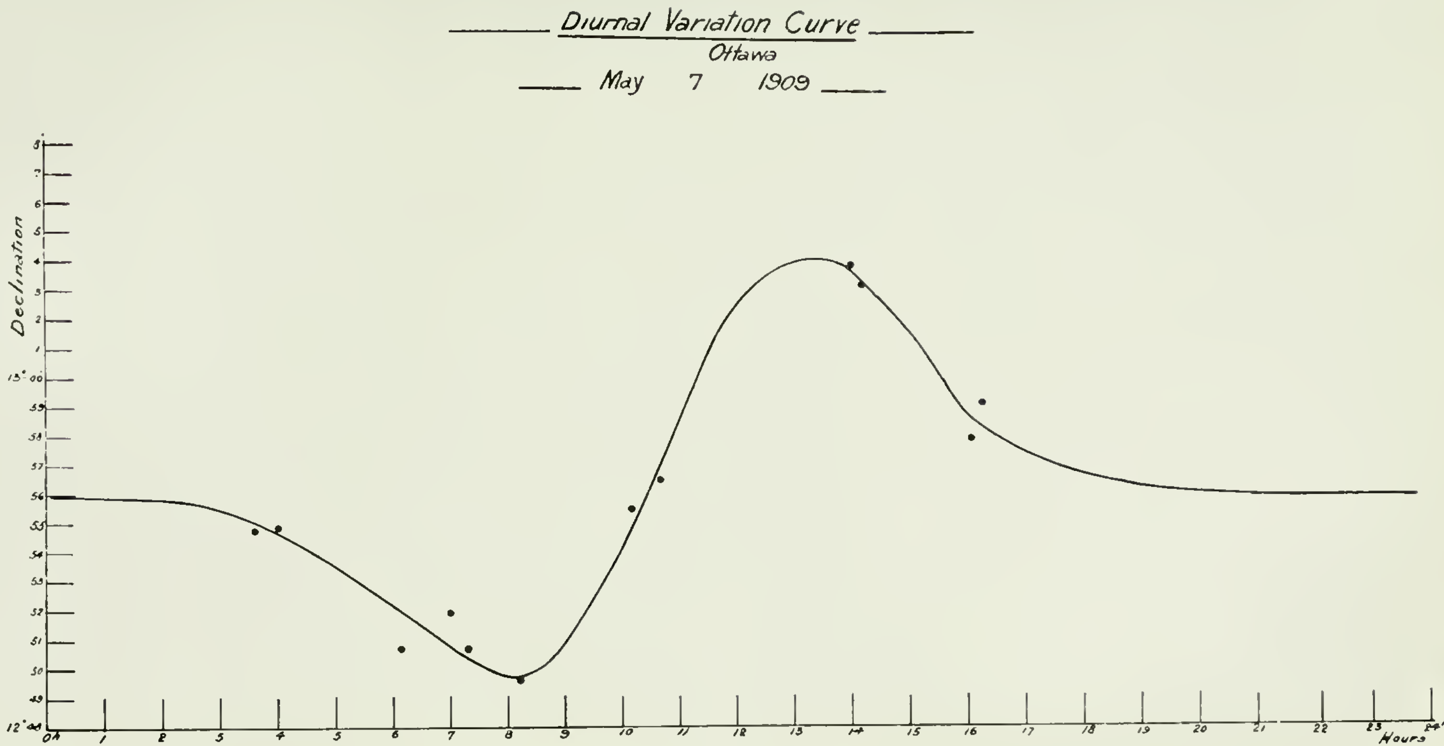

Diurnal Variation Curve
Ottawa
May 7 1909
Declination
8
7
6
5
4
3
2
1
15° 00
59
58
57
56
55
54
53
52
51
50
49
12° 48
0h
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24h
Hours

Fig. 4.

Survey Curve.

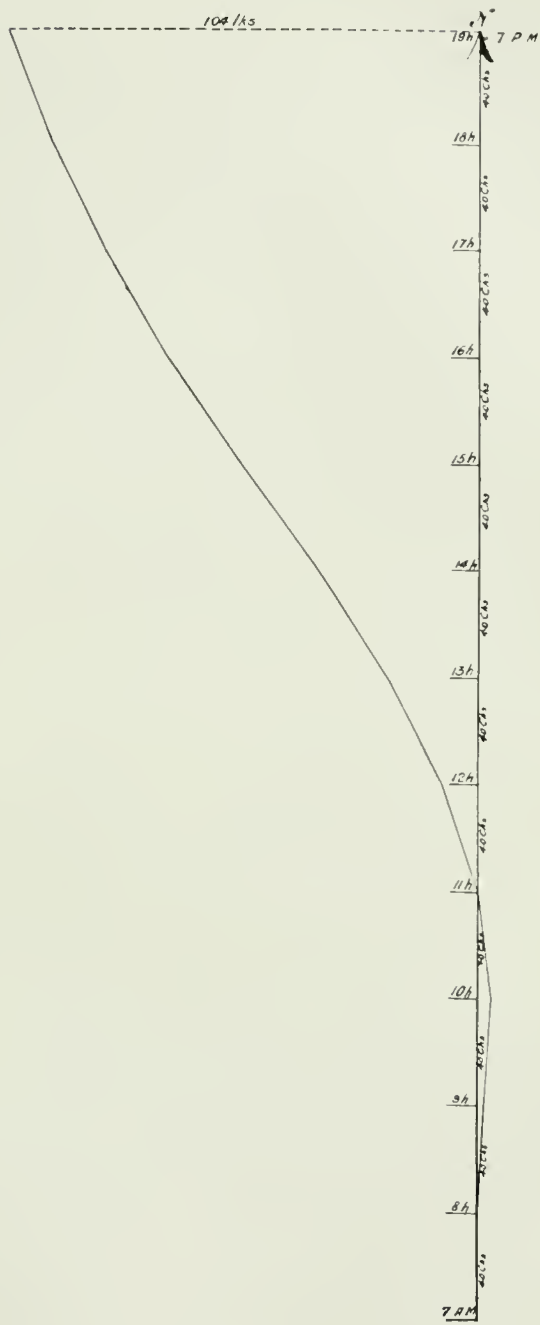


FIG. 5.

APPENDIX 2.

REPORT OF THE CHIEF ASTRONOMER, 1909.

ASTROPHYSICAL WORK

BY

J. S. PLASKETT, B.A.

CONTENTS.

Appendix B.—J. B. Cannon.

ILLUSTRATIONS.

APPENDIX 2.

ASTROPHYSICAL WORK BY J. S. PLASKETT, B.A.

OTTAWA, March 31, 1909.

W. F. KING, C.M.G., LL.D.,
Chief Astronomer,
Department of the Interior,
Ottawa.

SIR,—I have the honour to submit the following report upon the work carried on in the Astrophysical Department and in the other departments of the work of the Observatory under my direction during the past year.

It gives me pleasure to report satisfactory progress in all lines and to state that the work accomplished both in quality and quantity shows gratifying improvement over the records of previous years. As in previous years also it has been found necessary to spend considerable time in preparatory work, in testing, adjusting, and perfecting the instruments and appliances used, and in experimenting to determine the best methods of procedure. Although the time spent on such work necessarily diminishes the quantity of routine work accomplished, it is in my opinion time well spent, if through such investigations and experiments we are in a position to do a larger quantity of more accurate work. Consequently, much of my time during the past year has been devoted to investigations bearing on improvements in instruments and methods, of which full details will be given later.

It gives me much pleasure to be able to speak in the highest terms of the very satisfactory work done by my assistants, Messrs. Harper, Motherwell, DeLury, Cannon and Parker.

As heretofore, the principal work has been the determination of the radial velocities of stars by means of the spectroscope, and in this work observations have been chiefly confined to known spectroscopic binaries for the determination of the elements of their orbits. However, observations on some stars with early type spectra have also been secured during times when sufficient binaries have not been available, and in measuring up the plates we have found the velocities of four of these stars to be variable; δ Herculis, γ Aquarii, ι Andromedæ, ξ Persei. The two latter, it has since been learned, had been previousy found variable at the Yerkes Observatory, but not published, so that our discovery was independent.

The elements of the orbits of five spectroscopic binaries have been obtained, least squares corrections being applied in every case. The stars are θ Aquilæ, α Coronæ Borealis, η Boötis, ϵ Herculis, β Orionis. These stars will be discussed in detail below, but it may be of interest to mention that only in one case, η Boötis, have the observations been entirely satisfied by velocity curves due to simple elliptic orbits. In θ Aquilæ and ϵ Herculis a secondary disturbance due possibly to a third body, has been present. In α Coronæ Borealis the elements deduced from the hydrogen lines and the calcium, K, line differ from those obtained from the magnesium λ4481·4, while in β Orionis the amplitude of the velocity seems to be variable. This latter is of especial interest on account of the measures made at Yerkes and Lick Observatories showing its velocity to be constant within the apparent errors of observation.

Besides the binaries above, whose orbits have been determined, there are twelve others under observation, on three or four of which the work is well advanced. On the remainder, however, a considerable number of observations are still required. About 90 per cent of the binaries observed here are stars of early type, in the majority of which the lines in the spectra are broad and diffuse, in some cases unsymmetrically so, and consequently difficult of measurement. In such cases the agreement among the lines in a plate is poor and the error of measurement is high, the probable errors of single plates being as great as 7km. per second in some cases. It is evident that, unless there is a large range of velocity, the elements of the orbits of such stars are subject to considerable uncertainty, and indeed in several cases the star has had to be abandoned on this account after considerable work had been done on it.

The instrumental equipment for this work has been increased since my last report by the addition of a new single-prism spectrograph designed by myself, and constructed, except the optical parts, entirely in our own workshop. Owing to press of repair and other work it was not completed and put into commission until about the first of March, but it has fulfilled all expectations both as regards shortening of exposure time and in respect to its stability and freedom from flexure. The displacement of the spectrum lines produced by a revolution of 180°, this producing the maximum amount of flexure, is quite unmeasurable and is not even certainly visible under high power magnification: there is no question but that it is the most stable single-prism spectograph ever constructed. The difference between it and the previous instrument, which was for its type a rigid example, is very marked, the displacement in the early instrument being equivalent to a velocity of over 100km. per second.

My investigation on the fields given by different types of camera objectives for spectrographs was completed, and a concise account of the performance of all the objectives tested will be given below and will also appear in the Astrophysical Journal in May. Since my previous report a new single material Brashear objective for the new single prism spectrograph has been received and tested. Its angular aperture is about 50 per cent greater than the original one and when received, owing to the greater difficulty in correction, it had a small amount of positive aberration. By the kindness and through the skill of Mr. McDowell this aberration was finally removed and the objective is now practically perfect for its purpose. A special short focus objective by Ross has also been received and tested, giving beautiful definition and a fairly flat field. Thus, the requirements for all types of camera objectives have been successfully met, and there are now available suitable objectives for all classes of radial velocity and other spectroscopic work.

The investigation on the effect of increasing the slit width on the errors of measurement in radial velocity work has been continued with the two different dispersions now available. The new single-prism spectrograph and a short focus objective with the three prism instrument have been tested, giving results that bear out and extend those previously obtained. It is shown that, so far as early type spectra are concerned, both accidental and systematic errors approach a minimum value for a slit 0·051mm. wide and that the use of a narrower slit, instead of increasing the accuracy as has generally been supposed, has to a certain degree the opposite effect, to say nothing of the proportional increase of exposure required. A detailed report of this work will be postponed to allow it to be finally completed.

In presenting the work on radial velocities and allied investigations in detail, I have adopted the same plan as last year, of having each observer give the details and results of the work he has been engaged on. Consequently, below will be found, besides my own remarks on radial velocities in general, my description of the new spectrograph, the investigations on camera objectives and on the effect of slit width, and the orbit of β Orionis, the orbits of θ Aquilæ, η Boötis and ϵ Herculis by Mr. Harper, and the orbit of α Coronæ Borealis by Mr. Cannon. Mr. Parker, the third observer in radial velocity work, besides measuring many miscellaneous plates, spent a great deal of time on the binary τ Tauri, but owing to difficulties due to causes outlined above was unable to obtain a satisfactory orbit and further observations next season will probably be necessary.

Work with the coelostat telescope in spectroscopic investigations of the sun has made satisfactory progress, although not as much has been accomplished as we had hoped. This has been due to various unavoidable constructional delays in having the 23-foot spectrograph and its attachments completed, to a long delay while the solar research laboratory was torn up for the installation of underground pipes and an electric pump for draining the transit house piers, and to a very thorough investigation of some peculiar properties in the plane grating used as the dispersion piece in the spectrograph. This investigation, which is fully described by Dr. DeLury below, showed that only by masking part of the grating could even fair definition be secured, while the best definition is necessary for accurate results in the determination of the solar rotation. A number of plates for this purpose have been secured and some preliminary measures by Dr. DeLury will be given. An illustrated description of the coelostat telescope and mechanism will be given by myself, and a description of the spectrograph and attachments by Dr. DeLury.

Mr. Motherwell has used the equatorial on three half nights per week in micrometric measures of double stars and has obtained a number of good measures, although his, as well as all other work with the telescope, has been much handicapped by the exceptionally poor observing weather of last fall and early winter. For nearly four months, smoke and cloud prevented almost all observations. This was especially unfortunate on account of the presence of Morehouse's comet, an especially interesting object, photographically, which this bad weather prevented from being photographed here more than half a dozen times. However, Mr. Motherwell will give an account in Appendix D of the double star measures obtained, of the occultations of stars by the moon observed, and of the photographs of the comet secured.

A full account of an interesting and useful investigation by Mr. Motherwell on the aberration of the 8″ Brashear Photographic Doublet, used in making the comet pictures, will be given. When this instrument was first tested by me, soon after the Observatory was completed, it was found to give halos around the stars of medium intensity, while in the brighter stars this halo had become so fully exposed as to make images of uniform intensity and of large diameter. This difficulty I ascribed to spherical aberration, but this diagnosis was opposed by the makers of the lens.

I suggested to Mr. Motherwell as a suitable and useful subject for investigation to determine by Hartmann's method of extra-focal exposures the amount of spherical aberration present. His thorough tests showed the lens to have negative aberration to the extent of about 3·5mm., which in our opinion was quite sufficient to account for the halo observed. A suggestion of Mr. McDowell that it was due to chromatic aberration was found by Mr. Motherwell not to be the case. The matter remained in abeyance for some time, when on a further suggestion from Prof. Hastings the separation of the elements of the front component was changed to remove the halo, supposedly a 'ghost' due to internal reflections. However, a test showed no improvement on the original positions in the slight change proposed. Further correspondence with Mr. McDowell resulted in a suggestion from him to increase the separation by about 2mm., which would practically remove the aberration. On this being done and the distance adjusted so that the aberration was removed, the halo disappeared which was a striking confirmation of our contention that it was caused by aberration. A recent letter from Mr. McDowell admits that we were right as he had proved by refiguring a lens giving a similar halo.

In consequence, the objective will be sent to Alleghney to have this aberration removed and with its already very flat field we should have an unequalled star camera. In this regard, I would urge upon you the desirability of supplying the camera with a separate mounting. Its attachment to the equatorial telescope results in seriously limiting its usefulness; for when star photographs are being made, no work, other than the guiding, can be done with the equatorial. A separate mounting, however, would enable the two to be used independently and much more use could be made of the camera than is possible at present.

The quantity of repair and other work has increased so greatly. that the two mechanicians, Mr. Mackey and Mr. Lucas, the latter having been appointed since my last report, have not been able to keep up with all the work required. Repairs and minor alterations in the field instruments used in the Geodetic and Boundary Surveys, occupy about one-half their time, leaving the remainder for new work. The new single-prism spectrograph, the mechanical parts of the solar 23-foot focus spectrograph, and new hardened steel pivots on the meridian circle are the principal pieces of work accomplished. Besides these are numerous smaller pieces of work. Scarcely a day passes that some work does not come in.

The equipment of the machine shop has been increased by a 14 inch by 7 foot Hendry Norton lathe, which is installed and in use. With two lathes there is now no possibility of delaying work for lack of tools. The lathe is the tool most used in machine work and frequently cases occurred where both men required the lathe at the same time; in consequence the work could not be done to the best advantage. The workshop is too small for the tools and the amount of work done, and moreover the light in it is not of the best. It is desirable that, as soon as possible, provision be made for a suitable workshop above ground with ample room and light. The necessity and economy of a suitably equipped workshop for the Observatory are so evident, and the probability of an increase in its capacity being required is so great. as to justify the question of a more suitable location than the present one being carefully considered.

The field instruments and others of a portable nature have been most carefully looked after by Mr. Motherwell, who has kept a careful record of their movements. This work has become, with the increase in the staff and in the number of instruments, one of considerable labour and trouble and takes much of his time in the spring and fall.

The Saturday open nights of the telescope for the public continue to be well patronized, the average attendance on fine nights being upwards of fifty, and much intelligent interest is manifested by many of the visitors in astronomy. This interest is further fostered by the papers presented at the evening meetings of the Royal Astronomical Society of Canada, of which the majority are given by officers of the Observatory. It may not be amiss here to refer also to the value of the work done by the members of the Observatory staff in the afternoon or technical lectures given alternately with the evening ones. These lectures and papers presenting in most cases original work in different lines of astronomy have been of great value. not only in keeping us acquainted with each other's work but also in encouraging researches along original lines which have been frequently of distinct value to science.

The following papers by members of the staff of the Astrophysical Division have been published since the date of the last report:—

1. The spectroscopic Binary ι Orionis, by J. S. Plaskett and W. E. Harper. Astrophysical Journal XXVII., p. 272, May, 1908.

2. Effect of increasing the slit-width upon the accuracy of Radial Velocity Determinations, by J. S. Plaskett, Astrophysical Journal XXVIII., p. 259, Nov., 1908.

3. The spectroscopic Binary ψ Orionis, by J. S. Plaskett, Astrophysical Journal XXVIII., p. 266, November, 1908.

4. The Orbit of ι Orionis, by J. S. Plaskett, Astrophysical Journal XXVIII.. p. 274, November, 1908.

5. The Astronomical and Astrophysical Society of America, by J. S. Plaskett, Journal of the Royal Astronomical Society of Canada II., p. 255, September-October, 1908.

6. The Reduction of Cadmium by Mercury and the Electro-Motive Force of Cadmium Amalgam, by R. E. DeLury and G. A. Hulett, Journal of the American Chemical Society, volume 30, No. 12, p. 1805, December, 1908.

7. Comet 1908 (Morehouse), by R. M. Motherwell, Journal of the Royal Astronomical Society of Canada III., p. 28, January-February, 1909.

8. The Orbit of θ Aquilæ, by W. E. Harper, Journal of the Royal Astronomical Society of Canada VII., p. 87, March-April, 1909.

Besides the above the following papers are to appear shortly, the work on them having been completed and sent to the publishers:—

9. Camera Objectives for Spectrographs, by J. S. Plaskett, Astrophysical Journal, May, 1909.

10. The Spectroscopic Binary β Orionis, by J. S. Plaskett, Astrophysical Journal, July, 1909.

11. The design of Spectrographs, by J. S. Plaskett, Journal of the Astronomical Society of Canada, May-June, 1909.

In addition to the above the Astrophysical Division have sent in the titles of the following seven papers to be read before the Royal Society of Canada at their meeting, May 25, 1909:—

12. A new Single Prism Spectrograph, by J. S. Plaskett.

13. Slit width and Errors of Measurement in Radial Velocity Determinations, by J. S. Plaskett.

14. The spectroscopic Binary β Orionis, by J. S. Plaskett.

15. The System of ϵ Herculis, by W. E. Harper.

16. Aberration of a Stellar Camera Objective, by R. M. Motherwell.

17. Convection and Stellar Variation, R. E. DeLury.

18. The Orbit of α Coronæ Borealis, by J. B. Cannon.

In general the work represented by these papers will appear in detail below, arranged sometimes in a little different form, and including as a rule the whole of the original measurements and data which were abbreviated or left out in the published papers.

THE SPECTROGRAPHS.

During the year just passed the Ottawa spectrograph, illustrated and described in the 1907 report, has been used almost entirely, the new single-prism spectrograph not having been ready for service until about March 1, 1909. The former instrument has been used mostly in the single-prism form, the three prisms having been used only for some plates of β Orionis and a few others. The spectrograph has not been changed in any way since the last report, and its performance has continued satisfactory. Nothing further need be added about this instrument, except that towards the close of the year the Zeiss Tessar objective of 300mm. focus, referred to in the last report, was temporarily mounted for the purpose of continuing the tests on the effect of slit-width on errors of setting so far as applies to a dispersion of three prisms with a short focus camera. This mount will be placed in a permanent form as soon as time can be found in the workshop, and used on solar type binaries too faint to be obtained with the long focus camera.

Before proceeding to describe the new single-prism spectrograph, which was briefly referred to in my last report, it has seemed desirable to enter more fully than was there done into the principles on which its design was based, and for this purpose I can not do better than give here a paper on 'The Design of Spectrographs,' which I read at an afternoon technical meeting on May 25, 1908, and which will appear in the May-June number of the Journal of the Royal Astronomical Society of Canada.

THE DESIGN OF SPECTROGRAPHS FOR RADIAL VELOCITY DETERMINATIONS.

Read before R.A.S.C., May 28, 1908.

The subject of spectroscopy is so broad that one can not hope in a single paper to do more than touch upon a single aspect of it, and, even then, one must further limit his treatment to a particular application of this phase. Consequently, I propose to present some considerations bearing upon the design of spectrographs suitable for the accurate determination of stellar radial velocities. This branch of spectroscopy is comparatively new and is still probably only in the experimental and tentative stage. The present practice in this line has, however, reached a certain uniformity and the general theoretical principles governing the design of spectroscopes may be applied to the case under consideration, modified, of course, in many ways by the experience of the various observers. The question is one of a judicious combination of theory and experience, and I propose to present my own views, founded, of course, on theoretical considerations, but modified partly by the practice of other spectroscopists, partly by my own experience in the work and by the results of special investigations bearing on the most suitable form and dimensions of the instrument.

The determination of the radial velocities of stars by means of the spectroscope is one of the most exacting of astronomical investigations, and requires the closest attention to all details to ensure accurate values. This will be more readily recognized when the smallness of the displacement of the spectral lines on which the velocity depends is known. Thus, in the Ottawa Spectrograph a velocity of 20km. per second, which is greater than the average velocity of the stars, causes a displacement at $H\gamma$, the centre of the measurable range, of about 1/2700 inch for the single-prism, and about 1/800 inch for the three-prism form of the instrument. The accidental errors arising in the measurement of this displacement, in spectra with good lines, are, however, not so much to be feared as systematic displacements of the lines as a whole, of which no evidence is given in the measurements, caused by flexure of the parts of the spectrograph, by temperature changes in the prisms and lenses and also in the metal frame, by faulty adjustment of the focal positions of camera and collimator, as well as by numerous other causes. Some idea of the magnitudes of these displacements may be gained from the following figures. An hour's exposure in one of the modern spectrographs introduces flexure displacement equivalent, in some positions of the telescope, to a velocity of 10km. per second. A change of temperature of 1°C. in the prism displaces the lines by about 20km., which may be increased further by the expansion of the metal parts. An inaccuracy in the focal setting of the camera of only 0·1 mm. 1/250 inch, may, when combined with poor guiding, cause a displacement of about 5km. It does not follow that such displacements necessarily cause a corresponding error in the velocity as they may be compensated for, partially at any rate, by a similar displacement of the comparison lines. But the possibility remains, and inaccurate results can only be prevented by constant and careful attention to all details. It becomes, therefore, a question of equally great importance with proportioning the optical parts to give accurately measurable spectra in the shortest possible exposure time, to so design the whole instrument that systematic errors due to the above or other causes may be provided for and eliminated as far as possible.

The design of a spectrograph may be most conveniently attacked under two separate headings:

1. The character and proportions of the optical parts.

2. The mechanical connection of these parts into a symmetrical and stable whole, with suitable auxiliary devices for controlling the temperature, applying comparison, &c.

The Optical Parts.

'Up to the present, prisms of dense flint glass have been the sole dispersing medium used for radial velocity work. Gratings, so useful in other branches of spectroscopy, have not yet been applied in this work, chiefly on account of the division of the incident pencil into a number of spectra with the consequent loss of light, and also on account of the difficulty of maintaining their position invariable without distorting the surface. Prisms have very decided advantages over gratings in this respect as, when set at minimum deviation, a small angular rotation of the prism will scarcely displace the spectrum lines, while with a grating the angular displacement of the lines is double that of the prism. The optical parts of a spectrograph are then:—1. The slit, whose width is usually between 0·025 and 0·051mm., one and two thousandths of an inch, on which the star image is condensed by the telescope. 2. The collimating lens placed at its focal distance from the slit and consequently rendering the incident pencil parallel. 3. The prism or prisms placed at minimum deviation for some particular wave-length usually near $H\gamma$. 4. The camera lens which forms an image of the spectrum on the photographic plate.

'As the terms dispersion, resolving power, purity, &c., will be frequently used and as the prism angle, thickness of base, &c., require computing, it seems preferable to give here a short synopsis of the theory involved and the formulæ used, particularly as these are not readily available in a suitable form or collected together in one place.

'When a pencil of parallel white light is incident upon a prism, the direction is changed, the light is deviated, and it is also decomposed into its constituent colours forming a spectrum, the wave-lengths of the light giving rise to these colour-sensations, diminishing as you go from red to violet. The fundamental formula determining the direction after refraction is, i being the angle of incidence, r of refraction,

$$\sin i = \mu \sin r.$$

μ is the index of refraction which varies for different materials and for different wave lengths in the same material, increasing as the wave length diminishes. In all spectroscopes the prisms are used at the position of minimum deviation, which, it may be easily shown, requires the angles of incidence and emergence to be equal. The discussion will therefore be confined to this particular case, resulting in a considerable simplification.

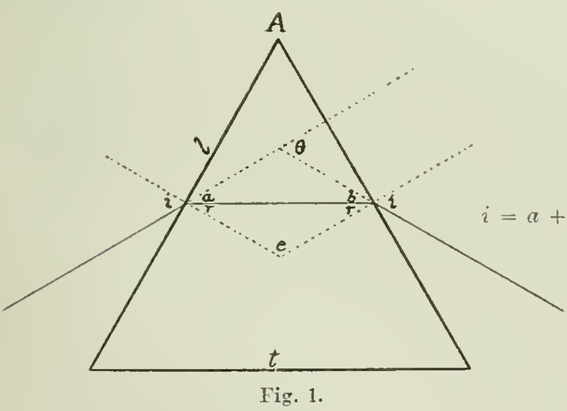


Fig. 1.

$$A + e = 180°$$
$$e + 2r = 180°$$
$$\therefore r = \frac{A}{2};$$
$$\theta = a + b; \quad a = b.$$
$$\therefore a = \frac{\theta}{2}.$$

$$i = a + r = \frac{A + \theta}{2}, \text{ and as } \sin i = \mu \sin r,$$

$$\mu = \frac{\sin \frac{A + \theta}{2}}{\sin \frac{A}{2}}.$$

If a is aperture of incident pencil just filling prism,

$$l = a \sec i.$$

$$t = 2\, l \sin \frac{A}{2} = 2\, a \sec i \sin \frac{A}{2}.$$

'If θ the deviation and μ the index are given to find A or the angle of the prism,

$$\sin \frac{A+\theta}{2} = \mu \sin \frac{A}{2} \text{ and reducing and simplifying}$$

$$A = 2 \sin^{-1} \frac{\sin \frac{\theta}{2}}{\sqrt{\sin^2 \frac{\theta}{2} + \left(\mu - \cos \frac{\theta}{2}\right)^2}}.$$

'The dispersion of a prism is usually defined as the ratio of the change in deviation to the change in wave length or $\frac{d\theta}{d\lambda}$. As the deviation varies with the index of refraction and as the latter varies with the wave length we may put

$$\frac{d\theta}{d\lambda} = \frac{d\theta}{d\mu} \cdot \frac{d\mu}{d\lambda}, \text{ but}$$

$$\mu = \frac{\sin \frac{A+\theta}{2}}{\sin \frac{A}{2}}$$

$$\therefore \frac{d\theta}{d\mu} = \frac{2 \sin \frac{A}{2}}{\cos \frac{A+\theta}{2}} = \frac{2 \sin \frac{A}{2}}{\cos i}$$

$$= \frac{2 \sin \frac{A}{2}}{\sqrt{1 - \sin^2 i}} = \frac{2 \sin \frac{A}{2}}{\sqrt{1 - \mu^2 \sin^2 \frac{A}{2}}},$$

$$\text{also } \frac{d\theta}{d\mu} = \frac{\frac{2 \sin i}{\mu}}{\cos i} = \frac{2}{\mu} \tan i.$$

'To obtain $\frac{d\mu}{d\lambda}$ we require a relation between λ and μ. The simplest is obtained from Hartmann's interpolation formula.

$$\mu = \mu_0 + \frac{c}{\lambda - \lambda_0}$$

$$\therefore \frac{d\mu}{d\lambda} = -\frac{c}{(\lambda - \lambda_0)^2} \text{ and consequently}$$

$$\frac{d\theta}{d\lambda} = \frac{d\theta}{d\mu} \cdot \frac{d\mu}{d\lambda} = -\frac{c}{(\lambda - \lambda_0)^2} \cdot \frac{2 \sin \frac{A}{2}}{\sqrt{1 - \mu^2 \sin^2 \frac{A}{2}}}.$$

'Let us now consider resolving power or the ability of the prism to separate lines close together in the spectrum. Lord Rayleigh has shown, in the case of the image of an infinitely narrow slit produced at the focus of a telescope lens, that the linear distance ξ of the first diffraction minimum from the principal maximum is given by the equation.

$$\frac{a\,\xi}{m\,\lambda\,f} = 1,$$

where a is the aperture and f the focus of the lens and m is a constant, 1·0 for rectangular and 1·2 for circular apertures.

$$\frac{\xi}{f} = \frac{m\,\lambda}{a}$$

$\frac{\xi}{f}$ is then the least angular distance at which two rays can be seen separated. Calling the angle $d\theta$ we have

$$d\,\theta = \frac{m\,\lambda}{a}.$$

For the case of a prism we have

$$a = l\cos i,\ t = 2\,l\sin\frac{A}{2}$$

$$\therefore\ \frac{t}{a} = \frac{2\sin\frac{A}{2}}{\cos i} = \frac{d\,\theta}{d\,\mu}$$

Combining we get the minimum condition of resolution

$$t = \frac{m\,\lambda}{d\,\mu}.$$

Again, omitting the constant m, we have

$$d\,\theta = \frac{t\,d\,\mu}{a} = \frac{\lambda}{a},$$

and multiplying by $\frac{a}{d\,\lambda}$ we get

$$a\,\frac{d\,\theta}{d\,\lambda} = t\,\frac{d\,\mu}{d\,\lambda} = \frac{\lambda}{d\,\lambda}$$

where $\frac{\lambda}{d\lambda}$ is the minimum value which permits resolution of close lines. $\frac{\lambda}{d\lambda}$ or the ratio between the mean wave length of a pair of lines which can just be resolved in a spectroscope and the difference in wave length between the two components is called the resolving power of the spectroscope and is usually designated by the letter R.

'The linear dispersion $\frac{ds}{d\lambda}$ where f = focal length of camera is

$$\frac{d\,s}{d\,\lambda} = f\cdot\frac{d\,\theta}{d\,\lambda} = f\cdot\frac{R}{a}.$$

'The resolving power R refers to infinitely narrow lines through an infinitely narrow slit. When, as necessarily occurs in practice, neither of these two conditions holds, we speak of the purity of the spectrum or the practical resolving power for wide slits. Schuster has given a simple expression for the purity which is always a fraction of the theoretical resolving power R. This expression has been elaborated by Wadsworth and later still Schuster has given tables for determining the purity. But as no appreciable error will be introduced in the relative values used in this work, it has seemed preferable to adhere to the simple form. If d = slit width and ψ = angular aperture of the collimator $= \frac{a}{f}$, the Purity $P = \frac{\lambda}{d\,\psi + \lambda} \cdot R$.

'We have now obtained all the formulæ necessary to compute the data for any optical system and to compare the efficiency of different forms of spectroscopes. To take a concrete case, which is more applicable for our purpose than a general discussion, I propose to consider the question of the most suitable aperture to be given a single-prism spectrograph which is being constructed for the Dominion Observatory. The present spectrograph, which is arranged to be used with either one or three prisms, has a collimator of 35mm. aperture, 525mm. focus and two cameras, one for each form of 525mm. focus. It performs excellently for both purposes, but when, as often happens, both single and three prisms are required on the same night, the change from one form to the other is somewhat tedious, requiring 15 or 20 minutes, and moreover, what is far more important, such change involves uncertainties as to the temperature conditions of the optical parts and therefore corresponding uncertainties as to the accuracy of the velocities obtained.

'In order to fill the collimator lens completely with star light its aperture ratio $\frac{a}{f}$ must be the same as that of the equatorial. The aperture ratio of the Ottawa telescope is 1 to 15, consequently the focal length of the collimator must be 15 times the aperture. This aperture is limited on the lower side by the condition that sufficient purity must be obtained, purity being proportional to the aperture at a practicable width of slit, to so separate lines and blends of lines that sufficiently accurate identifications of lines and the true wave lengths of blends may be obtained. It is limited on the upper side by the difficulty of obtaining homogeneous prisms of large size, by the increased absorption of such prisms, and by the increased size and weight of the instrument. In all the spectrographs used in radial velocity work the apertures lie between 30 and 51mm., and these seem to be about the practical limits. It remains to determine the most suitable.

'The basis of the discussion* rests upon the results obtained for the effective diameter of the star image given in my paper on 'The Star Image in Spectroscopic Work,' No. II, which was read here last fall and published in the Astrophysical Journal, March, 1908. The results of a number of experiments, photographs of star images, spectra and trails, went to show that only very rarely is the effective diameter of the image less than 2 secs. of arc (about 0·055mm.) at the focus of the refractor. Generally the diameters of images and the widths of spectra and trails are considerably greater, increasing to over 0·1mm. with longer exposures. As the theoretical diameter of the central disc is only 0·57″ (about 0·015mm.) and, as the condensing system of visual objective and photographic correcting lens is practically perfect, the enlargement in diameter is undoubtedly due to atmospheric disturbances. These consist probably partly of a blurring or spreading out of the central disc and partly of small displacements in all directions from its mean position. In consequence there results considerable loss of light at the slit jaws with the widths usually employed, and further experiments showed that the proportion transmitted varied almost directly with the width until this reached 3 or 4 secs. I reproduce below part of the table for slit transmission given in the paper referred to:—

* An able discussion of this subject on somewhat similar lines, to which I am much indebted, has been given by Newall (M. N. 65, p. 608).

SLIT TRANSMISSION.

Slit Width.		Comparative exposure for equal intensity of spectrum.	
Linear mm.	Angular secs.	Observed.	Corrected for loss by diffraction.
0·025	0·91	100	100
0·051	1·82	40	50
0·076	2·73	27	35
0·102	3·64	25	32

'This table shows that if the slit width can be increased the exposure is proportionally diminished, double the slit width halve the exposure, which means, of course, an increase in the output and in the practical range of the equipment. But on the other hand, a widening of the slit, other conditions remaining unchanged, decreases the accuracy of measurement of the resulting spectra. This loss of accuracy is due to two causes: first, diminished purity rendering uncertain identifications and wave lengths of blends; second, increased diffuseness of the spectral lines rendering measurements more difficult. We will take up these two considerations separately and find under what conditions the slit may be widened without loss of accuracy.

'The equation for purity of spectrum, $P = \frac{\lambda}{d\psi + \lambda} \cdot R$, shows that the purity is almost proportionally diminished as the slit width is increased as $d\psi$ is, even for slit 0·025mm., nearly ten times λ. To increase the purity of a spectrum only two courses are open—to diminish the slit width or increase the resolving power. As we wish to widen the slit the resolving power of the spectroscope must be increased, which may be done in three ways.

1. By increasing the aperture of the prism or prisms $R = \frac{\lambda}{d\lambda} = a\frac{d\theta}{d\lambda}$ or R varies directly with the aperture.

2. By increasing the number of prisms.

3. By shifting the region of spectrum under observation towards the violet. The resolving power varies inversely as the cube or slightly higher power of the wave length. This will be seen directly when we compute resolving powers, but it follows at once by differentiating Cauchy's form of dispersion formula.

$$\mu = A + \frac{B}{\lambda^2} + \frac{C}{\lambda^4} + \ldots \text{ or simply}$$

$$\mu = A + \frac{B}{\lambda^2}$$

$$\frac{d\mu}{d\lambda} = -\frac{2B}{\lambda^3}.$$

'The use of the second method increases the dispersion which is usually not allowable on account of the proportional increase of exposure time entailed. The third method can not be used with a refractor and glass prisms on account of the strong absorption of ultra violet light by the glass of the lenses and prisms. With a reflector and a quartz or ultra-violet glass spectrograph it might be applicable. We are therefore practically limited to the use of a larger prism and consequently larger collimator and camera lenses.

'The size of prisms in use in radial velocity work, as previously stated, lies between about 30 and 51mm. Prisms of 51mm. aperture are successfully used in the Yerkes Spectrograph, but Frost's experience as also that of Hale in large spectro-heliograph prisms shows that the limit is nearly reached.

'In discussing the necessary conditions for using a wider slit, let us take as an example a comparison between the efficiencies of single-prism spectrographs of 35mm., the aperture of the present instrument, and 51mm. aperture, the latter having been decided upon, after careful consideration, as the aperture of the new instrument. A spectrograph of such aperture, outside of considerations of the homogeneity of larger prisms, is the practical limit as regards size and weight that can be attached to a 15-inch equatorial.

'The glass generally used for the prisms is Jena glass 0·102, Dense Silicate Flint, and this was chosen for the spectrographs here. It is very colourless considering its density and dispersion. The indices of refraction of the particular melting from which the present prisms were made, as furnished by the makers, are as follows:—

Wave Length.	Index of Refraction.
·00006563 cm	1·6413
·00005893 cm	1·6467
·00004862 cm	1·6603

'From these values substituted in the Hartmann formula $\mu = \mu_0 + \frac{c}{\lambda - \lambda_0}$ we obtain the values of the three constants μ_0, c and λ_0.

$\lambda_0 =$ ·00002190.

$\mu_0 = 1·61146$.

$\log c = \bar{6}·115595$.

'From these constants were calculated for a number of wave lengths μ and $\frac{d\mu}{d\lambda}$. From $\frac{d\mu}{d\lambda}$, R was obtained for prisms of 35 and 51mm. aperture, and of refracting angle 63° 50', this being the angle required to deviate the ray at minimum, λ 4415, 60°. The formulæ used were previously derived and are:

$$\frac{d\mu}{d\lambda} = -\frac{c}{(\lambda - \lambda_0)^2}.$$

$$R = t\frac{d\mu}{d\lambda} \text{ where } t = 2\,a \sec\frac{A+\theta}{2}\sin\frac{A}{2}.$$

Wave Length.	μ	$\frac{d\mu}{d\lambda}$	R Prism 35 mm.	R Prism 51 mm.
4862	1·6603	1829	14420	21010
4550	1·6667	2343	18470	26910
4415	1·6701	2636	20780	30280
4341	1·6721	2822	22250	32420
4102	1·6796	3490	27520	40100
4000	1·6833	3983	31400	45750
3970	1·6848	4119	32380	47180

'The resolving power for the two apertures obtained, the purity of spectrum for different slit widths is readily calculated from $P = \frac{\lambda}{d\,\psi + \lambda} \cdot R$, ψ in this case, being $\frac{1}{15}$ or ·0667. The results are given in the following table for the wave length 4341 or $H\gamma$, this being the usual central ray.

PURITY OF SPECTRUM.

Slit Width.	Prism 35 mm.	Prism 51 mm.
0·025	4596	6697
·040	3114	4537
·051	2518	3670
·063	2084	3036
·076	1755	2558

'These figures show that with the larger prism the slit may be made 50 per cent wider and still have practically the same purity of spectrum, and consequently the same accuracy of velocity determinations.

'The slit transmission table previously given showed that an increase in slit width of 50 per cent when below 0·076mm. increased the quantity of star light transmitted by nearly 50 per cent; consequently, other conditions being equal, half as many more spectra could be made in a given time. But an increase in the size of the prism means also an increase in the quantity of light absorbed by the glass of the prism, although the amount reflected will be the same. We can obtain an accurate knowledge of the quantity of light absorbed in the two prisms of O. 102 glass from Vogel's experiments (Astrophysical Journal, V., p. 75), who showed that $H\gamma$ light transmitted through 100mm. of O. 102 glass suffered absorption of about 47 per cent. The absorption for prisms of 35 and 51mm. aperture, average length of path 39 and 57mm. respectively, may be readily calculated by the formula $I_1 = I_0 K^{\frac{x}{a}}$, where x is thickness of glass for which absorption is required, a is thickness for which percentage transmitted is K, I_0 intensity of incident, I_1 of transmitted beam. We obtain for prism of 35mm. aperture 78 per cent, of 51mm. aperture 71 per cent transmission. If 100 be intensity of incident pencil for small prism, then 150 will be intensity of pencil giving equal purity with large prism. After transmission intensities will be 78 and 150 × ·71 or 106·5, respectively, and the required exposures will be inversely proportional or as 3 to 4, a very considerable gain. Even when the slight additional absorption in the thicker camera and collimator lenses is considered a substantial saving of time will result by the use of the larger prism.

'We have tacitly assumed in the foregoing discussion that a decrease of purity entails loss of accuracy in the velocity values. This is undoubtedly true for complex spectra such as those given by solar or allied type stars, spectra in which are hundreds of lines and in which every decrease in purity means increased uncertainty in the wave lengths of the more complex blends of lines thereby produced. In the case of early-type stars, however, such as those of the hydrogen or helium groups, where there are only few lines, and these single, there can be no trouble with blends, and the question of the purity of the spectrum has not so much weight. On such grounds there would be no material advantage in using the larger aperture. However, a consideration of the second effect produced by widening the slit—the increased diffuseness of the spectral lines—will show a similar advantage for the larger aperture even where purity does not come into question.

'This may be best shown, as before, by considering a special case and we may take the same example with advantage. The present single-prism spectrograph has a collimator objective of 35mm. aperture and 35 x 15 or 525mm. focus. The camera has a focus of 525mm., and therefore the image of the slit on the plate will be of the same size, and the minimum width of line will be the width of the slit. The new spectrograph will have a collimator of 51mm. aperture and 51 x 15 or 765mm. focus. The camera will be of about 455mm. focus. Hence the image of the slit on the plate will be diminished in the proportion of 455 to 765 or about 3/5. If the camera were of the same focus as the one now in use, 525mm., the image of the slit would be diminished to about 7/10. Hence the slit can be made in the one case 5/3, in the other 10/7, the width with the present spectrograph, and have the lines of the same width, and consequently equally accurately measurable. The gain in efficiency is thus about equal under the latter consideration and that of the maintenance of equal purity, and we may therefore consider that a decided advantage may be obtained in stars of all types by increasing the aperture of the prism. Such conclusions are, of course, subject always to the test of actual use under similar external conditions before they can be accepted as final.

'However, some experiments that I made here last winter on the effect of widening the slit upon the accuracy of velocity determinations* substantiate the above conclusion, and I will therefore give a short summary of some of the results reached. As previously stated, when the slit is widened, the purity is diminished and the lines become broader and more diffuse. To simplify the investigation, the question of the effect of purity was eliminated by choosing a star, β Orionis, for the test whose lines are single and moderately sharp. There remains, then, only the question of the effect of the increasing breadth and diffuseness of the lines on the accuracy of the measures. Evidently such a question can only be settled by making and measuring a number of spectra at each slit width. Six plates were made for each slit width 0·025, 0·038, 0·051, 0·076mm. for two dispersions, (*a*) single-prism 525mm. camera, (*b*) three-prism 525mm. camera and six each at slit widths 0·025, 0·051 and 0·076mm. for a dispersion of three prisms and camera of 275mm. focus. In all 66 plates were made, of which I have to thank Mr. Harper for measuring 18 and thus lightening the considerable labour involved. Owing to the different dispersions, different lines were measured in the three sets, but as the main dependence can be placed on the three lines *Mg* λ4481·400, *He* λ4471·676, $H\gamma$ 4340·634, the results from these three lines only are given. Computations using all the star lines measured were also performed without, however, changing the conclusions reached.

'There are evidently two kinds of error to be considered, accidental and systematic. Under the first will be considered the accidental errors of the setting of the microscope wire on the individual lines in a plate, resulting in a mean velocity for that plate differing from the true velocity in a greater or less degree depending upon the quality of the lines. The systematic error of a plate is the displacement of the star lines as a whole with respect to the comparison lines. This may be due, as previously stated, to one or more of several causes—change of temperature, flexure, faulty adjustment or aberrations in the optical train, &c. As the lines are in general equally affected, such displacement will not be apparent in the measure of a single plate. It is only by comparing the velocities of a number of plates of a star of constant velocity that such an error can be detected.

'To compare the accidental errors for the different slit widths it will be necessary, to prevent systematic displacements from affecting the result, to treat the measures for each of the six plates for one slit width separately, to obtain the residuals from the mean velocity of each plate and finally the probable error of measurement of an average star line from these residuals. Some idea of the relative magnitude of the sys-

* Since published in the Astrophysical Journal, Vol. XXVIII, p. 259.

tematic errors may be obtained by treating the velocities from each of the six plates. However, this result will not be that due to systematic error only, as the velocity from each plate will also be affected by accidental errors. The results of the measures and computations are given below:—

PROBABLE ERRORS.

Dispersion.	Slit Width.	Accidental Prob. Error, Average Line.	Systematic Prob. Error, Single Plate.
Single Prism	0·025	±4·5 km.	±1·7 km.
	·038	2·4	2·7
525 mm. Camera	·051	2·3	3·0
	·076	4·3	7·7
Three Prisms	0·025	±2·3	±1·5
	·038	2·1	1·3
525 mm. Camera	·051	2·5	0·7
	·076	2·1	0·9
Three Prisms	0·025	±2·9	±2·1
	·051	2·9	3·0
275 mm. Camera	·076	3·8	2·9

'These results were to a considerable extent unexpected. The great difference in the apparent quality for measurement of the spectra made with slit 0·025 and 0·076mm., especially with the single-prism, would lead one to expect a marked increase in the errors of setting, but this is not very distinctly shown, not at all in the higher dispersion. The systematic errors, however, are very markedly increased in single-prism plates, so much so as to prohibit the use of slits wider than 0·051mm. In a higher dispersion spectroscope this increase has disappeared, and, so far as the rather small number of plates shows, it is slightly more accurate in the case of dispersion (*b*) to use slits 0·051 and 0·076mm. than slits 0·025 and 0·038mm. It is evident that these results corroborate the conclusions previously reached, by showing that increase in resolving power removes or diminishes the loss of accuracy when the slit is widened. Consequently, with the 50 per cent greater resolving power and the 60 per cent greater ratio of collimator to camera focus, it is probable that the slit-width may be increased 50 per cent without affecting the accuracy of the results and with a corresponding increase in the output.

Mechanical Design.

'The question of the most favourable dimensions of the optical parts having been discussed, there remains the mechanical structure connecting these parts into one stable whole. Owing to the attachment of the instrument to a moving telescope and the consequent varying direction of gravity on the parts, the prevention of flexure is one of the most difficult of the problems to be overcome, and this is especially the case where the instrument is to be attached to a telescope of moderate size, where its weight can not exceed a certain small limit. The weight of our spectrograph complete with temperature case, attaching truss, &c., can not much exceed 100 lbs., and the problem is consequently a much more difficult one than in the case of the Yerkes equipment, for example, where the spectrograph weighs about 500 lbs. Most of the early and some of the recent spectrographs have lacked sufficient stiffness and stability to prevent line displacements due to flexure of the parts. A displacement of the camera and plate of only one one-thousandth of an inch is equivalent in a single-prism spectrograph to a velocity of about 50km. per second. It is evidently a difficult matter in the extended form of a single-prism instrument to reduce this flexure to an inappreciable amount. No material is perfectly rigid and when we consider that even its own weight deforms the strongest material available, the difficulty of the problem will be realized.

'Until very recently all spectrographs were attached to and overhung the end plate of the telescope and thus, like a beam fixed at one end, were subjected to the maximum amount of flexure. An improvement in the principle of attachment was applied at the Lick Observatory recently, in which the spectrograph proper is made self-contained and is held in an independent cradle at two points of support. It is thus like a beam supported at both ends and the flexure is thereby much reduced.

'The original spectroscope belonging to the Observatory was by Brashear of an adjustable universal type and was not, for this very reason, suitable for radial velocity determinations. Braces were added to stiffen the frame as much as possible, but it could not be freed from flexure. Many of the results obtained were uncertain and its use was discontinued as soon as a new combined one and three-prism spectrograph, designed by myself and very satisfactorily constructed by Mr. Mackey in the Observatory workshop, was completed.

'This instrument, whose general form is readily obtained from the figures, page 78 in my report to the Chief Astronomer for 1906-7, has many original features, has given excellent satisfaction and produced reliable results. It is, as will be noticed, a form of the first class mentioned attached only to the end plate of the telescope. It was designed and partly constructed before anything was learned of the new type. Moreover it was desired for the sake of economy of time and money to combine single and three-prism instruments in one (since found by experience to be a mistake), and this could not be advantageously effected in the new form.

'The form of truss designed has some advantages over previous instruments, and has probably less flexure than any other of the same type and weight. The main difference lies in the close grouping of the triangular truss at the lower end and the addition of the substantial diagonal brace, which serves the two purposes of stiffening the outer end of the prism box and lower end of the camera when used in three-prism work, and of tying the outer end of the camera when used with a single prism. The maximum flexure of the three-prism instrument is equivalent to 1·8km. only, while the maximum flexure of the modern Bonn three-prism instrument, the only one for which data have been published, is about 70km. For an hour's exposure with the Bonn instrument there is a flexure of 7km., while a similar exposure with both single and three-prism forms here shows no appreciable flexure. The maximum flexure with our single prism is much greater, about 100km., equivalent to a linear displacement of about 1/400 inch. This great difference in the two forms is due to two causes. First, to the threefold greater kilometre value for the same linear displacement. Second, to the much more extended form of the single-prism instrument. Calculations have shown that the amount of flexure is nearly that caused by the actual extension and compression of the truss members due to their own weight, and consequently it can not be avoided or much reduced in this form of instrument. However, the flexure occurring during a two hour's exposure is only slight except at such great hour angles as are rarely used.

'Both forms of instrument are frequently required on the same night, for stars of varying brightness and type. The time lost in making the change from single to three prism or vice versa, and the uncertainty in the temperature conditions prevailing after the change, close temperature regulation being equally as important, perhaps more important than avoidance of moderate flexure, were considerations leading to the decision, which had the approval of Dr. King, to design and construct a separate single-prism spectrograph, with separate temperature control and attaching stand, so that the change could be made in a minute or two, and without disturbance of temperature.

'Besides using a larger prism for the reasons fully entered into above, the opportunity was taken of changing the mode of attachment to the telescope. Curtiss, of Ann Arbor, designed a form of single-prism instrument modelled after the Lick pattern, which has two points of support, one near the slit and the other near the base of the prism. The spectrograph proper consists of a triangular brass box with angles of about 120°, 30°, 30°. The prism is at the obtuse and the slit and camera at the acute angles of the triangle. The camera end hangs out unsupported and flexure will still occur though in a much diminished degree.

'The form I have designed and am now having constructed in the workshop follows that of Curtiss in that it is of the box form, but the design and construction of the box and the method of attachment to the telescope are different. The box is made of hard cast-steel plates (saw steel) much stiffer than brass, is rigidly braced and cross braced, and is provided with three points of support in a cradle of T iron attached to the end plate of the telescope. Two of the points are similarly situated to those of Curtiss, while the third acts near the camera end. The two first are attached by a kind of universal joint, so that no strain can be induced in the box by any bending of the cradle. The third support, near the camera, consists of a pair of counterbalancing levers, one on each side of the box, arranged to equalize the pressure on the three supports in any position of the telescope without it being possible to ever induce any strain in the box itself. By this means it is believed that no measurable or even noticeable flexure will occur.

'A simple triangular box of this form without projections of any kind is much more readily adapted for temperature regulation than the complicated shape of the regular truss form. Moreover, any stratification in the temperature case is much less likely to occur, and if it does, can not do nearly so much harm as if it were acting on only one member of the truss. A further improvement will be the introduction of a non-conducting material, such as vulcanized fibre in the supporting arms between the cradle and the box, so that heat will not be conducted away at these points and unequal temperature and possible distortions take place.

'In the present spectrograph, conduction through the arms of the truss is so great as to cause a gradual drop of the temperature in the prism box, as the outside temperature falls, of about 0·1°C. every one or two hours. The distance between the spectrograph box, which will be entirely covered with thick felt, and the inside of the felt-lined outer case will be uniform, the heating wires will be uniformly distributed, and consequently little difficulty with inequalities of temperature should result.

'Although until the instrument is completed and tested, no definite statement can be made, I have little doubt that the new spectrograph will be a considerable improvement over the present or any existing single-prism instrument.'

THE NEW SINGLE-PRISM SPECTROGRAPH.

The Optical Parts.—After the dimensions of the optical parts of the new instrument had been determined as above they were ordered from the J. A. Brashear Co., in the early part of 1908.

Some correspondence was carried on in regard to the 'Isokumatic' Collimator objective in reference to the yellowish colour of the middle component. It was, however, decided to use it in preference to the less absorbing ordinary objective, on account of the flatter colour curve given by the former. Consequently an 'Isokumatic' of 51mm. (2 inches) free aperture and 765mm. focus was ordered and received at the same time as the other optical parts, about the end of last March. Although no direct tests have as yet been made, there is no question of its being a first class objective, as otherwise the good definition now obtained would not be possible. The prism of Jena glass O. 102 had its angle 63° 30′ computed, so that the central ray for this instrument λ4325 had a deviation of 60°. The length of the side of the prism was made 110mm., so as to transmit the full pencil from the collimator, and the height 57mm. in order that any effect produced by pressure or unequal temperature of the supports might be minimized. The prism is a beautiful piece of glass and the tests have shown it to be of first rate optical quality, and fears as to its possible lack of homogeneity groundless.

The camera objective, owing to the excellent performance of the Brashear Single Material in the previous instrument, was chosen of the same type and is of 57mm. aperture, a sufficient margin above 51mm. to transmit the full usable pencil, and 455mm. focus. It was tested soon after being received and, although it gave a flat field, the definition was not as good as that given by the original objective, and a preliminary test showed this to be due to spherical aberration. The objective consists of two widely separated converging elements of very light crown glass, and consequently the resulting positive aberration can only be removed by departure from spherical surfaces. The amount to be removed in the case of the original objective of 45mm. aperture and 525mm. focus was quite within the possibilities of ordinary figuring, but when the aperture ratio is increased to so large an extent as from $f12$ to $f8$, it becomes a much more difficult problem to deal with. In this case it was only after the introduction of a special method and with the great personal skill of Mr. McDowell in figuring, that the aberration was finally removed, and the objective gave practically perfect definition and a widely extended flat field. A full description of the tests, with the plotted fields resulting from different objectives, is given in full in another place.

The Guiding Telescope.—Instead of reflecting the light used for guiding down a tube parallel with the collimator and there further reflecting it to the guiding telescope so placed as to also receive light reflected from the front surface of the prism, the guiding telescope has in this case been placed about 15cm. above the slit, where star light coming from the inclined speculum-metal jaws is reflected by a right-angled prism to a small objective placed at its focal distance along the optical path from the slit. The resultant parallel pencil is then received by the bent guiding telescope shown, Fig. 2, which can be rotated to any convenient direction. Two reflections are hereby avoided, resulting in some saving of light and probably better definition. It had been found in the previous instrument that the method of guiding by light reflected from the front prism surface was never used, and consequently in the new spectrograph this needless complication was omitted. It may be said, however, that the position of the guiding telescope is in some positions of the equatorial, not quite so convenient as if it were lower down.

The Comparison Apparatus.—Experience has shown that in actual work more than one metal is never used as electrode, and consequently the rotating wheel with four sets of electrodes used previously has been omitted here, and one pair of adjustable electrodes of the alloy of iron and vanadium, whose spectrum is exclusively used for comparison, has been substituted. These terminals are mounted on a brass plate which swivels on two points attached to the top of the guiding telescope, and when not in use is simply turned back upon the latter, thus leaving the star light unobstructed. Directly below the terminals in the optical axis is screwed the short tube shown, in the upper end of which is a piece of ground glass and in the lower a small condensing lens with an angular aperture twice that of the collimator. Both of these are adjustable and ensure in every case a uniform pencil of spark light incident upon the collimator objective and prism.

Slit and Slit Diaphragms.—The slit is of the Huggins type of reflecting slit, with polished speculum metal jaws inclined at an angle of 3½°, so that the reflected pencil of star light and consequently the prism which intercepts it is entirely out of the way of the direct pencil. One jaw is fixed and the other movable micrometrically, a single division representing ·001 inch (·025mm.). The slit has a tangent screw slow motion to enable it to be placed exactly parallel to the refracting edge of the prism, and is very

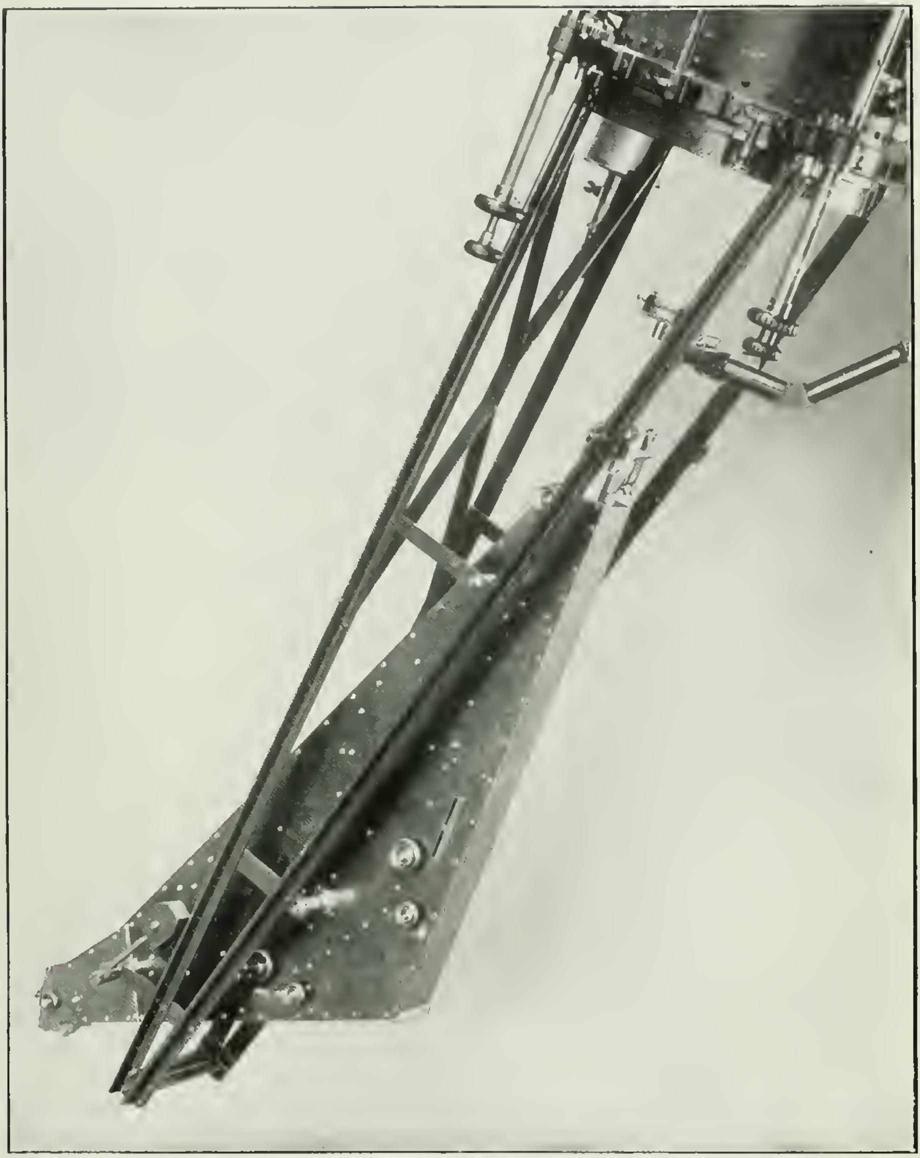


FIG. 2—New Single-Prism Spectrograph.

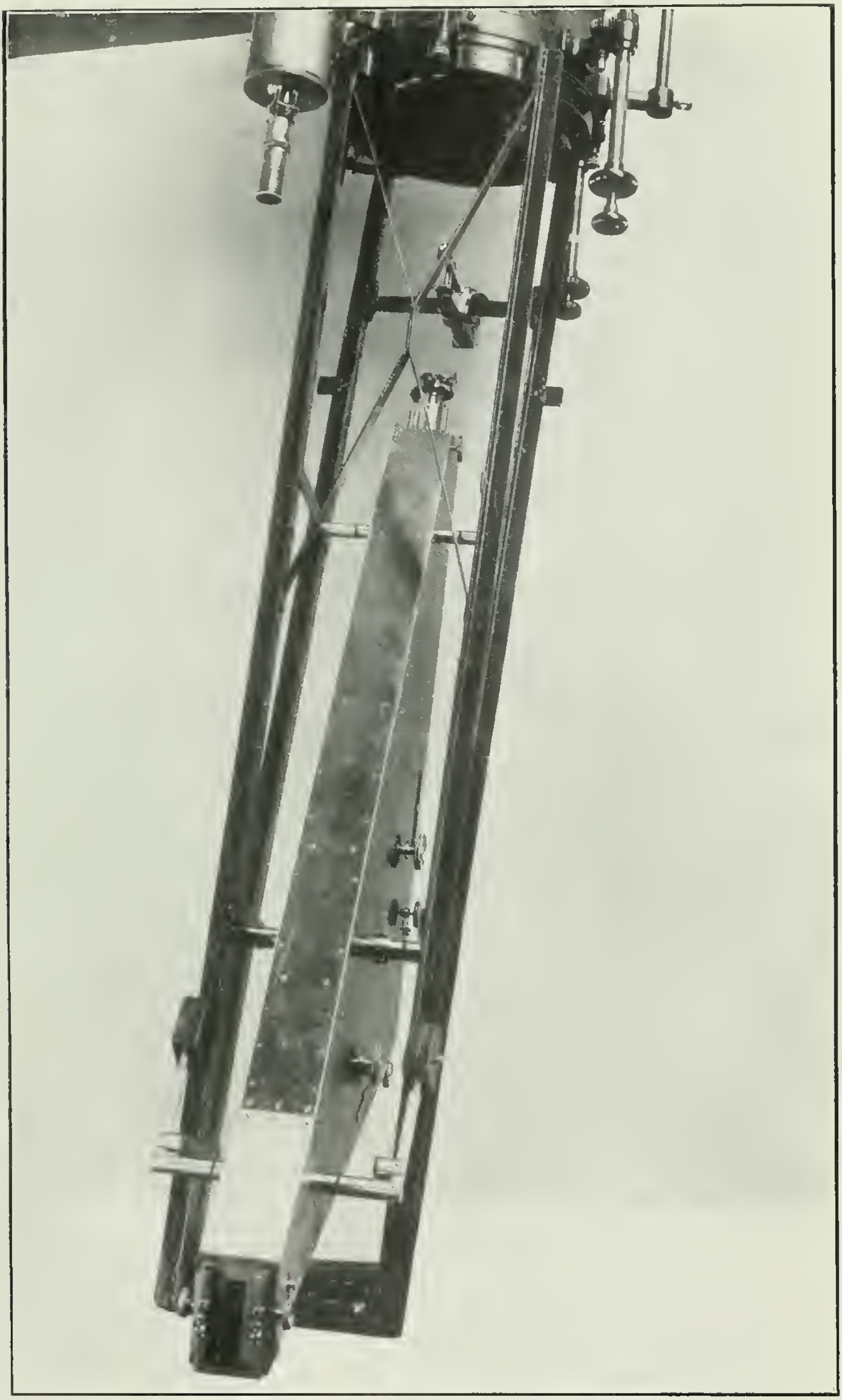


FIG. 3—New Single-Prism Spectrograph.

rigidly attached to the end of the heavy collimator tube. To the end of this tube is also screwed the attachment holding the sliding diaphragms, which serve to limit the star and comparison spectra. Rectangular openings of the proper width, in this case a single opening 0·4mm. for star spectrum and two openings 1·5mm. separated by a tongue 0·45mm. for comparison spectrum, are placed directly opposite one another on a plate which is moved by means of a knurled wheel transversely between stops across the slit. To expose the spark spectrum all that is necessary is to turn down the spark apparatus, turn the knurled wheel above mentioned about a quarter turn, and close the switch which controls the current through the step-up transformer used for producing the spark, this switch being on the telescope tube about a foot above the spark apparatus. To change back to star spectrum the operations are reversed, the whole cycle occupying only about ten seconds.

The Mechanical parts.—As outlined above the instrument consists essentially of two parts—1. A rigid, hollow, triangular shaped, steel box containing at the obtuse angle the prism, and at the two acute angles the slit and plate and comprising the spectrograph proper; 2. The T iron frame or cradle attached to the end plate of the telescope, in which the spectrograph proper is flexibly supported, and which serves to keep it collimated without flexure of this support producing any stresses in the box itself.

The Spectrograph Box.—The box consists of two triangular shaped plates made of hard saw steel about 1·7mm. thick forming the sides, while the edges consist of plates of the same material and thickness, 79·4mm. (3⅛ inches) wide. In addition to the edges there are a number of internal braces and supports of the same material, well shown in Fig. 4, which gives a good idea of the construction of the box. These braces as well as the edges of the box have pieces of small angle iron securely riveted along both edges, to which the side plates are firmly screwed. These angle irons are not shown in the figure, as the frame was first put together, the angles then riveted on and finally the plates screwed to these angles and to the internal castings, the heads of the screws being shown on the side of the box in Fig. 2. It was constructed in this manner to prevent as far as possible any internal stresses in the frame of the box. In addition there are iron castings *A, B, C, D, E, F,* Fig. 4, planed to exactly the same width as the edges and braces. *A,* may be called the main casting, having a hole bored through the centre through which the principal supporting shaft passes. The two legs projecting from the triangular part are bored out to fit the collimator and camera tubes. The casting, *D,* is also bored out for the collimator tube and forms the end plate of the box, while the casting, *F,* is bored out to carry the upper end of the camera tube. *C,* and, *E,* have clearance around them and do not touch the collimator tube, the upper support being attached to the centre of *C.* The part, *B,* has the third supporting shaft screwed into the centre of each side, and also forms the connection between the box proper and the camera end. The latter is made separate, so that camera objectives of different focal lengths may be used if desired.

The prism is mounted in a separate cast-iron cell, but is prevented from touching the metal at any point by facings of hard rubber about 3mm. thick, and is kept in its adjusted position by hard rubber stops. It is held firmly in this position in the cell by the gentle pressure produced by three small clamp screws passing through the top of the cell and bearing upon one of the facings of hard rubber 3mm. thick, above mentioned, resting on top of the prism. The base of the cell is surfaced flat, and rests in its compartment on one of the side plates, to which it is rigidly attached by five screws passing through slotted holes to permit of adjustment for minimum deviation.

Collimator and camera tubes are provided with racks and pinions for adjustment, their position being read on millimetre scales, the one attached to the camera being provided with a vernier, reading to tenths of a millimetre. The collimator tube is provided with two clamp screws, one at the top and one at the bottom bearing, while the camera tube has a single clamp screw at the front end. The pinion and clamp wheels and the scales are well shown in Figs. 2 and 3. The camera attachment, whose form and construction can be fairly well obtained from Figs. 2 and 3, is built in box form of the same material, and is firmly screwed to the casting, *B*, Fig. 4, it and the spectrograph box thus forming what is to all intents and purposes one continuous piece. Between the sides of the camera box, swivels the plate holder attachment which is quite similar in form to the one used with the other spectrograph. It consists essentially of a semi-cylinder 79·4mm. long, 101·6mm. diameter, pivoted along its axis between the sides of the box to permit a wide range in plate inclination. This cylinder is constructed from a section cut from a piece of 4-inch brass tubing, on the ends of which pieces of heavy brass plate are screwed and soldered, and on the plane of section is fastened the brass camera back provided with screws for clamping the holders firmly in place. The plate holder carrier has solidly constructed ways permitting lateral movement of about 15mm., enabling a number of narrow spectra to be made side by side on the same plate if desired. The axis on which the camera back rotates is provided with knurled clamping wheels, while other screws moving in concentric slots enable adjustment and firm clamping to be effected in any desired position, read off on graduations on the cylinder.

As will readily be seen from its design and construction and from the character of the material from which it is made, this spectrograph is exceedingly rigid and the flexure produced by changes of position, however supported, would be very small. This flexure, however, is reduced to a vanishingly small quantity by the new supporting system used in this instrument. The self-contained spectrograph box is, as has been indicated above, supported flexibly on three points in the carrying cradle.

The Supporting Cradle.—This truss made of 1⅜″ T steel is attached at the upper end to a heavy ring casting, which is fastened by the same three swivel bolts used for the other spectrograph to the end plate of the telescope, the mode of attachment being shown in Fig. 3, which with Fig. 4, well shows the form of the truss. It is evident that the only flexure of this truss in a direction parallel to the sides of the spectrograph will be that due to the extension of one arm and compression of the other in each pair, and this will hence be very slight. Owing to the fact that these two pairs of trusses had to be separated about 20cm. at the lower end, to admit the spectrograph with outside temperature case between them, it is evident that flexure in a direction at right angles, parallel to the movement in right ascension, will be greater. This is minimized as much as possible by joining the two ends by a solid webbed casting and by introducing cross braces at the upper end of the truss as shown. At small hour angles, however, which it is desirable for many reasons to use as far as possible, the component of the weight in this direction will be very small and the flexure negligible. Even at large hour angles which are sometimes required, the flexure cannot be great. In any case from the method of attaching cradle and box, to be presently described, no flexure of the cradle can induce any stresses in the box and the only effect of such flexure will be to slightly alter the axis of collimation of the spectrograph. This can not, however, induce any displacement of the spectral lines, not only on account of its relatively small magnitude but also because it can occur practically only parallel to the spectrum lines and to the refracting edge of the prism, which will have no effect on the position of the line.

The principal and central support and connection between cradle and box consists of a shaft 1 inch (25·4mm.) diameter passing through the hole in the main casting. This shaft is left the full size of the hole only for about 2mm. at the centre, so that the box is free to swivel in every direction around the centre to the extent of 2 or 3 degrees. This swivelling motion is, however, limited, by projecting points on the shaft at the ends of the hole, to one parallel to the motion in right ascension and to the slit, rotation around the axis of collimation being prevented. Consequently any flexure of the cradle can not induce any distorting stress in the box.

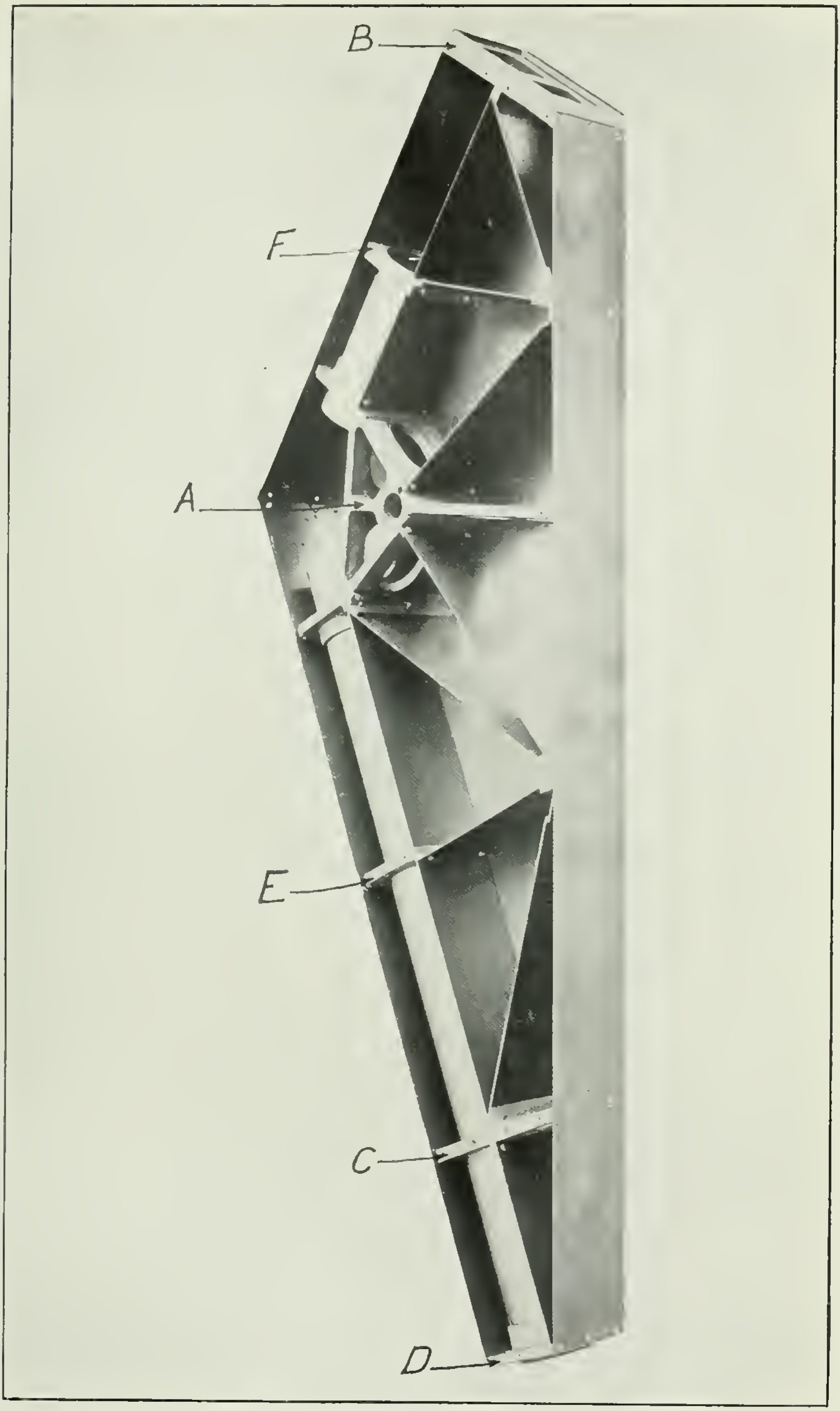


FIG. 4—Spectrograph Box.

The upper supporting shaft has a transverse hole in the centre through which a pin screwed into casting *C* passes, thus allowing longitudinal motion parallel to the axis of collimation as well as swivelling motion in every direction.

The third point of support consists of shafts rigidly screwed into the centre of each side of casting, *B*. A second short shaft at each side carried by plates screwed to the cradle, as shown (Figs. 2 and 3), is placed about 2·5cm. from the first in a direction which, if produced would nearly pass through the centre of mass of the box. A lever attached to these two shafts at each side in such a way as to allow more than sufficient motion without binding, carries a counterbalancing weight, the combined resultant upward thrust of the two on the box being computed to equal the proportional part of the weight that should be carried by this support.

The box is hence carried equally on the three supports without any possibility of distortional stresses occurring in it due to flexure of the cradle, the only effect of such flexure being to slightly change the axis of collimation, which at the utmost can only induce displacements of the second order in the position of the spectral lines.

Temperature Control.—Every precaution having been taken, successfully as will be seen later on, against flexure, there remains, as the other main cause of systematic displacements possibly more dangerous than flexure, displacement due to changes of temperature in the optical and mechanical parts of the instrument. The changes in temperature between day and night or even between evening and morning at Ottawa are considerable, averaging about 8°C. for the former and 6° for the latter. In many cases the temperature in the dome becomes 10°C. lower than that in the temperature case, rendering satisfactory maintenance of constant temperature in the case a difficult matter.

As mentioned in the two previous reports, such difficulty was experienced and the temperature in the prism box dropped gradually about 0·1°C. per hour as the temperature in the dome became lower. When practically the whole of the inside of the case was covered with the heating coils this drop was not so great, but was not entirely overcome. It was believed to be due to the conduction of the heat through the metal parts of the attaching truss, the collimator tube, &c., exposed to the outside air and that, although the temperature inside the case undoubtedly remained nearly constant, the temperature inside the prism box would diminish with the lowering of the outside temperature owing to the greater loss of heat through the exposed supports.

To overcome this as far as possible in the new instrument all of the shafts attaching the box to the cradle were cut at points about 3cm. from the box, just inside the outer case, were bored out and threaded, and a piece of vulcanized fibre separating the ends about 7mm. screwed in. This fibre, seen dark on the shafts in Fig. 3, is a poor conductor of heat, prevents direct metallic conduction from the box inside the temperature case to the cradle outside, and the only part of the spectrograph exposed is the slit head. The temperature inside the outer case is automatically controlled by a pair of electric contact thermometers placed not, as in the previous instrument, one on each side of the prism box, but one in the front near the upper end and one at the back near the camera.

Each of these thermometers controls the heating coils in the corresponding half of the outer case. It was hoped by thus arranging the thermometers and coils to keep the temperature over the whole interior of the case more nearly uniform than previously. These thermometers act in exactly the same way as in the former instrument described in the 1907 report. When the temperature in the case rises the mercury in the open capillary makes contact with an adjustable platinum wire and the resulting battery current attracts the armature of a relay, thus breaking the heating circuit; similarly when the temperature falls the mercury recedes from the platinum terminal, the relay armature is released and current is turned on the heating coils. In practice the regulation is very good, current in the coils as indicated by pilot lamps being turned on and off every few seconds. To smooth down any remaining irregularities the whole exterior of the spectrograph box is covered with a layer of half-inch thick felt, small hinged doors being made over the indexes and scales of collimator and camera.

The temperature case is in this instrument constructed of wood chiefly on account of its greater ease of construction, of its greater heat insulating power, and of the smaller danger of short circuits in the heating coils over one made of aluminum. Moreover, owing to the simple form of the spectrograph, a wooden case can easily be made amply strong. This case is made of ½-inch thick pine, lined inside with felt about ⅜-inch thick and is divided into three sections, the line of junction of the body of the case necessarily following the supporting shafts. The third section, which was necessary for constructional reasons, is a small box-shaped piece at the camera end. All joints between the sections and the joints around the doors in the case, necessary for the adjustment and clamping of collimator and camera and of the contact wires in the thermometers, are carefully padded with felt to be air-tight. This case, which is shown in Fig. 5, is attached securely to the supporting cradle and does not touch the spectrograph proper, the openings around the end of the collimator tube and the supporting shafts being made large enough for free clearance and at the same time heat-tight by washers of felt.

On the felt lining on the inside of this case is stretched about 1,200 feet No. 28 single silk covered German silver wire, arranged in four circuits of 300 feet each, two of these circuits in multiple are controlled by each of the electrical contact thermometers, each governing the coils in its own section of the case. This wire is distributed as uniformly as possible over the inside of the case, the space between the felt coverings of the case and spectrograph being about 2·5cm. and uniform throughout. By the division of the heating coils into two sections, their uniform distribution, and the uniform space between spectrograph and case, the temperature throughout the case should be maintained nearly uniform and not much trouble with unequal temperature should occur. There is no question that some method of mechanical stirring of the air inside the case would give better results, but the difficulty of additional weight and complication with possible vibration prohibit its use.

The temperature control so far as it has been tested works admirably. There is as before a slight drop in the temperature of the prism box when the external temperature drops rapidly, but that does not last long, and by applying the control in the afternoon, thoroughly ventilating the dome so that considerable of the cooling will have taken place, the temperature remains steady for the night.

Adjustment of the instrument.—After the instrument was completed there were several adjustments to be made before any measurable spectra could be obtained. The first of these was to set the slit at the principal focus of the collimator lens. This was done by Schuster's method of alternate focussing of collimator and observing telescope on the same spectral line, the prism being placed alternately to one side and the other of the position of minimum deviation. This method gives satisfactory results, successive values agreeing within two or three-tenths of a millimetre and the mean of several being taken. The prism was easily set to minimum deviation for the line *Fe,* 4325·9. This particular line was chosen on acount of the very irregular results given by the line H_β in the numerous measures of β Orionis, and the consequent determination to shift the central line towards the violet in the new instrument. The measures above referred to show that more accordant results are obtained with the lines to the violet end of the spectrum than with H_β, and as resolving power, purity, and linear dispersion are all greater there, this should result in a further increase in accuracy. The camera focus is determined in precisely the same way, as with the previous instrument, by making adjacent spectra through the refracting edge and base half of the prisms, and determining the focus by the continuity of the lines. A slit is cut in the side of the spectrograph box into which a semicircular diaphragm can be

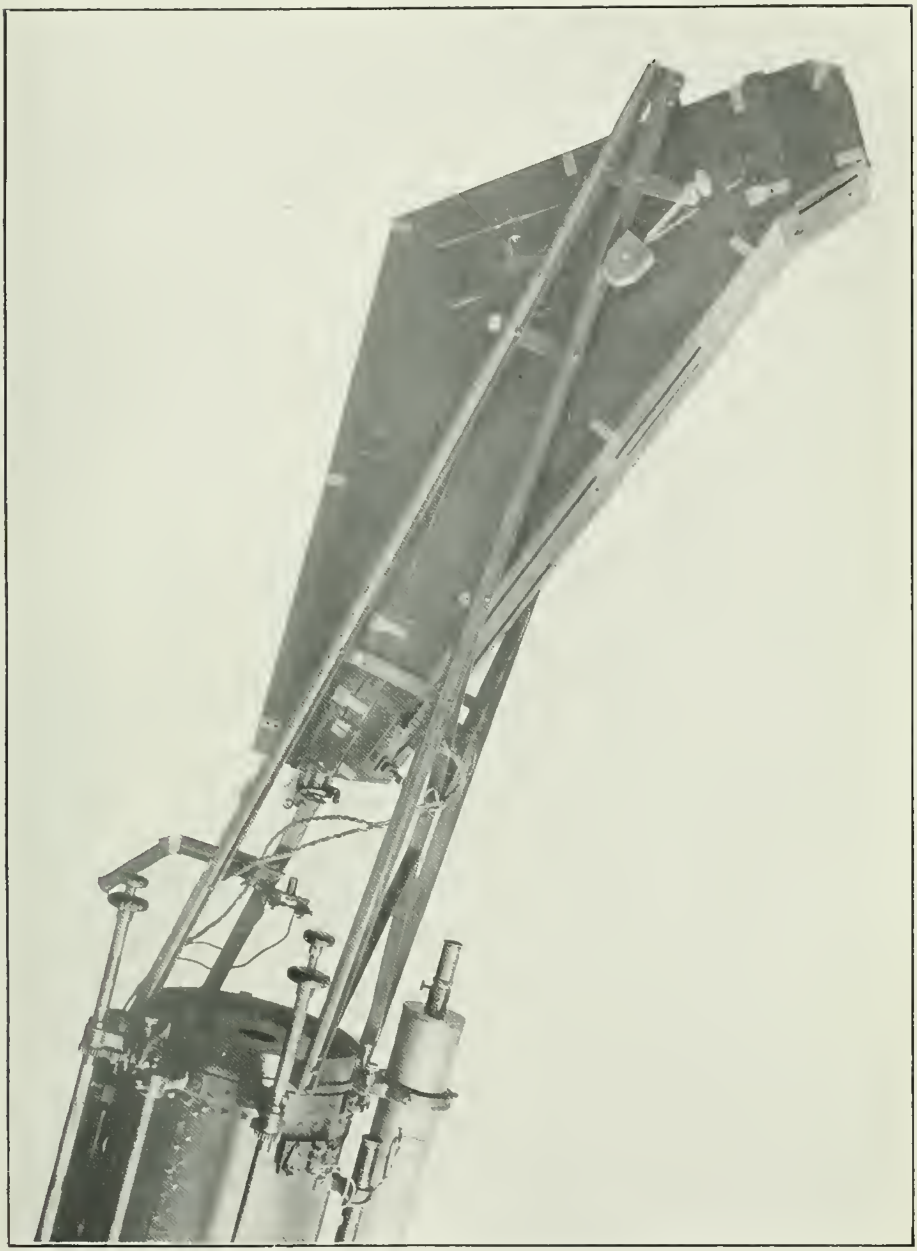


FIG. 5—New Single-Prism Spectrograph, ready for use.

placed and rotated, so as to occult first one and then the other half of the light pencil. The inclination of the plate, determined of course at the same time, is about 16°·5, the same as with the first objective of this type.

A very curious and at the same time very useful property of the new spectrograph is the constancy of focus of the system for different temperatures. With the two previous instruments, the focal setting increased with increase of temperature about ·012mm. per degree centigrade. Between the temperatures of 0° and 20°, all so far tested in the new spectrograph, the camera setting remains unchanged at 27·69 as determined by a number of careful tests. This with the absolute constancy and rigidity of the new instrument is a point of very great value in obtaining accurate results, as it obviates the necessity of testing the focus each time the instrument is used with the possibility of mistakes in the determination of the true setting. It is difficult to explain why there should be this difference, although it is probably due to the fact that the parts connecting camera objective and plate are of steel in the new instrument instead of brass, whose coefficient of expansion is greater. At any rate the combination of brass collimator tube, whose setting is unchanged, and steel camera tube gives settings for camera focus constant at all temperatures so far observed. If the collimator tube had been steel or the camera tube brass, there would have undoubtedly been a change in the setting with change of temperature.

The New Spectrograph in practice.—As stated above the instrument was only completed in the beginning of March, and consequently has not been in use long enough to enable its advantages and disadvantages to be fully determined. There is, however, no question that spectra of better quality for measurement will be obtained with it than with the single-prism form of the previous instrument in which the lines were occasionally, especially with the longer exposures somewhat blurred and diffuse, due to flexure or temperature change or both. As will be seen later, flexure in the new instrument is absent, and owing to its compact form any temperature changes should have much less effect on line displacements. As a matter of fact the temperature regulation is much better with the new instrument and no spectra yet obtained, even with very long exposure, show any trace whatever of diffuseness of the lines. Again, the constancy of the camera focus is another factor tending to better results, as one is always sure of the true focus and no fear of systematic displacements due to poor focus can arise.

Tests have been made similar to those of last year, on the relative freedom from accidental and systematic errors of spectra made at different slit-widths. These show, that on the whole in early type stars with this instrument more accurate values are obtained with a slit about 0·051mm. wide than with slits narrower or wider. The comparative exposures required with the new instrument at slit-width 0·051mm. and the previous single-prism instrument at slit-width 0·038mm., which gives about the maximum accuracy obtainable with it in early type stars, shows an advantage, so far as can be at present determined, of about 25 per cent for the new instrument. To offset this, however, it must be stated that, owing probably to the increased absorption of the larger prism, the intensity of the spectrum at the violet end is appreciably less and for equal intensity of the *K* line, sometimes required, most of the advantage will be lost. In the case of stars in which the extreme violet is not required, however, there is a considerable saving in time and increase in output by the use of the new instrument. This loss in the violet may be due possibly to other causes than absorption of the prism, such as in the guiding or the position of the corrector and form of the colour curve, and if such is the case, and this will be shortly tested, it may to a great extent be overcome.

Careful tests of the flexure of the new instrument have been carried out showing exceedingly satisfactory results. The method of testing was to attach the spectrograph to the telescope, the latter being pointed to the meridian. If the telescope is turned in declination pointing first to the south and then to the north horizon, it is evident that the spectrograph will have rotated in its own plane through 180°, and there will have been induced in it the maximum possible double flexure. In these two positions spectra were made through a suitable slit diaphragm, the one used for focussing in which the adjacent spectra touch each other being the best, as any displacement of the line between the two exposures will at once be evident. Three sets of exposures of the comparison spark were made on the one plate, by sliding the camera back in its ways between exposures, two for flexure and one with the spectrograph stationary for comparison. Examination of these plates showed no measurable flexure. In some of the lines a very slight displacement could just be detected under high power magnification, but this if due to flexure was quite beyond measurement. As a matter of fact, on the plate being given to Mr. Harper with the request to select from the three the spectrum in which no movement had occurred, he found it impossible to determine which spectra were affected by flexure. As the flexure present during any reasonable exposure can only be a small fraction of that given by the method above described, it is quite evident that the spectra will be absolutely free from any line displacement due to flexure of the spectrograph. It may be of interest to state that flexure tests made of the instrument with the counterbalancing weights removed, and with consequently only two points of support, also showed remarkable freedom from flexure. Although the flexure was slightly more perceptible it was again quite immeasurable, showing the great stability and rigidity of the form of construction adopted.

The previous single-prism spectrograph showed when first constructed a flexure of about ·035mm., equivalent to a velocity of 70km. per second. When tested at the same time as the new one it was found the flexure had increased to nearly ·060mm., equivalent to over 100km. per second. As a displacement of the sharp comparison lines equivalent to a velocity of two or three kilometres would be measurable, it is at once seen how much more stable the new instrument is. It is, so far as I can learn, more stable than any other single-prism spectrograph in existence.

The new single-prism instrument, owing to its greater aperture and its design, is necessarily heavier than the three-prism spectrograph and some changes were necessary in the arrangement of the counterweights for balancing. As will be seen from Figs. 2 and 5, the centre of mass is considerably to the left of the optical axis, and in order to properly balance in declination, weight would have to be added to the opposite side of the tube near the object glass. Consequently rods for carrying weights were attached to both north and south sides of the tube near the objective, and the telescope can now be easily placed in good balance whatever attachment is used.

A counterweighted stand for attaching and detaching the new spectrograph, and for carrying it when not in use is provided. It is of quite similar construction to that used with the previous instrument, and allows the spectrograph to be fastened to the telescope in about a minute. With the separate relay box and set of plug contacts, both spectrographs may be maintained at constant temperature, and the change from one prism to three prisms or vice versa made in two or three minutes without disturbance of the temperature regulation in either case.

There will now be given the results of the tests of the new 'Single Material' and the 'Ross Special Homocentric' lenses, and, for completeness, the whole paper, as it will later be published in the Astrophysical Journal, will be given.

CAMERA OBJECTIVES FOR SPECTROGRAPHS.

It is well known that the camera objectives in general use in stellar spectrographic work have a very limited field of good definition, not exceeding in general 2°, which covers, in the usual dispersion of three prisms, about 200 tenth-metres. While this is a sufficient range for spectra of the second type, which are rich in lines, it is not sufficient for early-type spectra which may contain only one or two lines in this region, and in which, consequently, the errors of measurement will be high. As practically the whole photographic region of the spectrum, H_β to K, may be obtained in one exposure with either refractor or reflector, it is evident that a considerable gain in the measurable material in such spectra would be obtained, without increase in exposure time, if a camera lens giving a considerably wider field were available.

Various attempts at the solution of this problem have been made, of which the most successful known to me is that described by Hartmann.* This objective made by Zeiss, known as the 'Chromat,' is constructed of the same material as the prisms, and is composed of two simple meniscus elements, one positive, one negative, separated by a small air space. As there is no chromatic correction the spectra are brought into focus by inclining the plate towards the violet about 16° from the normal to the axis with a dispersion of three prisms. According to Hartmann this objective gives a flat field of 14°. A Zeiss 'Chromat' has been in use in Ottawa for considerably over a year, entirely fulfilling expectations and giving, after slightly increasing the separation of the elements, the whole field used, from H_β to $H\delta$ (about 8°), almost absolutely flat with excellent definition. There can be no doubt that the field would extend farther if necessary.

Unfortunately, as was learned upon inquiry from Zeiss, this type of objective cannot be successfully made of a larger angular aperture than about $f12$. This was confirmed by the performance of a shorter focus lens of the same type (aperture ratio $f8$) constructed by Brashear which gave inferior definition. More recently, however, Ross Limited, London, have designed and constructed especially to conform to our requirements a lens similar in form to their 'Homocentric,' consisting of four separated elements, but following the principle of the 'Chromat' in being entirely made of the prism material and consequently requiring inclination of the plate to bring the spectrum into focus. This lens, which will be more fully discussed later, gives, at an aperture ratio of $f5{\cdot}6$, excellent definition and a flat field. The above remarks apply to a dispersion of three prisms for which this type is especially adapted. If it were used with one prism, in addition to the limitations as to aperture, the plate inclination required (about 50°) would be inconvenient and practically inadmissible in radial velocity work.

There are consequently required short-focus objectives giving a flat field with three prisms, and objectives giving a flatter field than the regular triplet with a single prism. This need, together with what had already been accomplished by Hartmann and Zeiss, was laid before the J. A. Brashear Co. who, with their usual willingness, put their best efforts at our disposal and, in collaboration with Prof. Hastings, produced two eminently successful objectives. In both of these the employment of one kind of glass only is followed, although not, as in the 'Chromat,' of the same material as the prisms, and the consequent chromatic differences in focus are overcome by inclining the plate. The objective first produced, to which they have given the name 'Single Material' is composed of two widely separated positive elements of crown glass of the lowest dispersion and is especially adapted for use with one prism, giving exquisite definition and a field flat within 0·1mm. over the whole visible and considerably into the ultra-violet spectrum. The other is similar to the 'Chromat' in form but made of light crown glass, giving also a flat field and good definition with three prisms with a plate inclination of only slightly over half that of the 'Chromat.'

The limiting aperture ratio of the former of these objectives is about $f8$, of the latter $f12$, so that evidently they can not supply the need of short-focus lenses of $f6$ or thereabouts for either single or three-prism work.

The only prospect of success in this respect seemed to lie in some of the modern anastigmat photographic lenses, and a number of different makes were accordingly obtained for trial. The definition of several of these, though good enough for ordinary

* Zeitschrift für Instrumentenkunde, September, 1904.

photographic work, would not stand the critical test of spectrum photography owing probably to some residual spherical aberration. Two, however, the Ross 'Homocentric' and the Zeiss 'Tessar,' gave good definition and the forms of their fields were accordingly determined.

It may not be out of place to give a brief description of the method employed in determining the fields of the ten lenses tested. The dispersion for eight of them was produced by the Ottawa spectrograph, having the following optical constants:—Hastings 'Isokumatic' collimator objective of 35mm. aperture and 525mm. focus; one or three prisms of Jena glass O. 102, angles 63° 50′ each; ray at minimum deviation λ4415. Two of the objectives were tested with a new single-prism spectrograph having 'Isokumatic' collimator of 51mm. aperture and 763mm. focus, O. 102 prism of angle 63° 30′, ray at minimum λ4325.

The positions of focus in different parts of the field were determined by a modification of Hartmann's method* of extra-focal exposures. By means of a revolvable semi-circular diaphragm behind the collimator lens and an occulting diaphragm in front of the slit, a narrow strip of spectrum, photographed through the half of the prisms near the refracting edge, was placed between and touching two narrow strips made through the base half of the prisms. Evidently, when the plate is in the focus of the camera lens for any particular line in the spectrum, the adjacent portions of this line will be continuous, while, if not in focus, the central section will be displaced to red or violet of the outside sections, the direction and magnitude of this displacement giving a measure of the position of the focal point for the line in question. Two such plates, one inside and one outside the focus, will suffice to determine the form of the field. In order to avoid the labour of measurement and computation and on account of the diffuseness of the lines and consequent inaccuracy of measurement, when the plate is more than a millimetre from the focus, I have generally preferred to make a number of spectra, by the method outlined above, at camera settings about 0·25mm. apart within and without the focus. Five of these have in general sufficed to determine the focal curve and, as the camera back can be moved laterally, they can all be made on one plate, thus allowing ready comparisons. Simple inspection of these spectra under a microscope or even by a hand magnifier enables the focus of any line to be determined to about 0·05mm. by observing at which of two successive spectra the central section has opposite displacements with respect to the outside sections. Interpolation to the above accuracy can then generally be made. This takes only one-tenth the time and is probably equally as accurate as the method of measureing the displacements and computing the distance from focus. I may say that the camera setting in our regular work is always determined in this way, enabling the plate to be certainly placed considerably within 0·1mm. of the true focus.

This method is probably open to the objection that it will not give the true focal point when the system has aberration, but it must be remembered that, to prevent systematic displacements in radial velocity work due to non-uniform illumination of the collimator objective, this method, which determines the focus by the absence of such displacement, is certainly the one that should be used. Moreover, in this case tests at full aperture, so far as the focus can be determined by definition, confirmed the results of the former method, and there is no reason to doubt the accuracy of the focal curves determined.

* Zeitschrift für Instrumentenkunde, 24, 1, 1904.

The following ten lenses, given in the order of procuring and testing, were tested for their curvature of field.

OBJECTIVES TESTED FOR FIELD.

Number	Objective.	Aperture.	Focal Length.	Tested with dispersion of
1....	Brashear Single Material.	45	525	1 Prism, 3 Prisms.
2....	Zeiss Chromat......	45	525	3 Prisms.
3 ...	Ross Homocentric..........	40	254	3 Prisms.
4....	Zeiss Tessar....	48	305	3 Prisms.
5....	Brashear Light Crown....	45	525	3 Prisms.
6 ...	" Telescope Flint..... . ..	45	525	3 Prisms.
7....	" O. 102 ("Chromat")........	45	375	3 Prisms.
8....	" Triplet	57	480	New 1 Prism, 3 Prisms.
9 ...	" Single Material	57	457	New 1 Prism.
10...	Ross Special Homocentric...........	40	254	3 Prisms.

The form of field of each of the lenses is given in the accompanying figures where the horizontal lines represent differences of focus of one millimetre, the wave length and angular distance from the optical axis are shown by the vertical lines, and the diameters of the circles representing the observed points are 0·2mm. Wherever the curves are not horizontal indicates that the inclination of the plate holder required changing slightly, but this of course has no effect on the form of the field. In order to group the curves according to the type and purpose of the objectives, the order given in the above table has been changed and those of longer focus used with a dispersion of three prisms will be first considered (Fig. 6).

Brashear Single Material (No. 1.)

This consists of two simple converging lenses, the front double convex, the rear convex meniscus, of crown glass of lowest index, separated by nearly one-third the focal length. As will be seen later, this objective gives a beautiful field with one prism, but is strongly concave towards the lens with three prisms, with about the same curvature of field as the regular Hastings Triplet. The inclination of the plate towards the violet is slightly over 5°. Allowing deviation from focus of 0·1mm., slightly over 2° of field is usable.

Zeiss Chromat (No. 2).

This consists of two strongly curved meniscus elements of Jena glass O. 102, the front diverging, the rear converging and of about half the focus of the combination. When received it gave a field convex towards the lens as shown in the upper curve. When the separation between the elements was increased from 2·25 to 4·5mm. the field became almost absolutely flat over the whole 8°, giving at the same time excellent definition. Inclination of the plate towards the violet about 16°.

Brashear Light Crown (No. 5).

This is a lens of the same form as the 'Chromat' except that it is made of light crown glass. With the original separation the field was concave but became flat on decreasing the separation from 4·8 to 3·2mm. This change in separation resulted in loss of defining power. The objective was re-figured at the new separation and gave good definition and field flat over practically the whole range. Inclination of plate to the violet about 9°.

Brashear Telescope Flint (No. 6).

An objective similar to the previous one only made of telescope flint glass. The field was originally convex but became flat on increasing the separation from 4·8 to 7·9mm. Refiguring did not give so much improvement as in the light crown objective. Field is now practically flat. Inclination of plate to the violet is about 13·5°.

Brashear Triplet (Hastings) (No. 8).

This is a lens of the same type as used in the Mills, Bruce and Lowell spectrographs. The field is, as shown, strongly concave towards the objective with a usable portion, allowing deviation of 0·1mm., of about 2·5°. The definition at the centre of the field is about the same as in the 'Chromat,' but towards the margins even when in focus is much inferior.

All the above objectives are of relatively long focus, small angular aperture, about *f* 12, tested with dispersion of three prisms. Let us now examine the fields given by shorter focus objectives, using the same dispersion (Fig. 7).

Ross Homocentric (No. 3).

This standard photographic objective gives good definition but a strongly concave field. An increase in separation from 59 to 124mm. appears to flatten the field, but at the expense of defining power and the lens is not usable at the increased separation. Useful field is not more than 2°.

Zeiss Tessar (No. 4).

This objective was one of the standard form taken from the stock of Bausch and Lomb. It gives good definition and a field very slightly convex. This convexity is removed by an increase in separation from 41·0 to 41·7mm., but with a slight loss in defining power, so that it is probably preferable to use it at the normal separation. Another lens of the same series, aperture, and focus was tested, giving practically the same field but considerably poorer definition. This is of interest as showing the differences between the performance of two objectives presumably identical and indicates the desirability of specially selecting and testing the lens to be used from a number.

Brashear O. 102 ('Chromat') (No. 7).

This objective of the same type and material as the Zeiss Chromat but of larger angular aperture, gives a field nearly flat with a separation of 6·3mm., but with poor definition even after refiguring. This shows that this type can not be successfully constructed of larger aperture ratio than *f*11, say. Inclination of the plate to the violet about 16°.

Ross Special Homocentric (No. 10).

This objective was, by the kindness of the makers, Messrs. Ross, Limited, especially computed and constructed for us. It has an aperture ratio of *f*5·6, is of practically the same form as their Homocentric, but with all four elements of O. 102 glass. It gives beautiful definition and a field nearly flat, usable over 8°. Change of separation is without appreciable effect on the form of field. Inclination of plate to the violet about 16°.

Two types of objectives of medium and long focus have been tested with a dispersion of one prism (Fig. 8).

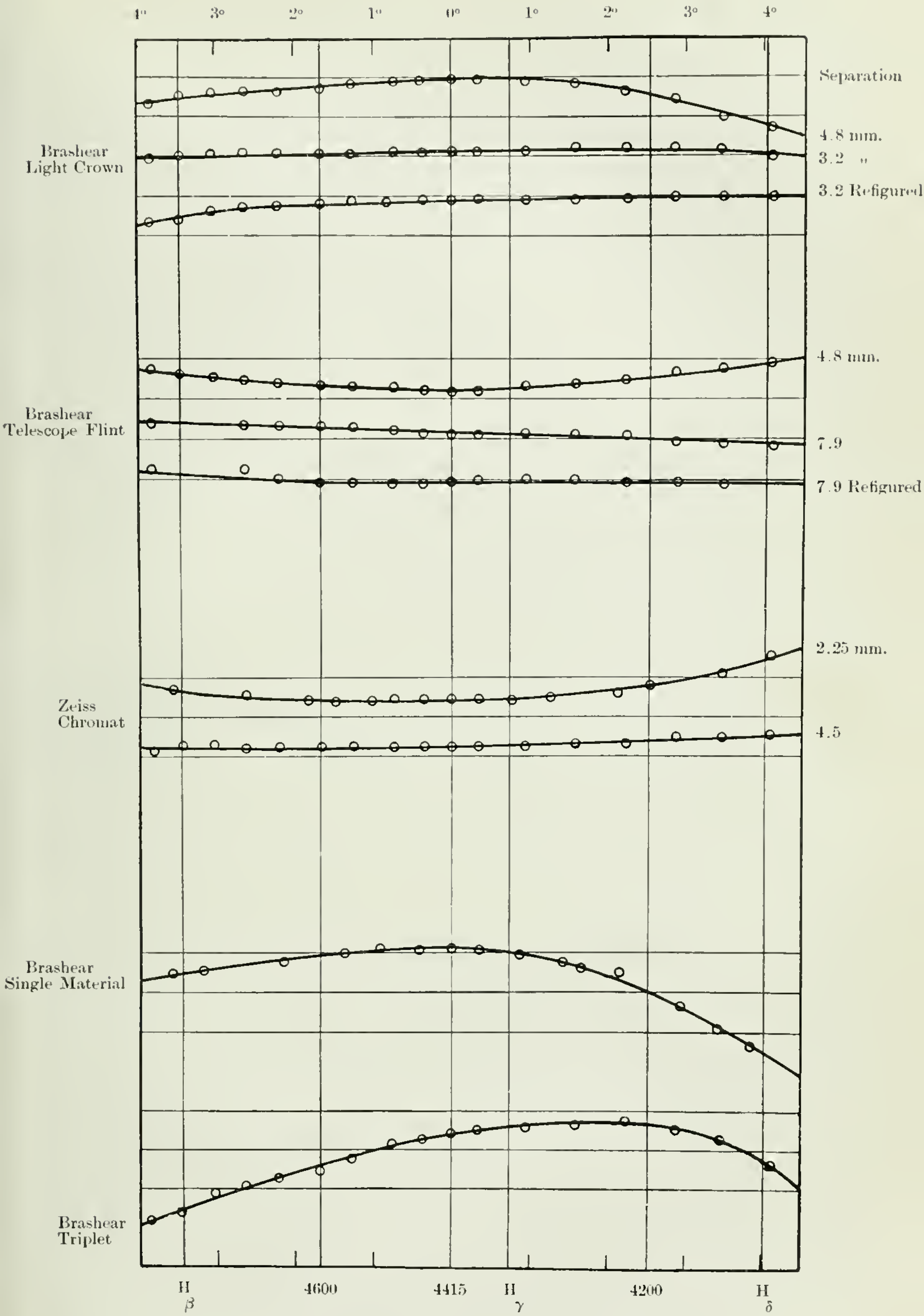


Fig. 6—Long Focus Objectives with three prisms.

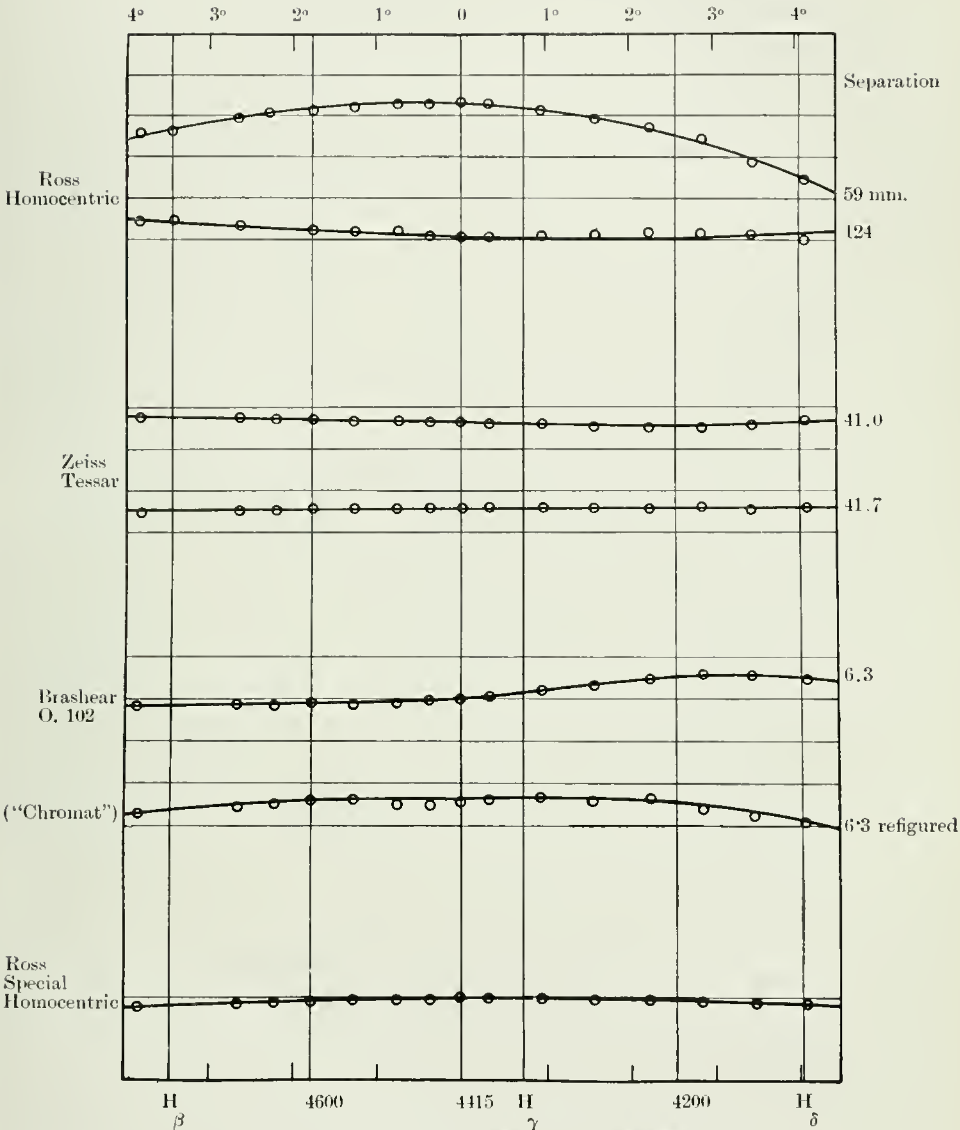


Fig. 7—Short Focus Objectives with three prisms.

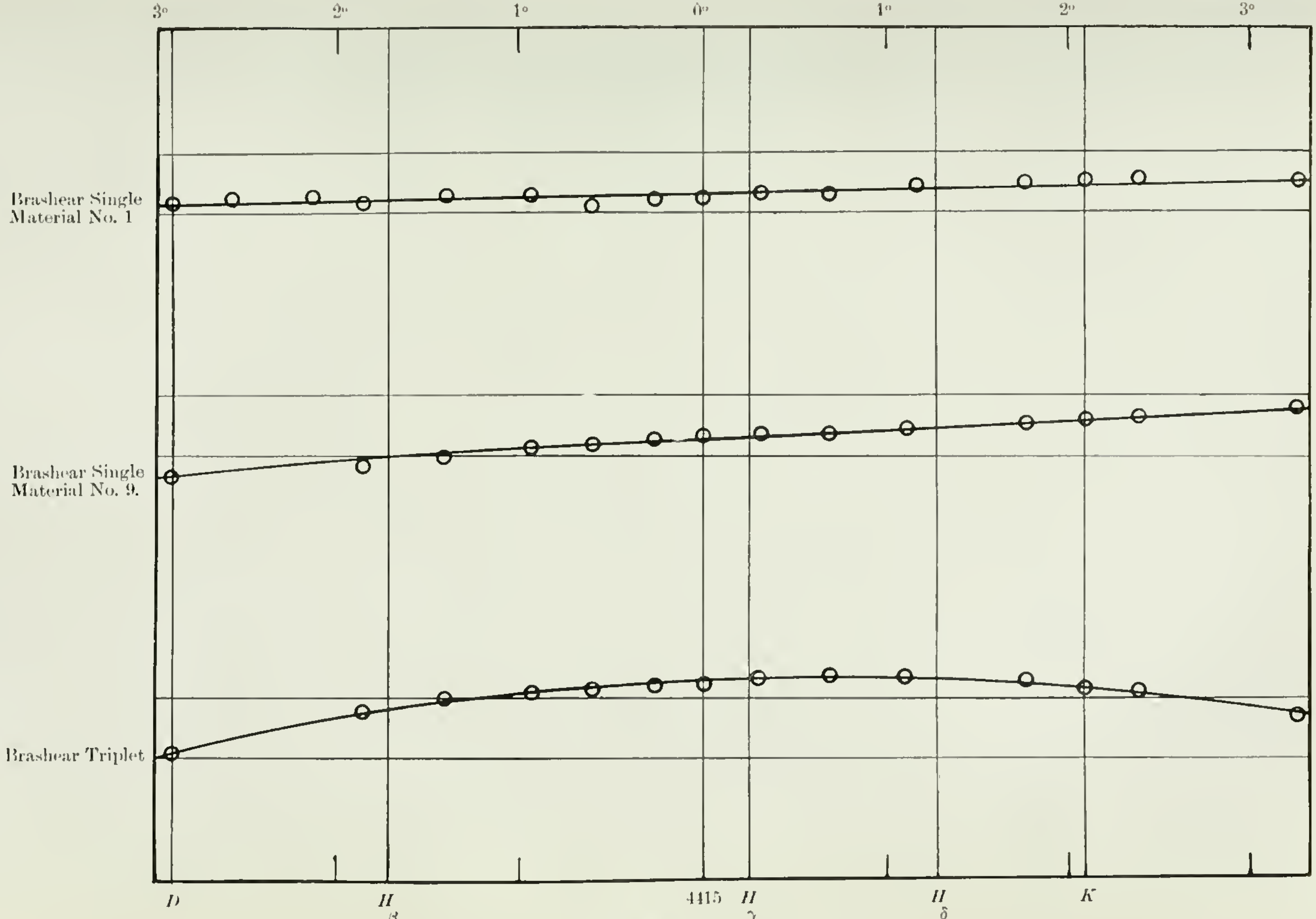


Fig. 8—Objectives tested with one prism.

Brashear Single Material (Nos. 1 and 9).

Both of these objectives, whose form was described above, are of the same type, No. 1 of an aperture ratio $f11{\cdot}5$; No. 9, $f8$. When used with three prisms they give the strongly concave field shown in Fig. 6, but with a single prism the field is almost absolutely flat over the whole range of visible and as far into the ultra-violet spectrum as the prism will transmit. The definition given is excellent and the objectives leave nothing to be desired for single-prism work. The inclination of plate to the violet is about 16°. I am glad to express here my appreciation of the efforts, as well as my admiration for the skill of Mr. McDowell in figuring these objectives. As both components are converging, the only means of removing the positive spherical aberration is by departure from spherical surfaces. While, as Mr. McDowell says, this was comparatively easy for No. 1, of the smaller angular aperture, it taxed even his skill to remove it entirely in the other, and it was only after a second trial and the use of a special device that the objective was finally made perfect.

Brashear Triplet (No. 8).

This, as with three prisms, gives a field concave towards the objective but with considerably less curvature. The usable field is somewhat over 2°. Definition good.

The final results of the investigation may be summarized as follows:—

For a dispersion of three prisms with a camera of fairly long focus two objectives are much superior to the others, the Zeiss 'Chromat' and the Brashear Light Crown. The former gives a flatter field and slightly better definition than the latter, but on the other hand the smaller plate inclination of 8° instead of 16° and the smaller absorption of the Brashear are an advantage. The definition of either of these is fully equal to the regular triplet in the centre of the field and much superior at the margins.

For short-focus lenses with three prisms both the Zeiss 'Tessar' and the Ross 'Special Homocentric' give good definition and flat fields. The Ross can be used of shorter focus than the Tessar, and gives exquisite definition, but the field of the Tessar is flatter and the plate is normal to the axis.

In single-prism work the Brashear 'Single Material' is much superior to the type of Triplet usually employed, both in definition and extent of field and can not be surpassed or even equalled for its purpose.

MEASUREMENT AND REDUCTION OF STELLAR SPECTRA.

With the exception of some plates measured on the spectro-comparator, which will be fully described below, all of the measurements have been made with the Toepfer microscope, and reduced by the modified Hartmann method previously described and explained. When the new single-prism spectrograph was brought into use it was found necessary to obtain tables, similar to those previously prepared, for the reduction of the spectrograms.

As before, plates of the comparison spectrum were made at three temperatures, as far separated as the time and season would permit, and these plates were measured. From these measures the constants of the Hartmann interpolation formula $\lambda - \lambda_o = \frac{c}{s - s^o}$ were computed, using as the three standards different sets of lines, for the purpose of determining which would give the best agreement over the whole range of spectrum. It was not thought necessary, after the work of Mr. McLean, described in the 1907 report, to use the complete formula,

$$s_o - s = \frac{c}{(\lambda - \lambda_o)^a},$$

as he showed that with the previous single-prism instruments, the best agreement was given when $a = 1$.

It was found that standards chosen at the middle and near the ends of the spectrum gave the best agreement on the whole and these, with the measures corresponding and the constants for the three temperatures, are given.

TABLE OF CONSTANTS.

Temp. C.	4864·943 / s_1	4341·162 / s_2	3930·450 / s_3	s_0	log c	λ_0
2·8..	75·9840	50·9383	20·5074	176·9410	5·4249320	2229·851
8·6..	75·9851	50·9168	20·4543	176·9951	5·4250393	2230·595
15·6..	75·9557	50·8696	20·3763	176·9751	5·4248560	2231·943

Forming the differences between the s's and the log. of the ratio we have:

Temp. C.	s_1-s_2	s_2-s_3	s_1-s_3	$\log \frac{s_1-s_2}{s_1-s_3}$
2·8......	25·0457	30·4309	55·4766	9·65462
8·6	25·0683	30·4625	55·5308	9 65459
15·6......	25·0861	30·4933	55·5794	9·65452

The changes in these differences and in the log. of the ratio are only about half those given with the other single-prism spectrograph. This is undoubtedly due to the fact that the camera setting remains unchanged with change of temperature in the new instrument, and, consequently, only the change in the angular dispersion appears, instead of that due to angular dispersion plus that due to increase in distance of the focal plane from the camera objective.

Averaging up the differences as far as possible, an increase of temperature of 1°C. increases $s_1 - s_3$ by ·008 revolution, and diminishes $\log.\frac{s_1 - s_2}{s_1 - s_3}$ by·00001.

Forming an arbitrary series with these differences from the last two columns of the previous table, keeping them as close as possible to the observed values and computing 2nd and 3rd columns we have for differences of 10°.

Temp. C.	s_1-s_2	s_2-s_3	s_1-s_3	$\log\frac{s_1-s_2}{s_1-s_3}$
−10..	25·0070	30·3675	55·3745	9·65475
0...	25·0376	30·4169	55·4545	9·65465
+10.	25·0681	30·4664	55·5345	9·65455
+20........	25·0985	30·5160	55·6145	9·65445

Again, taking the arbitrary equidistant values of s_2 for these four temperatures, which make the micrometer reading for the iron line at minimum deviation λ4325·9 as near as possible to 50·0000, we obtain the following values for s_1 s_2 s_3 and from them the three constants of the formula:—

Temp. C.	s_1	s_2	s_3	s_0	log c	λ_0
−10	75·9260	50·9190	20·5515			
0	75·9516	50·9200	20·5031	176·9129	5·4250327	2229·197
+10	75·9891	50·9210	20·4546	176·9736	5·4248342	2231·163
+20	76·0205	50·9220	20·4060	177·0327	5·4246277	2233·137

From these constants were computed the micrometer readings for all the star and comparison lines employed, and in addition the velocities corresponding to one revolution of the micrometer screw for each star line. This latter is obtained by differentiating the dispersion formula and applying Doppler's principle resulting in

$$v = \frac{299860}{\lambda} \cdot \frac{(\lambda - \lambda_0)^2}{c}$$

The velocities per revolution, as compared with those for the original single prism, are given for a few lines below to give some indication of the difference in dispersion.

Velocities per Revolution.

Temperature + 10° C.

Wave Length.	Old One Prism.	New One Prism.
4861·527	1454·4	1604·5
4713·308	1336·6	1473·7
4549·766	1209·0	1332·1
4481·400	1156·5	1273·9
4395·286	1091·1	1201·3
4340·634	1050·1	1155·8
4260·640	990·6	1089·9
4202·161	947·7	1042·3
4143·928	905·4	995·4
4101·890	875·2	961·9
4026·352	821·5	902·4
3970·177	728·1	858·3
3933·825	756·0	830·9

These velocities show that the new instrument has very approximately ten per cent less linear dispersion than the old. This, of course, is due almost entirely to the shorter focus camera lens used, as the prisms are nearly alike and the angular dispersion similar.

The Spectro-comparator.

The Spectro-comparator, which was briefly referred to in my last report, has not been used except on a few plates of β Geminorum more to test the capabilities of the instrument than for the purpose of obtaining definite measures of the velocity of this star. Before giving these measures, however, it may be well to shortly describe the instrument, its principle and the methods of measurement. These have been very fully described by its inventor, Dr. Hartmann, in the publications of the Astrophysical Observatory of Potsdam, Volume XVIII., Part 1, and consequently need not be gone into in great detail here.

The principle of measurement depends upon the direct comparison in a special form of double image microscope of the star spectrum, whose velocity is required with a standard spectrum of the sun, whose velocity at the instant the spectrum was made.

can be readily computed. The difference in the displacements of the star and the sun lines with respect to the same metallic comparison lines on each plate is measured by a micrometer screw, and this linear displacement can be at once converted into kilometres by multiplication by a known or easily computed constant. By adding to this radial velocity that of the sun with respect to the earth, with the proper sign, we obtain the velocity of the star with respect to the earth, and this can be readily reduced to the sun in the well known way.

The instrument of which a photograph is shown in Fig. 9 and diagrams in Figs. 10 and 11 was constructed by Zeiss in a very workmanlike manner. It consists essentially of a table T, Fig. 10, which carries at E_1 and E_2 the standard solar and the star spectrum respectively, and of a single ocular double objective microscope carried above the table on the bracket R, Fig. 11, which combines and compares the images of the two spectra.

The table T, which as Fig. 11 shows, is inclined at 45° to the horizontal for convenience in measuring, slides at its lower portion on the steel cylinder Z 35mm. diameter and at its upper part on the steel bar J. It is moved on these bearings over a range of 12cm. by rack and pinion of which the knurled wheel is shown at K and is clamped in any position, read off on the scale and vernier N, by the clamp screw near K. At the upper part of the table a carriage B_2 slides transversely in ways, adjustment being made by the screw G, while a secondary carriage A_2, having a slit 1cm. wide and 12cm. long, through which the star spectrum is illuminated by the plane mirror shown in Fig. 11 is oriented by the tangent screw D_2 and the opposing spring F_2, so that the spectrum, clamped on it may be placed parallel to the motion of the table T. The carriage B_1, which carries the standard or fundamental solar spectrum, has an orienting table A_1, adjusted by the screw D_1 and spring F_1, and slides in ways parallel to the motion of the table T. It is moved by means of the micrometer screw S of 0·5mm. pitch, having a range of movement slightly over 2cm. The head is divided into 100 parts so that the movement of the sun spectrum can be read direct to 0·005mm. and estimated to 0·0005mm.

The double microscope, Fig. 11, by which these two spectra are observed is supported by the bracket R on which the arm R_1 slides, moved by the screw H, the position being read on the scale W. The tubes carrying the objectives O_1 O_2 are attached at a fixed distance from one another to a plate L, movable in ways on the arm R_1 by the screw Q. At the upper ends of the objective tubes, which are provided with rack and pinion movement for focussing, are the prisms P_1 P_2, which reflect the light from the spectra on E_1 and E_2 to the compound prism P_3 P_4. On the hypothenuse of the prism P_4 is a surface silvered in the form shown in Fig. 12, and the two prisms are then

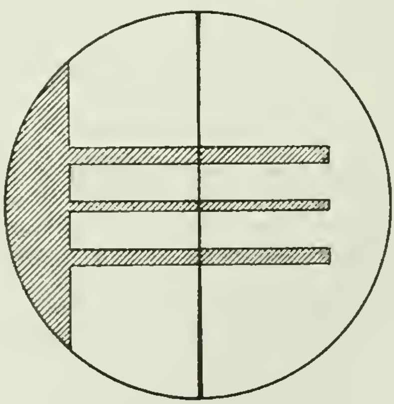


Fig. 12.

cemented together with Canada Balsam. The proper proportioning of the widths of the silver strips enables one to see, on looking through the eyepiece, a narrow strip of

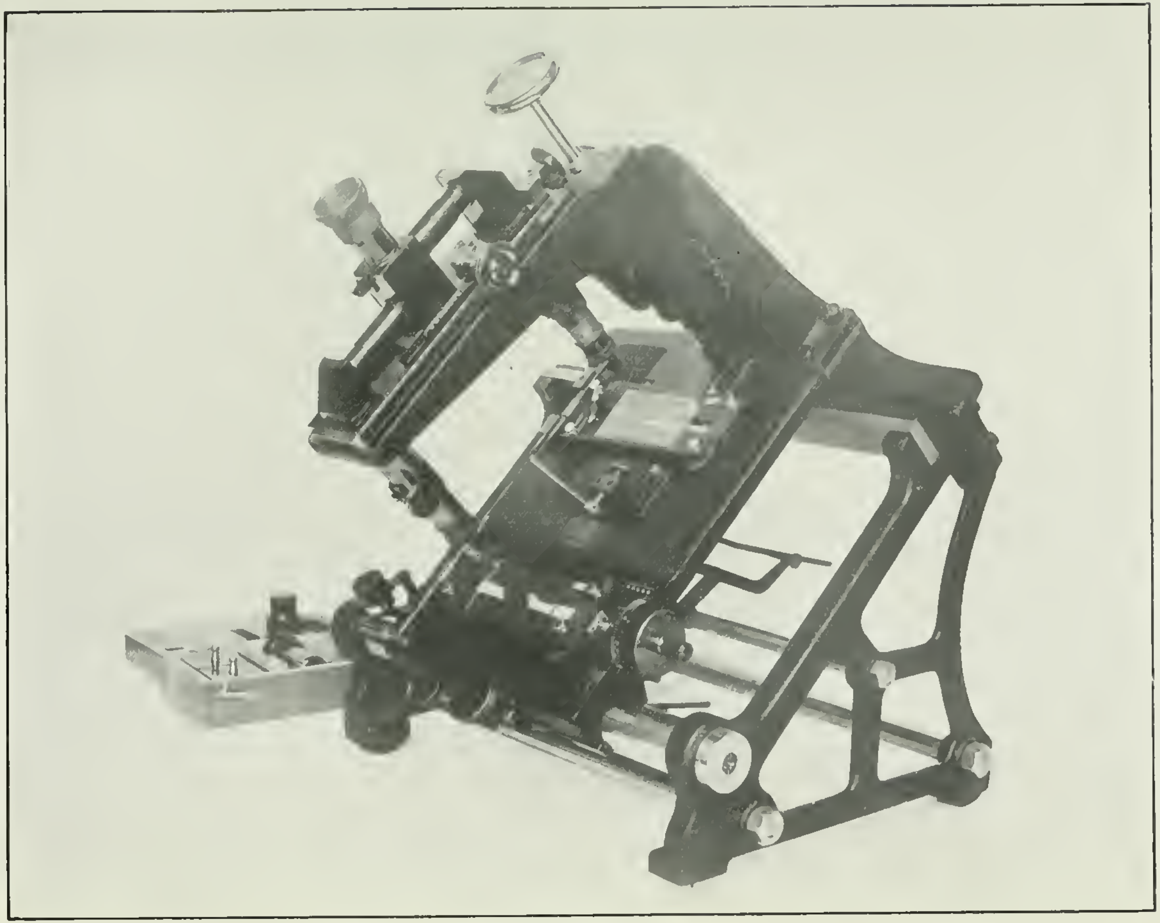


FIG. 9—Spectro-Comparator.

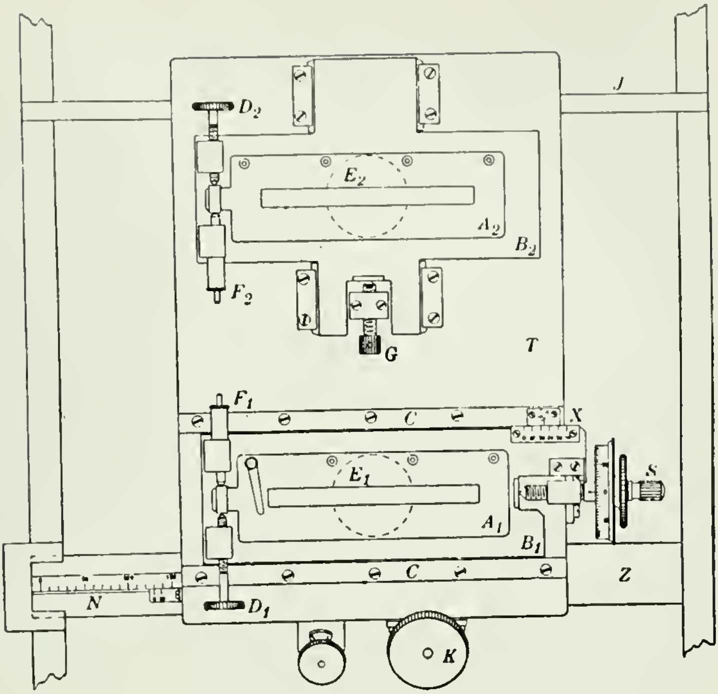

J
D2
E2
A2
B2
F2
G
T
F1
C
X
E1
S
A1
B1
Z
N
D1
K

FIG. 10.

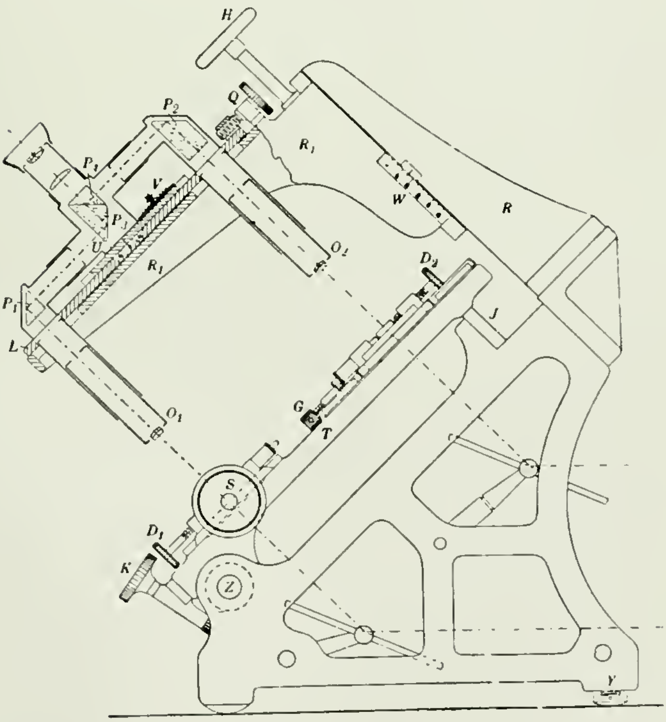

H
Q
P2
R1
P3
V
W
R
P3
U
O2
D2
R1
P1
J
L
G
T
O1
S
D1
K
Z
Y

FIG. 11.

star spectrum between and touching two strips of sun spectrum, and also on either side a narrow strip of the star comparison between and touching strips of sun comparison spectrum. The compound prism $P_3 P_4$, with the eyepiece, is carried on a slide U moved by rack and pinion V, so that the distance between the eyepiece and the objectives and consequently the magnification of the two spectra may be changed at will. This is to enable them, even though of different dispersions, to be made apparently identical in the field and hence readily and accurately comparable.

The adjustment of the spectra on the machine is a comparatively simple matter, only taking a few moments. The standard or fundamental solar spectrum usually made on a lantern or process plate in order to obtain sufficient contrast, is placed on its carriage, and clamped by a pair of spring microscope clamps. The carriage is then moved by the pinion K until the centre of rotation of the orienting arrangement is directly under the microscope 1, which is in this case at the reading 132·3 on the scale N.

The whole microscope system is now moved by the screw Q until the solar spectrum is centrally situated with respect to the central silver strip in the field. By moving the carriage back and forwards the spectrum can be rapidly oriented. The star spectrum may be similarly oriented while it is made central by the screw G. There then remains only to adjust the magnification of the separate spectra, the comparison lines of the two appear coincident in the whole extent of the field of view. By moving the ocular by the rack and pinion V, the magnification of one spectrum is increased and of the other decreased. This will evidently disturb the focus, but this can be easily corrected by adjusting the objectives O_1 and O_2 by their focussing screws seen in Fig. 9. This will again slightly change the magnification and the process may need to be repeated, but a little practice soon enables one to equalize the apparent dispersion very quickly.

Before making any measurements it is necessary to divide the fundamental solar spectrum into regions, indicated by small ink dots, and numbered for identification. These regions are so chosen that there is a slight overlapping of the field in adjacent regions with the magnification to be employed. The dots, which are brought under the wire in the measurement, are placed, as nearly as possible, in the centre of a group of good solar lines and at the same time so that the field includes a number of good comparison lines. The regions selected in a series of good fundamental solar spectra made on May 14, 1908, on Seed process plates are given in the following table. In addition in the third column of the table are given the velocities corresponding to one revolution of the micrometer screw. These velocities were computed from the measurement of lines on the fundamental spectrum by the micrometer screw of the comparator. These linear measurements were used to obtain the constants of the Hartmann formula, and from these constants the velocities corresponding to the wave length of each region were computed.

CONSTANTS OF FUNDAMENTAL SPECTRA, 1519-1526.

Exposed May 14, 1908.

No. of Region.	Wave Length.	Vel. per Rev. S.	No. of Region.	Wave Length.	Vel. per Rev. S.
1	4867·0	582·1	14	4374·5	364·2
2	4807·0	555·4	15	4346·5	352·1
3	4754·0	531·9	16	4322·8	341·8
4	4709·6	512·0	17	4298·2	331·1
5	4669·0	494·0	18	4273·3	320·4
6	4628·7	476·0	19	4249·9	310·4
7	4590·2	459·1	20	4226·8	300·6
8	4554·6	443·2	21	4206·0	291·7
9	4523·9	429·7	22	4184·3	282·1
10	4492·0	415·7	23	4157·2	271·2
11	4460·3	401·7	24	4139·5	263·4
12	4429·6	388·3	25	4117·8	255·7
13	4402·1	376·2	26	4099·0	246·7

$$\text{Log } f = \log. \frac{1}{2\Sigma\frac{1}{5}}$$

Region.	3	4	5	6	7
13	....	....	1·37646	1·42045	1·47137
14	....	....	1·32312	1·36175	1·40594
15	....	1·24332	1·27409	1·30846	1·34727
16	1·17577	1·20095	1·22877	1·25961	1·29412
17	1·13813	1·16116	1·18647	1·21436	1·24533
18	1·10239	1·12355	1·14671	1·17207	1·20008
19	1·06833	1·08786	1·10914	1·13236	1·15784
20	1·03576	1·05385	1·07349	1·09483	1·11815
21	1·00457	1·02139	1·03958	1·05928	1·08072
22	0·97452	0·99028	1·00710	1·02535	1·04514
23	0·94533	0·95996			
24	0·91718	0·93098			
25	0·88998	0·90283			
26	0·86348	0·87555			

The magnification of the two spectra may be varied between about 10 and 40 fold by means of two pairs of objectives and three oculars. Moreover, by suitably varying these the silver strips on the prism may be varied in apparent width to suit star spectra of different widths. It has been found that a magnification of about 20 seems to give better and easier measurements than either higher or lower powers, and it has generally been used, although tests have been made with different powers.

When the plates have been adjusted as described above, the line in the centre of the field is set on the dot towards the red end at which it is deemed advisable the measurement should begin. This is determined by the appearance of the star spectrum and of its comparison lines. It has not been generally taken lower down than No. 5 at wave length λ4669, as below that the comparison spectrum is not so good and no gain in accuracy would result. Towards the violet end the measurement is carried until the star spectrum becomes too weak for accurate comparisons, frequently about dot 20, wave length λ4227. However, in a well exposed star spectrum the measurement could be extended over the whole range on the plate from H_β to $H\delta$, although in my opinion nothing would be gained in accuracy by such procedure over that obtained by the use of a less number, say 12 or 15 regions. The measurement proceeds according to a regular scheme of alternation of star and comparison settings, so that at each region there are two settings on the star and two on the comparison lines, one by forward and one by backward rotation of the screw in each case. As soon as the measurement is completed, both star and fundamental spectra are reversed on the machine to overcome personality in the settings and the same regions are again measured.

It has been my experience that the most difficult part of the measurement is the determination of the point of coincidence of star and fundamental spectrum. Although with solar type stars of a considerable range in type, there is so little difference in the lines as to cause no trouble, nevertheless there are frequently apparently accidental irregularities in some of the lines in a region which render it difficult to determine the exact point of coincidence. The field extends over a considerable angle, and the eye can only observe at the most two or three lines at a time. These may be brought into the best coincidence, while lines in another part of the field may be better suited by a slightly different setting, and the best average is sometimes troublesome to obtain. These irregularities are chiefly due, I think, to irregular deposition of the silver grains in the comparatively coarse structure of the fast plates, to local distortions of the photographic film, to possibly non-uniform intensity of the star spectrum throughout its width and to other causes of a similar nature rather than to constant differences in the spectrum of star and sun. Such differences can be noted in the case of some lines, but these seem to be few compared with the accidental deviations observed. This difficulty does not exist to so great an extent with regard to the emission lines. Provided the comparison spectra are of nearly the same intensity, coincidences can be easily, quickly, and accurately obtained. The accidental deviations observed in the apparent positions of star lines serve to explain the comparatively high residual sometimes obtained in the direct measurement of good lines in solar type spectra.

After the measurement is completed the reduction of the separate measures to velocities is a simple matter. The difference in the settings for coincidence between emission and absorption spectra, multiplied by the velocity per revolution at the region under consideration gives the velocity at once. These differences are, however, tabulated for both positions of the plate, and the mean of the two for each region multiplied by the velocity factor gives the velocity for the region, while the velocity for the plate is obtained from the mean of the regions.

This considers all the regions as of equal weight, whereas such is not the case. In some parts of the spectrum the lines are more numerous or of better quality, and moreover as the dispersion increases, as we go towards the violet, greater weight should be given. There are then two courses open, to give weights according to the quality of the regions, increasing these as we go towards the violet, or to give weights proportional to the dispersion. The latter method is much simpler, and should give practically the same values as the more complex method and better values than the simple mean. Moreover, Hartmann has developed a very simple method of obtaining the velocity from the differences. If we call the differences with red to right d_1 and with red to left d_2, then the mean $d = \frac{1}{2}(d_1 + d_2)$, which multiplied by the velocity factor s, gives velocity sd for the region. Its weight is proportional to $\frac{1}{s}$, and hence the weighted mean velocity can be very simply represented by $\frac{\Sigma d}{\Sigma \frac{1}{s}}$. As $d = \frac{1}{2}(d_1 + d_2)$ we can avoid taking the means of the differences by changing it to $\frac{\Sigma d_1 + \Sigma d_2}{2\,\Sigma \frac{1}{s}}$. If we take the velocity values per revolution of the fundamental spectrum and form the expressions $\log\left(\frac{1}{2\,\Sigma \frac{1}{s}}\right)$ between all the regions which are likely to be used, the only procedure necessary to obtain the weighted mean velocity is to add all the differences together and add to the logarithm of the sum the tabulated value of the above expression. To the velocity of which this sum is the logarithm, must be added the computed radial velocity of the sum when the spectrum was made, and we have the radial velocity of the star with respect to the earth, which reduced for diurnal and annual motion will give us the velocity with respect to the sun.

As mentioned previously, only a few plates of β Geminorum made with the three-prism spectrograph have been measured, principally as a test of the capabilities of the instrument. It can practically be used only with spectra of the second and third classes, those with numerous well defined lines, allied to the spectrum of the sun. Our single-prism spectrograph has been almost entirely employed on stars of early type spectra, which can not be economically or accurately measured with the spectro-comparator. However, work on some solar type spectroscopic binaries with a short-focus camera on the three-prism spectrograph is about to start, and for the measurement of such spectra the comparator is especially suited.

One spectrum of β Geminorum No. 1373, of only moderately good quality, was selected as a test plate and has been measured fifteen times with different fundamental spectra, different arrangements of objectives and oculars and with two different ocular prisms.

The measures and their summary given below enable an estimate of the accuracy obtainable in measurement to be formed. Further ten additional plates of β Geminorum have been measured with constant conditions in the comparator, which enables an estimate to be formed of the instrumental errors to be expected in the making of the spectra. These also with a summary are given below:—

β GEMINORUM 1373.

SOLAR STANDARD 1360.

Observer }
Measurer } J. S. P.

Region.	d_1	d_2	d	V	v
7	053	049	052	24·84	−0·06
8	47	48	48	22·18	+2·60
9	53	51	53	24·01	+0·77
10	55	51	53	23·53	+1·25
11	60	51	55	23·87	+0·91
12	50	48	49	20·58	+4·20
13	64	57	61	25·07	−0·29
14	65	65	65	26·32	−1·54
15	64	60	62	24·68	−0·10
16	64	62	63	24·57	+0·21
17	67	66	66	25·34	−0·56
18	72	73	73	27·45	−2·67
19	78	69	73	27·01	−2·23
20	79	74	76	27·51	−2·73
21	70	73	72	25·56	−0·78
22	74	73	73	25·33	−0·55
23	71	68	70	23·94	−0·84
24	76	71	73	24·38	+0·40
25	71	75	73	23·80	−0·98
26	87	78	82	25·91	−1·13
27	84	76	80	24·48	+0·30
28	85	90	88	26·40	+1·62
29	91	91	91	26·57	+1·79
30	87	71	79	22·51	+2·26
31	89	90	89	24·03	+0·75
	1758	1683	Mean ..	.... +24·78	....

$\Sigma d = 3441$ log = ·53668

log f = ·85865

log $(Vs\text{-}Vo)$ = 1·39533

$Vs\text{-}Vo = +\ 24{\cdot}85$ $r = \pm\ 1{\cdot}10$

$Vo = +\ \ 0{\cdot}21$

$Va = -\ 21{\cdot}97$

$Vd = -\ \ 0{\cdot}16$ $V = +\ 2{\cdot}93$

β GEMINORUM 1373.

SOLAR STANDARD 1461.

Observer } J. S. P.
Measurer }

Region.	d_1	d_2	d	V	v
1	·049	·051	·050	24·90	−0·32
2	49	51	50	24·21	+0·37
3	48	47	48	22·61	−1·97
4	48	51	49	22·56	−2·02
5	50	55	53	23·84	+0·74
6	54	51	52	22·85	+1·73
7	52	53	53	22·76	−1·82
8	57	57	57	23·88	+0·70
9	59	63	61	24·99	−0·41
10	64	62	63	25·21	−0·62
11	66	65	65	25·43	−0·85
12	68	65	66	25·25	−0·67
13	70	67	69	25·87	−1·29
14	73	70	71	26·04	−1·46
15	64	70	67	24·05	+0·53
16	68	73	71	24·94	−0·36
17	72	72	72	24·80	−0·22
18	74	72	73	24·60	−0·02
19	75	74	74	24·43	+0·15
20	76	82	79	25·55	−0·97
21	82	80	81	25·62	−1·04
22	78	80	79	24·47	+0·11
23	85	84	84	25·48	−0·90
24	78	87	83	24·68	−0·10
25	93	82	88	25·55	−0·97
	1652	1658	Mean...	....+24·58	....

$\Sigma d = 3310$

log = ·51983
log f = ·87155
log $(V_s - V_o)$ = 1·39138

$V_s - V_o = +\ 24·63$
$V_o = +\ 0·52$
$V_a = -\ 21·97$
$V_d = -\ 0·16$

$r = \pm\ 0·71$

$V = -\ 3·02$

β GEMINORUM 1373.

Solar Standard 1461.

Observer } J. S. P.
Measurer }

Region.	d_1	d_2	d	V	v
3	·055	·051	·053	24·96	−1·06
4	45	52	48	22·10	+1·80
5	47	53	50	22·49	+1·41
6	50	47	49	21·53	+2·37
7	53	53	53	22·76	+1·14
8	49	51	50	20·95	+2·95
9	58	63	60	24·58	−0·68
10	64	62	63	25·21	−1·31
11	60	59	60	23·47	+0·43
12	65	61	63	24·10	−0·20
13	67	62	64	24·00	−0·10
14	68	72	70	25·68	−1·78
15	69	62	66	23·69	+0·21
16	79	65	72	25·29	−1·39
17	68	69	69	23·78	+0·12
18	68	76	72	24·26	−0·36
19	74	74	74	24·43	−0·53
20	74	72	73	23·61	+0·29
21	77	74	75	23·72	+0·18
22	78	79	78	24·16	−0·26
23	79	81	80	24·26	−0·36
24	88	83	86	25·57	−1·67
25	91	82	86	24·97	−0·07
	1526	1503	Mean..	.... +23·90	....

$\Sigma d = 3029$ log = ·48130

log f = ·89871

log ($V_s - V_o$) = 1·38001 $r = \pm 0·81$

$V_s - V_o = + 23·99$

$V_o = + 0·35$

$V_a = - 21·97$

$V_d = - 0·16$ $V = + 2·23$

β GEMINORUM 1373

SOLAR STANDARD 1462.

Observer } J. S. P.
Measurer }

Region.	d_1	d_2	d	V	v
4	·049	·049	·049	22·56	−2·12
5	52	51	51	22·94	+1·44
6	53	54	54	23·73	+0·65
7	60	57	58	24·91	0·53
8	53	52	53	22·21	+2·16
9	64	57	60	24·58	−0·20
10	65	61	63	25·21	−0·83
11	67	64	66	25·82	−1·44
12	63	67	65	24·87	−0·49
13	68	69	68	25·50	−1·12
14	73	70	72	26·41	−2·03
15	67	64	65	23·34	+1·04
16	67	67	67	23·54	+0·84
17	68	73	71	24·47	−0·09
18	73	71	72	24·26	+0·12
19	69	70	69	22·78	+1·60
20	76	74	75	24·26	+0·12
21	83	83	83	26·25	−1·87
22	78	84	81	25·09	−0·71
23	79	79	79	23·96	−0·42
24	81	82	81	24·08	−0·30
25	89	87	88	25·59	−1·21
	1497	1485	Mean.	+24·38	. . . .

$\Sigma d = 2992$ log = ·47451

log f = ·91356

Log (Vs-Vo) = 1·38807

Vs-Vo = −24·44 $r = \pm 0·81$

Vo = −0·54

Va = −21·97

Vd = −0·16 V = +2·85

β GEMINORUM 1373.

SOLAR STANDARD 1462.

Observer } J. S. P.
Measurer }

Region.	d_1	d_2	d	V	v
1	·052	051	·051	25·40	−0·72
2	48	49	49	23·72	+0·96
3	55	50	52	24·50	+0·18
4	47	47	47	21·64	+3·04
5	50	54	52	23·39	+1·29
6	52	51	52	22·85	+1·83
7	60	54	57	24·48	+0·20
8	58	57	57	23·88	+0·80
9	61	62	62	25·40	−0·72
10	65	62	63	25·21	−0·53
11	64	61	63	24·65	+0·03
12	73	70	71	27·16	−2·48
13	74	66	70	26·25	−1·57
14	67	69	68	24·94	−0·26
15	65	67	66	23·69	+0·99
16	72	67	70	24·58	+0·10
17	70	69	69	23·77	+0·93
18	72	72	72	24·26	+0·42
19	74	74	74	24·43	+0·25
20	78	76	77	24·90	−0·22
21	84	79	81	25·62	−0·94
22	82	82	82	25·40	−0·72
23	83	79	81	24·57	+0·11
24	82	81	82	24·38	+0·30
25	94	87	90	26·13	−1·45
	1682	1636	Mean..	....+24·68	....

$\Sigma d = 3318$

log = ·52088
log f = ·87155
log (V_s−V_o) = 1·39243

V_s−V_o = + 24·68
V_o = + 0·48
V_a = − 21·97
V_d = − 0·16

V = − 3·03

r = ± 0·77

β GEMINORUM 1373.

SOLAR STANDARD 1462.

Observer } Measurer } J. S. P.

Region.	d_1	d_2	d	V	v
3	·053	049	·051	24·03	+0·73
4	46	51	49	22·56	+2·20
5	55	52	53	23·84	+0·92
6	56	54	55	24·17	+0·59
7	47	55	51	21·90	+2·86
8	54	60	57	23·88	+0·88
9	62	61	61	24·99	−0·23
10	58	67	63	25·21	−0·45
11	59	68	63	24·65	+0·11
12	69	68	69	26·40	−1·64
13	72	67	69	25·87	−1·11
14	68	65	67	24·58	+0·18
15	70	64	67	24·05	+0·71
16	72	71	72	25·29	−0·53
17	72	74	73	25·15	−0·39
18	72	71	72	24·26	+0·50
19	78	77	77	25·42	−0·66
20	80	82	81	26·19	−1·43
21	85	80	82	25·94	−1·18
22	83	81	82	25·40	−0·64
23	88	85	86	26·08	−1·32
24	89	91	90	26·76	−2·00
25	89	84	85	25·26	−0·50
	1577	1577	Mean......	+24·76	....

$\Sigma d = 3154$

log = ·49886

log f = ·89871

log (Vs-Va) = 1·39757

Vs-Vo = + 24·98

Vo = + 0·33

Va = − 21·97

Vd = − 0·16

V = + 3·18

$r = \pm 0·79$

β GEMINORUM 1373.

SOLAR STANDARD 1462.

Observer } J. S. P.
Measurer }

Region.	d_1	d_2	d	V	v
1	·049	·047	·048	23·91	+0·27
2	44	51	48	23·24	+0·94
3	50	51	50	23·55	+0·63
4	50	45	48	22·10	+2·08
5	53	51	52	23·39	+ ·79
6	54	56	55	24·17	+ ·01
7	60	59	60	25·76	−1·58
8	56	58	57	23·88	+ ·30
9	57	59	58	23·76	+ ·42
10	59	60	60	24·01	+ ·17
11	59	64	61	23·86	+ ·32
12	61	66	63	24·10	+ ·08
13	65	65	65	24·37	− ·19
14	66	68	67	24·58	− ·40
15	68	68	68	24·41	− ·23
16	60	64	62	21·77	+2·41
17	70	75	72	24·80	− ·62
18	70	77	74	24·94	− ·76
19	74	72	73	24·10	+ ·08
20	76	75	76	24·58	− ·40
21	82	74	78	24·67	− ·49
22	85	78	81	25·09	− ·91
23	85	78	82	24·87	− ·69
24	88	82	85	25·27	−1·09
25	89	90	89	25·84	−1·66
26	78	95	87	24·84	− ·66
	1707	1728	Mean..	....+24·18	....

Σd = 3435

log = ·53618
log f = ·84949
log (Vs−Vo) = 1·38567

Vs−Vo = + 24·30
Vo = + 0·33
Va = − 21·97
Vd = − 0·16

r = ± 0·63

V = + 2·50

β GEMINORUM 1373.

SOLAR STANDARD 1462.

High Power Objective.
Low Power Ocular.

Observer } J. S. P
Measurer }

Region.	d_1	d_2	d	V	v
3	·053	·050	·051	24·03	+0·28
4	50	47	49	22·56	+1·75
5	53	50	51	22·94	+1·37
6	60	51	56	24·61	−0·30
7	57	53	55	23·62	+0·69
8	58	53	55	23·04	+1·27
9	59	57	58	23·76	+0·55
10	59	62	61	24·41	−0·10
11	63	65	64	25·04	−0·73
12	66	73	69	26·40	−2·09
13	73	69	71	26·62	−2·31
14	73	64	69	25·31	−1·00
15	69	65	67	24·05	+0·26
16	71	66	68	23·88	+0·43
17	66	69	68	23·43	+0·88
18	72	70	71	23·93	+0·38
19	73	66	70	23·11	+1·20
20	75	77	76	24·58	−0·27
21	81	73	77	24·35	+0·04
22	87	74	80	24·78	0·47
23	80	73	77	23·35	+0·96
24	86	83	84	24·97	−0·66
25	97	85	91	26·42	−2·11
	1575	1495	Mean...	....+24·31	....

$\Sigma d = 3070$

log = ·48714
log f = ·89871
log $(V_s - V_o)$ = 1·38585

$r = \pm 0·74$

$V_s - V_o = +24·32$
$V_o = +0·33$
$V_a = -21·97$
$V_d = -0·16$

$V = +2·52$

β GEMINORUM 1373.

SOLAR STANDARD 1465.

Observer. } J. S. P.
Measurer. }

Region.	d_1	d_2	d	V	v
3	·051	·055	053	24·96	−0·90
4	48	50	49	22·56	+1·50
5	47	45	46	20·69	+3·37
6	48	51	49	21·53	+2·53
7	51	57	54	23·19	+0.87
8	51	48	50	20·95	+3·11
9	61	64	62	25·40	−1·34
10	63	57	60	24·01	+0·05
11	66	65	66	25·82	−1·76
12	68	67	67	25·63	−1·57
13	67	63	65	24·37	−0·31
14	71	63	67	24·58	0·52
15	72	65	69	24·77	0·71
16	65	66	65	22·83	+1·23
17	72	68	70	24·12	−0·06
18	69	70	70	23·59	+0·47
19	72	70	71	23·43	+0·63
20	75	75	75	24·25	−0·19
21	82	76	79	24·99	−0·93
22	83	82	82	25·39	−1·33
23	85	77	81	24·57	−0·51
24	89	84	87	25·87	−1·81
25	88	90	89	25·84	−1·78
	1544	1508	Mean...	... +24·06	....

$\Sigma d = 3052$ log = ·48458

log f = 89871

log (V_s−V_o) = 1·38329

V_s−V_o = + 24·17 $r = \pm$ 1·02

V_o = + 0·27

V_a = − 21·97

V_d = − 0·16 V = + 2·31

β GEMINORUM 1373.

Solar Standard 1468.

Observer } J. S. P.
Measurer }

Region.	d_1	d_2	d	V	v
3	·054	·056	·055	25·91	−1·74
4	50	54	52	23·94	+0·23
5	49	50	50	22·94	+1·68
6	53	51	52	22·85	+1·32
7	55	56	55	23·62	+0·55
8	57	48	53	22·21	+1·96
9	57	61	59	24·17	0·00
10	65	66	65	26·01	−1·84
11	58	56	57	22·30	+1·87
12	66	64	65	24·87	−0·70
13	72	66	69	25·87	−1·70
14	72	67	69	25·31	−1·14
15	69	68	69	24·77	−0·60
16	72	68	70	24·58	0·41
17	67	63	65	22·39	+1·78
18	75	67	71	23·93	+0·24
19	73	70	71	23·44	+0·73
20	75	75	75	24·25	−0·08
21	80	82	81	25·62	−1·45
22	77	80	79	24·47	−0·30
23	75	79	77	23·35	+0·82
24	81	82	82	24·38	−0·21
25	86	89	87	25·26	−1·09
	1538	1518	Mean...	... +24·17	... .

$\Sigma d = 3056$ log = ·48515

log f = ·89871

Log (Vs-Vo) = 1·38386

Vs-Vo = + 24·20 $r = \pm\ 0·80$

Vo = + 0·23

Va = − 21·97

Vd = − 0·16 V = + 2·30

β GEMINORUM 1373.

SOLAR STANDARD 1517.

High Power. Observer } Measurer } J. S. P.

Region.	d_1	d_2	d	V	v
4	·047	·046	·046	21·18	+2·79
5	45	50	48	21·59	+2·28
6	52	53	52	22·85	+1·12
7	55	56	55	23·62	+0·35
8	52	51	52	21·79	+2·18
9	59	60	59	24·17	−0·20
10	61	66	64	25·61	−1·64
11	62	62	62	24·25	−0·28
12	61	63	62	23·72	+0·25
13	63	66	64	24·00	−0·03
14	70	66	68	24·94	−0·97
15	66	70	68	24·41	−0·44
16	68	68	68	23·88	+0·09
17	72	68	70	24·12	−0·15
18	71	73	72	24·26	−0·29
19	73	71	72	23·77	+0·20
20	79	75	77	24·90	−0·93
21	77	85	81	25·62	−1·65
22	80	82	81	25·09	−1·12
23	78	84	81	24·57	−0·60
24	81	80	81	24·08	−0·11
25	87	86	86	24·97	−1·00
	1459	1481	Mean...	.... +23·97	....

Σd = 2940 log = ·46835
log f = ·91360
log (Vs−Vo) = 1·38195

Vs−Vo = + 24·10 r = ± 0·79
Vo = + 0·54
Va = − 21·97
Vd = − 0·16 V = + 2·51

β GEMINORUM 1373.

Solar Standard 1519.

Observer } J. S. P.
Measurer }

Region.	d_1	d_2	d	V	v
5	·047	·048	·048	23·71	+0·94
6	49	52	50	23·80	+0·85
7	50	54	52	23·87	+0·78
8	51	53	52	23·05	+1·60
9	53	54	54	23·20	+1·45
10	55	56	55	22·86	+1·79
11	61	59	60	24·10	+0·55
12	63	65	64	24·85	−0·20
13	68	70	69	25·96	−1·31
14	72	69	71	25·86	−1·21
15	69	72	70	24·65	0·00
16	76	72	74	25·29	−0·64
17	81	75	78	25·87	−1·16
18	77	79	78	24·99	−0·34
19	83	81	82	25·45	−0·80
20	86	84	85	25·55	−0·90
21	92	85	89	25·96	−1·31
	1133	1128	Mean.	+24·65	

Σd = 2261   log = ·35430
log f = 1·03958
log ($Vs - Vo$) = 1·39388

$Vs - Vo$ = + 24·77 $r = \pm 0·72$
Vo = + 0·41
Va = 21·97
Vd = − 0·16   V = + 3·05

β GEMINORUM 1373.

SOLAR STANDARD 1520.

Observer / Measurer } J. S. P.

Region.	d_1	d_2	d	V	v
5	·046	·048	·047	23·22	+1·70
6	53	51	52	24·75	+0·17
7	50	51	51	23·41	+1·61
8	59	57	58	25·71	−0·79
9	57	60	58	24·92	0·00
10	59	55	57	23·69	1·23
11	64	61	64	25·71	0·79
12	68	68	68	26·40	−1·48
13	72	70	71	26·71	−1·79
14	67	72	70	25·49	0·57
15	68	72	70	24·65	+0·27
16	73	69	71	21·27	+0·65
17	73	73	73	24·17	+0·75
18	78	81	80	25·63	−0·71
19	83	81	82	25·45	−0·53
20	79	83	81	24·35	+0·57
21	88	84	86	25·09	−0·17
	1147	1139	Mean...	+24·92	....

$\Sigma d = 2286$ log = 35908

log f = 1·03958

log ($V_s - V_o$) = 1·39866

$V_s - V_o = +\ 25·04$ $r = \pm\ 0·65$

$V_o = +\ 0·38$

$V_a = -\ 21·97$

$V_d = -\ 0·16$ $V = +\ 3·29$

β GEMINORUM 1373

SOLAR STANDARD 1524.

Observer. } J. S. P.
Measurer. }

Region.	d_1	d_2	d	V	v
5	·050	·049	·049	24·21	+0·02
6	49	48	49	23·32	+0·91
7	47	47	47	21·57	+2·66
8	52	49	51	22·60	+1·63
9	58	53	55	23.63	+0·60
10	62	53	58	24·11	+0·12
11	64	63	63	25·31	−1·08
12	63	63	63	24·46	−0.23
13	69	70	70	26·33	−2·10
14	68	73	70	25·49	−1·27
15	62	66	64	22·53	+1·70
16	67	72	70	23·93	+0·30
17	72	79	75	24·83	+0·60
18	72	76	74	23·71	+0·52
19	83	83	83	25·76	−1·53
20	82	82	82	24·65	−0·42
21	89	84	87	25·38	−1·15
	1109	1110	Mean...	...+24·23	....

Σd = 2219

log = ·34616
log f = 1·03958
log (V_s-V_o) = 1·38574

V_s-V_o = + 24·31
V_o = + 0.23
V_a = − 21·97
V_d = − 0·16

r = ± 0·84

V = + 2·41

β GEMINORUM 1306.

Observer. } J. S. P.
Measurer. }

Region.	d_1	d_2	d	V	v
3	·023	·020	·021	9·89	+0·47
4	22	22	22	10·13	+0·23
5	19	18	19	8·55	+1·83
6	24	21	23	10·11	+0·25
7	28	25	26	11·16	−0·80
8	25	23	24	10·06	+0·30
9	26	28	27	11·06	−0·70
10	22	24	23	9·20	+1·16
11	32	26	29	11·34	−0·98
12	28	24	26	9·95	+0·41
13	30	21	26	9·75	+0·61
14	26	30	28	10·27	+0·09
15	30	38	34	12·21	−1·85
16	26	26	26	9·13	+1·23
17	29	36	32	11·02	−0·66
18	27	25	26	8·76	+1·60
19	36	24	30	9·90	+0·46
20	38	31	35	11·32	−0·96
21	37	28	32	10·12	+0·24
22	36	32	34	10·53	−0·17
23	41	35	38	11·53	−1·17
24	40	37	39	11·59	−1·23
25	38	36	37	10·74	−0·38
	683	630	Mean...	....+10·36	....

Σd = 1313

log = ·11826
log f = ·89871
log (V_s-V_o) = 1·01697

V_s-V_o = + 10·40
V_o = + 0·33
V_a = − 8·67
V_d = − 0·22

V = + 1·84

r = ± 0·63

β GEMINORUM 1417.

Observer } J. S. P.
Measurer }

Region.	d_1	d_2	d	V	v
3	·061	·058	·059	27·79	+0·80
4	65	65	65	29·93	−1·34
5	59	58	59	26·54	+2·05
6	66	64	65	28·56	+0·03
7	67	65	66	28·34	+0·25
8	65	64	65	27·24	−1·35
9	74	69	71	29·08	−0·49
10	73	77	75	30·01	−1·42
11	75	76	76	29·73	1·14
12	77	76	76	29·08	−0·49
13	78	75	77	28·87	0·28
14	82	74	78	28·61	−0·02
15	78	79	78	28·00	+0·59
16	80	76	78	27·39	−1·20
17	79	77	78	26·87	+1·72
18	83	84	84	28·31	+0·28
19	85	85	85	28·06	+0·53
20	91	87	89	28·78	−0·19
21	96	96	96	30·36	−1·77
22	96	96	96	29·73	−1·14
23	92	94	93	28·21	+0·38
24	94	100	97	28·84	0·25
25	105	98	101	29·32	−0·73
	1821	1793	Mean...	.... +28·59	....

$\Sigma d = 3615$ log = ·55811

log f = ·89871

log ($V_s - V_o$) = 1·45682

$r = \pm 0·68$

$V_s - V_o = +28·63$

$V_o = +0·33$

$V_a = -27·36$

$V_d = -0·19$

$V = +1·41$

β GEMINORUM 1424.

Observer } J. S. P.
Measurer }

Region.	d_1	d_2	d	V	v
3	·063	·060	·062	29·21	0·07
4	61	61	61	28·08	-1·06
5	62	63	62	27·89	+1·25
6	66	63	65	28·56	-0·58
7	65	66	65	27·91	-1·23
8	62	60	61	25·56	-3·58
9	68	71	69	28·26	+1·88
10	72	74	73	29·21	-0·07
11	74	70	72	28·17	+0·97
12	70	82	76	29·08	-0·06
13	73	82	78	29·25	0·11
14	78	83	80	29·34	0·20
15	77	83	80	28·72	-0·42
16	83	85	84	29·50	0·36
17	89	91	90	31·00	1·86
18	94	93	93	31·34	2·20
19	87	93	90	29·70	0·56
20	92	96	94	30·40	-1·26
21	90	94	92	29·10	-0·04
22	97	98	98	30·35	-1·21
23	90	96	93	28·21	+0·93
24	101	107	104	30·92	-1·78
25	106	103	105	30·48	1·34
	1820	1874	Mean ....+	29·14	....

$\Sigma d = 3694$

$\log = \cdot 56750$
$\log f = \cdot 89871$
$\log (Vs\text{-}Vo) = 1 \cdot 46621$

$r = \pm 0 \cdot 88$

$Vs\text{-}Vo = + 29 \cdot 26$
$Vo = + 0 \cdot 33$
$Va = - 27 \cdot 89$
$Vd = - 0 \cdot 12$

$V = + 1 \cdot 58$

β GEMINORUM 1443.

Observer } J. S. P.
Measurer }

Region.	d_1	d_2	d	V	v
3	·061	·060	·061	28·76	+2·80
4	66	67	66	30·39	+1·17
5	66	65	66	29·69	+1·87
6	66	67	66	29·00	+2·56
7	68	75	72	30·92	−0·64
8	74	78	76	31·84	−0 28
9	80	77	78	31·95	−0·39
10	78	80	79	31·62	−0·06
11	79	83	81	31·69	−0·13
12	86	87	87	33·29	−1·73
13	87	82	84	31 50	+0·06
14	86	86	86	32 64	−1·08
15	85	88	87	31·23	+0.33
16	92	83	88	30 91	+0·65
17	93	94	93	32 05	−0·49
18	95	95	95	32·01	−0·45
19	92	94	93	30·70	+0·86
20	100	99	100	32 34	−0·78
21	104	96	100	31·63	−0 07
22	107	103	105	32·52	−0·96
23	108	106	107	32·45	−0·89
24	114	108	111	33 00	−1·44
25	118	114	116	33·67	−2·11
	2005	1987	Mean......	−31·56	

Σd = 3992 log = ·60119
log f = ·89871
log ($Vs-Vo$) = ·49990

$Vs-Vo$ = + 31·62 $r = \pm 0·84$
Vo = + 0·33
Va = − 28·83
Vd = − 0·09 V = + 3·03

β GEMINORUM 1452.

Observer } J. S. P.
Measurer }

Region.	d_1	d_2	d	V	v
3	·065	·062	·063	29·21	+1·43
4	65	62	64	29·47	+1·17
5	66	65	65	29·24	+1·40
6	65	72	69	30·32	+0·32
7	74	68	71	30·49	+0·15
8	73	69	71	29·75	+0·89
9	70	78	74	30·31	+0·33
10	80	76	78	31·22	−0·58
11	79	72	76	29·73	+0·91
12	84	79	81	30·99	−0·35
13	88	87	88	33·37	−2·73
14	85	79	82	30·08	+0·56
15	88	95	91	32·67	−2·03
16	88	92	90	31·61	−0·97
17	93	87	90	31·00	−0·36
18	89	94	92	31·00	−0·36
19	93	89	91	30·04	+0·60
20	87	89	88	28·78	+1·88
21	98	98	98	31·00	−0·36
22	99	97	98	30·35	+0·29
23	99	105	102	30·94	−0·30
24	105	106	105	31·22	−0·58
25	108	111	110	31·93	−1·29
	1941	1932	Mean.......	+30·64	....

$\Sigma d = 3873$ $\qquad \log = \cdot 58805$

$\log f = \cdot 89871$

$\log (Vs - Vo) = 1 \cdot 48676$

$r = \pm 0 \cdot 74$

$Vs - Vo = + 30 \cdot 67$

$Vo = + 0 \cdot 33$

$Va = - 29 \cdot 19$

$Vd = - 0 \cdot 11$ $\qquad V = + 1 \cdot 70$

β GEMINORUM 1460.

Observer } J. S. P.
Measurer }

Region.	d_1	d_2	d	V	v
3	065	.064	·064	30·15	+1·91
4	68	63	66	30·39	+1·67
5	66	70	68	30·59	+1·47
6	66	66	66	29·00	+3·06
7	68	70	69	29·63	+2·43
8	70	71	71	29·75	+2·31
9	76	80	78	31·95	+0·11
10	83	82	82	32·82	−0·76
11	85	83	84	32·86	−0·80
12	86	82	84	32·14	−0·08
13	90	83	87	32·62	−0·56
14	93	89	91	33·38	−1·32
15	94	88	92	33·03	−0·97
16	93	89	91	31·96	−0·10
17	101	97	99	34·11	−2·05
18	92	92	92	31·00	+1·06
19	95	100	98	32·35	−0·29
20	102	105	103	33·31	−1·25
21	102	105	104	32·90	−0·84
22	102	108	105	32·52	−0·46
23	107	104	105	31·85	+0·21
24	117	119	118	35·08	−3·02
25	113	121	117	33·96	−1·90
	2034	2031	Mean. . . .	+32·06	. . . .

Σd = 4065

log = ·60906
log f = ·89871
log (Vs−Vo) = ·50777

Vs−Vo = + 32·19
Vo = + 0·33
Va = − 29·24
Vd = − 0·09

V = + 3·19

$r = \pm 1·14$

β GEMINORUM 1472.

SOLAR STANDARD 1520.

Observer } J. S. P.
Measurer }

Region.	d_1	d_2	d	V	v
5	·053	·056	·055	27·17	+3·94
6	61	63	62	29·51	+1·60
7	71	69	70	32·14	−1·03
8	67	67	67	29·69	+1·42
9	70	73	71	30·51	+0·60
10	73	73	73	30·35	0·76
11	76	77	77	30·93	+0·18
12	77	80	78	30·29	+0·82
13	83	86	85	31·98	0·87
14	89	87	88	32·41	−1·30
15	88	92	90	31·69	−0·58
16	95	93	94	32·13	−1·02
17	96	97	96	31·81	0·70
18	100	103	102	32·68	1·57
19	104	102	103	31·97	−0·86
20	104	103	104	31·26	−0·15
21	115	108	111	32·38	1·27
	1422	1429	Mean...	...+31·11	.. ...

$\Sigma d = 2851$ log = ·45500

log f = 1·03958

log (Vs-Vo) = 1·49458

Vs-Vo = + 31·23 $r = \pm$ 0·94

Vo = + 0·38

Va = − 29·41

Vd = − 0·21 V = + 1·99

β GEMINORUM 1500.

SOLAR STANDARD 1519.

Observer } J. S. P.
Measurer }

Region.	d_1	d_2	d	V	v
5	·061	·064	·062	30·63	+0·20
6	66	66	66	31·42	−0·59
7	64	64	64	29·38	+1·45
8	61	66	64	28·36	+2·47
9	73	69	71	30·51	+0·32
10	69	70	70	29·10	+1·73
11	77	78	77	30·93	−0·10
12	79	77	78	30·29	+0·54
13	86	78	82	30·85	−0·02
14	91	89	90	32·77	−1·94
15	87	80	84	29·58	+1·25
16	92	88	90	30·76	+0·07
17	100	92	96	31·79	−0·96
18	98	102	109	32·04	−1·21
19	104	106	105	32·59	−1·76
20	106	103	105	31·56	−0·73
21	112	104	108	31·50	−0·67
	1426	1396	Mean...	.....30·83	....

$\Sigma d = 2822$ log = ·45056

log f = 1·03958

log (Vs—Vo) = 1·49014

r = ± 0·81

Vs—Vo = + 30·91

Vo = + 0·41

Va = − 29·14

Vd = − 0·15 V = + 2·03

β GEMINORUM 1502

Observer / Measurer } J. S. P.

Region.	d_1	d_2	d	V	v
3	·059	·065	·062	29·21	+1·98
4	69	62	65	29·93	+1·26
5	65	65	65	29·24	+1·95
6	64	70	67	29·44	+1·75
7	67	68	68	29·20	+1·99
8	73	71	72	30·17	+1·02
9	82	76	79	32·36	−1·17
10	83	81	82	32·82	−1·63
11	79	80	80	31·30	−0·13
12	85	90	87	33·29	−2·10
13	89	87	88	33·00	−1·81
14	80	86	83	30·44	+0·75
15	88	88	88	31·59	−0·40
16	90	85	88	30·91	+0·28
17	89	91	90	31·02	+0·17
18	89	91	90	30·33	+0·86
19	99	100	99	32·68	−1·49
20	100	100	100	32·34	−1·15
21	98	100	99	31·31	−0·12
22	108	102	105	32·32	−1·13
23	101	93	97	29·42	+1·77
24	108	114	111	33·00	−1·81
25	110	113	111	32·22	−1·03
	1975	1978	Mean...	.... +31·19	

$\Sigma d = 3953$

log = ·59693

log f = ·89871

log ($V_s - V_o$) = 1·49564

$V_s - V_o = +\ 31·31$

$V_o = +\ 0·33$

$V_a = -\ 29·09$

$V_d = -\ 0·12$

V = + 2·43

$r = \pm\ 0·93$

β GEMINORUM 1527.

Solar Standard 1520.

Observer } J. S. P.
Measurer }

Region.	d_1	d_2	d	V	v
5	·047	053	·050	24·70	+2·16
6	51	52	52	24·75	+2·11
7	55	58	56	25·71	+1·15
8	62	61	62	27·48	−0·62
9	58	64	61	26·21	+0·65
10	60	64	62	25·77	+1·09
11	69	65	67	26·91	−0·05
12	66	72	69	26·79	−0·07
13	74	73	73	27·46	−0·60
14	75	79	77	28·04	1·18
15	83	74	79	27·82	−0·96
16	85	82	83	28·37	−1·51
17	86	82	84	27·81	−0·95
18	87	79	83	26·59	+0·27
19	93	90	91	28·25	1·39
20	90	90	90	27·05	−0·19
	1141	1138	Mean ..	.... +26·86	....

Σd = 2279

log = ·35774
log f = 1·07349
log (V_s-V_o) = 1·43123

V_s-V_o = + 26·99
V_o = + 0·38
V_a = − 24·85
V_d = − 0·24

V = − 2·37

r = ± 0·77

SUMMARY OF COMPARATOR MEASURES OF β GEMINORUM 1373.

Solar Standard.	No. of Regions.	Velocity.	Residual O − C.	Probable error of Single Region.
1360........................	25	+2·93	−0·21	±1·10
1461........................	25	+3·02	−0·31	0·71
1461........................	23	+2·23	+0·49	0·81
1462........................	22	+2·85	−0·13	0·81
1462........................	25	+3·03	−0·31	0·77
1462........................	23	+3·18	0·46	0·79
1462........................	26	+2·50	+0·22	0·63
1462........................	23	+2·52	+0·20	0·74
1465........................	23	+2·31	+0·41	1·02
1468........................	23	+2·30	+0·42	0·80
1517........................	22	+2·51	+0·21	0·79
1519........................	17	+3·05	−0·33	0·72
1520........................	17	+3·29	−0·57	0·65
1524........................	17	+2·41	+0·31	0·84

Mean velocity + 2·72. Mean P. E. ± 0·80.

Probable error of single measure = ± 0·24km.
Probable error of mean velocity = ± 0·065km.

SUMMARY OF MEASURES OF 11 PLATES OF β GEMINORUM.

Plate No.	No. of Regions.	Velocity.	Residual.	Probable error of Single Region.
1306	23	+1·84	+0·37	±0·63
1373	..	2·72	−0·51	0·80
1417	23	1·41	+0·80	0·68
1424	23	1·58	+0·63	0·88
1443	23	3·03	−0·82	0·84
1452	23	1·70	+0·51	0·74
1460	23	3·19	−0·98	1·14
1472	17	1·99	+0·22	0·94
1500	17	2·03	+0·18	0·81
1502	23	2·43	−0·22	0·93
1527	16	2·37	−0·16	0·77

Mean velocity + 2·21. Mean P. E. ± 0·83.

Probable error of plate = ± 0·40.
Probable error of mean = ± 0·12.

As the summaries and probable errors above show, the error of setting on a single region is on the average in the several measures of the plate No. 1373 ± 0·80km., and only slightly greater ± 0·83 for the other plates. Hartmann obtained a probable error of ± 0·67km., somewhat smaller than above. The difference may be due partly to his greater skill and experience in measurement and partly possibly to better quality of spectra. If a better spectrum than 1373 had been selected and it were measured with the best of the fundamental spectra, I have no doubt the probable error would be considerably diminished.

The measures of the 11 plates of β Geminorum give an indication of the systematic discrepancies to be expected in the production of the spectra, although some allowance should be made for accidental errors of measurement. A total range of nearly 1·8km. is shown and the probable error of a plate is ± 0·40km. These plates were made under average conditions, no special care being taken, and the plates are of average quality only. A systematic difference between these measures and other determinations by the old method of measurement at this, and other observatories of slightly over a kilometre + 3·5km. with micrometer microscope, + 2·2km. with comparator is present. These plates have only been measured by the comparator, and hence it cannot be determined yet whether this difference is in the plates or in the method of measurement, but the latter seems the more probable. It is interesting to note in this connection that there is a gradual and systematic increase in the velocity of the different regions from the red to the violet in all the star plates measured, but no explanation of the cause of this discrepancy can be offered. It is unquestionable that if this were removed the probable error of a single region would be materially reduced. Finally, it is probable that, as more experience is gained with the instrument, the accuracy of the measures will be considerably increased.

THE COELOSTAT TELESCOPE.

Although the optical and mechanical parts of this instrument have been ready for nearly two years, the shelter and connecting passage and tunnel were not finally completed until about July, 1908, and it was not possible to make any use of the installation until some time after that date. The spectrograph, which is described by Dr. DeLury in Appendix C, was erected and adjusted as soon as possible, but owing to the inferior quality of the grating, the work has been much handicapped.

The telescope itself performs admirably and as it has not yet been described, it seems desirable to mention here its principal features.

Essentially the optical parts of the installation consist of the coelostat mirror, which reflects the sun's light in a southerly direction to a secondary plane mirror, which in turn reflects the beam north to a concave mirror forming a solar image 80 feet south in the basement of the observatory building.

A general view of the coelostat and secondary mirror, and of the shelters and connecting passages for the beam is given in Fig. 13. The coelostat and secondary mirror are covered by a house on wheels, which can be easily rolled back (and is thus shown in the figure) by a convenient mechanism over the louvred passageway which contains the concave mirror. Between the latter and the basement of the Observatory is another ventilated passage and a tunnel. The house and passages are constructed of wood, covered with galvanized iron painted white, and all very thoroughly ventilated by galvanized iron louvres to prevent as far as possible temperature stratification or disturbance in the course of the beam. It would have been preferable to continue the ventilated passage along the whole course of the beam from the coelostat to the Observatory wall, but this was not possible on account of the necessity of a driveway. This difficulty was overcome by making a tunnel for the last 20 feet, or so, through which the beam passes to the focus. As the latter is usually five feet or so outside the wall, this leaves an unventilated distance of about 15 feet, which apparently has no very serious effect on the definition.

A general view of the telescope looking north is given in Fig. 14, and another view looking south towards the Observatory in Fig. 15. The coelostat has a plane mirror 20 inches in diameter which rotates on an axis, in or parallel to its plane, which is parallel to the axis of the earth and driven by clockwork at half the diurnal rate. The whole instrument is moved bodily east and west by the sheave and cable, shown in the figures, on cast-iron ways resting on a cement pier. The purpose of this movement is to enable the coelostat mirror to receive the sun light more nearly normally by placing it towards the west in the morning and the east in the afternoon. The ways are long enough to permit of sufficient movement to prevent any interception of the return beam from the concave, which passes under the secondary mirror.

The beam of sunlight from the coelostat mirror is reflected in a constant direction so long as the declination remains the same, but evidently any change in the declination of the incident light entails a similar change in the direction of the reflected light, and it is necessary to have a movable secondary mirror to receive this beam and direct it towards the image forming concave. This change of direction of the reflected beam, due to the change of declination of the sun, is provided for by attaching the mirror to a carriage rolling on ways in a north and south direction, the mechanism for changing the position of the secondary being identical with that used for moving the coelostat and the concave mirror, and being well shown in the figures. During the winter when the sun is low in the sky, the secondary has to be brought close to the coelostat, and in the summer away from it. The secondary mirror, also of 20 inches diameter, can be quickly adjusted in inclination by quick and slow motions so as to send the beam directly to the concave mirror.

The latter of 18 inches diameter and 80 feet focus is movable in the north and south direction over ways about 20 feet long, in order to be able to vary the position of the image for different purposes. It is also adjustable vertically and has slow motions provided for moving around a vertical and horizontal axis in order to place any desired part of the image, say, on the slit of the spectroscope or in any other required position. The beam of light from this mirror passes directly under the secondary mirror through the opening in its support, and is inclined downward 3½°, the same inclination being given to the ways on which the concave mirror carriage moves. This inclination was adopted in order to enable the coelostat to be raised a little above

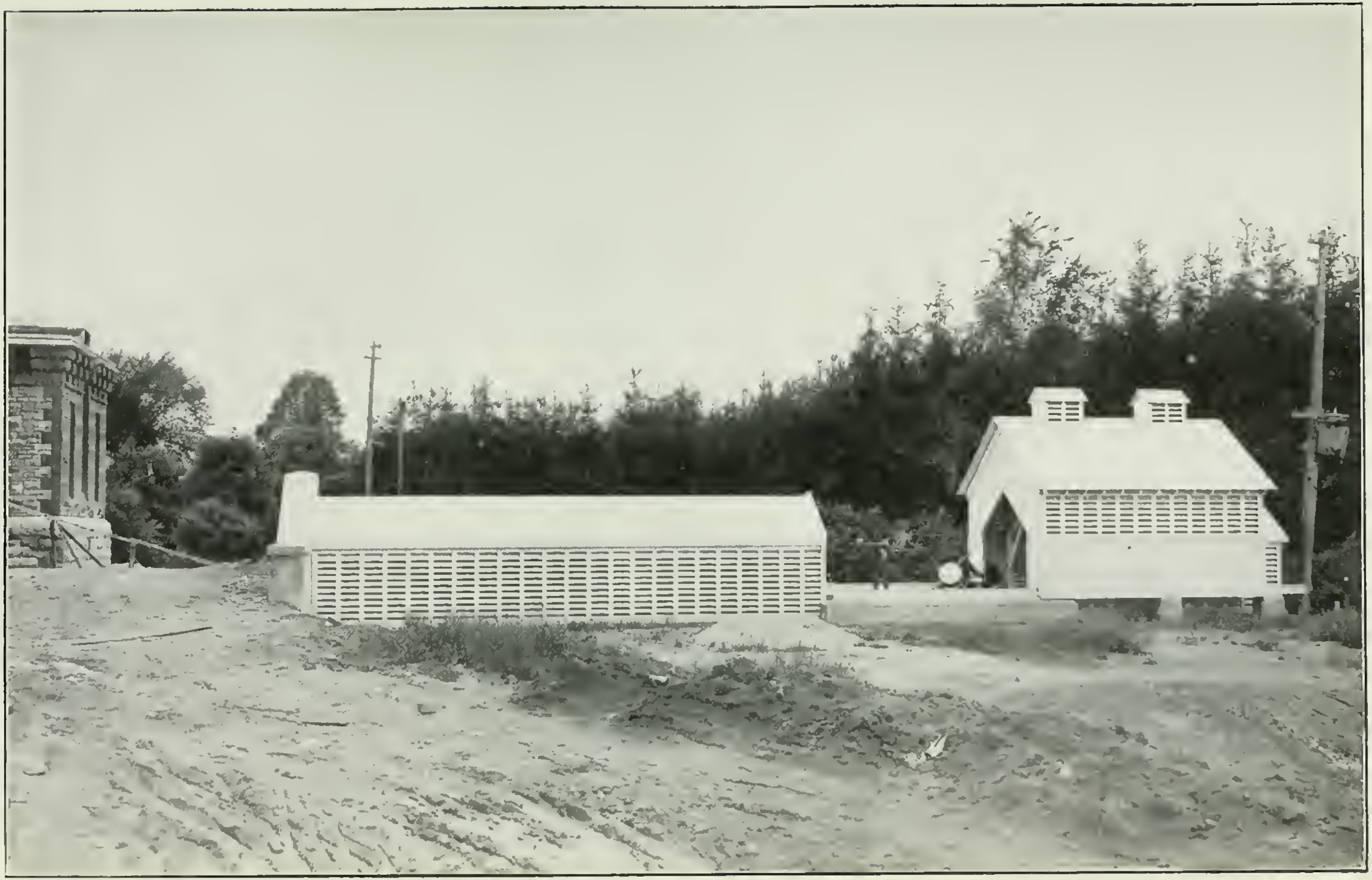


FIG. 13—Cœlostat House.

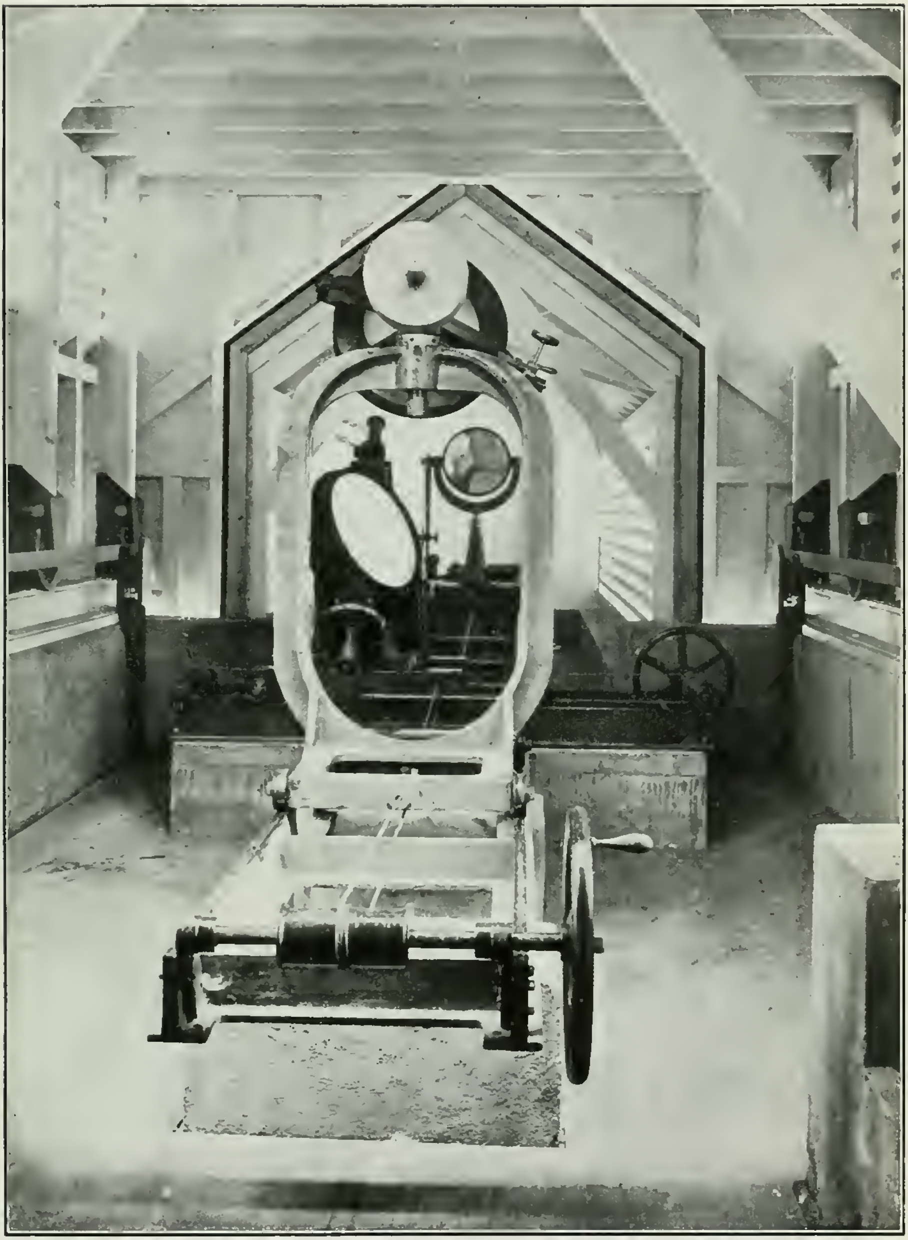


FIG. 14—Cœlostat Telescope Mechanism, looking north.

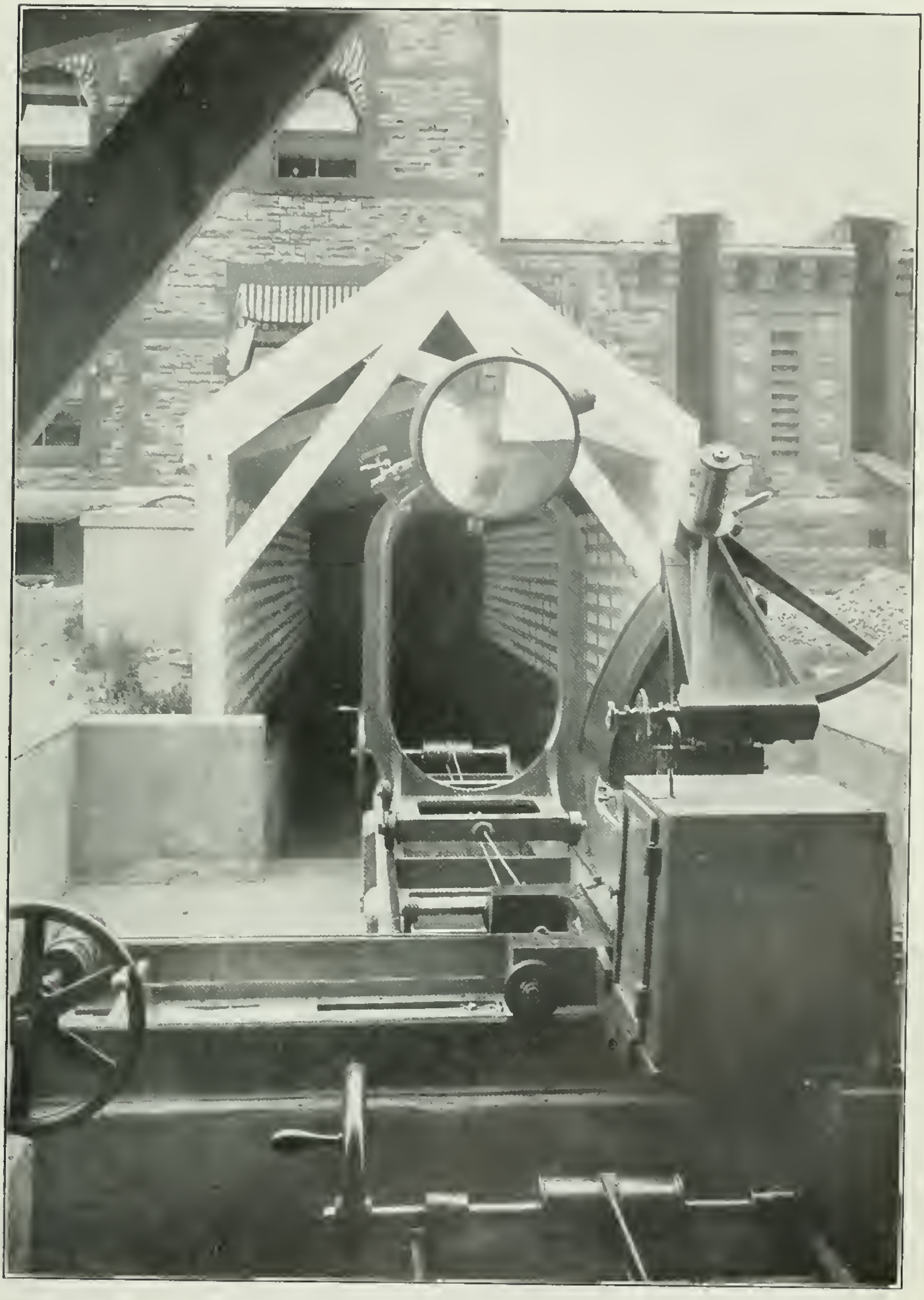


FIG. 15—Cœlostat Telescope Mechanism, looking south.

the surface of the ground, and to keep the beam some distance away from the roof of the tunnel.

The coelostat was made by the J. A. Brashear Co., in 1905, for eclipse purposes, and the secondary and concave mirrors in 1907. The designs and drawings for the remainder of the mechanical parts were made by myself, while the mechanism was constructed by the Victoria Foundry. It was found necessary, owing to the vibration of the secondary mirror support and carriage by the wind, to design one of a heavier pattern, which has been constructed by the same firm since the photographs were made, and entirely overcomes the difficulty.

The definition given by this equipment is much better than was expected from the somewhat unfavourable conditions, such as the low position of the coelostat, and the presence of the unventilated tunnel through which the beam passes. Its location north of the Observatory is also objectionable on account of radiation or convection from the building, affecting the beam between coelostat and sun. However, as the position of the installation was the only one available, we were forced to make the best of these adverse conditions and as the result shows successfully. In the early morning and the late afternoon when the mirrors are in their normal condition the definition is very good, but this is soon deteriorated by the irregular figure produced by the heating action of the sun on the mirrors. However, by keeping them shielded from the sun's rays except during actual use, this causes no especial difficulty in solar rotation work.

RADIAL VELOCITIES.

The work of determining the radial velocities of stars has been actively carried on during the last year, the addition to the staff enabling a considerable increase in the number of measurements made, and in the amount of computational work accomplished. So far as observing is concerned, however, the weather has not been as good as in the previous year. In April and May there were considerably fewer observing nights, many of them also being rendered practically useless by haze. June, July and August were good, but they were followed by three months in which very few useful spectra were obtained owing to continuous dense smoke at first and afterwards to cloudy weather. The remainder of the year has been of about average quality. There have been photographed in the year, 1,010 spectra, 18 sun for use with the spectro-comparator and 992 star spectra on 160 nights. Of these 218 have been made with the three-prism, 698 with the one-prism and 94 with the new one-prism spectrograph.

Of these spectra, 775 have been measured and reduced. Probably a number of spectra made previous to April 1, 1908, have also been measured during the past year, but we have no record of the exact number.

Detailed measures, which in this report have all been collected together at the end (Appendix E), have been made of 635 plates, of which 581 are used in obtaining the orbits of the five binary stars discussed below. The other 54 are measures of two stars whose orbits are not yet completed. The remaining 138 plates measured are chiefly of spectroscopic binaries under investigation, but they also include a number of plates of some early type stars not known to be binaries.

The five binaries discussed below with the number of plates used for each are:—

Star.	Right Ascension		Declination.		No. of Plates.
	h.	m.			
β Orionis	5	10	− 8°	19′	273
θ Aquilæ	20	06·2	− 1	7	54, + 43 in 1908
α Coronæ Borealis	15	30·4	+27	3	103
ε Herculis	16	56·5	+31	4	106
η Boötes	13	49·9	+18	54	45

The 34 measures of δ Aquilæ which follow are given for the reason that there seems little prospect of obtaining an orbit and little use, owing to the uncertainty of the results and the small range in velocity, in carrying the work on this star any further.

The binaries under observation here at present are given in the following table. In two of these stars τ Tauri, B.D. – 1° 1004, and ν Orionis, the work is well advanced, but on many of the others not much has yet been done:—

BINARIES UNDER OBSERVATION.

—	R. A.	Declination.	Mag.	Type.
	h. m.	° ′		
φ Persei	1 37	+ 50 11	4·3	I a 2
τ Tauri	4 36	+ 22 36	4·2	I b
ζ Camelopardalis	4 49·3	+ 53 35	4·7	VII a
B. D. – 1° 1004	5 36	– 1 11	5·1	I b
ν Orionis	6 1·8	+ 14 47	4·6	IV a.b
γ Geminorum	6 31·9	+ 16 9	2·9	VIII a
ω Ursæ Majoris	10 48·2	+ 43 43	4·7	I a 2
93 Leonis	11 43	+ 20 46	4·8	XII
γ Corvi	12 11	– 16 59	3·3	VI a
δ Herculis	17 11	+ 24 57	3·7	VII b
B.A.C. – 5890	17 21·3	– 5 0	4·8	XII
α Ophiuchi	17 30	+ 12 37	2·9	XIII b
γ Aquarii	22 16	– 1 53	4·1	VII a

The majority of these stars have, as will be noticed, early type spectra and in many of them the lines are very diffuse; consequently many plates are required before a satisfactory orbit can be obtained, an example of this being given in the preceding table of the binaries completed, where the average number of plates used is well over 100.

In the measures of stars not known to be binaries, those that were observed having in every case spectra of the hydrogen or helium type generally with diffuse lines, the following four stars were discovered to be variable in their velocity:—

NEW SPECTROSCOPIC BINARIES.

Star.	R. A.	Declination.	Mag.	Type.
	h. m.	° ′		
δ Herculis	17 11	+ 24 57	3·7	VII b
γ Aquarii	22 16·5	– 1 53	4·1	VII a
ι Andromedæ	23 33·2	+ 42 43	4·4	A
ξ Persei	3 52·4	+ 35 30	4·4	I b

In addition to the above, β Orionis is definitely announced as of binary character, but as it is more fully discussed later, nothing more need be said about it here.

δ *Herculis.*

Practically the only lines measurable in this spectrum are the hydrogen series, and these are very diffuse and difficult to measure. Consequently, the measures are subject to much uncertainty, and it was only after several plates had been obtained that its binary character was established. The velocities are as follows:—

Plate Number.	Date.	Velocity.	Plate Number.	Date.	Velocity.
	1907.			1908.	
839	June 12·79	− 27	1404	March 16·93	− 44
894	″ 27·74	− 9	1480	April 13·83	− 73
929	July 9·66	− 35	1495	″ 15·89	− 47
			1512	″ 22·89	− 57
	1908.		1532	May 15·85	− 47
			1541	″ 18·81	− 18
1392	March 8·89	− 59			

The variability in its velocity was discovered by Mr. Harper.

γ Aquarii.

This star is of the hydrogen type, having *Mg.* 4481, *Fe* 4549, *Ca* 3934, in addition to the hydrogen lines, and the measures are consequently much more reliable than the previous star. They are:

Plate Number.	Date.	Velocity.	Plate Number.	Date.	Velocity.
	1908.			1908.	
1745	July 29·86	− 18	1790	August 17·81	− 40
1770	August 5·81	− 8	1847	″ 28·70	− 7
1779	″ 7·81	+ 3	1858	″ 31·77	+ 23

Its variability was discovered by Mr. Cannon.

ι Andromedæ.

The spectrum of this star is similar to that of γ Aquarii, having the hydrogen *Mg.* 4481, and *K* lines, although possibly not so well defined. Its variability was discovered by Mr. Cannon, and it was announced in the Journal of the Royal Astronomical Society of Canada, Vol. II., No. 5. I learned afterwards that it had been informally announced by Prof. Frost at the Put-in-Bay meeting of the Astronomical and Astrophysical Society of America. Although present at the meeting, I had taken no notes and had forgotten its announcement. The discovery here was consequently entirely independent. The velocities of all the plates measured here are given:

Plate Number.	Date.	Velocity.	Plate Number.	Date.	Velocity.
	1908.			1908.	
1772	August 5·87	6	1954	November 9·58	0
1781	″ 7·87	− 11	1963	″ 13·60	+ 14
1832	″ 26·87	+ 12	1969	″ 16·69	+ 29
1922	October 9·76	− 36	1971	″ 20·59	− 13
1928	″ 12·71	14	1977	″ 21·53	+ 7
1939	″ 19·63	+ 6	1995	December 2·55	+ 1

ξ Persei.

The spectrum of this star is of the helium type, and is principally characterized by the extreme breadth and diffuseness of the lines. Frost and Adams, in 1903, published the measures of some plates which agreed well within errors of observation in giving it a positive velocity of 85km. per second. They surmised that later plates might show the velocity to be variable. Consequently, I thought it desirable to obtain a few plates here, and their measures by Mr. Cannon soon showed that the star was a binary. I have since learned personally from Prof. Frost that this had been a long time established by them. The following are all the velocities measured here:—

Plate Number.	Date, G. M. T.	Velocity.	Plate Number.	Date, G. M. T.	Velocity.
	1908.			1908.	
1946	October 30·37	+ 120	1974	November 20·83	+ 45
1953	November 6·66	+ 143	1998	December 2·69	+ 32
1958	" 9·77	+ 54	1999	" 4·72	+ 51
1964	" 13·65	+ 2			

δ Aquilæ.

Mr. Parker has spent considerable time at work on δ Aquilæ without being able to obtain a period, and it looks as if the small range, combined with the poor quality of the spectrum, will prevent any orbit being determined. Mr. Parker has also been unfortunate in the other binary on which he has been engaged, τ Tauri, which has very bad lines in its spectrum and over which he has spent a great deal of time. He has, however, determined the period as nearly 1·5 days, but it has not been thought desirable to complete the work until further plates are secured next season. Consequently no measures of it will be given in this report, but a summary of the measures and some data concerning δ Aquilæ are given below, while the detailed measures are given in Appendix E.

This star ($\alpha = 19^h\ 20^m{\cdot}5$, $\delta = 2°\ 55'$) was discovered to be of variable velocity by Campbell and Curtis from observations made at the Lick Observatory in 1900-03.* Observations were begun upon it here in August, 1906, and since then some thirty-four plates have been measured and computed. δ Aquilæ is taken as the typical star in Group XI., according to Miss Maury's classification.† The principal lines in the spectrum are those of hydrogen, iron, magnesium and titanium. All, and especially those of hydrogen, are broad and not defined, the region measured being from H_β to λ 4005. These will be found in Table I. The range of resulting radial velocities, as seen in Table II. is not large (− 15 to − 47kms.), and, as yet the period cannot be determined from the curve of the present observations.

* L.O.B., 1903, A. J. XVIII., 306.

† Annals Harvard College Observatory, Vol. 28.

TABLE I.

PRINCIPAL LINES MEASURED IN δ AQUILÆ.

Wave-Length.	Element.	Wave-Length.	Element.
4861·527	H	4274·922	Ti & Cr
4549·766	Fe & Ti	4271·760	Fe
4534·139	Ti	4260·640	Fe
4501·448	Ti	4246·996	Y
4481·400	Mg	4227·010	Fe
4443·976	Ti	4216·351	Fe
4404·927	Fe	4198·494	Fe
4395·286	Ti, V, Zy.	4143·928	Fe
4374·905	Ti	4102·000	H
4340·634	H	4071·901	Fe
4325·939	Fe	4063·756	Fe
4320·992	Sc	4045·975	Fe
4282·722	Fe	4005·429	Fe

TABLE II.

TABLE OF OBSERVATIONS OF δ AQUILÆ.

Plate.	Date, G. M. T.	Velocity.
368	1906, August, 6·73	−41·8 kms.
377	" 15·65	45·2
382	" 24·65	45·1
390	Sept. 10·64	25·0
399	" 27·61	29·0
413	Oct. 23·57	37·7
803	1907. May, 31·79	29·9
818	June, 10·80	42·8
904	July, 2·76	19·5
923	" 8·75	28·0
930	" 9·68	15·6
938	" 10·68	18·5
966	" 25·68	16·5
980	Aug. 3·61	25·7
982	" 5·68	29·4
1034	Sept. 6·65	25·4
1049 (a)	" 18·58	25·9
1049 (b)	" 18·58	28·0
1543	1908, May, 18·83	21·9
1550	" 22·85	40·1
1575	June, 3·83	28·2
1575	" 3·83	31·6
1584	" 5·85	35·5
1633	" 24·77	29·5
1642	" 26·78	39·8
1650	" 27·75	40·9
1660	July, 3·77	21·9
1678	" 8·75	36·4
1690	" 10·77	26·1
1695	" 11·77	34·6
1703	" 13·78	47·0
1753	" 31·69	30·7
1754	" 31·72	39·1
1768	August, 5·75	29·7
1783	" 15·73	31·9
1837	" 27·62	−39·5

THE ORBIT OF β ORIONIS.

As was mentioned in my report of last year, under a description and discussion of the effect of slit-width on the errors of setting, this star showed such a difference in the mean velocities obtained on two nights (mean of 10 plates on March 20, 24·9km.; mean of 12 plates on March 24, 20·6km.) as to lead to a strong suspicion of the variability of its velocity. This suspicion was strengthened by plates obtained on other nights up to April 13, 1908, and it was decided on account of its brightness and its interesting history to follow it closely as soon as it again came into position where it could be observed.

The radial velocity of β Orionis was first determined at Potsdam by Vogel and Scheiner* in the years 1888-1891, in the beginning of photographic determinations of radial velocity. From their measures of the 14 plates, velocities varying between about + 3 and + 34kms. per second were obtained. They suspected a variation in the star's velocity due to orbital motion, but were unable to obtain evidence of its periodicity, and the accuracy of these early measures was scarcely sufficiently high to decide the question. The next published measures of the star's velocity were by Frost and Adams† from plates obtained in 1901-1902. They found values ranging between + 14·9 and + 23·4km., but they attributed this range to the character of the lines in the star's spectrum and concluded that their results showed no indication of variability in velocity. The measures of 5 plates of β Orionis obtained at the Lick Observatory‡ indicate a range of 10km. from + 15 to + 25km., in its velocity, but Campbell and Curtis in discussing these measures attribute this range to the small number of lines available, to their poor quality, and to over-exposure of some of the negatives. They consider that proper exposure would considerably reduce the observed range, and conclude that their results do not give any evidence of variability of velocity. However, a recent personal communication from Prof. Campbell informs me that they have suspected variation, but owing to press of their regular programme have not followed up the matter.

There seemed to be no question of the smallness of the range in velocity, if any, and it was evident that the only hope of obtaining anything definite, considering this and the fairly large accidental errors of a velocity determination owing to the character of the lines of the spectrum, was to obtain several plates on each night the star was observed and use their mean velocity as the velocity of the star at their mean epoch. As the star is bright, a spectrum can be obtained in ten minutes or less with the three-prism spectrograph, and in about two minutes with the one-prism. Consequently not much time is required to obtain half a dozen plates and unless the period is very short no error due to change of phase can enter. The probable error of a night's observation will by this means be considerably reduced and a much better chance obtained of determining its period of variation.

Plates were accordingly obtained whenever possible until the star became inaccessible in April, 1908, and observations were continued during the present season until March 23, 1909. Owing to the very smoky and cloudy weather last fall, very few plates were obtained until December. In all 273 plates, obtained on 54 nights, have been used in this discussion. Of these 150 were made with a dispersion of three prisms, 123 with one prism. The investigation on slit-width in the last report showed that lower probable errors were obtained with the higher dispersion and it was used wherever possible. However, the star was also observed with the one-prism spectrograph when our programme would not permit the use of three prisms. Three-fourths of the observations and all the measurements were made by myself in order to avoid as far as possible any chance of systematic discrepancies.

*Potsdam Publications, Band VII., p. 146.
† Publications of the Yerkes Observatory, 2, 61.
‡ Lick Observatory Bulletin No. 70.

The star β Orionis is of the helium type, Miss Maury's VI.c, and has fairly well defined lines of hydrogen and helium, the magnesium λ 4481 and the calcium *H* and *K*. It also contains lines due to silicon, oxygen and carbon and a few faint metallic lines. In my early measures for slit-width effect eight lines were measured in the three-prism plates and seven in the single-prism plates.

Lines measured in β Orionis.

Three-Prism Plates.	One-Prism Plates.
4862 *H*	4862 *H*
4481 *Mg*	4481 *Mg*
4472 *He*	4472 *He*
4388 *He*	4341 *H*
4341 *H*	4102 *H*
4131 *Si*	4026 *He*
4128 *Si*	3934 *Ca*
4102 *H*	

It was found, however, that lower probable errors were obtained where the three best lines λ 4481, 4472, 4341 only were used than when more or all of the measured lines were discussed. Consequently in the later plates only the three lines mentioned above have been measured and in general four comparison lines, thus considerably lightening the labour. Considerable difference in the quality of the negatives for measurement, even when taken under, so far as could be judged, identical conditions, has been noticed; this difference seems to lie principally in the character of the lines themselves. They are sometimes sharply defined and symmetrical, at others not so sharp and apparently stronger at one side. Sometimes also the contrast between them and the continuous spectrum appears considerably diminished. These changes seem almost too marked to be due entirely to instrumental or photographic effects, and one would be inclined to attribute part at any rate to changes in the spectrum. No evidence can be found, however, of any dependence of this quality of the lines upon the phase of the orbit.

In the measurements the lines were weighted according to their apparent quality and the weighted mean velocity used. In combining the separate plates on each night they were also weighted, partly according to their quality and partly according to the internal agreement of the measures, and finally the resultant mean velocity for the night was similarly weighted for use in the grouping and discussion.

The record of the observations and the individual plate measures are given in Appendix E, where all the measures are collected together, while a summary of the velocities, &c., is given in the following table:—

β ORIONIS.

Summary of Measures.

Plate Number.	Date.	G.M.T.	Julian Date.	Velocity.	Residual.
	1908.				
1241 a	January 20	15·02	2,417,961·63	+23·3	+ 2·4
1241 b	" 20	15·06	961·63	+20·9	0·0
1241 c	" 20	15·10	961·63	+25·4	+ 4·5
1242 a	" 20	15·12	961·63	+23·7	+ 2·8
1242 b	" 20	15·15	961·64	+25·9	+ 5.0
1242 c	" 20	15·18	961·64	+19·7	− 1·2
1243 a	" 20	15·24	961·64	+21·3	+ 0·4
1243 b	" 20	15·27	961·65	+23·5	+ 2·6
1243 c	" 20	15·30	961·65	+24·8	+ 3·9
1244 a	" 20	15·43	961·66	+24·5	+ 3·6
1244 b	" 20	15·47	961·66	+16·5	− 4·4
1244 c	" 20	15·50	961·66	+26·4	+ 5·5
1245 a	" 20	15·52	961·66	+25·0	+ 4·1
1245 b	" 20	15·54	961·66	+21·8	+ 0·9
1245 c	" 20	15·56	961·66	+20·5	− 0·4
1247 a	" 20	16·15	961·68	+23·8	+ 2·9
1247 b	" 20	16·17	961·68	+31·3	+10·4
1247 c	" 20	16·19	961·68	+19·0	− 1·9
1248 a	" 20	16·25	961·68	+11·6	− 9·3
1248 b	" 20	16·27	961·68	+ 5·8	−15·1
1248 c	" 20	16·29	961·68	+36·1	+15·2
1249 a	" 20	16·35	961·69	+14·0	− 6·9
1249 b	" 20	16·37	961·69	+16·0	− 4·9
1249 c	" 20	16·39	961·69	+24·2	+ 3·3
1285 a	" 27	15·45	968·68	+15·3	− 5·8
1285 b	" 27	15·51	968·66	+19·2	− 1·9
1285 c	" 27	15·57	968·67	+17·9	− 3·2
1286 a	" 27	16·03	968·67	+21·3	+ 0·2
1286 b	" 27	16·09	968·67	+18·7	− 2·4
1286 c	" 27	16·15	968·67	+24·3	+ 3·2
1289 a	" 27	17·13	968·72	+18·1	− 3·0
1289 b	" 27	17·17	968·72	+19·9	− 2·3
1289 c	" 27	17·21	968·72	+27·8	+ 6·6
1290 a	" 27	17·24	968·73	+15·6	− 5·6
1290 b	" 27	17·28	968·73	+21·6	+ 0·4
1290 c	" 27	17·32	968·73	+16·1	− 5·1
1405.	March 20	11·51	2,418,021·50	+23·1	− 1·4
1406.	" 20	12·07	021·50	+24·3	− 0·2
1407.	" 20	12·21	021·51	+21·4	− 3·1
1408.	" 20	12·32	021·52	+24·9	+ 0·4
1409.	" 20	12·46	021·53	+28·0	+ 3·5
1410.	" 20	13·00	021·54	+23·3	− 1·2
1411.	" 20	13·12	021·55	+23·5	− 1·0
1412.	" 20	13·27	021·56	+24·9	+ 0·4
1413.	" 20	13·47	021·57	+27·5	+ 3·0
1414.	" 20	13·57	021·58	+26·9	+ 2·4
1426.	" 24	12·03	025·50	+19·2	− 2·9
1427.	" 24	12·15	025·51	+21·1	− 1·0
1428.	" 24	12·23	025·52	+19·2	− 2·9
1429.	" 24	12·36	025·52	+21·6	− 0·5
1430.	" 24	12·42	025·53	+18·8	− 3·3
1431.	" 24	12·52	025·53	+18·6	− 3·5
1433.	" 24	13·16	025·55	+17·5	− 4·6
1434.	" 24	13·32	025·56	+19·3	− 2·8
1435.	" 24	13·39	025·57	+16·1	− 6·0
1436.	" 24	13·46	025·57	+17·2	− 4·9
1437.	" 24	13·56	025·58	+18·7	− 3·4
1438.	" 24	14·07	025·58	+18·0	− 4·1
1439.	" 30	12·19	031·51	+14·4	− 4·1
1440.	" 30	12·29	031·52	+14·4	− 4·1
1441.	" 30	12·38	031·53	+14·5	− 4·0
1442.	" 30	12·49	031·53	+17·0	− 1·5
1448.	April 3	12·16	035·51	+24·9	+ 1·5
1449.	" 3	12·28	035·52	+27·9	+ 4·5
1450.	" 3	12·40	035·53	+32·2	+ 8·7
1451	" 3	12·53	035·53	+27·1	+ 3·6

β ORIONIS.

SUMMARY OF MEASURES—*Continued.*

Plate Number.	Date.	G.M.T.	Julian Date.	Velocity.	Residual.
	1908.				
1457	April 4	12·19	2,418,036·51	+29·9	+ 5·0
1458	" 4	12·28	036·52	+27·4	+ 2·5
1459	" 4	12·37	036·53	+27·0	+ 2·1
1469	" 13	12·10	045·51	+21·3	− 2·0
1470	" 13	12·22	045·52	+25·0	+ 1·7
1471	" 13	12·34	045·52	+24·8	+ 1·5
1873	September 7	21·52	192·92	+28·2	+ 2·2
1874	" 7	22·10	192·93	+27·1	+ 1·1
1935	October 13	21·19	228·90	+18·3	− 0·2
1936	" 13	21·48	228·91	+17·0	− 1·5
1937	" 13	22·19	228·93	+17·5	− 1·0
1938	" 13	22·47	228·95	+14·3	− 4·2
1978	November 21	18·24	267·77	+17·0	− 4·2
1979	" 21	18·43	267·78	+17·3	− 3·9
1980	" 21	19·05	267·79	+24·5	+ 3·3
1981	" 21	19·33	267·81	+25·0	+ 3·8
1984	" 28	16·05	274·67	+21·0	+ 0·9
1985	" 28	16·34	274·69	+22·7	+ 2·6
1986	" 28	17·08	274·71	+20·5	+ 0·4
1987	December 1	17·53	277·75	+16·4	− 8·9
1988	" 1	18·18	277·76	+20·9	− 4·4
1989	" 1	18·36	277·77	+16·1	− 9·2
1990	" 1	18·52	277·78	+23·1	− 2·2
2003	" 5	16·10	281·67	+22·6	− 3·1
2004	" 5	16·22	281·68	+25·1	− 0·6
2005	" 5	16·38	281·69	+25·6	− 0·1
2006	" 5	16·53	281·70	+27·5	+ 0·8
2054	" 21	15·24	297·64	+21·5	− 0·6
2055	" 21	15·29	297·65	+21·9	− 0·2
2057	" 21	16·54	297·70	+25·7	+ 3·6
2058	" 21	17·00	297·71	+22·0	− 0·1
2065	" 22	17·38	298·73	+28·1	+ 4·0
2066	" 22	17·52	298·74	+21·7	− 2·4
2067	" 22	18·02	298·75	+23·1	− 1·0
2068	" 22	18·14	298·76	+23·2	− 0·9
2070	" 23	14·01	299·58	+20·9	− 4·3
2071	" 23	14·41	299·61	+26·8	+ 1·6
2072	" 23	15·08	299·63	+23·5	− 1·7
2073	" 23	15·20	299·64	+21·2	− 4·0
2075	" 26	15·50	302·66	+25·6	− 0·4
2076	" 26	16·00	302·67	+25·9	− 0·1
2077	" 26	16·09	302·67	+22·5	− 3·5
2078	" 26	16·18	302·68	+22·0	− 4·0
2079	" 27	14·07	303·59	+33·2	+ 7·6
2080	" 27	15·12	303·64	+29·7	+ 4·1
2082	" 31	15·19	307·64	+22·7	− 1·0
2083	" 31	15·23	307·64	+24·7	+ 1·0
2084	" 31	15·29	307·65	+23·0	− 0·7
2085	" 31	15·57	307·67	+20·5	+ 2·8
	1909.				
2092	January 6	16·49	2,418,313·70	+19·1	− 0·7
2093	" 6	16·53	313·70	+19·6	− 0·2
2094	" 6	17·13	313·72	+18·5	− 1·3
2095	" 6	17·16	313·72	+21·2	+ 1·4
2105	" 7	12·49	314·53	+16·8	− 2·4
2106	" 7	13·01	314·54	+21·9	+ 2·7
2107	" 7	13·04	314·54	+12·8	− 7·1
2108	" 7	13·07	314·54	+20·7	+ 1·5
2111	" 7	16·27	314·69	+19·2	0·0
2112	" 7	16·37	314·69	+16·6	− 2·6
2114	" 7	16·56	314·71	+17·8	− 1·4
2117	" 8	15·48	315·66	+18·9	+ 0·2
2118	" 8	15·52	315·66	+20·3	+ 1·6
2122	" 12	11·55	319·50	+26·5	+ 4·5
2123	" 12	11·59	319·50	+26·0	+ 4·0

β ORIONIS.

SUMMARY OF MEASURES—*Continued.*

Plate Number.	Date.	G.M.T.	Julian Date.	Velocity.	Residual.
	1909.				
2124	January 12	12·09	2,418,319·51	+20·5	−1·5
2125	" 12	12·12	319·51	+21·3	−0·7
2126	" 12	12·15	319·51	+27·2	+5·0
2127	" 12	12·18	319·51	+25·5	+3·5
2128	" 13	15·36	320·65	+30·2	+6·1
2129	" 13	15·41	320·65	+15·7	−8·4
2130	" 13	15·46	320·66	+28·8	+4·7
2141	" 15	14·54	322·62	+18·6	+7·3
2142	" 15	15·11	322·63	+24·5	−1·4
2143	" 15	15·15	322·63	+27·2	+1·3
2144	" 15	15·19	322·64	+21·8	−4·1
2151	" 16	12·25	323·52	+31·4	+5·3
2152	" 16	12·36	323·52	+27·6	+1·5
2153	" 16	12·44	323·53	+34·4	+8·3
2154	" 16	12·52	323·53	+40·9	+14·8
2155	" 16	12·59	323·54	+33·0	+6·9
2156	" 16	13·12	323·55	+35·8	+9·7
2157	" 17	13·48	324·57	+29·9	+3·9
2158	" 17	13·56	324·58	+26·2	+0·2
2161	" 18	12·41	325·53	+37·1	+11·5
2162	" 18	12·46	325·53	+31·3	+5·7
2163	" 18	12·51	325·53	+28·3	+2·7
2164	" 18	13·06	325·54	+35·8	+10·2
2165	" 18	13·10	325·55	+31·2	+5·6
2166	" 18	13·14	325·55	+30·5	+4·9
2177	" 26	10·36	333·44	+24·6	+3·4
2178	" 26	10·51	333·45	+17·8	−3·4
2179	" 26	10·56	333·46	+24·9	+3·7
2180	" 26	11·01	333·46	+23·5	+2·3
2181	" 26	11·11	333·47	+22·4	+1·2
2182	" 26	11·16	333·47	+16·2	−5·0
2183	" 26	11·21	333·47	+20·5	−0·7
2184	" 28	11·21	335·47	+16·3	−3·6
2185	" 28	11·25	335·48	+22·2	+3·3
2186	" 28	11·29	335·48	+14·2	−5·7
2187	" 28	11·41	335·48	+14·3	−5·6
2188	" 28	11·44	335·49	+10·6	−9·3
2189	" 28	11·47	335·49	+18·4	−0·9
2195	" 29	12·53	336·54	+14·9	−4·3
2196	" 29	12·57	336·54	+17·9	−1·3
2197	" 29	13·01	336·54	+26·4	+7·2
2198	" 29	13·05	336·54	+22·1	+2·9
2201	" 30	12·29	337·52	+14·0	−4·7
2202	" 30	12·41	337·53	+17·3	−1·4
2203	" 30	12·45	337·53	+25·0	+6·3
2204	" 30	12·48	337·53	+14·2	−4·5
2205	" 30	15·47	337·66	+21·0	+2·3
2206	" 30	16·04	337·67	+22·6	+4·1
2207	" 30	16·24	337·68	+22·3	+3·8
2211	" 31	17·16	338·72	+19·8	+1·2
2212	" 31	17·20	338·72	+23·2	+4·6
2213	" 31	17·24	338·73	+16·6	−2·6
2214	" 31	17·29	338·73	+16·6	−2·0
2215	February 2	11·14	340·47	+24·8	+4·6
2216	" 2	11·23	340·48	+23·1	+2·9
2217	" 2	11·26	340·48	+23·6	+3·4
2218	" 2	11·29	340·48	+22·5	+2·3
2219	" 2	11·41	340·49	+16·5	−3·7
2220	" 2	11·45	340·49	+21·5	+1·3
2236	" 6	12·29	344·52	+18·2	−7·7
2239	" 6	12·50	344·53	+20·0	−5·9
2240	" 6	12·52	344·53	+21·0	−4·9
2241	" 6	16·12	344·68	+21·9	−4·0
2242	" 6	16·43	344·70	+19·1	−6·8
2243	" 7	15·11	345·63	+21·0	−5·1
2244	" 7	15·25	345·64	+21·9	−4·2

β ORIONIS.

Summary of Measures.—*Continued.*

Plate Number.	Date.	G.M.T.	Julian Date.	Velocity.	Residual.
	1909.				
2245	February.. 7	15·37	2,418,345·65	+18·0	− 8·1
2249	" 8	13·32	346·56	+31·6	+ 5·2
2250	" 8	13·36	346·56	+25·9	0·0
2251	" 8	13·41	346·57	+21·8	− 4·1
2252	" 8	14·01	346·58	+17·6	− 8·3
2253	" 8	14 05	346·58	+24·1	− 1·8
2254	" 8	14·09	346.59	+23·3	− 2·6
2265	" 10	12·07	348·50	+29·6	+ 4·4
2266	" 10	12·12	348·51	+23·3	− 1·9
2267	" 10	12·16	318·51	+16·9	− 8·3
2268	" 10	12·21	348·51	+12·8	−12·4
2269	" 10	12·33	348·52	+20·3	− 4·9
2270	" 10	12·37	348·53	+23·0	− 2·2
2272	" 11	11 26	349·48	+18·9	− 5·8
2273	" 11	11·32	349.48	+33·4	+ 8·7
2274	" 11	11·35	349·48	+30·8	+ 6·1
2275	" 11	11·38	349·49	+19·7	− 5·0
2276	" 11	11·46	349·49	+17·3	− 7·4
2277	" 11	11·49	349·49	+23·5	− 1·2
2278	" 13	12 27	351·52	+22·2	− 1·4
2279	" 13	12·49	351·53	+22·0	− 1·6
2280	" 13	12·53	351·54	+21·1	− 2·2
2284	" 20	12·29	358·52	+17·7	− 1·4
2285	" 20	13·05	358·54	+22·6	+ 3·5
2286	" 20	15·12	358·63	+19·8	+ 0·7
2288	" 21	12·51	359·53	+21·0	+ 2·3
2289	" 21	13·07	359 54	+18·2	− 0·5
2290	" 21	13·17	359·55	+18·4	− 0·3
2291	" 21	13·27	359.56	+18·7	0·0
2292	" 22	12 02	360·50	+19·7	+ 1 1
2293	" 22	12·15	360·51	+25·1	+ 6·5
2294	" 22	12·30	360·52	+20·2	+ 1·6
2295	" 22	12·45	360·53	+20·2	+ 1·6
2309	" 27	11·35	365·48	+22·0	− 3·4
2311	" 28	11·56	366·50	+22·2	− 3·8
2312	" 28	12·07	366·50	+22·0	− 4·0
2313	" 28	12·18	366·51	+23·7	− 2·3
2314	" 28	12·27	366·52	+25·3	− 0·7
2315	" 28	12·39	366·53	+22·4	− 3·6
2316	" 28	12·50	366·53	+22·8	− 3·2
2317	March.... 2	11·05	368·46	+25·9	0·0
2318	" 2	11·19	368·47	+24·4	− 1·5
2319	" 2	11·29	368·48	+24·2	− 1·7
2320	" 3	11·36	368·48	+21·6	− 4·3
2364	" 13	12·12	379·51	+18·6	− 1·1
2365	" 13	12·24	379·52	+18·4	− 1·3
2366	" 13	12·36	379·52	+20·3	+ 0·6
2367	" 13	12·46	379·53	+17·6	− 2·1
2368	" 13	12·57	379·54	+19·3	− 0·4
2372	" 15	11·45	381·49	+16·9	− 1·8
2373	" 15	11·56	381·50	+20·5	+ 1·8
2374	" 15	12·05	381·50	+17·6	− 1·1
2375	" 15	12·13	381·51	+18·9	+ 0·2
2376	" 15	12·21	381·52	+16·2	− 2·5
2386	" 18	11·42	384·49	+19·5	− 1·1
2387	" 18	11·52	384·50	+20·0	− 0·6
3388	" 18	12·02	384·50	+21·7	+ 1·1
2389	" 18	12·12	384·51	+21·0	+ 0·4
2390	" 20	12·16	386·51	+22·2	− 2·1
2391	" 20	12·26	386·52	+18·3	− 6·0
2392	" 20	12·38	386·53	+23·4	− 0·9
2393	" 20	12·48	386·53	+21·9	− 2·4
2394	" 20	12·58	386·54	+23·1	− 1·2
2397	" 21	13·38	387·56	+23·9	− 1·6
2398	" 21	13·48	387·57	+25·2	− 0·3
2399	" 21	14·00	387·58	+24·8	− 0·7

β ORIONIS.

SUMMARY OF MEASURES—*Continued.*

Plate Number.	Date.	G.M.T.	Julian Date.	Velocity.	Residual.
	1909.				
2400	March 21	14·14	2,418,387·59	+25·5	0·0
2402	" 22	11·51	388·49	+26·0	0·0
2403	" 22	12·02	388·50	+25·0	− 1·0
2404	" 22	12·13	388·51	+21·1	− 4·9
2405	" 22	12·35	388·52	+21·2	− 4·8
2420	" 23	11·46	389·49	+23·1	− 3·0
2421	" 23	11·57	389·50	+24·4	− 1·7
2422	" 23	12·05	389·50	+25·9	− 0·2
2423	" 23	12·13	389·51	+26·2	+ 0·1
2424	" 23	12·27	389·52	+25·5	− 0·6
2425	" 23	12·38	389·53	+25·7	− 0·4

In the preceding table are given the plate number, the Greenwich mean and Julian dates, the weighted mean velocity for the plate, and finally the residual obtained by scaling from the final velocity curve. The velocities on each night were obtained by taking the weighted means of the plate velocities, the weights being assigned, as before stated, partly on the basis of apparent quality, partly according to the internal agreement of the measures. In the following table of mean velocities are given various data concerning the observations of each night, as the date, Julian date, velocity, phase, the number of plates, the dispersion used, the weight assigned and finally the residual obtained by scaling from the curve:—

β ORIONIS.

SUMMARY OF MEAN VELOCITIES PER NIGHT.

Date.	Julian Date.	Mean Velocity.	Mean Phase.	No. of Plates.	Spectrograph.	Weight.	Residual.
1908.							
Jan. 20....	2,417,961·65	22·3	0·65	24	I L	16	+1·40
" 27 ...	968·71	19·7	7·71	12	III S	6	−1·50
March 20....	2,418,021·54	24·9	16·74	10	III L	10	+0·45
" 24....	025·54	20·6	20·74	12	"	6	−1·47
" 30....	031·52	15·1	4·82	4	"	6	−3·46
April 3..	035·52	27·3	8·82	4	"	4	+3·87
" 4....	036·52	28·2	9·82	3	"	3	+3·28
" 13....	045·52	24·2	18·82	3	"	3	+0·93
Sept. 7....	192·92	27·1	12·92	2	"	2	+1·10
Oct. 13....	228·92	16·8	5·12	4	"	5	−1·76
Nov. 21....	267·79	22·3	0·19	4	"	3	+1·08
" 28....	274·69	21·4	7·09	3	"	2	+1·32
Dec. 1 ...	277·77	20·1	10·17	4	"	1	−5·19
" 5....	281·69	25·9	14·09	4	"	2	−1·36
" 21....	297·68	23·0	8·18	4	I L	2	+0·85
" 22....	298·75	24·0	9·25	4	III L	2	−0·10
" 23...	299·63	23·8	10·13	4	"	2	−1·43
" 26....	302·67	24·6	13·17	4	"	3	−1·36
" 27....	303·65	31·4	14·15	2	"	2	+5·77
" 31....	307·65	24·2	18·15	4	I L	2	+0·56
1909.							
Jan. 6....	313·71	19·6	2·31	4	I L	2	−0·20
" 7....	314·62	17·9	3·22	7	I & III	4	−1·34
" 8 ...	315·66	19·6	4·26	2	I L	1	+0·87
" 12....	319·50	24·7	8·10	6	"	3	+2·70
" 13....	320·66	24·9	9·26	3	"	1	+0·77
" 15...	322·62	24·0	11·22	4	"	1	−1·93
" 16 ...	323·53	33·4	12·13	6	"	3	+7·30
" 17....	324·57	28·1	13·17	2	"	1	+2·15
" 18....	325·54	32·4	14·14	6	"	3	+6·78
" 26....	333·47	21·3	0·17	7	"	4	+0·08
" 28 ..	335·49	16·7	2·19	6	"	2	−3·18
" 29....	336·54	19·7	3·24	4	"	1	+0·46
" 30....	337·61	20·0	4·31	7	I & III	5	+1·28
" 31....	338·72	18·3	5·42	4	I L	2	−0·29
Feb. 2....	340·49	21·5	7·19	6	"	4	+1·30
" 6....	344·59	20·7	11·29	5	I & III	3	−5·26
" 7....	345·64	20·0	12·34	3	III L	2	−6·08
" 8...	346·57	24·7	13·27	6	I L	2	−1·23
" 10....	348·52	21·0	15·22	6	"	1	−4·17
" 11....	349·49	23·9	16·19	6	"	1	−0·83
" 13 ...	351·53	21·9	18·23	3	III L	3	−1·71
" 20....	358·57	19·4	3·37	3	"	2	−0·36
" 21...	359·55	19·2	4·35	4	"	3	+0·49
" 22....	360·52	20·0	5·32	4	"	3	+1·43
" 27 ...	365·48	22·0	10·28	1	"	1	−3·38
" 28....	366·53	22·8	11·33	6	"	4	−3·18
March 2...	368·47	23·4	13·27	4	"	2	−2·52
" 13....	379·53	18·8	2·43	5	"	5	−0·91
" 15 ...	381·50	18·0	4·40	5	"	3	−0·68
" 18....	384·50	20·55	7·40	4	"	3	−0·04
" 20 ...	386·53	22·2	9·43	5	"	4	−2·15
" 21....	387·57	24·85	10·47	4	"	3	−0·68
" 22...	388·51	23·3	11·41	4	"	2	−2·69
" 23....	389·51	25·1	12·41	6	"	4	−0·97

It was not difficult to trace periodic changes in the velocities thus determined, and comparatively early in the present season the period was found to be very nearly 21·90 days. The Potsdam observations, however, did not group themselves satisfactorily with this period, and owing to their probably inferior accuracy were not considered. The Yerkes observations showed a fairly satisfactory arrangement, although there were some discrepant single plates, due possibly to accidental errors of setting on the rather broad lines of the spectrum, or to another cause to be referred to later on. The Lick observations, extending over seven years, followed the velocity curve determined as closely as could be expected, although as there are only five plates this agreement may be accidental. It was found, however, that a period of 21·87 instead of 21·90 days was required to bring the Lick observations forward to ours.

Although some discrepancies are to be expected on account of the small range in velocity and the relatively high errors of measurement, still it was felt that all the irregularities noted could not be explained on the above grounds. Consequently, although sufficient evidence had been secured of the binary character of β Orionis and sufficient data to obtain the elements of the orbit by the end of January, it was deemed desirable to continue the observations in the hope of finding a clue to some of the anomalies. The later observations revealed some peculiar and interesting features in the star's motion which served, if not to explain the cause of the irregularities, at least to indicate a reason for their existence.

The phase of minimum velocity due January 30-31 followed prediction, but the succeeding maximum, due February 6-7, although present, was of much lower amplitude than those previously obtained. The curve already drawn showed a range of velocity between about + 17 and + 29km. The maximum of February 6 reached only about 23km., and the succeeding minima and maxima until the end of the observations were as follows:— + 19·5, + 23·0; + 18·5, + 24·5; 19·0, + 24·5. All of these values, as well as the previous ones, depend upon several plates, and there is no doubt in my mind that they indicate, if not a change in the amplitude of the velocity curve, certainly some progressive shift in the position of the absorption maximum of the lines measured due to some physical cause in the star's atmosphere. If it is a change in the amplitude of the motion, it may be due to the presence of a third body and will probably be periodic. If an epoch of low amplitude occurred in 1901-1902 this, together with the fact of their only making one plate per night and the consequently higher accidental errors, would form a sufficient explanation why Frost and Adams with the high accuracy of their work were unable to find any periodicity in the motion. Furthermore, a change in the amplitude is probably accompanied by changes in the other elements of the orbit, which may account for the slight change in the period requisite when the Lick observations are brought up to the same epoch as those at Ottawa.

If all the Ottawa observations are plotted continuously on cross-section paper, they form a curve somewhat similar to the trace given by two beating tuning forks. It shows curves similar to the velocity curve of Fig. (16) periodically repeated with gradually increasing amplitude, then with a sudden diminution followed by another gradual increase. The observations have not been sufficiently continuous or extended to decide whether this variation in amplitude is periodic, and in any case the very small range combined with the comparatively poor quality of the spectrum for measurement would render such a determination difficult and uncertain even if a very large number of plates were obtained.

I have, therefore, thought it preferable now, as all these successive curves have, so far as can be determined, the same form, to consider the variations in amplitude as accidental or, if you like, as due to errors in measurement; and to obtain a mean curve and from it the elements of the orbit by grouping together into normal places the mean velocities obtained on the 54 nights under discussion. The period chosen was that mentioned above, 21·90 days, which best suited our own and the Lick observations and which under the conditions cannot probably be improved upon. The initial phase T_0 was taken as Julian day 2,417,961·0. The basis of grouping into the normal places was the phase, the total difference in phase in the nights in a group being kept generally less than half a day, except in three groups where the velocity changes but slowly.

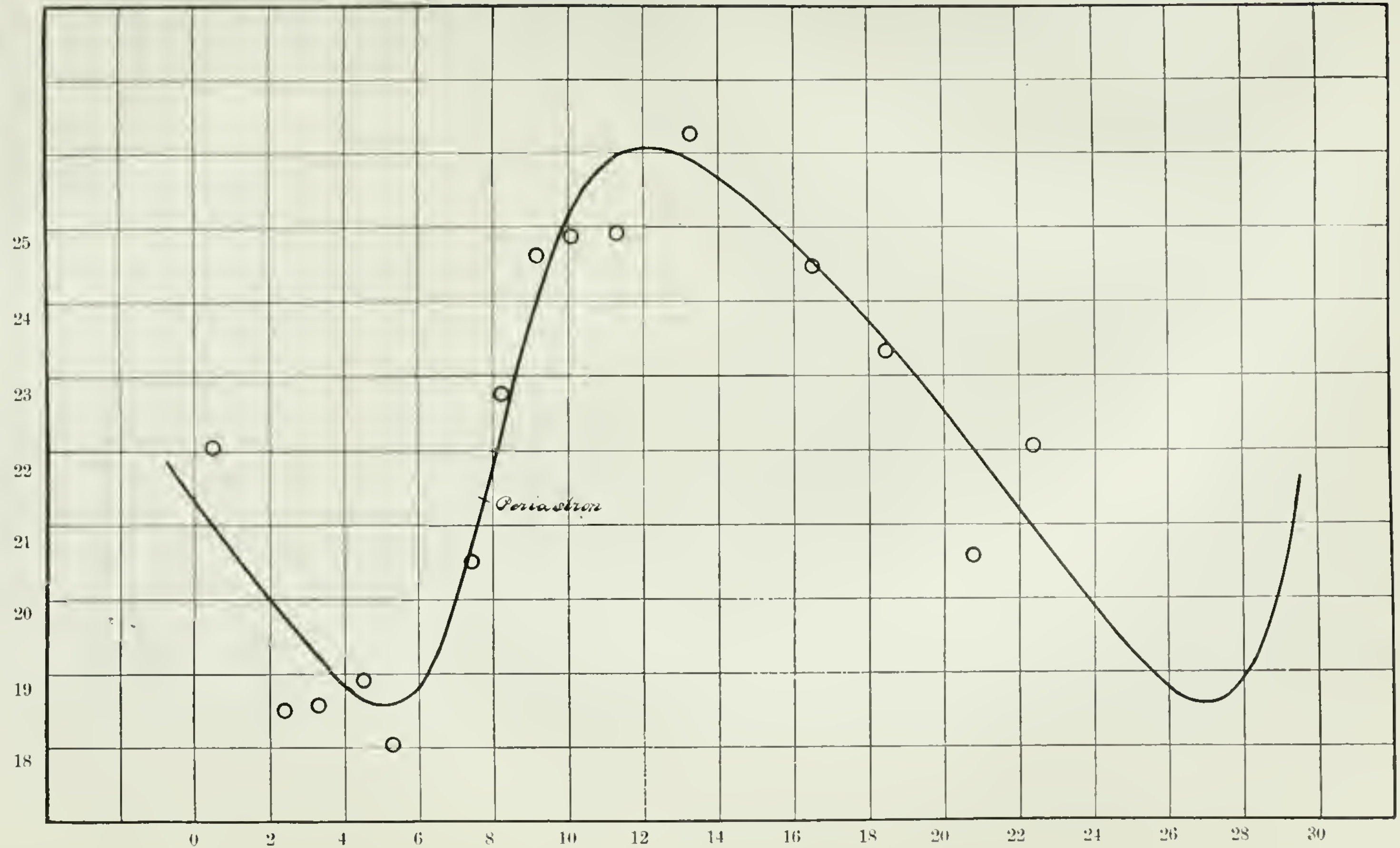


FIG. 16—Velocity Curve of β Orionis.

These normal places with other data are given in the table below, and the places themselves are indicated by circles on the velocity curve Fig. (16) corresponding to the final elements.

NORMAL PLACES β ORIONIS.

No.	Mean velocity.	Mean phase.	No. of nights.	No. of plates.	Total diff. of phase.	Weight.	Weight used in solution.	Residual O C
1	22·06	0·444	3	35	0·48	17	3/4	+1 02
2	18·51	2·350	3	15	0·24	9	1/3	−1 24
3.....	18·59	3·266	3	14	0·15	7	1/4	−0 60
4.....	18·92	4·481	5	22	0·59	17	3/4	+0 27
5	18 06	5·240	3	12	0·30	10	1/2	−0·47
6.....	20·51	7·427	4	25	0·62	15	3/4	−0·10
7	22·76	8·200	2	10	0·27	5	1/4	+0·61
8...	24·63	9·160	4	16	0·63	11	1/2	+0·65
9.... . .	24·90	10·024	4	10	0·46	7	1/4	−0 26
10....	24·91	11·265	6	31	1·66	16	1/2	−1·10
11	26·28	13·253	10	39	1·81	23	1	+0·34
12 ...	24·49	16·567	3	22	1·52	12	1/2	−0·05
13	23·34	18·431	3	10	0·67	8	1/3	−0·17
14	20·60	20·740	1	12	0·00	6	1/4	−1·48

With these normal places and by the graphical method developed by you, described in last year's report, the elements given below were readily determined, with which the observations seemed to agree closely. However, owing to the considerable differences in the weight of the normal places, which could not very well be allowed for in a graphical solution, and to the advantages demonstrated by previous experience, it was felt desirable to apply a least squares correction to these elements.

For coefficients of the corrections the equations developed by Lehmann-Filhés* were used, and from these and from the ephemeris obtained from the normal places and preliminary elements, the following observation equations were derived. All of the elements except the period, which was considered as closely determined as possible from the range of velocity present and the short interval used, were included in this solution and an unknown of coefficient unity for the velocity of the system was added.

OBSERVATION EQUATIONS β ORIONIS.

x $\delta\gamma$	y δK	z $K\delta\omega$	u $K\delta e$	v $\frac{K\mu\,\delta T}{(1-e^2)^{\frac{3}{2}}}$	V	Weight.	s
1 000	−0·505	−0·698	+0 892	+0·892	−1·51	3/4	+0·071
" ..	−0·851	−0·408	+0·859	+0·601	+0·74	1/3	−1·937
" ..	−0·975	−0·190	+0·523	+0·384	+0·20	1/4	+0·942
" ..	−1·052	+0·178	−0·223	+0·015	−0·42	3/4	−0·507
" ..	−1·020	+0·443	−0·528	−0·249	+0·56	1/2	+0·206
" ..	−0·464	+1·104	−0 598	−0·911	+0 19	3/4	+0·325
" ..	−0·138	+1·189	+0·140	−0·996	−0·83	1/4	+0·365
" ..	+0·267	+1·141	+0·924	−0·948	−1·18	1/2	+1·204
" ..	+0·569	+0 977	+0·845	−0·784	−0·33	1/4	+2·277
" ..	+0 876	+0·565	+0·519	−0·372	+0·80	1/2	+3 388
" ..	+0 941	+0·071	−0·486	+0 122	−0·31	1	+1·338
" ..	+0·588	−0·575	−0·869	−0·774	+0·16	1/2	+1·078
" ..	+0·267	−0·755	−1·366	+0·948	+0 10	1/3	+0·194
" ..	−0·183	−0·798	+0·460	+0·991	+1·16	1/4	+2·630

* A. N., No. 3242.

From these observation equations the following normal equations were obtained:—

$$6{\cdot}833x - 0{\cdot}558y + 1{\cdot}110z - 0{\cdot}041u + 0{\cdot}213v - 1{\cdot}132=0$$
$$-0{\cdot}558x + 3{\cdot}755y + 0{\cdot}085z - 0{\cdot}466u - 0{\cdot}192v + 0{\cdot}185=0$$
$$+1{\cdot}110x + 0{\cdot}085y + 3{\cdot}284z + 0{\cdot}192u - 3{\cdot}072v - 0{\cdot}211=0$$
$$-0{\cdot}041x - 0{\cdot}466y + 0{\cdot}192z + 3{\cdot}363u - 0{\cdot}202v - 1{\cdot}192=0$$
$$+0{\cdot}213x - 0{\cdot}192y - 3{\cdot}072z - 0{\cdot}202u - 3{\cdot}118v - 0{\cdot}009=0$$

From the elimination there resulted the following values of the unknowns with their probable errors:—

$$x \text{ or } \delta\gamma = +{\cdot}1721 \qquad \pm {\cdot}1584$$
$$y \text{ or } \delta K = +{\cdot}0212 \qquad \pm {\cdot}2096$$
$$z \text{ or } K\delta\omega = -{\cdot}0157 \qquad \delta\omega = -{\cdot}0042 = -0.24 \pm 3{\cdot}48^\circ.$$
$$u \text{ or } K\delta e = +{\cdot}3604 \qquad \delta e = +{\cdot}0961 \pm {\cdot}0587$$
$$v \text{ or } \frac{K\mu\delta T}{(1-e^2)^{\frac{3}{2}}} = 0 \qquad \delta T = 0$$

When these are applied to the preliminary values we obtain:

ELEMENTS OF β ORIONIS.

Name.	Symbol.	Preliminary.	Corrected.
Eccentricity................	e	0·20	0·296 ± ·059
Half-Amplitude................	K	3·75	3·771 ± ·210 km.
Longitude of Apse................	ω	255°	254°·76 ± 3°·48
Periastron Passage................	T	7·80	J.D. 2,417,968·80
Period................	U	21·90	21·90 dys.
Velocity of System................	γ	+22·444	+22·616 ± ·158 km.
Projection of Semi-axis................	$a \sin i$	1,100,500	1,108,900 km.
Maximum Velocity................	N_1	+26·0	+26·09 km.
Minimum Velocity................	N_2	−18·5	+18·55 km.

It will be noticed that except for the eccentricity the changes in the elements are very small and a comparison between the residuals from the corrected ephemeris and from substitution in the observation equations shows that the solution is satisfactory enough, as there are none greater than ·25km. It was not deemed necessary to make a second solution considering the assumptions made in combining the observations. That the solution has improved the elements was shown at once on comparing the curves and is also evident by the reduction of Σpvv from 3·88 to 3·16.

The probable error of a normal place of unit weight is ± 0·40km. The probable error of a night obtained by scaling from the curve is ± 1·80. The probable error of a plate obtained with a dispersion of three prisms is ± 1·98km., with dispersion of one prism ± 3·22km. and including all the plates ± 2·62km. If, as was done, the observations are divided into two sets—those before and those after January 29, 1909, when the sudden change in amplitude was noticed—and separate curves and elements are obtained roughly for these sets, the probable error of a night reduces to ± 1·37km. with a proportional reduction in the probable errors of single plates, and this would probably be not much greater than 1km. if the amplitude remained constant. For the two sets mentioned above, it may be of interest to compare the maximum and minimum velocities. Those of the first set are + 17 and + 29 and of the second + 19 and + 23·5.

This solution must, however, owing to the peculiar behaviour of the star, be regarded as preliminary only. It is only when many more observations have been secured and the star has been closely followed for some time that any more definite idea of the nature of the changes taking place may possibly be obtained, and it is proposed in the future to follow it as closely as the other work on hand will permit.

I have the honour to be, sir,

Your obedient servant,

J. S. PLASKETT.

APPENDIX A.

ORBITS OF θ AQUILÆ, ϵ HERCULIS, AND η BOÖTIS.

W. E Harper.

THE ORBIT OF θ AQUILÆ.

The star θ Aquilæ ($a = 20^h\ 06^m.2$, $\delta = -1°\ 07'$, photographic magnitude 3·6) was discovered to be a spectroscopic binary by M. Deslandres* in 1902. From the twenty-six plates secured he obtained a period of 16·7 days and eccentricity about 0·6. As the results obtained by him were regarded as only provisional, the star was placed on our observing list here in May, 1907, when the single-prism spectrograph was ready for use. In all forty-five measurable plates were secured that year and from these, preliminary values of the elements were obtained.† For convenience of reference these are given here:

$$
\begin{aligned}
P &= 17{\cdot}17^d \\
\gamma &= -26{\cdot}7^{km} \\
e &= 0{\cdot}725 \\
\omega &= 20° \\
T &= 1907,\ \text{Oct. } 2{\cdot}15\ \text{G.M.T.} \\
&= \text{J. D. } 2{,}417{,}851{\cdot}15 \\
a \sin i &= 8{,}455{,}500^{km}
\end{aligned}
$$

As unfavourable weather prevented the securing of spectrograms in all its phases, particularly near the time of periastron passage, work was resumed on it this year with the object of filling up any gaps in the curve. Fifty-two spectrograms were secured this year and these have been combined with those of last year to determine the orbit. Some half-dozen plates of last year in which the agreement among the various lines was not all that could be desired were remeasured, but only two, Nos. 924 and 959, were changed in velocity appreciably. Plates 1038 and 1050 which had not been measured last year are also added.

Four of the plates Nos. 1001, 1100, 1101 and 1794 were made with the three-prism spectrograph, whose linear dispersion at $H\gamma$ is 10·1 tenth-metres per millimetre. The balance were all made with the single-prism spectrograph which at $H\gamma$ has a linear dispersion of 30·2 tenth-metres per millimetre and gives the whole visible spectrum in sharp focus. The region used for velocity determinations is that lying between and including $H\beta$ and K. The plates used were Seed 27.

The spectrum is of the type VII*a*, and in the portion used the *Mg* line (λ 4481) and K (λ 3933) are best defined. The hydrogen lines are fairly well measurable, especially $H\gamma$, the line λ 4549 is fairly sharp as are also the silicon lines. In addition to those given in Table I. some faint metallic lines also appear in some of the plates. The velocities corresponding to one revolution of the micrometer screw (0·5mm. pitch) are also attached.

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* Bulletin Astronomique XX., 129, 1903.

† Journal of the Royal Astronomical Society of Canada I., 357, 1907.

TABLE I.

LINES IN θ AQUILÆ.

Element.	Wave-Length.	Velocity per Revolution.
H	4861·527	1451
Fe	4549·642	1204·
Mg	4481·400	1151·
H	4340·634	1044·
Fe	4233·328	964
He	4143·928	898·
Si	4131·047	889·
Si	4128·211	887
H	4101·890	868·
H	3970·177	774·
Ca	3933·825	749·

Practically all the plates made have been used in the discussion, even although one or two have not been of the best quality, No. 865 being a case in point. In the preliminary curve for this year ($P = 17{\cdot}120$) No. 873 gave an abnormally high residual (− 28km.) and following out a suggestion of Mr. J. S. Plaskett, to whom I am much indebted for help during this work, the result was omitted from consideration in the least-square solution, as an excessive residual tends to distort the elements out of all agreement with the mean values, as obtained from the remaining observations.

The following table gives all the data of the plates, the phase being reckoned from periastron, Julian Day 2.417.731.504, using the period finally determined, 17·112 days.

TABLE II.

MEASURES OF θ AQUILÆ.

Plate No.	Julian Date.	Phase.	No. of lines.	Wt.	Velocity.	Residual.
	1907.					
803	2,417,727·814	13·425	4	5	− 24	− 0·2
819	737·787	6·284	4	5	− 39	+ 3·1
841	739·836	8·333	4	5	− 38	− 0·4
854	741·813	10·310	4	5	− 42	− 5·9
865	747·778	16·275	1	2	+ 45	+ 16·0
905	759·777	11·162	5	4	− 40	− 5·2
924	765·777	0·050	5	4	+ 30	− 19·5
931	766·711	0·984	7	5	− 30	+ 9·8
942	770·703	4·976	4	4	− 40	+ 5·7
946	773·713	7·986	3	3	− 43	− 5·0
959	777·764	12·037	5	3	− 40	− 7·8
969	784·760	1·921	4	4	− 40	− 1·8
1001	798·660	15·821	5	4	+ 19	+ 6·2
1012	801·692	1·741	4	3	− 39	− 2·0
1013	803·573	3·622	6	4	− 51	− 4·1
1027	815·630	15·679	3	3	+ 10	+ 1·1
1028	815·669	15·718	2	5	+ 11	+ 1·0
1033	825·612	8·519	4	3	− 38	− 0·6
1038	831·635	14·572	4	2	− 8	+ 3·6
1043	833·673	16·610	7	3	+ 55	+ 10·5
1050	837·614	3·438	4	4	− 47	− 0·4
1072	849·543	15·367	5	4	+ 3	− 1·3
1073	849·559	15·383	4	5	+ 4	+ 2·1
1074	849·589	15·413	6	5	− 7	− 9·4
1080	850·502	16·326	3	2	+ 28	− 2·6
1081	850·521	16·345	5	3	+ 33	− 0·8
1082	850·548	16·372	6	4	+ 30	− 3·8
1085	850·613	16·437	8	5	+ 25	− 10·5
1086	850·642	16·466	5	3	+ 36	− 1·0
1089	851·528	0·240	5	4	+ 18	− 12·0
1091	851·570	0·282	3	2	+ 28	+ 0·2
1092	851·589	0·301	5	2	+ 23	− 2·6

TABLE II.

MEASURES OF θ AQUILÆ—*Continued.*

Plate No.	Julian Date.	Phase.	No. of lines.	Wt.	Velocity.	Residual.
	1907.					
1093	2,417,851·605	0·317	5	3	+ 26	+ 2·6
1094	851·625	0·337	2	1	+ 12	− 9·0
1100	867·510	16·223	1	1	+ 28	+ 1·7
1101	867·574	16·287	3	3	+ 33	+ 4·0
1106	874·535	6·135	4	2	− 44	+ 1·4
1128	884·437	16·038	5	5	+ 16	− 4·0
1129	884·452	16·052	5	5	+ 32	+11·6
1146	896·500	10·988	4	2	− 35	− 2·8
1149	898·448	12·936	3	1	− 31	− 3·4
1150	898·526	13·014	5	3	− 20	+ 7·2
1154	899·445	13·933	4	3	− 18	+ 1·8
1155	899·458	13·946	3	2	− 30	−10·0
1157	903·529	0·905	3	3	− 33	+ 3·9
	1908.					
1533	2,418,077·871	4·126	5	3	− 50	− 3·0
1544	080·873	7·128	2	2	− 37	+ 3·0
1576	096·857	6·000	3	3	− 48	− 5·0
1583	098·821	7·964	5	3	− 31	+ 7·0
1604	105·814	14·943	7	3	− 11	− 5·0
1605	105·843	15·000	6	3	− 15	−10·0
1626	115·774	7·805	7	4	− 29	+ 9·3
1634	117·824	9·855	7	5	− 29	+ 7·5
1643	119·821	11·852	6	5	− 30	+ 3·0
1651	120·781	12·812	9	5	− 32	− 4·0
1659	126·729	1·648	2	2	− 36	− 0·5
1679	131·785	6·704	5	3	− 39	+ 2·0
1691	133·812	8·731	5	3	− 41	− 4·0
1696	134·799	9·718	5	4	− 34	+ 2·5
1704	136·818	11·737	6	2	− 33	± 0·0
1708	137·764	12·683	5	4	− 26	+ 3·3
1716	138·809	13·728	7	5	− 19	+ 2·5
1727	148·687	6·494	5	5	− 37	+ 4·6
1730	149·735	7·542	5	4	− 39	± 0·0
1731	149·755	7·562	5	3	− 41	− 2·2
1732	150·760	8·597	5	3	− 33	+ 4·3
1733	150·840	8·617	2	2	− 41	− 3·8
1735	151·743	9·551	6	3	− 43	− 6·5
1736	151·756	9·564	2	1	− 30	+ 6·5
1747	153·740	11·547	5	3	− 31	+ 3·0
1755	154·744	12·551	5	2	− 31	− 1·0
1756	154·764	12·571	5	3	− 26	+ 4·0
1762	159·619	0·316	7	3	+ 35	+10·0
1766	159·687	0·384	4	3	+ 33	+13·0
1767	159·722	0·419	5	3	+ 16	+ 3·0
1769	159·784	0·481	3	2	± 0	− 8·0
1776	161·708	2·395	4	2	− 41	+ 1·5
1777	161·740	2·443	7	4	− 39	+ 4·0
1789	171·763	12·458	5	3	− 21	+ 9·0
1794	173·697	14·392	5	3	− 24	−10·0
1799	174·635	15·328	8	2	± 0	− 1·0
1800	174·658	15·351	6	2	− 2	− 3·0
1801	174·695	15·398	6	3	+ 7	+ 4·5
1807	175·581	16·273	6	2	+ 29	+ 1·0
1808	175·605	16·297	7	2	+ 26	3·0
1810	175·645	16·337	5	2	+ 22	−10·0
1811	176·645	0·228	5	3	+ 35	+ 4·0
1812	176·664	0·247	5	1	+ 39	+10·0
1813	176·681	0·264	7	2	+ 35	+ 6·0
1814	177·659	1·242	6	4	− 30	− 1·5
1815	177·680	1·263	8	4	− 33	− 4·0
1822	178·702	2·285	7	5	− 35	+ 7·0
1835	181·584	5·165	5	4	− 49	− 3·0
1864	188·678	12·259	8	5	− 33	− 1·7
1875	193·529	0·000	5	4	+ 51	− 2·0
1876	193·570	0·040	5	4	+ 51	+ 1·0
1878	2,418,196·625	3·094	5	4	− 48	− 2·0

The observations of 1907 and 1908 were grouped separately and the period which suited best was 17·120 days. The phases for this period were computed, being reckoned from an initial epoch T_0, Julian Day 2,417,727, the date of the first observation. The observations of the two years were now combined and grouped into 18 normal places. Weights were assigned to these groups depending not only upon the sum of the weights of the individual plates, but upon the number of nights involved. The maximum weight was taken as 5. In the weighting of the individual plates, not only the quality of the plate *per se*, but the agreement among the various lines was taken into account. The groups are given in Table III.

TABLE III.
NORMAL PLACES.

Mean Phase.	Mean Velocity.	Wt.	Mean Phase.	Mean Velocity.	Wt.
1·09	−22·3	3	5·49	−31·3	2
2·13	−11·7	1	6·47	−38·2	3
2·66	+ 0·7	3	7·96	−48·9	2
3·09	+13·3	1	9·46	−44·5	1
3·42	+24·9	2	10·73	−40·5	2
3·72	+34·3	3	12·05	−36·4	2
4·31	+51·0	1	13·93	−37·4	5
4·54	+33·6	1	16·28	−33·0	2
4·72	+22·5	3	17·05	−26·7	3

Using the graphical method* of Dr. King, various values of e and ω were tried, those finally decided upon as suiting the grouped observations best being $e = \cdot 680$, $\omega = 20°$, $K = 49$km. and time of periastron passage, T, 4·30 days from initial epoch. Thus for preliminary elements we have:

$P = 17{\cdot}120$ days
$e = 0{\cdot}680$
$\omega = 20°$
$T =$ Julian Day 2,417,731·30
$K = 49$km.
$\gamma = -\ 25{\cdot}3$km.

With these elements it was decided to make a least-square solution for the normal places. Using the differential equation of Lehmann-Filhés†

$$\delta\left(\frac{dz}{dt}\right) = \delta\gamma + (\cos u + e\cos\omega)\,\delta K + \left[\cos\omega - \frac{\sin u\ \sin v}{1-e^2}\cdot(2 + e\cos v)\right]K\,\delta e$$
$$-\ [\sin u + e\sin\omega].\ K\,\delta\omega - \sin u\,(1 + e\cos v)^2\,(t - T).\ \frac{K}{(1-e^2)^{\frac{3}{2}}}\cdot\ \delta\mu$$
$$+\ \sin u\,(1 + e\cos v)^2\,\frac{K}{(1-e^2)^{\frac{3}{2}}}\cdot\ \mu.\ \ \delta T$$

eighteen observation equations were formed, connecting the six unknowns with the residuals between the observed and computed values of the velocity. To make the observation equations homogeneous the following substitutions were made:—

$x = \delta\gamma$
$y = \delta K$
$z = 10{,}000\delta\mu$
$u = 100\delta e$
$v = 10\delta T$
$w = 10\delta\omega$

* Astrophysical Journal, XXVII., 125, 1908.
† Astronomische Nachrichten 3242.

There result the following normal equations:—

$$
\begin{aligned}
40{\cdot}000x + 9{\cdot}571y - 15{\cdot}944z - 11{\cdot}075u + 5{\cdot}696v + 4{\cdot}981w + 18{\cdot}200 &= 0\\
+16{\cdot}015y - 19{\cdot}340z - 13{\cdot}924u + 6{\cdot}444v + 2{\cdot}043w - 6{\cdot}419 &= 0\\
+242{\cdot}697z + 11{\cdot}554u - 327{\cdot}008v + 255{\cdot}472w + 14{\cdot}267 &= 0\\
+19{\cdot}651u - 4{\cdot}122v + 1{\cdot}212w - 4{\cdot}459 &= 0\\
+486{\cdot}538v - 372{\cdot}234w - 36{\cdot}352 &= 0\\
+413{\cdot}976w - 102{\cdot}105 &= 0
\end{aligned}
$$

Whence the corrections to the first approximations:

$\delta\gamma = -0{\cdot}6$ km.	$\delta e = +\ {\cdot}011$
$\delta K = +2{\cdot}1$ km.	$\delta T = +\ 134$ days.
$\delta P = -\ {\cdot}004$ days.	$\delta\omega = \ 5^\circ{\cdot}27$

The resulting elements with their probable errors, as determined at a later stage, are:

$P = 17{\cdot}116$ days	$\pm\ {\cdot}008$ days.	Final elements (simple solution).
$e = 0{\cdot}691$	$\pm\ {\cdot}017$	
$\omega = 25^\circ{\cdot}27$	$\pm\ 2^\circ{\cdot}1$	
$T =$ J. D. 2,417,731·434	$\pm\ {\cdot}100$ days.	
$K = 51{\cdot}1$ km.	$\pm\ 3{\cdot}20$ km.	
$\gamma = -25{\cdot}9$ km.	$\pm\ 0{\cdot}64$	
$A = 83{\cdot}0$ km.		
$B = 19{\cdot}2$ km.		

The residuals from the curve using these corrected values of the elements seemed themselves to lie on a curve, which repeated itself approximately twice during the period of the principal star and having an amplitude of about 8 km. The way the residuals from the observed velocities grouped themselves was not mere chance, there was no doubt that there was some secondary disturbance. The assumption was therefore made that there was a third body whose period was commensurable with the period of the principal star, it going through all its phases in half the time required for that of the principal star. The orbit of the third body was considered circular and the secondary curve taken to cross the primary from above at a time T', Julian Day 2,417,732·634. Taking K' as 4km. and considering θ as the angle at any time from T' the extra terms in the differential equation are:

$$- \sin\theta\,\delta K' + \frac{2\pi}{P'}\cdot K'.\ \cos\theta.\ \ \delta T'.$$

Correcting now our values of the computed velocity for each of the eighteen normal places by an amount representing that due to the third body we have a new set of eighteen observation equations connecting the eight unknowns. In these equations, for sake of homogeneity, we put

$$
\begin{aligned}
x &= \partial\gamma\\
y &= \partial K\\
z &= \frac{100\,K}{(1-e^2)^{\frac{3}{2}}}\cdot\partial\mu &&= 13525{\cdot}67\ \partial\mu\\
u &= K\,.\,\partial e\\
v &= \frac{K}{(1-e^2)^{\frac{3}{2}}}\cdot\mu\,.\,\partial T &&= 49{\cdot}355\,\partial T.\\
w &= K\,.\,\partial\omega\\
y' &= \partial K'\\
v' &= \frac{2\pi}{P'}\,.\,K'\,.\,\partial T' &&= 2{\cdot}937\,\partial T'.
\end{aligned}
$$

There result the following normal equations:—

$$40{\cdot}000x + 9{\cdot}394y - 16{\cdot}283z - 22{\cdot}704u + 3{\cdot}111v + 0{\cdot}405w + 7{\cdot}526y' + 3{\cdot}349v' + 33{\cdot}400 = 0$$
$$+15{\cdot}353y - 19{\cdot}924z - 28{\cdot}003u + 3{\cdot}284v + 0{\cdot}016w + 11{\cdot}548y' + 2{\cdot}222v' + 50{\cdot}731 = 0$$
$$+176{\cdot}184z + 20{\cdot}361u - 62{\cdot}767v + 43{\cdot}949w - 7{\cdot}554y' - 27{\cdot}991v' - 30{\cdot}492 = 0$$
$$+82{\cdot}772u - 2{\cdot}485v + 0{\cdot}072w - 22{\cdot}165y' - 4{\cdot}273v' - 102{\cdot}683 = 0$$
$$+24{\cdot}411v - 17{\cdot}105w - 0{\cdot}687y' + 9{\cdot}534v' - 3{\cdot}337 = 0$$
$$+17{\cdot}037w + 2{\cdot}279y' - 10{\cdot}776v' + 9{\cdot}934 = 0$$
$$+20{\cdot}463y' + 1{\cdot}950v' + 54{\cdot}446 = 0$$
$$+19{\cdot}533v' - 1{\cdot}088 = 0$$

Whence the following corrections are obtained:—

$\delta\gamma = -0{\cdot}01$ km.	$\delta T = +{\cdot}020$ days.
$\delta K = -1{\cdot}4$ km.	$\delta\omega = +0^\circ{\cdot}12$
$\delta P = -{\cdot}0017$ days.	$\delta K' = -1{\cdot}3$ km.
$\delta e = +{\cdot}007$	$\delta T' = +{\cdot}159$ days.

The resulting values of the elements with their probable errors, as determined at a later stage, are:

$P =$ 17·114 days	$\pm$ ·008 days		First approximation (solution (with secondary oscillation.)
$e =$ 0·698	$\pm$ ·017		
$\omega =$ 25°·39	$\pm$ 2°·45		
$T =$ J. D. 2,417,731·464	$\pm$ ·092 days.		
$K =$ 49·7 km.	$\pm$ 3·31 km.		
$\gamma = -25{\cdot}91$ km.	$\pm$ 0·66 km.		
$T' =$ J. D. 2,417,732·793	$\pm$ ·349 days.		
$K' =$ 2·7 km.	$\pm$ 1·02 km.		
$A =$ 81·04 km.			
$B =$ 18·36 km.			

The size of the corrections in some of the elements, and the fact that the residuals (computed—observed) as obtained direct were not in all cases in close agreement with those obtained from the differential equation, *i.e.*, by substituting the values of the corrections in the observation equations, made another solution necessary. The values of ω and γ were, however, considered established as the corrections were very small and the remaining six unknowns were, with the last elements as the basis, formed anew into eighteen observation equations. In these equations

$$y = \delta K.$$
$$z = \frac{100\,K}{(1-e^2)^{\frac{3}{2}}}\,\delta\mu = 13534{\cdot}86\,\delta\mu.$$
$$u = K\,.\,\delta e$$
$$v = \frac{K}{(1-e^2)^{\frac{3}{2}}}\cdot\mu\,.\,\delta T = 49{\cdot}6906\,\delta T.$$
$$y' = \delta K'.$$
$$v' = \frac{2\,\pi}{P}\cdot K'.\delta T' = 1{\cdot}9825\,\delta T'.$$

There result the following normal equations:—

$$14{\cdot}733y - 19{\cdot}889z - 28{\cdot}221u + 3{\cdot}499v + 11{\cdot}503y' + {\cdot}938v' + 1{\cdot}153 = 0$$
$$+174{\cdot}454z + 23{\cdot}938u - 61{\cdot}517v - 10{\cdot}663y' - 26{\cdot}344v' + 17{\cdot}185 = 0$$
$$+87{\cdot}120u - 4{\cdot}059v - 23{\cdot}403y' - 2{\cdot}458v' + 7{\cdot}668 = 0$$
$$+23{\cdot}708v + {\cdot}794y' + 9{\cdot}359v' - 9{\cdot}616 = 0$$
$$+21{\cdot}411y' + 1{\cdot}290v' + 1{\cdot}868 = 0$$
$$+18{\cdot}584v' - 4{\cdot}992 = 0$$

Whence the corrections:

$\delta K = -0{\cdot}02$ km.	$\delta T = +0{\cdot}039$ days.
$\delta P = -0{\cdot}0022$ days.	$\delta K' = -0{\cdot}05$ km.
$\delta e = +0{\cdot}0037$	$\delta T' = +0{\cdot}080$ days.

The corrected values of the elements with their probable errors, as determined at this stage, are:

$P =$	17·1121 days	± ·005 days	Second approximation (solution with secondary oscillation).
$e =$	0·6943	± ·013	
$\omega =$	25°·39		
$T =$	J. D. 2,417,731·503	± ·070 days	
$K =$	49·68 km.	± 2·28 km.	
$\gamma =$	− 25·91 km.		
$T' =$	J.D. 2,417,732·873	± ·416 days	
$K' =$	2·65 km.	± 0·86 km.	
$A =$	80·84 km.		
$B =$	18·52 km.		

This solution should have been sufficient, but when substituting directly in the observation equations and comparing the residuals with those obtained in the ordinary way, there was one fairly large difference 0·40km., two were 0·30km. and the rest varied between 0·0 and 0·2 km. Furthermore, the probable errors of some of the quantities, particularly K, seemed too large. It was decided then to compute the probable errors corresponding to the previous corrections made. They are collected in the accompanying Table IV.:—

TABLE IV.

SUMMARY OF CORRECTIONS.

Elements.	Preliminary Values.	First Corrected Values.	Second Corrected Values.	Third Corrected Values.
P	17·120 d	17·116 d ± ·008	17·114 d ± ·008	17·112 d ± ·005
e	0·680	0·691 ± ·017	0·698 ± ·017	0·6943 ± ·013
ω	20°	25°·27 ± 2°·1	25°·39 ± 2°·45	
T	J. D. 2417731·30	...731·434 ± 100	...731·464 ± ·092	...731·503 ± ·070
K	49·0 km.	51·1 km. ± 3·20 km.	49·7 km. ± 3·31 km.	49·68 km. ± 2·28 km.
γ	25·3 km.	− 25·9 km. ± 0·64 km.	− 25·91 km. ± 0·66 km.	
		Assumed.		
T'		2417732·634	...732·793 ± ·343	...732·873 ± ·416
K'		4·0 km.	2·7 km. ± 1·02 km.	2·65 km. ± 0·86 km.
Σpvv	485 km.	292 km.	251 km.	235 km.

The values for P, γ, T' and K' were now considered determined. The probable errors, especially those in K, did not seem to be as low as they should be. As the probable error in ω in the later determination was larger than in the preceding one, it was thought advisable to take e, ω, T and K and see if by another solution lower probable errors would be had, and a better agreement between the ephemeris and equation.

As before, for the sake of homogeneity, let

$$x = \partial K$$
$$y = K\partial e \qquad = 49 \cdot 68\, \partial e$$
$$z = K\partial\omega \qquad = 49 \cdot 68\, \partial\omega$$
$$u = \frac{K}{(1 - e^2)^{\frac{3}{2}}} \cdot \mu\partial T = 48 \cdot 9307\, \partial T.$$

And the resulting normal equations are:

$$14{\cdot}480x - 28{\cdot}036y - \cdot077z + 3{\cdot}931u - 3{\cdot}236 = 0$$
$$85{\cdot}688y + \cdot387z - 3{\cdot}660u + 4{\cdot}604 = 0$$
$$17{\cdot}243z - 17{\cdot}072u - 1{\cdot}533 = 0$$
$$24{\cdot}149u + \cdot080 = 0$$

from which corrections result as follows:—

$\delta K = + 0{\cdot}29$km.
$\delta e = + 0{\cdot}0009$
$\delta\omega = + 0^\circ{\cdot}1743$
$\delta T = + 0{\cdot}0013$ days

The final elements, taking into account the secondary oscillation, are then as follows. The Allegheny results as discussed later are, for purposes of comparison, given here:—

	OTTAWA.	ALLEGHENY.
P =	17·112 ± ·005.	17·117 ± ·0042
e =	0·695 ± ·010	0·685 ± ·011
ω =	25°·57 ± 1°·54	17°·53 ± 1°·58
T =	J. D. 2,417,731·504 ± ·024	1907, Aug. 28, ·697 ± ·034 dys.
K =	49·97 km. ± 1·35 km.	44·69 km. ± 1·15 km.
γ =	− 25·91 km. ± 0·66	− 30·10 km.
A =	81·31 km.	73·88 km.
B =	18·63 km.	15·50 km.
$a \sin i$ =	8,452,100 km.	7,665,000 km.
P' =	8·556 days	8·558 days.
T' =	J.D. 2,417,732·873 ± ·416	1907, Sept. 9, ·176 ± ·368 days
=	time when secondary crosses primary from above.	
K =	2·65 km. ± 0·86	2·39 km. ± 0·77 km.
$a' \sin i'$ =	311,800 km.	281,000 km.

Final elements (solution with secondary oscillation.)

What seems peculiar is that the least-square solution diminished the period in each case, although from a comparison of the 1907 and 1908 observations, when plotted the period would seem to be fixed about 17·120 days. The successive approximations in each case decreased the sum of the squares of the residuals, as seen from Table IV. The final approximation gave Σpvv = 238·3km., practically the same as the previous one. The agreement, however, between the equation and ephemeris is much improved, the greatest difference being 0·27km.; the average 0·15km. and the probable errors are much lower. Table V. contains the phases for the normal places, reckoned from periastron with the period finally adopted, 17·112 days; the corresponding velocity with its weight, and the residuals as computed directly.

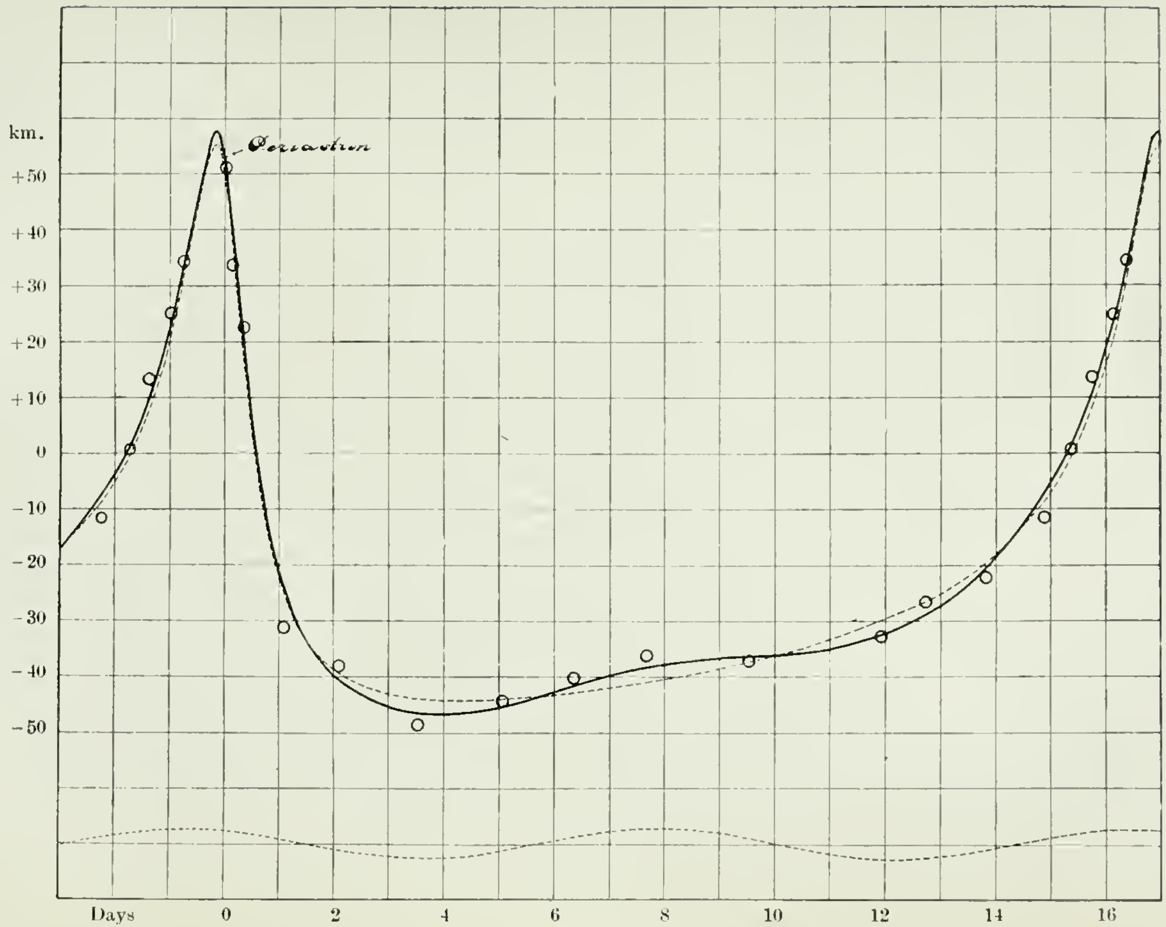


Fig. 17—Final Velocity Curve of θ Aquilæ.

TABLE V.

NORMAL PLACES.

No.	Mean Phase from T	Mean Velocity.	Wt.	Residuals C – O
1.............	13·810	–22·33	3	+1·85
2.............	14·871	–11·75	1	+4·21
3.............	15·378	+ 0·66	3	+0·85
4.............	15·740	+13·33	1	–3·21
5.............	16·143	+24·87	2	–1·55
6.............	16·385	+34·34	3	–0·44
7.............	0·019	+51·00	1	+0·38
8.............	0·166	+33·60	1	+4·75
9.............	0·346	+22·48	3	–3·03
10.............	1·102	–31·31	2	+5·95
11.............	2·107	–38·20	3	–3·16
12.............	3·533	–48·93	2	+1·93
13.............	5·070	–44·50	1	–1·17
14.............	6·357	–40·50	2	–1·53
15.............	7·694	–36·42	2	–2·39
16.............	9·527	–37·38	5	+0·36
17.............	11·932	–33·00	2	+0·07
18.............	12·713	–26·74	3	–2·31

The curve representing the final elements is shown in Fig. 17, the dotted lines being the velocity curves of the primary and secondary components and the heavy continuous line the resultant of these two. The final solution reduces the quantity Σpvv of the residuals for the normal places from 485 to 238·3. The least-square solutions, with the assumption of a secondary disturbance, seem, therefore, to have materially improved the values of the elements. The probable error of a normal place of weight unity as determined by $r = \pm \cdot 6745 \sqrt{\frac{\Sigma\, pvv}{n - \mu}}$ where n is the number of normal places and μ the number of unknowns is $\pm$ 2·75km. The probable error of a plate as derived from the residuals in last column, Table II., which are scaled directly from the curve is for the 1907 observations $\pm$ 4·5km., and for those of 1908 $\pm$ 3·5km. Grouping the two years together the probable error of a plate is $\pm$ 4·0km.

Previous Observations.

There remains a discussion of M. Deslandres' observations of 1901 and 1902. These were tried in connection with our 1907 observations to determine the period more accurately than could be done by using our own alone. The only period which suits Deslandres' observations alone is the one which he suggests, viz., 16·7 days. If the two observations of 1901 were omitted the other observations will give a better curve when a period of 17·112 days is used. Fig. 18 shows Deslandres' observations using his period of 16·7 days. Fig. 19 shows his 1902 observations using our period of 17·112 days. He suggested an eccentricity of about 0·6; such a value for e with K = 45 km. and ω = 27°, gives a curve represented by the broken line in Fig. 18, while a similar value for K and ω, with an eccentricity 0·4 is represented in the continuous curve and appears to suit the observations as well as, if not better, than the other. The velocities he gives as relative only: I have added 14 km. to each to bring them into agreement with the general run of mine.

As his measures depended upon one line only, λ 4481, and among themselves gave a more or less uncertain determination of the elements, I decided in my preliminary determination to confine myself to our own observations. Now that a definite solution has been secured, it is well to look at them anew. For convenience the data is reproduced here, the tenth of a day being assumed. As stated before, 14km. is added to each velocity determination. The phase with the period 16·7 days is reckoned from the date of first observation of 1902, being Julian Day 2,417,964·4, the phase with the period 17·112 days is reckoned from my own periastron time.

M. DESLANDRES' OBSERVATIONS.

Julian Date.	Phase $P = 16·7$.	Phase $P = 17·112$	Velocity.
2,415,568·5	4·7	10·221	+ 11
583·5	3·0	8·109	+ 34
964·4	0·0	12·545	− 2
969·4	5·0	0·133	− 36
971·4	7·0	2·433	− 46
982·4	1·3	13·433	− 6
989·4	8·3	3·321	− 40
2,416,010·4	12·6	7·209	− 39
011·4	13·6	8·209	− 36
012·4	14·6	9·209	− 43
015·4	0·9	12·209	− 25
020·4	5·9	0·097	− 22
029·3	14·8	8·997	− 31(?
040·3	9·1	2·885	− 46(?
047·3	16·1	9·885	− 24
048·3	0·4	10·885	− 7
052·3	4·4	14·885	+ 39
054·3	6·4	16·885	− 44
057·3	9·4	2·773	− 48
069·3	4·7	14·773	+ 10
071·3	6·7	16·773	− 26
072·3	7·7	0·661	− 50
076·3	11·7	4·661	− 47
086·3	5·0	14·661	+ 2
088·3	7·0	16·661	− 15
2,416,095·3	14·0	6·549	− 54

It is rather hard to say how best to make use of these early observations. Though the measures are liable to accidental errors of considerable magnitude they may, owing to the interval of some six years which has elapsed between the two series of observations, have an important bearing on whether or not any changes in the elements have taken place during that time. Our 1908 observations seemed to be slightly greater positive than the velocities for 1907 for the corresponding phase. This may have been accidental, the difference being at most less than 2 km. If the absolute velocities of Deslandres' observations were known, it would decide whether the velocity of the system has been changing or not during these six years.

If his two observations of the year 1901 are as they appear in his paper, we must conclude that the period has been changing during the interval. If we omit these two and use the remaining twenty-four of 1902 with our elements we get what appears on the face of it to be a much better agreement of the observations with the curve. There is one discrepancy. The observations fall short of the curve by a common amount, 1·5 days. The number of periods elapsed between the two epochs is in round numbers 125. By increasing the period $\frac{1·5}{125}$ or ·012 days, this would be remedied, but while this value of 17·124 days would not make much difference in Deslandres' observations, the least-square solution in our own shows it to be improbable. Here is a suggestion: Is it not probable that the presence of the third body will cause a rotation of the line of apsides similar to that caused by the sun and moon on the earth? A motion of the apse line in the direction of ω decreasing and at the uniform rate of $\frac{·012}{17·112} \times 360°$ or $0°·2524$ per period would account for this discrepancy. This motion, if it exists,

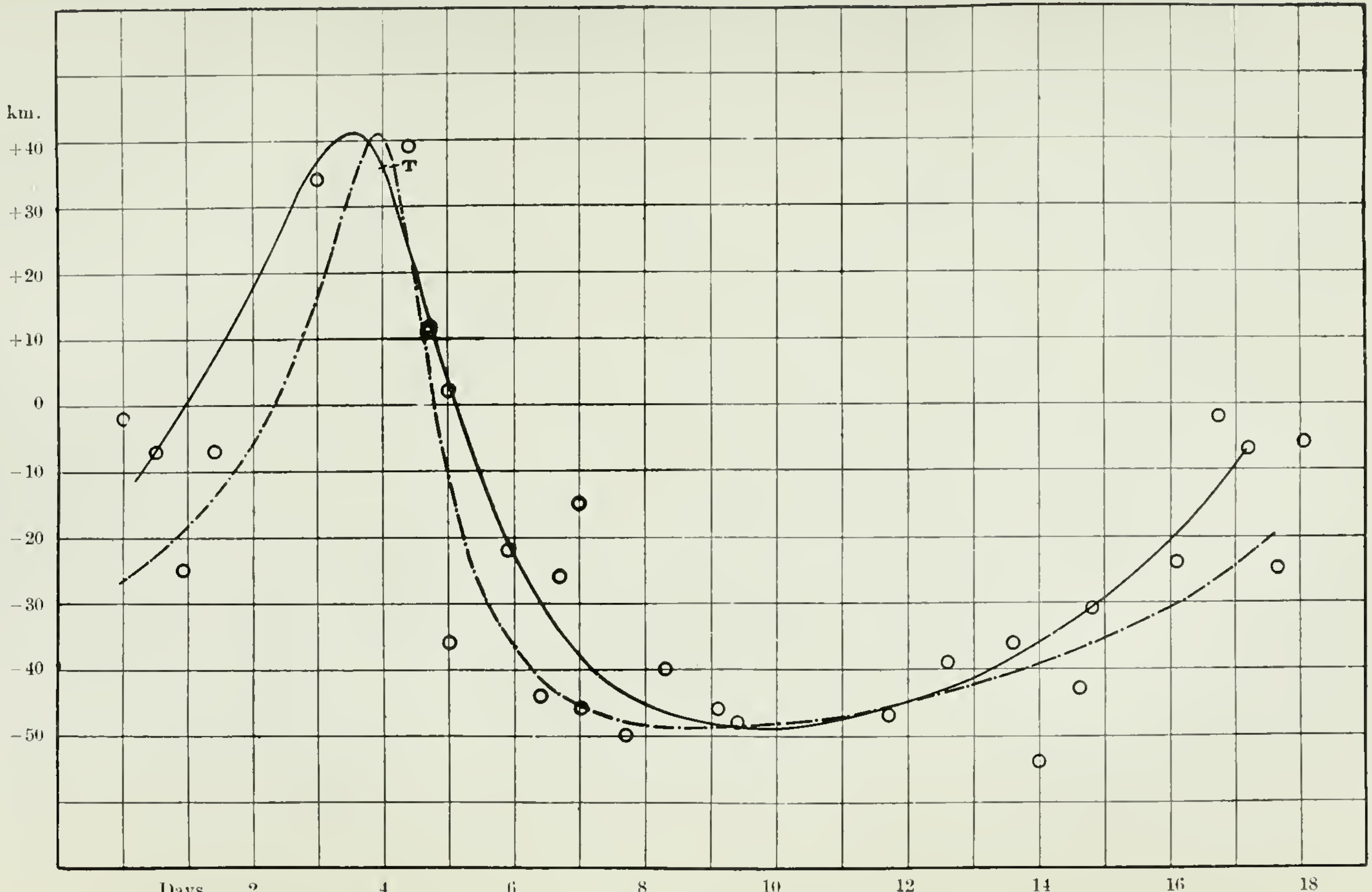


Fig. 18—M. Deslandres' Observations.

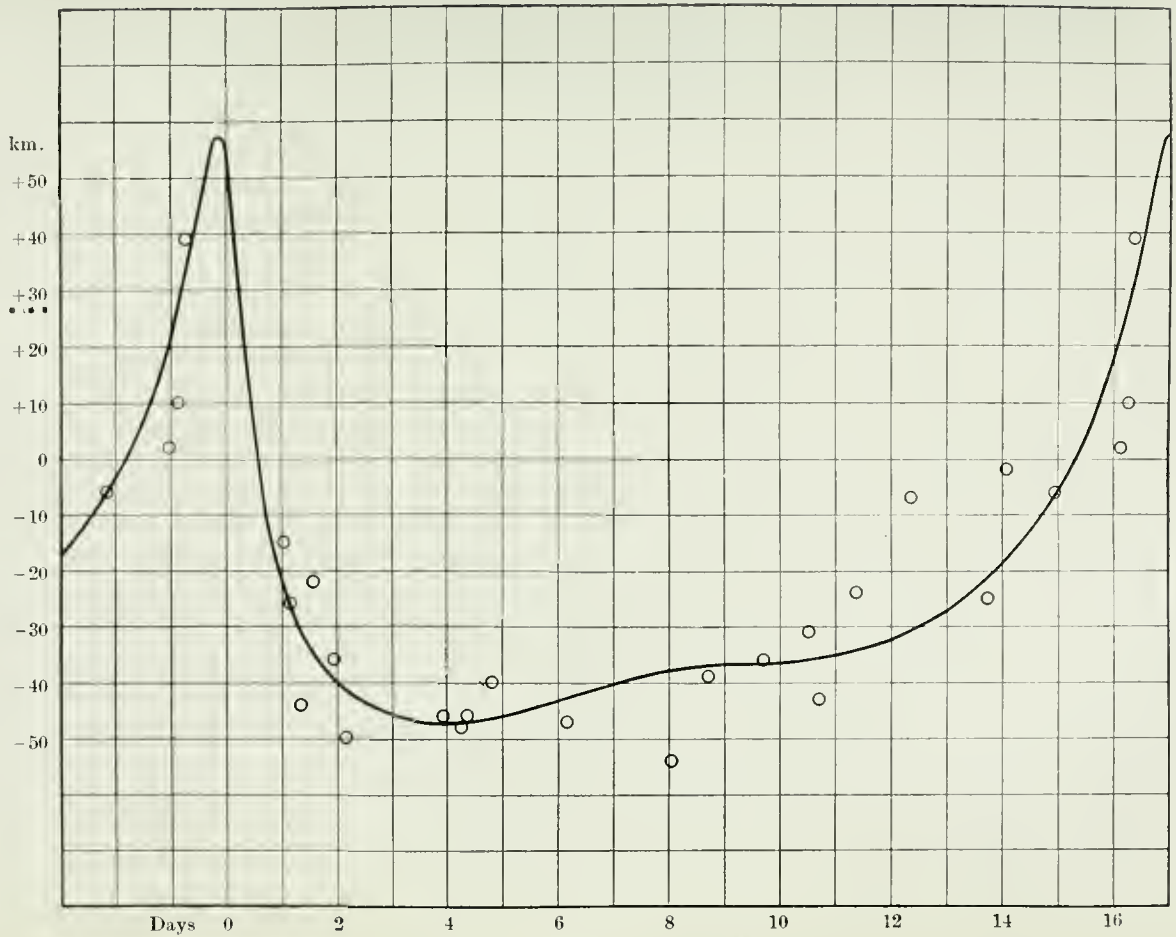


Fig. 19—Deslandres' 1902 Observations.

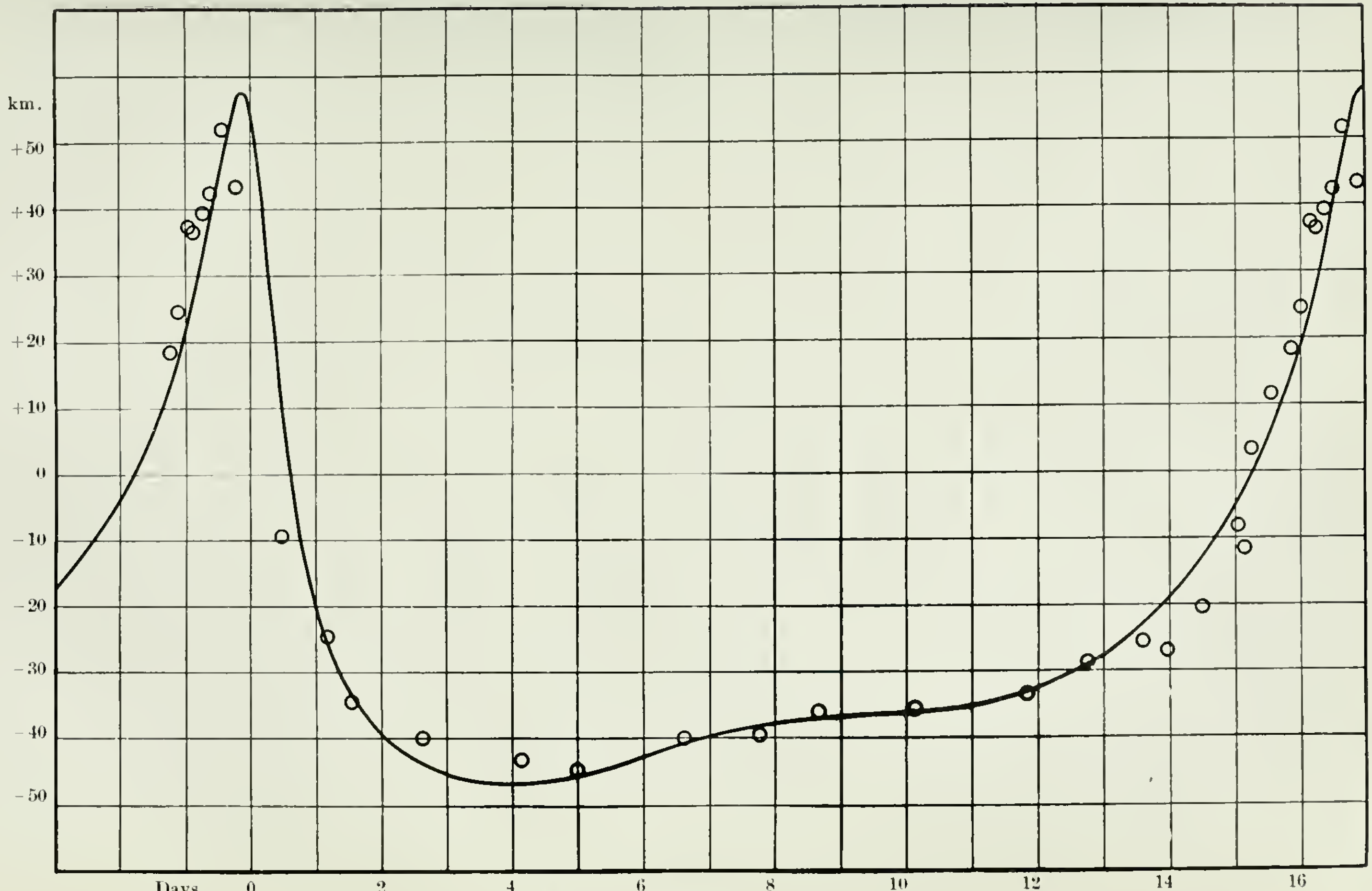


FIG. 20—Allegheny Observations. Ottawa Curve.

would, in addition to decreasing ω and consequently the slope of the curve near periastron, also cause the maximum positive velocity to increase and the maximum negative velocity to decrease numerically.

These questions seem to call for further work on the star at some future time. I do not think the data is sufficient at present to make any definite assertion regarding any change in the elements themselves.

Additional Note on the Allegheny Determination of the Orbit.

Since the foregoing was completed, No. 7 of Vol. I. of the Publications of the Allegheny Observatory has come to hand, containing the orbit of this same star as determined by Mr. Robert H. Baker. It is possibly the first case where two observers, working with different instruments and entirely independent of each other, have completed a discussion of an orbit at about the same time.

A comparison of the results is interesting. In some cases the agreement is remarkable, for instance the secondary oscillation; in other cases the agreement is not what might be expected. Speaking generally, I may say the reason for the differences exists in the observations themselves, the values Mr. Baker has determined suiting his observations best, while the same may be said of our own. There is a gap in the Allegheny observations near periastron passage. The first normal place, phase 0·16 days, depends upon two plates made the same night, the weights of the plates being about one-half the average weight assigned to a plate. The next normal place falls at phase 0·88 days and depends on two plates made on separate nights. These have relatively low weights also. In this interval of 0·7 days additional observations might, and I feel safe in saying, would tend to change the form of the curve. Our observations for phase 0·16 days depend upon one plate made in 1907 and three made in 1908, the plates being a little below the average weight. We have observations, however, for phase 0·34 days depending upon five plates made in 1907 and four made in 1908, the plates being all of average quality, and it is at this point that additional observations would be an advantage to the Allegheny data.

Looking at the results more in detail we see that Mr. Baker's value for γ is about 4km. more negative than ours. The greater positive velocities secured here, account in a measure for this. There may be an explanation also if the velocity of the system be changing, as suggested previously. The bulk of Allegheny observations were made in 1907, while ours are about equally distributed over 1907 and 1908. There is a minor cause in the assumed wave-lengths of the lines used, causing a systematic difference in the two series of velocities. The wave-lengths given in the first part of my report are those at present universally accepted: those given in Mr. Baker's work are sometimes greater, sometimes less, but on the whole would yield a velocity more negative than would those in use here.

The differences are indicated in the accompanying table:—

Line.	Difference in Velocity.	Line.	Difference in Velocity.
λ 4549	− 0·7 km.	λ 4131	− 1·2 km.
4481	− 0·9 "	4128	− 2·4 "
4340	− 1·7 "	3933	+ 2·8 "
4233	− 6·3 "		

On the average a difference of from 1 to 2 km. would be thus accounted for. In certain stars, by examining the trend of the residuals of the various lines and changing their assumed wave-lengths accordingly, a better agreement among the lines themselves can be secured, but unless there are valid reasons therefor it would seem better to retain a constant set of values. Mr. Baker no doubt has good reasons for the change, and the question of absolute velocity is not the most important one.

The probable error of an average plate here is ± 4·0, at Allegheny ± 3·3. The Seed 23 plates used at Allegheny have an advantage over those used here as, being of a finer grain, the spectrum lines would be easier to measure. Our greater number of observations around periastron ought to have much weight, however, in the consideration of the differences between the two results.

The Allegheny observations, with a correction for T to bring the times of periastron passage into coincidence, and the addition of 3 km. to each velocity, being a systematic difference, are plotted in Fig. 20, the curve shown representing the elements as determined here. A glance suffices to show that such a curve does not suit the observations as well as their own curve, and it would seem, therefore, that some further work on the subject would be necessary to explain the discrepancies.

THE SYSTEM OF ε HERCULIS.

$\alpha = 16^h\ 56^m{\cdot}5,\ \delta = 31°\ 4'.$

This star was announced as a spectroscopic binary by both the Lick and Yerkes astronomers in 1903. The two plates secured at Lick showed both the *Mg.* and $H\gamma$ lines as broad and diffuse. On the three plates secured at Yerkes, Adams noticed evidences of the composite nature of the spectrum.

Work was commenced on the star here May 24, 1907, and up to the present some one hundred spectrograms have been secured. After quite a number of these had been measured, the period was found to be in the neighbourhood of four days. The observations seemed to group themselves into four sets, showing that the period was very close to the integral number. Thus quite an interval elapsed before observations were secured in the intermediate phases.

When in 1908 the curve was fairly complete an attempt was made to bring up the five early observations so as to determine the period with greater accuracy. The period which suited our 1907 and 1908 observations best was 4·012 days. The early observations, made about the same date in 1903, required an increase in the period of ·0034 days. As the Lick observations were based on the *Mg* line alone and the Yerkes were for the brighter component and were regarded as provisional only, it was decided to confine our attention to our 1907 and 1908 plates alone.

Keeping the two years separate these were grouped into eighteen normal places. When an attempt was made by the graphical method of Dr. King to obtain preliminary values of the elements it was found that no simple elliptic curve would suit. Having previously found in θ Aquilæ that the assumption of a secondary disturbance due to the presence of a third body would account very well for deviations in the oscillation curve, a similar assumption was made in regard to this star. Here, however, the residuals from the most suitable elliptic curve seemed to repeat themselves thrice in the period of the main star. It was therefore assumed that there was this third body, if so we may speak of it, revolving about the bright star in a period one-third that of its primary, the two in turn revolving about the other component of the system. This was the theory first acted upon.

After a great many trials the set of elements which gave a resultant curve in best agreement with the observations were the following:—

P = 4·012 days
e = ·10
K = 56 km.
ω = 210°
T = J. D. 2.417,721·512
γ = − 28.15 km.
K' = 12 km.
T' = J. D. 2,417,722·162
= time where secondary crosses primary from above.

With these elements a set of eighteen observation equations were formed connecting the eight unknown elements with the residuals. These were transformed into normal equations and the solution gave the following corrections to the elements accepted as preliminary. The new values are also given:—

Elements.	Corrections.	Corrected Values.
P	+ ·00065 days	4·01265 days
e	− ·030	·070
K	+ ·237 km.	56·237 km.
ω	− 18°·35	191°·65
T	− ·178 days	J.D.2417721·334
γ	−1·04 km.	− 29·19 km.
K'	+ ·262 km.	12·262 km.
T'	+ ·015 days	J.D.2417722·177

The new set of elements decidedly improved the agreement as is indicated by a decrease in the sum of the squares of the residuals from 1044 to 715, over thirty per cent. When, however, the residuals were computed directly and compared with those obtained by substitution in the observation equations the differences in most cases were larger than they should be, showing that another solution was necessary. Such a solution has as yet not been made.

Before the work had been carried thus far, observations had been made on the star in 1909. To bring these into agreement with the curve the period would need to be increased to 4·023 days; this period if used would utterly destroy the agreement of the first two years. It seemed then that the period was a varying quantity.

At this stage it was decided to review the plates for evidences of the spectrum of the other component. From time to time in measuring, notes had been made regarding any evidences of duplicity, with corresponding velocities, but now the plates were examined critically with this object in view. Out of the hundred odd plates only six showed the doubling of the lines. Two of them showed $H\gamma$ doubled, two $H\delta$ doubled and two both $H\delta$ and K. The instrument used in almost every case was the single-prism spectrograph which has a dispersion at $H\gamma$ of 30·2 tenth-metres per millimetre. At $H\delta$ the instrument should theoretically resolve lines differing in wave-length by 1·2 tenth-metres. This corresponds to a velocity of 90 km. per second. In practice, however, owing to various causes, a separation corresponding to a much greater difference in velocity would be necessary before the lines could be seen as doubled. The maximum separation found to exist is approximately 160 km. Hence, we can understand how such a small percentage of the plates showed the duplicity of the lines. In the case of these six plates the velocities corresponding to the two components are tabulated in the column of remarks, Table II.

In Vol. I., No. 13 of the Allegheny Publications, which came to hand while the plates were being reviewed, Mr. Robert H. Baker discussed the spectroscopic components of 2 Lacertæ. His blended curve being very similar to that of ϵ Herculis, it seemed possible that the systems might be similar and that his explanation might answer in the case before us. The velocities, while very rough approximations at best, were plotted for each component and elements were obtained for the components as follows:—

Elements.	Brighter component.	Fainter component.
Maximum pos. vel.	+ 64 km.	+ 40 km.
Maximum neg. "	−138 "	− 96 "
K	101 "	68 "
e	·15	·15
ω	210°	30°

Physical conditions in the system itself might serve to explain the curious form of the curve, but the two previous theories have much more evidence to support them. The change in the period, if real, would lend strength to the theory of a disturbing satellite. The presence of this third body would tend to cause the line of apsides to rotate, varying the form of the curve and consequently the elements.

Tables I. and II. give all the data of the plates. The residuals for each plate are scaled directly from the curve; the other columns are self-explanatory. Table III. gives the eighteen normal places, the phases being reckoned from the final periastron. The curve, Fig. 21, represents the corrected values of the elements on the assumption of a disturbing body; the dotted lines representing the primary and the secondary, and the heavy continuous one the resultant of the two.

Further work on the star is necessary. Spectrograms of the star at times of maximum velocities are now being secured on plates of fine grain, and it is hoped that some further evidences of the doubling of the lines will thus be secured.

TABLE I.

EARLY OBSERVATIONS OF ϵ HERCULIS.

Julian Date.	Phase.	Velocity.	Residual.	Observatory.	Remarks.
2,416,235·687	3·046	58	....	Yerkes.	....
242·718	2·052	− 43	....	"	....
259·910	3·193	− 70	....	Lick.	Mg. line.
262·827	2·098	− 34	....	"	"
272·664	3·910	− 22	....	Yerkes.	....
616·680	2·837	− 24*	....	Lick.	Mg. line, not very good.
658·849	·867	− 31*	....	"	Mg. line.

* Kindly communicated by Professor Campbell.

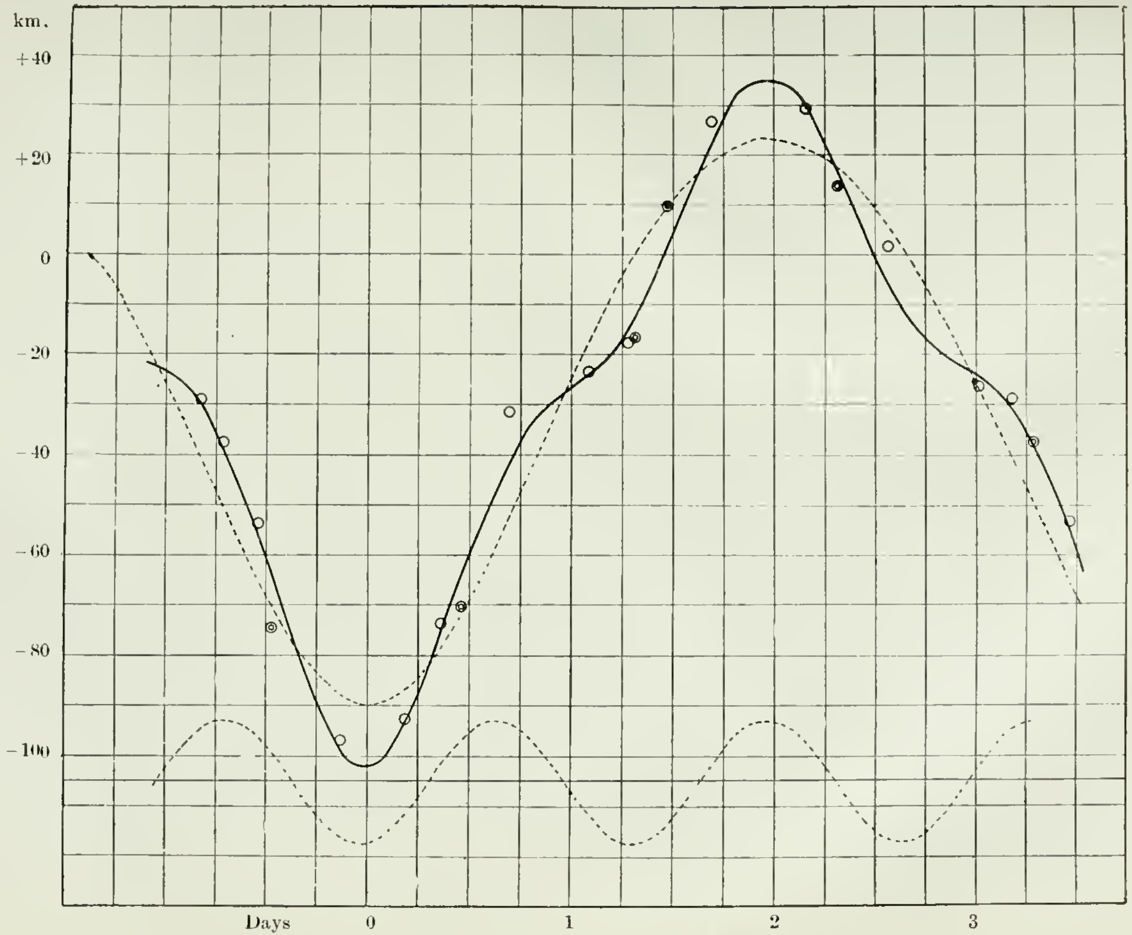


FIG. 21—Velocity Curve of Herculis.

TABLE II.

Ottawa Measures of ε Herculis.

No. of Plate.	Julian Date.	Phase.	Velocity.	Wt.	Residual.	Remarks.
	1907.					
786	2,417,721·767	0·433	−55·6	5	− 1·6	
801	728·735	3·388	−81·4	4	−18·0	
810	736·812	3·410	−83·7	4	− 5·0	
816	738·741	1·356	+12·7	5	+11·0	
827	739·652	2·267	+17·8	4	+ 8·5	
838	740·774	3·389	−61·7	5	+ 1·0	Hγ 128 and − 19
847	741·767	0·370	−83·2	5	−24·0	
851	742·738	1·341	+ 7·0	6	+ 6·0	
862	748·692	3·282	−34·5	5	+15·0	Hγ 111_3 and − 15_2
871	749·757	0·270	−65·7	5	+ 5·0	
881	753·669	0·234	−80·4	3	− 6·0	
893	755·688	2·253	+ 4·0	3	− 7·0	
913	762·679	1·219	−21·2	2	−11·0	
920	766·666	1·195	−17·5	7	− 6·0	
928	767·635	2·162	+ 9·0	5	−10·0	Metallic lines seen.
937	768·622	3·149	−39·0	4	− 2·0	
952	776·673	3·175	−57·6	4	−18·0	
957	778·693	1·182	− 7·0	7	+ 6·0	
976	790·722	1·173	−26·8	5	−12·8	
979	792·562	3·013	+15·4	6	....	Mg − 125_1 and + 55_3
987	795·732	2·170	+ 6·2	3	−12·0	
1018	811·660	2·048	+30·6	3	+ 2·6	
1062	2,417,840·609	2·908	− 2·9	2	+22·0	
	1908.					
1391	2,418,010·868	0·623	−28·6	6	+ 8·0	
1403	017·904	3·647	−100·9	6	− 9·0	Hδ − 110_1 and + 28_1
1483	045·900	3·555	−90·7	3	− 8·2	λ 4713 gives + 158.
1494	047·861	1·502	+38·5	7	+22·0	
1511	054·856	0·472	−37·0	7	+12·4	
1531	077·813	3·367	−74·0	7	−14·0	
1540	080·767	2·307	+ 6·1	6	+ 1·0	
1515	082·708	0·236	−74·0	5	+ 1·5	
1547	084·770	2·298	−28·5	2	−34·5	
1567	094·813	0·303	−83·1	3	−14·0	
1573	096·747	2·237	−11·0	6	−23·5	K intense to red.
1582	098·778	0·255	−65·6	5	+ 6·6	
1603	105·774	3·239	−46·2	4	0·0	
1625	115·733	1·159	−13·8	5	+ 0·7	
1630	117·691	3·117	−31·0	8	+ 3·5	
1640	119·710	1·124	+ 6·1	2	+23·0	Depends on Mg alone.
1648	120·715	2·129	+24·8	6	+ 3·4	
1653	124·676	2·077	+20·0	6	− 5·5	
1658	126·680	0·069	−99·5	3	− 7·0	
1661	126·820	0·208	−86·1	5	− 8·7	
1666	129·730	3·119	−27·0	7	+ 8·0	
1675	131·658	1·034	−14·5	6	+ 6·8	
1676	131·688	1·064	−22·2	6	− 2·2	λ 4267 gives +128.
1682	132·716	2·092	+31·2	6	+ 6·2	Hδ − 80 and + 70
1685	133·609	2·966	−27·9	6	0·0	K − 14 and + 62.
1686	133·649	3·026	−36·0	5	− 6·6	Metallic lines.
1693	134·707	0·071	−108·0	5	−16·0	All lines def. on violet.
1699	136·679	2·042	+26·0	4	− 2·6	
1707	137·737	3·100	−43·6	8	− 9·6	
1712	138·708	0·059	−81·1	5	+ 8·1	
1713	138·739	0·083	−65·8	6	+24·5	
1719	139·725	1·075	−13·8	6	+ 6·0	
1720	145·708	3·047	−23·7	7	+ 7·0	
1723	147·583	0·908	−23·8	9	+ 2·2	
1728	148·722	2·047	+23·9	6	+ 5·9	
1729	149·707	3·033	−17·6	8	+12·2	
1734	151·716	1·028	−27·8	5	− 6·3	
1737	152·598	1·911	+34·3	8	− 0·5	Hδ 84 and 58
1738	152·631	1·944	+34·7	5	+ 0·7	K − 115_2 and + 32_3
1743	152·753	2·066	+40·2	4	+13·2	
1746	153·712	3·026	−22·3	3	+ 7·0	
1751	154·653	3·967	−82·5	5	+11·2	

TABLE II.

OTTAWA MEASURES OF ε HERCULIS.—*Continued.*

No. of Plate.	Julian Date.	Phase.	Velocity.	Wt.	Residual.	Remarks.
	1908.					
1757	2,418,154·795	0·096	−94·3	5	− 4·8	
1760	155·701	1·001	−22·1	3	+ 0·4	
1761	159·586	0·873	−28·6	8	− 2·2	
1774	161·649	2·937	−24·0	7	+ 2·5	
1782	169·701	2·964	−35·0	7	− 8·7	
1793	173·612	2·862	−47·8	5	−14·1	
1818	178·585	3·843	−92·4	7	+ 4·2	
1838	181·660	2·904	−24·0	7	0·0	
1844	182·588	3·811	−98·9	8	− 2·8	
1853	185·578	2·790	− 6·1	5	+16·0	
1866	189·604	2·804	−20·1	4	+ 2·0	
1903	216·550	1·660	+11·2	4	−19·0	
1905	217·516	2·627	+21·0	5	+37·8	
1906	217·556	2·667	−10·0	5	+ 8·0	
1917	220·531	1·628	+18·1	2	− 9·1	
1926	227·593	0·665	−26·8	4	+ 8·3	
1961	259·440	0·411	−70·3	4	−14·2	
1983	272·422	1·356	−30·9	5	−33·0	
1993	278·461	3·382	−30·0	5	+29·0	
	1909.					
2263	2,418,346·923	3·629	−43·5	...	...	
2264	346·958	3·664	−39·3	...	...	
2305	360·899	1·554	−18·3	...	...	
2306	360·942	1·597	−16·4	...	...	
2327	369·883	2·512	+49·5	...	...	
2328	369·935	2·564	+12·5	...	...	
2370	379·788	0·379	−78·0	...	...	
2371	379·808	0·399	54·3	...	...	
2384	381·814	2·405	+36·4	...	...	
2385	381·833	2·424	+38·4	...	...	
2454	397·836	2·376	+30·0	...	...	
2455	397·861	2·401	+29·8	...	...	

TABLE III.

NORMAL PLACES.

No.	Phase from *T*.	Mean Velocity.	Weight.	Residual O − C.
1	0·337	−70·22	2	− 6·72
2	1·187	−16·57	2	− 4·00
3	1·348	+ 9·59	1	+ 8·65
4	2·183	+13·26	2	− 4·34
5	3·168	−37·65	2	+ 0·46
6	3·404	−74·53	1	−11·49
7	0·571	−31·63	1·5	+ 9·40
8	0·952	−23·75	3·5	+ 0·67
9	1·152	−17·80	3	− 2·87
10	1·570	+26·96	1	+ 4·53
11	2·034	+29·16	5	− 0·23
12	2·442	+ 1·16	2	+ 6·97
13	2·889	−26·60	4	− 2·61
14	3·062	−28·98	5·5	+ 1·78
15	3·340	−53·30	1·5	+ 2·20
16	3·747	−96·50	2·5	+ 1·45
17	0·048	92·52	2·5	+ 1·26
18	0·235	−73·35	3	+ 1·84

THE SPECTROSCOPIC BINARY η BOÖTIS.

This star ($\alpha = 13^h\ 49^m \cdot 9$, $\delta = +\ 18°\ 54'$, photographic magnitude 3·8) was announced as a spectroscopic binary by Moore in L. O. B. 70, 1905. The thirteen measures given extended over the years 1897, 1899, 1901, 1903, 1904 and 1905. Of these, four were approximate, the remaining nine definite. Besides these measures there were available the recently published measures*, six in all, by Kustner of the Bonn Observatory.

Work was commenced on the star here June 25, 1906, and from that time until the date of the last plate mentioned, March 20, 1909, forty-five plates were secured. The determination of the orbit depends then on these sixty-four plates, thirteen of the Lick Observatory, six of the Bonn and the remaining forty-five of our own.

Some objection might be taken to the grouping of observations from different observatories in view of the possibility of a systematic difference in the results used, but it has been deemed expedient by the writer to use these early observations in conjunction with our own to make a preliminary determination of the orbit. Meanwhile plates of the star in the required phases will continue to be made with the new three-prism spectrograph, and when all phases are complete, which cannot be before January, 1910, a new determination of the elements will be made using our three-prism plates alone. The comparison of results ought to be worth the extra labour involved.

The star is of solar type, XIV*a* according to Miss Maury's grouping, and thus permits of accurate velocity determination. As a rule about fifteen lines were measured on each plate. The plates up to No. 752 were made with the Universal spectroscope, and were reduced by means of the Hartmann interpolation formula. From that time the plates were made with either the new single or the three-prism spectrograph, and were reduced from tables used here in which the micrometer settings for zero displacement of the lines are tabulated. Eleven were made with the former, twenty-one with the latter. The plates used were Seed 27. Our own plates made at the commencement of our work are weighted one-half; later plates with the Universal spectroscope, the single-prism plates, most of those made at Bonn, as well as those of 1897 and 1899 made at Lick, are weighted unity, while the later plates of Lick Observatory and our own new three-prism plates are weighted three.

The following tables contain all the data of the plates. The phases are reckoned from the period and periastron finally adopted and the residuals are scaled directly from the curve representing the final elements:—

OBSERVATIONS AT LICK OBSERVATORY.

Julian Date.	Phase.	Velocity.	Weight.	Residual.
2,413,959·8	192·9	− 0·6	1	−0·4
4,035·7	268·8	− 2·	1	+2·3
4,036·7	269·8	− 4·	1	+0·3
4,057·6	290·8	− 2·	1	+3·4
4,693·8	431·6	− 2·2	1	+3·4
5,524·6	271·7	− 4·9	3	−0·4
6,259·6	16·1	+ 6·9	3	−0·1
6,542·6	299·1	− 8·2	3	−2·4
6,571·6	328·1	− 4·9	3	+1·9
6,603·6	360·1	− 7·6	3	−0·1
6,646·6	403·1	−10·	3	−2·8
6,658·6	415·1	− 7·3	3	−0·6
6,850·9	112·1	+ 5·5	3	+0·1

* Astrophysical Journal, 27-5-1908.

OBSERVATIONS AT BONN OBSERVATORY.

Julian Date.	Phase.	Velocity.	Weight.	Residual.
2,416,258·4	14·9	+ 7·6	3	+0·7
6,595·5	352·0	– 2·2	1	+5·2
6,608·5	365·0	– 4·2	1	+3·3
6,994·4	255·6	– 3·4	1	+0·4
7,234·7	0·6	+ 6·2	1	+1·5
7,369·4	138·3	+ 3·9	1	+0·4

OTTAWA OBSERVATIONS.

Plate Number.	Julian Date.	Phase.	Velocity.	Wt.	Residual.
308	2,417,387·7	153·6	– 0·2	0.5	– 2·5
313	389·6	155·5	0·0	0·5	– 2·2
318	391·6	157·5	+ 1·8	0·5	– 0·3
326	396·6	162·5	– 1·7	0·5	– 3·4
333	398·6	164·5	– 1·6	0·5	– 3·2
366	429·6	195·5	– 0·4	0·5	0·0
372	431·6	197·5	– 4·7	0·5	– 4·2
657	643·8	409·7	– 5·6	1·0	– 1·3
670	655·8	421·7	– 6·9	1·0	– 0·6
691	669·7	435·6	–10·2	1·0	– 5·0
731	685·8	451·7	– 3·8	1·0	– 0·5
739	692·7	458·6	– 4·5	1·0	– 2·3
752	703·6	469·5	+ 0·7	1·0	+ 0·9
760	710·7	476·6	– 0·1	3·0	– 1·2
764	716·7	482·6	+ 2·9	3·0	+ 0·7
769-771	718·7	484·6	+ 2·5	2·0	– 0·2
774	719·6	485·5	+ 3·2	1·0	+ 0·4
779	720·6	486·5	+ 0·6	1·0	– 2·4
793	725·7	491·6	+ 5·7	1·0	+ 1·7
797	727·6	493·5	+ 5·1	1·0	+ 0·8
812	737·6	8·1	+ 7·2	1·0	+ 1·4
868	748·6	19·1	+ 5·0	1·0	– 2·4
891	754·6	25·1	+ 5·7	1·0	– 2·3
918	765·6	36·1	+ 6·8	1·0	– 1·8
950	775·6	46·1	+ 5·3	1·0	3·5
972	789·6	60·1	+11·4	1·0	– 2·8
990	795·6	66·1	+ 9·0	3·0	– 0·6
1231	955·9	226·4	– 3·3	1·0	– 1·1
1294	968·8	239·3	– 3·8	3.0	– 0·9
1307	970·9	241·4	– 3·5	3·0	– 0·4
1332	989·9	260·4	– 5·2	3·0	– 1·2
1357	996·8	267·3	– 7·1	3·0	– 2·7
1446	2,418,031·9	302·4	– 7·5	3·0	– 1·6
1513	066·8	337·3	– 6·7	3·0	+ 0·3
1557	085·7	356·2	– 8·7	3·0	– 1·3
1553	087·7	358·2	– 6·6	3·0	– 0·8
1621	115·6	386·1	– 6·0	3·0	– 1·0
1663	129·6	400·1	– 7·4	3·0	– 0·1
1710	138·6	409·1	– 6·8	3·0	– 0·2
1792	173·5	444·0	8·6	3·0	4·3
1867	192·5	463·0	– 0·3	3·0	– 1·2
2115	315·0	90·2	+ 8·6	3·0	+ 1·7
2209	337·8	113·0	+ 5·2	3·0	– 0·2
2283	355·8	131·0	+ 6·0	3·0	+ 2·1
2396	386·7	161·9	+ 2·8	3·0	+ 1·0

The observations when plotted gave a period about 492 days. Using this period they are combined into twenty-one groups, no group including observations of different periods. Preliminary elements were determined by the graphical method* of Dr.

* A. J., 27-2-1908.

King and, using these, twenty-one observation equations of the form of Lehmann-Filhés were formed. They were then transformed into the following normal equations, where for sake of homogeneity these substitutions were made:

$$x = \delta\gamma$$
$$y = \delta K$$
$$z = K.\delta e$$
$$u = K.\delta\omega$$
$$v = 1000. \frac{K}{(1 - e^2)^{\frac{3}{2}}} \cdot \delta\mu$$
$$w = \mu. \frac{K}{(1 - e^2)^{\frac{3}{2}}} \cdot \delta T.$$

The normal equations are:—

$$\begin{array}{rrrrrrrl}
116\,000x & - 11{\cdot}974y & + 1{\cdot}830z & + 19{\cdot}935u & - 2{\cdot}354v & - 20{\cdot}565w & + 6{\cdot}260 & = 0 \\
 & 54{\cdot}535y & - 14{\cdot}444z & + 2{\cdot}376u & - 13{\cdot}460v & - 7{\cdot}212w & - 28{\cdot}055 & = 0 \\
 & & 57{\cdot}796z & - 2{\cdot}404u & - 4{\cdot}352v & + 3{\cdot}883w & - 19{\cdot}760 & = 0 \\
 & & & 59{\cdot}931u & - 13{\cdot}104v & - 62{\cdot}528w & - 4{\cdot}652 & = 0 \\
 & & & & 45{\cdot}343v & + 14{\cdot}515w & + 40{\cdot}046 & = 0 \\
 & & & & & 69{\cdot}129w & + 7{\cdot}200 & = 0
\end{array}$$

The solution of these equations gave as corrections:

$$\begin{array}{lll}
\delta\gamma & = & - \cdot 02 \text{ km.} \\
\delta K & = & + \cdot 43 \text{ “} \\
\delta e & = & + \cdot 050 \\
\delta\omega & = & - 1^\circ{\cdot}025 \\
\delta P & = & + 3{\cdot}32 \text{ days} \\
\delta T & = & - .520 \text{ “}
\end{array}$$

The sum of the squares of the residuals for the normal places was reduced from 186·1 to 122·7, and the agreement between equation and ephemeris residuals was considered satisfactory. These are given in the accompanying table of normal places:

NORMAL PLACES.

No.	Mean Phase.	Mean Vel.	Wt.	Residual.	Equation-Ephemeris.
1	255·5	−2·15	4	+1·64	−0·13
2	431·6	−2·20	1	+3·41	−0·08
3	271·7	−4·90	1	−0·33	−0·26
4	15·5	+7·25	6	+0·28	−0·08
5	333·0	−6·90	16	+0·02	−0·56
6	112·1	+5·50	3	+0·11	+0·14
7	255·6	−3·40	1	+0·39	−0·03
8	0·6	+6·20	1	+1·50	−0·13
9	138·3	+3·90	1	+0·45	−0·29
10	435·5	6·20	5	0·96	+0·01
11	417·7	−7·60	9	−0·98	−0·01
12	480·8	+1·63	11	−0·21	+0·03
13	463·0	−0·30	3	+1·19	+0·12
14	0·9	+6·00	3	+1·25	−0·04
15	48·1	+7·65	8	−1·17	+0·02
16	111·4	+6·60	9	+1·16	+0·02
17	161·9	+2·80	3	+1·02	0·00
18	169·5	−0·97	3	−2·23	0·00
19	238·4	−3·60	7	−0·70	−0·32
20	276·7	6·60	9	−1·81	−0·02
21	359·4	−7·00	12	+0·49	−0·06

The probable error of a plate as determined from the last two columns of the table, giving the data of the plates and using the formula $r = \pm \cdot 6745 \sqrt{\frac{\Sigma\, pvv}{\Sigma\, p - 1}}$ is $\pm$ 1·04 km. per second. The curve, Fig. 22, is plotted from the corrected elements given in the following table. These are considered close approximations to the true values until observations in all phases of the star have been secured with the three-prism spectrograph when a final determination will be made:—

ELEMENTS OF ORBIT.

Elements.	Graphical.	Corrected.
Period P	492 days.	495·3 days.
Eccentricity e	0·25	0·300
Longitude of apse ω	300°	298°·98
Half amplitude K	7·8 km.	8·23 km.
Velocity of system γ	−0·57 km.	−0·60 km.
Periastron passage T	J. D. 2417730·0	J. D. 2417729·48
Projection semi-major axis $a \sin i$	....	53,474,000 km.
pvv	186·1	122·7

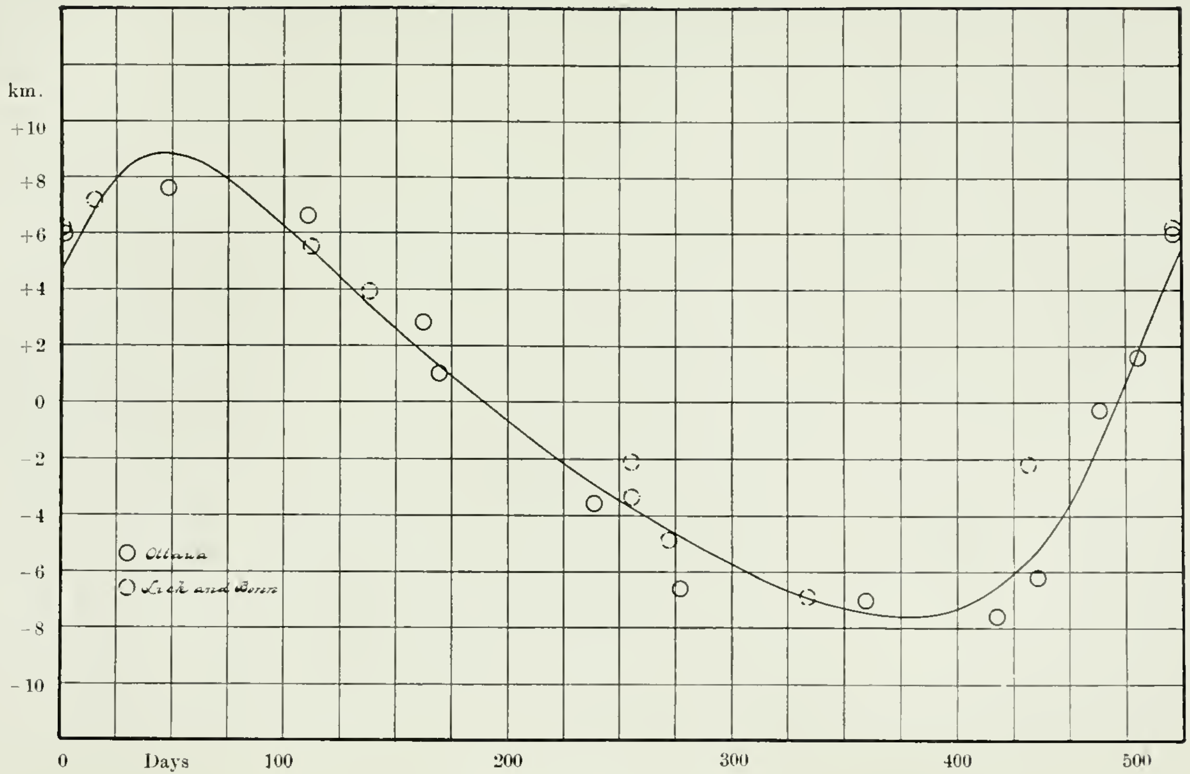


FIG. 22—Velocity Curve of η Boötis.

APPENDIX B.

THE SPECTROSCOPIC BINARY, α CORONÆ BOREALIS.

J. B. CANNON.

The star α Coronæ Borealis ($\alpha = 15^h\ 30^m$; $\delta = +27°\ 3'$), was discovered to be a binary by Hartmann from measures of six plates taken at Potsdam in 1902 and 1903.* It was under observation at this Observatory during the years 1907 and 1908. In all 103 plates were secured, 46 in 1907 and the remaining 57 in 1908; the instrument used being the single-prism spectroscope.

This star belongs to the class I*a* 2 in the Vogel classification. The spectrum shows the dark lines, $H\beta$, $H\gamma$, $H\delta$, $H\epsilon$, the magnesium line λ 4481, the iron line λ 4549, the calcium line λ 3934 and a few other very faint lines. The hydrogen lines are all very broad and diffuse and very difficult of accurate measurement. $H\epsilon$ is so diffuse that it has not been measured at all. The line λ 4481 varies in character, in some plates well defined, in others diffuse. The line λ 4549 is very faint and has only been measured in a very few cases. The line λ 3934 is in general a fairly good line, being weighted about the same as $H\gamma$ and $H\delta$. In the measurement of nearly every plate it was found that the lines λ 4481 and λ 4549 gave entirely different velocities from the H lines and K. It was decided therefore to consider only $H\beta$, $H\gamma$, $H\delta$ and K in the first measurements and the elements determined in this treatment are from the consideration of these alone.

The lines measured, together with the velocities per revolution of the micrometer screw (0·5 pitch), are given in Table I.

TABLE I.

LINES (MEASURED) IN α CORONÆ BOREALIS.

Element.	Wave-Length.	Velocity per revolution.
Hydrogen....	4861 527	1451
"	4340·634	1044
"	4101·890	868
cium	3933·825	749

These lines vary in quality and were weighted accordingly. The whole plate was then weighted, regard being had, first, to the appearance of the spectrum, and second and more particularly, to the number of lines measured and the agreement in the measurements. The velocities found were plotted successively and gave a period of between seventeen and eighteen days. Trials of several periods ranging between these, gave 17·35 as the most satisfactory. There were available measurements of three plates of 1902 and ten of 1903 taken at Potsdam*, and it was found that on plotting these with the observations obtained here that if the period were increased to 17·355 days, they would, with one exception, lie very close to the curve. Table II. contains

* A. N., 163, 31, 1903.

the number of the plate, the Julian date, the phase—computed from the time of periastron finally accepted, and period 17·355 days,—the weight of the plate, the velocity and the residual between the observed velocity and that computed from the corrected elements.

In order to obtain observations in which the errors might be reduced and a curve drawn showing smaller residuals, the one hundred and three observations were combined into fourteen groups. Plates of both years were combined indiscriminately, those at nearly the same phase being grouped together. The weight of each plate (Table II.) was taken into account and the weighted mean of each group computed, with the mean phase.

(Table III. contains the mean phase from T mean velocity, weight and residual of these normal places.)

TABLE II.

MEASURES OF α CORONÆ BOREALIS.

Plate No.	Year.	Julian Day.	Phase.	Wt.	Velocity.	Residual.
784	1907.	2,417,720·74	13·041	4	−40	+12·5
790	"	725·63	0·576	4	+32	0·
794	"	725·75	0·696	3	+44	−10·
800	"	727·72	2·666	3	+17	+17·
808	"	735·69	10·636	3	−37	+15·
813	"	737·64	12·581	4	−30	+ 3·
830	"	738·74	13·681	2	−26	0·
837	"	739·73	14·671	4	−17	− 3·5
845	"	740·69	15·641	3	− 1	− 8·
850	"	741·69	16·641	4	+11	− 1·5
861	"	747·67	5·266	2	+17	− 4·5
869	"	748·64	6·236	4	+ 9	− 4·5
880	"	752·65	10·246	1	−41	+20·
888	"	753·62	11·216	2	−27	− 3·
892	"	754·64	12·236	4	−28	− 1·
912	"	761·64	1·876	2	+25	+13·5
917	"	762·64	2·876	3	+30	+ 2·5
919	"	765·65	5·886	3	+ 8	0·
927	"	766·61	6·846	3	− 5	+ 4·5
936	"	767·58	7·816	4	+ 8	−15·
939	"	769·68	9·916	3	−29	−10·
941	"	770·64	10·876	1	−30	− 7·
944	"	773·62	13·851	2	−26	+ 0·5
951	"	775·62	15·851	3	−19	−15·
956	"	777·67	0·546	3	+32	0·
973	"	789·58	11·466	2	−16	− 9·
978	"	791·54	14·421	3	−24	− 1·5
986	"	794·69	0·216	2	+12	+16·
1060 and 1061	"	839·77	10·386	2	−25	+ 4·
1006	"	800·69	6·216	2	−14	+18·
1014	"	803·63	9·156	2	− 7	− 8·5
1017	"	810·63	16·161	1	−14	+13·
1022	"	811·66	17·151	1	+ 5	+15·
1026	"	815·50	3·676	3	+30	− 4·
1032	"	825·57	13·741	2	−22	− 3·5
1037	"	831·67	2·486	2	+36	− 0·5
1047 and 1048	"	837·53	8·356	3	−15	+ 5·
1083 and 1084	"	850·56	4·016	4	+26	− 2·5
1393	1908.	2,418,010·92	8·186	3	− 5	+ 0·5
1402	"	017·87	15·136	3	−17	+ 1·
1493	"	047·80	10·356	3	− 6	−15·
1571 and 1572	"	096·69	7·181	3	−15	+12·5
1581	"	098·73	9·221	1	− 5	−10·
1601	"	105·71	16·201	3	+ 7	+ 5·5
1608	"	110·58	3·716	3	+ 9	+17·
1623 and 1624	"	115·69	8·831	4	−14	+ 1·
1628 and 1629	"	117·64	10·776	3	−11	−11·5
1638 and 1639	"	119·66	12·796	4	−21	− 6·5
1646 and 1617	"	120·68	13·816	3	−21	− 4·5
1652	"	124·64	0·421	3	+42	−11·
1656 and 1657	"	126·64	2·421	3	+27	+10·
1655	"	129·70	5·481	3	+12	− 1·

TABLE II.

MEASURES OF *α* CORONÆ BOREALIS—*Continued.*

Plate No.	Year.	Julian Day.	Phase.	Wt.	Velocity.	Residual.
1673 and 1674	1908.	2,418,131·62	7·401	4	− 3	− 1·5
1683 and 1684	"	133·57	9·351	3	18	+ 2·
1692................	"	134·68	10·461	2	−29	+ 7·5
1697 and 1698	"	136·65	12·431	4	−24	− 3
1711....	"	138·68	14·461	4	−17	+ 5·
1721 and 1722	"	147·54	5·966	6	0	+ 7·
1739	"	152·65	11·076	2	−44	+20·
1748 and 1749	"	154·57	12·996	6	−36	+ 8·5
1764...............	"	159·61	0·711	4	+37	− 3·
1773 and 1775	"	161·60	2·671	7	+43	− 8·5
1798...............	"	174·54	15·611	2	−16	+ 6·
1809...............	"	175·62	16·681	3	− 3	+13·
1816 and 1817	"	178·55	2·266	6	+41	− 4·
1827	"	179·54	3·256	2	+27	+ 2·5
1836.....	"	181·61	5·326	4	+10	+ 2·
1841 and 1842	"	182·54	6·256	7	+ 8	− 3·5
1852......	"	185·56	9·276	2	−15	− 0·5
1861	"	188·53	12·246	4	−30	+ 3·5
1865......	"	189·56	13·276	1	−15	−12·
1882 and 1883	"	199·54	5·901	8	+11	− 3·5
1894, '95, '96 and '97...	"	204·50	10·861	10	−21	− 2·
1949, 1950 and 1951....	"	247·45	1·746	6	+46	− 7·5
1991	"	278·42	15·361	1	+ 8	−20·

TABLE III.

NORMAL PLACES OF *α* CORONÆ BOREALIS.

No.	Mean Phase.	Mean Velocity.	Wt.	Residual.
1	12·656	− 29·77	6	− 2·37
2	13·777	− 23·54	2	− 2·34
3	14·664	− 18·50	3	− 2·29
4	15·831	− 5·77	2·5	− 0·36
5	16·723	+ 5·00	1·5	+ 6·22
6	0·556	+ 34·63	4	− 2·17
7	2·302	+ 37·14	6	− 0·71
8	3·559	+ 24·33	3	+ 2·66
9	5·657	+ 11·10	4	− 2·47
10.	6·250	+ 2·41	4	+ 1·46
11	7·968	− 6·71	4	− 1·65
12	9·444	− 17·27	2	+ 0·31
13	10·517	− 22·21	3	+ 0·25
14....	11·000	− 24·35	3	+ 0·75

From the radial velocity curve the elements of the orbit were determined by the graphic method of Dr. King.* These were:—

P = 17·355 days

T = J. D. 2,417,725·55

K = 33 km.

e = ·28

ω = 309°

γ = 0 km.

* Astro. Journal, Vol. XXVII.

To obtain elements which would give a curve more nearly suiting the normal places, a least-square solution was made. On the advice of Mr. Plaskett, the period 17·355 days was taken as fixed, and the fourteen observation equations (formed by the method of Lehmann-Filhés*) were determined without considering $\delta\mu$. From these the following normal equations result:—

$$\begin{array}{rrrrrl}
+48x \quad 0{\cdot}4500y & +\ 3{\cdot}7267z & +\ 1{\cdot}1799u & +\ 2{\cdot}8166v & -14{\cdot}4350 & -n = 0 \\
+24{\cdot}0451y & -\ 7{\cdot}2422z & +\ {\cdot}4420u & -\ {\cdot}1050v & -\ 4{\cdot}1083 & -n = 0 \\
 & +23{\cdot}0108z & -\ {\cdot}2779u & -\ {\cdot}8737v & +\ 3{\cdot}9440 & -n = 0 \\
 & & +19{\cdot}5267u & +17{\cdot}5676v & +63{\cdot}4280 & -n = 0 \\
 & & & +17{\cdot}8291v & -67{\cdot}9099 & -n = 0
\end{array}$$

Where

$$x = \delta\gamma$$
$$y = \delta K$$
$$z = K\delta e$$
$$u = -K\delta\omega$$
$$v = \frac{K\mu\delta T}{(1-e^2)^{\frac{3}{2}}}.$$

The solution of the above equations gave the corrections to the element:—

$\delta\gamma$ = + ·635 km.
δK = − ·031 km.
δe = − ·015
$\delta\omega$ = − 3°·76
δT = − ·449 days.

and hence the following new elements:—

γ = + ·635 km.
K = 32·969 km.
e = ·265
ω = 305°·24
T = 2,417,725·101 J. D.
P = 17·355 days.

An ephemeris computed with these elements reduces the value of Σpvv from 498·94 to 217·35, but the differences found between these residuals and the observation equation residuals were in some cases rather large, and at a suggestion by Mr. Harper—whom I owe much for other valuable suggestions as well—a second solution was made. This time δK was omitted owing to the small correction obtained in the first solution, and the new observation equations contain only four unknowns, and hence only four normal equations follow:—

$$\begin{array}{rrrrl}
48x +\ 2{\cdot}0615y & +\ 1{\cdot}1149z & +\ 2{\cdot}0989u & +6{\cdot}1200 & -n = 0 \\
+24{\cdot}8703y & +\ {\cdot}2750z & +\ {\cdot}3566u & -9{\cdot}4127 & -n = 0 \\
 & +19{\cdot}7284z & +18{\cdot}6666u & -5{\cdot}8754 & -n = 0 \\
 & & +19{\cdot}2174u & -4{\cdot}4691 & -n = 0
\end{array}$$

in which

$$x = \delta\gamma$$
$$y = K\delta e$$
$$z = -K\delta\omega$$
$$u = \frac{K\mu\delta T}{(1-e^2)^{\frac{3}{2}}}.$$

The solution gives the corrections:—

$\delta\gamma$ = − ·137
δe = + ·012
$\delta\omega$ = − 1°·558
δT = − ·0475

* A. N., 136, 17, 1894.

The probable error of a normal place of unit weight was computed and found to be ± 3·07, that of a plate as determined from the residual for each plate scaled from the curve to be ± 5·386. The probable error of each element was also computed and is attached to the final values below, the values obtained after applying the corrections found in the second least-squares solution:—

γ = + ·498 km. ± ·330 km.
K = 32·969 km.
e = ·277 ± ·0012
ω = 303°·68 ± 4°·25
T = 2,417,725·054 J. D. ± ·187
P = 17·355 days
$a \sin i$ = 7,560,000

These values give a second reduction of Σpvv from 217·35 to 207·7 and satisfactory differences between equation and ephemeris residuals, the average being ·08. The curve shown is drawn from the above elements and the circles show the position of the observed normal places.

Since the completion of the foregoing treatment of the binary, from the point of view of the hydrogen lines and the calcium line, λ 3934, all the plates have been reviewed, and the magnesium line λ 4481 carefully measured where measurement was possible, with the intent of determining in what respects the orbit deduced from this line might differ from that already determined from the other lines. The method of treatment was exactly similar to that formerly followed. The period was taken as before—17·355 days. The observations were grouped into normals, the same plates being taken together as in the former treatment and the relative weights assigned as before. The normals were plotted, and the best curve possible drawn through them, or rather the graphic method of Dr. King was employed to obtain the elements of the orbit, the velocity curve corresponding to which best suited these normal places.

The elements thus found were as follows:—

γ = + 6·69 km.
K = 33 km.
e = ·35
P = 17·355 days.
ω = 316°

Comparing these with the corresponding elements from the other lines, the main differences are seen to be in the values of γ and e.

In the work which has been done on the radial velocities of stars other than binary, some stars have been found, certain of whose lines gave consistently different velocities from other lines. Among them is *o* Ceti, the emission and absorption lines giving a considerable difference in the value of the radial velocity; so with nearly all Novæ. Nova Aurigæ has been discussed at some length by several astronomers and a similar phenomenon has been noted. Explanations have been suggested as to the cause of the different displacement of different lines. These consist chiefly of two,—first, a lagging envelope producing the lines of less displacement towards the red end of the spectrum, and second, an ever-expanding envelope coming from a continuously productive source. How far such conditions would go to explain a state of affairs such as we find in *α* Coronæ, it is difficult to say. We may also look upon the system as receding with a velocity of 6·69 km. per second—the velocity given by the magnesium line—and constantly expelling hydrogen and calcium vapors, the velocity of expulsion affected by the periodic recurrence of physical conditions, brought about by the changing relative positions of the stars in the orbit, which conditions fail to influence magnesium in any way so far as changes in the lines are concerned. This is quite plausible, for in the spectroscopic study of the Sun's surface, regions have been found, such as sun-spots, the spectra of which show certain lines considerably affected in character and position, while other lines denoting other elements remain unchanged.

After the first part of this work had been completed, Mr. Jordan issued from the Allegheny Observatory his publication on the Orbit of α Coronæ Borealis. Comparing his results with those obtained here from the lines H_ζ, H_γ, H_δ and K, it was seen that, although on the whole they agreed fairly well, there was considerable difference in the values of e. This is largely due no doubt to the fact that Mr. Jordan used the line (Mg) λ 4481, together with the above lines in the determination of his elements. However, the fact that the plates we obtained here were measured by several men and all agreed that the Mg line gave large discrepancies seems to justify the separate treatment.

The accompanying curves represent—Fig. 23, the hydrogen and calcium curve, and Fig. 24 the curve from the hydrogen and calcium lines, and that from the magnesium lines.

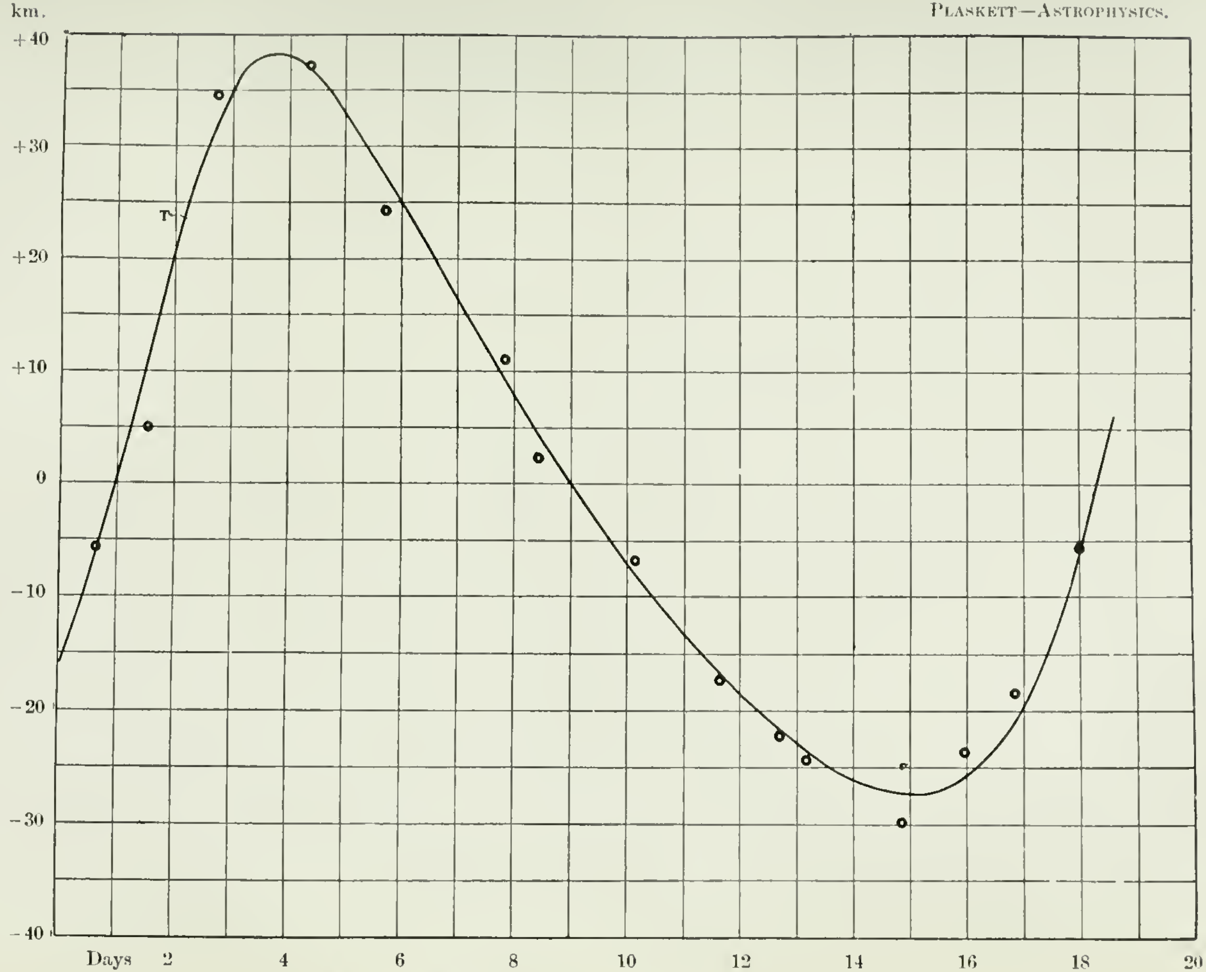


Fig. 23—α Coronæ Borealis, Curve from Hydrogen Lines and Calcium Line.

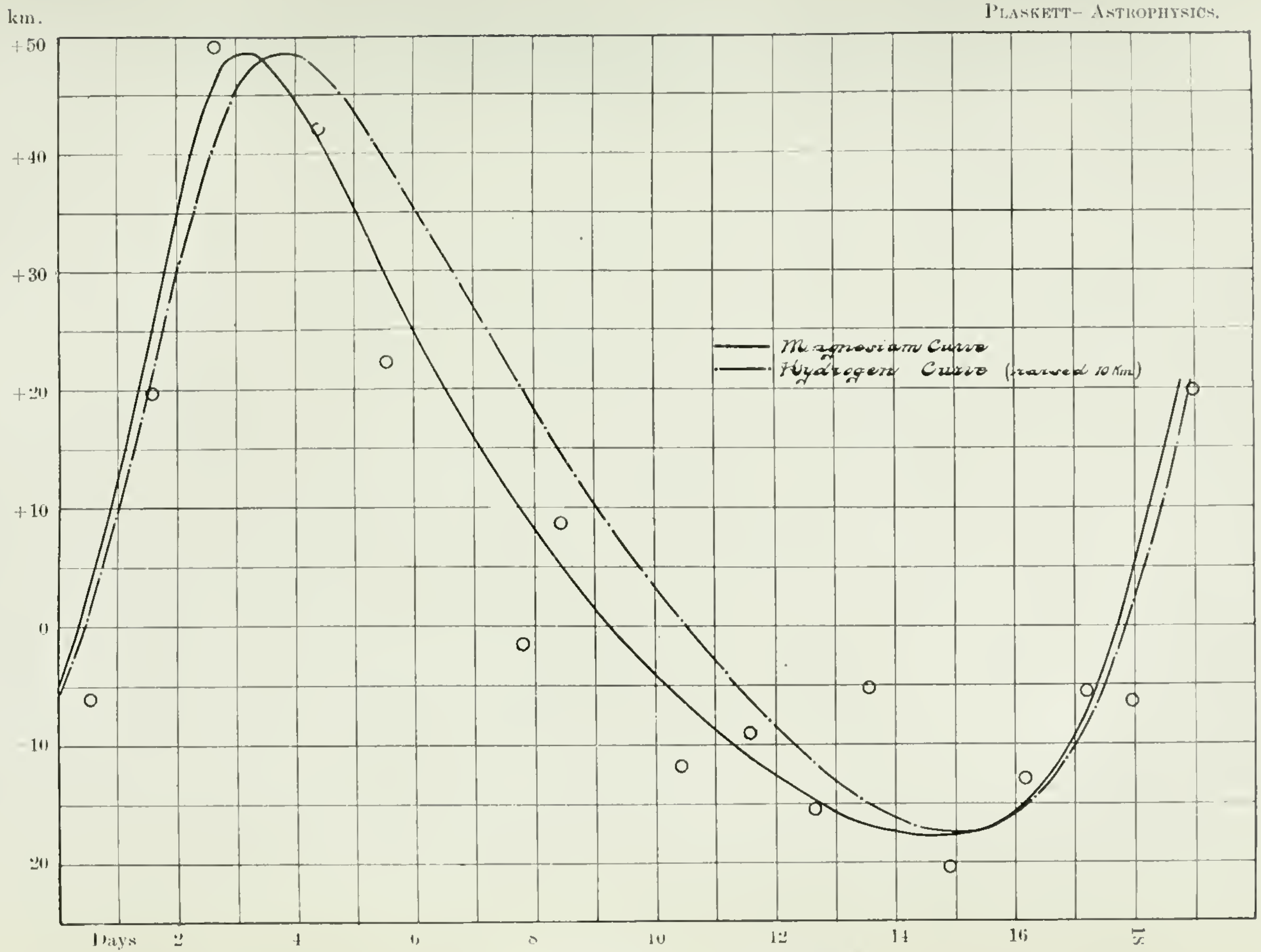


FIG. 24—Velocity Curve of α Coronæ Borealis.

APPENDIX C.

THE TWENTY-THREE FOOT SOLAR SPECTROGRAPH.

RALPH E. DELURY.

This instrument is adapted for analyzing with great dispersion the light of the sun and of laboratory sources, such as the electric spark, arc, flame, &c., and is primarily intended for investigating the conditions in the sun. It is situated in the basement of the Observatory in the Solar Research Room, which is connected on the north side by a cement tunnel to the louvred passage of the Coelostat House from which the image of the sun is directed to the spectrograph, and on the east side to the Chemical Laboratory, which is used also as a photographic dark-room in which are developed the photographs of the spectra taken in the spectrograph. The spectrograph may be described under the following heads:—(*a*) Optical Parts; (*b*) Mountings; (*c*) Slit-Attachment; (*d*) Camera and Plate-Holders; (*e*) Guide-plate for the Sun's Image.

(a) Optical Parts.

The optical parts are:—a slit with metal jaws 1·3 in. (3·4cm.) long, mounted so as to leave 1 in. (2·5 cm.) clear, and provided with a micrometer, for adjusting the width of the slit, reading to thousandths of an inch; a six-inch (15 cm.) collimating lens of 22 ft. 10 in. (695·5 cm.) focal length for yellow light; and one of the earlier Michelson plane gratings of speculum metal having a 4·25 in. by 4·75 in. (10·8 cm. by 12 cm.) surface ruled 12,700 lines to 1 in. (500 lines to 1 mm.). These parts are arranged after the plan described by O. Von Littrow in 1863 (see Kayser Handbuch der Spectroscopie 1, 513). In this arrangement the slit is placed at (or near) the focus of the lens and the dispersing system (in this case the grating) is placed on the other side of the lens in such a manner that the dispersed light returns through the lens which focuses it near the slit, as illustrated in Fig. 25, which represents a vertical section through the middle of the spectrograph and mountings. *S* is the slit, *L* the lens, placed at its focal distance from the slit and *G* is the reflecting grating placed just behind the lens *L*, and tilted so that its ruled lines are parallel to the slit. The beam of light to be examined passes through *S* spreading out to fill *L*, which renders it parallel before it reaches *G*, which disperses it and reflects or diffracts it back through *L*. By tilting the top of the grating slightly towards the slit the diffracted light is made to pass back through the lens which focuses it below the slit where it may be examined with an eye-piece or photographed in the plate-holder (*C*). By rotating *G* about a vertical axis on either side of the normal, the different parts of the different orders of spectra are diffracted back through the lens *L*, and by sliding the lens forward or backward the light of the different wave-lengths may be focussed sharply at *C*.

(b) Mountings.

The two tilting movements of the grating mentioned in (*a*) were provided in the cell of the grating by the John A. Brashear Co., from whom it was purchased. The forward tilt is given by screw *J* and suitable springs pressing against the back of the grating; and a screw placed on the side gives the means for adjusting the lines of the grating parallel to the slit. The grating in the cell rests on the stand *G′*, the axis of which fits into a cylindrical socket in the bottom of the end, *B*, of the spectrograph, and by turning a handle *K''* (Fig. 26), attached to a worm which works in the toothed sector, *K*, which is attached rigidly to the axis of *G'*, the grating may be rotated about this axis which passes through the centre of the plane of the grating, thus reflecting any desired part of the spectrum of any order through the lens to *C*. By means of the vernier-pointer, *V*, readings to tenths of a degree may be made on the graduated arc *E* and a record of these readings with the corresponding wave-lengths of the spectra reflected to *C* is kept, so that by turning *K''* until *V* points to the proper angle, any desired wave-length may be reflected to the centre of *C* and the grating may be clamped in this position by tightening the screw-clamp *K'*. The lens may be shifted and clamped at any focus by means of the handle *H*, and the position of the pointer *F* is read on a millimetre scale attached to the bottom of *B*, as shown in Fig. 26. Ordinarily the side represented in Fig. 26 is facing downwards and a mirror is placed below the scale and the arc so that the reading may be made conveniently. In addition to these movements of the grating and lens, the mountings permit of rotation of the spectrograph as a whole about its axis, *i.e.*, about the line joining the centre of the slit and the centre of the lens. This idea was suggested by Mr. Plaskett (Report Chief Astronomer for the year ending March 31, 1907, p. 58) and employed by Newall (Monthly Notices 68, 7, Nov., 1907), and used also in the spectrograph mounted vertically and used with the vertical telescope of the Mount Wilson Solar Observatory. It facilitates the study of the rotation of the sun, by enabling the observer to reflect the limbs of the sun at opposite ends of any diameter always tangentially to the slit, as described in detail under (*c*). in Fig. 25, *A* and *B* are the two ends resting on the supports *A'* and *B'* which rest on the cement piers *P* and *P'* built on the cement floor. The end *A* is of half-inch cast brass. It has a V-groove running around its circular rim into which the semi-circular cast-iron support *A'* is bevelled to fit. The back of *A* is a rectangular box 3 in. by 11 in. by 14 in., over which the wooden box *O* is tightly screwed and clamped. The axis of *B*, which is of cast-iron, rests in a cylindrical bearing in the brass support *B'*. The box on *B* projects 3 in. on top and 16 in. on the sides and bottom to give good support for the lens and grating and to provide a surface to which the box *O* is screwed tightly. The bottom of *B* is milled smooth to give easy bearings for the grating and lens mountings. The box *O* is painted black on the inside and is provided with diaphragms, *M*, to prevent as much as possible the diffused light reflected from the lens and grating from striking the photographic plate in the holder, *C*. There is a hinged door, *D*, just above the grating and lens so that these may be conveniently reached.

The spectrograph thus rests at its two ends on the supports *A'* and *B'* on which it may be rotated about its axis. The rim of *A* is toothed (*T*, Fig. 25) and into these teeth fits a gear attached to *T'* (Fig. 27), which is supported in *A'* and which may be turned by means of the handle *T'* (Figs. 27 and 28). The circular face of *A* is graduated in degrees and by means of the vernier attached to *A'* the angle may be read to tenths of degrees. This is necessary in determining the 'East and West' line by allowing the image of the sun to drift across the face of *A* tangentially to some arbitrary line on *A*. From this angle read on the vernier, the position of the diameter of the sun's disc which lies in the plane of the sun's equator, is easily found since the inclination of these two lines to each other at any time is known, and hence the arbitrary line on *A* may be made parallel to any required diameter of the sun's image.

The mountings were constructed by the Victoria Foundry Co. from designs made in accordance with the suggestions of Mr. Plaskett who supervised the construction of the spectrograph. The mechanisms for rotating the grating and the spectrograph were skillfully constructed by Messrs. Mackay and Lucas.

(*c*) *Slit-Attachment.*

The slit-attachment is shown in Fig. 27. It was designed by Mr. Plaskett and made by the John A. Brashear Co., *a*, *b*, *c*, *d* are 45° reflecting prisms mounted on

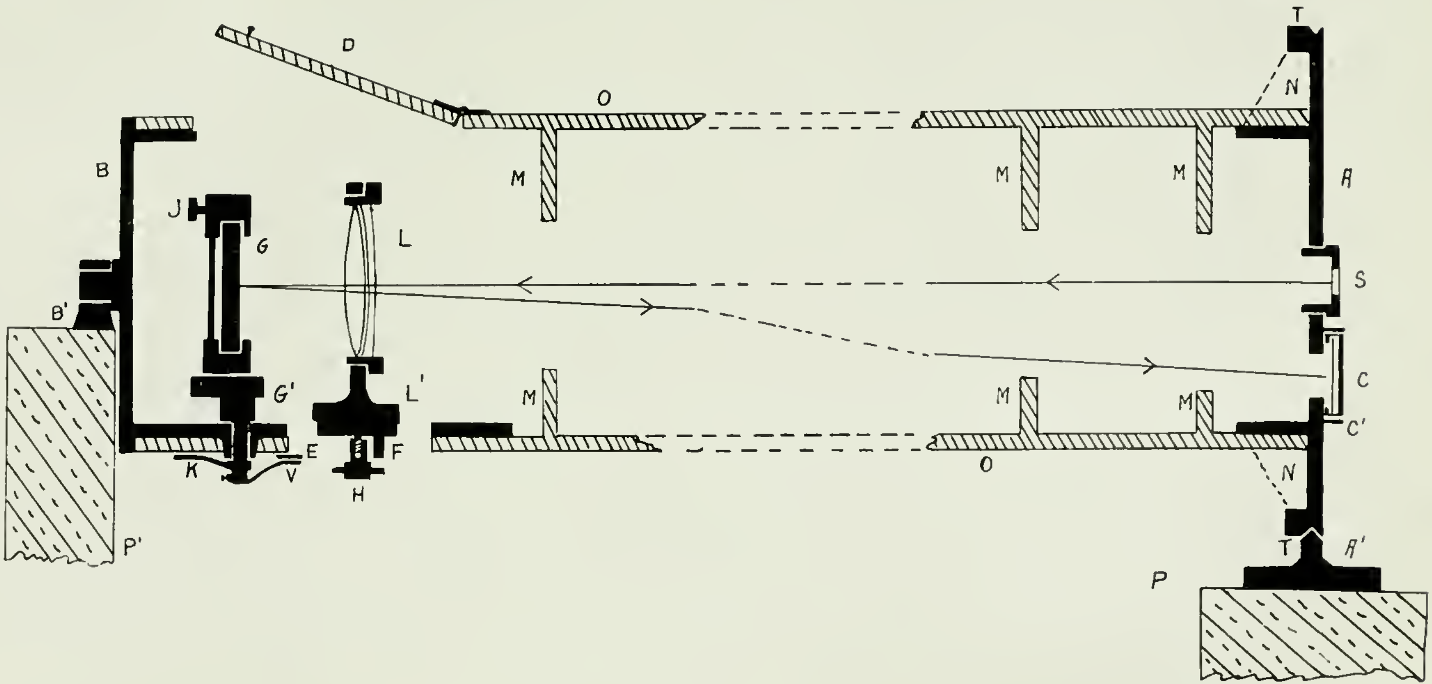


Fig. 25—Solar Spectrograph.

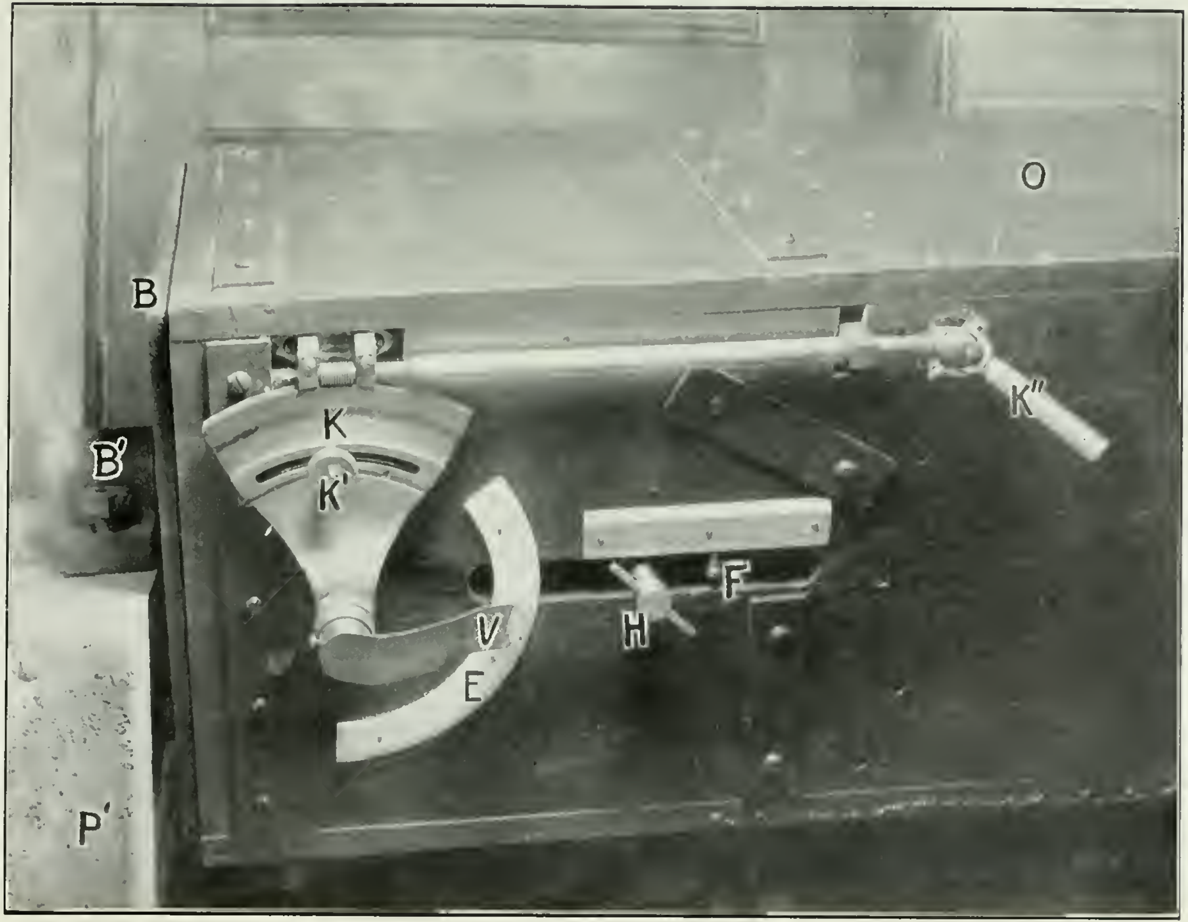


FIG. 26—Rear end of Solar Spectrograph.

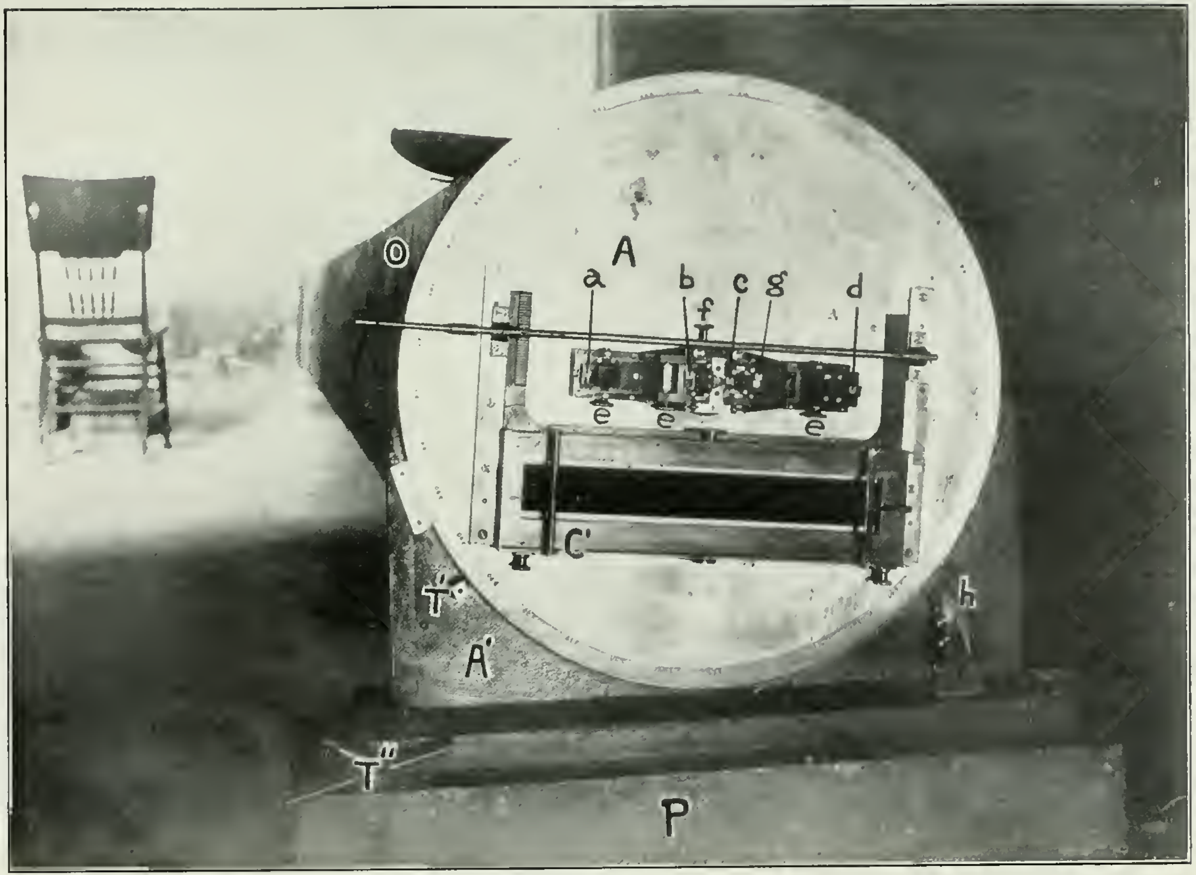


FIG. 27—Slit Mechanism of Solar Spectrograph.

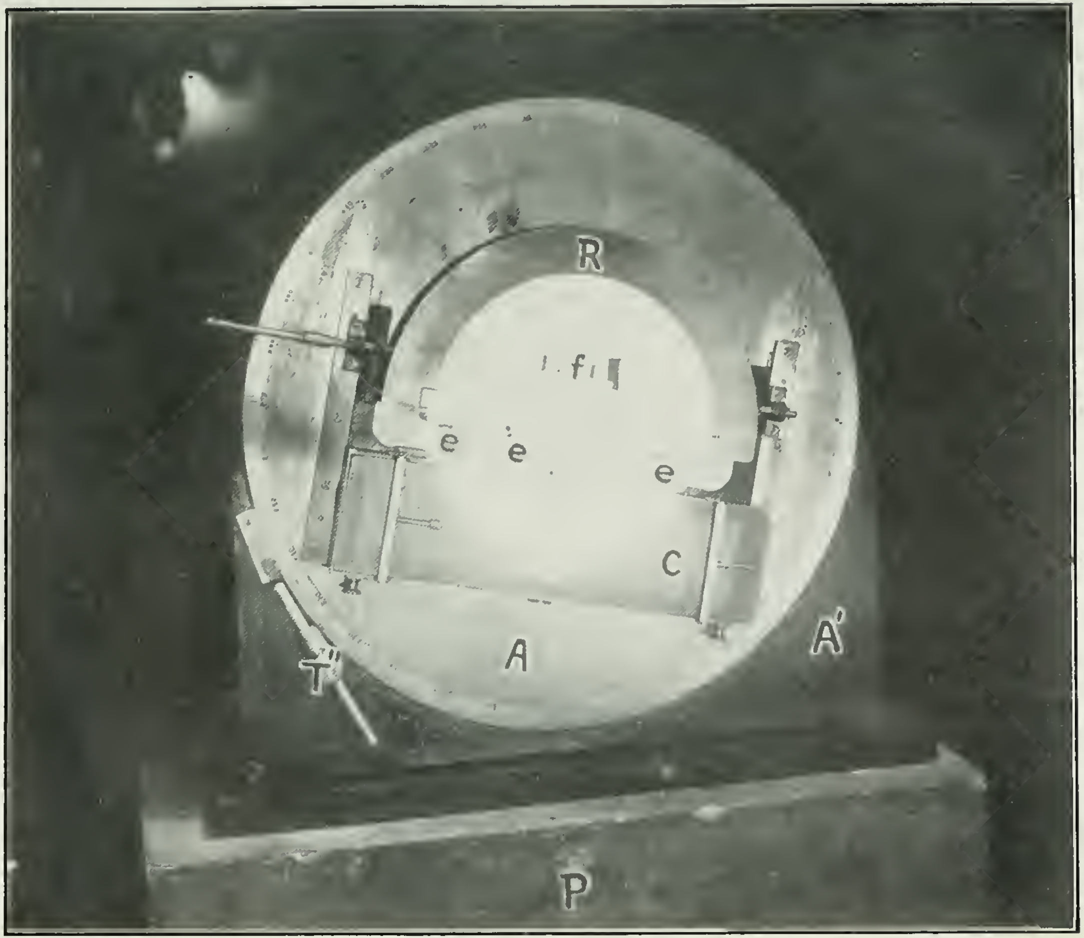


FIG. 28—Front End of Solar Spectrograph.

brass plates which are supplied with racks and pinions *e, e, e*. When the sun's image is placed concentric with the circular front of the spectrograph, the prism *d* is moved to take the light from any desired point near the sun's east limb and reflects it to the prism *c*, which directs it down through the slit to the lens and grating. In a similar way the larger prism, *a*, reflects to the west limb through the prism *b*, whose tapering ends form a V-shaped space into which the tapering end of *c* fits closely, so that the spectrum from the east limb is placed closely between two strips of the spectrum from the west limb. The widths of these strips may be varied by moving the plate holding the prisms *b* and *c* back and forth, and by means of two little slides placed directly over the ends of the slit. When desired the shutter, *f*, may be used to keep the light passing through the slit from reaching the lens. In place of the plate bearing the prisms *b* and *c*, the attachment, *h*, may be used and by means of two adjustable screws which serve as stops between which it may be shifted so that two spectra of any desired widths may be taken in succession, the one being placed between two strips of the other, the V-shaped openings and the V-shaped slides providing the means for adjusting the widths of the strips. The prism arrangement is intended for obtaining plates for measuring the rotation of the sun or for any investigations where it is desirable to take the spectra simultaneously, while the attachment, *h*, is designed for taking spectra in succession, and of course the time of an exposure will be less in using it than in using the prisms which diminish the intensity of the light considerably.

(d) Camera and Plate-holders.

The plate-holders are made to take a 2·5 in. x 12 in. plate, a hinged back with three springs pressing the back of the plate at its edges holding the plate firmly in place without danger of bending it. The plate-holder, *C*, Fig. 28, is slid into the frame *C′*, Fig. 27, and clamped, as shown in Fig. 28. The frame *C′* can be raised or lowered by rack and pinion as shown, so that several strips of spectra may be put side by side on the same plate, and spaced as desired by reference to the millimetre scale on the right hand side. The plate-holder fits over a 1·5 in. opening in *A*, Fig. 27. The frame *C′* may be tilted slightly so that the plane of the photographic plate may be made to follow more closely the focal surface of the lens.

(e) Guide-plate for the Sun's Image.

In Fig. 28 is shown the guide-plate *R*, screwed tightly over the slit-attachment. *R* has a number of concentric circles and a diameter scratched on its surface and blackened so as to be easily visible. These circles are concentric with the circular front of the end-piece *A*. The figure shows the sun's image placed concentric with these circles. At each end of the diameter of these circles is a small rectangular opening, back of which is a little slotted silver-plated shutter which runs in bevelled slides. These shutters may be adjusted by means of the millimetre scales on the edges of the two rectangular openings, so that the slots are tangential to the same circle whose diameter is read off directly, the distance between the nearest ends of the rectangular openings being 200 mm. In the same manner the diameter of the solar image is measured. Back of these slots the prisms are adjusted to give the maximum brightness in the light reflected from the grating, and thus the spectrum from a point in the image near one limit may be placed between two strips of the spectrum from a part of the image at the other end of the diameter. To get any desired latitude on the sun's disc, the image is allowed to drift across the guide-plate tangentially to the diameter—the arbitrary line mentioned above—scratched on the plate and the vernier reading taken of the angle corresponding to this 'east and west line' which makes a known angle at any time with the sun's equator. The handle *T″* is then turned to place the diameter in the desired position. One slit will thus be placed at a certain latitude north of the sun's equator and the other at the same latitude south of the equator, and the displacement of the spectral lines resulting therefrom will give a measure of the rotation of the sun in this latitude by turning T'' so that the slits are placed at the same latitude, but on the opposite sides of the equator to those of the former position the same displacement should result if: (1) the sun's equator has been accurately determined, (2) the image in both cases is concentric with the circles on the guide-plate, and (3) the rotation of the sun is the same for the same latitude in both hemispheres. Taking the mean of the two measures from plates taken in succession would eliminate most of the errors introduced.

SOME RESULTS.

The spectrograph was mounted in August, 1908. The cement piers, P, P' (Figs. 26, 27, 28), are made so as to make the axis of the spectrograph coincident with the axis of the concave mirror in the coelostat house, when the image from it is placed in the middle of the face, A, of the spectrograph, P being a few inches higher than P', giving the proper inclination (about 3½°). The spectrograph was adjusted and numerous test photographs were taken in the various parts from λ 3800 to λ 6000. To keep the light reflected back from the surfaces of the lenses from striking the photographic plate the ordinary method of putting a strip across the lens, parallel to the plate, was tried; also, in some tests, the lens was tilted forward so as to throw the reflected light below the photographic plate. This latter method does not alter the character of the lines very much and possesses the advantage of doing away with the strip which masks the central part of the grating and lens. It was soon found that the character of the spectral lines in the different orders from either the left or right inclinations of the grating was not as good as desired. By directly reflected light the grating appears to have three areas of different reflecting powers and it was found that the spectra from these areas did not harmonize. The best spectra were obtained by masking the two smaller areas and using the remaining strip which constituted the right three-fifths of the grating. Even from this part of the grating the spectral lines are poor. In the first and second orders the spectra from the grating tilted to the right are much more intense than those obtained when the grating is tilted to the left, while the reverse is the case in the third order, and furthermore the lines are sharper when the grating is tilted to the left. Consequently the rotation plates obtained were made with the grating tilted to the left and the left two-fifths of the grating masked together with the central strip placed over the face of the lens to cut off the reflected light. The focal curves, for left and right inclinations of the grating were obtained in the first three and part of the fourth orders, for the whole grating with the central strip masked. These are plotted in Fig. 29, the dotted lines being the photographically determined curves and the continuous lines, those visually determined. It will be seen that the locus of the foci for any wave-length in the different orders, instead of being a straight line of constant focus, is a curve (nearly a straight line) of varying focus. This is very likely due to the character of the reflecting surfaces between the scratches on the grating, for it may be assumed that the diamond scratching-point distorted the strips between the scratches in such a way as to make one side of the surface slightly convex and the other slightly concave, as might easily happen since on one side of the diamond-point the speculum is scratched or furrowed, while on the other side it is not. At any rate the grating is not what it should be for the work planned for this spectrograph. This work must necessarily deal with the exact positions and character of the spectral lines and any large or small changes in these. It is chiefly the minute changes that are of interest at present in solar investigations, and the very best possible definition of the spectrum lines is required for a satisfactory measurement of these changes. It is hoped that a new grating of first quality may soon be secured, as such is necessary to yield satisfactory results. Everything else is now in readiness for the careful study of solar problems.

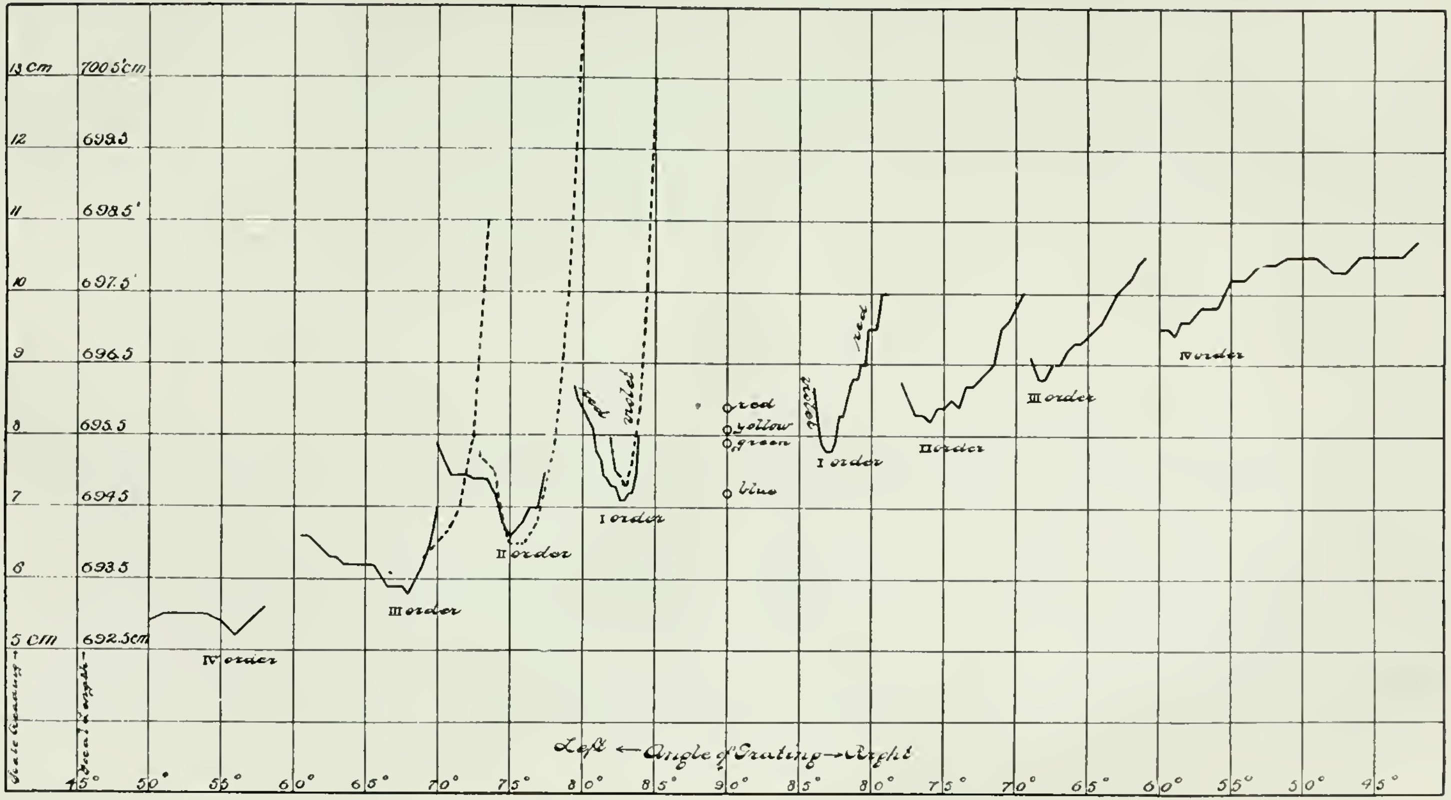
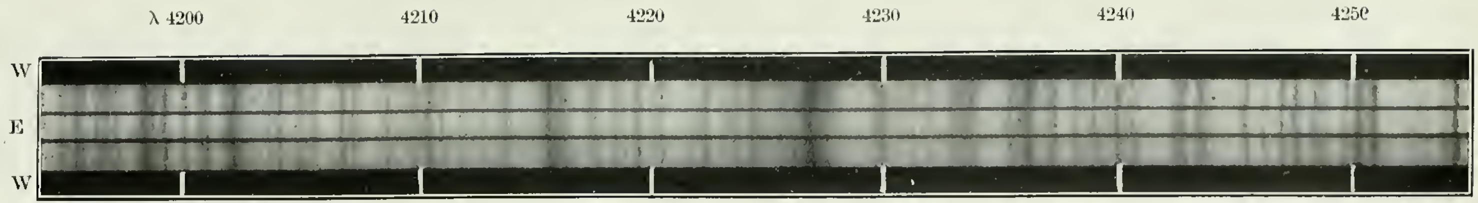


FIG. 29—Focal Curves of Solar Spectrograph.



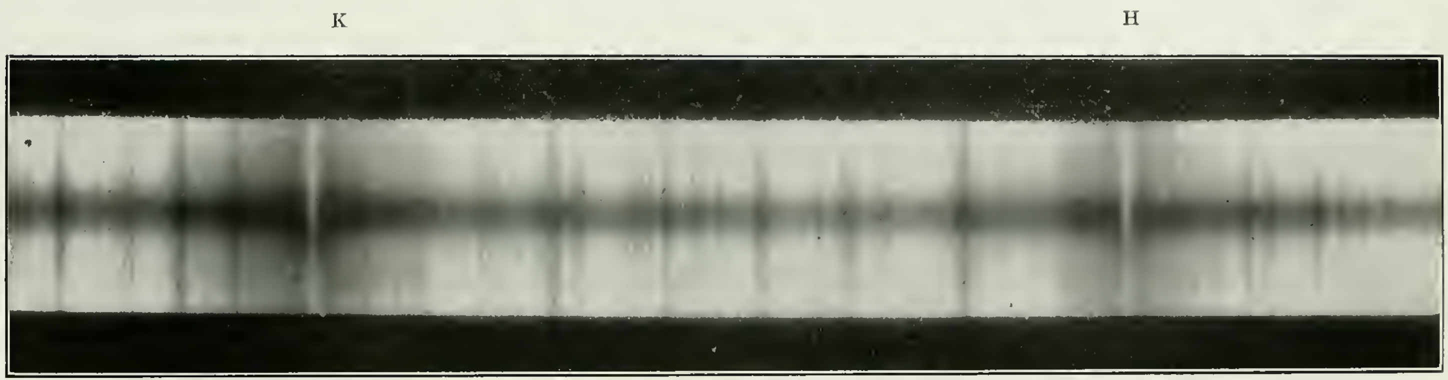


FIG. 30—Part of Rotation Plate L 413. Scale of the original, 1 A.U. = 1.115 mm.
Part of sun-spot Plate, L 405, showing emission in K and H. Scale of the original 1 A.U. = 1.11 mm.

In addition to rotation-plates, plates of the sun spot spectra were obtained whenever the conditions were suitable. Samples of both are shown in Fig. 30. In the following table the measurements of a sample rotation-plate (L 413) are given. In taking these plates long exposures (10 or 12 minutes in the third order near 4300) were necessary owing to the fact that a very small area of the grating was used. During this interval the sun's image would become blurred and distorted, thus allowing light from different points on the sun's surface to pass through the slits. The poor values in the following table are probably partially due to this cause and partially also to aberrations produced by some of the curious properties of the grating and to the very poorly defined lines produced. Many of the lines were so poor that measurements of them were not made and many of the finer lines were spread out and weakened so as to be almost invisible. It is hoped that the new grating will remedy these defects.

Measurements of plate L 413, 0°·0, slits 226mm. apart, diameter of the sun 232 mm.:—

λ	Mean of 5 mm. readings middle strip	Mean of 5 mm. readings lower strip.	Mean of 5 mm. readings upper strip.	Mean difference.	2δλ	Velocity km. per sec.
4136·678	2·9828	3·0314	3·0430	0·0544	0·0488	1·77
4137·156	3·5233	3·5650	3·5931	557	499	1·81
4140·089	6·7876	6·8342	6·8411	500	448	1·62
4147·836	15·4109	15·4623	15·4711	558	500	1·81
4149·533	17·2990	17·3517	17·3520	529	474	1·71
4150·411	18·2771	18·3256	18·3411	513	460	1·66
4154·071	22·5768	22·6215	22·6324	502	450	1·62
4154·667	23·0205	23·0724	23·0828	571	512	1 85
4154·976	23·3789	23·4309	23·4333	532	477	1·72
4157·948	26·6898	26·7408	26·7492	452	405	1·46
4157·948	26·6868	26·7431	26·7558	627	562	2·03
4158·959	27·8144	27·8550	27·8718	490	439	1·58
4163·818	33·2268	33·2824	33·2919	604	542	1·95
4169·110	39·1097	39·1550	39·1763	560	502	1·81
4171·068	41·2803	41·3317	41·3462	587	526	1·89
4174·095	44·6767	44·7188	44·7331	489	438	1·57
4175·806	46·6005	46·6480	46·6549	510	457	1·64
4176·739	47·6361	47·6780	47·6990	524	470	1·69
4179·025	50·1899	50·2346	50·2450	499	447	1·60
4179·025	50·1928	50·2358	50·2405	454	407	1·47
4181·919	53·4269	53·4799	53·4878	571	512	1·84
4182·548	54·1376	54·1827	54·1958	517	463	1 66
4187·204	59·3360	59·3872	59·3987	570	511	1·83
4187·943	60·1723	60·2212	60·2388	577	517	1·85
4187·943	60·1754	60·2208	60·2423	562	504	1·81
4196·372	69·5688	69·6076	69·6247	474	425	1·52
4199·267	72·7938	72·8540	72·8663	664	596	2·13
4199·267	72·8065	72·8626	72·8720	608	545	1·95
4201·089	74·8526	74·9020	74·9137	553	496	1·77
4202·919	76·8960	76·9398	76·9492	485	434	1·55
4203·730	77·8073	77·8667	77·8677	599	537	1·92
4204·622	78·7510	78·8003	78·8116	550	493	1·76
4207·291	81·7826	81·8279	81·8413	520	466	1·66
4208·766	83·4393	83·4904	83·4972	545	488	1·74
4213·812	89·0824	89·1385	89 1469	601	539	1·92
4216·351	91·9078	91·9656	91·9685	593	532	1·89
4220·509	96·5671	96·6150	96·6305	557	499	1·77
4233·328	110·4159	110·4651	110·4745	539	483	1·71
4236·112	113·1064	113·1574	113·1659	553	496	1·76
4236·279	113·2910	113·3460	113·3567	604	542	1·92
4236·279	113·2911	113·3482	113·3563	612	549	1·94
4238·970	116·3636	116·4092	116·4177	499	447	1·58
4246·966	126·2158	126·2723	126·2819	613	550	1·94
4258·774	139·0965	139·1464	139·1514	524	470	1·66
4265·418	147·6064	147·6630	147·6666	584	524	1·84
4268·915	150·7909	150·8440	150·8464	543	487	1·71
4271·325	153·4834	153·5426	153·5454	606	544	1·91
4271·934	154·6638	154·7190	154·7275	595	533	1·87

Measurements of Plate L 413 (Continued).

λ	Mean of 5 mm. readings middle strip	Mean of 5 mm. readings lower strip	Mean of 5 mm. readings upper strip.	Mean difference.	2δλ	Velocity km. per sec.
4274·958	157·5662	157·6159	157 6230	0·0533	0·0478	1·68
4279·643	162·8316	162·8856	162·8923	574	515	1·81
4282·565	166·1090	166·1575	166·1650	523	469	1·64
4283·169	166·7867	166·8456	166·8437	580	520	1·82
4287·566	171 7201	171·7671	171·7684	477	427	1·49
4288·310	172·5555	172·6182	172·6188	630	565	1·98
4289·525	173·9153	173·9697	173·9714	553	496	1·73
4289·885	174·3185	174·3698	174·3829	579	519	1·82
4290·080	174·8803	174·9256	174·9400	525	475	1·66
4390·377	175·0671	175·1189	175·1266	557	499	1·74
4291·114	176·2785	176·3263	176·3375	534	479	1·67
4295·383	181·0754	181·1309	181·1437	619	555	1·94
4300·211	185·9150	185·9642	185·9754	548	491	1·71
4300·211	184·7011	184·7533	184·7603	557	499	1·74
4302 692	187·4850	187·5400	187·5453	577	517	1·80
4312·462	200·4632	200·5002	200·5203	571	512	1·78
4316·962	205·6104	205·6557	205·6737	543	487	1·69
4320·907	207·9588	207·9978	207·0193	498	446	1·55
4321·119	208·1885	208·2350	208·2553	567	508	1·76
4331·811	220·2219	220·2719	220·2817	549	492	1·71
4337·216	226 3078	226 3617	226·3729	595	533	1·85
4338·084	227 2934	227·3348	227·3580	530	475	1·64
4338·430	227·6796	227·7315	227·7403	563	505	1·75
4339·617	229·0152	229 0619	229·0751	533	478	1·65
4339·882	229·3068	229·3559	229·3787	605	542	1·87
4343 861	233·7958	233·8477	233·8647	604	542	1·87
4344·451	234·4621	234·5066	234·5309	567	508	1·74
4344·670	234·7022	234·7509	234·7669	567	508	1 75
4344·670	234·7023	234·7510	234·7679	572	513	1·77
4351·216	242·0735	242·1259	242·1400	595	533	1·84
4351·216	242·0719	242·1223	242·1343	564	506	1·74
					Mean....	1·77

The scale, which is practically constant over the whole plate, is 1 A. U. = 1·115 mm., hence $2\delta\lambda = \frac{\text{mean difference}}{1{\cdot}115}$. The velocity is $\frac{\delta\lambda}{\lambda}$ (Velocity of light) = $299860 \frac{\delta\lambda}{\lambda}$ km. per second. Heliographic latitude of the centre of the sun's disc was 6° 26′ when plate L 413 was taken, consequently the velocity at the equator, as determined by this plate is $\frac{232}{226} \cdot 1{\cdot}77 \cdot \frac{1}{\cos 6^\circ\ 26'} = 1{\cdot}83$ km. per second. This value is the linear velocity of the sun's limit at the equator, as measured, and will evidently give the synodic period of the rotation, the value for which is 1·86, as given by Adams. To reduce to the sidereal period requires the addition of 0·14km., making the velocity 1·97km. The generally accepted value is approximately 2·05km. per second, and the deficiency in the present case may be safely ascribed to errors introduced by the grating.

APPENDIX D.

DOUBLE STAR MEASURES. PHOTOGRAPHS OF COMET MOREHOUSE. OCCULTATIONS OF STARS BY THE MOON. FIELD INSTRUMENTS. ABERRATIONS OF THE STELLAR CAMERA OBJECTIVE.

R. M. Motherwell.

DOUBLE STAR MEASURES.

Three half nights each week have been devoted to micrometer and photographic work, including the series of tests made on the camera objective. Micrometer work has consisted principally of the determination of the position angles and distances of visual double stars, the working list being prepared from Burnham's Catalogue of Double Stars. An endeavour is being made to measure only those which have not been measured for some time or whose motion is such as to require frequent measurements.

The filar micrometer used, is the Warner and Swasey type, and it has been found rather unsatisfactory in the determination of position angles owing to there being no quick-motion screw for moving the position circle. A self-registering attachment would be a great improvement as the present arrangement requires the frequent use of a hand-lamp which dazzles the eye. Considerable difficulty has also been experienced in keeping the eye-piece clear of frost in the winter, each setting of the micrometer-head or position-circle requiring several clearings of the glass.

Following are the measures made during the past year, each measure being the mean of eight settings for position angle and four double-distance measures:—

Star No.	Date.	Position Angle.	Distance.	Star No.	Date.	Position Angle.	Distance.
		°	"			°	"
151..........	1908·786	279 0	1·34	7117....	1908·464	298·2	Cloudy.
269..........	1908 765	113·9	5·78	7318..........	1908·317	184·3	3·81
1427..........	1908·921	313·9	3·28	....	1908·575	186·8	4·01
1750..........	1908·921	249·1	17·24	7429·5........	1909·429	252·9	9·39
2040..	1908·921	218·8	4·21	7450..........	1908·575	15·2	8·70
2043..........	1908·921	328·5	....	....	1908·617	14·3	9·21
2536...... ...	1908·996	305·3	2 73	....	1908·631	14·0	9·53
3398..........	1908 996	6·4	....	....	1909·412	14·9	8·91
4452....... ..	1909·341	43·3	2·60	....	1909·429	13 9	9·32
4530...... ..	1909·086	139·6	6·12	7451....	1908·317	255·4	16·64
4890..........	1908·247	196·9	5·14	....	1908·464	254·1	17·11
....	1909·086	196·7	4·88	....	1908·575	254·8	16·57
....	1909·303	197·0	5·11	....	1908·617	256·0	16 17
5011..........	1908·247	45·5	1·88	....	1908·631	254·6	16·65
5014...... ..	1909·202	235·9	3·50	7458	1908·575	288·9	3 24
....	1909·303	234 0	3·39	7604..........	1908 464	211·9	17·12
....	1909 341	235·5	3·40	....	1908·497	211·9	16 89
5125...... .	1908·304	146·5	3·43	....	1908·575	214·0	16·59
5319..........	1908·304	176·9	2·50	7642..	1908·575	89 8	1·77
....	1908·426	177·3	2·78	7915..........	1908·439	18·2	5·03
5337.........	1908·977	295·2	30·78	....	1908·492	20·0	5 38
....	1909·183	294·4	31 50	....	1908·617	18·4	5·48
....	1909·202	294·8	31·89	5388..........	1908 247	117·4	3 88
....	1909·399	294·3	31·09	....	1908·426	115 5	3 43
6780..	1909·183	353·4	Too frosty	....	1909·183	114·1	3 89
7065..........	1909·183	111·1	"	....	1909·399	116·4	3 82

Star No.	Date.	Position Angle.	Distance.	Star No.	Date.	Position Angle.	Distance.
		°	"			°	"
5126........	1908·247	68·6	3·05	....	1908·641	338·7	27·47
....	1909·303	68·1	3·50	....	1908·765	339·3	26·90
....	1909·399	66·5	3·27	9034........	1908·541	51·9	7·84
5705........	1909·303	32·2	3·37	....	1908·581	50·5	8·50
5809........	1908·977	27·6	24·86	9037........	1908·541	7·41	5·90
....	1909·078	28·0	25·17	....	1908·581	7·33	5·88
....	1909·086	30·7	24·90	....	1908·641	7·24	5·68
....	1909·202	27·6	24·89	....	1908·765	7·12	5·91
....	1909·303	28·3	25·33	9167........	1908·541	154·8	0·84
6030........	1908·426	308·5	2·80	....	1908·613	154·5	0·89
6033........	1908·426	108·8	6·28	9604........	1908·541	9·7	2·81
....	1909·078	107·8	5·72	....	1908·613	10·5	2·75
....	1909·202	106·8	6·06	9693........	1908·492	138·6	4·07
....	1909·303	106·7	6·57	....	1908·522	138·0	3·74
6035........	1909·078	178·9	16·32	....	1908·575	138·3	....
....	1909·086	181·7	16·10	....	1908·581	138·6	4·01
....	1909·183	179·3	16·50	....	1908·613	137·8	3·93
....	1909·399	179·4	16·41	9905........	1908·600	271·1	....
6211........	1908·426	359·2	2·60	9969........	1908·600	155·7	Cloudy.
6386........	1909·360	119·0	2·99	9977........	1908·641	170·1	4·31
7927........	1908·617	127·0	33·08	....	1908·765	171·0	4·31
....	1908·631	125·3	33·24	....	1908·786	171·8	3·50
....	1909·429	126·5	33·21	10061........	1908·765	185·3	7·18
7930........	1908·617	180·8	24·94	10072........	1908·613	212·2	Hazy.
....	1908·631	180·5	24·93	10305........	1908·522	74·2	"
8003........	1908·309	312·4	4·15	10385........	1908·581	111·0	3·51
....	1908·445	313·3	4·17	10685........	1908·522	164·6	1·89
8082........	1908·309	22·8	8·11	10709........	1908·613	158·3	3·39
....	1908·426	22·6	7·98	10742........	1908·613	349·2	22·90
....	1908·439	25·4	7·91	....	1908·765	351·5	23·89
....	1908·445	24·4	7·95	10773........	1908·522	309·3	3·37
8303........	1908·309	258·5	2·67	....	1908·541	307·9	....
....	1908·445	258·7	....	....	1908·581	307·5	3·71
....	1908·617	259·7	2·53	....	1908·786	307·8	3·44
8364........	1908·617	81·6	2·71	....	1908·805	308·8	3·18
....	1908·746	78·2	2·87	10901........	1908·613	112·6	5·68
....	1908·765	79·4	2·70	....	1908·641	112·0	5·60
....	1909·429	78·2	3·00	12043........	1908·765	34·3	5·91
8384........	1908·624	79·0	1·49	12753........	1908·765	160·1	3·09
8404........	1908·631	338·4	27·15				

COMET 1908c (MOREHOUSE).

This comet was visible for over three months, but dense smoke and unusually cloudy weather prevented any attempt at obtaining an extensive series of photographs. Single exposures were made on seven different nights, with the Brashear Doublet attached to the equatorial telescope. A filar micrometer was used in guiding and was very satisfactory in preventing drifting but, owing to the smallness of its field, did not permit of the head of the comet being shifted appreciably from the centre of the camera field. Had it been possible to so shift the head, more of the tail would have been included in the photograph.

The following table gives the date and duration of each exposure:—

Plate.	Eastern Standard Time.	Beginning of Exposure.		Duration.		Remarks.
	1908.	h	m	h	m	
31....................	October 16.......	6	45	1	0	Very smoky.
32....................	" 19.......	6	10	1	5	"
33....................	" 31.......	7	25	0	55	Clear.
34....................	November 1.......	7	15	0	55	Clear but unsteady.
35....................	" 13.......	6	15	1	0	Very clear.
36....................	" 26.......	5	30	1	25	Clear, high wind.

FIG. 31 & 32—Morehouse's Comet.

Fig. 33 & 34—Morehouse's Comet.

FIG. 35 & 36—Morehouse's Comet.

An exposure of one hour was made on October 20, but the smoke was too dense. In the course of the exposure the head of the comet passed over an eighth magnitude star without perceptibly dimming it.

Fig. 31. The dense smoke accounts for the faintness of this photograph, but still it is the most interesting one of the set, on account of the knots in the tail about one and a half degrees from the head. This portion seems to have separated from the head and drifted off while new matter has been given out. There has also probably been a motion southward on the part of this detached mass, greater than that of the comet as the new matter in the tail connects with the north side of the knots, while the southern part is altogether clear of the tail. The curved form of the central and southern portions of the detached mass is also worthy of notice. The new matter is connected to the head by a narrow neck and on either side rays extend back about 0·5 degrees.

Fig. 32. This photograph is even more faint than Fig. 31, but the head shows considerable detail. The new portion of the tail spoken of in Fig. 31 has apparently been forced back by the rays on either side, they being joined together now just back of the head. Although only three days have elapsed between these exposures we can readily see that, during this interval, the comet has been very active internally.

Figs. 33 and 34 indicate a continuation of this activity. Fig. 33 shows several distinct knots in the tail about one to one and a half degrees from the head. Beyond these the tail gradually widens out, being uniform on the north side but broken on the south side. Fig. 34, one day later, shows the same knots farther away from the head and more diffused. They seem to have been separated from the nucleus, the bright portion next to the head in Fig. 33 broadening out here into a fan-shaped tail. Beyond the knots the tail has widened slightly.

Fig. 35 shows a very bright tail extending out about two degrees with short rays on both sides of the head. As in Fig. 33 the north side of the tail is uniform, while the south side shows several offshoots. The comet was apparently in a very active state at this time, but thirteen days elapsed before I had an opportunity for another exposure, and Fig. 36 shows a much fainter and divided tail. Evidently the activity has become much less, the faintness of the tail being partly due to its division into two parts, but more particularly to a change in the conditions governing the state of the comet's head. Are these changes in appearance due to some internal state or are they due to changes in the surrounding medium?

While this set of photographs can lay no claim to completeness, it demonstrates clearly the necessity for frequent exposures at as close intervals as possible if we wish to know with any degree of accuracy the changes actually taking place. It also shows that these exposures should not be too long, otherwise one plate might be a combination of several phases.

No other comets were visible here in 1908, but several exposures were made toward the close of the year in search of Halley's comet. The end of July or the early part of August, 1909, should see the discovery of this famous celestial visitor. Photography will doubtless first reveal its presence and on account of this it is desirable that the stellar camera should be available for work every night. With the present mounting of the camera this means the suspending of all work with the equatorial at such times when the comet may be observed. This is much to be regretted as both the equatorial telescope and the camera are excellent instruments, and it is hoped that a separate mounting may be provided for the camera at an early date. Halley's comet will not return for at least seventy-five years, but every year brings with it new comets; so if our Dominion Observatory is to take a foremost place in the discovery and study of these strange visitors, the equipment necessary for camera work should be provided at once.

OCCULTATIONS OF STARS BY THE MOON.

The observations of occultations have been made mostly with the 15-inch equatorial telescope as its superior mounting and clock-work render it much more satisfactory than the 4½-inch Cooke telescope. Predictions have been made by the graphical method of Wm. F. Rigge, but less than 10 per cent of the predicted occultations were observed owing to cloudy weather. Following are the observations:—

OCCULTATIONS OF STARS BY THE MOON.

Date.	Phenomenon.	Star.	Limb.	G.M. Time of observation.		
1908.				h.	m.	s.
April 9	Disappearance	η Cancri	Dark	6	53	53·2
" 13	"	ν Virginis	"	7	2	55·6
	Reappearance	"	Bright	8	8	36·5
June 11	Disappearance	o¹ Libræ	Dark	13	44	23·3
" 12	"	ν² Scorpii	"	11	28	11·1
	Reappearance	"	Bright	12	0	16·8
October 13	Disappearance	n Tauri	"	16	52	41·0
November 1	"	γ Capricorni	Dark	5	30	1·8
1909.						
January 7	"	γ Cancri	Bright	12	19	15·8
March 12	"	β¹ Scorpii	"	16	35	6·1
	Reappearance	"	Dark	17	25	37·8
	Disappearance	56B Scorpii	Bright	16	35	59·7
	Reappearance	"	Dark	17	24	50·0
March 14	Disappearance	63 Ophiuchi	Bright	16	12	3·1
	Reappearance	"	Dark	17	30	57·4

INSTRUMENTS USED ON THE BOUNDARY AND GEODETIC SURVEYS.

The instruments used on these surveys have all been carefully catalogued and stamped, an index system being used which shows the office number, description of instrument, price, date of receival, name of maker, location and disposal of each instrument. A separate account is also kept of the instruments as taken out by each party in the spring, so that each man can readily see what instruments he is held responsible for.

Following is a list of the principal instruments used during the season of 1908:—

Name of Instrument.	Number Used.	Name of Instrument.	Number Used.
Barometers	20	Heliotropes	8
Balances	5	Levels	11
Binoculars	18	Plane Tables	5
Cameras	18	Sextants	2
Chronometers	14	Tapes	25
Clinometers	4	Telescopes	9
Compasses	25	Transits	47

ABERRATION OF THE STELLAR CAMERA OBJECTIVE.

The stellar camera used in the Dominion Observatory, Ottawa, for photographing star clusters, nebulæ, comets, or any other celestial objects covering a wide field, is fitted with a Brashear photographic doublet of 203mm. aperture and 1060·3mm. focus. The camera tube (Fig. 37) is bolted to the telescope tube opposite to its place of attachment to the declination axis. This method of mounting is rather unsatisfactory, however, as the telescope tube intercepts a large portion of the light on the west side of the plate.

The effective field has a diameter of about 11° 20′, so the camera is well adapted in this respect to its work. The tube containing the objective is nickelled and moves freely in the main metal tube, the position of focus being adjusted by a rack and pinion with a clamp screw to hold it in the required position. This position is read on

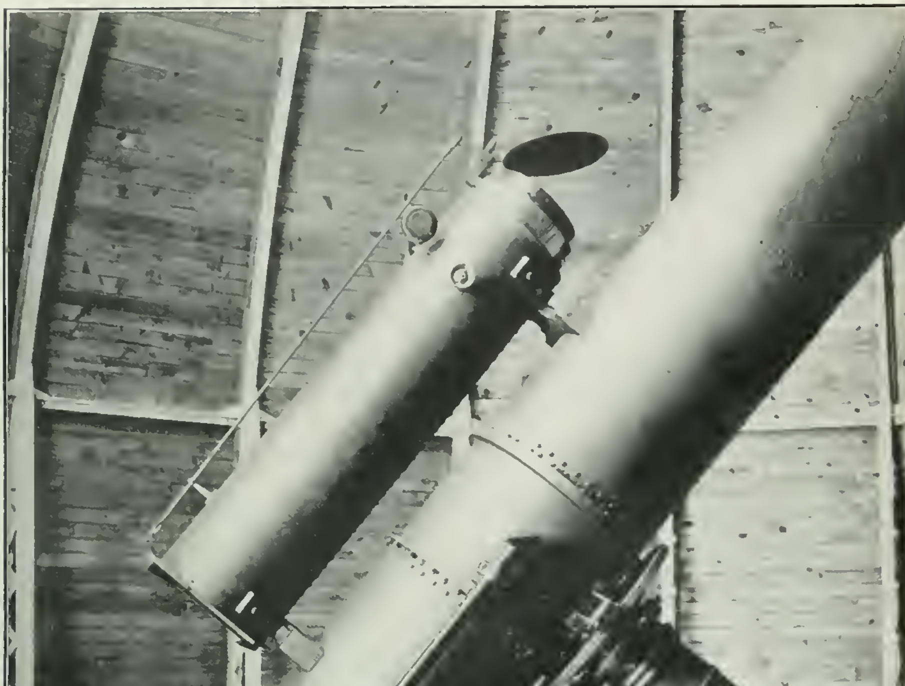


FIG. 37—Stellar Camera.

a millimetre scale. A metal shutter covers the objective and the plates are held in a metal frame fitted with springs. When accurate guiding is required the micrometer wires in the telescope are used, the great focal length of the refractor, as compared with the camera, rendering the guiding a simple matter.

The following description of the lens is given by Dr. Brashear:—

'The general construction is that which was first found by Petzval years ago, and has proven itself quite the best, where great angular aperture with sharp definition is required. The curves have been somewhat modified from our experience in the construction of other lenses—particularly those made for Dr. Max Wolf, of Heidelberg, Germany. It departs, however, from the ordinary practice of opticians in being corrected for short wave-lengths of light. This would be quite objectless in a camera which is to be used for portraits, but is not without moment in astronomical photography. The materials employed were specially chosen for their transparency, the flint being very light and the crown very white. The focal lengths of the front and rear combinations are in a ratio of about 7 to 12, while the focal length of the system is very nearly five times the aperture. The focal length we may find very slightly modified: indeed it is our custom to balance the inevitable zonal differences of magnification, which difficulty is found the most formidable to all constructors of astronomical photographic objectives.'

The camera gives a more uniformly defined field than most cameras of this type, but the definition is not sufficiently sharp to produce clear cut images. When a long exposure is made to reach faint stars there are three resulting forms of image. The fainter stars give a clear cut image, the next in brightness give an image with a dark centre surrounded by a halo, while the brighter stars give an image of uniform density but much enlarged. This variation in the images must be due to aberration, either spherical or chromatic, producing, instead of point images, discs of sensible size, possibly with a centre somewhat more intense than the surrounding portion. The difference in the appearance of the images of stars of different brightness on the negative is thus readily explained by the light of the fainter stars not being sufficient to form a halo, as in the next brighter stars, while in the very bright stars the light is strong enough to make the halo as dense as the central portion. The only question is whether this aberration is spherical or chromatic.

The most simple test for the presence of zonal errors in a lens is that of Hartmann, the theory involved being very simple, and the equipment for the experiment

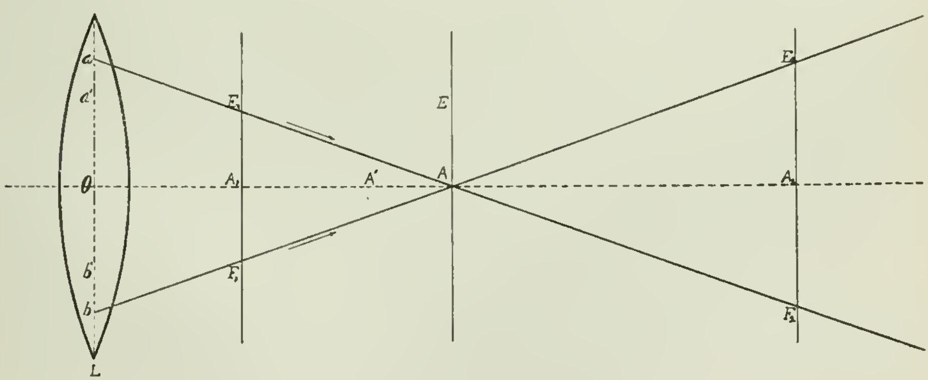


Fig. 38.

being within reach of any one. This method involves the determination of the point of intersection of rays of light passing through the lens at opposite ends of a diameter and equidistant from the centre.

Let L (Fig. 38) be the lens under test and consider two rays passing through a, b, so that $0a = 0b$. These rays converge to a point A which is called the focus of these rays. If these rays are intercepted at A we find them in a single point, but if intercepted at E_1 or E_2 we find them separated by a distance d_1 or d_2. These distances may be measured with a micrometer, or photographic plates may be placed at E_1, E_2, and the distances between the resulting images measured. This latter method has been employed in the present test.

Measuring the distances $0A_1$, $0A_2$ and d_1, d_2, we can easily obtain the correct position of focus.

$$\text{Let } 0A_1 = A_1 \qquad E_1 F_1 = d_1$$
$$0A_2 = A_2 \qquad E_2 F_2 = d_2$$
$$0A = A$$

Then $A = A_1 + \dfrac{d_1}{d_1 + d_2}(A_2 - A_1)$. This is a simple geometrical property requiring no proof.

Again, consider two rays passing through at a', b'. If the lens is correctly ground these two rays will converge to the point A as did a and b, and so with rays from all parts of the lens. But unfortunately this is a difficult condition to obtain, the best of lenses being but a close approximation to it. In place of converging to A, a' and b' converge to some other point, say A', giving what is called zonal aberration, so that if we focus our camera for a and b, it is out of focus for a',b'. and we get a disc about our image.

Take two rays at a distance $0a$ from the centre but on a diameter perpendicular to a, b, and consider their focus. If the lens is symmetrical for this zone, then the four rays will meet at the point A, their common focus, but if not symmetrical there will be two different foci for the two pairs of rays. This difference is called axial astigmatism and can be revealed in the Hartmann test for aberration.

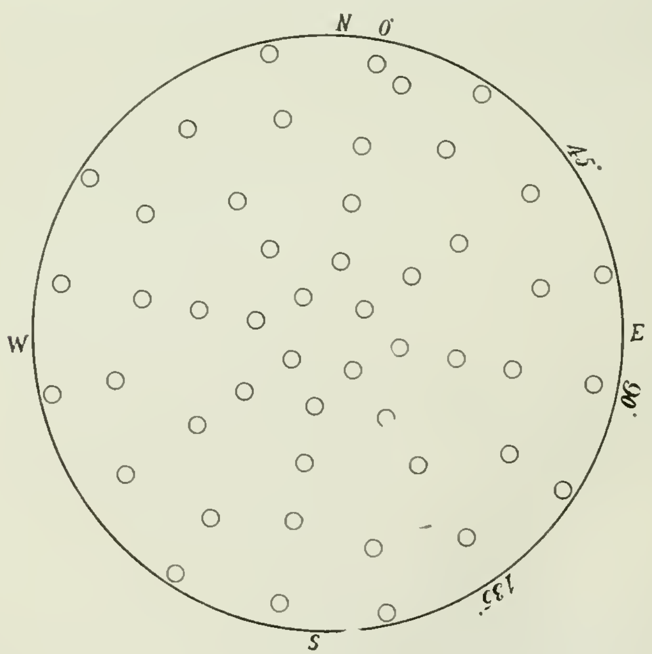


Fig. 39—Zonal Disc.

The lens is covered with a zone plate of the form shown in Fig. 39. The apertures are placed in ten zones of 15, 25, 35, 45, 55, 65, 75, 85, 94 and 98 mm. radius respectively. Each pair of openings is duplicated by a second pair at right angles in order to determine the axial astigmatism. In the case of the zones of 15, 25, 35, 45, 55, 65, 85 and 94 mm. radius, symmetrical pairs of apertures are placed 90° apart, but in the zones of 75 and 98 mm. radius the apertures are only 45° apart, so the outer part of the lens is more thoroughly tested than the centre. This is necessary owing to the greater amount of light admitted by the outer zones.

By making an exposure at E_1 and another at E_2, we can determine two positions of focus for each of the ten zones, these two positions being perpendicular to each other. An extra aperture in the zone plate enables one to identify the angle for the several zones and so avoid confusion in the determination of astigmatism.

The first zone plate used had apertures of 10 mm., but the diffraction at the edges was so great that in place of solid dark spots there were circular dark rings which did not permit of accurate measurement. The second zone plate used had a diameter of 203 mm. with apertures of 5·5 mm. These plates were made of medium weight bristol board. Exposures of 6 minutes were made on Capella. In order to avoid as much as possible chromatic aberration, Seed Process plates were used, their band of sensitiveness being narrow and confined chiefly to the blue and violet light beyond λ 4600. A plate with a wider range of sensitiveness would give images so elongated radially by chromatic aberration as to render accurate measurements very difficult or impossible.

All measures were made on the Zeiss comparator, the graduations reading to thousandths of a millimetre and readily estimated to ten thousandths. Test plates were first made with 4 x 5 Seed plates, to determine the correct time of exposure, a plate-adapter being used in the regular plate-holder. The positions corresponding to E_1 and E_2 were at 22 mm. and 67 mm., respectively, on the focussing scale on the camera tube. This gave the distance $A_2 - A_1$ equal to 45 mm. In the appended results the focus given is that which would be used in setting according to the above mentioned scale. The actual focus of the camera was determined as follows:—The telescope was set midway between Castor and Pollux and a photograph taken, with the camera at its usual focus (47·5 mm. on the scale) and the zone plate removed. The distance between the images on the photographic plate was measured and found to be $d = 79{\cdot}5260$ mm.

From the Ephemeris we have—

	R. A.	Dec.
Castor,	$7^h\ 28^m\ 43^s{\cdot}9$	$+\ 32°\ \ 5'\ 28''{\cdot}13$
Pollux,	$7^h\ 39^m\ 41^s{\cdot}284$	$+\ 28°\ 14'\ 56''{\cdot}34$

The difference in R. A. is $0^h\ 10^m\ 57^s{\cdot}384 = 2°\ 44'\ 20''{\cdot}76$
Zenith distance of Castor is $57°\ 54'\ 31''{\cdot}87$
Zenith distance of Pollux is $61°\ 45'\ \ 3''{\cdot}6$
From $\cos a = \cos b \cos c + \sin b \sin c \cos A$, we have $a = 4°\ 30'\ 48''$
= the distance between Castor and Pollux.

Hence, from the cotangent of a and the value of d we have the focus required

$$f = 1060{\cdot}3 \text{ millimetres.}$$

When the correct time of exposure had been obtained, the regular 8 x 10 plates were used and a series of exposures made at E_1 and E_2. Although the original object in view was to test for spherical aberration at the centre, this was extended to cover the whole field of the lens and images were made extending across the plate from south to north, in order to determine the curvature of field. Nine images were obtained within the focus and nine without, their respective positions being:—

Position	A, 5°·3	from	centre	towards	south	end.
"	B, 4°	"	"	"	"	
"	C, 2°·5	"	"	"	"	
"	D, 1°	"	"	"	"	
"	E, at centre.					
"	F, 1°	from	centre	towards	north	end.
"	G, 2°·5	"	"	"	"	
"	H, 4°	"	"	"	"	
"	I, 5°·5	"	"	"	"	

Owing to the uncertainty of the weather, exposures at positions A, B, C, D and E were made on one plate without the focus, and then exposures were made on another plate at the same positions within the focus. Exposures at F, G, H and I were then made on two other plates. This unfortunately caused a slight change in the adjustment of the camera and the result was an unaccountable dip in the curvature of the field. Further test plates were made at positions E, F and H, which showed clearly that the dip was not due to any fault of the lens, the resulting curve being quite uniform, as shown in Figs. 43 and 44.

The several plates were first measured for aberration and astigmatism. A summary of the results is given in the appended tables and curves. As stated before, the positions E_1 and E_2 correspond to 22 mm. and 67 mm. on the scale attached to the camera. The camera was set at 47·5 mm. to determine the focus f = 1060.3 mm. So we have $A = 1034{\cdot}8$ mm. and $A_2 - A_1 = 45$ mm. To obtain the actual focus for each zone in the following results we must add 1034.8 mm. to each given focus.

Position	A	shows	a negative	aberration of	3·61 mm.
"	B	"	"	"	3·82 mm.
"	C	"	"	"	3·75 mm.
"	D	"	"	"	3·63 mm.
"	E	"	"	"	3·60 mm.
"	F	"	"	"	3·63 mm.
"	G	"	"	"	3·64 mm.
"	H	"	"	"	3·82 mm.
"	I	"	"	"	3·63 mm.

Such a marked aberration, extending so uniformly across the field, shows beyond any doubt the cause of the diffuse appearance of the images already referred to. The curves in Figs. 40 and 41, each division representing 1 millimetre, show very clearly the magnitude of the aberration and its uniformity across the field from south to north. Another plate R, made on the east side of the field, shows a similar aberration, curve *P*, Fig. 42, representing it graphically.

Taking the mean focus for each zone we find the astigmatism so small as to be neglected at the centre of the field but increasing as we move outward. A closer examination reveals the fact that where $\varphi = 0°$, 90°, 67°·5 and 157°·5, the astigmatism is the greatest. This is due to the varying angle of incidence of the rays on the plate in the several positions A, B, C, etc. This variation in angle affects the distance between the images in the respective zones inversely as the angles they make with the north and south line. Thus (see Fig. 39) when $\varphi = 0°$, the change in distance is greatest; when $\varphi = 90°$, the change in distance is least; when $\varphi = 45°$, the change is almost the same as when $\varphi = 135°$. So we see that the apparent variation in astigmatism is due to the position of the plate and consequent distortion of some of the images rather than to any defect in the lens.

As already stated, the Seed Process plate used has its maximum sensitiveness about λ 4300 in the blue light. Thinking perhaps the lens had originally been tested with yellow light, owing to the difficulty of obtaining monochromatic light in the blue, it was consequently decided to test the lens by visual or yellow light. Cramer Iso-

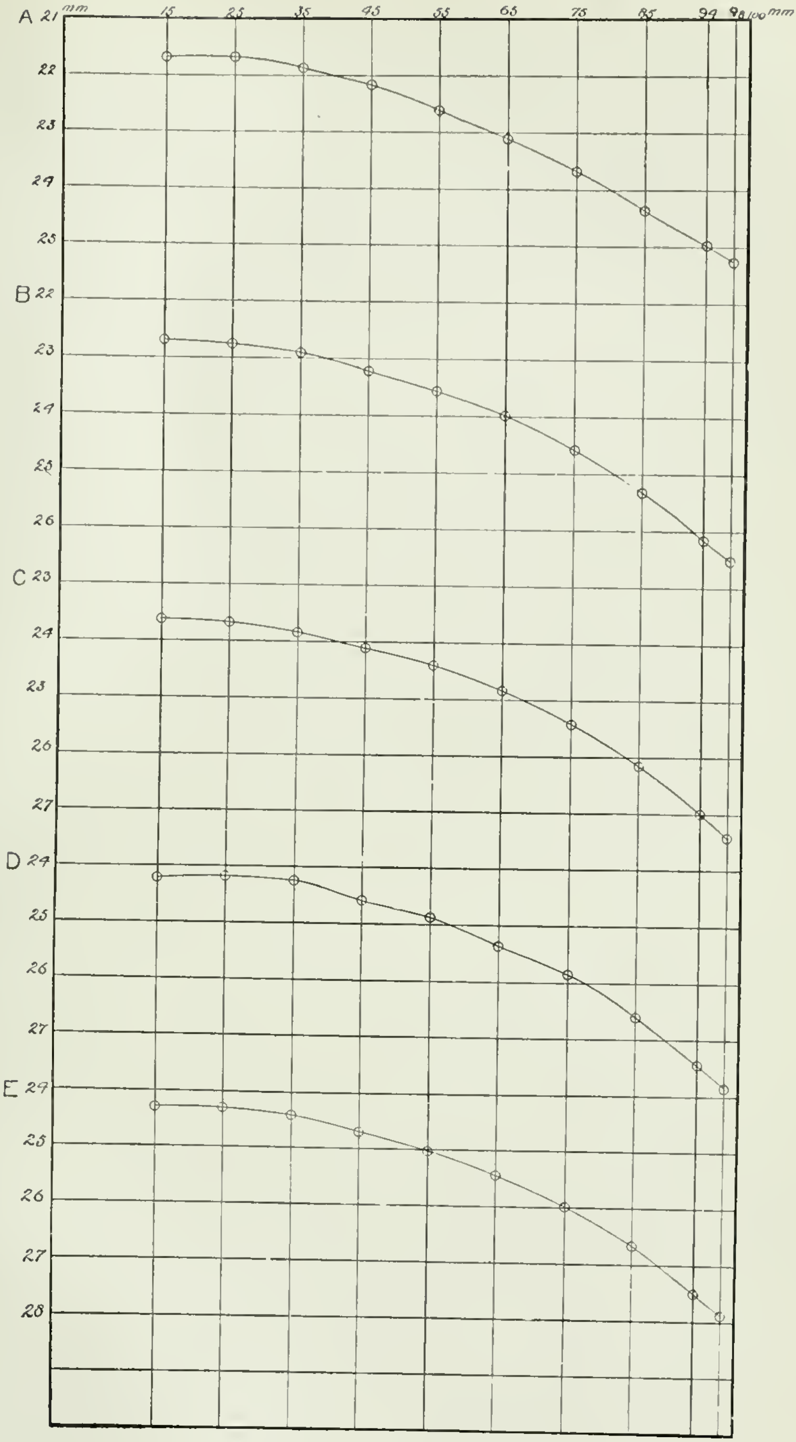


FIG. 40—Zonal Differences of Focus.

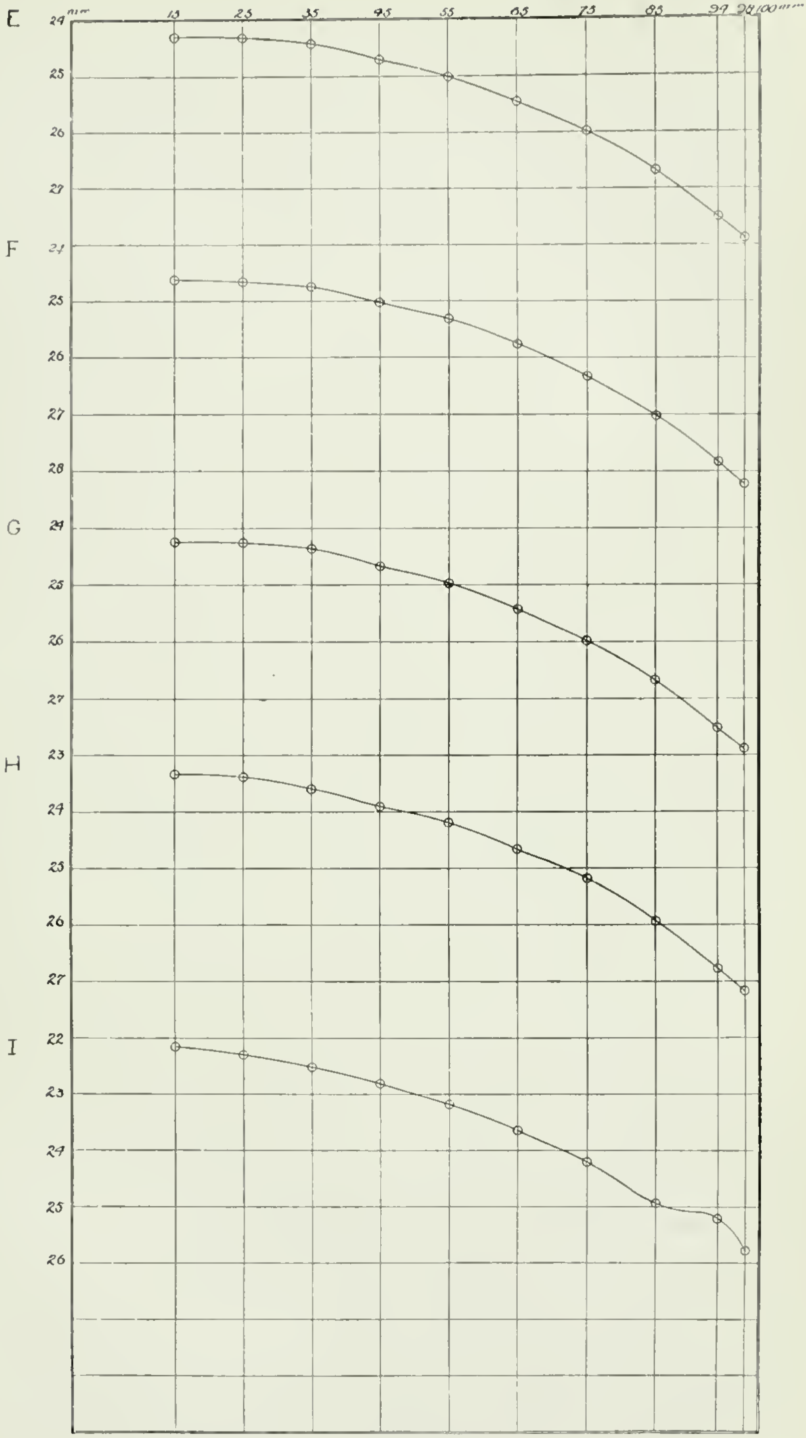


FIG. 41—Zonal Differences of Focus.

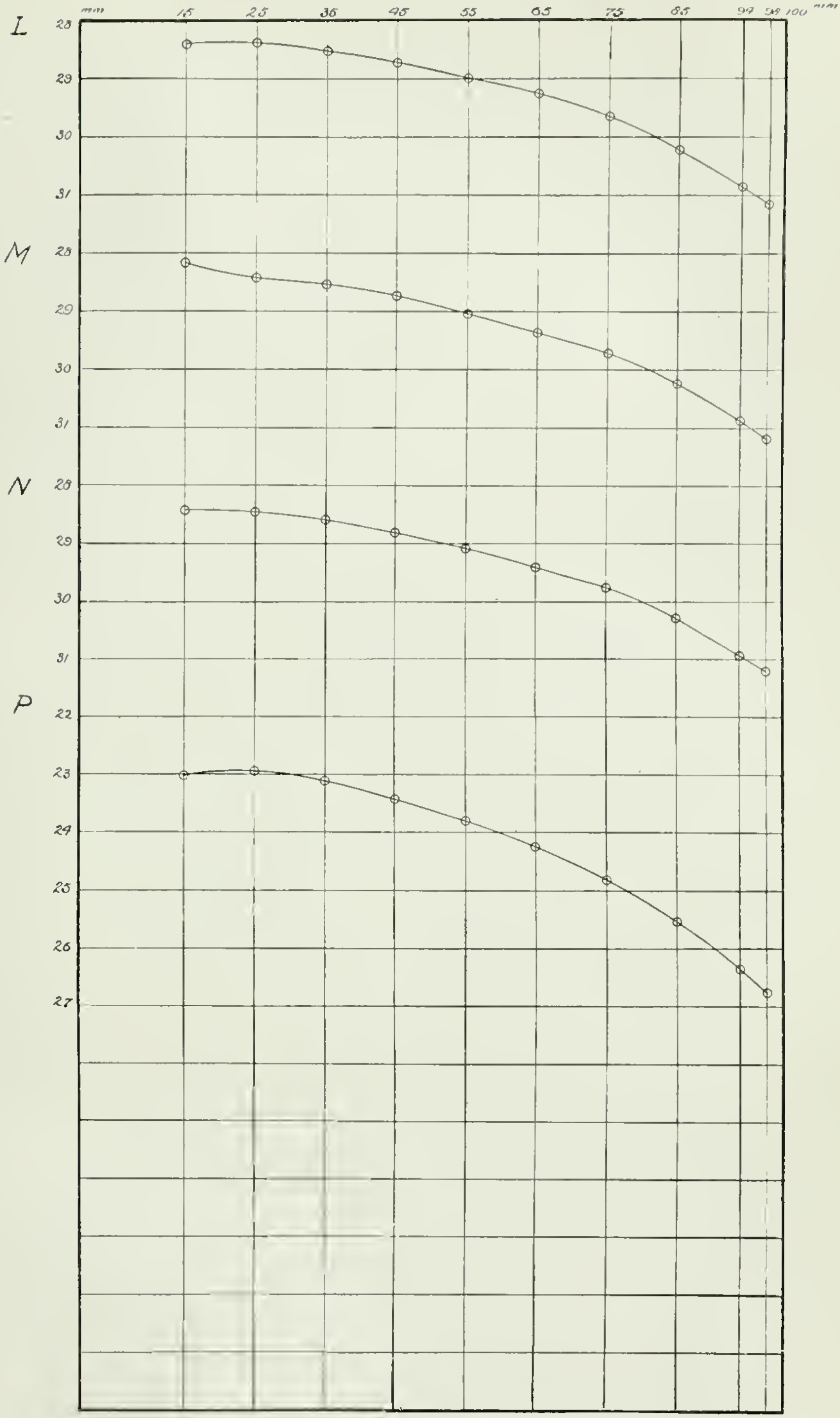


FIG. 42—Zonal Differences of Focus.

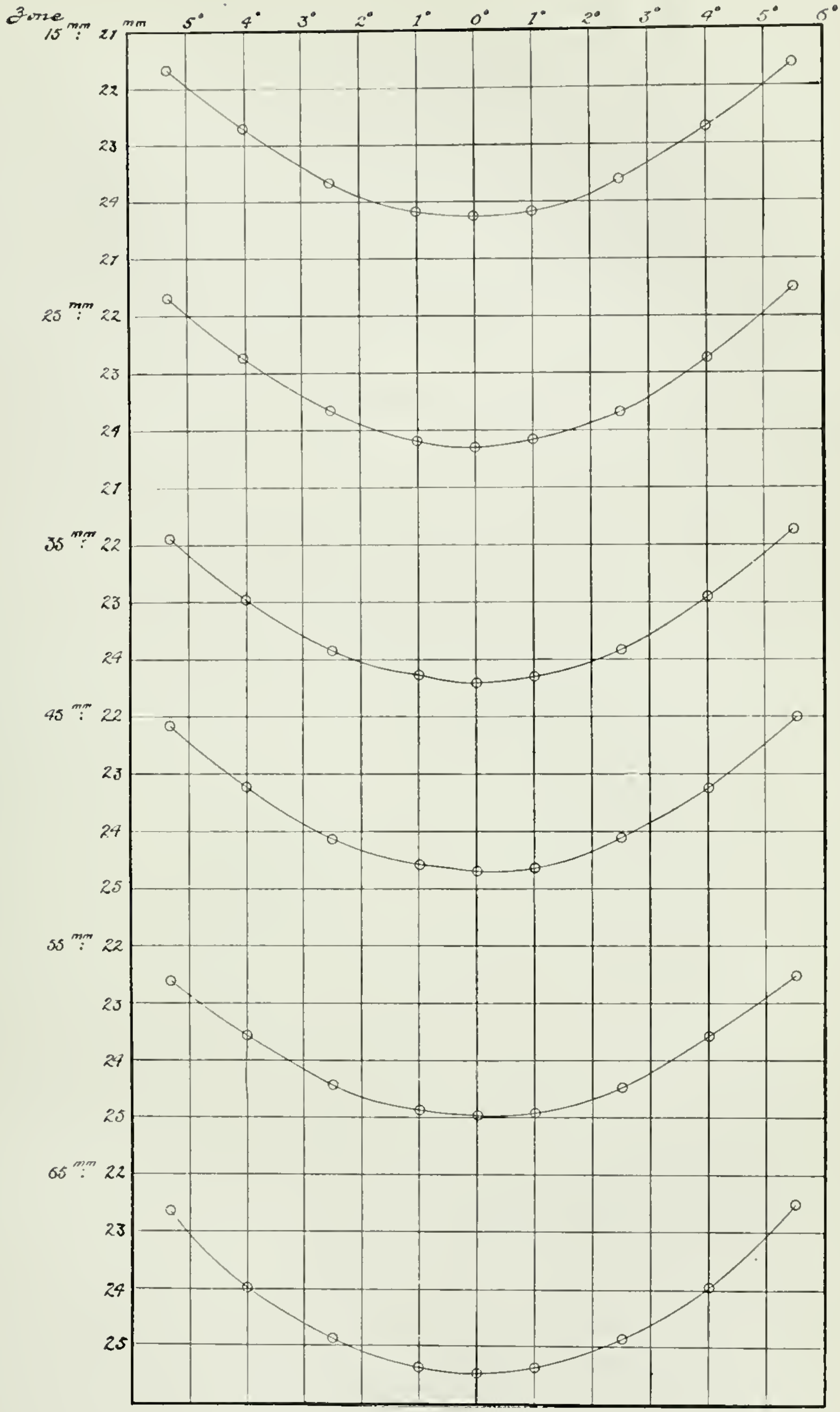


FIG. 43—Curvature of Field at different Zones.

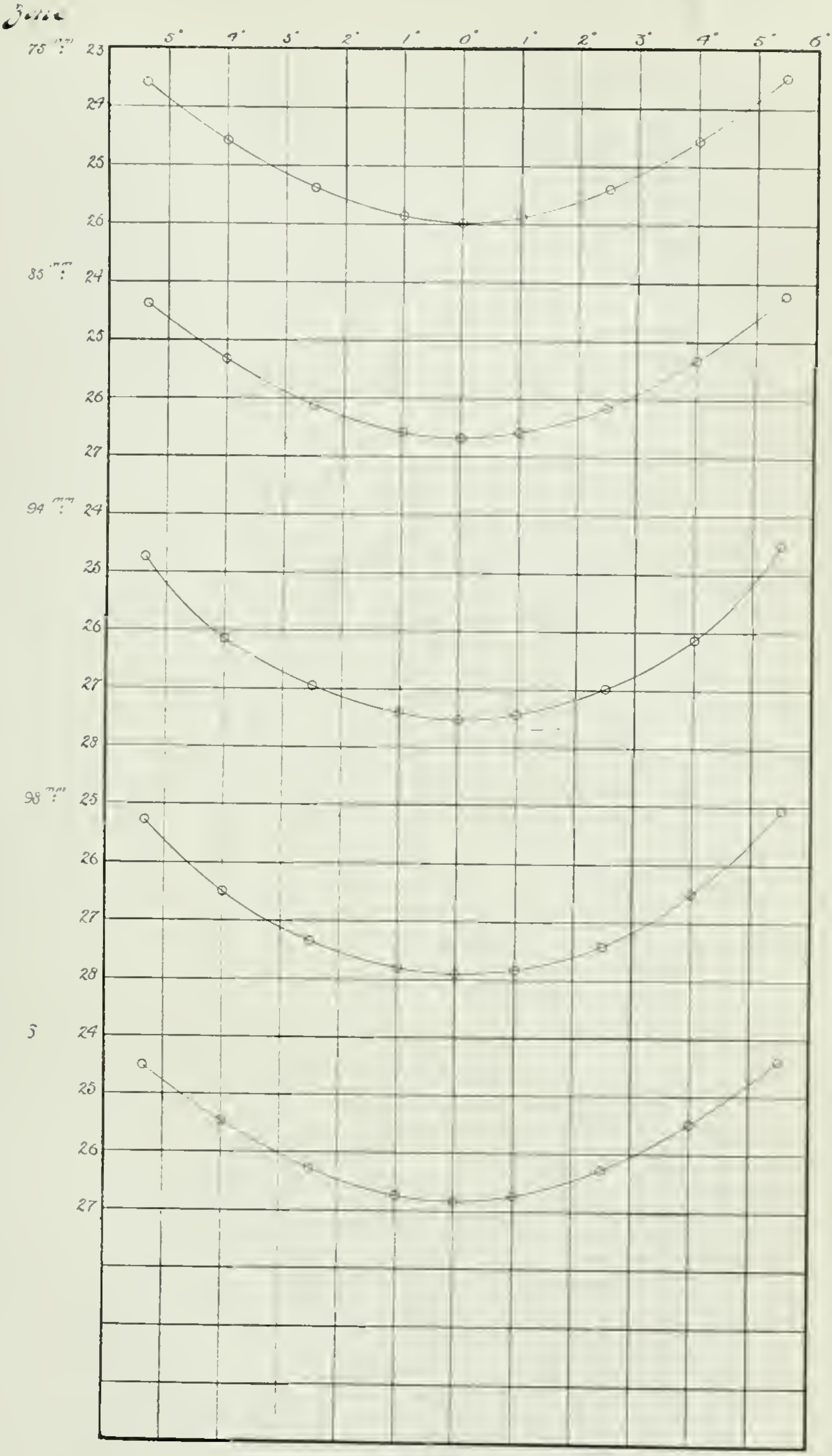


FIG. 44—Curvature of Field at different Zones.

chromatic plates were substituted for the Seed Process plates and a yellow screen was placed just above the plate-holder to cut out the blue and violet light. The Cramer plate was used as it has a band of sensitiveness in the yellow-green light about λ 5650, as well as the band of sensitiveness to blue and violet light possessed by all plates. Three exposures were made within the focus and three without, their positions being:

Position L, 50′ from centre to south.
" M, at centre.
" N, 50′ from centre to north.

The exposure in each case was 5 minutes.

Comparing these with positions A to I, we find the aberration less by about 0·6 mm.

Position	L	showing	negative	aberration of	2·77 mm.
"	M	"	"	"	3·03 mm.
"	N	"	"	"	2·78 mm.

But it is not small enough to indicate any special adjustment of the lens surface to yellow light. The uniformity of the aberration is shown in *L, M, N,* Fig. 42. The astigmatism is similar to that shown by the Seed Process plate.

A uniform increase of about 3·5 mm. in the focus, as compared with the blue light, is due partly to refraction of the light in passing through the yellow screen. The screen being about 6 mm. thick, the refraction would lengthen the focus by about 2 mm., the refractive index of glass being about 1·57. The remaining 1·5 mm. is due to the difference in focus of blue and yellow light.

Combining the results of positions A to I (see table XIV.), we have the focus of each zone of the lens at nine different points extending from 5°·3 on one side of the centre to 5°·5 on the other side. Figs. 43 and 44 show the curvature as given from these foci, the coordinates being the diameter of the field in degrees and the zonal foci in millimetres. As in the case of the aberration these curves are very uniform, indicating a difference of about 2·5 mm. between the focus at the edge of the field and that at the centre.

Since the zonal foci of the lens vary so much from the centre to the edge no one position of focus is suitable to all the lenses. To obtain a uniform field and at the same time get as sharp a definition as possible, we must study the effect produced by the various zones when out of focus.

If we set, for example, the camera at the focus of the zone with radius of 65 mm., then other zones will be out of focus and there will be discs or circles of confusion about each image. The density and size of these circles depend on the extent to which the several zones are out of focus and also on the area of these zones. The diameter of these circles of confusion may be determined as follows:—

$$d = 2r\frac{(F - F_0)}{F_0}$$

where d = diameter of circle of confusion,
r = radius of zone,
F = focus of zone,
F_0 = focus at which the camera is set.

This determines for us the circles of confusion but it does not give us any idea of the effect on the image. A circle of confusion of 20″ diameter and produced by a zone of 15 mm. radius would not be nearly so injurious to the image as one of the same diameter produced by a zone of 75 mm. radius. We see that simply determining the circles of confusion for the several zones will not give us the effect of the circles on the images, and so will not aid us in adjusting the camera to obtain the best images possible under existing conditions. We must determine at what position of focus the lens is most efficient. The following formula by Hartmann gives a test for the efficiency of a lens at various foci:—

$$T = \frac{200000}{F_0^2} \cdot \frac{\Sigma r^2 (F - F_0)}{\Sigma r}$$

where T = efficiency of lens,
F = focus of zone,
F_0 = focus at which the camera is set,
r = radius of zone.

(100000 is introduced simply to transfer the decimal point and so avoid exceedingly small numbers.) According to this test an objective is moderately good when T is greater than 1·5, good when T is between 0·5 and 1·5, and exceedingly good when T is less than 0·5. But as this criterion of efficiency refers to telescope objectives where the field of view and angular aperture are small, it is not an accurate test for photographic objectives of wide aperture.

Using the above formula, the best positions of focus at the several positions, A, B, C, etc., were obtained. Table XV. gives these foci, the diameters of the circles of confusion, and the efficiency of the lens. Curve *S*, Fig. 44, shows the combined results for the several positions A to I. From this curve it may be concluded that the best uniform field would be obtained by setting the camera at 25·75 mm. or 26·0 mm.

Testing for Chromatic Aberration.

Although the foregoing tests revealed a much greater spherical aberration than is consistent with the production of good negatives, objection was taken to the statement that this aberration was the cause of the observed defects in the images. Accordingly it was decided to test for chromatic aberration also.

The camera was detached from the telescope and mounted on a table, the source of light being an arc-lamp about 400 yards distant. The spectrograph was placed with the slit at the focus of the camera which was in line with the collimation tube. A cardboard disc was placed over the camera objective, the light entering through two oblong openings, 3 mm. by 8·5 mm., symmetrically placed on a common diameter.

Exposures were made with the slit first inside the camera focus and then outside, isochromatic plates being used to obtain the *D* lines. Images of the slits in the disc were thus obtained as produced by light of various wave-lengths. By measuring the distances between these images at twelve points and applying the Hartmann formula the focus of the camera was obtained for twelve different wave-lengths, as shown in the following table:—

Wave-length.	Focus.
λ 5893, *D*	41·93 mm.
5500	41·24 "
5180	40·33 "
4880 H_β	39·30 "
4737	39·07 "
4520	38·62 "
4370	38·73 "
4230	38·79 "
4115	39·00 "
4020	39·71 "
3933, *K*	39·98 "
3780	40·88 "

Fig. 45 represents graphically the various foci and the chromatic aberration. The minimum focus is about $H\gamma$ and, while there is a range of 3·12 mm. in focus in the region between λ 5893 and λ 3780, there is less than 1 mm. range in the photographic region.

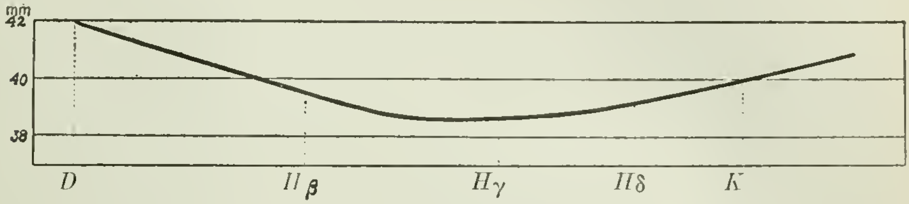


FIG. 45—Chromatic Aberration Curve.

Comparing this with the test for spherical aberration we have—

(*a*) Minimum spherical aberration of − 3·6 mm.

(*b*) Maximum chromatic aberration in photographic region of 1 mm.

Even if we allow for the chromatic aberration of 3 mm. at λ 5893, the light here is not rich enough in actinic properties to produce the observed halo. It seemed, therefore, unnecessary to continue the investigation *re* chromatic aberration.

Changing the Distance between the Components of the Outer Combination.

Prof. Hastings, of Yale University, who had been kept informed of the results of these tests, suggested that there might be sufficient internal reflection between the components of the objective to produce the observed halo and that this might be eliminated by increasing or decreasing the separation. Although we still felt that the defect was due to spherical aberration, this suggestion coming from the designer of the lens claimed our most careful attention and a series of tests were accordingly made. The original separation (one thickness of a postage stamp) was removed and new separations of various thicknesses used. Little blocks built up from bristol board were used until the best adjustment was obtained, after which hard rubber blocks were used.

The following table shows the tests and results:—

Date.	Separation of Components.	Focus.*	Spherical Aberration.	Description of Images.
1908.				
Jan	0 004 inches.	47·5 mm.	− 3·6 mm.	Described in first part of appendix.
1909.				
Jan. 12. . . .	0·012 "	47·0 "	. . . .	No change.
" 26. . . .	Tissue paper.	47·5 "	. . . .	"
Feb. 2.	"	47·5 "	. . . .	½″ and ¼″ discs were placed on lens to cut off outer portion, but there was very little improvement.
" 25.	0 132 inches.	26·5 "	+ 2·4 mm.	Images about the same as originally.
Apr. 20.	0·070 "	36·5 "	− 0·5 "	Images much improved. Halo greatly reduced.
May 25. . . .	0·077 "	36·0 "	− 0·3 "	Images much the same as with .070 separation.

* Focus here refers to the scale on the camera tube.

Curve a, Fig. 46, shows the aberration with a separation of 0·004 inches, curve β shows the aberration with a separation of 0.132 inches, and curve γ shows the aberration with a separation of 0·070 inches. Figure 47 shows cuts of the Pleiades taken with the different separations.

Examining the above table it is seen that increasing the separation, shortened the focus and changed the aberration. Coincident with the change in aberration there was a decided change in the star images. Aberrations of − 3·6 mm. and + 2·4 mm. were accompanied by a very marked halo, while with an aberration of − 0·5 mm. the halo was negligible. Changing the separation to 0·070 inches has undoubtedly improved the objective as the field remained practically unchanged, and the halo was so small as to be neglected. But that this improvement has been effected by the removal of internal reflection does not seem at all probable. On the contrary, the above results seem to me to be but additional proof that the observed halo has been caused by spherical aberration, as was stated at the beginning of this appendix. It is not at all likely that the aberration and the halo would disappear simultaneously if the halo were caused by internal reflection.

Note.—Since the conclusion of the above work a communication has been received from the makers of the objective, stating that they also believe the defect to be due to spherical aberration and expressing their willingness to remove it without additional charge.

TABLE I.

ZONAL FOCI: POSITION A.

Radius of Zone	ϕ	d_1	d_2	Focus.	Mean.	Astigmatism.
	°	mm.	mm.			
15 mm.	45	0·6450	0 6826	21·86	....	+0·20
	135	0·6333	0·6938	21·47	21·66	−0·19
25	0	1·0432	1·1627	21·28	....	−0·37
	90	1·0746	1·1201	22 03	21·65	+0·38
35	45	1·5131	1·5651	22·12	....	+0·23
	135	1·4948	1·6115	21·66	21·89	−0·23
45	0	1·9259	2·0621	21·73	....	−0·44
	90	1·9921	1·9715	22·62	22·17	+0·45
55	45	2·4355	2·3590	22·86	....	+0·26
	135	2·4166	2·4523	22·34	22·60	−0·26
65	0	2·8795	2·8646	22·56	....	−0·05
	90	2·9851	2·7288	22·66	22·61	+0·05
75	22·5	3·4195	3·1358	23·17	....	−0·15
	67·5	3·5344	3·0497	24·16	....	+0·54
	112 5	3·4794	3·1066	23·77	....	+0·15
	157·5	3·3935	3·2266	23·07	23·62	−0·55
85	45	4·0807	3·3663	24·66	....	+0·29
	135	4·0195	3·4899	24·09	24·37	−0·28
94	0	4·5566	3·7376	24 72	....	....
	90	....	....	....	24·72	....
98	22·5	4·8567	3·7280	25·46	....	+0 20
	67·5	....	....	....	....	....
	112·5	....	....	....	....	....
	157·5	4·8157	3 8320	25·06	25·26	−0·20

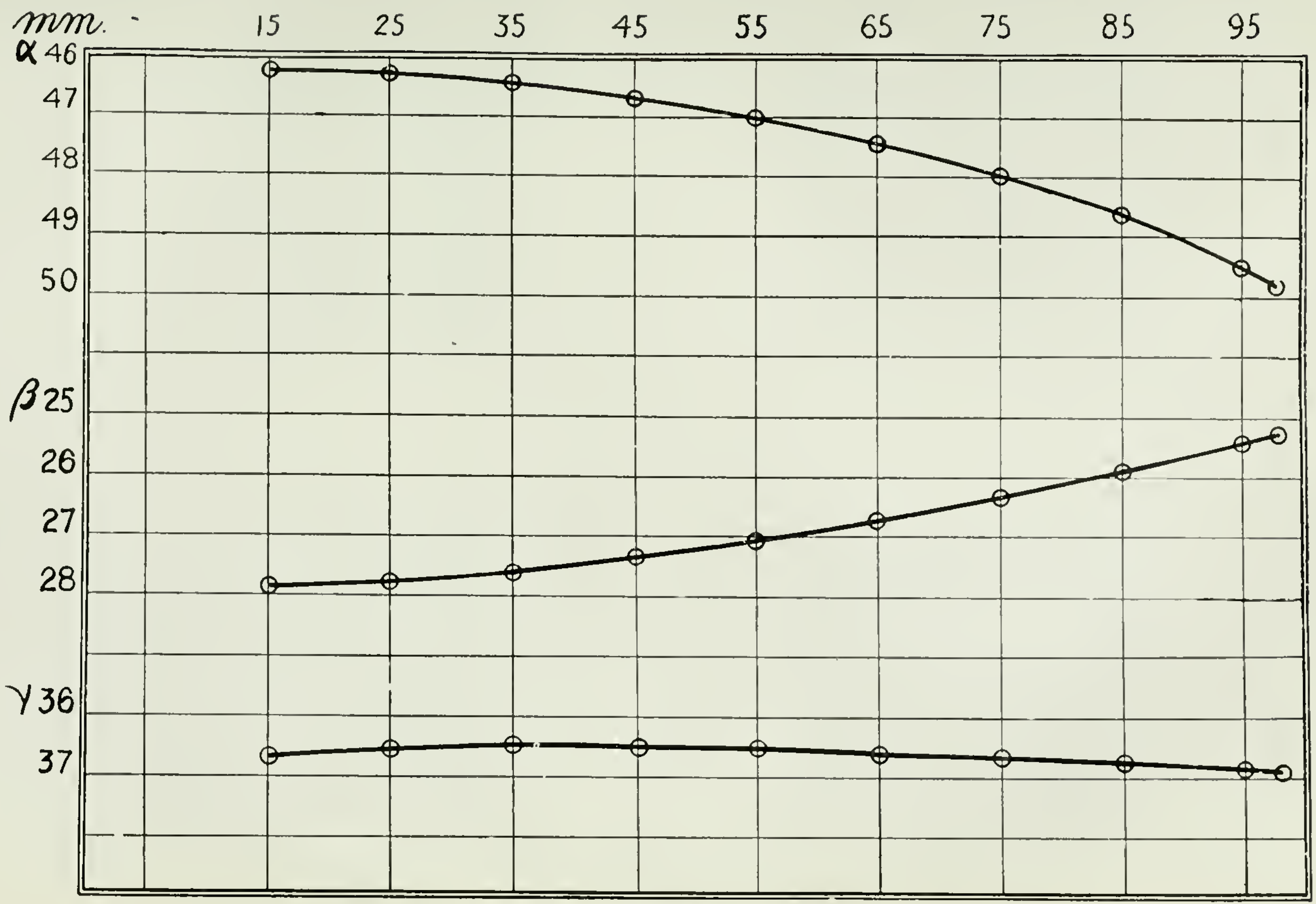


Fig. 46—Zonal Differences of Focus.

Focus 47·0
Separation—Tissue Paper.
No Disc.

Focus 47·0
Separation—Tissue Paper.
¼-in. Disc.

Focus 26·5
Separation—0·132 inches.

Focus 36·5
Separation—0·070 inches.

FIG. 47—Star Photographs at Different Separations.

TABLE II.

ZONAL FOCI: POSITION B.

Radius of Zone.	ϕ	d_1	d_2	Focus.	Mean.	Astigmatism.
	°	mm.	mm			
15 mm	45	0·6694	0·6536	22·77	...	+0·08
	135	0·6625	0·6555	22·62	22·69	−0·07
25	0	1·1061	1·1020	22·54	...	−0·22
	90	1·1238	1·0793	22·99	22·76	+0·23
35	45	1·5766	1·5057	23·02	...	+0·10
	135	1·5740	1·5298	22·82	22·92	−0·10
45	0	2·0353	1·9518	22·97	...	−0·25
	90	2·0708	1·8979	23·48	23·22	+0·26
55	45	2·5308	2·2741	23·70	...	+0·14
	135	2·5368	2·3375	23·42	23·56	−0·14
65	0	3·0385	2·7147	23·77	...	−0·22
	90	3·0850	2·6503	24·21	23·99	+0·22
75	22·5	3·5797	2·9946	24·50	...	−0·07
	67·5	3·6489	2·9584	24·85	...	+0·28
	112·5	3·6175	2·9892	24·64	...	+0·07
	157·5	3·5760	3·0462	24·30	24·57	−0·27
85	45	4·2251	3·2505	25·43	...	+0·12
	135	4·2075	3·3061	25·20	25·31	−0·11
94	0	4·7707	3·5186	25·90	...	−0·28
	90	4·8840	3·4186	26·47	26·18	+0·29
98	22·5	5·0522	3·5470	26·44	...	−0·07
	67·5	5·0494	3·4591	26·71	...	+0·20
	112·5	5·0914	3·5125	26·63	...	+0·12
	157·5	5·0384	3·5950	26·26	26·51	−0·25

TABLE III.

ZONAL FOCI: POSITION C.

Radius of Zone.	ϕ	d_1	d_2	Focus.	Mean.	Astigmatism.
	°	mm.	mm.			
15 mm	45	0·7003	0·6365	23·57	...	−0·04
	135	0·7023	0·6334	23·66	23·61	+0·05
25	0	1·1571	1·0546	23·54	...	−0·10
	90	1·1701	1·0470	23·75	23·64	+0·11
35	45	1·6446	1·4542	23·88	...	+0·05
	135	1·6394	1·4625	23·78	23·83	−0·05
45	0	2·1303	1·8615	24·02	...	−0·10
	90	2·1444	1·8404	24·22	24·12	+0·10
55	45	2·6238	2·2009	24·47	...	+0·05
	135	2·6415	2·2368	24·37	24·42	−0·05
65	0	3·1652	2·5791	24·80	...	−0·05
	90	3·1857	2·5686	24·91	24·85	+0·06
75	22·5	3·7187	2·8718	25·39	...	−0·01
	67·5	3·7533	2·8700	25·50	...	+0·10
	112·5	3·7401	2·8848	25·40	...	0·00
	157·5	3·7206	2·8957	25·30	25·40	−0·10
85	45	4·3530	3·1223	26·20	...	+0·07
	135	4·3522	3·1638	26·06	26·13	−0·07
94	0	4·9560	3·3371	26·89	...	0·09
	90	5·0073	3·3159	27·07	26·98	+0·09
98	22·5	5·2 15	3·3850	27·32	...	−0·04
	67·5	5·2741	3·3635	27·48	...	+0·12
	112·5	5·2528	3·3800	27·38	...	+0·02
	157·5	5·2405	3·4089	27·26	27·36	−0·10

TABLE IV.

Zonal Foci: Position D.

Radius of Zone.	φ	d_1	d_2	Focus.	Mean.	Astigmatism.
	°	mm.	mm.			
15mm..........	45	0·7204	0·6208	24·17	....	−0·03
	135	0·7128	0·6106	24·24	24·20	+0·04
25..........	0	1·1883	1·0255	24·15	....	−0·02
	90	1·1963	1·0292	24·19	24·17	+0·02
35..........	45	1·6786	1·4273	24·32	....	+0·04
	135	1·6764	1·4340	24·25	24·28	−0·03
45..........	0	2·1796	1·8131	24·57	....	−0·02
	90	2·1843	1·8102	24·61	24·59	+0·02
55..........	45	2·6726	2·1618	24·88	....	−0·01
	135	2·7039	2·1805	24·91	24·89	+0·02
65..........	0	3·2398	2·5165	25·33	....	−0·02
	90	3·2503	2·5140	25·37	25·35	+0·02
75..........	22·5	3·7991	2·8022	25·90	....	+0·03
	67·5	3·8159	2·8151	25·90	....	+0·03
	112·5	3·8110	2·8295	25·83	....	−0·04
	157·5	3·8084	2·8193	25·86	25·87	−0·01
85..........	45	4·4340	3·0715	26·58	....	+0·01
	135	4·4454	3·0862	26·56	26·57	−0·01
94..........	0	5·0594	3·2538	27·39	....	−0·03
	90	5·0882	3·2528	27·45	27·42	+0·03
98..........	22·5	5·3326	3·2971	27·81	....	+0·01
	67·5	5·3485	3·3117	27·78	....	−0·02
	112·5	5·3394	3·3005	27·81	....	+0·01
	157·5	5·3453	3·3101	27·79	27·80	−0·01

TABLE V.

Zonal Foci: Position E.

Radius of Zone.	φ	d_1	d_2	Focus.	Mean.	Astigmatism.
	°	mm.	mm.			
15mm..........	45	0·7243	0·6159	24·32	....	+0·03
	135	0·7189	0·6145	24·26	24·29	−0·03
25..........	0	1·1937	1·0189	24·28	....	−0·02
	90	1·2020	1·0215	24·33	24·30	+0·03
35..........	45	1·6884	1·4238	24·41	....	+0·01
	135	1·6907	1·4277	24·40	24·40	0·00
45..........	0	2·1965	1·8049	24·70	....	0·00
	90	2·1948	1·8038	24·70	24·70	0·00
55..........	45	2·6918	2·1478	25·03	....	+0·02
	135	2·7202	2·1765	25·00	25·01	−0·01
65..........	0	3·2594	2·5023	25·46	....	0·00
	90	3·2631	2·5050	25·46	25·46	0·00
75..........	22·5	3·8166	2·7969	25·97	....	−0·01
	67·5	3·8365	2·8062	25·99	....	+0·01
	112·5	3·8381	2·8112	25·97	....	−0·01
	157·5	3·8347	2·8057	25·99	25·98	+0·01
85..........	45	4·4596	3·0610	26·68	....	0·00
	135	4·4751	3·0733	26·68	26·68	0·00
94..........	0	5·0876	3·2357	27·51	....	0·00
	90	5·1113	3·2509	27·51	27·51	0·00
98..........	22·5	5·3623	3·2966	27·87	....	−0·02
	67·5	5·3789	3·2991	27·89	....	0·00
	112·5	5·3738	3·3000	27·88	....	−0·01
	157·5	5·3729	3·2913	27·91	27·89	+0·02

TABLE VI.

ZONAL FOCI: POSITION F.

Radius of Zone.	ϕ	d_1	d_2	Focus.	Mean.	Astigmatism.
	°	mm.	mm.			
15 mm.	45	0·7396	0·6078	24·70	....	+0·11
	135	0·7315	0·6130	24·48	24·59	−0·11
25	0	1·2242	1·0149	24·60	....	−0·04
	90	1·2304	1·0127	24·68	24·64	+0·04
35	45	1·7274	1·4155	24·73	....	+0·01
	135	1·7267	1·4160	24·72	24·72	0·00
45	0	2·2431	1·7927	25·01	....	−0·03
	90	2·2483	1·7875	25·07	25·04	+0·03
55	45	2·7507	2·1330	25·35	....	+0·01
	135	2·7761	2·1567	25·33	25·34	−0·01
65	0	3·3281	2·4797	25·79	....	−0·01
	90	3·3424	2·4826	25·82	25·80	+0·02
75	22·5	3·9033	2·7731	26·31	....	−0·02
	67·5	3·9215	2·7751	26·35	....	+0·02
	112·5	3·9230	2·7794	26·34	....	+0·01
	157·5	3·9134	2·7826	26·30	26·33	−0·03
85	45	4·5513	3·0286	27·02	....	0·00
	135	4·5709	3·0376	27·03	27·02	+0·01
94	0	5·1894	3·2095	27·80	....	−0·04
	90	5·2240	3·2063	27·88	27·84	+0·04
98	22·5	5·4615	3·2621	28·17	....	−0·05
	67·5	5·4831	3·2539	28·24	....	+0·02
	112·5	5·4846	3·2448	28·27	....	+0·05
	157·5	5·4797	3·2630	28·21	28·22	−0·01

TABLE VII.

ZONAL FOCI: POSITION G.

Radius of Zone.	ϕ	d_1	d_2	Focus.	Mean.	Astigmatism.
	°	mm.	mm.			
15 mm.	45	0·7307	0·6203	24·29	....	+0·04
	135	0·7256	0·6228	24·22	24·25	−0·03
25	0	1·1958	1·0336	24·14	....	−0·10
	90	1·2129	1·0297	24·34	24·24	+0·10
35	45	1·7039	1·4425	24·37	....	+0·01
	135	1·6995	1·4409	24·35	24·36	−0·01
45	0	2·2025	1·8339	24·55	....	−0·10
	90	2·2164	1·8137	24·75	24·65	+0·10
55	45	2·7191	2·1758	25·00	....	+0·03
	135	2·7339	2·1962	24·95	24·97	−0·02
65	0	3·2652	2·5402	25·31	....	−0·12
	90	3·2975	2·5100	25·55	25·43	+0·12
75	22·5	3·8418	2·8348	25·89	....	−0·07
	67·5	3·8710	2·8123	26·06	....	+0·10
	112·5	3·8743	2·8281	26·01	....	+0·05
	157·5	3·8565	2·8481	25·88	25·96	−0·08
85	45	4·5039	3·0808	26·72	....	+0·04
	135	4·5072	3·1024	26·65	26·68	−0·03
94	0	5·1090	3·2893	27·38	....	−0·13
	90	5·1685	3·2472	27·64	27·51	+0·13
98	22·5	5·3913	3·3340	27·80	....	−0·08
	67·5	5·4340	3·3009	28·00	....	+0·12
	112·5	5·4298	3·3093	27·96	....	+0·08
	157·5	5·3990	3·3450	27·78	27·88	−0·10

TABLE VIII.

ZONAL FOCI: POSITION H.

Radius of Zone.	ϕ	d_1	d_2	Focus.	Mean.	Astigmatism.
	°	mm.	mm.			
15 mm	45	0·7033	0·6505	23·38	....	+0·04
	135	0·7010	0·6528	23·30	23·34	−0·04
25	0	1·1515	1·0961	23·05	....	−0·31
	90	1·1775	1·0610	23·67	23·36	+0·31
35	45	1·6507	1·4920	23·64	....	+0·07
	135	1·6408	1·5005	23·50	23·57	−0·07
45	0	2·1198	1·9152	23·64	....	−0·27
	90	2·1580	1·8560	24·19	23·91	+0·28
55	45	2·6321	2·2501	24·26	....	+0·06
	135	2·6458	2·2870	24·14	24·20	−0·06
65	0	3·1527	2·6581	24·41	....	−0·26
	90	3·2126	2·5830	24·94	24·67	+0·27
75	22·5	3·7121	2·9610	25·03	....	−0·16
	67·5	3·7705	2·9036	25·42	....	+0·23
	112·5	3·7646	2·9178	25·35	....	+0·16
	157·5	3·7126	2·9823	24·95	25·19	−0·24
85	45	4·3805	3·1994	26·01	....	+0·06
	135	4·3703	3·2255	25·89	25·95	−0·06
94	0	4·9372	3·4590	26·46	....	−0·33
	90	5·0597	3·3340	27·13	26·79	+0·34
98	22·5	5·2258	3·4928	26·97	....	−0·19
	67·5	5·3153	3·4031	27·43	....	+0·27
	112·5	5·3021	3·4164	27·37	....	+0·21
	157·5	5·2219	3·5158	26·89	27·16	−0·27

TABLE IX.

ZONAL FOCI: POSITION I.

Radius of Zone.	ϕ	d_1	d_2	Focus.	Mean.	Astigmatism.
	°	mm.	mm.			
15 mm	45	0·6675	0·6798	22·29	....	+0·14
	135	0·6580	0·6869	22·02	22·15	−0·13
25	0	1·0786	1·1508	21·77	....	−0·53
	90	1·1344	1·1005	22·84	22·30	+0·54
35	45	1·5761	1·5551	22·65	....	+0·17
	135	1·5518	1·5765	22·32	22·48	−0·16
45	0	1·9937	2·0341	22·27	....	−0·55
	90	2·0805	1·9245	23·38	22·82	+0·56
55	45	2·5249	2·3421	23·34	....	+0·16
	135	2·5131	2·3998	23·02	23·18	−0·16
65	0	2·9778	2·8323	23·06	....	−0·59
	90	3·1123	2·6623	24·25	23·65	+0·60
75	22·5	3·5401	3·1225	23·91	....	−0·30
	67·5	3·6580	2·9877	24·77	....	+0·56
	112·5	3·6314	3·0360	24·51	....	+0·30
	157·5	3·5107	3·1646	23·67	24·21	−0·54
85	45	4·2245	3·3275	25·17	....	+0·20
	135	4·1720	3·4060	24·77	24·97	−0·20
94	0	4·7029	3·6958	25·20	....	....
	90	....	....	....	25·20	....
98	22·5	5·0145	3·6885	25·93	....	+0·15
	67·5	....	....	....	....	....
	112·5	....	....	....	....	....
	157·5	4·9712	3·7578	25·63	25·78	−0·15

TABLE X.

ZONAL FOCI: POSITION L.

Radius of Zone.	ϕ	d_1	d_2	Focus.	Mean.	Astigmatism.
	°	mm.	mm.			
15 mm................	45	0·8580	0 5011	28 41	....	+0·03
	135	0·8478	0·4980	28·35	28·38	−0·03
25....	0	1·4122	0 8305	28·34	....	−0·02
	90	1·4257	0·8345	28 38	28·36	+0·02
35..................	45	2·0004	1·1616	28·47	....	−0·04
	135	2·0018	1 1533	28 55	28·51	+0·04
45....................	0	2·5920	1·4647	28·75	....	+0·03
	90	2·5883	1·4712	28 69	28·72	−0·03
55......	45	3·1567	1·7504	28·95	....	−0·05
	135	3·1968	1·7537	29·06	29·00	+0·06
65....	0	3·8030	2 0479	29·25	....	−0·01
	90	3·8094	2·0455	29·28	29·26	+0·02
75	22·5	4·4142	2·2996	29·59	....	−0·08
	67·5	4·4469	2·2925	29·69	....	+0·02
	112·5	4·4305	2·2881	25·68	....	+0·01
	157·5	4·4525	2·2920	29·71	29·67	+0·04
85............... . .	45	5·1293	2·5171	30·19	....	−0·05
	135	5·1351	2·4940	30·29	30·24	+0·05
94..............	0	5·7941	2·6695	30·81	....	−0·04
	90	5·8120	2·6555	30·89	30·85	+0·04
98..........	22·5	6·0783	2·7200	31·09	....	−0·06
	67·5	6·0767	2·6950	31·17	....	+0·02
	112·5	6·0729	2·6946	31·17	....	+0·02
	157·5	6·0908	2·7050	31·16	31·15	+0·01

TABLE XI.

ZONAL FOCI: POSITION M.

Radius of Zone.	ϕ	d_1	d_2	Focus.	Mean.	Astigmatism.
	°	mm.	mm.			
15 mm................	45	0·8617	0·5145	28·18	....	+0·02
	135	0·8519	0·5111	28·13	28·16	−0·03
25.....	0	1·4154	0·8238	28·44	....	−0·02
	90	1·4309	0·8295	28·49	28·46	+0·03
35....	45	2·0053	1·1647	28·47	.. ..	−0·06
	135	2·0039	1·1490	28·60	28·53	+0·07
45	0	2·5951	1·4685	28·74	.. ..	−0·01
	90	2·5865	1·4601	28·76	28·75	+0·01
55.................. .	45	3·1740	1·7598	28·95	....	−0·08
	135	3·2043	1·7498	29·11	29·03	+0·08
65.........	0	3·8230	2·0360	29·36	....	0·00
	90	3·8263	2 0381	29·36	29·36	0·00
75	22·5	4·4467	2·2842	29·73	....	+0·03
	67·5	4·4591	2 2817	29·59	....	−0·11
	112·5	4·4541	2 2803	29·76	....	+0·06
	157·5	4·4353	2 2760	29·74	29·70	+0·04
85	45	5·1375	2·4931	30·30	... .	+0·05
	135	5·1476	2·5197	30·21	30·25	−0·04
94.................	0	5·8073	2·6596	30·86	....	−0·01
	90	5·8189	2·6630	30·87	30·87	0·00
98	22·5	6·0981	2·6932	31·21	....	+0·02
	67·5	6·1118	2·7059	31·19	....	0·00
	112·5	6·0862	2·7090	31·14	....	−0·05
	157·5	6·0983	2·6950	31·21	31·19	+0 02

TABLE XII.

ZONAL FOCI: POSITION N.

Radius of Zone.	φ	d_1	d_2	Focus.	Mean.	Astigmatism.
	°	mm.	mm.			
15mm	45	0·8573	0·4968	28·49	....	+0·07
	135	0·8578	0·5042	28·34	28·42	−0·08
25..................	0	1·4272	0·8332	28·41	....	−0·05
	90	1·4232	0·8235	28·51	28·46	+0·05
35..................	45	2·0043	1·1518	28·58	....	−0·02
	135	2·0138	1·1536	28·61	28·60	+0·01
45..................	0	2·6017	1·4565	28·85	....	+0·04
	90	2·5934	1·4642	28·76	28·81	−0·05
55..................	45	3·1837	1·7478	29·05	....	0·00
	135	3·2112	1·7647	29·04	29·05	−0·01
65..................	0	3·8245	2·0250	29·42	....	+0·01
	90	3·8307	2·0334	29·40	29·41	−0·01
75..................	22·5	4·4507	2·2902	29·71	....	−0·04
	67·5	4·4655	2·2819	29·78	....	+0·03
	112·5	4·4729	2·2797	29·81	....	+0·06
	157·5	4·4521	2·2895	29·72	29·75	−0·03
85..................	45	5·1540	2·5082	30·27	....	−0·02
	135	5·1560	2·4981	30·31	30·29	+0·02
94..................	0	5·8248	2·6439	30·95	....	+0·03
	90	5·8086	2·6549	30·88	30·92	−0·04
98..................	22·5	6·0993	2·6965	31·20	....	0·00
	67·5	6·1101	2·7062	31·19	....	−0·01
	112·5	6·1006	2·6947	31·21	....	+0·01
	157·5	6·0933	2·6951	31·20	31·20	0·00

TABLE XIII.

ZONAL FOCI: POSITION R.

Radius of Zone.	φ	d_1	d_2	Focus.	Mean.	Astigmatism.
	°	mm.	mm.			
15mm	45	0·6950	0·6533	23·20	....	+0·18
	135	0·6707	0·6506	22·84	23·02	−0·18
25..................	0	1·1187	1·1000	22·69	....	−0·23
	90	1·1413	1·0780	23·14	22·92	+0·23
35..................	45	1·6051	1·5079	23·20	....	+0·08
	135	1·5904	1·5168	23·03	23·12	−0·09
45..................	0	2·0648	1·9508	23·14	....	−0·30
	90	2·0968	1·8769	23·74	23·44	+0·30
55..................	45	2·5811	2·2793	23·90	....	+0·12
	135	2·5683	2·3143	23·67	23·78	−0·11
65..................	0	3·0716	2·7009	23·94	....	−0·28
	90	3·1285	2·6173	24·50	24·22	+0·28
75..................	22·5	3·6463	2·9964	24·70	....	−0·09
	67·5	3·6927	2·9238	25·11	....	+0·32
	112·5	3·6642	2·9616	24·89	....	+0·10
	157.5	3·6180	3·0345	24·47	24·79	−0·32
85..................	45	4·2902	3·2352	25·68	....	+0·15
	135	4·2542	3·2864	25·39	25·53	−0·14
94..................	0	4·8501	3·5156	26·09	....	−0·30
	90	4·9240	3·3800	26·68	26·39	+0·29
98..................	22·5	5·1406	3·5317	26·67	....	−0·12
	67·5	5·2145	3·4394	27·12	....	+0·33
	112·5	5·1649	3·4780	26·89	....	+0·10
	157·5	5·1125	3·5791	26·47	26·79	−0·32

TABLE XIV.

ZONAL FOCI.

Radius of Zone.	Position.					
	A	B	C	D	E	F
15 mm	21·66	22·69	23·61	24·20	24·29	24·59
25	21·65	22·76	23·64	24·17	24·30	24·64
35	21.89	22·92	23·83	24·28	24·40	24·72
45	22·17	23·22	24·12	24·59	24·70	25·04
55	22·60	23·56	24·42	24·89	25·01	25·34
65	22·61	23·99	24·85	25·35	25·46	25·80
75	23·62	24·57	25·40	25·87	25·98	26·33
85	24·47	25·31	26·13	26·57	26·68	27·02
94	24·72	26·18	26·98	27·42	27·51	27·84
98	25·26	26·51	27·36	27·80	27·89	28·22
	G	H	I	L	M	N
15 mm	24·25	23·34	22·15	28·38	28·16	28·42
25	24·24	23·36	22·30	28·36	28·46	28·46
35	24·36	23·57	22·48	28·51	28·53	28·60
45	24·65	23·91	22·82	28·72	28·75	28·81
55	24·97	24·20	23·18	29·00	29·03	29·05
65	25·43	24·67	23·65	29·26	29·36	29·41
75	25·96	25·19	24·21	29·67	29·70	29·75
85	26·68	25·95	24·97	30·24	30·25	30·29
94	27·51	26·79	25·20	30·85	30·87	30·92
98	27·88	27·16	25·78	31·15	31·19	31·20

TABLE XV.

Plate.	Best Focus.	Confusion Circle.	Efficiency.
		"	
A	24·5	44·2	11·46
B	25·5	38·5	13·43
C	26·25	39·2	13·11
D	26·75	37·9	13·01
E	26·8	38·5	12·77
F	27·00	43·1	12·56
G	26·7	41·7	12·71
H	26·00	41·00	13·08
I	25·00	36·00	10·52
L	30·20	33·3	9·64
M	30·25	33·0	9·47
N	30·30	31·7	9·38

TABLE XVI.

ZONAL TEST.

Settings 6·5 & 51·5; Separation 0·132 inches.

Radius of Zone.	φ	d_1	d_2	Focus.	Mean.
	°	mm.	mm.		
15 mm	45	0·6422	0·7178	21·25	
	135	0·6389	0·7130	21·27	21·26
25	0	1·0595	1·1848	21·24	
	90	1·0605	1·1895	21·21	21·22
35	45	1·4779	1·6885	21·00	
	135	1·4683	1·6827	20·97	20·98
45	0	1·8743	2·1880	20·76	
	90	1·8729	2·1754	20·82	20·79
55	45	2·2487	2·6728	20·56	
	135	2·2606	2·6841	20·57	20·56
65	0	2·6086	3·2090	20·18	
	90	2·6180	3·2997	19·91	20·04
75	22·5	2·9475	3·7395	19·83	
	67·5	2·9587	3·7468	19·86	
	112·5	2·9633	3·7468	19·87	
	157·5	2·9505	3·7495	19·82	19·84
85	45	3·2795	1 3160	19·43	
	135	3·2858	4·3213	19·44	19·43
94	0	3·5285	4·8575	18·93	
	90	3·5398	4·8555	18·97	18·95
98	22·5	3·6505	5·0963	18·78	
	67·5	3·6643	5·0935	18·83	
	112·5	3·6723	5·0755	18·89	
	157·5	3·6566	5·0691	18·86	18·84

TABLE XVII.

ZONAL TEST.

Settings 16·5 & 61·5; Separation 0·070 inches.

Radius of Zone.	φ	d_1	d_2	Focus.	Mean.
	°	mm.	mm.		
15 mm	45	0·6014	0·7362	20·23	
	135	0·5953	0·7372	20·10	20·16
25	0	0·9944	1·2348	20·07	
	90	0·9931	1·2375	20·03	20·05
35	45	1·3921	1·7460	19·96	
	135	1·3905	1·7501	19·93	19·95
45	0	1·7970	2·2300	20·08	
	90	1·7882	2·2236	20·06	20·07
55	45	2·1784	2·7251	19·99	
	135	2·1720	2·7159	19·99	19·99
65	0	2·5940	3·2068	20·12	
	90	2·5899	3·2110	20·09	20·11
75	22·5	2·9884	3·6893	20·14	
	67·5	2·9855	3·6896	20·13	
	112·5	2·9914	3·6926	20·14	
	157·5	2·9805	3·6919	20·10	20·13
85	45	3·4127	4·1765	20·24	
	135	3·4084	4·1754	20·22	20·23
94	6	3·7945	4·5940	20·36	
	90	3·7910	4·6020	20·33	20·35
98	22·5	3·9770	4·7611	20·48	
	67·5	3·9740	4·7611	20·47	
	112·5	3·9755	4·7650	20·47	
	157·5	3·9755	4·7735	20·45	20·47

TABLE XVIII.

SETTINGS 16·5 AND 61·5; 0·077 SEPARATION

Radius of Zone.	ϕ	d_1	d_2	Focus.	Mean.
	°	mm.	mm.		
15	45	0·5717	0·7561	19·38	
	135	0·5830	0·7540	....	19·38
25	0	0·9550	1·2645	19·36	
	90	0·9549	1·2662	19·35	19·36
35	45	1·3335	1·7745	19·31	
	135	1·3365	1·7831	19·28	19·30
45	0	1·7208	2·2832	19·34	
	90	1·7228	2·2750	19·39	19·37
55	45	2·0918	2·7819	19·31	
	135	2·0909	2·7681	19·36	19·34
65	0	2·4909	3·2762	19·44	
	90	2·4915	3·2844	19·41	19·43
75	22·5	2·8593	3·7774	19·39	
	67·5	2·8637	3·7804	19·39	
	112·5	2·8707	3·7829	19·42	
	157·5	2·8585	3·7694	19·41	19·40
85	45	3·2567	4·2874	19·43	
	135	3·2742	4·2702	19·53	19·48
94	0	3·6387	4·7187	19·59	
	90	3·6456	4·7240	19·60	19·60
98	22·5	3·7929	4·9030	19·63	
	67·5	3·7942	4·9054	19·63	
	112·5	3·8191	4·8918	....	
	157·5	3·7988	4·8958	19·66	19·64

APPENDIX E.

OBSERVING RECORDS AND DETAILED MEASURES OF β ORIONIS, θ AQUILÆ, ϵ HERCULIS, η BOÖTIS, α CORONÆ BOREALIS AND δ AQUILÆ.

P.—Plaskett.
H.—Harper.
C.—Cannon.
P[1]—Parker.

β ORIONIS.

RECORD OF SPECTROGRAMS.

Star.	No. of Negative.	Camera.	Plate.	Date.	Middle of Exposure. G. M. T.	Duration.	Hour Angle at end.	Temperature Centigrade. Room. Beginning.	Room. End.	Prism Box. Beginning.	Prism Box. End.	Slit Width.	Seeing.	Observer.	Remarks.
				1908.	h. m.	m.	h. m.								
β Orionis ...	1241a	IL	Seed 27 ..	Jan. 20..	15 03	2½	52 W.	- 7·0	....	- 6·9	6·9	001	Poor ...	P	
" ...	1241b	"	" ..	" 20.	15 05	"	55 "	....	....	"	"	"	"	P	
" ...	1241c	"	" ..	" 20..	15 07½	"	57½ "	....	....	"	"	"	"	P	
" ...	1242a	"	" ..	" 20..	15 12½	"	1 02½ "	....	....	"	"	"	"	P	
" ...	1242b	"	" ..	" 20..	15 15	"	1 05 "	....	....	"	"	"	"	P	
" ...	1242c	"	" ..	" 20..	15 17½	"	1 07½ "	....	....	"	"	"	"	P	
" ...	1243a	"	" ..	" 20..	15 25	1½	1 16 "	....	....	"	"	·0015	"	P	
" ...	1243b	"	" ..	" 20..	15 27	"	1 18 "	....	....	"	"	"	"	P	
" ...	1243c	"	" ..	" 20..	15 29	"	1 20 "	....	....	"	"	"	"	P	
" ...	1244a	"	" ..	" 20..	15 45	1¼	1 36 "	....	....	"	"	"	"	P	
" ...	1244b	"	" ..	" 20..	15 47	"	1 38 "	....	....	"	"	"	"	P	
" ...	1244c	"	" ..	" 20..	15 49	"	1 40 "	....	....	"	"	"	"	P	
" ...	1245a	"	" ..	" 20..	15 52	50^s	1 43 "	....	....	"	"	·002	"	P	
" ...	1245b	"	" ..	" 20..	15 53	"	1 44 "	....	....	"	"	"	"	P	
" ...	1245c	"	" ..	" 20..	15 54	"	1 45 "	....	....	"	"	"	"	P	
" ...	1247a	"	" ..	" 20..	16 16	40^s	2 05 "	....	....	"	"	.003	"	P	
" ...	1247b	"	" ..	" 20..	16 17	"	2 06 "	....	....	"	"	"	"	P	
" ...	1247c	"	" ..	" 20..	16 18	"	2 07 "	....	....	"	"	"	"	P	
" ...	1248a	"	" ..	" 20..	16 26	"	2 15 "	....	....	"	"	"	"	P	
" ...	1248b	"	" ..	" 20..	16 27	"	2 16 "	....	....	"	"	"	"	P	
" ...	1248c	"	" ..	" 20..	16 28	"	2 17 "	....	....	"	"	"	"	P	
" ...	1249a	"	" ..	" 20..	16 35	1	2 23 "	....	....	"	"	·002	"	P	
" ...	1249b	"	" ..	" 20..	16 37	"	2 25 "	....	....	"	"	"	"	P	
" ...	1249c	"	" ..	" 20..	16 39	"	2 27 "	....	- 6·5	"	"	"	"	P	
" ...	1285a	IIIS	" ..	" 27..	15 46	5	2 00 "	- 13·0	- 13·0	- 16·0	- 16·0	·001	Good. ..	P	
" ...	1285b	"	" ..	" 27..	15 51	"	2 05 "	"	"	"	"	"	"	P	

" ...	1285c	"	" ..	" 27..	15 56	"	2 10 "	"	"	"	"	"	" ...	P	
" ...	1286a	"	" .	" 27..	16 04	"	2 18 "	"	"	"	"	·0015	" ...	P	
" ...	1286b	"	" ..	" 27..	16 09	"	2 23 "	"	"	"	"	"	"	P	
" ...	1286c	"	" ..	" 27..	16 14	"	2 28 "	"	"	"	"	"	"	P	
" ...	1289a	"	" ..	" 27 .	17 14	2½	3 30 "	"	"	"	"	·002	"	P	
" ...	1289b	"	" ..	" 27..	17 17	"	3 33 "	"	"	"	"	"	"	P	
" ..	1289c	"	" ..	" 27..	17 20	"	3 36 "	"	"	"	"	"	"	P	
" ...	1290a	"	" ..	" 27..	17 25	"	3 41 "	"	"	"	"	"	"	P	
" ...	1290b	"	" ..	" 27..	17 28	"	3 44 "	"	"	"	"	"	"	P	
" ...	1290c	"	" ..	" 27..	17 31	"	3 47 "	"	"	"	"	"	"	P	
" ...	1405	IIIL	" ..	Mar. 20..	11 51	13	1 37 "	− 3·4	− 3·4	1·2	1·2	·001	Fair......	P	
" ...	1406	"	" ..	" 20..	12 07	14	1 50 "	"	− 4·0	"	"	"	......	P	
" ...	1407	"	" ..	" 20..	12 21	13	2 04 "	− 4·0	− 4·3	"	1·1	"	....	P	
" ...	1408	"	" ..	" 20..	12 32	11	2 15 "	− 4·3	− 5·2	1·1	"	"	to ...	P	
" ...	1409	"	" ..	" 20..	12 46	14	2 30 "	− 5·2	− 5·2	"	1·0	"	....	P	
" ...	1410	"	" ..	" 20..	13 00	11	2 45 "	"	− 6·0	1·0	"	"	...	P	
" ...	1411	"	" ..	" 20..	13 12	9	2 52 "	− 6·0	− 6·5	1·0	0·9	·0015	.. ..	P	
" ...	1412	"	" ..	" 20 .	13 25	15	3 10 "	− 6·5	− 6·8	0·9	0·8	"	good	P	Off part of time.
" ...	1413	"	" ..	" 20..	13 47	8	3 30 "	− 6·8	− 7·0	0·8	0·8	"	....	P	
" ...	1414	"	" ..	" 20..	13 57	11	3 40 "	− 7·0	− 6·5	"	"	"	....	P	
" ...	1426a	"	" ..	" 24..	12 03	10	2 02 "	1·0	1·0	5·1	5·1	·002	Fair......	P	
" ...	1427	"	" .	" 24..	12 14	8	2 12 "	....	....	....	....	"	"	P	
" ...	1428	"	" ..	" 24..	12 23	8	2 20 "	....	....	....	....	"	"	P	
" ...	1429	"	" ..	" 24..	12 32	9	2 30 "	− 2·0	....	5·0	....	"	" ...	P	
" ...	1430	"	" ..	" 24..	12 42	9	2 40 "	....	....	....	....	"	"	P	
" ...	1431	"	" ..	" 24..	12 52	8	2 50 "	− 3·4	....	4·9	....	"	"	P	
" ...	1433	"	" ..	" 24..	13 16	7	3 15 "	....	....	....	....	·003	"	P	
" ...	1434	"	" ..	" 24..	13 32	6	3 30 "	− 4·5	....	4·7	....	"	"	P	
" ...	1435	"	" ..	" 24..	13 39	6	3 36 "	....	....	....	....	"	"	P	
" ...	1436	"	" ..	" 24..	13 46	6	3 44 "	....	....	....	....	"	. ....	P	
" ...	1437	"	" ..	" 24..	13 56	9	3 56 "	....	....	....	....	"	"	P	
" ...	1438	"	" ..	" 24..	14 07	10	4 05 "	− 5·0	− 5·0	4·6	4·6	"	"	P	
" ...	1439	"	" ..	" 30..	12 19	8	2 40 "	3·5	3·5	5·7	5·7	·0022	"	P	Slit intended for ·0018.
" ...	1440	"	" ..	" 30..	12 29	8	2 50 "	"	"	"	"	"	"	P	
" ...	1441	"	" ..	" 30..	12 38	9	3 00 "	3·5	3·3	5·7	5·7	·0022	"	P	
" ...	1442	"	" ..	" 30..	12 49	10	3 13 "	3·3	3·0	"	"	"	"	P	
" ...	1448	"	" ..	April 3..	12 16	9	2 57 "	− 2·8	− 3·2	1·7	1·7	·002	"	P	
" ...	1449	"	" ..	" 3..	12 28	10	3 10 "	− 3·2	− 3·8	"	"	"	"	P	
" ...	1450	"	" ..	" 3..	12 40	10	3 22 "	− 3·8	− 3·4	"	"	"	" ...	P	
" ...	1451	"	" ..	" 3..	12 53	10	3 35 "	− 3·4	− 3·1	"	"	"	"	P	
" ...	1457	"	" ..	" 4..	12 19	8	3 00 "	− 1·6	....	2·0	2·0	·0018	"	P	
" ...	1458	"	" ..	" 4..	12 28	8	3 10 "	"	....	"	"	"	"	P	
" ...	1459	"	" ..	" 4..	12 37	8	3 20 "	2·0	....	"	"	"	"	P	
" ...	1469	"	" ..	" 13..	12 10	10	3 30 "	5·8	....	9·7	....	·002	Good.	P	
" ...	1470	"	" ..	" 13..	12 22	10	3 42 "	....	....	....	....	"	"	P	
" ...	1471	"	" ..	" 13..	12 34	11	3 53 "	....	....	....	....	"	"	P	
" ...	1873	"	" ..	Sept. 7..	21 52	16	....	12·0	11·8	21·0	21·0	·0015	"	C	
" ...	1874	"	" ..	" 7..	22 10	19	....	11·8	11·6	"	"	"	"	C	
" ...	1935	"	" ..	Oct. 13..	21 19	20	0 45 W.	7·3	7·6	11·7	11·6	·0016	Fair......	P	
" ...	1936	"	" ..	" 13..	21 48	28	1 20 "	7·6	"	11·6	"	"	"	P	

P.—Plaskett.
H.—Harper.
C.—Cannon.
P1—Parker.

β ORIONIS.

RECORD OF SPECTROGRAMS—*Continued.*

Star.	No. of Negative.	Camera.	Plate.	Date.	Middle of Exposure G. M. T.	Duration.	Hour Angle at end.	Temperature Centigrade. Room. Beginning.	Room. End.	Prism Box. Beginning.	Prism Box. End.	Slit Width.	Seeing.	Observer.	Remarks.
				1908.	h. m.	m.	h. m.								
β Orionis....	1937	IIIL	Seed 27...	Oct. 13..	22 19	30	1 50 W.	7·6	7·6	11·6	11·6	·0016	Fair......	P	
" ...	1938	"	" ..	" 13..	22 47	25	2 15 "	"	7·5	"	"	"	"	P	
" ...	1978	"	" ..	Nov. 21..	18 24	18	0 25 "	2·7	2·6	4·9	4·9	·0015	"	P	
" ...	1979	"	" ..	" 21..	18 43	17	0 45 "	2·6	1·5	"	"	"	....	P	
" ...	1980	"	" ..	" 21..	19 05	22	1 10 "	1·4	− 0·3	"	4·8	"	....	P	
" ...	1981	"	" ..	" 21..	19 33	30	1 40 "	− 0·3	− 1·5	4·8	"	"	....	P	Fog.
" ...	1981	"	" ..	" 28..	16 05	20	1 30 E.	5·2	5·0	6·7	6·7	·0016	....	P	
" ...	1985	"	" ..	" 28..	16 34	22	1 00 "	5·0	5·5	"	"	"	....	P	
" ...	1986	"	" ..	" 28..	17 08	15	0 10 "	5·5	"	"	"	"	....	P	
" ...	1987	"	" ..	Dec. 1..	17 53	27	0 35 W.	− 3·8	− 4·0	− 1·8	− 1·8	"	Good.....	P	
" ...	1988	"	" ..	" 1..	18 18	16	1 00 "	− 4·0	− 4·1	"	"	"	"	P	
" ...	1989	"	" ..	" 1..	18 36	16	1 18 "	− 4·1	− 4·2	"	"	"	"	P	
" ...	1990	"	" ..	" 1..	18 52	15	1 31 "	− 4·2	− 4·5	"	"	"	"	P	
" ...	2003	"	" ..	" 5..	16 10	10	1 00 E.	− 16·0	− 16·5	− 7·9	7·9	"	Fair.....	P	
" ...	2004	"	" ..	" 5.	16 22	10	0 48 "	....	....	....	....	·0016	"	P	
" ...	2005	"	" ..	" 5..	16 38	13	0 32 "	....	....	....	....	"	Poor.....	P	
" ...	2006	"	" ..	" 5..	16 53	13	0 15 "	....	− 17·8	....	− 7·9	"	"	P	
" ...	2054	IL	" ..	" 21..	15 24	3	0 21 "	− 11·2	− 11·2	− 1·6	− 1·6	·0015	Good.....	P1	
" ...	2055	"	" ..	" 21..	15 29	2	0 20 "	"	"	"	"	"	"	P1	
" ...	2057	"	" ..	" 21..	16 54	2	0 45 W.	− 12·4	− 12·4	− 1·9	− 1·9	"	"	P1	
" ...	2058	"	" ..	" 21..	17 00	2	0 51 "	"	"	"	"	"	"	P1	
" ...	2065	IIIL	" ..	" 22..	17 38	10	1 20 "	− 18·5	....	− 13·0	....	·0016	"	P	
" ...	2066	"	" ..	" 22..	17 52	9	1 32 "	....	....	....	....	"	"	P	
" ...	2067	"	" ..	" 22..	18 02	8	1 43 "	....	....	....	....	"	"	P	
" ...	2068	"	" ..	" 22.	18 14	8	2 10 "	....	19·0	....	13·0	"	"	P	
" ...	2070	"	" ..	" 23..	14 01	14	1 55 E.	− 14·5	− 14·5	− 7·5	− 7·5	"	....	H	Drifting.
" ...	2071	"	" ..	" 23..	14 41	44	1 00 "	− 16·0	− 15·0	− 7·8	7·9	"	Poor.....	H. P.	
" ...	2072	"	" ..	" 23..	15 08	8	0 50 "	"	"	− 7·9	"	"	" ..	P	
" ...	2073	"	" ..	" 23..	15 19	8	0 40 "	"	"	"	"	"	......	P	
" ...	2075	"	" ..	" 26..	15 49	8	0 00	− 9·8	....	− 4·1	....	"	Steady...	P	

"	...	2076	"	" ..	" 26..	15 59	8	0 10 W.	......	......	− 4·2	......	"	......	P	
"	...	2077	"	" ..	" 26..	16 09	8	0 20 "	"	"	"	......	"	......	P	
"	...	2078	"	" ..	" 26..	16 19	8	0 30 "	......	......	......	......	"	......	P	
"	...	2079	"	" ..	" 27..	14 07	20	1 30 E.	0·0	......	0·0	......	"	Hazy	P	
"	...	2080	"	" ..	" 27..	15 12	15	0 20 "	0·5	......	0·1	......	"	Poor.....	P	Only 5m. seeing.
"	...	2082	1L	" ..	" 31..	15 19	2	0 06 "	−10·0	−13·5	− 3·3	− 3·3	·0015	......	H	
"	...	2083	"	" ..	" 31..	15 23	2½	0 02 "	"	"	"	"	"	......	H	
"	...	2084	"	" ..	" 31..	15 29	3	0 02 W.	"	"	"	"	"	......	H	
"	...	2085	"	" ..	" 31..	15 57	5	0 31 "	"	"	"	"	"	......	H	
					1909.											
"	...	2092	"	" ..	Jan. 6..	16 49	2	1 36 W.	−16·5	......	− 2·8	......	·0015	Good. ...	H	
"	...	2093	"	" ..	" 6..	16 53	2	1 40 "	......	......	......	......	"	"	H	
"	...	2094	"	" ..	" 6..	17 13	2	2 00 "	......	......	......	......	"	" ...	H	
"	..	2095	"	" ..	" 6..	17 16	2	2 04 "	......	−17·5	......	− 3·1	"	"	H	
"	...	2105	"	" ..	" 7..	12 49	2	2 15 E.	−16·3	−16·3	− 9·2	− 9·2	"	Poor.....	P	
"	...	2106	"	" ..	" 7..	13 01	2	2 03 "	"	"	"	"	"	"	P	
"	...	2107	"	" ..	" 7..	13 04	2	2 00 "	......	......	......	......	"	"	P	
"	...	2108	"	" ..	" 7..	13 07	2	1 57 "	−16·4	−16·4	− 9·2	− 9·3	"	......	P	
"	...	2111	111L	" ..	" 7..	16 28	8	1 20 W.	−18·0	......	−13·3	......	·0016	Fair.....	P	
"	...	2112	"	" ..	" 7..	16 36	7	1 30 "	......	......	......	......	"	" ...	P	
"	...	2114	"	" ..	" 7..	16 56	8	1 55 "	......	−18·0	......	−13·3	"	......	P	
"	...	2117	IL	" .	" 8..	15 48	2	1 00 "	−11·6	−11·6	− 8·9	− 8·9	·0015	Good.....	P[1]	
"	...	2118	"	" ..	" 8 .	15 52	2	1 04 "	−11·6	−11·6	"	"	·0015	"	P[1]	
"	...	2122	"	" ..	" 12..	11 55	2	2 50 E.	− 9·0	−11·5	− 6·8	− 6·9	·0013	Poor.....	P	
"	...	2123	"	" ..	" 12..	11 59	2	2 46 "	......	......	......	......	"	......	P	
"	...	2124	"	" ..	" 12..	12 09	2	2 36 "	......	......	......	......	"	......	P	
"	...	2125	"	" ..	" 12..	12 12	2	2 33 "	......	......	......	......	"	......	P	
"	...	2126	"	" ..	" 12..	12 15	2	2 30 "	......	−11·5	......	− 6·9	"	......	P	
"	..	2127	"	" ..	" 12..	12 18	2	2 27 "	......	"	......	"	"	......	P	
"	...	2128	"	" ..	" 13..	15 36	2	0 55 W.	−15·0	−15·0	−12·0	−12·0	·0013	......	C	Focus as Jan. 12.
"	...	2129	"	" ..	" 13..	15 41	2	1 00 "	"	"	"	"	"	Good. ...	H	
"	...	2130	"	" ..	" 13..	15 46	2	1 06 "	"	"	"	"	"	"	H	
"	...	2141	"	" ..	" 15..	14 54	2	0 19 "	−14·8	......	− 4·7	......	......	" ...	C	
"	...	2142	"	" ..	" 15..	15 11	2	0 36 "	......	......	......	......	......	"	C	
"	...	2143	"	" ..	" 15..	15 15	2	0 40 "	......	......	......	......	......	"	C	
"	...	2144	"	" ..	" 15..	15 19	2	0 47 "	......	−15·6	......	− 5·2	......	......	C	
"	...	2151	"	" ..	" 16..	12 25	10	2 00 E.	−21·5	−21·5	−12·0	−12·0	·0010	Very hazy	P	
"	...	2152	"	" ..	" 16..	12 36	7	1 49 "	......	......	......	......	"	Better.	P	
"	...	2153	"	" ..	" 16..	12 44	4	1 41 "	......	......	......	......	"	......	P	
"	...	2154	"	" ..	" 16..	12 52	5	1 33 "	......	......	......	......	"	......	P	
"	...	2155	"	" ..	" 16..	12 59	6	1 26 "	......	......	......	......	"	......	P	
"	....	2156	"	" ..	" 16..	13 12	16	1 10 "	......	−22·0	......	−12·0	"	......	P	
"	...	2157	"	" ..	" 17..	13 48	5	0 40 "	−13·5	......	−11·8	......	·0015	Good.....	P[1]	Focus unchanged.
"	...	2158	"	" ..	" 17..	13 56	7	0 30 "	......	−13·5	......	−11·8	"	"	P[1]	
"	...	2161	"	" ..	" 18..	12 41	3	1 40 "	−17·5	......	−13·8	......	"	......	P	
"	...	2162	"	" ..	" 18..	12 46	3	1 35 "	......	......	......	......	"	......	P	
"	...	2163	"	" ..	" 18..	12 51	3	1 30 "	......	......	......	......	"	......	P	
"	...	2164	"	" ..	" 18..	13 04	2	1 17 "	......	......	......	......	"	......	P	

P.—Plaskett.
H.—Harper.
C.—Cannon.
P[1]—Parker.

β ORIONIS.

RECORD OF SPECTROGRAMS.—*Continued.*

Star.	No. of Negative.	Camera.	Plate.	Date.	Middle of Exposure. G. M. T.	Duration.	Hour Angle at End.	Temperature Centigrade. Room. Beginning.	Room. End.	Prism Box. Beginning.	Prism Box. End.	Slit Width.	Seeing.	Observer.	Remarks.
				1909.	h. m.	m.	h. m.								
β Orionis....	2165	1L	Seed 27..	Jan. 18..	13 10	2	1 11 E.	....	....	....	....	·0015	.....	P	
" ...	2166	"	" ..	" 18..	13 14	2	1 08 "	....	−19·5	....	−13·8	"	....	P	
" ...	2177	"	" ..	" 26..	10 36	3	3 10 "	− 1·0	....	+ 1·8	....	·0013	Good.....	P	
" ...	2178	"	" ..	" 26..	10 51	2	2 55 "	....	....	....	....	"	" ...	P	
" ...	2179	"	" ..	" 26..	10 56	2	2 50 "	....	....	....	....	"	"	P	
" ...	2180	"	" ..	" 26..	11 01	3	2 45 "	....	....	....	....	"	"	P	
" ...	2181	"	" ..	" 26..	11 11	2	2 35 "	....	....	....	....	"	"	P	
" ...	2182	"	" ..	" 26..	11 16	3	2 30 "	....	....	....	....	"	"	P	
" ...	2183	"	" ..	" 26..	11 21	2	2 25 "	....	− 1·6	....	+ 1·8	"	"	P	
" ...	2184	"	" ..	" 28..	11 21	2	2 20 "	− 8·3	....	− 6·9	....	"	"	P	
" ...	2185	"	" ..	" 28..	11 25	2	2 16 "	....	....	....	....	"	"	P	
" ...	2186	"	" ..	" 28..	11 29	2	2 12 "	....	....	....	....	"	"	P	
" ...	2187	"	" ..	" 28..	11 41	2	2 00 "	....	....	....	....	"	"	P	
" ...	2188	"	" ..	" 28..	11 44	2	1 57 "	....	....	....	....	"	"	P	
" ...	2189	"	" ..	" 28..	11 47	2	1 55 "	....	− 9·0	....	− 6·9	"	"	P	
" ...	2195	"	" ..	" 29..	12 53	2	0 40 "	− 6·4	....	0·0	....	"	....	C	
" ...	2196	"	" ..	" 29..	12 57	3	0 38 "	....	....	....	....	"	....	C	
" ...	2197	"	" ..	" 29..	13 01	2	0 34 "	....	....	....	....	"	....	C	
" ...	2198	"	" ..	" 29..	13 05	3	0 30 "	....	− 6·4	....	0·0	"	....	C	
" ...	2201	"	" ..	" 30..	12 29	2	1 00 "	....	....	....	....	"	Fair....	P	
" ...	2202	"	" ..	" 30..	12 41	2	0 48 "	....	....	....	....	"	"	P	
" ...	2203	"	" ..	" 30..	12 45	2	0 45 "	....	....	....	....	"	"	P	
" ...	2204	"	" ..	" 30..	12 48	2	0 42 "	....	− 3·8	....	− 2·6	"	"	P	
" ...	2205	IIIL	" ..	" 30..	15 47	14	2 20 W.	− 6·0	....	− 2·7	....	·0016	Unsteady.	P	
" ...	2206	"	" ..	" 30..	16 04	16	2 37 "	....	....	....	....	"	....	P	
" ...	2207	"	" ..	" 30..	16 24	19	3 00 "	....	− 6·6	....	− 2·8	"	....	P	
" ...	2211	1L	" ..	. 31..	17 16	3	3 32 "	−19·0	....	− 6·0	....	·0013	Fair....	H	
" ...	2212	"	" ..	" 31..	17 20	3	3 36 "	−19·0	....	− 6·0	....	"	"	H	
" ...	2213	"	" ..	" 31..	17 24	5	3 40 "	....	....	....	....	"	"	H	
" ...	2214	"	" ..	" 31..	17 29	5	3 45 "	....	−19·0	....	− 6·0	"	"	H	

"	...	2215	"	"	..	Feb. 2..	11	14	2	2	05	E.	− 6·6		− 2·7		·0012		P	
"	...	2216	"	"	..	" 2..	11	23	2	1	56	"					"		P	
"	...	2217	"	"	..	" 2..	11	26	2	1	53	"					"		P	
"	...	2218	"	"	..	" 2..	11	29	2	1	50	"					"		P	
"	...	2219	"	"	..	" 2..	11	41	2	1	38	"					"		P	
"	...	2220	"	"	..	" 2..	11	45	2	1	35	"		− 7·1		− 2·8	"		P	
"	...	2236	"	"	..	" 6..	12	29	2		37	"	− 4·0		− 1·9		"		P	
"	...	2239	"	"	..	" 6..	12	50	1		16	"					"		P	
"	...	2240	"	"	..	" 6..	12	52	1		15	"		− 4·4		− 1·9	"		P	
"	...	2241	111L	"	..	" 6..	16	12	25	3	20	W.	− 3·8	− 3·5	− 3·0	− 3·0	·0016		P	Cloudy ⅔ time.
"	...	2242	"	"	..	" 6..	16	43	34	3	55	"	− 3·5	"	"	"	"	Poor	P	
"	...	2243	"	"	..	" 7..	15	11	13	2	15	"	− 2·5	− 3·5	− 1·2	− 1·2	"	Fair	P	
"	...	2244	"	"	..	" 7..	15	25	11	2	28	"					"	"	P	
"	...	2245	"	"	..	" 7..	15	37	10	2	39	"					"	"	P	
"	...	2249	1L	"	..	" 8..	13	32	2		38	"	−13·5		− 5·2		·0012	Good	P1	
"	...	2250	"	"	..	" 8..	13	36	2		42	"					"	"	P1	
"	...	2251	"	"	..	" 8..	13	41	2		47	"					"	"	P1	
"	...	2252	"	"	..	" 8..	14	01	2	1	07	"					"	"	P1	
"	...	2253	"	"	..	" 8..	14	05	2	1	11	"					"	"	P1	
"	...	2254	"	"	..	" 8..	14	09	2	1	15	"		−13·7		− 5·3	"	"	P1	
"	...	2265	"	"	..	" 10..	12	07	4		45	E.	− 4·0		− 1·8		·0011	Poor	H	Very windy.
"	...	2266	"	"	..	" 10..	12	12	3½		40	"					"		H	
"	...	2267	"	"	..	" 10..	12	16	2½		36	"					"		H	
"	...	2268	"	"	..	" 10..	12	21	2½		31	"					"		H	
"	...	2269	"	"	..	" 10..	12	33	2½		19	"					"		H	
"	...	2270	"	"	..	" 10..	12	37	2		10	"		− 4·0		− 1·8	"		H	
"	...	2272	"	"	..	" 11..	11	26	2				− 7·5		− 2·2		·0012	Good	P	
"	...	2273	"	"	..	" 11..	11	32	2	1	17	E.					"	"	P	
"	...	2274	"	"	..	" 11..	11	35	2	1	14	"					"	"	P	
"	...	2275	"	"	..	" 11..	11	38	2	1	11	"					"	"	P	
"	...	2276	"	"	..	" 11..	11	46	2	1	03	"					"	"	P	
"	...	2277	"	"	..	" 11..	11	49	2	1	00	"					"	"	P	
"	...	2278	IIIL	"	..	" 13..	12	27	10		05	"	− 4·5		+ 0·1		·0016	Fair	P	
"	...	2279	"	"	..	" 13..	12	40	10		08	W.					"	"	P	
"	...	2280	"	"	..	" 13..	12	53	10		21	"		− 5·0		0·0	"	"	P	
"	...	2284	"	"	..	" 20..	12	29	18		25	"	− 1·3		+ 3·8		·0015		P	
"	...	2285	"	"	..	" 20..	13	05	50	1	20	"		− 2·3		+ 3·6	"	Poor	P	Very cloudy.
"	...	2286	"	"	..	" 20..	15	12	15	3	10	"		− 3·4		+ 3·3	"	Fair	P	
"	...	2288	"	"	..	" 21..	12	57	9		55	"	− 1·6		+ 4·3		"	Good	P	
"	...	2289	"	"	..	" 21..	13	07	9	1	05	"					"	"	P	
"	...	2290	"	"	..	" 21..	13	17	9	1	15	"					"	"	P	
"	...	2291	"	"	..	" 21..	13	28	9	1	25	"		− 2·4		+ 4·2	"	"	P	
"	...	2292	"	"	..	" 22..	12	02	10		10	"	− 0·8	− 1·0	3·0	3·0	"	"	P1	
"	...	2293	"	"	..	" 22..	12	15	10		20	"	− 1·0	"	"	2 9	"	"	P1	
"	...	2294	"	"	..	" 22..	12	30	10		35	"	"	"	"	"	"	"	P1	
"	...	2295	"	"	..	" 22..	12	42	9		47	"	"	"	"	"	"	"	P1	
"	...	2309	"	"	..	" 27..	11	32	25		03	"	1·5	1·2	5·0	5·0	"	Hazy	P	
"	...	2311	"	"	..	" 28..	11	56	8		20	"	− 6·8		− 1·2		"	Good	P	
"	...	2312	"	"	..	" 28..	12	07	10		30	"					"	"	P	
"	...	2313	"	"	..	" 28..	12	18	7		41	"					"	"	P	

P.—Plaskett.
H.—Harper.
C.—Cannon.
P[1]—Parker.

β ORIONIS.

RECORD OF SPECTROGRAMS.—*Continued.*

Star.	No. of Negative.	Camera.	Plate.	Date.	Middle of Exposure. G. M. T.		Duration.	Hour Angle at End.		Temperature Centigrade. Room. Beginning.	Room. End.	Prism Box. Beginning.	Prism Box. End.	Slit Width.	Seeing.	Observer.	Remarks.
				1909.	h.	m.	m.	h.	m.								
β Orionis	2314	111L	Seed 27	Feb. 28	12	27	7		50 W.					·0015	Good	P	
"	2315	"	"	" 28	12	39	12	1	02 "					"	"	P	
"	2316	"	"	" 28	12	50	8	1	15 "		− 8·4		− 1·3	"	"	P	
"	2317	"	"	Mar. 2	11	05	10		22 E.	0·3		3·6		·0016	"	P	
"	2318	"	"	" 2	11	19	8		8 "					"	"	P	
"	2319	"	"	" 2	11	29	8		2 W.					"	"	P	
"	2320	"	"	" 2	11	39	8		10 "	1·0		3·6		"	"	P	
"	2364	"	"	" 13	12	12	8	1	28 "	2·8		7·2		·0015	"	P	
"	2365	"	"	" 13	12	24	8	1	40 "					"	"	P	
"	2366	"	"	" 13	12	36	8	1	52 "					"	"	P	
"	2367	"	"	" 13	12	46	7	2	02 "					"	"	P	
"	2368	"	"	" 13	12	57	6	2	10 "		2·1		7·0	"	"	P	
"	2372	"	"	" 15	11	45	10	1	10 "	−0·4		2·0		"	"	P	
"	2373	"	"	" 15	11	56	7	1	21 "					"	"	P	
"	2374	"	"	" 15	12	05	6	1	30 "					"	"	P	
"	2375	"	"	" 15	12	13	6	1	35 "					"	"	P	
"	2376	"	"	" 15	12	21	6	1	40 "		− 1·2		+1·9	"	"	P	
"	2386	"	"	" 18	11	42	9	1	20 "	−0·4		3·8		"		P	
"	2387	"	"	" 18	11	52	7	1	30 "					"		P	
"	2388	"	"	" 18	12	02	8	1	40 "					"		P	
"	2389	"	"	" 18	12	12	7	1	50 "		0·5		3·7	"		P	
"	2390	"	"	" 20	12	16	7	1	00 "	11·0		7·2		"	Fair	P	
"	2391	"	"	" 20	12	26	7	1	10 "					"	"	P	
"	2392	"	"	" 20	12	38	10	1	22 "					"	"	P	
"	2393	"	"	" 20	12	48	7	1	30 "					"	"	P	
"	2394	"	"	" 20	12	58	7	1	40 "		0·5		7·0	"	"	P	
"	2397	"	"	" 21	13	38	8	3	25 "	−1·8		4·0		"	"	P	
"	2398	"	"	" 21	13	48	9	3	35 "					"	"	P	
"	2399	"	"	" 21	14	00	11	3	47 "					"	"	P	
"	2400	"	"	" 21	14	14	12	4	02 "		−3·8		3·9	"	"	P	

"	...	2402	"	" ..	" 22..	11 51	10	1 31	"	3·1		4·8		"	Good....	P
"	...	2403	"	" ..	" 22..	12 02	10	1 42	"					"	"	P
"	...	2404	"	" ..	" 22..	12 13	11	1 51	"					"	"	P
"	...	2405	"	" ..	" 22..	12 35	9	2 15	"		2·6		4·8	"	"	P
"	...	2420	"	" ..	" 23..	11 46	6	1 40	"	5·4		8·1		"	"	P
"	...	2421	"	" ..	" 23..	11 57	6	1 51	"					"	"	P
"	...	2422	"	" ..	" 23..	12 05	6	1 59	"					"	"	P
"	...	2423	"	" ..	" 23..	12 13	7	2 07	"					"	"	P
"	...	2424	"	" ..	" 23..	12 27	8	2 20	"					"	"	C
"	...	2425	"	" ..	" 23..	12 38	8	2 33	"		3·5		6·8	"	"	C

β ORIONIS 1241 *a*.

1908. Jan. 20.
G. M. T. 15h 00m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·0256	....	....	....	1½	53 1058	....	....	....
3	53·0008	·0048	·0350	+40·28	3	45·2624	·2724	·0337	+55·17
2	53·4440	·4490	·0467	53·40	2	45·2628	....	....	....

Weighted mean		+41·64
V_a	−17·93	
V_d	− ·09	
Curvature	− 28	
Radial velocity		+ 23·3

β ORIONIS 1241 *b*.

1908. Jan. 20.
G. M. T. 15h 00m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7354	....	....	....	2	53·1094	....	....	....
2	54·0270	....	....	....	3	45·2712	·2755	·0368	+38·41
3	54·0008	·0048	·0350	+40·28	2	45·2684	....	....	....
1	53·4328	·4360	·0337	+38·54					

Weighted mean		+39·23
V_a	−17·93	
V_d	− ·09	
Curvature	− ·28	
Radial velocity		+ 20·9

β ORIONIS 1241 *c*.

1908. Jan. 20.
G. M. T. 15h 00m

Measured by } J. S. Plaskett.
Observed by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
	54·7640	....	....	....		53·1358	....	....	....
	54·0552	....	....	....		45·2960	....	....	....
2	54 0360	·0130	·0448	+51·56	3	45·2952	·2727	·0340	+35·49
1	53·4715	·4485	·0462	+52·83					

Weighted mean		+43·74
V_a	−17·93	
V_d	− ·09	
Curvature	− ·28	
Radial velocity		+ 25·4

β ORIONIS 1242 a.

1908. Jan. 20.
G. M. T. 15^h 15^m

Observed by }
Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7385	....	....	....	2	53·1054	....	....	....
2	54·0270	....	....	....	2	45·2652	·2737	·0350	+36·53
3	54·0012	·0052	·0354	+40·74	2	45·2653	....	....	....
3	53·4384	·4434	·0411	+47·00					

Weighted mean		+42·03
V_a	−17·93	
V_d	·09	
Curvature	− ·28	
Radial velocity		+ 23·7.

β ORIONIS 1242 b.

1908. Jan. 20.
G. M. T. 15^h 15^m

Observed by }
Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7430	....	....	....	2	53·1110	....	....	....
1	54·0320	....	....	....	3	45·2740	·2783	·0396	+41·34
2½	54·0078	·0078	·0380	+43·76	2	45·2692	....	....	....
1½	53·4467	·4467	·0444	50·75					

Weighted mean		+44·22
V_a	−17·93	
V_d	− ·09	
Curvature	− ·28	
Radial velocity		+25·9

β ORIONIS 1242 c.

1908. Jan. 20.
G. M. T. 15^h 15^m

Observed by }
Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7111	....	....	....	2	53·0790	....	....	....
1	54·0022	....	....	....	2	45·2307	·2655	·0268	+27·97
3	53·9678	·9990	0292	+33·61	2	45·2378	....	....	....
2	53·4174	·4500	·0477	+54·55					

Weighted mean		+37·98
V_a		−17·93
V_d		− ·09
Curvature	− ·28	
Radial velocity		+19·7

β ORIONIS 1243 *a*.

1908. Jan. 20.
G. M. T. 15ʰ 27ᵐ

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	54·7409	....	....	....	2	53·1154	....	....	....
2	54·0332	....	....	....	3	45·2837	·2760	·0373	−38·93
3	54·0104	·0064	·0366	+42·12	....	45·2814	....	....	....
2	53·4376	·4346	·0323	36·94					

Weighted mean.................. +39·63
V_a............ −17·93
V_d............ ·09
Curvature .... − ·28

Radial velocity.............. −21·3

β ORIONIS 1243 *b*.

1908. Jan. 20.
G. M. T. 15ʰ 27ᵐ

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	54·7300	....	....	....	2	53·1011	....	....	....
2	54·0188	....	....	....	3	45·2702	·2730	·0343	+35·80
2	53·9988	·0098	·0400	+46·04	......	45·2712	....	....	....
2	53·4319	·4429	·0406	46·43					

Weighted mean.................. −41·76
V_a............ −17·93
V_d............ ·09
Curvature........... − ·28

Radial velocity.................. +23·5

β ORIONIS 1243 *c*.

1908. Jan. 20.
G. M. T. 15ʰ 27ᵐ

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	54·7244	....	....	....	2	53·0980	....	....	....
2	54·0125	....	....	....	3	45·2705	·2820	·0433	+45·19
2	53·9841	·0000	·0302	+34·76	....	45·2622	....	....	....
2	53·4295	·4445	·0422	48·26					

Weighted mean.................. +43·09
V_a............ −17·93
V_d............ − ·09
Curvature......... − ·28

Radial velocity.............. +24·8

β ORIONIS 1244 *a*.

1908. Jan. 20. G. M. T. 15h 47m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7275	....	....	....	2	53·0998	....	....	....
2	54·0201	....	....	....	3	45·2686	·2811	·0424	+41·25
3	53·9956	·0056	·0358	+41·20	2	45·2611	....	....	....
2	53·1305	·4410	·0387	43·11					

Weighted mean .... +42·82
V_a .... 17·93
V_d .... ·09
Curvature .... − ·28

Radial velocity .... +24·5

β ORIONIS 1244 *b*.

1908. Jan. 20. G. M. T. 15h 47m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7310	....	....	....	2	53·1050	....	....	....
2	54·0209	....	....	....	3	45·2620	·2723	·0336	+35·07
3	53·9910	·9990	·0292	+33·61	2	45·2632	....	....	....
2	53·1264	·4340	·0317	36·25					

Weighted mean .... +34·82
V_a .... −17·93
V_d .... − ·09
Curvature .... − ·28

Radial velocity .... +16·5

β ORIONIS 1244 *c*.

1908. Jan. 20. G. M. T. 15h 47m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7336	....	....	....	2	53·1058	....	....	....
2	54·0231	....	....	....	3	45·2684	·2780	·0393	+41·02
3	54·0019	·0090	·0392	+45·11	2	45·2638	....	....	....
2	53·4595	·4460	·0437	49·97					

Weighted mean .... +44·75
V_a .... −17·93
V_d .... − ·09
Curvature .... − ·28

Radial velocity .... +26·4

β ORIONIS 1245 *a*.

1908. Jan. 20.
G. M. T. 15ʰ 53ᵐ

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	54·7272	....	....	....	2	53·1018	....	....	....
1	54·0156	....	....	....	3	45·2650	·2763	·0376	+39·24
3	53·9966	·0090	·0392	+45·12	2	45·2622	....	....	....
2	53·4315	·4430	·0407	46·54					

Weighted mean........ +43·27
V_a........ −17·93
V_d........ − ·09
Curvature........ − ·28

Radial velocity........ + 25.0

β ORIONIS 1245 *b*.

1908. Jan. 20.
G. M. T. 15ʰ 53ᵐ

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	54·7467	....	....	....	2	53·1202	....	....	....
2	54·0342	....	....	....	3	45·2774	·2750	·0363	+37·89
3	54·0134	·0074	·0376	+43·27	2	45·2760	....	....	....
2	53·4430	·4340	·0337	38·53					

Weighted mean........ +40·07
V_a........ −17·93
V_d........ − ·09
Curvature........ − ·28

Radial velocity........ + 21.8

β ORIONIS 1245 *c*.

1908. Jan. 20.
G. M. T. 15ʰ 53ᵐ

Observed by } J. S Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	54·7458	....	....	....	2	53·1193	....	....	....
2	54·0321	....	....	....	3	45·2750	·2740	·0353	+36·84
3	54·0084	·0034	·0336	+38·67	2	45·2742	....	....	....
2	53·4436	·4390	·0367	41·97					

Weighted mean........ +38·81
V_a........ −17·93
V_d........ − ·09
Curvature........ − ·28

Radial velocity........ + 20·5

β ORIONIS 1249 *a*.

1908. Jan. 20.
G. M. T. 16ʰ 37ᵐ

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings	Dispᵗ in revⁿˢ	Velocity.
2	54·7444	....	....	....	2	53·1200	....	....	.. ..
2	54·0334	....	.. ..	... .	3	45·2714	·2668	·0291	+30·37
3	54·0037	·9987	·0289	+33·26	2	45·2782	.. . .	....	....
2	53·4376	·4320	·0297	33·96					

Weighted mean .. .. +32·35
V_a .... −17·93
V_d ... . − ·09
Curvature........ − ·28

Radial velocity .... +14·0

β ORIONIS 1247 *a*.

1908. Jan. 20.
G. M. T. 16ʰ 17ᵐ

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	54·7364	....	....	....	2	53·1070	....	....	....
1	54·0227	.. ..	... .	....	2	45·2606	·2715	·0327	+34·13
3	54·0078	·0138	·0440	+50·64	2	45·2624	....	....	....
2	53·4296	·4350	0327	37·40					

Weighted mean. .... +42·14
V_a .... −17·93
V_d .... − 09
Curvature .... . − ·28

Radial velocity............... .... +23·8

β ORIONIS 1247 *b*.

1908. Jan. 20.
G. M. T. 16ʰ 17ᵐ

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity
2	54·7274	....	....	....	2	53·0931	... .	....	....
1	54·0096	....	....	....	3	45·2634	·2794	·0397	+41·43
3	53·9963	·0135	·0437	+50·29	2	45·2577	....	....	....
2	53·4377	·4557	·0534	61·06					

Weighted mean.... ... ... +49·66
V_a .... −17·93
V_d .... − ·09
Curvature . .... − ·28

Radial velocity................ +31·3

β ORIONIS 1247 c.

1908. Jan. 20.
G. M. T. 16h 17m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7281	......	......	......	2	53·0985	......	......	......
1	54·0124	......	......	......	3	45·2528	·2692	·0305	+31·83
3	53·9902	·0048	·0350	+40·28	2	45·2570	......	......	......
2	53·4238	·4386	·0363	41·51					

Weighted mean .... +37·42
V_a .... −17·93
V_d .... − ·09
Curvature ...... − ·28

Radial velocity .... +19·0

β ORIONIS 1248 a.

1908. Jan. 20
G. M. T. 16h 27m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7173	......	......	......	2	53·1167	......	......	......
1	54·0314	......	......	......	2	45·2794	......	......	......
2	53·9942	·9900	·0211	+24·28	3	45·2792	·2735	·0318	+36·32
1	53·4267	·4220	·0197	22·53					

Weighted mean .... +30·01
V_a .... −17·93
V_d .... − ·09
Curvature ...... − ·28

Radial velocity .... +11·6

β ORIONIS 1248 b.

1908. Jan. 20.
G. M. T. 16h 27m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7402	......	......	......	2	53·1140	......	......	......
1	54·0234	......	......	......	3	45·2624	·2660	·0273	+28·49
1	53·9742	·9760	·0071	+ 8·17	2	45·2770	......	......	......
1	53·4253	·4260	·0237	27·10					

Weighted mean .... +24·15
V_a .... −17·93
V_d .... − ·09
Curvature ...... − ·28

Radial velocity .... + 5·8 β ORIONIS 1248 c.

1908. Jan. 20.
G. M. T. 16h 27m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7472	....	....	....	2	53·1250	....	....	....
1	54·0420	....	....	....	3	45·2991	·2891	·0504	+52·60
2	54·0294	·0174	·0505	+58·12	2	45·2836	....	....	....
2	53·4593	·4493	·0470	53·75					

Weighted mean		+54·51
V_a	17·93	
V_d	− ·09	
Curvature	− ·28	
Radial velocity		+36·1

β ORIONIS 1249 b.

1908. Jan. 20.
G. M. T. 16h 37m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7478	....	....	....	2	53·1232	....	....	....
2	54·0356	....	....	....	3	45·2788	·2680	·0293	+30·58
2	54·0084	·0004	·0306	+35·22	—	45·2844	....	....	....
2	53·4450	·4365	·0342	39·11					

Weighted mean		+34·34
V_a	−17·93	
V_d	− ·09	
Curvature	− ·28	
Radial velocity		+16·0

β ORIONIS 1249 c.

1908. Jan. 20.
G. M. T. 16h 37m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7362	....	....	....	2	53·1092	....	....	....
2	54·0240	....	....	....	3	45·2725	·2760	·0373	+38·93
2	53·9998	·0040	·0342	+39·36	—	45·2704	....	....	....
2	53·4435	·4473	·0451	51·57					

Weighted mean		+42·66
V_a	−17·93	
V_d	− ·09	
Curvature	− ·28	
Radial velocity		+24·2

β ORIONIS 1285 *a*.

1908. Jan. 27.
G. M. T. 15h 30m

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns.	Velocity.
2	56·2642	....	......	....	2	54·8480	....	....	....
2	56·2207	·2768	·0470	+35·17	1½	42·3191	·3130	·0520	+32·61
1½	55·3517	·4083	·0539	39·88	2	42·3130	....	....	....

Weighted mean........ .... .. +35·81
V_a .... −20·08
V_d..... ... . − ·16
Curvature .... − ·30

Radial velocity. .. .. +15·3

β ORIONIS 1285 *b*.

1908. Jan. 27.
G. M. T. 15h 30m

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	57·3371	....	....	....	2	54·8307	....	....	....
2	56·2462	....	....	....	2	42·3000	·3283	·0673	+42·20
2	56·1983	·2724	·0426	+31·88	1½	42·3092	....	....	....
1	55·3500	·4241	·0697	51·53					

Weighted mean... .. .. +39·72
V_a...... .. . . 20·08
V_d...... .... ·16
Curvature.......... − ·30

Radial velocity..... .... .. +19·2

β ORIONIS 1285 *c*.

1908. Jan. 27.
G. M. T. 15h 30m.

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	57·3127	....	....	....	2	54·8130	....	....	....
2	56·2255	....	....	....	2	42·2834	....	....	....
2	56·1773	·2718	·0420	+31·43	1½	42·2936	·3293	·0683	+42·83
2	55·3222	·4147	·0603	44·62					

Weighted mean.. .. .. +39·38
V_a .... −20·08
V_d...... .... − ·16
Curvature.... .. .. − ·30

Radial velocity..... .... +17·9

β ORIONIS 1286 *a*.

1908. Jan. 27.
G. M. T. 16h 09m.

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	57·2727	......	......	......	2	54·7770	......	......	......
2	56·1937	......	......	......	2	42·2466	......	......	......
2	56·1589	·2869	·0571	+42·73	1½	42·2512	·3227	·0617	+38·6
2	55·2850	·4130	·0586	43·36					

Weighted mean .... +42·20
V_a .... −20·08
V_d .... ·19
Curvature .... − ·30

Radial velocity .... +21·3

β ORIONIS 1286 *b*

1908. Jan. 27.
G. M. T. 16h 09m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	57·3533	......	......	......	2	54·8539	......	......	......
2	56·2652	......	......	......	2	42·3240	......	......	......
2	56·2297	·2848	·0550	+41·16	1½	42·3241	·3192	·0582	+36·50
1½	55·3552	·4074	·0530	39·21					

Weighted mean .... +39·17
V_a .... −20·08
V_d .... ·20
Curvature .... − ·28

Radial velocity .... +18·7

β ORIONIS 1286 *c*.

1908. Jan. 27.
G. M. T. 16h 09m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	57·3761	......	......	......	2	54·8777	......	......	......
2	56·2915	......	......	......	2	42·3443	......	......	......
2	56·2610	·2898	·0600	+44·90	2	42·3548	·3296	·0686	+43·02
2	55·3896	·4175	·0631	46·68					

Weighted mean .... +44·87
V_a .... −20·08
V_d .... ·19
Curvature .... − ·30

Radial velocity .... +24·3

β ORIONIS 1289 *a*.

1908. Jan. 27.
G. M. T. 17h 17m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	57·3477	.....	.....	.....	2	54·8500	.....	.....	.....
2	56·2633	.....	.....	.....	3	42·3258	·3168	·0558	+34·99
2	56·2241	·1671	·0627	+46·92	2	42·3286	.....	.....	.....
1½	55·3630	·3070	·0474	35·07					

Weighted mean		+38·62
V_a	−20·08	
V_d	·19	
Curvature	− ·30	
Radial velocity		+18·1

β ORIONIS 1289 *b*.

1908. Jan. 27.
G. M. T. 17h 17m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	57·3801	.....	.....	.....	2	54·8794	.....	.....	.....
1	56·2921	.....	.....	.....	3	42·3664	·3275	·0665	+41·70
3	56·2507	·2780	·0482	+36·07	2	42·3584	.....	.....	.....
2	55·3890	·4155	·0611	45·21					

Weighted mean		+40·46
V_a	−20·08	
V_d	− ·19	
Curvature	·30	
Radial velocity		+19·9

β ORIONIS 1289 *c*.

1908. Jan. 27.
G. M. T. 17h 17m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	57·3608	.....	.....	.....	2	54·8612	.....	.....	.....
2	56·2675	.....	.....	.....	3	42·3602	·3425	·0815	+51·11
3	56·2378	·2900	·0602	+45·05	2	42·3378	.....	.....	.....
2	55·3721	·4200	·0656	48·54					

Weighted mean		+ 48·19
V_a	− 20·08	
V_d	− ·19	
Curvature	− ·30	
Radial velocity		+ 27·8

β ORIONIS 1290 *a*.

1908. Jan. 27.
G. M. T. $17^h 28^m$

Observed by } J. S. Plaskett
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	57·3519	....	....	....	2	54·8582	....	....	....
2	56·2658	....	....	....	2	42·3268	·3156	·0546	+34·24
3	56·2260	·2800	·0502	+37·56	2	42·3308	....	....	....

Weighted mean.................... + 36·23
V_a.................. − 20·08
V_d.................. − ·19
Curvature.................. − ·30

Radial velocity.................... + 15·6

β ORIONIS 1290 *b*.

1908. Jan. 27.
G. M. T. $17^h 28^m$

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	57·3527	....	....	....	2	54·8536	....	....	....
2	56·2622	....	....	....	2	42·3223	·3190	·0580	+36·37
3	56·2360	·2940	·0642	+48·04	2	42·3224	....	....	....
2	55·3534	·4074	·0530	39·21					

Weighted mean.................... + 42·18
V_a.................. − 20·08
V_d.................. − ·19
Curvature.................. − ·30

Radial velocity.................... + 21 6

β ORIONIS 1290 *c*

1908. Jan. 27.
G. M. T. $17^h 28^m$

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	57·3596	....	....	....	2	54·8680	....	....	....
2	56·2706	....	....	....	3	42·3490	·3313	·0503	+31·54
3	56 2320	·2810	·0512	+38·31	2	42 3368	....	....	....
1½	55·3704	·4134	·0590	43·65					

Weighted mean.................... + 36·70
V_a.................. − 20·08
V_d.................. − ·19
Curvature.................. − ·30

Radial velocity.................... + 16·1

β ORIONIS 1405.

1908. Mar. 20.
G. M. T. 11^h 51^m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3300	.....	.....	.....	2	58·7869	.....	.....	.....
2	61·3502	.....	.....	.....	2	36·2090	·2170	·1265	+44·48
2	61·3121	·3064	·1259	+52·05	2	36·1858	.....	.....	.....
1½	59·7292	7236	1271	52 00					

Weighted mean .... +48·37
V_a .... −24·86
V_d .... − ·14
Curvature .... − ·28

Radial velocity .... +23 1

β ORIONIS 1406.

1908. Mar. 20.
G. M. T. 12^h 07^m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3238	.....	.....	.....	2	58·7846	.....	.....	.....
2	61·3466	.....	.....	.....	1½	36·2180	·2235	·1330	+46·76
2	61·3115	·3095	·1290	+53·33	2	36 1886	.....	.....	.....
1½	59·7150	·7122	·1157	47·33					

Weighted mean .... +49·56
V_a .... −24·86
V_d .... − ·14
Curvature .... − ·28

Radial velocity .... + 24·3

β ORIONIS 1407.

1908. Mar. 20.
G. M. T. 12^h 21^m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3248	.....	.....	.....	2	58·7785	.....	.....	.....
2	61·3441	.....	.....	.....	2	36·1872	·2090	·1185	+41·66
3	61·2936	·2941	·1136	+46·96	2	36·1721	.....	.....	.....
1½	59·7240	·7260	·1295	52·98					

Weighted mean .... +46·72
V_a .... −24·86
V_d .... − ·14
Curvature .... − ·28

Radial velocity .... +21·4

β ORIONIS 1408.

1908. Mar. 20.
G. M. T. 12h 32m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3338	....	....	....	2	58·7904	....	....	....
2	61·3533	....	....	....	2	36·2218	·2315	·1410	+49·58
2	61·3036	2946	·1141	+47·17	1½	36·1832	....	....	....
1½	59·7392	7302	·1337	54·70					

Weighted mean.................... +50·15
V_a.............. −24·86
V_d.............. − ·14
Curvature......... − ·28

Radial velocity.................. + 24·9

β ORIONIS 1409.

1908. Mar. 20.
G. M. T. 12h 46m

Observed by } J. S. Plaskett.
Measured by }

Wt	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3224	....	....	....	1	58·7782	....	....	....
2	61·3452	....	....	....	2	36·2226	·2365	·1460	+51·33
2	61·3028	·3048	·1243	+51·39	2	36·1801	....	....	....
1½	59·7364	·7390	·1425	58·30					

Weighted mean.................... +53·25
V_a.............. −24·86
V_d.............. − ·14
Curvature......... − ·28

Radial velocity.................. +28·0

β ORIONIS 1410.

1908. Mar. 20.
G. M. T. 13h 00m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3280	....	....	....	2	58·7856	....	....	....
2	61·3492	....	....	....	2	36 2229	·2265	·1360	+47·82
2	61·3050	·3010	·1205	+49·81	2	36·1906	....	....	....
1½	59·7178	·7136	·1171	47·91					

Weighted mean.................... +48·57
V_a.............. 24·86
V_d.............. − ·14
Curvature......... − ·28

Radial velocity.................. +23·3

β ORIONIS 1411.

1908. March 20.
G. M. T. 13h 12m

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·1088	....	....	....	2	58·5647	....	....	....
3	61·0842	61·2989	+·1181	+48·95	2	35·9590	....	....	....
1½	59·5095	59·7259	·1294	52·94	2	0·9851	36·2203	·1298	+45·64

Weighted mean		+48·85
V_a	−24·86	
V_d	− ·17	
Curvature	− ·28	
Radial velocity		+23·5

β ORIONIS 1412.

1908. March 20.
G. M. T. 13h 27m

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·1178	....	....	....	2	58·5736	....	....	....
3	61·0974	61·3005	·1200	+49·60	2	35·9727	....	....	....
2	59·5242	59·7314	·1349	55·18	2	36·0000	36·2215	·1310	+46·06

Weighted mean		+50·18
V_a	−24·86	
V_d	− ·17	
Curvature	·28	
Radial velocity		+24·9

β ORIONIS 1413.

1908. March 20.
G. M. T. 13h 47m

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in Revns	Velocity.
2	63·3873	....	....	....	2	58·8412	....	....	....
3	61·3699	61·3083	·1278	+52·83	2	36·3010	36·2455	·1550	+54·50
1½	59·7810	59·7205	·1240	50·73	2	36·2495	....	....	....

Weighted mean		+52·86
V_a	−24·86	
V_d	− ·17	
Curvature	− ·28	
Radial velocity		+27·5

β ORIONIS 1414.

1908. March 20.
G. M. T. 13h 57m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3927	....	....	....	2	58·8485	....	....	....
3	61·3695	61·3015	·1210	+50·02	2	36·2981	36·2350	·1445	+54·40
2	59·7945	59·7270	·1350	53·38	2	36·2572	....	....	....

Weighted mean..........		+52·23
V_a..............	24·86	
V_d..............	− ·17	
Curvature..........	− ·28	
Radial velocity..........		+26·9

β ORIONIS 1426.

1908. March 24.
G. M. T. 12h 03m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3455	....	....	....	2	58·7935	....	....	....
2	61·2946	61·2780	·0975	+40·35	1½	36·1955	36·2300	·1395	+49·05
1½	59·7192	59·7040	·1075	43·98	2	36·1592	....	....	....

Weighted mean..........		+44·05
V_a..............	−24·36	
V_d..............	− 16	
Curvature..........	− ·28	
Radial velocity..........		+19·2

β ORIONIS 1427.

1908. March 24.
G. M. T. 12h 15m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3382	....	....	....	2	58·7912	....	....	....
2	61·2918	61·2798	·0993	+41·09	2	36·2085	36·2340	·1435	+50·45
1	59·7208	59·7098	·1133	46·35	2	36·1682	....	....	....

Weighted mean..........		+45·89
V_a..............	−24·36	
V_d..............	− ·16	
Curvature..........	− ·28	
Radial velocity..........		+21·1

β ORIONIS 1428.

1908. March 24.
G. M. T. 12h 23m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3148	....	....	....	2	58·7726	....	....	....
2	61·2682	61·2772	·0967	+40·01	2	36·1838	36·2255	·1350	+47·47
1½	59·6971	59·7060	·1095	44·80	2	36·1522	......	....	....

Weighted mean.................... .... +44·03
V_a .... -24·36
V_d .... - ·16
Curvature .... .. - ·28

Radial velocity..... .... +19·2

β ORIONIS 1429.

1908. March 24.
G. M. T. 12h 36m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3133	... .	....	....	2	58·7619	....	....	... .
2	61·2675	61·2825	·1020	+42·21	2	36·1559	36·2215	·1310	+46·06
1½	59·6988	59·7160	·1195	48·89	2	36·1282	....	... .	....

Weighted mean.. .... +45·43
V_a .... -24·36
V_d .... - ·16
Curvature. . . - ·28

Radial velocity.............. .... +21·6

β ORIONIS 1430.

1908. March 24.
G. M. T. 12h 42m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3288	....	....	....	2	58·7792	....	....	....
2	61·2808	61·2795	·0995	+41·17	1½	36·1830	36·2190	·1285	+45·18
1½	59·7068	59·7075	·1110	45·41	2	36·1581	....	....	....

Weighted mean............... ...... +43·65
V_a .... -24·36
V_d .... - ·16
Curvature. . .... - ·28

Radial velocity............ ..... +18·8

β ORIONIS 1431.

1908. March 24.
G. M. T. 12h 52m

Observed by } J. S. PLASKETT
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3248	....	....	....	2	58·7802	....	....	....
2	61·2775	61·2775	·0970	+40·14	2	36·1932	36·2350	·1445	+50·81
1½	59·6884	59 6890	·0925	+37·84	2	36·1520	....	....	....

Weighted mean..................		+43·39
V_a	−24·36	
V_d	− ·16	
Curvature........	− ·28	
Radial velocity		+18·6

β ORIONIS 1433.

1908. March 24.
G. M. T. 13h 16m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3394	....	....	....	2	58·7740	....	....	....
2	61·2791	61 2816	·1011	+41·84	2	36·1666	36·2106	1201	+42·23
1½	59·6956	59 7020	·1055	43·16	2	36·1490	....	....	....

Weighted mean..........................		+ 42 34
V_a	− 24·36	
V_d	− ·16	
Curvature..........	− ·28	
Radial velocity..........................		+ 17·5

β ORIONIS 1434.

1908. March 24.
G. M. T. 13h 32m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3430	....	....	....	2	58·7969	....	....	....
2	61·2968	61·2790	0985	+40·76	1	36·2018	36·2210	·1305	+45·88
1	59·7385	59 7215	1254	51·30	2	36 1742	....	....	....

Weighted mean..........................		+ 44·08
V_a	− 24·36	
V_d	− ·16	
Curvature..........	·28	
Radial velocity..........................		+ 19·3

β ORIONIS 1435.

1908. March 24.
G. M. T. 13h 39m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3082	......	......	......	2	58·7515	......	......	......
2	61·2508	61·2727	·0922	+38·15	1½	36·1366	36·2126	·1221	+42·93
1	59·6764	59·7034	·1069	43·32	2	36·1180	......	......	......

Weighted mean .... +40·89
V_a .... −24·36
V_d .... −·16
Curvature .... −·28

Radial velocity .... −16·1

β ORIONIS 1436.

1908. March 24.
G. M. T. 13h 48m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3496	......	......	......	2	58·8030	......	......	......
2	61·2902	61·2762	·0957	+39·60	1½	36·2066	36·2310	·1405	+49·40
1½	59·7106	59·6876	·0921	37·68	2	36·1692	......	......	......

Weighted mean .... +41·96
V_a .... −24·36
V_d .... −·16
Curvature .... −·28

Radial velocity .... −17·2

β ORIONIS 1437.

1908. March 24
G. M. T. 13h 5·6m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3020	......	......	......	2	58·7548	......	......	......
1½	61·2558	61·2800	·0995	+41·17	2	36·1466	36·2180	·1275	+44·83
1	59·6798	59·7050	·1085	44·39	2	36·1222	......	......	......

Weighted mean .... +43·51
V_a .... −24·36
V_d .... −·16
Curvature .... −·28

Radial velocity .... +18·7

β ORIONIS 1438.

1908. March 24.
G. M. T. 14h 07m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3504	....	....	....	2	58·8022	....	....	....
1½	61·3018	61·2780	·0975	+40·54	1½	36·2016	36·2170	·1265	+44·48
1	59·7345	59·7125	·1160	47·46	2	36·1784	....	....	....

Weighted mean	+43·75
V_a	− 24·36
V_d	·16
Curvature	− ·28
Radial velocity	+ 18·0

β ORIONIS 1439.

1908. March 30.
G. M. T. 12h 19m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3002	....	....	....	2	58·7534	....	....	....
3	61·2444	·2993	·0870	+35·86	2	36·1192	·1568	·1087	+38·11
1½	59·6804	·7304	·1066	43·48	2	36·1146	....	....	....

Weighted mean	+38·31
V_a	− 23·39
V_d	·21
Curvature	− ·28
Radial velocity	+14·4

β ORIONIS 1440.

1908. March 30.
G. M. T. 12h 29m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3356	....	....	....	2	58·7895	....	....	....
2	61·2894	·3087	·0964	+39·74	2	36·1602	·1480	·0999	+35·02
1½	59·6994	·7132	·0894	40·54	2	36·1642	....	....	....

Weighted mean	+38·24
V_a	− 23·39
V_d	− ·21
Curvature	− ·28
Radial velocity	+14·4

β ORIONIS 1441.

1908. Mar. 30.
G. M. T. 12h 38m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·4150	. . ....	....	... .	2	58·8640	.. ..	.. ..	... .
2	61·3622	·3042	·0919	+37·88	1½	36·2522	·1620	·1139	+39·93
1	59·7768	·7148	·0910	37·12	2	36·2426	. .. .	....	....

Weighted mean		+38·39
V_a............	−23·39	
V_d.	− ·21	
Curvature.........	− ·28	
Radial velocity.....		+14·5

β ORIONIS 1442.

1908. Mar. 30.
G. M. T. 12h 49m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3596	....	....	....	2	58·8129	....	. . .. .	....
2	61·3220	3175	·1052	+43·36	1½	36·1715	·1572	·1091	+38·25
1½	59·7322	·7220	·0982	40·06	2	36·1666	....	... .	....

Weighted mean..		+40·84
V_a.	−23·39	
V_d..........	− ·21	
Curvature...	− ·28	
Radial velocity.......		+17·0

β ORIONIS 1448.

1908. April 3.
G. M. T. 12h 16m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3573	....	....	....	2	58·8206	... .	.... . .	....
2½	61·3387	61·3037	·1232	+50·93	1½	36·2340	36·2126	·1184	+41·63
1½	59·7541	59·7160	·1195	48·89	2	36·2156	....	....	....

Weighted mean.............		+48·02
V_a.	−22·69	
V_d......	− ·16	
Curvature.	− ·28	
Radial velocity.......		+24·9

β ORIONIS 1449.

1908. April 3.
G. M. T. $12^h\ 28^m$

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3266	....	....	....	2	58·7829	....	....	....
2	61·3045	61·3024	·1219	+50·39	2	36·2068	36·2285	·1380	+48·52
1½	59·7338	59·7320	1355	55 43	2	36·1722	....	....	....

Weighted mean		+51·08
V_a	−22·69	
V_d	·16	
Curvature	− ·28	
Radial velocity		+27·9

β ORIONIS 1450.

908. April 3.
G. M. T. $12^h\ 40^m$

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3216	....	....	....	2	58·7768	....	....	....
2	61 3092	61·3124	·1319	+51·53	1	36·2098	36·2325	·1420	+49.93
1½	59·7388	59 7428	·1463	59·85	2	36·1714	...	....	....

Weighted mean		+55·28
V_a	−22·69	
V_d	− ·16	
Curvature	− ·28	
Radial velocity		+32·2

β ORIONIS 1451.

1908. April 3.
G. M. T. $12^h\ 53^m$

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3301	....	....	....	2	58·7860	....	....	....
2	61·3062	61·3007	·1202	+49 69	1½	36·2164	36·2275	·1370	+48·47
1½	59·7310	59·7260	·1295	52·98	2	36·1830	......	....	....

Weighted mean		+50·22
V_a	−22·69	
V_d	− ·16	
Curvature	− ·28	
Radial velocity		+27·1

β ORIONIS 1457.

1908. April 4.
G. M. T. 12h 19m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3698	......	......	......	2	58·8305	......	......	......
3	61·3515	61·3069	·1264	+52·25	2	36·2996	36·2580	·1638	+57·59
2	59·7708	59·7224	·1259	51·51	2	36·2358	......	......	......

Weighted mean		+53·56
V_a	−22·41	
V_d	− ·22	
Curvature	·28	
Radial velocity		+29·9

β ORIONIS 1458.

1908. April 4.
G. M. T. 12h 28m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3566	......	......	......	2	58·8112	......	......	......
2	61·3314	61·3004	·1199	+49·57	1½	36·2475	36·2460	·1551	+54·67
1½	59·7500	59·7196	·1231	50·36	2	36·1956	......	......	......

Weighted mean		+51·34
V_a	22·40	
V_d	− ·23	
Curvature	− ·28	
Radial velocity		+27·4

β ORIONIS 1459.

1908. April 4.
G. M. T. 12h 38m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3648	......	......	......	2	58·8227	......	......	......
3	61·3354	61·2944	·1139	+47·09	1½	36·2782	36·2500	·1625	+57·13
1½	59·7562	59·7150	·1185	48·47	2	36·2194	......	......	......

Weighted mean		+49·93
V_a	−22·40	
V_d	− ·23	
Curvature	− ·28	
Radial velocity		+27·0

β ORIONIS 1469.

1908. April 13.
G. M. T. 12h 10m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
......	63·3830	....	....	....	.....	58·8337	....	....	....
.....	61·4037	....	....	....	......	36·1867	....	....	....
2½	61·3453	·3210	·1087	+44·81	1	36·2037	·1690	·1209	+42·38
1½	59·7340	·7090	·1852	34·75					

Weighted mean		+42·03
V_a	−20·23	
V_d	− ·28	
Curvature	− ·28	
Radial velocity		+21·3

β ORIONIS 1470.

1908. April 13.
G. M. T. 12h 22m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
......	63·3425	....	....	....	.....	58·7861	....	....	....
.....	61·3570	....	....	....	......	36·1305	....	....	....
......	61·3030	·3230	·1107	+45·63	.....	36·1485	·1700	·1219	+42·73
......	59·7213	·7440	·1202	49·03					

Weighted mean		+45·75
V_a	−20·23	
V_d	− ·25	
Curvature	− ·28	
Radial velocity		+25·0

β ORIONIS 1471.

1908. April 13.
G. M. T. 12h 34m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
....	63·3504	....	....	....	....	58·7960	....	....	....
....	61·3650	....	....	....	....	36·1787	....	....	....
2½	61·3036	·3156	1033	+42·58	1½	36·1611	·1876	·1395	+48·89
1½	59·7275	·7400	1162	47·40					

Weighted mean		+45·61
V_a	−20·23	
V_d	− ·26	
Curvature	− ·28	
Radial velocity		+24·8

β ORIONIS 1873.

1908. Sept. 7.
G. M. T. $21^h\ 52^m$

Observed by J. B. Cannon.
Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3948	....	....	....	2	58·8286	....	....	....
2	61·4080	....	....	....	2	36·1061	....	....	....
2	61·2458	·2498	·0068	+2·18	1	35·9859	·9890	·0168	−5·87
2	59·6682	·6722	0208	+8·46					

Weighted mean		+ 3·08
V_a		+25·29
V_d		+ ·09
Curvature	·28	
Radial velocity		+28·2

β ORIONIS 1874.

1908. Sept. 7.
G. M. T. $22^h\ 10^m$

Observed by J. B. Cannon.
Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3952	....	....	....	2	58·8342	....	....	....
2	61·4064	....	....	....	2	36·1037	....	....	....
2	61·2468	·2495	·0050	+2·06	1	35·9972	0025	·0033	−1·15
2	59·6584	·6600	·0086	+3·50					

Weighted mean		+ 1·99
V_a		+25·29
V_d		+ ·09
Curvature	− ·28	
Radial velocity		+27·1

β ORIONIS 1935.

1908. Oct. 13.
G. M. T. $21^h\ 19^m$

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3985	....	....	....	2	58·8313	....	....	....
2	61·4043	....	....	....	2	36·1175	....	....	....
2	61·2224	·2270	·0175	−7·19	1	36·0062	·9982	·0076	−2·66
1	59·6723	·6760	·0210	+8·54					

Weighted mean	− 2·00	
V_a		+20·66
V_d	− ·05	
Curvature	− ·28	
Radial velocity		+18·3

β ORIONIS 1936.

1908. Oct. 13.
G. M. T. 21h 48m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3626	....	....	...	2	58·7965	....	....	...
2	61·3762	....	....	....	2	36·0878	....	....	....
3	61·1940	·2285	·0160	−6·58	1	35·9778	·0000	·0058	−2·03
1½	59·6216	·6576	·0062	+2·52					

Weighted mean........	−3·27	
V_a........	....	+20·06
V_d........	−·10	
Curvature........	−·28	
Radial velocity........		+17·0

β ORIONIS 1937.

1908. Oct. 13.
G. M. T. 22h 19m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3670	....	....	....	2	58·8030	....	....	....
2	61·3727	....	....	....	2	36·0830	....	....	....
2	61·2061	·2414	·0031	1·27	½	36·9604	·9875	·0183	−6·50
1	59·6093	·6423	·0091	3·70					

Weighted mean........	−2·71	
V_a........	....	+20·65
V_d........	−·11	
Curvature........	−·28	
Radial velocity........		+17·5

β ORIONIS 1938.

1908. Oct. 13.
G. M. T. 22h 47m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3806	....	....	....	2	58·8156	....	....	....
2	61·3922	....	....	....	2	36·1048	....	....	....
3	61·2124	·2304	·0141	−5·80	1	35·9790	·9840	·0218	−7·62
2	59·6301	·6386	·0128	5·20					

Weighted mean........	−5·90	
V_a........	....	+20·65
V_d........	−·18	
Curvature........	−·28	
Radial velocity........		+14·3

β ORIONIS 1978.

1908. Nov. 21.
G. M. T. 18h 24m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·3468	....	....	....	2	58·7938	....	....	....
2	61·3628	....	....	....	2	36·1436	....	....	....
1	61·2132	·2282	·0159	+ 6·55	½	36·0681	·0766	·0285	+ 9·99
½	59·6547	·6700	·0462	18·75					

Weighted mean....................		+10·46
V_a..........................		+ 6·82
V_d..............	− ·02	
Curvature........	− ·28	
Radial velocity..................		+17·0

β ORIONIS 1979.

1908. Nov. 21.
G. M. T. 18h 43m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·3061	....	....	....	2	58·7652	....	....	....
2	61·3300	....	....	....	2	36·1120	....	....	....
1½	61·1662	·2174	....	....	½	36·0187	·0587	·0106	+ 3·72
1	59·6141	·6591	·0353	+14·39					

Weighted mean....................		+10·83
V_a..........................		+ 6·82
V_d..............	− ·05	
Curvature........	− ·28	
Radial velocity..................		+17·3

β ORIONIS 1980.

1908. Nov. 21.
G. M. T. 19h 05m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings,	Disp^t in rev^ns	Velocity.
2	63·3533	....	....	....	2	58·7995	....	....	....
2	61·3671	....	....	....	2	36·1350	....	....	....
3	61·2382	·2480	·0357	+14·72	1½	36·0917	·1090	·0609	+21·34
2	59·6646	·6745	·0507	20·58					

Weighted mean....................		+18·08
V_a..........................		+ 6·82
V_d..............	− ·09	
Curvature........	− ·28	
Radial velocity..................		+24·5

β ORIONIS 1981.

1908. Nov. 21.
G. M. T. 19h 33m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3651	....	....	....	2	58·8100	....	....	....
2	61·3788	....	....	....	2	36·1536	....	....	....
3	61·2564	·2540	·0417	+17 19	1	36·1135	·1120	·0639	+22 40
1½	59·6711	·6700	·0462	18·75					

Weighted mean		+ 18·56
V_a..........		+ 6·82
V_d..........	− ·13	
Curvature	·28	
Radial velocity		+ 25·0

β ORIONIS 1984.

1908. Nov. 28.
G. M. T. 16h 05m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3672	....	....	....	2	58·8125	....	....	....
2	61·3818	....	....	....	2	36·1472	....	....	....
3	61·2562	·2518	·0395	+16·28	2	36·1186	·1236	·0755	+26·47
1½	59·6454	6418	·0180	7·34					

Weighted mean		+17·35
V_a..........		+ 3·79
V_d..........		+ ·15
Curvature	− ·28	
Radial velocity		+21·0

β ORIONIS 1985.

1908. Nov. 28.
G. M. T. 16h 34m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·4001	....	....	....	2	58·8418	....	....	....
2	61·4112	....	....	....	2	36·1728	....	....	....
3	61 2867	·2527	·0405	+16·65	1½	36·1352	·1155	·0674	+23·63
2	59·7043	·6713	·0475	19·37					

Weighted mean		+ 19·10
V_a..........		+ 3·79
V_d..........		+ ·10
Curvature	− ·28	
Radial velocity		+ 22·7

β ORIONIS 1986.

1908. Nov. 28.
G. M. T. 17h 08m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3743	....	......	....	2	58·8170	....	....	....
2	61·3865	.... .	....	....	2	36·1450	....	....	....
3	61·2439	·2340	·0217	+ 8·94	2	36·1220	·1290	·0869	+28·36
1½	59·6728	·6645	·0407	16·60					

Weighted mean .... +16·91
V_a .... + 3·79
V_d .... + ·05
Curvature...... − ·28

Radial velocity .... +20·5

β ORIONIS 1987.

1908. Dec. 1.
G. M. T. 17h 53m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3748	....	....	....	2	58·8267	....	....	....
2	61·3934	.. ..	....	....	2	36·2127	....	....	....
2	61·2490	·2005	·0200	+ 8·33	1	36·1757	·1573	·0668	+23·44
1	59·6824	·6385	·0420	17·13					

Weighted mean................. .... +14·31
V_a .. .. + 2·42
V_d .... − ·04
Curvature .. .. − ·28

Radial velocity............... .. +16·4

β ORIONIS 1988.

1908. Dec. 1.
G. M. T. 18h 18m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3353	....	....	....	2	58·7876	... .	....	....
2	61·3527	....	....	... .	2	36·1671	....	....	. . ....
2	61·2276	·2515	·0392	+16·16	1	36·1272	·1123	·0643	+22·54
1	59·6515	·6735	·0497	20·27					

Weighted mean............... . +18·78
V_a .... + 2·42
V_d ... ... − ·09
Curvature .... − ·28

Radial velocity. .... +20·9

β ORIONIS 1989.

1908. Dec. 1.
G. M. T. 18h 36m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3437	....	....	....	2	58·7973	....	....	....
2	61·3587	....	....	....	2	36·1794	....	....	....
2	61·2166	·2335	·0212	+ 8·74	1½	36·1287	·1015	·0535	+18·75
½	59·6620	·6760	·0522	21·29					

Weighted mean .... +14·06
V_a .... + 2·12
V_d .... − ·12
Curvature ..... − ·28

Radial velocity .... +16·1

β ORIONIS 1990.

1908. Dec. 1.
G. M. T. 18h 52m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
.....	63·3478	....	....	....	.....	58·8000	....	....	....
.....	61·3679	....	....	....	.....	36·1850	....	....	....
3	61·2397	·2520	·0397	+16·36	1	36·1648	·1320	·0839	+29·41
2	59·6724	·6830	·0592	24·15					

Weighted mean .... +21·13
V_a .... + 2·41
V_d .... − ·16
Curvature ...... − ·28

Radial velocity .... +23·1

β ORIONIS 2003.

1908. Dec. 5.
G. M. T. 16h 10m

Observed by J. B. CANNON.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
.	63·3465	....	....	....	.....	58·8090	....	....	....
.....	61·3690	....	....	....	...	36·2298	....	....	....
3	61·2456	·2215	·0410	+16·95	1	36·2074	·1715	·0810	+28·48
1½	59·6764	·6518	.0553	22·62					

Weighted mean .... +22·16
V_a .... + ·63
V_d .... + ·10
Curvature ..... − ·28

Radial velocity .... +22·6

β ORIONIS 2004.

1908. Dec. 5.
G. M. T. 16h 22m

Observed by / Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3170	....	....	....	2	58·7790	....	....	....
2	61·3390	....	....	....	2	36·1924	....	....	....
2	61·2216	·2275	·0470	+19·43	1	36·1868	·1886	·0981	+34·49
½	59·6557	·6610	·0635	25·98					

Weighted mean .... +24·67
V_a.. ... . + ·63
V_d..... .... + ·08
Curvature ..... − ·28

Radial velocity. .... +25·1

β ORIONIS 2005.

1908. Dec. 5.
G. M. T. 16h 38m

Observed by / Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3054	... .	.....	....	2	58·7707	......	....	....
2	61·3304	....	....	....	2	36·1884	....	....	....
2½	61·2269	·2415	·0610	+25·22	1½	36·1715	·1775	·0870	+30·59
1½	59·6314	·6450	·0485	19·84					

Weighted mean.................... +25·22
V_a.................... + ·63
V_d.......... .... + ·05
Curvature ..... − ·28

Radial velocity..... .... +25·6

β ORIONIS 2006.

1908. Dec. 5.
G. M. T. 16h 53m

Observed by / Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3019	....	....	....	2	58·7614	....	....	....
2	61·3242	....	....	....	2	36·1852	......	......	....
3	61·2261	·2480	·0675	+27·90	1	36·1782	·1872	·0967	+34·00
1½	59·6262	·6480	·0515	21·07					

Weighted mean.... .... +27·14
V_a.. .... + ·63
V_d .... + ·03
Curvature..... − ·28

Radial velocity. ... . +27·5

β ORIONIS 2054.

1908. Dec. 21.
G. M. T. 15h 24m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Setting.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns.	Velocity.
....	54·7148	....	....	....	...	53·0909	....	....	....
....	54·0045	....	....	....	....	45·2924	....	....	....
......	53·9654	·9630	·0198	22·90	......	45·2894	·2907	·0318	33·39
.....	53·4020	·4000	·0218	25·05					

Weighted mean .... 28·28
V_a............. 6·51
V_d 04
Curvature .... – ·28

Radial velocity .... +21·5

β ORIONIS 2055.

1908. Dec. 21.
G. M. T. 15h 29m

Observed by T. H. PARKER.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7334	....	....	....	2	53·1065	....	....	....
2	53·9890	·9690	·0258	+29·84	1	45·2957	·2907	·0318	+33·39
1½	53·4172	·3990	·0208	23·90	2	45·2891	....	....	....

Weighted mean .... +28·65
V_a. .... 6·51
V_d......................... + 03
Curvature....... – ·28

Radial velocity .... +21·9

β ORIONIS 2057.

1908. Dec. 21.
G. M. T. 16h 54m

Observed by T. H. PARKER.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	56·6288	....	....	....	2	53·0900	....	....	....
2	54·7099	....	....	....	1½	45·2802	·2926	·0327	+34·34
2	53·9683	·9695	·0263	+30·42	2	45·2730	....	....	....
1	53·4072	·4080	·0298	34·24					

Weighted mean......................... +32·57
V_a. ... . – 6·53
V_d............... – 07
Curvature ...... – ·28

Radial velocity.................. +25·7

β ORIONIS 2058.

1908. Dec. 21.
G. M. T. 17h 00m

Observed by T. H. Parker.
Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	56·6155	....	....	....	2	53·0753	....	....	....
2	54·6935	....	....	....	1½	45·2686	·2855	·0267	+28·04
1½	53·9424	·9585	·0143	+16·54	2	45·2681	....	....	....
1½	53·3996	·4140	·0358	41·14					

Weighted mean .... −28·91
V_a .... − 6·53
V_d .... − ·07
Curvature .... − ·28

Radial velocity .... +22·0

β ORIONIS 2065.

1908. Dec. 22.
G. M. T. 17h 38m

Observed by / Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·3046	....	....	....	2	58·7699	....	....	....
2	61·3280	....	....	....	1	36·2329	....	....	....
1½	61·2436	·2278	·0792	+32·84	2	36·2528	·2560	·1230	+43·38
2	59·6639	·6520	·0828	33·55					

Weighted mean .... +35·50
V_a .... − 6·98
V_d .... − ·11
Curvature .... ·28

Radial velocity .... +28·1

β ORIONIS 2066.

1908. Dec. 22.
G. M. T. 17h 52m

Observed by / Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·2896	....	....	....	2	58·7610	....	....	....
2	61·3178	....	....	....	2	36·2286	....	....	....
3	61·2262	·2220	·0734	+30·43	1	36·2245	·2320	·0990	+34·92
1½	59·6270	·6245	·0553	22·68					

Weighted mean .... +29·13
V_a .... − 6·98
V_d .... − ·12
Curvature .... − ·28

Radial velocity .... +21·7

β ORIONIS 2067.

1908. Dec. 22.
G. M. T. 18h 02m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·2842	....	....	....	2	58·7512	....	....	....
2	61·3040	....	....	....	2	36·2038	....	....	....
2	61·2047	·2110	·0624	+25·87	1	36·2081	·2405	·1075	+37·92
1	59·6403	·6480	·0788	32·32					

Weighted mean.............................. +30·49
V_a.................. − 6·98
V_d.................. − ·14
Curvature.............. − ·28

Radial velocity.............................. +23·1

β ORIONIS 2068.

1908. Dec. 22.
G. M. T. 18h 14m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·2842	....	....	....	2	58·7570	....	....	....
2	61·3115	....	....	....	2	36·2160	....	....	....
2	61·2151	·2160	·0674	+27·94	1	36·2098	·2300	·0970	+34·21
1	59·6468	·6483	·0791	32·45					

Weighted mean.............................. +30·63
V_a.................. − 6·98
V_d.................. − ·14
Curvature.............. − ·28

Radial velocity.............................. +23·2

β ORIONIS 2070.

1908. Dec. 23.
G. M. T. 14h 00m

Observed by W. E. Harper.
Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
3	63·2758	....	....	....	2	58·7363	....	....	....
2	61·2947	....	....	....	2	36·1449	....	....	....
3	61·1996	·2490	·0685	+28·32	½	36·1500	·1990	·1085	+38·15
1½	59·6100	·6580	·0615	25·16					

Weighted mean.............................. +28·36
V_a.................. − 7·36
V_d.................. + ·18
Curvature.............. − ·28

Radial velocity.............................. +20·9

β ORIONIS 2071.

1908. Dec. 23.
G. M. T. 14h 40m

Observed by W. E. Harper.
Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3263	......	......	......	2	58·7844	......	......	......
2	61·3499	......	......	......	2	36·2102	......	......	......
3	61·2612	·2580	·0775	+32·04	1	36·2124	·1964	·1059	+37·23
1	59·6928	·6920	·0935	38·25					

Weighted mean....		+34·32
V_a.....	− 7·36	
V_d....		+ ·12
Curvature	− ·28	
Radial velocity		+26·8

β ORIONIS 2072.

1908. Dec. 23.
G. M. T. 15h 08m

Observed by J. B. Cannon.
Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3214	......	......	......	2	58·7812	......	......	......
2	61·3398	......	......	......	2	36·2100	......	......	......
2½	61·2460	·2500	·0695	+28·73	1	36·2152	·1995	·1090	+38·32
1½	59·6670	·6703	·0738	30·19					

Weighted mean...		+31·09
V_a...	− 7·36	
V_d....		+ ·09
Curvature...	− ·28	
Radial velocity....		+23·5

β ORIONIS 2073.

1908. Dec. 23.
G. M. T. 15h 20m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·2965	......	......	......	2	58·7615	......	......	......
2	61·3207	......	......	......	2	36·1916	......	......	......
3	61·2222	·2470	·0665	+27·49	1	36·1928	·1954	·1049	+36·88
1½	59·6362	·6595	·0630	25·77					

Weighted mean....		+28·73
V_a....	− 7·36	
V_d....		+ ·07
Curvature.....	− ·28	
Radial velocity....		+21·2

β ORIONIS 2075.

1908. Dec. 26.
G. M. T. 15h 50m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3319	....	....	...	2	58·7877		....	....
2	61·3525	....	....	... ...	2	36·1851	.. ..	....	... ...
3	61·2697	·2622	·0817	+33·77	1½	36·1791	·1882	·0977	+34·45
1½	59·6900	·6850	·0885	36·21					

Weighted mean .... +34·52
V_a .... − 8·68
V_d .... ·01
Curvature..... .. ·28

Radial velocity......... ...... +25·6

β ORIONIS 2076.

1908. Dec. 26.
G. M. T. 16h 00m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3051	....	....	....	2	58·7573	....	....	....
2	61·3204	.. ..	....	....	2	36·1624	. ...	....	... .
3	61·2357	·2590	·0785	+32·45	1½	36·1630	·1950	·1045	+36·74
1½	59·6614	·6874	·0919	37·60					

Weighted mean... .... +34·81
V_a .... − 8·68
V_d .... − ·01
Curvature.. ... − ·28

Radial velocity.......... ..... +25·9

β ORIONIS 2077.

1908. Dec. 26.
G. M. T. 16h 09m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3424	....	......	. . ....	2	58·7943	....	....	....
2	61·3608	....	.. ....	....	2	36·1993	....	....	. ...
3	61·2612	·2450	·0645	+26·66	1½	36·2132	·2082	·1177	+41·38
1½	59·6812	·6730	·0765	31·30					

Weighted mean..... .... +31·48
V_a .... 8·68
V_d .... ·02
Curvature...... − ·28

Radial velocity................ +22·5

β ORIONIS 2078.

1908. Dec. 26.
G. M. T. 16h 18m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3147	....	....	....	2	58·7684	....	....	....
2	61·3334	....	....	....	2	36·1610	....	....	....
2	61·2290	·2410	·0605	+25·01	1	36·1567	·1900	·0995	+34·98
½	59·6970	·7120	·1135	46·45					

Weighted mean.... .... +30·92
V_a .... − 8·68
V_d .... ·04
Curvature...... .. − ·28

Radial velocity. .... +22·0

β ORIONIS 2079.

1908. Dec. 27.
G. M. T. 14h 07m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3248	....	....	....	2	58·7809	....	....	....
2	61·3453	....	....	....	2	36·1593	....	....	....
3	61·2754	·2750	·0945	+39·07	1	36·1787	·2140	.1235	+43·42
2	59·7087	·7115	·1150	47·05					

Weighted mean....... .... +42·45
V_a .... − 9·08
V_d .... + 15
Curvature.......... − ·28

Radial velocity . ... +33·2

β ORIONIS 2080.

1908. Dec. 27.
G. M. T. 15h 10m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3504	....	....	....	2	58·8064	....	....	....
2	61·3730	....	....	....	2	36·1823	....	....	....
3	61·3054	·2780	·0975	+40·31	½	36·1975	·2095	·1190	+41·84
1	59·7017	·6790	·0825	33·75					

Weighted mean........ .... +39·02
V_a .... − 9·08
V_d .... + ·05
Curvature. .... − ·28

Radial velocity...... . . .. + 29·7

β ORIONIS 2082.

1908. Dec. 31.
G. M. T. 15h 19m

Observed by W. E. HARPER.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7142	....	....	....	2	53·0938	....	....	....
2	54·0115	....	....	....	2	45·2860	·2855	·0368	+38·53
2	53·9684	·9790	·0224	+25·84	2	45·2716	....	....	....
2	53·4146	·4225	·0323	37·03					

Weighted mean .... + 33·80
V_a .... − 10·77
V_d .... ·00
Curvature .... − ·28

Radial velocity .... + 22·7

β ORIONIS 2083.

1908. Dec. 31.
G. M. T. 15h 23m

Observed by W. E. HARPER.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7063	....	....	....	2	53·0866	....	....	....
2	54·0015	....	....	....	1½	45·2868	·2850	·0363	+38·00
2	53·9690	·9860	·0294	+33·92	2	45·2719	....	....	....
1	53·4065	·4215	·0313	35·88					

Weighted mean .... + 35·72
V_a .... − 10·77
V_d .... ·00
Curvature .... − ·28

Radial velocity .... + 24·7

β ORIONIS 2084.

1908. Dec. 31.
G. M. T. 15h 29m

Observed by W. E. HARPER.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·6938	....	....	....	2	53·0745	....	....	....
2	53·9878	....	....	....	2	45·2702	·2812	·0325	+34·02
2	53·9587	·9880	·0314	+36·23	2	45·2600	....	....	....
1	53·3888	·4169	·0258	29·57					

Weighted mean .... + 34·01
V_a .... − 10·77
V_d .... ·00
Curvature .... − ·28

Radial velocity .... + 23·0

β ORIONIS 2085.

1908. Dec. 31.
G. M. T. 15h 57m

Observed by W. E. Harper.
Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·6997	......	......	......	2	53·0777	......	......	......
2	53·9927	......	......	......	2	45·2854	·2895	·0408	−42·71
3	53·9592	·9835	·0269	+31·03	2	45·2717	......	......	......
1½	53·4022	·4255	·0353	40·46					

Weighted mean.. .... + 37·57
V_a .... − 10·77
V_d .... ·00
Curvature.... .... − 28

Radial velocity.......... ...... + 26·5

β ORIONIS 2092.

1909. Jan. 6.
G. M. T. 16h 49m

Observed by W. E. Harper.
Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7150	......	......	......	2	53·0905	......	......	......
2	54·0102	......	......	......	1½	45·2713	·2730	·0243	+25·44
3	53·9756	9860	·0294	+33·92	2	45·2734	......	......	......
1½	53·1128	·4230	·0328	37·60					

Weighted mean .... +32·72
V_a .... −13·21
V_d .... − ·16
Curvature. ..... − ·28

Radial velocity.......... ...... +19·1

β ORIONIS 2093.

1909. Jan. 6.
G. M. T. 16h 53m

Observed by W. E. Harper.
Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7120	......	......	......	2	53·0884	......	......	......
2	54·0046	......	......	......	2	45 2787	·2750	·0263	+27·43
3	53·9727	·9860	·0294	+33·92	2	45·2773	......	......	......
1½	53·4136	·4250	·0348	39·89					

Weighted mean......... .... +33·30
V_a .... −13·21
V_d .... − 16
Curvature. ...... − ·28

Radial velocity....... .... +19·6

β ORIONIS 2094.

1909. Jan. 6.
G. M. T. 17ʰ 13ᵐ

Observed by W. E. Harper.
Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	54·7235	....	....	....	2	53·1074	....	....	....
2	54·0160	....	....	....	2	45·2957	·2830	·0343	+35·81
3	53·9867	·9850	·0284	+32·77	2	45·2876	....	....	....
2	53·4193	·4143	·0241	27·63					

Weighted mean .... +32·17
V_a .... −13·21
V_d .... ·16
Curvature .... ·28

Radial velocity .... +18·5

β ORIONIS 2095.

1909. Jan. 6.
G. M. T. 17ʰ 16ᵐ

Observed by W. E. Harper.
Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	56·6440	....	....	....	2	53·0990	....	....	....
2	54·7198	....	....	....	2	45·2880	·2815	·0328	+34·34
2	53·9780	·9830	·0264	+30·46	2	45·2821	....	....	....
1	53·4356	·4380	·0478	54·79					

Weighted mean .... +34·89
V_a .... −13·21
V_d .... − ·16
Curvature .... − ·28

Radial velocity .... +21·2

β ORIONIS 2105.

1909. Jan. 7.
G. M. T. 12ʰ 49ᵐ

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	54·7033	....	....	....	2	53·0832	....	....	....
2	53·9964	....	....	....	1	45·2868	....	....	....
3	53·9532	·9600	·0168	+19·43	2	45·2834	·2902	·0313	+32·87
1½	53·4150	·4215	·0433	49·76					

Weighted mean .... +30·57
V_a .... −13·59
V_d .... − ·11
Curvature .... − ·28

Radial velocity .... +16·8

β ORIONIS 2106.

1909 Jan. 7.
G. M. T. 13h 01m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7102	....	....	....	2	53·0883	....	....	....
2	54·0042	....	....	....	2	45·2895	....	....	....
3	53·9710	·9725	·0293	+33·89	1½	45·2880	·2920	·0331	+34·76
2	53·4114	·4125	·0343	39·41					

Weighted mean..................		+35·79
V_a	−13·59	
V_d	− ·11	
Curvature..............	− ·28	
Radial velocity..................		+21·9

β ORIONIS 2107.

1909. Jan. 7.
G. M. T. 13h 04m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7028	....	....	....	2	53·0852	....	....	....
2	54·0000	....	....	....	2	36·2832	....	....	....
3	53·9603	·9653	·0221	+25·56	1½	36·2708	·2810	·0221	+23·21
1½	53·4016	·4060	·0278	31·94					

Weighted mean..................		+26·57
V_a	−13·59	
V_d	− ·11	
Curvature..............	− ·28	
Radial velocity..................		+12·8

β ORIONIS 2108.

1909. Jan. 7.
G. M. T. 13h 07m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7190	....	....	....	2	53·0925	....	....	....
1	54·0072	....	....	....	2	45·2938	....	....	....
2½	53·9772	·9715	·0283	+32·73	2	45·2933	·2931	·0342	+35·91
1½	53·4133	·4097	·0315	36·20					

Weighted mean..................		+34·66
V_a	−13·59	
V_d	− ·11	
Curvature..............	− ·28	
Radial velocity..................		+20·7

β ORIONIS 2111.

1909. Jan. 7.
G. M. T. 16h 27m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·3019	......	......	......	2	58·7700	......	......	......
2	61·3278	......	......	......	1½	36·2038	·2023	·0693	+24·46
2	61 2471	·2315	·0829	+34·37	2	36·2253	......	......	......
1	59·6883	·6760	·1068	43·81					

Weighted mean .... + 33·16
V_a .... − 13·59
V_d .... − ·11
Curvature...... − ·28

Radial velocity. .... +19·2

β ORIONIS 2112.

1909. Jan. 7.
G. M. T. 16h 37m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·2779	......	......	......	2	58·7484	......	......	......
2	61·3033	......	......	......	1½	36·2003	·2120	·0790	+27·86
3	61·2146	·2236	·0750	+31·51	2	36·2131	......	......	......
2	59·6353	·6455	0763	31·30					

Weighted mean....... .... + 30·60
V_a .... − 13·59
V_d ... . − ·11
Curvature... .. − ·28

Radial velocity....... .... +16·6

β ORIONIS 2114.

1909. Jan. 7.
G. M. T. 16h 56m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·2829	......	......	......	1	58·7582	......	......	......
2	61·3072	......	......	......	1½	36·1955	·2045	·0715	+25·22
3	61·2181	·2220	·0734	+30·43	2	36·2146	......	......	......
1½	59 6679	·6695	·1003	41·14					

Weighted mean .... + 31·80
V_a .... − 13·59
V_d ... . − ·11
Curvature...... − ·28

Radial velocity....... .... +17·8

β ORIONIS 2117.

1909. Jan. 8.
G. M. T. 15ʰ 48ᵐ

Observed by T. H. Parker.
Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	54·6880	...	...	...	2	53·0662	...	...	...
1	53·9760	...	...	...	2	45·2638	·2850	·0261	+27·41
2	53·9517	·9750	·0318	+36·78	2	45·2622	...	...	...
1	53·3882	·4113	·0331	38·04					

Weighted mean .... + 33·28
V_a .... − 13·96
V_d .... − ·09
Curvature....... − ·28

Radial velocity.............. +18·9

β ORIONIS 2118.

1909. Jan. 8.
G. M. T. 15ʰ 52ᵐ

Observed by T. H. Parker.
Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	54·7077	...	...	...	2	53·0872	...	...	...
2	53·9948	...	...	...	2	45·2898	·2935	·0346	+36·33
2	53·9690	·9730	·0298	+34·47	2	45·2837	...	...	...
1	53·4030	·4060	·0278	31·84					

Weighted mean.................. + 34·69
V_a .... − 13·96
V_d .... − ·09
Curvature......... − ·28

Radial velocity .... + 20·3

β ORIONIS 2122.

1909. Jan. 12.
G. M. T. 11ʰ 55ᵐ

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	54·7074	...	...	...	2	53·0858	...	...	...
2	53·9968	...	...	...	2	45·2886	...	...	...
1½	53·9694	·9735	·0303	+33·80	2	45·2856	·2905	·0316	+34·92
2	53·4238	·4275	·0493	54·97					

Weighted mean..................... + 41·91
V_a .... − 15·39
V_d .... + ·23
Curvature.......... − ·28

Radial velocity................ + 26·5

β ORIONIS 2123.

1909. Jan. 12.
G. M. T 11ʰ 59ᵐ

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	54·7088	......	....	......	2	53·0880	......	....	......
2	53·9990	......	......	......	2	45·2791	......	......	......
3	53·9836	·9836	·0428	+47·75	1	45·2727	2890	·0301	+33·26
2	53·4085	·4105	·0323	36·01					

Weighted mean.................. + 41·42
V_a................ − 15·39
V_d.................... + ·23
Curvature.......... − ·28

Radial velocity.................. + 26·0

β ORIONIS 2124.

1909. Jan. 12.
G. M. T. 12ʰ 09ᵐ

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	54·7008	....	....	....	2	53·0750	......	......	....
2	53·9928	....	....	....	2	45·2813	....	......	....
3	53·9598	·9700	·0268	+29·90	2	45·2783	·2905	·0316	+34·92
1½	53·4100	·4225	0443	49·39					

Weighted mean.................. + 35·97
V_a............ 15·39
V_d.................. + ·23
Curvature.......... − ·28

Radial velocity.................. + 20·5

β ORIONIS 2125.

1909. Jan. 12.
G. M. T. 12ʰ 12ᵐ

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	54·7110	......	....	....	2	53·0858	....	....	....
2	54·0045	......	....	......	2	45·2870	....	....	....
4	53·9770	·9775	·0343	+38·27	2	45·2840	·2905	·0316	+34·92
3	53·4077	·4105	·0323	36·01					

Weighted mean.................. +36·77
V_a................ −15·39
V_d.................... + ·23
Curvature.......... − ·28

Radial velocity.................. +21·3

β ORIONIS 2126.

1909. Jan. 12.
G. M. T. 12h 15m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7047	....	....	....	2	53·0813	....	....	....
2	54·0000	....	....	....	2	45·2910	....	....	....
2½	53·9770	·9830	·0398	+44·40	1	45·2885	2910	·0321	+35·47
1½	53·4113	·4180	·0398	44·37					

Weighted mean		+42·60
V_a	−15·39	
V_d		+ ·23
Curvature	− ·28	
Radial velocity		+27.2

β ORIONIS 2127.

1909. Jan. 12
G. M. T. 12h 18m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7141	....	....	....	2	53 0960	....	....	....
2	54·0082	.....	....	....	2	45·2991	....	....	....
2½	53·9767	·9765	·0333	+37·15	2	45·3000	·2945	·0356	+39·34
1½	53·4291	4224	·0442	49·28					

Weighted mean		+40·91
V_a	−15·39	
V_d		+ ·23
Curvature	− ·28	
Radial velocity		+25·5

β ORIONIS 2128.

1909. Jan. 13.
G. M. T. 15h 36m

Observed by J. B. Cannon.
Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7086	....	....	....	2	53·0920	....	....	....
2	54·0031	......	....	....	2	45·2968	....	....	....
2	53,9775	·9790	·0358	+41·41	2	45·3012	2980	0391	+41·06
2	53 4281	·4275	·0493	56 65					

Weighted mean		+46·37
V_a	−15·81	
V_d	− ·09	
Curvature	− ·28	
Radial velocity		+30·2

β ORIONIS 2129.

1909. Jan. 13.
G. M. T. 15h 41m

Observed by W. E. Harper.
Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	54·7082	....	....	......	2	53·0893	......	....	......
2	54·0002	....	....	....	2	45·2978	....	......	....
2½	53·9730	·9748	·0316	+36·54	1½	45·2852	·2810	·0221	+23·20
1½	53·4061	·4068	·0286	32·86					

Weighted mean		+31·90
V_a	−15·81	
V_d	− ·09	
Curvature	·28	
Radial velocity		+15·7

β ORIONIS 2130.

1909. Jan. 13.
G. M. T. 15h 46m

Observed by W. E. Harper.
Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	54·6985	....	....	....	2	53·0813	....	....	....
2	53·9934	....	....	....	2	45·2892	....	....	....
2	53·9782	·9880	·0448	+51·82	2	45·2940	·2984	·0395	+41·48
1	53·4029	·4115	·0333	38·26					

Weighted mean		+44·97
V_a	−15·81	
V_d	− ·09	
Curvature	− ·28	
Radial velocity		+28·8

β ORIONIS 2142.

1909. Jan. 15.
G. M. T. 15h 11m

Observed by J. B. Cannon.
Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	54·7058	....	....	....	2	53·0911	....	....	....
2	53·9996	....	....	....	2	45·2970	....	....	....
1	53·9752	·9790	·0358	+41·40	2	45·3055	·3021	·0432	+45·36
2	53·4083	·4105	·0323	37·14					

Weighted mean		+41·28
V_a	−16·50	
V_d	− ·04	
Curvature	− ·28	
Radial velocity		+24·5

β ORIONIS 2141.

1909. Jan. 15.
G. M. T. 14h 54m

Observed by J. B. Cannon.
Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in Revns	Velocity.
2	56·6150	....	....	....	2	53·0735	....	....	....
2	54·7025	....	....	....	2	45·2772	....	....	....
2	53·9628	·9778	·0346	−40·02	3	45·2777	·2940	·0351	+36·86
1	53·3821	·3975	·0193	22·18					

Weighted mean..................		+35·47
V_a..................	−16·50	
V_d..................	− ·04	
Curvature..................	− ·28	
Radial velocity..................		+18·6

β ORIONIS 2143.

1909. Jan. 15.
G. M. T. 15h 15m

Observed by J. B. Cannon.
Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7162	....	....	....	2	53·0946	....	....	....
2	54·0069	....	....	....	2	45·2937	....	....	....
3	53·9895	·9844	·0412	+47·65	2	45·3062	·3061	·0472	+49·56
1½	53·4092	·4040	·0258	29·65					

Weighted mean..................		+44·08
V_a..................	−16·50	
V_d..................	− ·04	
Curvature..................	− ·28	
Radial velocity..................		+27·2

β ORIONIS 2144.

1909. Jan. 15.
G. M. T. 15h 19m

Observed by J. B. Cannon.
Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7053	....	....	....	2	53·0782	....	....	....
2	53·9945	....	....	....	2	45·2864	....	....	....
1	53·9672	·9750	·0318	+36·78	2	45·2847	·2920	·0331	+34·76
1	53·4103	·4200	·0418	48·03					

Weighted mean..................		+38·58
V_a..................	−16·50	
V_d..................	− ·04	
Curvature..................	− ·28	
Radial velocity..................		+21·8

β ORIONIS 2151.

1909. Jan. 16.
G. M. T. 12h 25m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·6926	...	...	...	2	53·0657	...	...	...
2	53·9756	...	...	...	2	45·2780	...	...	...
1	53·9598	·9850	·0418	+48·25	3	45·2970	·3139	·0511	−56·61
2	53·3854	·4104	·0322	36·00					

Weighted mean		+48·35
V_a	16·82	
V_d		+·13
Curvature	−·28	
Radial velocity		−31·4

β ORIONIS 2152.

1909. Jan. 16.
G. M. T. 12h 36m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·6990	...	...	...	2	53·0859	...	...	...
2	53·9982	...	...	...	2	45·2919	...	...	...
2	53·9738	·9820	·0388	+44·78	2	45·2978	·2995	·0406	+42·63
1	53·4168	·4210	·0428	48·18					

Weighted mean		+44·60
V_a	−16·82	
V_d		+·13
Curvature	−·28	
Radial velocity		−27·6

β ORIONIS 2153.

1909. Jan. 16.
G. M. T. 12h 44m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7003	...	...	...	2	53·0787	...	...	...
2	54·0022	...	...	...	2	45·2970	...	...	...
2	53·9786	·9886	·0454	+52·51	3	45·3131	·3100	·0511	+53·66
1	53·4072	·4160	·0378	43·44					

Weighted mean		+51·38
V_a	−16·82	
V_d		+·13
Curvature	−·28	
Radial velocity		+34·4

β ORIONIS 2154.

1909. Jan. 16. G. M. T. 12h 52m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	56·5114	....	....	....	2	53·0724	....	....	....
2	54·6911	....	....	....	2	45·2845	....	....	....
2	53·9844	·0025	·0593	+68·59	2	45·3008	·3100	·0511	+53·66
1½	53·4059	·4220	·0438	49·23					

Weighted mean .... + 57·88
V_a .... −16·82
V_d .... + ·13
Curvature .... − ·28

Radial velocity .... + 40·9

β ORIONIS 2155.

1909. Jan. 16. G. M. T. 12h 59m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	56·6278	....	....	....	2	53·4202	·4220	·0438	49·23
2	54·7078	....	....	....	2	53·0880	....	....	....
2	54·0014	....	....	....	2	45·2940	....	....	....
2	53·9853	·9875	·0443	+51·03	2	45·3136	·3130	·0541	+53·66

Weighted mean .... + 51·01
V_a .... −16·82
V_d .... + ·13
Curvature .... − ·28

Radial velocity .... + 33·0

β ORIONIS 2156.

1909. Jan. 16. G. M. T. 13h 12m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7101	....	....	....	2	53·0934	....	....	....
2	54·0028	....	....	....	2	45·3008	....	....	....
4	53·9856	·9845	·0413	+47·77	3	45·3214	·3140	·0551	+58·91
2	53·4297	·4250	·0468	53·78					

Weighted mean .... + 52·82
V_a .... −16·82
V_d .... + ·13
Curvature .... − ·28

Radial velocity .... + 35·8

β ORIONIS 2157.

1909. Jan. 17.
G. M. T. 13h 48m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	54·6992	....	....	....	2	53·0802	....	....	....
2	53·9936	....	....	....	2	45·2896	....	....	....
3	53·9741	[illegible]	·0418	+48·34	2	45·3062	·3102	·0513	+53·87
1	53·3965	·4055	·0273	31·37					

Weighted mean........................ + 47·35
V_a .... −17·17
V_d .... + ·05
Curvature.......... − ·28

Radial velocity.................... +29·9

β ORIONIS 2158.

1909. Jan. 17.
G. M. T. 13h 56m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	54·6898	....	....	....	2	53·0742	....	....	....
2	53·9898	....	....	....	2	45·2874	....	....	....
2	53·9655	·9835	·0403	+46·61	2	45·2947	·3010	·0421	+44·21
2	53·3969	·4130	·0348	39·99					

Weighted mean........................ +43·60
V_a .... −17·17
V_d .... + ·05
Curvature ..... − ·28

Radial velocity.................... +26·2

β ORIONIS 2161.

1909. Jan. 18.
G. M. T. 12h 41m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	54·7073	....	....	....	2	53·0908	....	....	....
2	53·9976	....	....	....	2	45·2916	....	....	....
2	53·9851	·9880	·0448	+51·81	2½	45·3141	·3160	·0571	+59·96
1½	53·4217	·4220	·0438	50·37					

Weighted mean.................... +54·84
V_a .... −17·17
V_d .... + ·05
Curvature .... − ·28

Radial velocity................ +37·1

β ORIONIS 2162.

1909. Jan. 18.
G. M. T. 12h 46m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7174	....	....	....	2	53·0979	....	....	....
2	54·0111	....	....	....	2	45·3097	....	....	....
3	53·9987	·9900	·0468	+54·12	2	45·3267	·3105	·0516	+54·19
2	53·4185	·4098	·0316	36·34					

Weighted mean .... +49·06
V_a .... −17·17
V_d .... + ·05
Curvature ...... − ·28

Radial velocity .... +31·3

β ORIONIS 2163.

1909. Jan. 18.
G. M. T. 12h 51m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7067	....	....	....	2	53·0858	....	....	....
2	53·9965	....	....	....	2	45·2994	....	....	....
3	53·9771	·9820	·0388	+44·87	2	45·3122	·3064	·0475	+49·88
1	53·4107	·4147	·0365	41·94					

Weighted mean .... +46·05
V_a .... −17·51
V_d .... + ·08
Curvature ...... − ·28

Radial velocity .... +28·3

β ORIONIS 2164.

1909. Jan. 18.
G. M. T. 13h 06m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7077	....	....	....	2	53·0867	....	....	....
2	53·9990	....	....	....	2	45·2983	....	....	....
2	53·9926	·9954	·0521	+59·16	3	45·3107	·3060	·0471	+49·46
2	53·4235	·4261	·0479	54·04					

Weighted mean .... +53·54
V_a .... −17·57
V_d .... + ·08
Curvature ...... − ·28

Radial velocity .... +35·8

β ORIONIS 2165.

1909. Jan. 18.
G. M. T. $13^h\ 10^m$

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7128	....	....	....	2	53·0967	....	....	....
2	54·0073	....	....	....	2	45·3114	....	....	....
3	53·9885	·9830	·0398	+45·93	2	45·3277	·3100	·0571	+53·66
1	53·4284	·4215	·0433	48·66					

Weighted mean .... +48·96
V_a .... −17·57
V_d .... + ·08
Curvature .... − ·28

Radial velocity .... +31·2

β ORIONIS 2166.

1909. Jan. 18.
G. M. T. $13^h\ 14^m$

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7106	....	....	....	2	53·0896	....	....	....
2	53·9998	....	....	....	2	45·3060	....	....	....
1½	53·9796	·9805	·0373	+43·14	3	45·3184	·3065	·0471	+49·46
1½	53·4221	·4225	·0443	50·95					

Weighted mean .... +48·25
V_a .... −17·57
V_d .... + ·08
Curvature .... − ·28

Radial velocity .... +30·5

β ORIONIS 2177.

1909. Jan. 26.
G. M. T. $10^h\ 36^m$

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7218	....	....	....	2	53·0968	....	....	....
2	54·0098	....	....	....	2	45·2904	....	....	....
2	53·9936	·9856	·0424	+49·04	2	45·2922	·2954	·0365	+38·33
1	53·4276	·4200	·0418	48·03					

Weighted mean .... +44·55
V_a .... −19·95
V_d .... + ·22
Curvature .... − ·28

Radial velocity .... +24·6

β ORIONIS 2178.

1909. Jan. 26.
G. M. T. 10^h 51^m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·7527	....	....	....	2	53·1294	....	....	....
2	54·0433	....	....	....	2	45·3207	....	....	....
3	54·0181	·9766	·0334	+38·63	1	45·3132	·2861	·0272	+28·56
1½	53·4554	·4150	·0368	42·29					

Weighted mean........................ +37·80
V_a ... . −19·95
V_d .... + ·22
Curvature............ − ·28

Radial velocity..................... +17·8

β ORIONIS 2179.

1909. Jan. 26.
G. M. T. 10^h 56^m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·7468	....	....	....	2	53·1221	....	....	....
2	54·0423	....	....	....	2	45·3160	....	....	....
2	54·0140	53·9780	·0348	+40·25	2	45·3215	·2890	·0401	+42·11
1½	53·4594	·4260	·0478	54·93					

Weighted mean .... +44·93
V_a.................. −19·95
V_d .... + ·22
Curvature........... − ·28

Radial velocity..... .... +24·9

β ORIONIS 2180.

1909. Jan. 26.
G. M. T. 11^h 01^m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·7250	....	....	....	2	53·1036	....	....	....
2	54·0212	....	....	....	2	45·2950	....	....	....
2½	53·9934	·9770	·0338	+39·09	1½	45·3008	·2994	·0405	+42·53
1	53·4420	·4270	·0488	56·08					

Weighted mean.......... .... +43·52
V_a . .. . 19·95
V_d .... + ·22
Curvature..... . .. − ·28

Radial velocity.................... +23·5

β ORIONIS 2181.

1909. Jan. 26.
G. M. T. 11ʰ 11ᵐ

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	54·7250	....	....	....	2	53·0986	.. ..	....	.. ....
2	54·0155	... .	....	....	2	45·2998	....	....	....
3	53·9908	·9780	·0358	+41·40	1½	45·3051	·2990	·0401	+42·11
1	53·4287	·4180	·0398	45·73					

Weighted mean ... . +42·38
V_a .. .. −19·95
V_d .... + ·22
Curvature .... − ·28

Radial velocity .... +22·4

β ORIONIS 2182.

1909. Jan. 26.
G. M. T. 11ʰ 16ᵐ

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	54·7440	....	....	....	2	53·1178	....	... .	....
2	54·0407	....	. . ..	....	2	45·3090	.. . ..	....	....
2	54·0083	·9770	·0338	+39·09	2	45·3066	·2912	·0323	+33·92
½	53·4372	·4080	·0298	34·24					

Weighted mean .... +36·25
V_a .... −19·95
V_d ... . + ·22
Curvature......:. − ·28

Radial velocity..... .... +16·2

β ORIONIS 2183.

1909. Jan. 26.
G. M. T. 11ʰ 21ᵐ

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	54·7394	. ...	.... . .	.. . .	2	53·1107	.. . .	....	......
2	54·0262	....	....	....	2	45·2972	....	....	....
3	54·0003	·9760	·0328	+37·93	2	45·3035	·3000	·0411	+43·16
½	53·4399	·4175	·0393	45·14					

Weighted mean....................... +40·49
V_a........ ... . −19·95
V_d .... + ·22
Curvature .... − ·28

Radial velocity............. .... +20·5

β ORIONIS 2184.

1909. Jan. 28.
G. M. T. 11h 21m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·7322	....	....	....	2	53·1120	....	....	....
2	54·0224	....	....	....	2	45·3111	....	....	....
3	51·0007	·9800	·0368	+42·56	2	45·3122	·2947	·0358	+37·59
1	53·4160	·3940	·0158	18·16					

Weighted mean................... ..		+36·84
V_a..	−20·51	
V_d.........		+ ·21
Curvature.........	− ·28	
Radial velocity..................		−16·3

β ORIONIS 2185.

1909. Jan. 28.
G. M. T. 11h 25m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·7073	....	....	....	2	53·0869	....	....	....
2	53 9993	....	....	....	2	45·2864	....	....	....
2	53·9800	·9830	·0398	+46·03	2	45·2882	·2954	·0365	+38·33
1	53·4194	·4220	·0438	50·33					

Weighted mean..........................		+43 81
V_a...........	−20·51	
V_d.......		+ ·21
Curvature.....	− ·29	
Radial velocity........		+23·2

β ORIONIS 2186.

1909. Jan. 28.
G. M. T. 11h 29m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	54·7073	....	....	....	2	53·0851	....	....	....
2	54·0002	....	....	....	2	45·2893	....	....	....
2	53·9697	·9735	·0303	+35·04	2	45·2888	·2930	·0341	+35·81
1	53·4020	·4060	·0278	31·94					

Weighted mean....................		+34·73
V_a......	−20·51	
V_d....		+ ·21
Curvature......	− 28	
Radial velocity		+14·2

β ORIONIS 2187.

1909. Jan. 28.
G. M. T. 11h 41m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7131	....	....	....	2	53·0944	....	....	....
2	54·0015	....	....	....	2	45·2911	....	....	... .
2	53·9731	·9705	·0273	+31·57	2	45·2883	·2908	·0318	+33·39
1½	53·4183	·4140	·0358	41·14					

Weighted mean............. .... +34·84
V_a .... −20·51
V_d .... + ·21
Curvature ..... − ·28

Radial velocity. .. .. +14 3

β ORIONIS 2188.

1909. Jan. 28.
G. M. T. 11h 44m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7128	....	....	....	2	53 0905	....	....	....
2	54 0033	....	....	....	2	45·2924	....	... .	....
2	53·9628	·9614	·0182	+21·05	1½	45·2857	·2869	·0280	+29·40
1½	53·4200	·4187	·0405	46·54					

Weighted mean............. .... +31·20
V_a .... −20 51
V_d .... + ·21
Curvature....... − ·28

Radial velocity. .. .. +10·6

β ORIONIS 2189.

1909. Jan. 28.
G. M. T. 11h 47m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7175	....	....	. ...	2	53·1003	....	....	....
2	54·0085	....	....	....	2	45·2987	... .	... .	....
2	53·9802	·9730	·0298	+34·46	1½	45·2937	·2886	·0397	+41·69
1½	53·4243	·4150	·0368	42·29					

Weighted mean........ .... +38·98
V_a .... - 20·51
V_d .... + ·21
Curvature........ − ·28

Radial velocity..... .... +18·4

β ORIONIS 2195.

1909. Jan. 29. G. M. T. 12h 53m

Observed by J. B. CANNON.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7212	....	....	....	2	53·1014	....	....	....
2	54·0176	....	....	....	2	45·2906	....	....	....
2	53·9840	·9710	·0278	+32·15	1	45·2928	·2958	·0369	+38·75
1	53·4261	·4135	·0353	40·56					

Weighted mean........................		+35·90
V_a..............	−20·79	
V_d..............................		+ ·05
Curvature........	− ·28	
Radial velocity..............................		+14·9

β ORIONIS 2196.

1909. Jan. 29. G. M. T. 12h 57m.

Observed by J. B. CANNON.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7168	....	....	....	2	53·0946	....	....	....
2	54·0073	....	....	....	2	45·2894	....	....	....
3	53·9817	·9762	·0330	+38·16	1½	45·2877	·2919	·0330	+34·65
½	53·4324	·4270	·0488	56·08					

Weighted mean........................		+38·90
V_a..............	−20·79	
V_d..............................		+ ·05
Curvature........	− ·28	
Radial velocity..............................		+17·9

β ORIONIS 2197.

1909. Jan. 29. G. M. T. 13h 01m

Observed by J. B. CANNON.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7222	....	....	....	2	53·0981	....	....	....
2	54·0097	....	....	....	2	45·2919	....	....	....
2	53·9881	·9790	·0358	+41·40	1	45·3034	·3050	·0461	+48·41
½	53·4480	·4390	·0608	69·87					

Weighted mean........................		+47·47
V_a..............	−20·79	
V_d..............................		+ ·05
Curvature........	− ·28	
Radial velocity..............................		+26·4

β ORIONIS 2198.

1909. Jan. 29.
G. M. T. 13h 05m

Observed by J. B. CANNON.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7170	....	....	....	2	53·0924	....	....	....
2	54·0100	....	....	....	2	45·2871	....	....	....
2	53·9896	·9840	·0108	+47·18	2	45·2927	·2992	·0403	+42·32
1½	53·4164	·4120	·0338	38·84					

Weighted mean		+43·14
V_a	−20·79	
V_d		+05
Curvature	−·28	
Radial velocity		+22·1

β ORIONIS 2201.

1909. Jan. 30.
G. M. T. 12h 29m

Observed by, Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7150	....	....	....	2	53·0957	....	....	....
2	54·0093	....	....	....	2	45·2906	....	....	....
3	53·9791	·9730	·0298	+34·46	2	45·2884	·2914	·0325	+34·13
1	53·4193	·4130	·0348	39·99					

Weighted mean		+35·27
V_a	−21·05	
V_d		+·06
Curvature	−·28	
Radial velocity		+14·0

β ORIONIS 2202.

1909. Jan. 30.
G. M. T. 12h 41m

Observed by, Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7150	....	....	....	2	53·5937	....	....	....
2	54·0022	....	....	....	2	45·2878	....	....	....
1½	53·9764	·9710	·0268	+30·99	2	45·2963	·3020	·0431	+45·26
1	53·4141	·4100	·0318	36·54					

Weighted mean		+38·57
V_a	−21·05	
V_d		+·06
Curvature	−·28	
Radial velocity		+17·3

β ORIONIS 2203.

1909. Jan. 30.
G. M. T. 12h 45m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7115	....	....	....	2	53·0902	....	....	....
2	53·9970	....	....	....	2	45·2808	....	....	....
1	53·9941	·9950	·0518	+59·91	2	45·2822	2950	·0361	+37·91
½	53·4224	·4240	·0458	52·63					

Weighted mean		+46·29
V_a	−21·05	
V_d		+ ·06
Curvature	− ·28	
Radial velocity		+25·0

β ORIONIS 2204.

1909. Jan. 30.
G. M. T. 12h 48m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7152	....	....	....	2	53·0917	....	....	....
2	54·0046	....	....	....	2	45·2933	....	....	....
1	53·9739	·9712	0280	+32·38	2	45·2969	·2972	·0383	+40·22
1	53·4059	·4034	·0252	28·96					

Weighted mean		+35·45
V_a	−21·05	
V_d		+ ·06
Curvature	− ·28	
Radial velocity		+14·2

β ORIONIS 2205.

1909. Jan. 30.
G. M. T. 15h 47m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3385	....	....	....	2	58·7894	....	....	....
2	61·3585	....	....	....	2	36·1737	....	....	....
3	61·2878	·2744	·0939	+38·82	1½	36·1979	·2180	·1275	+44·83
1½	59·7215	·7140	·1175	48·07					

Weighted mean		+42·63
V_a	−21·05	
V_d		+ ·06
Curvature	− ·28	
Radial velocity		+21·0

β ORIONIS 2206.

1909. Jan. 30.
G. M. T. 16h 04m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3436	.....	.....	.....	2	58·7994	.....	.....	.....
2	61·3644	.....	.....	.....	2	36·1900	.....	.....	.....
2	61·3040	·2850	·1045	+43·20	1½	36·2046	·2088	·1173	+41·24
1½	59·7313	·7150	·1185	48·48					

Weighted mean ..... +44·20
V_a ..... −21·10
V_d ..... − ·24
Curvature ..... − ·28

Radial velocity ..... +22·6

β ORIONIS 2207.

1909, Jan. 30.
G. M. T. 16h 24m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3410	.....	.....	.....	2	58·7983	.....	.....	.....
2	61·3604	.....	.....	.....	2	36·1943	.....	.....	.....
3	61·3037	·2880	·1075	+44·44	2	36·2027	·2026	·1121	+39·41
1½	59·7308	·7160	·1195	48·89					

Weighted mean ..... +43·92
V_a ..... −21·10
V_d ..... − ·24
Curvature ..... − ·28

Radial velocity ..... +22·3

β ORIONIS 2211.

1909, Jan. 31.
G. M. T. 17h 16m

Observed by W. E. HARPER.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7191	.....	.....	.....	2	53·0951	.....	.....	.....
2	54·0068	.....	.....	.....	2	45·2834	.....	.....	.....
2	53·9870	·9800	·0368	+42·56	2	45·2806	·2908	·0319	+33·50
1	53·4342	·4275	·0493	56·65					

Weighted mean ..... +41·75
V_a ..... −21·33
V_d ..... − ·31
Curvature ..... − ·28

Radial velocity ..... +19·8

β ORIONIS 2212.

1909. Jan. 31.
G. M. T. 17ʰ 20ᵐ

Observed by W. E. Harper.
Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	54·7084	....	....	....	2	53·0894	....	....	....
2	54·0012	....	....	....	2	45·2894	....	....	....
2	53·9833	9835	·0403	+46·61	1½	45·2886	2928	·0339	+35·60
1	53·4274	4273	0491	56·42					

Weighted mean....................		+45·12
V_a	−21·33	
V_d	− ·31	
Curvature............	− ·28	
Radial velocity..............		+23·2

β ORIONIS 2213.

1909. Jan. 31.
G. M. T. 17ʰ 24ᵐ

Observed by W. E. Harper.
Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	54·7118	....	....	....	2	53·0904	....	....	....
2	54·0115	....	....	....	2	45·2938	....	....	....
2	53·9797	·9737	·0305	+35·27	2	45·2925	·2923	·0334	+35·07
1	53·4258	·4190	·0408	46·88					

Weighted mean....................		+37·91
V_a	−21·33	
V_d	− ·31	
Curvature............	− ·28	
Radial velocity..............		+16·0

β ORIONIS 2214.

1909. Jan. 31.
G. M. T. 17ʰ 29ᵐ

Observed by W. E. Harper.
Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	54·7065	....	....	....	2	53·0873	....	....	....
2	53·9988	....	....	....	2	45·2835	....	....	....
1½	53·9808	9840	·0408	+47·18	2	45·2763	·2864	·0275	+28·88
1	53·4149	·4174	·0392	45·04					

Weighted mean....................		+38·57
V_a	−21·33	
V_d	− ·31	
Curvature............	− ·28	
Radial velocity..............		+16·6

β ORIONIS 2215.

1909. Feb. 2.
G. M. T. 11h 14m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7098	....	....	....	2	53·0885	....	....	....
2	54·0038	....	....	....	2	45·2951	....	....	....
2	53·9791	·9803	·0371	+42·90	2	45·3072	·3067	·0478	+50·19
2	53·4182	·4192	·0410	47·11					

Weighted mean .... +46·73
V_a .... −21·79
V_d .... + ·14
Curvature .... − ·28

Radial velocity .... +24·8

β ORIONIS 2216.

1909. Feb. 2.
G. M. T. 11h 23m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7162	....	....	....	2	53·0940	....	....	....
2	54·0091	....	....	....	2	45·3030	....	....	....
3	53·9864	·9810	·0378	+43·72	2	45·3047	·2953	·0364	+38·22
2	53·4299	·4250	·0468	53·78					

Weighted mean .... +45·02
V_a .... −21·79
V_d .... + ·14
Curvature .... − ·28

Radial velocity .... +23·1

β ORIONIS 2217.

1909. Feb. 2.
G. M. T. 11h 26m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7143	....	....	....	2	53·0916	....	....	....
1	54·0053	....	....	....	2	45·2940	....	....	....
3	53·9820	·9790	·0358	+41·40	2	45·3032	·3028	·0439	+46·10
1	53·4303	·4277	·0495	56·88					

Weighted mean .... +45·35
V_a .... −21·79
V_d .... + ·14
Curvature .... − ·28

Radial velocity .... +23·6

β ORIONIS 2218.

1909. Feb. 2.
G. M. T. 11h 29m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7101	....	....	....	2	53·0910	....	....	....
2	54·0023	....	....	....	2	45·2961	....	....	....
2	53·9848	·9845	·0413	+47·76	2	45·3020	·2995	·0406	+42·63
1	53·4172	·4160	·0378	43·44					

Weighted mean		+44·44
V_a	−21·97	
V_d		+ ·14
Curvature	− ·28	
Radial velocity		+22·5

β ORIONIS 2219.

1909. Feb. 2.
G. M. T. 11h 41m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7180	....	....	....	2	53·0937	....	....	....
2	54·0106	....	....	....	2	45·3002	....	....	....
3	53·9813	·9740	·0308	+35·62	2	45·3032	·2966	·0377	+39·59
1½	53·4213	·4150	·0368	42·29					

Weighted mean		+38·39
V_a	−21·79	
V_d		+ ·14
Curvature	− ·28	
Radial velocity		+16.5

β ORIONIS 2220.

1909, Feb. 2.
G. M. T. 11h 45m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7143	....	....	....	2	53·0952	....	....	....
2	54·0073	....	....	....	2	45·2903	....	....	....
3	53·9847	·9800	·0368	+42·56	2	45·2967	·3000	·0411	+43·16
1	53·4305	·4250	·0468	53·78					

Weighted mean		+44·63
V_a	−21·79	
V_d		+ ·14
Curvature	− ·28	
Radial velocity		+22·7

β ORIONIS 2220*

1909, Feb. 2.
G. M. T. 11ʰ 45ᵐ

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	54·7580	....	....	....	3	53·1366	....	....	....
2	54·0249	·9779	·0347	+40·03	2	45·3355	·3006	·0417	+43·78
1½	53·4623	·4151	·0369	42·40	3	45·3285	....	....	....

Weighted mean .... +42·04
V_a .... −21·79
V_d .... + ·14
Curvature...... − ·28

Radial velocity.............. +20·2

* Check.

β ORIONIS 2236.

1909, Feb. 6.
G. M. T. 12ʰ 29ᵐ

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	54·7129	....	....	....	2	53·0895	....	....	....
2	54·0040	....	....	....	2	45·2921	....	....	....
2	53·9767	·9750	·0318	+36·78	3	45·2985	·3000	·0411	+43·16
1	53·4149	·4143	·0361	41·48					

Weighted mean.................... +40·75
V_a .... −22·07
V_d .... − ·24
Curvature.... − ·28

Radial velocity.............. +18·2

β ORIONIS 2239.

1909, Feb. 6.
G. M. T. 12ʰ 50ᵐ

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	54·7144	....	....	....	2	53·0925	....	....	....
2	54·0085	....	....	....	2	45·2967	....	....	....
2	53·9843	·9810	·0378	+43·72	2	45·3043	·3012	·0423	+44·42
1½	53·4083	·4052	·0270	31·03					

Weighted mean.................... +42·62
V_a .... −22·07
V_d .... − ·24
Curvature.... − ·28

Radial velocity.............. +20·0

β ORIONIS 2240.

1909. Feb. 6.
G. M. T. 12ʰ 52ᵐ

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	54·7160	....	....	....	2	53·0936	....	....	....
2	54·0066	....	....	....	2	45·2951	....	....	....
2	53·9845	·9800	·0368	+42·56	1	45·2950	·2935	·0346	+36·33
2	53·4254	·4210	·0428	49·18					

Weighted mean		+43·96
V_a	−22·07	
V_d	− ·24	
Curvature	− ·28	
Radial velocity		+21·0

β ORIONIS 2241.

1909. Feb. 6.
G. M. T. 16ʰ 12ᵐ

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	63·3172	....	....	....	2	58·7726	....	....	....
2	61·3357	....	....	....	2	36·1652	....	....	....
2	61·2768	·2858	·1053	+43·53	1½	36·1710	·2000	·1095	+38·00
1½	59·7176	·7280	·1315	54·10					

Weighted mean		+45·19
V_a	−22·73	
V_d	− ·30	
Curvature	− ·28	
Radial velocity		+21·9

β ORIONIS 2242.

1909. Feb. 6.
G. M. T. 16ʰ 43ᵐ

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean. of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	63·3249	....	....	....	2	58·7845	....	....	....
2	61·3494	....	....	....	2	36·1810	....	....	....
2	61·2686	·2670	·0865	+35·76	1½	36·1972	·2104	·1199	+42·16
1½	59·7224	·7220	·1255	51·34					

Weighted mean		+42·36
V_a	−22·73	
V_d	− ·30	
Curvature	− ·28	
Radial velocity		+19·1

β ORIONIS 2243.

1909. Feb. 7.
G. M. T. 15h 11m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3350	....	....	....	2	58·7918	....	....	....
2	61·3619	....	....	....	2	36·1731	....	....	....
2	61·2972	·2872	·1065	+44·03	2	36·1874	·2085	·1180	+41·77
1½	59·7234	·7150	·1185	48·48					

Weighted mean.................. +44·42
V_a.................. −22·93
V_d.................. −·23
Curvature.......... −28

Radial velocity.................. +21·0

β ORIONIS 2244.

1909. Feb. 7.
G. M. T. 15h 25m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3380	....	....	....	2	58·7900	....	....	....
2	61·3554	....	....	....	2	36·1752	....	....	....
2	61·2952	·2855	·1050	+43·41	1½	36·1830	·2020	·1115	+39·20
1	59·7458	·7388	·1423	58·21					

Weighted mean.................. +45·30
V_a.................. −22·93
V_d.................. −·23
Curvature.......... −·28

Radial velocity.................. +21·9

β ORIONIS 2245.

1909. Feb. 7.
G. M. T. 15h 37m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3424	....	....	....	2	58·7988	....	....	....
2	61·3620	....	....	....	2	36·1867	....	....	....
1½	61·2862	·2692	·0887	+35·97	1	36·1858	·1963	·1058	+37·20
1	59·7488	·7338	·1373	56·05					

Weighted mean.................. +41·45
V_a.................. −22·93
V_d.................. −·23
Curvature.......... −·28

Radial velocity.................. +18·0

β ORIONIS 2249.

1909. Feb. 8.
G. M. T. 13ʰ 32ᵐ

Observed by T. H. Parker.
Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	54·7050	....	....	....	2	53·0824	....	....	....
2	53·9998	....	....	....	2	45·2868	....	....	....
3	53·9795	·9845	·0413	−47·76	2	45·3024	·3092	·0503	+52·82
2	53·4276	·4375	·0593	68·14					

Weighted mean		+ 55·03
V_a	− 23·11	
V_d	− ·08	
Curvature	− ·28	
Radial velocity		+ 31·6

β ORIONIS 2250.

1909. Feb. 8.
G. M. T. 13ʰ 36ᵐ

Observed by T. H. Parker.
Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	54·6972	....	....	....	2	53·0777	....	....	....
2	53·9910	....	....	....	2	45·2869	....	....	....
2	53·9713	·9835	·0403	−46·61	1½	45·2950	·3027	·0438	+45·99
1	53·4184	·4304	·0522	59·98					

Weighted mean		+ 49·37
V_a	− 23·11	
V_d	− ·08	
Curvature	− ·28	
Radial velocity		+ 25·9

β ORIONIS 2251.

1909. Feb. 8.
G. M. T. 13ʰ 41ᵐ

Observed by T. H. Parker.
Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	54·7049	....	....	....	2	53·0838	....	....	....
2	53·9982	....	....	....	2	45·2878	....	....	....
2	53·9698	·9755	·0323	+37·35	1½	45·2914	·2972	·0383	+40·22
3	53·4168	·4225	·0443	50·91					

Weighted mean		+ 44·27
V_a	− 23·11	
V_d	− ·08	
Curvature	− ·28	
Radial velocity		+ 21·8

β ORIONIS 2252.

1909. Feb. 8.
G. M. T. 14h 01m

Observed by T. H. PARKER.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7056	....	....	....	2	53·0882	....	....	....
2	53·9980	....	....	....	2	45·2960	....	....	....
1½	53·9779	·9815	·0383	+44·29	1½	45·2982	·2958	·0369	+38·75
½	53·4076	·4095	·0313	35·97					

Weighted mean .... +41·05
V_a .... 23·11
V_d .... − ·08
Curvature .... − ·28

Radial velocity .... +17·6

β ORIONIS 2253.

1909. Feb. 8.
G. M. T. 14h 05m

Observed by T. H. PARKER.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7217	....	....	....	2	53·1030	....	....	....
2	54·0110	....	....	....	2	45·3090	....	....	....
2	53·9862	·9762	·0330	+38·16	2	45·3240	·3086	·0497	+52·19
3	53·4354	·4230	·0448	51·48					

Weighted mean .... +47·88
V_a .... −23·11
V_d .... − ·08
Curvature .... − ·28

Radial velocity .... +24·1

β ORIONIS 2254.

1909. Feb. 8.
G. M. T. 14h 09m

Observed by T. H. PARKER.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7152	....	....	....	2	53·0993	....	....	....
2	54·0084	....	....	....	2	45·3112	....	....	....
2	53·9930	·9860	·0428	+49·50	2	45·3142	·2966	·0377	+39·59
1	53·4357	·4265	·0483	55·50					

Weighted mean .... +46·74
V_a .... −23·11
V_d .... − ·08
Curvature .... − ·28

Radial velocity .... +23·3

β ORIONIS 2265.

1909. Feb. 10. G. M. T. 12^h 07^m

Observed by W. E. Harper. Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·6987	....	....	....	2	53·0767	....	....	.. ..
2	53·9911	.... .	....	... .	2	45·2770	....	....	.. ..
2	53·9691	·9800	·0368	+42·56	2	45·2980	·3146	·0557	+58·49
1½	53·4197	·4310	·0528	69·67					

Weighted mean		+53·29
V_a	−23·48	
V_d		+ ·05
Curvature.....	− ·28	
Radial velocity......................		+29·6

β ORIONIS 2266.

1909. Feb. 10. G. M. T. 12^h 12^m

Observed by W. E. Harper. Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7090	....	....	....	2	53·0932	.... .	....	... .
2	54·0052	....	....	. ..	2	45·2916	....	....	....
2	53·9815	·9780	·0348	+40·25	2	45·2989	·3009	0420	+44·10
2	53·4312	·4275	·0493	56·65					

Weighted mean.........		+47·00
V_a	−23·48	
V_d		+ ·05
Curvature	− ·28	
Radial velocity.....		+23·3

β ORIONIS 2267.

1909. Feb. 10. G. M. T. 12^h 16^m

Observed by W. E. Harper. Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54 7055	. .. ...	....	....	2	53·0868	....	....	....
2	53 9982	. ....	....	....	2	45 2923	....	....	....
2	53·9744	·9780	·0348	+40·25	2	45·2994	·3007	·0418	+43·89
1½	53·4070	·4100	·0318	36·54					

Weighted mean...............		+40·56
V_a	−23·48	
V_d		+ ·05
Curvature......... ..	− ·28	
Radial velocity		+16·9

β ORIONIS 2268.

1909. Feb. 10. G. M. T. 12h 21m

Observed by W. E. Harper. Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	54·7108	....	....	....	2	53·0920	....	....	....
2	54·0029	....	....	....	2	45·2948	....	....	....
2	53·9702	·9690	·0258	+29·84	2	45·2962	·2950	·0361	+37·91
1½	53·4186	·4160	·0378	43·44					

Weighted mean		+36·48
V_a	−23·48	
V_d		+ ·05
Curvature	− ·28	
Radial velocity		+12·8

β ORIONIS 2269.

1909. Feb. 10. G. M. T. 12h 33m

Observed by W. E. Harper. Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	54·7094	....	....	....	2	53·0894	....	....	....
2	53·9959	....	....	....	2	45·2919	....	....	....
3	53·9814	·9830	·0398	+46·03	2	45·2979	·2996	·0407	+42·74
2	53·4142	·4145	·0363	41·71					

Weighted mean		+44·00
V_a	−23·48	
V_d		+ ·05
Curvature	− ·28	
Radial velocity		+20·3

β ORIONIS 2270.

1909. Feb. 10. G. M. T. 12h 37m

Observed by W. E. Harper. Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	54·7124	....	....	....	2	53·0940	....	....	....
2	54·0066	....	....	....	2	45·2995	....	....	....
2	53·9901	·9870	·0438	+49·50	2	45·3078	·3019	·0430	+45·15
1	53·4211	·4167	·0385	44·24					

Weighted mean		+46·71
V_a	−23·48	
V_d		+ ·05
Curvature	− ·28	
Radial velocity		+23·0

β ORIONIS 2272.

1909. Feb. 11.
G. M. T. 11h 26m

Observed by }
Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7167	…	…	…	2	53·0917	…	…	…
2	54·0032	…	…	…	2	45·2881	…	…	…
2	53·9806	·9785	·0353	+40·82	2	45·2997	·3052	·0463	+48·62
1½	53·4114	·4092	·0310	35·62					

Weighted mean .... + 42·78
V_a .... 23·65
V_d .... + ·10
Curvature.... ... − ·28

Radial velocity .... + 18·9

β ORIONIS 2273.

1909. Feb. 11.
G. M. T. 11h 32m

Observed by }
Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7138	…	…	…	2	53·0875	…	…	…
2	54·0025	…	…	…	2	45·2844	…	…	…
2	53·9970	·9960	·0528	+61·06	2	45·3006	·3098	·0509	+53·45
1	53·4268	·4280	·0498	57·23					

Weighted mean .... + 57·25
V_a .... − 23·65
V_d .... + ·10
Curvature....... − ·28

Radial velocity.................. + 33·4

β ORIONIS 2274.

1909. Feb. 11.
G. M. T. 11h 35m

Observed by }
Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	54·7114	…	…	…	2	53·0881	…	…	…
2	54·0044	…	…	…	2	45·2877	…	…	…
2	53·9812	·9810	·0378	+43·72	2	45·3071	·3130	·0540	+56·81
1½	53·4353	·4360	·0578	66·42					

Weighted mean...................... + 43·72
V_a .... − 23·65
V_d .... + ·10
Curvature. .. ... − ·28

Radial velocity.................. +30·8

β ORIONIS 2275.

1909. Feb. 11.
G. M. T. 11ʰ 38ᵐ

Observed by }
Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	54·7133	....	....	....	2	53·0921	....	....	....
2	54·0063	....	....	....	2	45·2911	....	....	....
3	53·9782	·9760	·0328	+36·78	2	45·2979	·3024	·0435	+45·68
2	53·4256	·4230	·0448	51·48					

Weighted mean..................		+43·52
V_a	−23·65	
V_d		+·10
Curvature..................	−·28	
Radial velocity..................		+19·7

β ORIONIS 2276.

1909. Feb. 11.
G. M. T. 11ʰ 46ᵐ

Observed by }
Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	54·7082	....	....	....	2	53·0893	....	....	....
2	53·9963	....	....	....	2	45·2824	....	....	....
2	53·9792	·9840	·0408	+47·19	2	45·2835	·2947	·0358	+37·59
1	53·4083	·4095	·0313	35·97					

Weighted mean..................		+41·11
V_a	−23·65	
V_d		+·10
Curvature..................	−·28	
Radial velocity..................		+17·3

β ORIONIS 2277.

1909. Feb. 11.
G. M. T. 11ʰ 49ᵐ

Observed by }
Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	54·7099	....	....	....	2	53·0878	....	....	....
2	54·0019	....	....	....	2	45·2944	....	....	....
2	53·9798	·9810	·0378	+43·72	1½	45·3021	·3013	·0424	+44·52
1	53·4279	·4294	0512	58·83					

Weighted mean..................		+47·34
V_a	−23·65	
V_d		+·10
Curvature..................	−·28	
Radial velocity..................		+23·5

β ORIONIS 2278.

1909. Feb. 13.
G. M. T. $12^h\ 27^m$

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3466	....	....	....	2	58·8021	....	....	....
2	61·3632	....	....	....	2	36·1817	....	....	....
3	61·3156	·2975	·1175	+48·37	1	36·1930	·2055	·1150	+40·31
2	59·7290	·7110	·1145	46·84					

Weighted mean........................		+46·52
V_a........................	−24·00	
V_d........................	·00	
Curvature........................	− ·28	
Radial velocity........................		+22·2

β ORIONIS 2279.

1909. Feb. 13.
G. M. T. $12^h\ 40^m$

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3312	....	....	....	2	58·7858	....	....	....
2	61·3531	....	....	....	2	36·1657	....	....	....
3	61·3032	·2970	·1165	+48·16	1½	36·1698	·1983	·1078	+37·78
2	59·7212	·7180	·1215	49·71					

Weighted mean........................		+46·24
V_a........................	−24·00	
V_d........................	·00	
Curvature........................	− ·28	
Radial velocity........................		+22·0

β ORIONIS 2280.

1909. Feb. 13.
G. M. T. $12^h\ 53^m$

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3520	....	....	....	2	58·8035	....	....	....
2	61·3710	....	....	....	2	36·1748	....	....	....
3	61·3192	·2940	·1135	+46·92	1	36·1848	·2042	·1137	+39·85
2	59·7314	·7105	·1140	46·64					

Weighted mean........................		+45·65
V_a........................	−24·00	
V_d........................	·00	
Curvature........................	− ·28	
Radial velocity........................		+21·4

β ORIONIS 2284.

1909. Feb. 20.
G. M. T. 12ʰ 29ᵐ

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3507	....	....	....	2	58·8010	....	....	....
2	61·3686	....	....	....	2	36·1520	....	....	....
3	61·2988	·3100	·0977	+40·27	2	36·1728	·1730	·1249	+43·78
1	59·7346	·7440	·1202	49·33					

Weighted mean .... +42·95
V_a .... −24·82
V_d .... − ·08
Curvature .... − ·28

Radial velocity .... +17·7

β ORIONIS 2285.

1909. Feb. 20.
G. M. T. 13ʰ 05ᵐ

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3177	....	....	....	2	58·7696	....	....	....
2	61·3352	....	....	....	2	36·1246	....	....	....
2	61·2860	·3278	·1155	+47·61	1½	36·1377	·1653	·1172	+41·08
1	59·7262	·7665	·1427	58·21					

Weighted mean .... +47·79
V_a .... −24·82
V_d .... − ·08
Curvature .... − ·28

Radial velocity .... +22·6

β ORIONIS 2286.

1909. Feb. 20.
G. M. T. 15ʰ 12ᵐ

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3440	....	....	....	2	58·7989	....	....	....
2	61·3648	....	....	....	2	36·1571	....	....	....
2	61·3160	·3320	·1197	+49·34	1½	36·1733	·1684	·1203	+42·16
1	59·7233	·7245	·1007	41·08					

Weighted mean .... +45·14
V_a .... −24·82
V_d .... − ·08
Curvature .... − ·28

Radial velocity .... +19·8

β ORIONIS 2288.

1909. Feb. 21.
G. M. T. 12ʰ 57ᵐ

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	63·3644	....	....	....	2	58·8118	....	....	....
2	61·3779	....	....	....	2	36·1550	....	....	....
2	61·3268	·3250	·1127	+46·45	1	36·1798	·1770	·1770	+45·18
½	59·7422	·7400	·1162	47·40					

Weighted mean....................		+46·45
V_a	−25·04	
V_d	·09	
Curvature........	−·28	
Radial velocity..................		+21·0

β ORIONIS 2289.

1909. Feb. 21.
G. M. T. 13ʰ 07ᵐ

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	63·3543	....	....	....	2	58·8071	....	....	....
2	61·3695	....	....	....	2	36·1572	....	....	....
2	61·3040	·3105	·0982	+40·48	2	36·1726	·1676	·1195	+41·88
1	59·7518	·7545	·1307	53·39					

Weighted mean....................		+45·62
V_a	−25·04	
V_d	−·09	
Curvature........	−·28	
Radial velocity..................		+18·2

β ORIONIS 2290.

1909. Feb. 21
G. M. T. 13ʰ 17ᵐ

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispᵗ in revⁿˢ	Velocity.
2	63·3632	....	....	....	2	58·8130	....	....	....
2	61·3830	....	....	....	2	36·1631	....	....	....
2	61·3238	·3200	·1077	+44·39	2	36·1767	·1658	·1177	+41·25
1	59·7450	·7415	·1177	48·01					

Weighted mean....................		+43·86
V_a	−25·04	
V_d	−·09	
Curvature........	−·28	
Radial velocity..................		+18·4

β ORIONIS 2291.

1909, Feb. 21.
G. M. T. 13h 27m

Observed by | J. S. Plaskett.
Measured by |

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3650	....	....	....	2	58·8109	....	....	....
2	61·3777	....	....	....	2	36·1475	....	....	....
3	61·3190	·3170	·1047	43·16	2	36·1659	·1706	·1225	+42·94
1½	59·7433	·7416	·1168	47·64					

Weighted mean		+44·13
V_a	25·04	
V_d	·09	
Curvature	− ·28	
Radial velocity		+18·7

β ORIONIS 2292.

1909, Feb. 22.
G. M. T. 12h 02m

Observed by T. H. Parker.
Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3642	....	....	....	2	58·8102	....	....	....
2	61·3755	....	....	....	2	36·1595	....	....	....
2	61·3167	·3157	·1034	+42·62	1	36·1831	·1758	·1277	+44·76
1	59·7493	·7483	·1245	50·78					

Weighted mean		+45·19
V_a	−25·14	
V_d	− ·02	
Curvature	·28	
Radial velocity		+19·7

β ORIONIS 2293.

1909, Feb.22
G. M. T. 12h 15m

Observed by T. H. Parker.
Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3503	....	....	....	2	58·8000	....	....	....
2	61·3637	....	....	....	2	36·1558	....	....	....
2	61·3018	·3125	·1002	+41·30	½	36·1807	·1771	·1290	+45·21
1	59·7474	·7570	·1332	54·33					

Weighted mean		+45·58
V_a	−25·14	
V_d	− ·02	
Curvature	− ·28	
Radial velocity		+25·1

β ORIONIS 2294.

1909. Feb. 22. G. M. T. 12h 30m

Observed by T. H. Parker. Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·3495	....	....	....	2	58·8022	....	....	....
2	63·3678	....	....	....	2	36·1610	....	....	....
2	61·3121	·3210	·1087	+44·81	2	36·1809	·1720	·1239	+43·43
1½	59·7381	·7458	·1220	49·76					

Weighted mean		+45·66
V_a	−25·14	
V_d	− ·02	
Curvature	− ·28	
Radial velocity		+20·2

β ORIONIS 2295.

1909. Feb. 22. G. M. T. 12h 42m

Observed by T. H. Parker. Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·3622	....	....	....	2	58·8095	....	....	....
2	61·3780	....	....	....	2	36·1677	....	....	....
2	61·3248	·3280	·1157	+47·69	1½	36·1881	·1726	·1245	+43·64
2	59·7345	·7344	·1106	45·11					

Weighted mean		+45·65
V_a	−25·14	
V_d	− ·02	
Curvature	− ·28	
Radial velocity		+20·2

β ORIONIS 2309.

1909. Feb. 27. G. M. T. 11h 35m

Observed by } Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·3682	....	....	....	2	58·8129	....	....	....
2	61·3790	....	....	....	2	36·1491	....	....	....
2	61·3288	·3240	·1117	+46·04	2	36·1814	1845	·1364	+47·81
1½	59·7498	·7460	·1222	49·85					

Weighted mean		+47·71
V_a	−25·48	
V_d	·00	
Curvature	− ·28	
Radial velocity		+22·0

β ORIONIS 2311.

1909. Feb. 28.
G. M. T. 11h 56m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3272	...	...	...	2	58·7792	...	...	...
2	63·3402	...	...	...	2	36·1567	...	...	...
2	61·2899	·2940	·1135	+46·92	1½	36·1805	·2180	·1275	+44·83
1½	59·7215	7250	·1285	52·63					

Weighted mean ... +48·01
V_a ... −25·53
V_d ... − ·02
Curvature ... − ·28

Radial velocity ... +22·2

β ORIONIS 2312.

1909. Feb. 28.
G. M. T. 12h 07m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3345	...	...	...	2	58·7913	...	...	...
2	61·3567	...	...	...	2	36·1739	...	...	...
3	61·2980	·2890	·1085	+44·85	2	36·2048	·2251	·1346	+47·33
2	59·7342	·7260	·1295	53·04					

Weighted mean ... +47·90
V_a ... −25·53
V_d ... − ·02
Curvature ... − ·28

Radial velocity ... +22·0

β ORIONIS 2313.

1909. Feb. 28.
G. M. T. 12h 18m

Observed by } J. S. Plaskett.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3394	...	...	...	2	58·7911	...	...	...
2	61·3602	...	...	...	2	36·1740	...	...	...
2	61·3112	·3000	·1195	+49·40	1	36·1806	·2026	·1121	+39·41
1	59·7515	·7435	·1470	60·21					

Weighted mean ... +49·61
V_a ... −25·53
V_d ... − ·02
Curvature ... − ·28

Radial velocity ... +23·7

β ORIONIS 2314.

1909. Feb. 28.
G. M. T. 12h 27m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3298	....	....	....	2	58·7866	....	....	....
2	61·3467	....	....	....	2	36·1742	....	....	....
2	61·3037	·3005	·1200	+49·61	1½	36·1998	·2198	·1293	−45·46
1½	59·7434	·7408	·1443	59 11					

Weighted mean..................		+51·22
V_a	−25·53	
V_d	− ·02	
Curvature	− ·28	
Radial velocity..................		+25·3

β ORIONIS 2315.

1909. Feb. 28.
G. M. T. 12h 39m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3247	....	....	....	2	58 7759	....	....	....
2	61·3422	....	....	....	2	36·1541	....	....	....
3	61·2979	·3005	·1200	+49 61	2	36·1757	·2158	·1253	+44 06
1½	59 7148	·7215	·1250	51·14					

Weighted mean		+48·26
V_a	−25 53	
V_d	− ·02	
Curvature	− ·28	
Radial velocity..................		+22·4

β ORIONIS 2316.

1909. Feb. 28.
G. M. T. 12h 50m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3355	....	....	....	2	58·7887	....	....	....
2	61·3528	....	....	....	2	36·1782	....	....	....
2	61·2998	·2920	·1115	+46·09	1½	36 1944	·2105	·1200	+42·19
1½	59·7455	·7400	·1435	58·71					

Weighted mean..................		+48·71
V_a	−25 53	
V_d	− ·02	
Curvature	− ·28	
Radial velocity..................		+22·8

β ORIONIS 2317.

1909, Mar. 2.
G. M. T. 11h 20m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3647				2	58·8147			
2	61·3807				2	36·1744			
2	61·3360	·3320	·1197	+49·34	1½	36·1960	·1738	·1257	+44·06
2	59·7707	·7655	·1417	57·80					

Weighted mean	+50·97
V_a	−25·61
V_d	− ·02
Curvature	− ·28
Radial velocity	+25·9

β ORIONIS 2318.

1909, Mar. 2.
G. M. T. 11h 19m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3626				2	59·8075			
2	61·3804				2	36·1516			
2	61·3217	·3210	·1087	+44·81	1½	36·1860	·1866	·1385	+48·54
2	59·7622	·7640	·1402	57·19					

Weighted mean	+50·33
V_a	−25·61
V_d	− ·02
Curvature	− ·28
Radial velocity	+24·4

β ORIONIS 2319.

1909, Mar. 2.
G. M. T. 11h 29m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3438				2	58·7920			
2	61·3600				2	36·1442			
2	61·3090	·3260	·1137	+46·87	2	36·1763	·1843	·1363	+47·77
1½	59·7476	·7650	·1412	57·59					

Weighted mean	+50·12
V_a	−25·61
V_d	− ·02
Curvature	− ·28
Radial velocity	+24·2

β ORIONIS 2320.

1909. Mar. 2.
G. M. T. 11h 36m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3522	....	....	....	2	58·7996	....	....	....
2	61·3707	... .	....	....	2	36·1541	....	. . ...	....
2	61·3197	·3290	·1167	+48·10	2	36·1921	1902	·1421	+49·81
1½	59·7315	7312	·1074	43·81					

Weighted mean .... +47·55
V_a .... −25·61
V_d .... − ·02
Curvature.... − ·28

Radial velocity .... +21·6

β ORIONIS 2364.

1909. Mar. 13
G. M. T. 12h 12m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3696	....	....	.. ..	2	58·8145	....	....	....
2	61·3870	. . ...	....	... .	2	36·1448	....	... .	....
2	61·3327	·3250	·1127	+46·5	1½	36·1611	·1685	·1204	+42·2
1½	59·7380	·7320	·1082	44·1					

Weighted mean .... +44·50
V_a .... −25·45
V_d .... − ·16
Curvature.... − ·28

Radial velocity............... +18·6

β ORIONIS 2365.

1909. Mar. 13
G. M. T. 12h 24m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3760	....	....	....	2	58·8161	....	....	....
2	61·3876	....	....	....	2	36·1348	.. ..	....	....
3	61·3228	·3120	·0997	+41·1	1½	36·1591	·1765	·1284	+45·0
2	59·7507	·7425	·1187	48·4					

Weighted mean..................... +44·25
V_a .... −25·45
V_d .... − ·16
Curvature.... − ·28

Radial velocity..... .... +18·4

β ORIONIS 2366.

1909. Mar. 13
G. M. T. $12^h\ 36^m$

Observed by }
Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3662	....	....	......	2	58·8112	....	......	....
2	61·3821	....	....	......	2	36·1400	....	....	....
2	61·3198	·3160	·1037	+42·7	1½	36·1692	·1814	·1333	+46·7
1½	59·7506	·7475	·1237	50·4					

Weighted mean.................. +46·21
V_a .... −25·45
V_d .... − ·16
Curvature.... − ·28

Radial velocity.... .... +20·3

β ORIONIS 2367.

1909. Mar. 13.
G. M. T. $12^h\ 46^m$

Observed by }
Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3600	....	....	....	2	58·7981	....	....	....
2	61·3738	....	....	....	2	36·1272	....	....	......
2½	61·3086	·3125	·1002	+41·30	1½	36·1460	·1710	·1229	+43·10
1½	59·7297	·7400	·1162	47·40					

Weighted mean .... +43·45
V_a .... −25·45
V_d .... − ·16
Curvature...... − ·28

Radial velocity .... +17·6

β ORIONIS 2368.

1909. Mar. 13.
G. M. T. $12^h\ 57^m$

Observed by }
Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3640	....	....	....	2	58·8093	....	....	......
2	61·3800	....	......	......	2	36·1354	....	......	......
2	61·3300	·3280	·1157	+47·7	1½	36·1578	·1746	·1265	+44·3
2	59·7306	·7300	·1062	43·3					

Weighted mean...................... +45·17
V_a .... −25·45
V_d .. .. − ·16
Curvature...... − ·28

Radial velocity............. .... +19·3

β ORIONIS 2372.

1909. Mar. 15.
G. M. T. 11h 45m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3472	....	....	....	2	58·8015	....	....	....
2	61·3664	....	....	....	2	36·1624	....	....	....
2	61·3098	·2890	·1085	+44·85	1½	36·1712	·2030	·1125	+39·55
1	59·7205	·7015	·1050	42·96					

Weighted mean		+42·66
V_a	−25·34	
V_d	− ·14	
Curvature	− ·28	
Radial velocity		+16·9

β ORIONIS 2373.

1909. Mar. 15.
G. M. T. 11h 56m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3475	....	....	....	2	58·7985	....	....	....
2	61·3660	....	....	....	2	36·1478	....	....	....
2½	61·3094	·2890	·1085	+44·85	1½	36·1697	·2161	·1256	+44·16
1	59·7421	·7260	·1295	52·98					

Weighted mean		+46·27
V_a	−25·34	
V_d	− ·14	
Curvature	− ·28	
Radial velocity		+20·5

β ORIONIS 2374.

1909. Mar. 15.
G. M. T. 12h 05m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3415	....	....	....	2	58·7942	....	....	....
2	61·3612	....	....	....	2	36·1598	....	....	....
2	61·2924	·2764	·0959	+39·65	1½	36·1784	·2128	·1223	+43·00
1	59·7336	·7220	·1255	51·34					

Weighted mean		+43·36
V_a	−25·34	
V_d	− ·14	
Curvature	− ·28	
Radial velocity		+17·6

β ORIONIS 2375.

1909. Mar. 15.
G. M. T. 12h 13m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·3430	....	....	....	2	58·7960	....	....	....
2	61·3618	....	....	....	2	36·1654	....	....	....
2	61·3146	·2976	·1171	+48·41	1½	36·1837	·2125	·1223	+43·00
1½	59·7102	·6972	·1007	41·20					

Weighted mean		+44·62
V_a	−25·34	
V_d	− ·14	
Curvature	− ·28	
Radial velocity		+18·9

β ORIONIS 2376.

1909. Mar. 15.
G. M. T. 12h 21m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·3492	....	....	....	2	58·8022	....	....	....
2	61·3678	....	....	....	2	36·1743	....	....	....
2	61·3032	·2800	·0995	+41·13	1	36·1771	·1970	·1065	+37·45
1½	59·7281	·7088	·1123	45·94					

Weighted mean		+41·92
V_a	−25·34	
V_d	− ·14	
Curvature	− ·28	
Radial velocity		+16·2

β ORIONIS 2386.

1909. Mar. 18.
G. M. T. 11h 42m

Observed by / Measured by } J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·3427	....	....	....	2	58·7936	....	....	....
2	61·3610	....	....	....	2	36·1518	....	....	....
3	61·3020	·3185	·1062	+43·78	1	36·1820	·1824	·1343	+47·07
2	59·7188	·7346	·1108	45·20					

Weighted mean		+44·98
V_a	−25·09	
V_d	− ·15	
Curvature	− ·28	
Radial velocity		+19·5

β ORIONIS 2387.

1909. Mar. 18.
G. M. T. 11^h 52^m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·3645	....	....	....	2	58·8071	....	....	....
2	61·3782	....	....	....	2	36·1581	....	....	....
2	61·3205	·3200	·1077	+44·39	1	36·1684	·1625	·1144	+40·10
1½	59·7465	·7480	·1242	50·66					

Weighted mean.. .... +45·53
V_a .... −25·09
V_d......... − ·15
Curvature.... − ·28

Radial velocity...... .. .. +20·0

β ORIONIS 2388.

1909. Mar. 18.
G. M. T. 12^h 02^m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·3541	....	....	....	2	58·8001	....	....	....
2	61·3718	....	....	....	2	36·1635	....	....	....
2	61·3210	·3280	·1157	+47·69	1½	36·1828	·1715	·1235	+43·29
1½	59·7396	·7480	·1242	50·66					

Weighted mean .... +47·26
V_a. ... . −25·09
V_d.......... − ·15
Curvature.... − ·28

Radial velocity............... +21·7

β ORIONIS 2389.

1909. Mar. 18.
G. M. T. 12^h 12^m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^ns	Velocity.
2	63·3492	....	....	....	2	58·7998	....	....	....
2	61·3646	....	....	....	2	36·1597	....	....	....
1½	61·2927	·3050	·0927	+38·21	1½	36·1954	·1879	·1398	+49·00
2	59·7380	·7485	·1247	50·86					

Weighted mean.... .... +46·51
V_a.......... −25·09
V_d... ...... − ·15
Curvature.... − ·28

Radial velocity........... ... +21·0

β ORIONIS 2390.

1909. Mar. 20.
G. M. T. 12h 16m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3657	....	....	....	2	58·8128	....	....	....
2	61·3836	....	....	....	2	36·1496	....	....	....
2½	61·3307	·3260	·1137	+46·86	1½	36·1655	·1681	·1200	+42·06
1½	59·7601	·7561	·1323	53·96					

Weighted mean .... +47·49
V_a .... −24·88
V_d .... − ·12
Curvature .... − ·28

Radial velocity .... +22·2

β ORIONIS 2391.

1909. Mar. 20.
G. M. T. 12h 26m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3724	....	....	....	2	58·8192	....	....	....
2	61·3859	....	....	....	2	36·1414	....	....	....
2	61·3292	·3192	·1069	+44·06	1½	36·1637	·1745	·1264	+44·30
1½	59·7392	·7292	·1054	42·99					

Weighted mean .... +43·81
V_a .... −24·88
V_d .... − ·12
Curvature .... − ·28

Radial velocity .... +18·3

β ORIONIS 2392.

1909. Mar. 20.
G. M. T. 12h 38m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3775	....	....	....	2	58·8197	....	....	....
2	61·3892	....	....	....	2	36·1569	....	....	....
3	61·3352	·3320	·1197	+49·34	2	36·1862	·1815	·1334	+46·76
1½	59·7575	·7460	·1222	49·85					

Weighted mean .... +48·66
V_a .... −24·88
V_d .... − ·12
Curvature .... − ·28

Radial velocity .... +23·4

β ORIONIS 2393.

1909. Mar. 20.
G. M. T. 12h 48m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3659	....	....	....	2	58·8108	....	....	....
2	61·3800	....	....	....	2	36·1480	....	....	....
2	61·3215	·3184	·1061	+43·73	1½	36·1857	·1900	·1419	+49.74
1½	59·7468	·7448	·1210	49·36					

Weighted mean....		+47·22
V_a....	−24·88	
V_d....	·12	
Curvature....	− ·28	
Radial velocity		+21·9

β ORIONIS 2394.

1909. Mar. 20.
G. M. T. 12h 58m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3661	....	....	....	2	58·8130	....	....	....
2	61·3815	....	....	....	2	36·1565	....	....	....
2½	61 3319	·3275	·1152	+47·49	1½	36·1806	·1763	·1282	+44·93
1½	59·7587	·7547	·1309	53·39					

Weighted mean....		+48·40
V_a....	−24·88	
V_d....	− ·12	
Curvature....	− ·28	
Radial velocity....		+23·1

β ORIONIS 2397.

1909. Mar. 21.
G. M. T. 13h 38m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3695	....	....	....	2	58·8189	....	....	....
2	61·3856	....	....	....	2	36·1752	....	....	....
2	61·3328	·3240	·1117	+46·07	1½	36·2220	·1999	·1509	+52·89
2	59·7550	·7460	·1222	49·85					

Weighted mean....		+49·30
V_a....	−24·76	
V_d....	− ·32	
Curvature....	− ·28	
Radial velocity....		+23·9

β ORIONIS 2398.

1909. Mar. 21.
G. M. T. 13h 48m

Observed by }
Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3667	....	....	....	2	58·8120	....	....	....
2	61·3818	....	....	....	2	36·1571	....	....	....
2	61·3396	·3350	·1227	+50·60	2	36·2053	·2004	·1523	+53·38
2	59·7441	·7410	·1172	47·81					

Weighted mean .... +50·60
V_a .... −24·76
V_d .... − ·32
Curvature .... − ·28

Radial velocity .... +25·2

β ORIONIS 2399.

1909. Mar. 21.
G. M. T 14h

Observed by }
Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3483	....	....	....	2	58·7972	....	....	....
2	61·3664	....	....	....	2	36·1511	....	....	....
2	61·3124	·3245	·1122	+46·27	1	36·1884	·1894	·1414	+49·56
2	59·7452	·7572	·1334	54·41					

Weighted mean .... +50·18
V_a .... −24·76
V_d .... − ·32
Curvature .... − ·28

Radial velocity .... +24·8

β ORIONIS 2400.

1909. Mar. 21.
G. M. T. 14h 14m

Observed by }
Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3505	....	....	....	2	58·8071	....	....	....
2	61·3712	....	....	....	2	36·1516	....	....	....
2	61·3198	·3300	·1177	+48·54	½	36·1855	·1861	·1380	+48.37
1½	59·7490	·7580	·1342	54·74					

Weighted mean .... +50·84
V_a .... 24·76
V_d .... − ·32
Curvature .... − ·28

Radial velocity .... +25·5

β ORIONIS 2402.

1909. Mar. 22.
G. M. T. 11h 51m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3584	...	...	...	2	58·8043	...	...	...
2	61·3737	...	...	...	2	36·1447	...	...	...
2	61·3370	·3410	·1287	+53·05	1½	36·1712	·1787	·1307	+45·81
1½	59·7510	·7560	·1322	53·92					

Weighted mean .... +51·14
V_a .... −24·66
V_d .... − ·16
Curvature .... − ·28

Radial velocity .... +26·0

β ORIONIS 2403.

1909. Mar. 22.
G. M. T. 12h 02m

Observed by / Measured by } J. S. Plaskett.

Wt	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3517	...	...	...	2	58·8009	...	...	...
2	61·3688	...	...	...	2	36·1536	...	...	...
2	61·3260	·3355	1232	+50·78	1½	36·1846	·1832	·1832	+47·35
1½	59 7423	·7573	·1275	52 01					

Weighted mean .... +50·12
V_a .... −24 66
V_d .... − ·16
Curvature .... − ·28

Radial velocity .... +25·0

β ORIONIS 2404.

1909. Mar. 22.
G. M. T. 12h 13m

Observed by / Measured by } J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3608	...	...	...	2	58·8094	...	...	...
2	61·3126	...	...	...	2	36·1640	...	...	...
2	61·3242	·3260	·1137	+46·87	1½	36·1917	·1800	·1319	+46·23
1½	59·7329	·7335	·1107	45·15					

Weighted mean .... +46·16
V_a .... −24·66
V_d .... − ·16
Curvature .... − ·28

Radial velocity .... +21·1

β ORIONIS 2405.

1909. Mar. 22.
G. M. T. 12^h 35^m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3570	......	....	....	2	58·8019	......	......	....
2	61·3713	....	....	....	2	36·1480	......	....	....
2	61·3138	·3228	·1105	+45·55	1½	36·1698	·1740	·1259	+44·13
1½	59·7375	·7450	·1212	49·44					

Weighted mean.................... +46·29
V_a ..... −24·66
V_d .... − ·16
Curvature .... − ·28

Radial velocity.................. +21·2

β ORIONIS 2420.

1909. Mar. 23.
G. M. T. 11^h 46^m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3586	....	....	....	2	58·8059	....	....	....
2	61·3757	....	....	....	2	36·1332	....	....	....
1½	61·3160	·3190	·1067	+43·99	2	36·1699	·1889	·1108	+49·35
1½	59·7445	7480	·1242	50·66					

Weighted mean .... +48·14
V_a .... − 24·54
V_d.................... − ·19
Curvature............ − ·28

Radial velocity .... +23·1

β ORIONIS 2421.

1909. Mar. 23.
G. M. T. 11^h 57^m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Disp^t in rev^{ns}	Velocity.
2	63·3700	....	....	....	2	58·8151	....	....	....
2	61·3800	....	....	....	2	36·1310	....	....	....
2½	61·3418	·3358	·1235	+50·92	2	36·1608	·1820	·1339	+46·93
1½	59·7447	·7390	1152	49·99					

Weighted mean .... +49·36
V_a .... − 24·54
V_d.................... − ·19
Curvature.............. − ·28

Radial velocity.................. +24·4

β ORIONIS 2422.

1909. Mar. 23.
G. M. T. 12h 05m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3572	....	....	....	2	58·8081	......	....	....
2	61·3728	....	....	....	2	36·1372	....	....	....
2	61·3253	·3290	·1177	+48·53	2	36·1920	·2070	·1589	+55·69
1	59·7348	·7370	·1132	46·17					

Weighted mean		+50·92
V_a	−24·54	
V_d	− ·19	
Curvature	− ·28	
Radial velocity		+25·9

β ORIONIS 2423.

1909. Mar. 23.
G. M. T. 12h 13m

Observed by } J. S. PLASKETT.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.
2	63·3787	....	....	....	2	58·8225	....	....	....
2	61·3936	....	....	....	2	36·1500	....	....	....
2	61·3330	·3170	·1047	+43·17	2	36·2082	·2104	·1623	+56·89
2	59·7696	·7551	·1313	53·56					

Weighted mean		+51·21
V_a	− 24·54	
V_d	− ·19	
Curvature	− ·28	
Radial velocity		+26·2

β ORIONIS 2424.

1909. Mar. 23.
G. M. T. 12h 27m

Observed by J. B. CANNON.
Measured by J. S. PLASKETT.

Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Dispt in revns	Velocity
2	63·3774	....	....	....	2	58·8212	....	....	....
2	61·3930	....	....	....	2	36·1341	....	....	....
1½	61·3425	·3275	·1152	+47·51	2	36·1822	·1997	·1516	+53·14
1½	59·7590	·7465	·1227	50·35					

Weighted mean		+50·52
V_a	−24·54	
V_d	− ·19	
Curvature	− ·28	
Radial velocity		+25·5

β ORIONIS 2425.

1909. Mar. 23.
G. M. T. 12h 38m

Observed by J. B. Cannon.
Measured by J. S. Plaskett.

Wt.	Mean of Settings.	Corrected Star Settings.	Displ in revns	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displ in revns	Velocity.
2	63·3650	... .	....	....	2	58·8098	....	....	... .
2	61·3793	....	....	....	2	36·1269	....	....	....
2	61·3350	·3327	·1204	+49·65	1½	36·1707	·1960	·1479	+51·84
1½	59·7498	·7490	·1252	51·07					

Weighted mean.........		+50·72
V_a....	−25·54	
V_d.....	− ·19	
Curvature..	− ·28	
Radial velocity.....		+25·7

P.—Plaskett.
P¹.—Parker.
H.—Harper.
C.—Cannon.
T.—Tribble.

OBSERVING RECORD AND DETAILED MEASURES OF θ AQUILÆ.

RECORD OF SPECTROGRAMS.

Star.	No. of Negative.	Camera.	Plate.	Date.	Middle of Exposure. G.M.T.	Duration.	Hour Angle at end.	Temperature Centigrade. Room. Beginning.	Room. End.	Prism Box. Beginning.	Prism Box. End.	Slit Width.	Seeing.	Observer.	Remarks.
				1907.	h. m.	m.	h. m.								
θ Aquilæ ..	1038	IL	Seed 27..	Sept. 12..	15 15	41	1 55 W.	16·8	15·7	20·9	20·9	·0012	Good.....	T	
" ..	1050	"	" ..	" 18..	14 45	37	1 40 "	12·5	11·7	17·0	17·0	·0014	Unsteady.	T	
				1908											
" ..	1533	"	" ..	May 15..	20 54	25	28 E.	11·0	10·5	18·0	17·9	·0017	Good.....	H	
" ..	1544	"	" ..	" 18..	20 49	22	25 "	15·0	15·0	23·4	23·4	·0016	Hazy.....	H	
" ..	1576	"	" ..	June 3..	20 35	25	30 W.	12·5	13·0	18·3	18·3	·0015	Fair.....	H	
" ..	1583	"	" ..	" 5..	19 42	45	10 E.	14·5	14·1	24·5	24·4	·0016	"	P¹	
" ..	1604	"	" ..	" 12..	19 32	35	10 W.	15·5	14·7	24·8	24·6	·0017	"	P¹	
" ..	1605	"	" ..	" 12..	20 15	40	45 "	14·7	14·4	24·6	24·5	"	Good.....	P¹	
..	1626	"	" ..	" 22..	18 35	40	10 E.	17·5	17·5	23·8	23·8	·0015	Hazy.....	P¹	
" ..	1634	"	" ..	" 24..	19 46	39	1 07 W.	18·5	18·0	27·5	27·5	"	Good.....	H	
" ..	1643	"	" ..	" 26..	19 42	35	1 15 "	17·5	17·3	30·0	30·0	·0016	"	P¹	
" ..	1651	"	" ..	" 27..	18 45	30	20 "	19·1	18·7	23·4	23·3	·0014	"	P	
" ..	1659	"	" ..	July 3..	17 30	60	25 "	21·5	20·5	25·4	25·1	·0016	Hazy.....	H-P¹	
" ..	1679	"	" ..	" 8..	18 49	30	1 02 "	17·5	17·0	21·6	21·6	·0015	Good.....	H	
" ..	1691	"	" ..	" 10..	19 30	40	2 .. "	20·4	19·3	28·0	26·6	·0016	....	P¹	
" ..	1696	"	" ..	" 11..	19 10	40	1 40 "	25·4	24·1	29·7	29·7	·0015	....	P	
" ..	1701	"	" ..	" 13..	19 37	35	2 15 "	18·0	17·6	23·0	23·0	"	Good.....	P¹	
" ..	1708	"	" ..	" 14..	18 19	23	52 "	20·0	19·5	20·6	20·6	·0016	"	H	
" ..	1716	"	" ..	" 15..	19 24	22	2 02 "	14·5	14·5	22·0	22·0	·0015	"	H	
" ..	1727	"	" ..	" 25..	16 20	42	5 E.	21·4	20·6	24·7	24·6	·0015	Fair.....	P	
" ..	1730	"	" ..	" 26..	17 38	24	58 W.	22·0	21·5	23·6	23·6	"	Good.....	H	
" ..	1731	"	" ..	" 26..	18 07	33	1 32 "	21·5	21·5	"	"	"	"	H	
" ..	1732	"	" ..	" 27..	18 15	130	1 50 "	25·5	24·0	29·7	29·5	"	No good..	P	Clouds 100ᵐ
" ..	1733	"	" ..	" 27..	20 10	40	3 45 "	23·4	23·0	29·5	29·5	"	Fair.....	P¹	
" ..	1735	"	" ..	" 28..	17 49	22	1 17 "	25·0	24·0	29·8	29·7	·0016	Good.....	H	
" ..	1736	"	" ..	" 28..	18 08	17	1 34 "	24·0	25·0	29·7	29·7	"	"	H	
" ..	1747	"	" ..	" 30..	17 47	25	1 25 "	26·0	26·0	31·1	31·0	·0015	"	H	

" ..	1755	"	" ..	" 31..	17 52	25	1 36 "	19·0	18·7	25·5	25·6	"	"	P1-H	
" ..	1756	"	" ..	" 31..	18 19	21	2 .. "	18·7	18·5	25·6	"	"	"	H	
" ..	1762	"	" ..	Aug. 5..	14 05	50	1 30 "	22·6	22·6	27·0	27·0	"	Fair	P	
" ..	1766	"	" ..	" 5..	16 29	38	35 "	21·6	21·6	26 8	26 8	"	....	P	
" ..	1767	"	" ..	" 5.	17 18	48	1 25 "	21·3	20·8	26·8	26·7	"	. ...	P	
" ..	1769	"	" ..	" 5..	18 48	30	2 47 "	20·5	20·	26·5	26·5	"	....	C	Windy.
" ..	1776	"	" ..	" 7..	17 00	40	1 15 "	19·0	19 3	23·6	23·6	"	Fair	P1	
" ..	1777	"	" ..	" 7..	17 45	40	2 02 "	19·2	18·8	23·5	23·4	"	"	P1-C	
" ..	1789	"	" ..	" 17..	18 18	34	3 11 "	21·5	20·5	26 2	26·1	"	Unsteady.	H	
" ..	1794	HIL	" ..	" 19..	16 45	90	2 12 "	14·5	14·0	23·3	23·2	·0017	Good...	H	Cloudy 26m
" ..	1799	IL	" ..	" 20..	15 15	39	20 "	18·0	17·0	22·6	22·4	·0015	Fair......	H	
" ..	1800	"	" ..	" 20..	15 47	25	47 "	17·0	17·0	22·4	22·3	"	Good. ..	H	
" .	1801	"	" ..	" 20..	16 42	29	1 43 "	17·0	16·5	22·3	22·2	"	Fair	H	
" ..	1807	"	" ..	" 21..	13 57	35	1 .. E.	20·2	19·8	25 4	25·2	"	"	C	Off 5m
" ..	1808	"	" ..	" 21..	14 32	30	26 "	19·8	18·8	25·2	25·0	"	Good.....	C	
" ..	1810	"	" ..	" 21..	15 28	30	30 W.	18·4	18·4	25·4	25·4	"	"	C	
" ..	1811	"	" ..	" 22..	15 29	26	37 "	16·0	15·5	18·0	17·8	"	"	H	
" ..	1812	"	" ..	" 22..	15 56	25	1 03 "	15·5	16·0	17·8	"	"	"	H	
" ..	1813	"	" ..	" 22..	16 21	26	1 29 "	16·0	"	"	"	"	"	H	
" ..	1814	"	" ..	" 23..	15 48	27	1 02 "	18 0	17·5	20·5	20·5	"	Fair	H	
" ..	1815	"	" ..	" 23..	16 18	30	1 30 "	17·5	17·0	"	20·3	"	"	H	
" ..	1822	"	" .	" 24..	16 56	32	2 15 "	14·7	14·4	23·0	22·8	"	Good.....	H	
" ..	1835	"	" ..	" 27..	14 02	35	25 .	18 6	18·6	23·2	23·2	"	"	C	
" ..	1864	"	" ..	Sept. 3..	16 17	55	2 30 W.	14·8	14·0	20 5	20 1	"	Smoky ...	P	
" ..	1875	"	" ..	" 8..	12 42	15	55 E.	21 0	20 4	22·9	22·9	"	Fair	P	
" ..	1876	"	" .	" 8..	13 40	69	20 W.	20·4	18·6	"	22·7	"	Hazy	P	
" ..	1878	"	" .	" 11..	15 00	60	1 47 "	22·6	20·5	28·2	28·0	"	"	C	

θ AQUILÆ 1038.

1907. Sept. 12. Observed by J. N. Tribble.
G. M. T. 15h 15m Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7334				½	27·3601	·4161	·0035	3·04
1	53·9733	·9818	·0120	+13·81	2	27·1906			
2	53·1041				1½	11·7684	·8670	·0156	+11·68
2	45·2469				2	11·4086			
1½	45·2273	·2540	·0153	15·97					

Weighted mean	+12·62
V_a	−20·23
V_d	− ·14
Curvature	− ·28
Radial velocity	− 8·0

θ AQUILÆ 1050.

1907. Sept. 18. Observed by } J. N. Tribble.
G. M. T. 14h 45m Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0318				2	45·2738			
1	72·8699	·8031	·0156	−22·66	1½	45·2139	·2237	·0250	26·17
2	72·4635				½	27·3813	·4591	·0374	−32·59
2	54·0294				2	27·2441			

Weighted mean	−26·06
V_a	−22·14
V_d	− ·14
Curvature	− ·28
Radial velocity	−48·6

θ AQUILÆ 1050.*

1907. Sept. 18. Observed by J. N. Tribble.
G. M. T. 14h 45m Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0040				2	53·1850			
½	72·8394	·8450	·0198	−28·73	2	45·2417			
1	72·4318				1½	45·1800	·2119	·0268	27·98
2	54·7082				¾	27·3593	·3996	·0130	−11·28
½	53·9314	·9651	·0044	5·06	2	27·2063			

Weighted mean	−22·43
V_a	−22·14
V_d	− ·14
Curvature	− ·28
Radial velocity	−45·0

* Check measurement.

θ AQUILÆ 1533.

1908. May 15.
G. M. T. 20h 54m

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7742	....	....	....	2	27·2579	....	....	....
½	53·9093	·8781	·0917	−105·54	1½	15·3876	·3776	·0956	−73·99
2	53·1421	....	....	....	2	15·4086	....	....	....
2	45·2974	....	....	....	½	11·7542	·7520	·0994	−74·45
1½	45·1779	·1541	·0846	−88·32	2	11·5091	....	....	....
1½	27·3612	·3498	·0628	−54·51					

Weighted mean........................		−75·50
V_a................	+26·05	
V_d................	+ ·06	
Curvature....................		− ·28
Radial velocity........................		−49·7

θ AQUILÆ 1544.

1908. May 18.
G. M. T. 20h 49m

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7267	....	....	....	2	45·2655	....	....	....
2½	53·8990	·9160	·0538	−61·92	½	45·1692	·1773	·0614	−64·10
2	53·0932	....	....	....					

Weighted mean........................		−62·30
V_a................	+25·50	
V_d................	+ ·04	
Curvature....................		− ·28
Radial velocity........................		−37·0

θ AQUILÆ 1576.

1908. June 3.
G. M. T. 20h 35m

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7369	....	....	....	¾	45·1970	·1900	·0487	−50·84
2	53·8906	·8976	·0722	−83·10	1	11·8670	·7770	·0744	−55·72
2	53·1029	....	....	....	2	11·5975	....	....	....
2	45·2806	....	....	....					

Weighted mean........................		−69·34
V_a................	+21·62	
V_d................		− ·02
Curvature....................		− ·28
Radial velocity........................		−48·0

θ AQUILÆ 1583.

1908. June 5.
G. M. T. 9h 42m

Observed by T. H. Parker.
Measured by C. R. Westland.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72 9953	......	....	....	2	45·2607	......	....	....
1	72·8212	·8347	·0301	−43·68	1½	45·1648	·1776	·0611	−63·79
2	72·4342	....	....	....	1	27·3467	·3418	·0708	−61·45
2	54·7250	....	....	....	2	27·2518	....	....	....
2	53·9156	·9287	·0411	−47·31	2	11·8084	·7915	·0599	−44·87
2	53·1028	....	....	....	2	11·5245	....	....	....

Weighted mean		−51·35
V_a	+20·91	
V_d	+ ·04	
Curvature		− ·28
Radial velocity		−30·7

θ AQUILÆ 1604.

1908. June 12.
G. M. T. 19h 32m

Observed by T. H. Parker.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73 0475	....	....	....	2	45·2995	....	....	....
½	72·8819	·8436	·0212	−30 76	1	45 2281	·2022	·0365	−38·11
2	72·4848	....	....	....	1	37 7627	·7265	·0282	−27·21
2	57·8373	·7895	·0373	−44·91	2	37·9955	....	....	....
1	57·7974	....	....	....	1	27·4133	·3852	·0274	−23·78
2	54 7562	....	....	....	2	27·2746	....	....	....
2	53·9652	·9492	·0206	−23·71	1	11·8637	·8173	·0341	−25·54
2	53 1298	....	....	....	2	11·5542	....	....	....

Weighted mean		−29·64
V_a	+18·58	
V_d		− ·04
Curvature		− ·28
Radial velocity		−11·4

θ AQUILÆ 1605.

1908. June 12.
G. M. T. 20h 15m

Observed by } T. H. Parker.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revns.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revns.	Velocity.
2	72·9907				2	53·0714			
½	72·8128	·8345	·0303	−43·96	2	45·2430			
2	72·4181				1	45·1817	·2124	·0263	−27·45
2	57·7935				2	43·5027			
1	57·7576	·7934	·0334	−40·21	1	27·3562	·3619	·0507	−44·00
1	56·6375				2	27·2410			
2	54·7059				1	11·7999	·7969	·0545	−41·56
1	53·9117	·9500	·0198	−22·78	2	11·5103			

Weighted mean .... −32·99
V_a .... +18·58
V_d .... − ·04
Curvature .... − ·28

Radial velocity .... −14·7

θ AQUILÆ 1626.

1908. June 22.
G. M. T. 18h 35m

Observed by T. H. Parker.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revns.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revns.	Velocity.
1	57·8274				½	37·7445	·7260	·0287	−27·67
½	57·7977	·7957	·0311	−37·44	½	29·7998	·7680	·0629	−55·92
2	54·7455				2	29·6306			
2	53·9400	·9377	·0321	−36·95	1	27·3906	·3481	·0645	−55·98
2	53·1130				2	27·2891			
2	45·2851				2	11·8445	·7902	·0612	−58·39
1½	45·2209	·2094	·0293	−30·60	2	11·5615			
2	37·9777								

Weighted mean .... −44·13
V_a .... +15·01
V_d .... ∓ ·04
Curvature .... ·28

Radial velocity .... −29·0

θ AQUILÆ 1626.*

1908. June 22.
G. M. T. 18h 35m

Observed by T. H. PARKER.
Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revns.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revns.	Velocity.
1	57·8369	...	...	...	½	37·7667	·7262	·0383	−36·92
½	57·8165	·8025	·0243	−29·26	½	29·8124	·7624	·0685	−60·90
2	54·7682	...	...	...	2	29·6441	...	...	...
2	53·9534	·9294	·0404	−46·50	1	27·4266	·3746	·0380	−32·98
2	53·1347	...	...	...	2	27·3062	...	...	...
2	45·3077	...	...	...	2	11·8604	·7864	·0650	−48·68
1½	45·2463	·2123	·0264	−27·56	2	11·5823	...	...	...
2	38·9962	...	...	...					

Weighted mean		−41·03
V_a	+15·01	
V_d	+ ·04	
Curvature		− ·28
Radial velocity		−26·3

*Check measurement.

θ AQUILÆ 1634.

1908. June 24.
G. M. T. 19h 46m

Observed by } W. E. HARPER.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revns.	Velocity.	Wt.	Mean of Settings	Corrected Star Settings.	Displacement in Revns.	Velocity.
2	57·9245	...	...	...	1	37·8255	·7200	·0347	−33·45
½	57·8639	·7688	·0580	−69·83	2	30·0385	...	...	...
2	54·8405	...	...	...	1	29·8974	·7819	·0490	−43·56
3	54·0327	·9347	·0351	−40·40	1½	27·4733	·3561	·0565	−49·04
2	53·2094	...	...	...	2	27·3638	...	...	...
2	45·3719	...	...	...	2½	11·9231	·8011	·0503	−37·67
2	45·2924	·1941	·0446	−46·56	2	11·6292	...	...	...
2	38·0650	...	...	...					

Weighted mean		−42·95
V_a	+14·12	
V_d		− ·06
Curvature		− ·28
Radial velocity		−29·2

θ AQUILÆ 1643.

1908. June 26.
G. M. T. 19h 42m

Observed by T. H. PARKER.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revns.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revns.	Velocity.
2	57·8751	....	....	....	2	38·0110	....	....	....
2	57·8285	·7742	·0526	−63·33	2	37·7647	·7131	·0416	−40·10
2	54·7850	....	....	....	1	27·4172	·3588	·0538	−46·70
2	53·9798	·9370	·0328	−37·75	2	27·3150	....	....	....
2	53·1545	....	....	....	3	11·8629	·8040	·0474	−35·50
2	45·3226	....	....	....	2	11·5661	....	....	....
2	45·2498	·2008	·0379	−39·57					

Weighted mean........		−42·90
V_a	+13·22	
V_d		− ·09
Curvature........		− ·28
Radial velocity........		−30·0

θ AQUILÆ 1651.

1908. June 27.
G. M. T. 18h 45m

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revns.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revns.	Velocity.
2	57·8640	....	....	....	1	30·8717	·8126	·0630	−56·57
1	57·8292	·7946	·0322	−38·77	2	29·6583	....	....	....
2	54·7825	....	....	....	1	29·6105	·5510	·0479	−42·53
2½	53·9715	·9320	·0378	−43·51	1½	27·4256	·3590	·0536	−46·52
2	53·1535	....	....	....	2	27·3135	....	....	....
2	45·3175	....	....	....	1½	15·4903	·4182	·0551	−42·65
1½	45·2365	·1926	·0461	−48·13	2	15·4707	....	....	....
2	38·0075	....	....	....	3	11·8646	·7958	·0556	−41·64
1	37·7459	·6973	·0554	−53·40	2	11·5760	....	....	....
2	30·9295	....	....	....					

Weighted mean........		−45·06
V_a	+12·83	
V_d		·00
Curvature........		− ·28
Radial velocity........		−32·5

θ AQUILÆ 1659.

1908. July 3.
G. M. T. 17h 30m

Observed by W. E. Harper.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revns.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revns.	Velocity.
2	54·6001	....	....	....	2	11·6263	11·7883	·0631	−47·26
2	53·7884	53·9309	·0389	−44·77	2	11·3448	....	....	....
2	52·9687	....	....	....					

Weighted mean		−46·01
V_a	+10·32	
V_d		·00
Curvature		− ·18
Radial velocity		−35·9

θ AQUILÆ 1679

1908. July 8.
G. M. T. 18h 49m

Observed by W. E. Harper.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revns.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revns.	Velocity.
1	73·1291	....	....	....	2	45·3990	....	....	....
1	72·9478	·8298	·0350	−50·78	1	45·3177	·1923	·0464	−48·44
1	72·5626	....	....	....	1	27·4959	·3539	·0587	−50·95
2	54·8610	....	....	....	2	27·3903	....	....	....
2	54·0581	·9390	·0308	−35·45	1½	11·9333	·7803	·0711	−53·25
2	53·2311	....	....	....	2	11·6602	....	....	....

Weighted mean		−46·30
V_a	−8·05	
V_d		·09
Curvature		− ·28
Radial velocity		−38·6

θ AQUILÆ 1691.

1908. July 10.
G. M. T. 19h 30m

Observed by } T. H. Parker.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9970	....	....	....	1½	53·9308	·9368	·0330	−37·98
½	72·8227	·8352	·0296	−42·94	2	53·1036	....	....	....
2	72·4327	....	....	....	2	45·2729	....	....	....
2	57·7960	....	....	....	½	45·1767	·1777	·0610	−63·68
1	57·7501	·7831	·0463	−55·74	⅓	27·3741	·3471	·0655	−56·85
2	56·6372	....	....	....	2	27·2739	....	....	....
2	54·7314	....	....	....					

Weighted mean		−48·88
V_a	+7·14	
V_d		·12
Curvature		− ·28
Radial velocity		−42·1

θ AQUILÆ 1691*.

1908. July 10.
G. M. T. 19h 30m

Observed by T. H. Parker.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings	Displacement in Revolutions	Velocity.
1	73·0001	....	....	....	1½	53·9446	·9446	·0252	−29·00
½	72·8210	·8277	·0371	−53·83	2	53·1121	....	....	....
1	72·4443	....	....	....	2	45·2831	....	....	....
2	57·8282	....	....	....	1½	45·1971	·1874	·0513	−53·56
1	57·7688	·7700	·0568	−68·39	½	27·4088	·3658	·0468	−39·62
2	54·7417	....	....	....	2	27·2902	....	....	....

Weighted mean........ −47·79
V_a .... +7·14
V_d .... − ·12
Curvature........ − ·28

Radial velocity........ −41·0

* Check measurement.

θ AQUILÆ 1696.

1908. July 11.
G. M. T. 19h 10m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings	Displacement in Revolutions.	Velocity.
2	57·8543	....	....	....	1½	45·2351	·1991	·0396	−41·34
1	57·8215	·7968	·0300	−36·12	2	29·6333	....	....	....
2	54·7744	....	....	....	1	29·6020	·5676	·0313	−27·54
2	53·9587	·9274	·0424	−48·80	2	11·8235	·7982	·0532	−39·85
2	53·1422	....	....	....	2	11·5325	....	....	....
2	45·3096	....	....	....					

Weighted mean........ −40·40
V_a .... +6·60
V_d .... − ·12
Curvature........ − ·28

Radial velocity........ −34·2

θ AQUILÆ 1704.

1908. July 13.
G. M. T. $19^h 37^m$

Observed by T. H. PARKER.
Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0441				2	53·1318			
½	72·8608	·8565	·0083	−12·05	2	45·3027			
1	72·4491				1	45·2546	·2156	·0231	−24·12
2	57·8483				½	27·4155	·3555	·0561	−48·60
½	57·8073	·7883	·0385	−46·35	2	27·3060			
2	54·7666				1½	11·8718	·7958	·0556	−41·64
2	53·9556	·9296	·0402	−46·27	2	11·5838			

Weighted mean		−38·78
V_a	+5·77	
V_d		− ·16
Curvature		− ·28
Radial velocity		−33·5

θ AQUILÆ 1708.

1908, July 14.
G. M. T. $18^h 19^m$

Observed by W. E. HARPER.
Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0051				2	45·2705			
1	72·8307	·8351	·0297	−43·09	2	45·2015	·2045	·0342	−35·70
1	72·4410				1½	27·3918	·3786	·0430	−37·32
2	54·7316				2	27·2622			
2	53·9435	·9505	·0193	−22·21	2	11·8489	·8199	·0315	−23·58
2	53·1072				2	11·5364			

Weighted mean		−30·83
V_a	+5·34	
V_d		·00
Curvature		− ·28
Radial velocity		−25·8

θ AQUILÆ 1716.

1908, July 15.
G. M. T. 19h 24m

Observed by W. E. Harper.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0426	....	....	....	2	45·3046	....	....	....
½	72·8798	·8475	·0173	−25·10	1	45·2469	·2159	·0228	23·80
1	72·4764	....	....	....	2	29·6384	....	....	....
	57·8582	....	....	....	1½	29·6106	·5716	·0273	24·22
	57·8243	·7943	·0313	37·68	1½	27·4356	·3871	·0255	22·15
2	54·7774	....	....	....	2	27·2951	....	....	....
2	53·9873	·9543	·0155	17·84	1½	11·8697	·8197	·0317	−23·74
2	53·1427	....	....	....	2	11·5523	....	....	....

Weighted mean..................		−23·88
V_a	+4·86	
V_d		− ·16
Curvature..................		− ·28
Radial velocity..................		−19·5

θ AQUILÆ 1727.

1908, July 25.
G. M. T. 16h 29m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0229	....	....	....	2	45·2811	....	....	....
1	72·8498	·8385	·0263	−38·16	2	45·2157	·2082	·0305	31·84
1	72·4507	....	....	....	½	27·3982	·3715	·0411	35·67
2	54·7506	....	....	....	2	27·2733	....	....	....
2	53·9420	·9323	·0375	43·16	2½	11·8282	·8011	·0503	−37·67
2	53·1227	....	....	....	2	11·5343	....	....	....

Weighted mean..................		−37·52
V_a	+ ·25	
V_d	+ ·04	
Curvature..................		− ·28
Radial velocity..................		−37·5

θ AQUILÆ 1730.

1908, July 26.
G. M. T. 17h 38m

Observed by / Measured by } W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0205	....	....	....	2	45·2945	....	....	....
½	72·8350	·8244	·0404	–58·62	1½	45·2203	·1994	·0393	41·02
½	72·4551	....	....	....	1	27·4096	·3642	·0484	42·01
2	57·8380	....	....	....	2	27·2920	....	....	....
2	54·7570	....	....	....	2	11·8572	·8032	·0482	–36·10
2	53·9564	·9427	·0271	31·19	2	11·5612	....	....	....
2	53·1243	....	....	....					

Weighted mean	38·20
V_a	– ·24
V_d	·11
Curvature	·28
Radial velocity	–38·8

θ AQUILÆ 1731.

1908. July 26.
G. M. T. 18h 07m

Observed by / Measured by } W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	57·8287	....	....	....	1½	45·1997	·1980	·0407	42·49
½	57·7975	·7982	·0286	–41·50	½	27·3970	·3792	·0334	29·00
2	54·7409	....	....	....	2	27·2644	....	....	....
2	53·9365	·9368	·0330	38·00	½	11·8173	·7869	·0645	–48·31
2	53·1122	....	....	....	2	11·5376	....	....	....
2	45·2753	....	....	....					

Weighted mean	–39·83
V_a	– ·24
V_d	– ·11
Curvature	– ·28
Radial velocity	–40·5

θ AQUILÆ 1732.

1908. July 27.
G. M. T. 18^h 15^m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	57·6860				1	45·0540	·2035	·0352	36·75
¼	57·6422	·7856	·0412	−49·60	2	29·4545			
2	54·5924				1½	29·4224	·5668	·0321	28·47
2	53·7915	·9405	·0293	33·72	¼	11·6850	·8415	·0099	−7·41
2	52·9636				2	11·3507			
2	45·1239								

Weighted mean	−32·23
V_a	− ·73
V_d	− ·12
Curvature	− ·28
Radial velocity	−33·4

θ AQUILÆ 1733.

1908. July 27.
G. M. T. 20^h 10^m

Observed by T. H. Parker.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	57·8173				1	53·9094	·9241	·0457	−52·60
2	57·7872	·7993	·0273	−32·87	2	53·1007			
2	54·7239								

Weighted mean	−39·45
V_a	− ·73
V_d	− ·24
Curvature	− ·28
Radial velocity	−40·7

θ AQUILÆ 1735.

1908. July 28.
G. M. T. 17^h 49^m

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	57·7810				2	37·9067			
1	57·7302	·7786	·0182	−57·91	½	37·6760	·7285	·0262	25·26
2	54·6993				2	29·5479			
2	53·8959	·9391	·0307	35·33	1	29·4960	·5470	·0519	46·14
2	53·0681				½	27·3178	·3688	·0438	−38·02
2	45·2233				2	27·1956			
1	45·1554	·2057	·0330	34·45					

Weighted mean	−40·13
V_a	− 1·20
V_d	− ·10
Curvature	− ·28
Radial velocity	−42·7

θ AQUILÆ 1736.

1908. July 28.
G. M. T. 18h 08m

Observed by / Measured by } W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7038	....	....	....	2	37·9039	....	....	....
1½	53·9012	·9418	·0280	−32·23	½	37·6815	·7368	·0179	−17·25
2	53·0684	....	....	....					

Weighted mean .... −28·48
V_a .... − 1·20
V_d .... − ·12
Curvature .... − ·28

Radial velocity .... −30·1

θ AQUILÆ 1747.

1908. July 30.
G. M. T. 17h 47m

Observed by / Measured by } W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0586	....	....	....	2	45·2720	....	....	....
½	72·8916	·8438	·0210	−30·47	1½	45·1954	·1970	·0417	43·53
2	72·4899	....	....	....	½	27·3662	·3783	·0343	29·77
2	54·7537	....	....	....	2	27·2345	....	....	....
2	53·9640	·9538	·0160	18·42	½	11·7805	·8237	·0287	−21·50
2	53·1210	....	....	....	2	11·4640	....	....	....

Weighted mean .... −28·60
V_a .... − 2·13
V_d .... − ·10
Curvature .... − ·28

Radial velocity .... −31·1

θ AQUILÆ 1755.

1908. July 31.
G. M. T. 17h 52m

Observed by / Measured by } W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	57·9005	....	....	....	2	29·6870	....	....	....
1	57·8680	·7968	·0300	−36·12	1	27·4678	·3771	·0355	30·81
2	45·3421	....	....	....	2	27·3373	....	....	....
1	45·2829	·2144	·0243	25·37	1	11·8987	·8159	·0355	−26·59
1½	29·6625	·5744	·0245	21·78	2	11·5900	....	....	....

Weighted mean .... −27·56
V_a .... − 2·59
V_d .... − ·11
Curvature .... − ·28

Radial velocity .... −30·5

θ AQUILÆ 1756.

1908. July 31.
G. M. T. 18h 19m

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·1090				2	45·3718			
½	72·9433	·8464	·0184	−26·70	2	45·3132	·2150	·0237	24·74
2	72·5395				1½	27·5107	·3881	·0245	21·27
2	54·8279				2	27·3692			
1½	54·0425	·9526	·0172	19·80	2	11·9418	·8239	·0275	−20·60
2	53·2057				2	11·6251			

Weighted mean	−23·42
V_a	− 2·59
V_d	− ·15
Curvature	− 28
Radial velocity	−26·4

θ AQUILÆ 1762.

1908. Aug. 5.
G. M. T. 14h 50m

Observed by J. S. Plaskett.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0445				2	37·9735			
½	72·9019	·8689	·0041	+ 5·94	½	37·8169	·8026	·0479	46·17
2	72·4763				½	30·9439	·9214	·0458	41·12
2	54·7639				2	30·8932			
1	54·0333	·0153	·0455	52·37	1	27·4672	·4477	·0351	30·46
2	54·0467				2	27·2659			
2	53·1283				1	11·9221	·9161	·0647	+48·46
2	45·2915				2	11·5123			
1½	45·2840	·2661	·0274	28·60					

Weighted mean		+39·69
V_a	− 4·91	
V_d		+ ·09
Curvature	− ·28	
Radial velocity		+34·6

θ AQUILÆ 1766.

1908. Aug. 5.
G. M. T. 16h 29m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7555	....	....	....	2	37·9696	....	....	....
1½	54·0175	·0058	·0360	+41·44	1	37·8146	·8042	·0495	47·72
2	53·1220	....	....	....	2	11·9212	·9096	·0582	−43·59
2	45·2833	....	....	....	2	11·5188	....	....	....
1½	45·2691	·2594	·0207	21·61					

Weighted mean		−38·25
V_a	− 4·91	
V_d	·02	
Curvature	− ·28	
Radial velocity		+33·0

θ AQUILÆ 1767.

1908. Aug. 5.
G. M. T. 17h 18m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7650	....	....	....	1	37·7837	·7738	·0191	16·98
1	54·0152	·9958	·0260	+29·93	½	27·4480	·4226	·0100	8·68
2	53·1277	....	....	....	2	27·2720	....	....	....
2	45·2725	·2545	·0158	16·50	½	11·9180	·8968	·0454	+34·00
2	45·2916	....	....	....	2	11·5284	....	....	....
2	37·9791	....	....	....					

Weighted mean		+21·19
V_a	− 4·91	
V_d	− ·09	
Curvature	− ·28	
Radial velocity		+15·9

θ AQUILÆ 1769.

1908. Aug. 5.
G. M. T. 18h 48m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0800	....	....	....	2	54·0263	·9743	·0045	+ 5·18
½	72·9310	·8618	·0030	− 4·35	2	53·1625	....	....	....
2	72·5112	....	....	....	2	45·3224	....	....	....
2	54·7953	....	....	....	1	45·2968	·2476	·0089	+ 9·29

Weighted mean	+ 5·00	
V_a		− 4·91
V_d		− ·19
Curvature		− ·28
Radial velocity		− 0·4

θ AQUILÆ 1776.

1908, Aug. 7.
G. M. T. 17h

Observed by T. H. Parker.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0105	.....	.....	.....	2	53·1270	.....	.....	.....
⅓	72·8287	·8311	·0337	−48·90	2	45·2947	.....	.....	.....
2	72·4393	.....	.....	.....	1	45·2207	·1991	·0393	41·03
2	54·7527	.....	.....	.....	2	11·8727	·8100	·0414	−30·64
1½	53·9542	·9413	·0285	32·80	2	11·5703	.....	.....	.....

Weighted mean	−35·19
V_a	−5·87
V_d	−·08
Curvature	−·28
Radial velocity	−41·4

θ AQUILÆ 1777.

1908. Aug. 7.
G. M. T. 17h 45m

Observed by T. H. Parker.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0173	.....	.....	.....	2	45·3157	.....	.....	.....
½	72·8345	·8281	·0367	−53·25	1	45·2536	·2117	·0270	28·19
2	72·4482	.....	.....	.....	1	27·4414	·3756	·0370	32·12
2	57·8521	.....	.....	.....	2	27·3125	.....	.....	.....
1	57·8257	·8028	·0240	28·90	1½	11·9090	·8208	·0306	22·64
2	54·7686	.....	.....	.....	2	11·5960	.....	.....	.....
1½	53·9666	·9371	·0327	37·64	1	29·8450	·7881	·0428	−38·05
2	53·1442	.....	.....	.....	2	29·6558	.....	.....	.....

Weighted mean	−32·57
V_a	−5·87
V_d	−·14
Curvature	−·28
Radial velocity	−38·9

θ AQUILÆ 1789.

1908. Aug. 17.
G. M. T. 18h 18m

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1½	57·8885	·8148	·0120	−13·81	2	45·3395	.....	.....	.....
2	57·9031	.....	.....	.....	1	45·2972	·2313	·0071	7·72
2	54·8125	.....	.....	.....	2	38·0187	.....	.....	.....
2	54·0320	·9614	·0084	9·67	1	37·8079	·7484	·0063	−6·07
2	53·1826	.....	.....	.....					

Weighted mean	−9·78
V_a	−10·39
V_d	−·21
Curvature	−·28
Radial velocity	−20·7

θ AQUILÆ 1789.*

1908. Aug. 17.
G. M. T. 18h 18m

Observed by, Measured by: W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	57·8769	....	....	....	1	45·2667	·2271	·0116	12·11
1	57·8580	·8105	·0163	−20·15	2	37·9966	....	....	....
2	54·7899	....	....	....	1	37·7900	·7526	·0021	2·02
2½	54·0078	·9618	0080	9·21	½	29·8666	·8260	·0049	− 4·36
2	53·1557	....	....	....	2	29·6395	....	....	....
2	45·3130	....	....	....					

Weighted mean	− 9·91
V_a	−10·39
V_d	− ·21
Curvature	− ·28
Radial velocity	−20·8

* Inadvertently remeasured.

θ AQUILÆ 1794*.

1908. Aug. 19.
G. M. T. 16h 45m

Observed by, Measured by: W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	111·6998	....	....	....	2	68·7143	....	....	....
½	111·3210	·1330	·0193	−11·19	2	63·3902	....	....	....
2	110·2983	....	....	....	4	61·2072	·2159	·0286	11·75
2	71·8920	....	....	....	2	60·3880	....	....	....
1	71·8568	·8664	·0392	17·29	2	36·0921	....	....	....
½	69·5153	·5373	0155	6·73	½	35·9450	·9631	·0427	−14·90

Weighted mean	−12·41
V_a	−11·21
V_d	− ·12
Curvature	− ·28
Radial velocity	−24·0

* Plate made with three-prism spectrograph.

θ AQUILÆ 1799.

1908. Aug. 20.
G. M. T. 15ʰ 15ᵐ

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9899	......	......	......	2	45·2480	·2644	·0257	+26·83
½	72·8610	8811	·0163	+23·65	2	37·9470	......	......	......
2	72·4241	......	......	......	1	37.7533	·7655	·0108	+10·41
2	57·8022	......	......	......	1	29 6165	·6164	·0175	+15·56
1	57·8095	·8387	·0119	+14·33	2	29.5990	......	......	......
2	54·7204	......	......	......	½	27·4145	·4051	0075	− 6·51
2	53·9533	·9751	·0053	+ 6·11	2	27 2560	......	......	......
2	53 0898	......	......	......	2½	11·8457	·8229	0185	−13·90
2	45·2572	......	......	......	2	11·5300	......	......	......

Weighted mean..................		+12·45
V_a	−11·63	
V_d	·00	
Curvature	− ·28	
Radial velocity..................		+ 0·4

θ AQUILÆ 1800.

1908. Aug. 20.
G. M. T. 15ʰ 47ᵐ

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0033	......	......	......	1½	45·2531	·2537	·0150	+15·66
½	72·8582	·8648	·0000	0·00	1	27·4586	·4290	·0164	+14·23
2	72 4383	......	......	......	2	27·2762	......	......	......
2	54·7375	......	......	......	2	11·9005	·8700	·0186	+13·93
1	53·9710	·9747	·0049	+ 5 64	1	59·8045	......	......	......
2	53·1090	......	......	......	1	59 6690	·6736	·0009	− 1·23
2	45·2729	......	......	......					

Weighted mean	+10 00	
V_a		−11·63
V_d		− ·05
Curvature		− ·28
Radial velocity..................		− 2·0

θ AQUILÆ 1801.

1908. Aug. 20.
G. M. T. 16h 42m

Observed by / Measured by } W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7354	....	....	....	1	29·6294	·6194	·0205	18·24
2	53·9787	·9881	·0183	+21·06	2	29·6095	....	....	....
2	53·0997	....	....	....	1	27·4557	·4361	·0235	20.39
2	45·2665	....	....	....	2	27·2662	....	....	....
1½	45·2453	·2524	·0137	14·30	½	11·8902	·8614	·0100	+ 7·49
2	29·9322	....	....	....	2	11·5362	....	....	....
1	29·8670	·8575	·0266	23·67					

Weighted mean........................		+18·52
V_a	−11·63	
V_d	− ·12	
Curvature..............	− ·28	
Radial velocity..........................		+ 6·5

θ AQUILÆ 1807.

1908. Aug. 21.
G. M. T. 13h 57m

Observed by J. B. Cannon.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0196	....	....	....	¾	45·3011	·2689	·0302	31·52
¼	72·9000	·8880	·0232	+33·66	2	29·6480	....	....	....
2	72·4635	....	....	....	1	29·9315	·8830	·0521	46·32
2	54·7685	....	....	....	?¼	27·4940	·4406	·0280	24·30
1½	54·0400	·0124	·0426	49·03	2	27·3002	....	....	....
2	53·1406	....	....	....	?¼	11·9607	·8961	·0410	+30·71
2	45·3058	....	....	....	2	11·5717	....	....	....

Weighted mean		+41·42
V_a	−12·04	
V_d	− ·11	
Curvature..............	− ·28	
Radial velocity..........................		+28·7

θ AQUILÆ 1808.

1908. Aug. 21.
G. M. T. 14ʰ 32ᵐ

Observed by J. B. Cannon.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9966	…	…	…	2	45·2823	…	…	…
½	72·8700	·8818	·0170	+24·67	1	45·2779	·2692	·0305	31·84
2	72·4343	…	…	…	2	37·9791	…	…	…
2½	57·8783	·8783	·0515	62·00	1	37·8077	·7978	·0431	41·55
2	57·8294	…	…	…	½	27·4542	·4226	·0100	8·68
2	54·7475	…	…	…	2	27·2782	…	…	…
1½	54·0150	·0110	·0412	47·42	1	11·9453	·9014	·0500	+37·45
2	53·1145	…	…	…	2	11·5512	…	…	…

Weighted mean		+38·27
V_a	−12·04	
V_d		+ ·06
Curvature	− ·28	
Radial velocity		+26·0

θ AQUILÆ 1810.

1908. Aug. 21.
G. M. T. 15ʰ 28ᵐ

Observed by J. B. Cannon.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7201	…	…	…	2	29·5981	…	…	…
3	53·9840	·0054	·0356	+40·97	2½	27·4505	·4459	·0333	28·90
2	53·0910	…	…	…	2	27·2512	…	…	…
2	45·2620	…	…	…	½	11·8967	·8831	·0317	+23·74
2	45·2523	·2659	·0272	28·40	2	11·5218	…	…	…
½	29·8745	·8753	·0414	39·47					

Weighted mean		+34·73
V_a	−12·04	
V_d	− ·02	
Curvature	− ·28	
Radial velocity		+22·4

θ AQUILÆ 1811.

1908. Aug. 22.
G. M. T. 15h 29m

Observed by / Measured by } W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9587	....	....	....	2	45·2600	....	....	....
½	72·8387	·8901	·0253	+36·71	1	45·2775	·2911	·0524	54·70
2	72·3930	....	....	....	1	27·4871	·4580	·0454	39·43
2	54·7138	....	....	....	2	27·2762	....	....	....
2	53·9876	·0134	·0436	50·18	2	11·9679	·9170	·0656	+49·13
2	53·0885	....	....	....	2	11·5587	....	....	....

Weighted mean..........................		+47·86
V_a	−12·50	
V_d	− ·03	
Curvature................	− ·28	
Radial velocity..........................		+35·0

θ AQUILÆ 1812.

1908. Aug. 22.
G. M. T. 15h 56m

Observed by / Measured by } W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9892	....	....	....	2	45·2531	....	....	....
½	72·8897	·9116	·0468	+67·91	1	45·2633	·2838	·0451	47·08
2	72·4190	....	....	....	¾	27·5378	·4728	·0602	52·25
2	54·7430	....	....	....	2	27·3121	....	....	....
1	54·0200	·0182	·0484	55·71	2	12·0073	·9163	·0649	+48·61
2	53·1145	....	....	....	2	11·5988	....	....	....

Weighted mean..........................		+52·03
V_a	−12·50	
V_d	− 08	
Curvature................	− ·28	
Radial velocity..........................		+39·1

θ AQUILÆ 1813.

1908. Aug. 22.
G. M. T. 16^h 21^m

Observed by / Measured by } W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9817	......	......	......	2	45·2804	......	......	......
½	72·8487	·8779	·0131	+19·01	1	45·2807	·2739	·0352	36·75
2	72·4145	......	......	......	½	29·7215	·6886	·0897	79·74
½	57·8665	·8839	·0571	68·75	2	29·6318	......	......	......
2	57·8120	......	......	......	½	27·4825	·4387	·0221	19·18
2	54·7342	......	......	......	2	27·2904	......	......	......
1	54·0030	·0118	·0420	48·34	2½	11·9879	·9218	·0704	+52·73
2	53·1022	......	......	......	2	11·5733	......	......	......

Weighted mean		+47·73
V_a	−12·50	
V_d	− ·11	
Curvature	− ·28	
Radial velocity		+34·8

θ AQUILÆ 1814.

1908. Aug. 23.
G. M. T. 15^h 48^m

Observed by / Measured by } W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0102	......	......	......	2	53·1312	......	......	......
½	72·8535	·8541	·0103	−14·94	2	45·3009	......	......	......
2	72·4415	......	......	......	1	45·2574	·2301	·0086	8·98
2	57·8425	......	......	......	1	27·4527	·3856	·0270	23·44
1	57·8224	·8093	·0175	21·07	2	27·3137	......	......	......
2	54·7607	......	......	......	2	11·9226	·8286	·0228	−17·08
2	53·9771	·9581	·0117	13·47	2	11·6012	......	......	......

Weighted mean	−16·27
V_a	−12·95
V_d	− ·08
Curvature	− ·28
Radial velocity	−29·6

θ AQUILÆ 1815.

1908. Aug. 23.
G. M. T. 16ʰ 18ᵐ

Observed by } W. E. HARPER.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0307	....	....	....	1½	45·2666	·2192	·0195	20·36
½	72·8645	·8438	·0210	30·47	2	38·0157	....	....	....
2	72·4655	....	....	....	½	37·7910	·7348	·0199	19·18
2	57·8525	....	....	....	½	29·6320	·5663	·0336	29·87
1½	57·8167	·7936	·0332	39·97	2	29·6646	....	....	....
2	54·7766	....	....	....	2½	27·4726	·4035	·0091	7·90
1½	54·0057	·9686	·0012	1·38	2	27·3157	....	....	....
2	53·1516	....	....	....	2	11·9125	·8329	·0185	−13·86
2	45·3210	....	....	....	2	11·5870	....	....	....

Weighted mean .... −19·30
V_a .... −12·95
V_d .... − ·10
Curvature .... − ·28

Radial velocity .... −32·6

θ AQUILÆ 1822.

1908. Aug. 24.
G. M. T. 16ʰ 51ᵐ

Observed by } W. E. HARPER.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0206	....	....	....	3	45·2872	....	....	....
1	72·8615	·8505	·0143	−20·75	1½	45·2305	·2169	·0218	22·76
2	72·4567	....	....	....	2	37·9830	....	....	....
2	57·8371	....	....	....	1	37·7598	·7360	·0187	18·03
1	57·8167	·8090	·0178	21·43	1	27·4280	·3884	·0232	20·14
2	54·7477	....	....	....	2	27·2862	....	....	....
2	53·9567	·9471	·0227	26·13	2½	11·8689	·8272	·0242	−18·12
2	53·1254	....	....	....	2	11·5489	....	....	....

Weighted mean .... −21·20
V_a .... −13·40
V_d .... − ·16
Curvature .... − ·28

Radial velocity .... −35·0

θ AQUILÆ 1835.

1908. Aug. 27.
G. M. T. $14^h\ 02^m$

Observed by } J. B. Cannon.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0129	....	....	....	2	45·2808	....	....	....
½	72·8466	·8451	·0197	−28·58	1½	45·2153	·2081	·0306	31·95
1	72·4418	....	....	....	1	27·3961	·3662	·0536	45·42
2	54·7388	....	....	....	2	27·2768	....	....	....
1	53·9403	·9413	·0285	32·80	1	11·8524	·8125	·0389	−29·14
2	53·1131	....	....	....	2	11·5472	....	....	....

Weighted mean	−33·92	
V_a	−14·56	
V_d		+ ·06
Curvature ..	− ·28	
Radial velocity	−48·8	

θ AQUILÆ 1864.

1908. Sept. 3.
G. M. T. $16^h\ 17^m$

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0322	....	....	....	1½	45·2772	·2317	·0070	7·33
1	72·8740	·8526	·0122	−17·73	2	29·9972	....	....	....
2	72·4635	....	....	....	1½	29·8930	·8174	·0135	12·08
2	57·8686	....	....	....	1	29·6557	·5860	·0129	11·49
½	57·8351	·7959	·0309	37·26	2	29·6787	....	....	....
2	54·7801	....	....	....	1	27·4700	·3816	·0310	27·03
2½	54·0005	·9616	·0082	9·46	2	27·3355	....	....	....
2	53·1516	....	....	....	1½	11·9352	·8254	·0260	−19·58
2	45·3191	....	....	....	2	11·6205	....	....	....

Weighted mean.	−14·96
V_a	−17·37
V_d	− ·16
Curvature	− ·28
Radial velocity	−32·8

θ AQUILÆ 1864.*

1908. Sept. 3.
G. M. T. 16h 17m

Observed by J. S. Plaskett.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9854	......	......	......	2	45·2737	......	......	......
½	72·8295	·8541	·0107	−15·52	1	45·2348	·2347	·0040	4·16
2	72·4198	......	......	......	½	29·8500	·8107	·0202	17·80
2	57·8199	......	......	......	2	30·9097	......	......	......
½	57·8027	·8122	·0172	20·70	1	29·6055	·5660	·0181	16·05
2	54·7376	......	......	......	1	11·8883	·8258	·0256	−19·17
1½	53·9573	·9618	·0080	9·20	2	11·5697	......	......	......
2	53·1065	......	......	......					

Weighted mean	−15·34
V_a	−17·37
V_d	− ·16
Curvature	− ·28
Radial velocity	−33·1

* Independent measurement.

θ AQUILÆ 1875.

1908. Sept. 8.
G. M. T. 12h 42m

Observed by J. S. Plaskett.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0022	......	......	......	2	45·2770	......	......	......
½	72·8789	·8850	·0202	+29·31	1½	45·3101	·3067	·0680	70·99
1	72·4437	......	......	......	1	27·5014	·4694	·0568	49·34
2	54·7440	......	......	......	2	27·2778	......	......	......
1	54·0395	·0356	·0658	75·73	1	12·0038	·9496	·0982	+73·55
2	53·1178	......	......	......	2	11·5614	......	......	......

Weighted mean		+67·85
V_a	17·08	
V_d		− 09
Curvature	− ·28	
Radial velocity		+50·6

θ AQUILÆ 1875*.

1908. Sept. 8. G. M. T. 12h 42m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7676	....	....	....	2	29·6453	....	....	....
2	54·0485	·0218	·0520	+59·85	1½	29·7430	·6966	·0977	86·66
2	53·1396	....	....	....	1	12·0185	·9417	·0903	+67·63
2	45·3024	....	....	....	2	11·5840	....	....	....
1½	45·3295	·3007	·0620	64·73					

Weighted mean....................		+69·07
V_a	−17·08	
V_d		+ ·09
Curvature.....	− ·28	
Radial velocity.............		+51·8

* Check measurement.

θ AQUILÆ 1876.

1908. Sept. 8. G. M. T. 13h 40m

Observed by J. S. Plaskett.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0136	....	....	....	1½	45·3045	·3014	·0627	65·45
½	72·9175	·9105	·0457	+66·31	1	27·5001	·4706	·0580	50·34
2	72·4645	....	....	....	2	27·2761	....	....	....
2	54·7428	....	....	....	1½	11·9869	·9574	·1060	+79·39
1½	54·0359	·0350	·0652	75·04	2	11·5444	....	....	....
2	45·2767	....	....	....					

Weighted mean.....		+68·88
V_a	−17·08	
V_d	·00	
Curvature.....	− ·28	
Radial velocity...........		+51·5

θ AQUILÆ 1878.

1908. Sept. 11. G. M. T. 15h

Observed by J. B. Cannon.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0192	....	....	....	2	45·2692	....	....	....
½	72·8480	·8396	·0252	−36·56	1	45·2233	·2277	·0110	11·48
2	72·4503	....	....	....	1	27·3789	·3712	·0414	35·93
2	54·7399	....	....	....	2	27·2541	....	....	....
2	53·9497	·9515	·0183	21·06	1½	11·8400	·8283	·0231	−17·30
2	53·1104	....	....	....	2	11·5249	....	....	....

Weighted mean	−22·29
V_a	−20·21
V_d	− ·09
Curvature.....	− ·28
Radial velocity	−47·7

P.—Plaskett.
H.—Harper.
C.—Cannon.
P[1]—Parker.
T.—Tribble.

OBSERVING RECORD AND DETAILED MEASURES OF ε HERCULIS.

RECORD OF SPECTROGRAMS.

Star.	No. of Negative.	Camera.	Plate.	Date.	Middle of Exposure G. M. T. (h.)	(m.)	Duration. (m.)	Hour Angle at end. (h.)	(m.)	Temperature Centigrade. Room. Beginning.	Room. End.	Prism Box. Beginning.	Prism Box. End.	Slit Width.	Seeing.	Observer.	Remarks.
				1907.													
ε Herculis..	786	H.	Seed 27 ..	May 24..	18	25	20	0	40 W.	8·5	9·5	16·4	16·4	·001	Fair......	P	
" ..	801	"	" .	" 31..	17	38	20		25 W.	12·7	12·6	18·8	18·8	·001	Good. ...	P	
" .	810	"	" ..	June 8..	19	28	30	2	45 W.	13·0	13·0	16·9	16·8	·001	....	P	
" ..	816	"	" ..	" 10..	17	47	35	1	20 W.	13·1	12·8	17·9	17·9	·001	Good.....	P	
" .	827	"	" ..	" 11..	15	39	26		55 E.	15·6	15·5	19·1	19·1	·001	"	H	
" ..	838	"	" ..	" 12..	18	35	30	2	10 W.	15·4	15·2	19·0	18·9	·0012	Fair.....	P	
" ..	847	"	" ..	" 13..	18	25	10	1	55 W.	19·0	19·0	25·8	25·8	·0015	"	H	
"	851	"	" ..	" 14..	17	43	34	1	30 W.	20·5	19·8	23·1	23·1	·0012	Good. ...	P	
" ..	862	"	" ..	" 20..	16	37	31		46 W.	21·5	21·0	25·4	25·4	·0012	"	H	
" .	871	"	" ..	" 21..	18	10	35	2	25 W.	23·1	22·6	29·0	29·0	·001	....	P	
" ..	881	"	" ..	" 25..	16	04	28		30 W.	23·8	23·8	27·3	27·3	·0012	Good.....	H	
" ..	893	"	" ..	" 27..	16	32	35	1	10 W.	20·9	20·0	24·5	24·5	·0012	Fair......	H	
" ..	913	"	" ..	July 4..	16	18	40	1	25 W.	20·0	19·5	28·6	28·4	·0012	Poor. ...	H	
" .	920	"	" ..	" 8..	16	00	35	1	30 W.	21·2	21·2	22·4	22·4	·0012	Fair......	P	
" ..	928	"	" ..	" 9..	15	15	38		40 W.	22·2	22·2	24·8	24·8	·0012	Good.....	T	
" ..	937	"	" ..	" 10..	14	55	70		10 W.	24·5	23·6	24·7	24·6	·0012	Poor.	P	
" ..	952	"	" ..	" 18..	16	10	60	2	22 W.	22·5	22·5	28·5	28·3	·0014	Hazy	H	
" ..	957	"	" ..	" 20..	16	39	32	2	45 W.	18·6	18·8	21·5	21·5	·0012	Good.....	P	
" ..	976	"	" ..	Aug. 1..	17	20	50	4	24 W.	20·0	20·0	24·8	24·8	·0012	Very hazy	T	
" ..	979	"	" ..	" 3..	13	28	34		30 W.	20·8	20·3	24·1	24·0	·0012	....	P	
" .	987	"	" .	" 6..	17	35	80	5	13 W.	19·4	18·0	23·3	23·3	·0013	Poor.....	T	
" ..	1018	"	" ..	" 22..	15	49	53	1	15 W.	18·5	18·0	24·2	24·2	·0014	Fair......	H	
"	1062	"	" ..	Sept. 20..	14	37	45	4	54 W.	22·3	22·3	22·9	22·8	·0014	Poor	H	
				1908.													
" .	1391	"	" ..	Mar. 9..	20	50	60	1	31 E.	-12·5	-13·0	1·0	1·0	·0013	...	H	
" ..	1403	"	" ..	" 16..	21	42	50		16 E.	-13·0	-13·5	2·3	2·3	·0014	Good.....	H	
" .	1183	"	" ..	Apr. 13..	21	35	60	1	36 W.	-0·5	1·5	8·0	8·0	·0018	Poor.....	H	

"	..	1491	"	"	"	15	20	40	11		40 W.	3·6	2·6	7·6	7·6	·0015	Good.....	P
"	..	1511	"	"	"	22	20	33	40	1	00 W.	5·2	3·5	12·5	12·6	·0017	"	P
"	..	1531	"	"	May	15	19	29	48	1	28 W.	13·0	11·5	17·8	18·0	·0017	"	H
"	..	1540	"	"	"	18	18	25	40		36 W.	16·6	16·5	23·4	23·4	·0016	Fair.....	P¹
"	..	1545	"	"	"	20	17	15	70		15 W.	18·0	16·9	21·0	21·0	·0016	St'dy, hazy	P
"	..	1547	"	"	"	22	18	28	57		58 W.	20·0	20·0	25·0	25·0	·0017	Fair.....	P¹H
"	..	1567	"	"	June	1	19	30	10	2	45 W.	13·6	12·5	21·2	21·2	·0015	"	P¹
"	..	1573	"	"	"	3	17	56	62	1	15 W.	14·2	13·7	18·3	18·3	·0015	"	P-H
"	..	1582	"	"	"	5	18	40	60	2	15 W.	16·6	15·5	24·5	24·5	·0016	"	P¹
"	..	1603	"	"	"	12	18	35	60	2	35 W.	17·0	15·7	24·9	24·9	·0017	Good.....	P¹
"	..	1625	"	"	"	22	17	27	65	2	00 W.	18·0	17·6	23·8	23·8	·0015	"	P
"	..	1630	"	"	"	24	16	27	45	1	00 W.	21·5	20·5	27·5	27·6	·0015	"	P
"	..	1640	"	"	"	26	16	46	53	1	13 W.	20·0	17·7	30·0	30·0	·0016	"	H-C
"	..	1648	"	"	"	27	17	07	55	2	00 W.	20·5	19·8	23·8	23·7	·0014	Fair.....	P
"	..	1653	"	"	July	1	16	15	80	1	30 W.	23·5	21·0	25·8	26·8	·0015	Cloudy..	P
"	..	1658	"	"	"	3	16	18	69	1	40 W.	21·9	21·5	25·4	25·4	·0016	Good.....	H
"	..	1661	"	"	"	3	19	40	60	5	05 W.	20·0	19·5	25·1	25·1	·0016	Hazy	P¹
"	..	1666	"	"	"	6	17	35	60	3	00 W.	25·8	23·6	26·4	26·4	·0015	Good.....	P-P¹
"	..	1675	"	"	"	8	15	47	40	1	15 W.	19·0	18·0	21·8	21·6	·0015	"	C
"	..	1676	"	"	"	8	16	32	45	2	05 W.	18·0	17·5	21·6	21·6	·0015	"	C
"	..	1682	"	"	"	9	17	12	50	2	47 W.	20·0	19·7	21·5	21·5	·0015	"	H
"	..	1685	"	"	"	10	14	37	60		22 W.	24·5	24·0	27·5	27·4	·0016	"	C
"	..	1686	"	"	"	10	15	34	52	1	12 W.	24·0	22·5	27·4	27·3	·0016	"	H
"	..	1693		"	"	11	16	58	53	2	45 W.	27·5	26·5	30·1	29·9	·0015	Fair.....	P
"	..	1699	"	"	"	13	16	19	52	2	15 W.	19·6	19·5	23·1	23·1	·0015	"	P
"	..	1707	"	"	"	14	17	42	48	3	37 W.	20·5	20·0	20·6	20·6	·0016	Good.....	H
"	..	1712	"	"	"	15	17	00	40	2	55 W.	17·0	16·3	21·6	22·3	·0015	"	C
"	..	1713	"	"	"	15	17	45	10	3	10 W.	16·3	15·0	22·3	22·0	·0015	"	H
"	..	1719	"	"	"	16	17	25	43	3	26 W.	18·0	17·0	19·6	20·0	·0015	"	H
"	..	1720	"	"	"	22	17	00	115	5	00 W.	22·6	21·0	24·7	24·7	·0015	Very poor	P-H
"	..	1723	"	"	"	24	14	00	60		40 W.	24·0	23·0	26·3	26·2	·0016	Fair.....	H
"	..	1728	"	"	"	25	17	20	85	4	30 W.	20·6	20·5	24·6	24·5	·0015	Poor.....	P
"	..	1729	"	"	"	26	16	58	17	3	40 W.	23·0	22·0	23·6	23·6	·0015	Good.....	H
"	..	1734	"	"	"	28	17	12	45	4	02 W.	21·0	25·0	29·8	29·8	·0016	"	H
"	..	1737	"	"	"	29	14	22	55	1	20 W.	27·5	27·0	30·3	30·2	·0015	Hazy	P
"	..	1738	"	"	"	29	15	08	30	1	53 W.	27·0	26·6	30·2	30·2	·0015	Fair.....	P
"	..	1743	"	"	"	29	18	05	60	4	58 W.	25·6	25·0	30·1	30·0	·0015	"	P-C
"	..	1746	"	"	"	30	17	06	33	4	00 W.	27·0	26·0	31·1	31·1	·0015	"	H
"	..	1751	"	"	"	31	15	40	39	2	40 W.	21·0	20·0	26·0	26·0	·0015	Good.....	P¹
"	..	1757	"	"	"	31	19	05	60	6	14 W.	18·5	17·0	25·6	25·3	·0015	"	H
"	..	1760	"	"	Aug.	1	16	49	82	4	15 W.	20·6	20·4	23·2	23·2	·0015	Fair.....	P
"	..	1761	"	"	"	5	14	05	50	1	30 W.	22·6	22·6	27·0	27·0	·0015	"	P
"	..	1771	"	"	"	7	15	35	80	3	25 W.	20·2	19·1	23·6	23·6	·0015	Very hazy	P¹
"	..	1782	"	"	"	15	16	50	50	4	50 W.	18·6	18·0	22·8	22·6	·0015	Fair.....	P
"	..	1793	IIIL.	"	"	19	14	41	98	3	17 W.	16·5	14·5	23·8	23·6	·002	"	H
"	..	1818	IL.	"	"	24	14	03	52	2	45 W.	17·5	17·0	23·3	23·2	·0015	Good.....	H
"	..	1838	"	"	"	27	15	50	45	4	36 W.	17·0	16·3	23·0	22·8	·0015	"	C
"	..	1841	"	"	"	28	14	07	45	3	00 W.	18·5	17·0	23·2	23·2	·0015	"	C
"	..	1853	"	"	"	31	13	52	46	2	55 W.	21·0	22·0	28·0	27·8	·0015	Fair.....	H
"	..	1866	"	"	Sept.	4	14	32	56	3	53 W.	19·3	18·8	23·5	23·4	·0015	"	C

P.—Plaskett.
H.—Harper.
C.—Cannon.
P[1]—Parker.
T.—Tribble.

RECORD OF SPECTROGRAMS—*Concluded.*

Star.	No. of Negative.	Camera.	Plate.	Date.	Middle of Exposure G. M. T.	Duration.	Hour Angle at end.	Temperature Centigrade. Room. Beginning.	Room. End.	Prism Box. Beginning.	Prism Box. End.	Slit Width.	Seeing.	Observer.	Remarks.
				1908.	h. m.	m.	h. m.								
ι Herculis..	1903	1L.	Seed 27..	Oct. 1..	13 12	60	4 30 W.	13·5	12·5	19·0	18·8	·0015	Bad......	H	
" ..	1905	"	" ..	" 2..	12 23	11	3 40 W.	9·2	8·0	13·2	13·1	·0015	Clear....	P[1]	
" ..	1906	"	" ..	" 2..	13 18	44	4 30 W.	8·0	7·3	13·1	13·0	·0015	Good.....	P[1]	
" ..	1917	"	" ..	" 5..	12 45	50	4 10 W.	9·7	8·5	14·5	14·5	·0015	Hazy....	P[1]	
" ..	1926	"	" ..	" 12..	14 15	60	6 25 W.	5·9	5·5	6·6	7·2	·0016	Good.....	P[1]	
" ..	1961	"	" ..	Nov. 13..	10 33	53	4 32 W.	3·5	3·0	8·3	7·3	·0015	"	H	
" ..	1983	"	" ..	" 26..	10 07	45	4 52 W.	11·0	12·0	12·0	13·0	·0016	.....	H	
" ..	1993	"	" ..	Dec. 2..	11 05	57	6 15 W.	−7·5	−8·2	2·0	−2·0	·0016	Windy...	C	
				1909.											
" ..	2263	"	" ..	Feb. 8..	22 08	45	2 12 E.	−19·0	−18·0	5·3	−5·1	·0016	Fair.....	H	
" ..	2264	"	" ..	" 8..	23 00	56	1 15 E.	−18·0	−19·0	−5·1	−5·0	·0016	"	H	
" ..	2305	"	" ..	" 22..	21 34	62	1 45 E.	6·0	7·8	0·8	0·6	·0016	"	C	
" ..	2306	"	" ..	" 22..	22 36	60	43 E.	−7·8	−7·5	0·6	0·6	·0016	"	C	
" ..	2327	"	" ..	Mar. 3..	21 12	75	1 25 E.	5·8	6·4	0·6	0·7	·0016	"	C	
" ..	2328	"	" ..	" 3..	22 26	68	10 E.	−6·4	−6·4	−0·7	−0·7	·0016	Poor.....	C	
" ..	2370	L.	" ..	" 13..	18 55	30	3 25 E.	2·0	−1·9	3·0	2·9	·002	Fair.....	P	
" ..	2371	"	" ..	" 13..	19 23	24	3 00 E.	−1·9	−2·0	2·9	2·8	·002	"	P	
" ..	2384	"	" ..	" 15..	19 32	27	2 29 E.	5·0	5·2	0·8	−1·2	·002	Good.....	H	
" ..	2385	"	" ..	" 15..	20 00	27	2 13 E.	−5·2	−5·0	−1·2	−1·2	·002	"	H	
" ..	2454	"	" ..	" 31..	20 05	30	1 00 E.	1·0	0·6	9·8	9·8	·002	"	C	
" ..	2455	"	" ..	" 31..	20 39	32	25 E.	0·6	0·0	9·8	9·7	·002	"	C	

ϵ HERCULIS 786.

1907. May 24.
G. M. T. $18^h\ 25^m$

Observed by J. S. Plaskett.
Measured by W E. Harper.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected wave length.	Normal wave length.	Displacement in revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected wave length.	Normal wave length.	Displacement in revolutions.	Velocity.
2	73·9685	4891·134	...	...	...	...	3	52·5955	4460·292	...	...	...	...
1½	73·1420	4871·413	...	...	...	...	3	47·6274	4379·348	...	...	...	...
2	72·6821	4860·564	607	·527	·920	−56·76	2	45·0505	4339·626	·714	·634	·920	−63·48
2	56·5256	4528·760	...	...	...	...	3	44·1325	4325·827	...	...	...	...
½	53·8061	4480·945	·985	·400	·415	−27·76							

Weighted mean		−56·53
V_a	+ 1·45	
V_d		− ·04
Curvature		− ·28
Radial velocity		−55·4

ϵ HERCULIS 801.

1907. May 31.
G. M. T. $17^h\ 38^m$

Observed by J. S. Plaskett.
Measured by C. R. Westland.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0174	...	...	...	1	53·9504	·9078	·0620	71·36
2	72·8193	·8105	·0543	−78·79	2	53·1565	...	...	...
2	72·4559	...	...	...	2	45·2192	·1557	·0830	−86·65
2	54·7825	...	...	...	2	45·3368	...	...	...

Weighted mean	−80·45
V_a	− ·68
V_d	− ·02
Curvature	− .28
Radial velocity	−81·4

ϵ HERCULIS 810.

1907. June 8.
G. M. T. $19^h\ 28^m$

Observed by J. S. Plaskett.
Measured by C. R. Westland.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9982	...	...	...	3	53·9506	·8942	·0756	−87·02
1	72·8130	·8281	·0367	−53·25	2	53·1734	...	...	...
2	72·4367	...	...	...	2	45·3626	...	...	...
2	54·7931	...	...	...	1	45·2450	·1556	0831	−86·76

Weighted mean	−80·21
V_a	− 3·00
V_d	− ·19
Curvature	− ·28
Radial velocity	−83·7

ε HERCULIS 816.

1907. June 10.
G. M. T. 17ʰ 47ᵐ

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected wave length.	Normal wave length.	Displacement.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected wave length.	Normal wave length.	Displacement.	Velocity.
2	73·3707	4875·671	....	......	......	....	1½	53·2681	4470·617	....	...	......	....
1½	72·9235	4865·085	....	......	......	....	2	45·2728	4341·820	..	......	......	....
1	72·7904	4861·951	·807	·527	·320	+19·74	2	45·2356	4341·256	·594	·634	·040	− 2·76
2	54·3881	4489·915	.....	......	......	....	½	27·4999	4102·238	·106	·890	·216	+15·60
1	53·9850	4482·931	·150	·400	·750	+50·17	3	27·3170	4100·053	.....	.....	......	....

Weighted mean		+16·04
V_a	− 3·57	
V_d	− ·07	
Curvature	− ·28	
Radial velocity		+12·7

ε HERCULIS 827.

1907. June 11.
G. M. T. 15ʰ 39ᵐ

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9503	....	....	....	1	54·0175	·0146	·0448	−51·56
1	72·8122	·8724	·0076	+11·02	3	45·3037	....	....	....
2	72·3825	....	....	....	½	45·2540	·2237	·0150	−15·66
2	54·0317	....	....	....					

Weighted mean		+21·90
V_a	−3·86	
V_d		− ·07
Curvature	− ·28	
Radial velocity		+17·8

ε HERCULIS 838.

1907. June 12.
G. M. T. 18ʰ 35ᵐ

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9986	....	....	....	2½	45·2585	·1957	·0430	44·89
1½	72·8160	·8258	·0390	−56·59	2	45·3356	....	....	....
2	72·4380	....	....	....	½	27·4375	·3116	·1010	−87·67
2	54·0675	....	....	....	2	27·3726	....	....	....
½	53·9500	·9113	·0585	67·33					

Weighted mean	−54·93
V_a	− 4·15
V_d	− ·14
Curvature	− ·28
Radial velocity	−59·5

ε HERCULIS 838.

1907. June 12.
G. M. T. 18h 35m

Observed by J. S. Plaskett.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	72·9608	....	....	....	1	45·2100	·1853	·0534	55·74
1	72·7742	·7756	·0392	−56·87	2	43·5655	....	....	....
1½	72·3915	....	....	....	½	27·4011	·3175	·0951	−82·54
2	45·2982	....	....	....	2	27·33 3	....	....	....

Weighted mean	−61·55
V_a	− 4·15
V_d	− ·14
Curvature	− ·28
Radial velocity	−66·1

The mean of the two measurements, −61·7 used.

ε HERCULIS 847.

1907. June 13.
G. M. T. 18h 25m

Observed by W. E. Harper.
Measured by C. R. Westland.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7738	....	....	....	2	45·3226	....	....	....
2	53·9268	·8948	·0750	−86·32	2	45·1962	·1472	·0915	−95·52
2	53·1442	....	....	....					

Weighted mean	−90·87
V_a	− 4·43
V_d	− ·16
Curvature	− ·28
Radial velocity	−95·7

ε HERCULIS 847.

1907. June 13.
G. M. T. 18h 25m

Observed by W. E. Harper.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9662	....	....	....	1	52·2373	....	....	....
½	72·7752	·8186	·0462	−67·03	2	48·7615	....	....	....
1	72·4080	....	....	....	½	45·2105	·2068	·0319	−33·30
1	54·0198	....	....	....	1	45·2774	....	....	....
1	53·8890	·8990	·0708	−81·48					

Weighted mean	−65·82
V_a	− 4·43
V_d	− ·16
Curvature	− ·28
Radial velocity	−70·7

Mean of two measurements, −83·2 used.

ε HERCULIS 851.

1907. June 14.
G. M. T. 17ʰ 43ᵐ

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Measured Wave Length.	Normal wave length.	Displacement.	Velocity.	Wt.	Mean of Settings.	Measured Wave Length.	Normal wave length.	Displacement.	Velocity.
2	73·3997	4875·675	......	......	....	1½	53·9475	4482·744	·400	·344	+23·74
1½	72·9468	4864·956	......	....	....	2	45·2453	4341·337	...	......	....
1	72·8165	4861·887	.527	·360	+22·21	1½	45·2036	4340·534	·634	·100	− 6·90
1	72·3854	4851·790	......	......	....	1	27·4152	4101·900	·890	·010	+ 0·73
1	53·9856	4482·656	......	......	....	2	27·2529	4099·650	.....	......	....

Weighted mean		+ 9·64
V_a	− 4·72	
V_d	− ·09	
Curvature	− ·28	
Radial velocity		+ 4·5

ε HERCULIS 851.

1907. June 14
G. M. T. 17ʰ 43ᵐ

Observed by J. S. Plaskett.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0227	....	....	....	1	53·1210	....	....	....
1	72·8756	·8898	·0250	+36·27	½	45·2536	·2267	·0120	−12·52
½	72·4630	....	....	....	2	45·3006	....	....	....
1	54·7568	....	....	....	2	27·2977	....	....	....
1	54·0085	·9991	·0293	+33·72	1	27·4617	·1108	·0018	− 1·56

Weighted mean		+17·76
V_a	− 4·72	
V_d	− ·09	
Curvature	− ·28	
Radial velocity		+12·7

The mean of two measurements, +7·0 used.

ε HERCULIS 862.

1907. June 20.
G. M. T. 16ʰ 37ᵐ

Observed by W. E. Harper.
Measured by J. N. Tribble.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1½	72·9908	....	....	....	2	53·1120	....	....	....
2	72·4301	....	....	....	2	45·2676	....	....	....
1	72·8461	·8644	·0004	− 0·29	1	45·1917	·1977	·0410	−42·79
2	54·7464	....	....	....	2	27·2746	....	....	....
½	53·9312	·9290	·0408	−46·96	¼	27·3742	·3462	·0764	−57·70

Weighted mean	−31·26
V_a	− 6·33
V_d	− ·07
Curvature	− ·28
Radial velocity	−37·9

ε HERCULIS 862.

1907. June 20.
G. M. T. 16ʰ 37ᵐ

Observed by W. E. Harper.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions	Velocity.
1	73·0166	....	....	....	1	45·2182	·1950	·0437	45·62
1	72·8604	·8527	·0121	−17 55	2	43 5599	.. ..	....	....
2	72·4557	....	....	....	1	27·4358	·3833	·0293	−25·43
2	45·2969	....	....	....	2	27·2991	....	....	....

Weighted mean	−27·53
V_a	− 6 33
V_d	− ·07
Curvature	− 28
Radial velocity	−34·2

Mean of measurements,—34·5 used.

ε HERCULIS 871.

1907. June 21.
G. M. T. 18ʰ 10ᵐ

Observed by J. S. Plaskett.
Measured by J. N. Tribble.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1½	72·9582	....	....	....	1½	45·1420	·1655	·0732	76·39
2	72·3957	....	....	....	1½	27·2546	....	....	....
1½	72·7847	·8357	·0291	−42·22	½	27·3658	·3578	·0641	−55·63
2	45·2501	....	....	....					

Weighted mean	−58 78
V_a	− 6·49
V_d	− ·19
Curvature	− ·28
Radial velocity	−65·7

ε HERCULIS 881.

1907 June 25.
G. M. T. 16ʰ 04ᵐ

Observed by }
Measured by } W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	49·4200	....	....	....	½	27·3185	·3189	·1030	−89·40
1	45·2146	·1775	·0612	−63·89	1	27·2462	. . ..	....	....
2	44·2931	....	....	....					

Weighted mean	−72·40
V_a	− 7·64
V_d	− ·04
Curvature	− ·28
Radial velocity	−80·4

ε HERCULIS 893.

1907. June 27.
G. M. T. 16h 32m

Observed by W. E. Harper.
Measured by J. N. Tribble.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1½	73·2721	....	....	....	1	53·9786	·9741	·0043	4·95
2	72·9900	....	....	....	2	45·2810	....	....	....
½	72·8555	·8745	·0097	+14·07	½	45·2918	·2843	·0456	+47·59
2	54·0335	....	....	....					

Weighted mean.................... +12·64
V_a.................... −8·22
V_d.................... −·11
Curvature.................... −·28

Radial velocity.................... +4·0

ε HERCULIS 913.

1907. July 4.
G. M. T. 16h 18m

Observed by W. E. Harper.
Measured by J. N. Tribble.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·0216	....	....	....	2	45·2683	....	....	....
2	53·9485	·9557	·0141	−16·22					

Weighted mean.................... −16·22
V_a.................... −9·98
V_d.................... −·14
Curvature.................... −·28

Radial velocity.................... −26·6

ε HERCULIS 920.

1907. July 8.
G. M. T. 16h

Observed by J. S. Plaskett.
Measured by J. N. Tribble.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9265	....	....	....	2	45·2319	....	....	....
2	72·3632	....	....	....	1	45·1886	·2403	·0084	8·79
1½	72·7804	·8172	·0015	−2·17	2	27·2471	....	....	....
1½	53·9754	....	....	....	½	27·4015	·4763	·0202	−17·60
½	53·9156	·9556	·0010	−1·15					

Weighted mean.................... −6·12
V_a.................... −10·92
V_d.................... −·14
Curvature.................... −·28

Radial velocity.................... −17·5

ε HERCULIS 928.

1907. July 9.
G. M. T. 14h 32m

Observed by } J. N. TRIBBLE.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1½	54·0232	....	....	....	1	45·2855	·2775	·0388	49·90
½	54·0319	·0375	·0677	+77·91	1½	30·9135	....	....	....
2	45·2815	....	....	....	1	29·6773	·6342	·0501	+44·42

Weighted mean .... +53·31
V_a .... −11·26
V_d .... − ·11
Curvature .... − ·28

Radial velocity. . .. . +41·6

ε HERCULIS 928.*

1907. July 9.
G. M. T. 14h 32m

Observed by J. N. TRIBBLE.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity
2	72·9585	......	....	....	2	53·9874	....	....	....
1½	72·8250	·8764	·0116	+ 16·83	½	53·9415	·9829	·0131	+15·08
1	72·3931	....	....	....	2	45·2441	....	....	....
½	57·8595	·8969	·0700	[+ 84·28]	1½	45·2136	·2431	·0044	+ 3·82
1	57·7826	....	....	....	2	29·6396	·6406	·0417	+37·00
½	57·6674	·7048	·1220	[−144·18]	2	29·5979	....	....	....

Weighted mean .... +20·60
V_a .... −11·26
V_d .... − ·11
Curvature .... − ·28

Radial velocity .... + 9·0

* This result used.

ε HERCULIS 937.

1907. July 10.
G. M. T. 14h 55m

Observed by J. S. PLASKETT.
Measured by J. N. TRIBBLE.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	72·9735	....	....	....	1	45·2284	·2288	·0199	−20·83
1	72·8361	·8261	·0054	+ 7·84	2	27·2965	....	....	....
2	45·2832	......	....	....	½	27·4291	·4545	·0420	−36·60

Weighted mean .... −20·86
V_a .... −11·49
V_d .... − ·09
Curvature .... − ·28

Radial velocity .... −32·7

ε HERCULIS 937.

1907. July 10.
G. M. T. $14^h\ 55^m$

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	54·6678	....	....	....	2	45·2121	....	....	....
1	53·8654	·9382	·0316	−36·37	1	45·1485	·2100	·0287	−29·96
1	53·0405	....	....	....					

Weighted mean..................	−33·16
V_a..................	−11·49
V_d..................	− ·09
Curvature..................	− ·28
Radial velocity..................	−45·0

Mean of measurements, −39·0 used.

ε HERCULIS 952.

1907. July 18.
G. M. T. $16^h\ 10^m$

Observed by W. E. Harper.
Measured by J. N. Tribble.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9883	....	....	....	½	53·9283	·9333	·0365	42·01
2	72·4271	....	....	....	2	45·2698	....	....	....
1	72·8008	·8208	·0440	−63·85	1	45·2109	·2147	·0240	−25·05
2	54·0238	....	....	....					

Weighted mean..................	−43·96
V_a..................	−13·18
V_d..................	− ·19
Curvature..................	− ·28
Radial velocity..................	57·6

ε HERCULIS 957.

1907. July 20.
G. M. T. $16^h\ 39^m$

Observed by J. S. Plaskett.
Measured by J. N. Tribble.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9599	....	....	....	2	45·2827	....	....	....
2	72·3852	....	....	....	1	45·2473	·2482	·0000	0·00
1	72·8265	·8315	·0128	+18·34	2	27·3141	....	....	....
2	54·0154	....	....	....	½	27·5080	·5158	·0193	+16·82
1	53·9642	·9642	·0076	+ 8·77					

Weighted mean..................	+10·15
V_a..................	−13·57
V_d..................	− ·19
Curvature..................	− ·28
Radial velocity..................	− 3·9

ε HERCULIS 976.

1907. Aug. 1.
G. M. T. 17ʰ 20ᵐ

Observed by } J. N. TRIBBLE.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0008	......	....	....	2	45·2806	....	....	.. ..
½	72·8353	·8443	·0205	−29·74	1	45·2454	·2384	·0003	0·00
2	54·0320	....	....	. ...	2	27·2821	....	....	.. .. ..
2	53·9627	·9595	·0103	11·85	½	27·4465	·4110	·0109	9·46

Weighted mean	10·79
V_a	−15·51
V_d	− ·27
Curvature	− ·28
Radial velocity	−26·8

ε HERCULIS 979.*

1907. Aug. 3.
G. M. T. 13ʰ 28ᵐ

Observed by J. S. PLASKETT.
Measured by TRIBBLE & HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9868	....	....	....	½	27·4924	·4509	·0290	+25·17
½	72·8703	·8953	·0305	+44·26	2	54·7430	....	....	....
2	54·0237	... .	....	....	1½	54·0280	·0278	·0620	+71·36 red.
2	54·0309	·0360	·0662	+76·19					
2	54·7369	....	.. ..	.. . .	C'ntre	53·9537	·9535	·0163	+18·76
2	45·2775	... .	....	....	½	53·8760	·8758	·0940	−108·19 violet.
1	45·2820	·2780	·0393	+41·08					
2	27·2883	....	....	....	2	o3 1113	....	....	....

*Plate not used in the results.

ε HERCULIS 987.

1907. Aug. 6.
G. M. T. 17ʰ 35ᵐ

Observed by } J. N. TRIBBLE.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·6897	... .	....	....	2	44·9512	... .	.. . .	....
½	72·5573	·7843	·0122	+17·75	1	44·9849	·2833	·0244	+25·63

Weighted mean		+22·96
V_a	−16·16	
V_d	− ·28	
Curvature... .	− ·28	
Radial velocity		+6·2

ε HERCULIS 1018.

1907. Aug. 22.
G. M. T. 10ʰ 49ᵐ

Observed by W. E. Harper.
Measured by J. N. Tribble.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·0698	......	....	....	2	45·2977	......	....	....
1	54·0566	·0156	·0458	+52·71	½	45·3014	·2774	·0387	+40·39

Weighted mean		+48·60
V_a	−17·45	
V_d	− ·27	
Curvature	− ·28	
Radial velocity		+30·6

ε HERCULIS 1062.

1907. Sept. 20.
G. M. T. 14ʰ 37ᵐ

Observed by W. E. Harper.
Measured by J. N. Tribble.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·0379	....	....	....	2	45·2630	......	......	....
1	53·9738	·9647	·0051	− 5·86	1	45·2412	·2512	·0125	−13·04

Weighted mean	+ 3·59	
V_a		− 5·90
V_d		− ·28
Curvature		− ·28
Radial velocity		− 2·9

ε HERCULIS 1391.

1908. March 9.
G. M. T. 20ʰ 50ᵐ

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7533	....	....	....	½	27·3570	·3650	·0566	49·13
2	53·9358	·9253	·0445	−51·22	2	27·2385	....	....	....
2	53·1215	....	....	.....	½	11·7667	·7897	·0617	−46·21
2	45·2735	....	....	......	2	11·4840	....	....	......
1	45·2060	·2061	·0326	34·03					

Weighted mean		−46·03
V_a	+17·56	
V_d	+ ·14	
Curvature		− ·28
Radial velocity		−28·6

ε HERCULIS 1403.

1908. March 16.
G. M. T. 21^h 42^m

Observed by } W. E. HARPER.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7088	....	....	....	1	27·4090	·3380	·0746	[−64·75]†
1	53·8238	·8561	·1137	−129·87	1	27·3376	·2666	·1460	−126·73‡
2	53·0835	....	....	....	2	27·3180	....	....	....
3	45·2754	....	....	....	½	11·8287	·7037	·1477	−110·63
2	45·1363	·1345	·1042	−108·78	2	11·6327	....	....	....
1	27·4961	·4251	·0125	[+10·85]*					

Weighted mean 4 lines.............. −117·66
V_a.............. +16·96
V_d.............. + ·05
Curvature.............. − ·28

Radial velocity.............. 100·9

* Red. † Centre. ‡ Violet.

ε HERCULIS 1483.

1908. April 13.
G. M. T. 21^h 35^m

Observed by } W. E. HARPER.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	55·0591	·0413	·0839	−97·83	½	45·2031	·1830	·0557	−58·15
2	54·7597	....	....	....	2	73·0290	....	....	....
3	53·8897	·8728	·0970	−111·65	2	66·3185	·2998	·1119	+145·09
2	53·1281	....	....	....	1	41·4857	·4625	·1653	+165·30
2	45·2936	....	....	....	2	41·3097	....	....	....

Weighted mean neg. lines......... −102·63
V_a.............. +12·31
V_d.............. − ·09
Curvature.............. − ·28

Radial velocity.............. − 90·7

ε HERCULIS 1494.

1908. April 15.
G. M. T. 20ʰ 40ᵐ

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7571	....	....	....	1	27·5470	·4416	·0290	25·17
1	54·0087	·9910	·0212	+24·40	2	27·3528	....	....	....
2	53·1325	....	....	....	1½	12·0567	·8947	·0433	−32·43
2	45·3117	....	....	....	2	11·6701	....	....	....
1½	45·2995	·2614	·0227	23·70					

Weighted mean		−26·75
V_a		−11·87
V_d	−·04	
Curvature	−·28	
Radial velocity		−38·3

ε HERCULIS 1511.

1908. April 22.
G. M. T. 20ʰ 33ᵐ

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7537	....	....	....	1½	27·4398	·3576	·0550	47·74
1	53·9496	·9343	·0355	−40·86	2	27·3292	....	....	....
2	53·1311	....	....	....	1	11·9322	·7951	·0557	−41·72
2	45·2841	....	....	....	2	11·6453	....	....	....
1½	45·2051	·1947	·0440	45·93					

Weighted mean		−44·61
V_a	10·16	
V_d		−·05
Curvature		−·28
Radial velocity		−34·8

ε HERCULIS 1511.*

1908. April 22. G. M. T. 20h 53m

Observed by J. S. Plaskett. Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	51·7475	....	....	....	1	27·4466	·3521	·0605	52·51
½	53·9314	·9240	·0498	−57·31	2	27·3416	....	....	....
2	53·1213	....	....	....	½	11·9315	·7915	·0600	44·94
2	45·3027	....	....	....	2	11·6479	....	....	....
1	45·2245	·1995	·0393	41·02					

Weighted mean .... 48·22
V_a .... + 10·16
V_d .... − ·05
Curvature .... − ·28

Radial velocity .... − 38·4

* Check measurement.

ε HERCULIS 1531.

1908. May 15. G. M. T. 19h 29m

Observed by W. E. Harper. Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0237	....	....	....	½	45·1314	·1565	·0822	85·81
½	72·8254	·8127	·0521	−75·59	2	43·5083	....	....	....
1	72·4550	....	....	....	½	27·3377	·3301	·0825	−71·04
1	45·2488	....	....	....	2	27·2542	....	....	....

Weighted mean .... − 77·18
V_a .... + 3·87
V_d .... − ·11
Curvature .... − ·28

Radial velocity .... − 74·0

ε HERCULIS 1531.*

1908. May 15. G. M. T. 19h 29m

Observed by } Measured by } W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	45·2620	....	....	....	2	15·3652	....	....	....
1½	45·1435	·1651	·0736	−76·84	1	15·3325	·3730	·1003	77·63
1	27·2702	·3206	·0920	79·86	½	11·7025	·7530	·0984	−73·70
2	27·1935	....	....	....	2	11·4650	....	....	....

Weighted mean .... −77·10
V_a .... +3·87
V_d .... − ·11
Curvature .... − ·28

Radial velocity .... −73·9

* Check measurement.

ε HERCULIS 1540.

1908. May 18. G. M. T. 18ʰ 25ᵐ

Observed by / Measured by } T. H. PARKER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	72·9755				½	45·2462	·2547	·0160	16·70
½	72·8376	·8724	·0076	+11·02	2	43·5332			
1	72·4074				2	27·2667			
2	45·2650				½	27·4414	·4293	·0077	+ 6·68

Weighted mean .... +11·47
V_a .... + 3·01
V_d .... − ·04
Curvature .... − ·28

Radial velocity .... +14·2

ε HERCULIS 1540.*

1908. May 18. G. M. T. 18ʰ 25ᵐ

Observed by T. H. PARKER.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	57·8390				½	27·4464	·3946	·0180	15·62
½	57·8150	·8054	·0214	−25·76	2	27·2984			
2	54·7533				1	11·9200	·8464	·0050	− 3·75
1	53·9750	9629	·0019	− 2·18	2	11·5812			
1½	53·1249								

Weighted mean .... − 4·73
V_a .... + 3·01
V_d .... − ·04
Curvature .... − ·28

Radial velocity .... − 2·0

* Check measurement.

ε HERCULIS 1545.

1908. May 20. G. M. T. 14ʰ

Observed by J. S. PLASKETT.
Measured by T. H. PARKER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7596				½	27·4008	·3230	·0896	77·77
½	53·9253	·9080	·0618	−71·13	1	27·3245			
2	53·0461				½	15·4875	·3780	·0953	−73·76
2	43·5702				1	15·5081			

Weighted mean .... −76·10
V_a .... + 2·47
V_d .... + ·07
Curvature .... − ·28

Radial velocity .... −73·8

ε HERCULIS 1547.

1908. May 22.
G. M. T. 18h 28m

Observed by } W. E. HARPER.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7307	....	....	....	2	45·2669	....	....	....
½	53·9373	·9479	·0219	−25·21	½	45·1984	·2051	·0336	−35·08
2	53·1021	....	....	....					

Weighted mean .... − 30·15
V_a .... + 1·93
V_d .... − ·04
Curvature .... − ·28

Radial velocity .... − 28·5

ε HERCULIS 1567.

1908. June 1.
G. M. T. 17h 30m

Observed by T. H. PARKER
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7282	....	....	....	2	45·2682	....	....	....
¾	53·8856	·8976	·0722	−83·10	¼	45·1598	·1652	·0735	−76·73
2	53·1018	....	....	....					

Weighted mean .... − 81·51
V_a .... − 1·17
V_d .... − ·16
Curvature .... − ·28

Radial velocity .... − 83·1

ε HERCULIS 1573.

1908. June 3.
G. M. T. 17h 56m

Observed by } W. E. HARPER.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9922	....	....	....	2	53·1190	....	....	....
1	72·8323	·8513	·0135	−19·59	2	45·2871	....		....
2	72·4216	....	....	....	1½	45·2517	·2382	·0005	0·52
2	54·7443	....	....	....	1	27·4595	·4062	·0064	−5·55
½	53·9692	·9645	·0053	6·10	2	27·2999	....	....	....

Weighted mean .... − 7·23
V_a .... − 1·74
V_d .... − ·06
Curvature .... − ·28

Radial velocity .... − 9·3

ε HERCULIS 1573.*

1908. June 3. G. M. T. 17h 56m

Observed by / Measured by } W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0222	......	......	......	½	45·2750	·2294	·0093	9·71
½	72·8697	·8570	·0078	−11·32	½	27·4850	·4000	·0126	−10·94
2	72·4536	......	......	......	2	27·3321	......	......	......
2	45·3195	......	......	......					

Weighted mean	....	−10·66
V_a	....	−1·74
V_d	....	−·06
Curvature	....	−·28
Radial velocity	....	−12·7

* Check measurement.

ε HERCULIS 1582.

1908. June 5. G. M. T 18h 40m

Observed by / Measured by } T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0057	......	......	......	2	45·2847	......	......	......
½	72·8289	·8328	·0320	−46·43	1	45·1877	·1766	·0621	64·83
1	72·4415	......	......	......	2	43·5492	......	......	......
1	54·7435	......	......	......	1	27·3405	·3509	·0617	−53·55
2	53·9113	·9085	·0613	70·55	2	27·2362	......	......	......
1	53·1160	......	......	......					

Weighted mean	....	−62·82
V_a	....	−2·34
V_d	....	−13
Curvature	....	−·28
Radial velocity	....	−65·6

ε HERCULIS 1603.

1908. June 12. G. M. T. 18h 35m

Observed by / Measured by } T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0039	......	......	......	½	27·3556	·3660	·0466	40·44
½	72·8098	·8174	·0474	−68·77	2	27·2362	......	......	......
2	72·4334	......	......	......	2	54·7252	......	......	......
2	45·2849	......	......	......	1	53·9368	·9481	·0217	−24·97
1	45·1905	·1792	·0595	62·11	1	53·0175	......	......	......
3	43·5509	......	......	......					

Weighted mean	....	−47·23
V_a	....	−4·39
V_d	....	−·14
Curvature	....	−·28
Radial velocity	....	−52·0

ε HERCULIS 1603.*

1908. June 12.
G. M. T. 18ʰ 35ᵐ

Observed by T. H. Parker.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7390	....	....	....	1	45·1900	·1834	·0553	−57·73
1½	53·9468	·9515	·0183	−21·06	2	45·2802	....	....	....
1	53·1052	....	....	....					

Weighted mean	−35·73
V_a	4·39
V_d	− ·14
Curvature	− ·28
Radial velocity	−40·5

* Check measurement.

ε HERCULIS 1625.

1908. June 22.
G. M. T. 17ʰ 27ᵐ

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7181	....	....	....	½	27·4445	·4251	·0125	+10·85
2	53·9437	·9684	·0014	− 1·91	2	27·2660	....	....	....
2	53·0867	....	....	....	½	11·8797	·8502	·0012	− 0·90
2	45·2605	....	....	....	2	11·5367	....	....	....
1	45·2005	·2137	·0250	26·10					

Weighted mean	− 6·24
V_a	− 7·15
V_d	− ·11
Curvature	− ·28
Radial velocity	−13·8

ε HERCULIS 1630.

1908. June 24.
G. M. T. 16ʰ 27ᵐ

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0647	....	....	....	2	45·3237	....	....	....
1	72·9033	·8481	·0167	−24·23	2	45·2575	·2074	·0313	32·68
2	72·5011	....	....	....	1½	27·4458	·3860	·0266	23·09
2	54·7925	....	....	....	2	27·3065	....	....	....
1½	53·9978	·9484	·0214	24·63	2	11·8987	·8362	·0152	−11·38
2	53·1602	....	....	....	2	11·5698	....	....	....

Weighted mean	−23·00
V_a	− 7·68
V_d	− ·04
Curvature	− ·28
Radial velocity	−31·0

ε HERCULIS 1640.

1908. June 26. G. M. T. 16ʰ 46ᵐ

Observed by } Measured by } W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7353	....	....	....	2	53·1042	....	....	....
1	53·9739	·9826	·0128	−14·73					

V_s		+ 14·73
V_a	− 8·21	
V_d	− ·09	
Curvature	− ·28	
Radial velocity		+ 6·1

ε HERCULIS 1648.

1908. June 27. G. M. T. 17ʰ 07ᵐ

Observed by J. S. Plaskett. Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·6613	....	....	....	2	27·3914	·4389	·0266	22·06
1½	53·9578	·0373	·0675	−77·80	3	27·2075	....	....	....
2	53·0325	....	....	....	1	11·8777	·9092	·0578	+43·29
2	45·2056	....	....	....	3	11·4693	....	....	....
1½	45·1725	·2405	·0018	1·88					

Weighted mean		+ 34·49
V_a	− 8·47	
V_d	− ·11	
Curvature	− ·28	
Radial velocity		+ 25·6

ε HERCULIS 1648.*

1908. June 27. G. M. T. 17ʰ 07ᵐ

Observed by J. S. Plaskett. Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0323	....	....	....	2	45·3181	....	....	....
1	72·9046	·8746	·0098	+14·22	1½	45·2971	·2531	·0144	15·05
2	72·4869	....	....	....	1½	27·5276	·4536	·0410	35·59
2	54·7837	....	....	....	3	27·3309	....	....	....
1½	54·0660	·0260	·0562	64·69	1½	12·0159	·9229	·0715	+53·63
2	53·1513	....	....	....	3	11·5935	....	....	....

Weighted mean		+ 42·15
V_a	− 8·47	
V_d	− ·11	
Curvature	− ·29	
Radial velocity		+ 29·4

* Check measurement.

ε HERCULIS 1648.*

1908. June 27.
G. M. T. 17h 07m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7470	....	....	....	½	27·4466	·4322	·0196	17·01
1	54·0110	·0063	·0365	+42·01	2	27·2610	....	....	....
2	53·1164	....	....	....	1	11·9287	·9037	·0523	+39·17
2	45·2902	....	....	....	2	11·5322	....	....	....
1½	45·2737	·2571	·0184	19·21					

Weighted mean .... +29·62
V_a .... − 8·47
V_d .... − ·11
Curvature ..... − ·28

Radial velocity .... + 20·8

* Check measurement.

ε HERCULIS 1653.

1908. July 1.
G. M. T. 16h 15m

Observed by J. S. Plaskett.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7746	....	....	....	1	27·5156	·4756	·0630	54·68
2	54·0547	·0247	·0549	+63·19	3	27·2893	....	....	....
2	53·1395	....	....	....	1½	11·9291	·8871	·0357	+26·76
2	45·3045	....	....	....	3	11·5478	....	....	....
1	45·2795	·2490	·0103	10·75					

Weighted mean .... +42·17
V_a .... − 9·48
V_d .... − ·11
Curvature ..... − ·28

Radial velocity .... +33·3

ε HERCULIS 1653.*

1908. July 1.
G. M. T. 16h 15m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7392	....	....	....	½	27·4403	·4400	·0274	23·78
1	53·9887	·9943	·0245	+28·20	2	27·2470	....	....	....
1	53·1035	....	....	....	1	11·8804	·8856	·0342	+25·61
2	45·2625	....	....	....	2	11·5020	....	....	....
½	45·2276	·2387	·0000	·00					

Weighted mean .... +21·90
V_a .... − 9·48
V_d .... − ·06
Curvature ..... − ·28

Radial velocity .... +12·1

* Check measurement.

ε HERCULIS 1653.*

1908. July 1.
G. M. T. 16h 15m

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·8447	....	....	....	½	45·3489	·2537	·0150	15·66
1	53·0962	·9977	·0279	32·11	1	44·9904	·8880	·0366	−27·41
2	53·2062	....	....	....	2	44·6096	....	....	....
2	45·3688	....	....	....					

Weighted mean		+26·94
V_a	9·48	
V_d	11	
Curvature......	− ·28	
Radial velocity		−17·1

* Check measurement.

ε HERCULIS 1661.

1908. July 3.
G. M. T. 19h 40m

Observed by T. H. PARKER.
Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7681	....	....	....	2	45·2998	....	....	....
2½	53·9294	·9004	·0694	−79·88	1	45·2548	·2268	·0119	−13·61
2	53·1436	....	....	....					

Weighted mean....................	49·53
V_a	− 9·97
V_d	·26
Curvature....................	·28
Radial velocity....................	−60·0

ε HERCULIS 1661.*

1908. July 3.
G. M. T. 19h 40m

Observed by T. H. PARKER.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7214	....	....	....	2	45·2530	....	....	....
2	53·8761	·8968	·0730	−84·02	¾	45·1670	·1877	·0510	−53·21
2	53·0911	....	....	....					

Weighted mean....................	−75·62
V_a	− 9·97
V_d	− ·26
Curvature....................	− ·28
Radial velocity....................	−86·1

* Check measurement.

ε HERCULIS 1666.

1908. July 6.
G. M. T. 17h 35m

Observed by J. S. Plaskett.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity
2	54·7101	......	....	....	1½	27·3494	·3934	·0192	16·66
1	53·8809	·9180	·0518	−59·62	2	27·1962	....	....	......
2	53·0710	....	....	....	1	11·7754	·8284	·0230	−17·23
2	45·2333	....	....	....	2	11·4534	....	....	....
1½	45·1985	·2375	·0012	1·25					

Weighted mean....	−20·74
V_a	−10·70
V_d	− ·06
Curvature	− ·28
Radial velocity	−31·7

ε HERCULIS 1666.*

1908. July 6.
G. M. T. 17h 35m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	57·8433	....	....	....	1½	45·2230	·2223	·0164	−17·20
½	57·8432	·8293	·0025	+ 3·01	½	27·3862	·3874	·0252	−21·87
2	54·7567	....	....	....	2	27·2454	....	....	....
2	53·9847	·9752	·0054	+ 6·21	½	11·8301	·8383	·0131	− 9·81
1	53·1164	....	....	....	2	11·5190	....	....	....
2	45·2745	....	....	....					

Weighted mean	− 5·54
V_a	−10·70
V_d	− ·06
Curvature	− ·28
Radial velocity.	−16·6

* Check measurement.

ε HERCULIS 1675.

1908. July 8.
G. M. T. 15h 47m

Observed by J. B. Cannon.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0235	....	....	....	3	45·2741	....	....	....
1	72·8670	·8534	·0114	−16·54	1½	45·2271	·2267	·0120	−12·53
2	72·4584	....	....	....	1	27·4307	·4076	·0050	− 4·34
2	54·7415	....	....	....	2	27·2697	....	....	....
1½	53·9786	·9803	·0105	+12·08	1	11·8571	·8288	·0226	−16·93
1½	53·1090	....	....	....	2	11·5355	....	....	....

Weighted mean	−	6·41
V_a	−	11·15
V_d	−	·07
Curvature	−	·28
Radial velocity	−	17·9

ε HERCULIS 1675.*

1908. July 8.
G. M. T. 15h 47m

Observed by J. B. Cannon.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
½	57·7785	·8317	·0049	+ 6·02	1½	45·1881	·2350	·0037	− 3·86
2	57·7762	....	....	....	2	30·8478	....	....	....
2	54·6950	....	....	....	1	27·3860	·4072	·0054	− 4·69
2	53·9312	·9798	·0100	+11·51	2	27·2254	....	....	....
2	53·0617	....	....	....	1	11·8146	·8303	·0211	−15·80
2	45·2267	....	....	....	2	11·4915	....	....	....

Weighted mean	−	0·04
V_a	−	11·15
V_d	−	·07
Curvature	−	·28
Radial velocity	−	11·5

* Check measurement.

ε HERCULIS 1676.

1908. July 8.
G. M. T. 16ʰ 32ᵐ

Observed by } J. B. CANNON.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·8885	...	...	...	1	27·5711	·4031	·0095	8·25
1½	54·0948	·9498	·0200	−23·02	2	27·4152	...	...	...
2	53·2536	...	...	...	1	12·0378	·8489	·0025	− 1·87
2	45·4243	...	...	...	2½	11·6959	...	...	...
1	45·3866	·2356	·0031	3·24					

Weighted mean	− 10·64
V_a	− 11·15
V_d	− ·14
Curvature	− ·28
Radial velocity	− 22·2

ε HERCULIS 1682.

1908. July 9.
G. M. T. 17ʰ 12ᵐ

Observed by } W. E. HARPER.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0156	...	...	...	1½	45·2675	·2565	·0178	+18·58
½	72·8768	·8714	·0066	+ 9·57	2	41·2977	...	...	...
2	72·4490	...	...	...	½	27·4402	·4102	·0024	− 2·08
2	54·7490	...	...	...	2	27·2766	...	...	...
3	54·0263	·0207	·0609	+70·09	½	11·9452	·9044	·0530	+39·70
2	53·1160	...	...	...	2	11·5482	...	...	...
2	45·2846	...	...	...					

Weighted mean		+ 42·97
V_a	− 11·36	
V_d	− ·15	
Curvature	− ·28	
Radial velocity		+ 31·2

ε HERCULIS 1685.

1908. July 10.
G. M. T. 14h 37m

Observed by } J. B. Cannon.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7810	....	....	....	1½	27·4458	·3880	·0246	21·35
2	53·9982	·9602	·0096	– 11·49	2	27·3042	....	....	....
2	53·1500	....	....	....	1½	11·8880	·8260	·0254	– 19·02
2	15·3197	....	....	....	2	11·5696	....	....	....
1	45·2720	·2260	·0127	13·26					

Weighted mean .... – 16·13
V_a .... – 11·58
V_d .... ·00
Curvature .... ·28

Radial velocity .... – 27·9

ε HERCULIS 1686.

1908. July 10.
G. M. T. 15h 34m

Observed by } J. B. Cannon.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7365	....	....	....	½	27·4528	....	....	....
1½	53·9495	·9535	·0163	– 18·76	2	27·2597	....	....	....
2	53·1102	....	....	....	1½	11·8304	·8099	·0415	– 31·07
2	45·2762	....	....	....	2	11·5280	....	....	....
1	45·2158	·2146	·0230	24·01					

Weighted mean .... – 24·56
V_a .... – 11·58
V_d .... – ·06
Curvature .... – ·28

Radial velocity .... – 36·4

ε HERCULIS 1693.

1908. July 11.
G. M. T. 16h 58m

Observed by J. S. Plaskett.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0160	....	....	....	1½	45·1437	·1197	·1198	125·07
1	72·7961	·7998	·0650	– 94·52	1	27·2885	·2685	·1440	124·99
1	54·7200	....	....	....	2	27·2267	....	....	....
2	53·8695	·8415	·1283	147·67	1	11·7051	·6841	·1073	– 115·31
2	53·0811	....	....	....	2	11·4860	....	....	....
2	45·2396	....	....	....					

Weighted mean .... – 125·81
V_a .... – 11·83
V_d .... – ·14
Curvature .... ·28

Radial velocity .... – 138·1

ε HERCULIS 1693.*

1908. July 11.
G. M. T. 16h 58m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	54·6857	....	....	....	1½	27·2729	·3166	·0960	83·33
2	53·8389	·8908	·0790	−90·93	2	27·2031	....	....	....
1	53·0466	....	....	....	1	11·6737	·7328	·1186	88·83
2	45·2135	....	....	....	2	11·4481	....	....	....
1	45·1326	·1927	·0460	48·02					

Weighted mean	80·67
V_a	11·83
V_d	·14
Curvature	·28
Radial velocity	−92·9

* Check measurement.

ε HERCULIS 1699.

1908. July 13.
G. M. T. 16h 19m

Observed by J. S. Plaskett.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	72·9161	....	....	....	½	27·3386	·3706	·0513	+44·53
½	72·7681	·8611	·0037	− 5·37	2	27·2138	....	....	....
½	72·3520	....	....	....	1½	11·8957	·9057	·0543	+40·67
2	45·2128	....	....	....	2	11·4945	....	....	....
1	45·1745	·2353	·0034	− 3·55					

Weighted mean		+22·00
V_a	−12·28	
V_d	− ·14	
Curvature	− ·28	
Radial velocity		+ 9·3

ε HERCULIS 1699.*

1908. July 13
G. M. T. 16h 19m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	72·8786	....	....	....	1	52·9980	....	....	....
½	72·7355	·8648	·0000	0·00	2	45·1721	....	....	....
½	72·3211	....	....	....	1	45·1655	·2670	·0283	+29·54
2	54·6267	....	....	....	1½	11·8675	·9317	·0803	+60·14
1	53·8710	·9856	·0158	+18·18	2	11·4430	....	....	....

Weighted mean		+34·48
V_a	12·28	
V_d	− ·14	
Curvature	− ·28	
Radial velocity		+21·8

* Check measurement.

ε HERCULIS 1707.

1908. July 14.
G. M. T. 17ʰ 42ᵐ

Observed by W. E. Harper.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	72·9823	....	....	....	2	45·2751	....	....	....
1	72·8174	·8454	·0194	−28·15	2	45·2115	·2100	·0287	29·96
1	72·4157	....	....	....	2	27·4009	·3709	·0417	36·20
2	54·7221	....	....	....	2	27·2759	....	....	....
½	53·9413	·9573	·0125	14·39	2	11·8686	·8106	·0408	30·56
2	53·0976	....	....	....	2	11·5667	....	....	....

Weighted mean	−30·50
V_a	−12·58
V_d	− ·19
Curvature	− ·28
Radial velocity	−43·6

ε HERCULIS 1712.

1908. July 15.
G. M. T. 17ʰ

Observed by, Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7925	....	....	....	1	27·4303	·3593	·0533	46·26
½	53·9323	·8803	·0795	−91·50	2	27·3102	....	....	....
2	53·1660	....	....	....	1	11·7814	·7214	1300	−97·37
2	45·3233	....	....	....	2	11·5675	....	....	....
1½	45·2363	·1863	·0524	54·71					

Weighted mean	−67·88
V_a	−12·81
V_d	− ·14
Curvature	− ·28
Radial velocity	−81·1

ε HERCULIS 1713.

1908. July 15.
G. M. T. 17ʰ 45ᵐ

Observed by W. E. Harper.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	72·9943	....	....	....	2	45·2700	....	....	....
½	72·8335	·8495	·0153	−22·20	1½	45·1889	·1924	·0463	48·34
1	72·4275	....	....	....	1½	27·3745	·3583	·0543	47·13
2	51·7248	....	....	....	2	27·2630	....	....	....
1	53·8913	·9083	·0615	70·79	1½	11·8010	·7715	·0799	−59·92
2	53·1022	....	....	....	2	11·5368	....	....	....

Weighted mean	−52·49
V_a	−12·80
V_d	− ·19
Curvature	− ·28
Radial velocity	−65·8

ε HERCULIS 1719.

1908. July 16.
G. M. T. 17ʰ 25ᵐ

Observed by W. E. Harper.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7686	....	....	....	1	27·4669	·4142	·0077	− 6·68
2	53·9945	·9675	·0023	− 2·65	2	27·2995	....	....	....
2	53·1399	....	....	....	2	11·9217	·8562	·0048	+ 3·59
2	45·3019	....	....	....	2	11·5731	....	....	....
1½	45·2698	·2368	·0019	− 1·98					

Weighted mean	− 0·27
V_a	− 13·03
V_d	− ·19
Curvature	− ·28
Radial velocity	− 13·8

ε HERCULIS 1720.

1908. July 22.
G. M. T. 17h

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	57·8345	....	....	....	1	45·2245	·2114	·0173	−18·06
1	57·8370	·8333	·0065	+ 7·83	1½	24·1614	....	·0076	+ 6·46
1	54·7533	.....	....	.....	2	24·1536	....	....	....
1½	53·9636	·9510	·0188	−21·64	1	11·8589	·8290	·0224	−22·57
1	53·1255	....	....	......	2	11·5373	....	....	....
2	45·2867	....	.	....					

Weighted mean	−	9·26
V_a	−	14·00
V_d	−	·19
Curvature	−	·28
Radial velocity	−	23·7

ε HERCULIS 1723.

1908. July 24.
G. M. T. 14h

Observed by / Measured by } W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9270	....	. .	....	2	53·0155	..... .	....	....
½	72·7558	·8416	·0232	−33·66	2	45·1800	....	....	....
1	72·3561	....	...	....	1½	45·1312	·2248	·0139	−14·51
2	59·7270	......	.....	....	2	37·8697	....	....	....
1	58·9550	·0377	·0030	− 3·66	1½	37·6784	·7674	·0127	+12·24
1	57·7351	·8188	·0080	− 9·63	1	27·3058	·3850	·0276	23·96
2	57·5079	....	....	....	2	27·1684	....	....	....
2	51·6556	....	....	....	1	11·7612	·8374	·0140	−10·49
1½	53·8752	·9665	·0033	− 3·80	2	11·4310	....	....	....

Weighted mean	−	8·20
V_a	−	14·35
V_d		·00
Curvature	−	·28
Radial velocity		23·8

ε HERCULIS 1728.

1908. July 25.
G. M. T. 17h 20m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·8772	....	....	....	1½	45·3992	·2740	·0353	+36·85
2	54·1331	·0021	·0323	+37·18	1	24·5975	·4648	·0522	+45·31
2	53·2387	....	....	....	2	24·3793	....	....	....
2	45·3988	....	....	....					

Weighted mean....................		+ 38·89
V_a	14·53	
V_d	− ·22	
Curvature............	·28	
Radial velocity		+ 23·9

ε HERCULIS 1729

1908. July 26
G. M. T. 16h 58m

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0485	....	....	....	2	53·1465	....	....	....
1	72·8867	·8482	·0166	−24·08	2	45·3092	....	....	....
2	72·4827	....	....	....	1½	45·2855	·2500	·0113	+11·80
1	57·8605	·8279	·0011	+ 1·32	1	27·4567	·4100	·0026	− 2·26
2	57·8620	....	....	....	2	27·2950	....	....	....
2	54·7767	....	....	....	1½	11·8964	·8496	·0018	− 1·35
1	53·9981	·9635	·0063	− 7·25	2	11·5540	....	....	....

Weighted mean	− 2·37
V_a	−14·71
V_d	− ·20
Curvature....................	− ·28
Radial velocity..................	− 17·6

ε HERCULIS 1734.

1908. July 28.
G. M. T. 17h 12m

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·4230	....	....	....	1	45·1967	·2434	·0047	+ 4·91
2	59·7721	....	....	....	½	27·3527	·3951	·0175	−15·19
2	54·7033	....	....	....	2	27·2043	....	....	....
1	53·9145	·9547	·0151	−17·38	1	11·7436	·8210	·0304	−22·77
2	53·0702	....	....	....	2	11·4292	....	....	....
2	45·2269	....	....	....					

Weighted mean....................	−12·24
V_a....................	−15·07
V_d....................	− ·22
Curvature....................	− ·28
Radial velocity....................	− 27·8

ε HERCULIS 1737.

1908. July 29.
G. M. T. 14h 22m

Observed by J. S. Plaskett.
Measured by W. E. Harpér.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9830	....	....	....	1	29·8960	·9563	·0333	+32·10
1	72·8682	·8968	·0320	+46·45	2	29·8627	....	....	....
1	72·4145	....	....	....	½	27·3845	·4478	·0352	+30·55
2	54·6912	....	....	....	2	27·1833	....	....	....
1	53·9795	·0321	·0623	+71·71	1½	11·8437	·9232	·0718	+53·78
2	54·0574	....	....	....	1	11·6321	....	....	....
2	45·2190	....	....	....	2	11·4277	....	....	....
1	45·2345	·2891	·0504	+52·61					

Weighted mean....................		+49·80
V_a....................	−15·17	
V_d....................	− ·06	
Curvature....................	− ·28	
Radial velocity....................		+34·3

ε HERCULIS 1738.

1908. July 29.
G. M. T. $15^h 08^m$

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7011	....	....	....	1	45·2290	·2753	·0366	+38·21
1	53·9824	·0240	·0542	+62.38	2	29·8783	....	....	....
2	53·0696	....	....	....	1	11·8603	·9186	·0672	+50·35
2	45·2273	....	....	....	2	11·4489	....	....	....

Weighted mean		+50·31
V_a	−15·17	
V_d	− ·11	
Curvature	− ·28	
Radial velocity		+ 34·7

ε HERCULIS 1743.

1908. July 29.
G. M. T. $18^h 05^m$

Observed by J. B. CANNON.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0345	....	....	....	2	54·0317	·0317	·0619	+71·25
½	72·8884	·8670	·0022	+ 3·19	2	53·1037	....	....	....
2	72·4567	....	....	....	2	45·2694	....	....	....
2	54·7492	....	....	....	1	45·2692	·2734	·0347	+36·23
3	54·0298	....	....	....					

Weighted mean		+ 55·91
V_a	− 15·17	
V_d	− ·25	
Curvature	− ·28	
Radial velocity		+ 40·2

ε HERCULIS 1746.

1908. July 30.
G. M. T. $17^h 06^m$

Observed by } W. E. HARPER.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7460	....	....	....	2	45·2629	....	....	....
2	53·9640	·9628	·0070	− 8·06	½	45·2283	·2390	·0003	+ 0·31
2	53·1102	....	....	....					

Weighted mean		− 6·47
V_a		− 15·27
V_d		− ·24
Curvature		− ·28
Radial velocity		− 22·3

ε HERCULIS 1751.

1908. July 31.
G. M. T. $15^h\ 40^m$

Observed by T. H. Parker.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	57·8225	....	....	....	2	53·1145	....	....	....
½	57·7790	·7859	·0410	– 49·36	2	45·2711	....	....	....
2	54·7461	....	....	....	½	45·1693	·1717	·0670	– 69·95
1½	53·9111	·9078	·0620	– 71·36					

Weighted mean	– 66·38
V_a	– 15·65
V_d	·15
Curvature	·28
Radial velocity	– 82·5

ε HERCULIS 1757.

1908. July 31.
G. M. T. $19^h\ 05^m$

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0630	....	....	....	2	53·1403	....	....	....
1	72·8552	·8035	·0613	– 88·95	2	45·2950	....	....	....
2	72·4921	....	....	....	2	45·1940	·1726	·0661	– 69·00
2	54·7682	....	....	....	½	27·3792	·3631	·0495	– 42·97
1½	53·9147	·8874	·0824	– 94·84	1	27·2627	....	....	....

Weighted mean	– 78·14
V_a	15·65
V_d	– ·28
Curvature	– ·28
Radial velocity	– 94·3

ε HERCULIS 1760.

1908. Aug. 1.
G. M. T. $16^h\ 49^m$

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7274	....	....	....	2	45·2642	....	....	....
1½	53·9500	·9643	·0055	– 6·35	1	45·2251	·2345	·0043	– 4·49
2	53·0979	....	....	....					

Weighted mean	– 5·61
V_a	– 16·03
V_d	– ·22
Curvature	– ·28
Radial velocity	– 22·1

ε HERCULIS 1761.

1908. Aug. 5.
G. M. T. 14h 05m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0351	....	....	....	2	53·1047	....	....	....
1	72·8896	·8680	·0032	+ 4·64	2	45·2597	....	....	....
2	72·4630	....		....	1½	45·2062	·2201	·0186	−19·42
2	57·8205	....		....	1	27·3982	·4028	·0098	− 8·52
1½	57·8034	·8123	·0145	−17·46	2	27·2420	....	....	....
2	54·7326	....	....	....	1½	11·8337	·8494	·0020	− 1·50
1½	53·9471	·9554	·0144	−16·57	2	11·4915	....	....	....

Weighted mean........	−12·04
V_a............	−16·25
V_d............	− ·08
Curvature........	− ·28
Radial velocity........	−28·6

ε HERCULIS 1774.

1908. Aug. 7.
G. M. T. 15h 35m

Observed by T. H. Parker.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	57·8210	....	....	....	½	45·2291	·2317	·0070	− 7·31
1	57·8004	·8088	·0180	−21·67	½	27·4238	·4026	·0100	− 8·68
2	54·7349	....	....	....	2	27·2676	....	....	....
½	53·9647	·9711	·0013	+ 1·50	1½	11·8833	·8514	·0000	0·00
2	53·1063	....	....	....	2	11·5393	....	....	....
2	45·2710	....	....	....					

Weighted mean........	− 7·23
V_a............	−16·35
V_d............	·17
Curvature........	− ·28
Radial velocity........	−24·0

ε HERCULIS 1782.

1908. Aug. 15.
G. M. T. 16h 50m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9712	....	....	....	2	53·9308	·9566	·0132	−15·19
1	72·8162	·8545	·0103	−14·94	2	53·0801	....	....	....
2	72·4052	....	....	....	2	45·2550	....	....	....
2	57·7983	....	....	....	2	45·2055	·2241	·0146	−15·24
1½	57·7814	·8125	·0143	−17·21	1	27·3902	·3902	·0336	−29·16
2	54·7181	....	....	....	2	27·2578	....	....	....

Weighted mean	−17·44
V_a	−17·09
V_d	− ·24
Curvature	− ·28
Radial velocity	−35·0

ε HERCULIS 1793.

1908. Aug. 19.
G. M. T. 14h 41m

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	71·8997	....	....	....	1	66·5842	·5905	·0873	−37·19
1	71·8180	·8198	·0673	−29·58	2	61·4037	....	....	....
2	68·7255	....	....	....	½	61·1977	·2033	·0412	−16·93

Weighted mean	−30·09
V_a	−17·29
V_d	− ·15
Curvature	− ·28
Radial velocity	−47·8

ε HERCULIS 1818.

1908 Aug. 24.
G. M. T. 14h 03m

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9400	....	....	....	1	53·0350	....	....	....
1	72·7367	·8053	·0595	−86·33	2	45·2000	....	....	....
2	72·3715	....	....	....	1½	45·1002	·1737	·0650	−67·86
2	54·6722	....	....	....	1	27·2776	·3336	·0790	−68·57
2	53·9557	....	....	....	2	27·1906	....	....	....
1	53·8285	·9018	·0680	−78·27					

Weighted mean	−74.44
V_a	−17·55
V_d	− ·15
Curvature	− 28
Radial velocity	− 92·4

ε HERCULIS 1838.

1908. Aug. 27.
G. M. T. 15h 50m

Observed by J. B. Cannon.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9994	...	...	...	2	45·2716	...	...	...
1	72·8367	·8463	·0185	−26·84	1	45·2345	·2365	·0022	− 2·30
2	72·4383	...	...	...	1	27·4216	·3991	·0135	−11·72
2	57·8226	...	...	...	2	27·2694	...	...	...
1	57·8302	·8344	·0076	+ 9·15	1	11·8840	·8453	·0061	− 4·55
2	54·0265	...	...	...	2	11·5462	...	...	...
1½	54·9656	·9679	·0019	− 2·19					

Weighted mean	− 5·82
V_a	−17·66
V_d	− ·24
Curvature	− ·28
Radial velocity	−24·0

ε HERCULIS 1844.

1908. Aug. 28.
G. M. T. 14h 07m

Observed by J. B. Cannon.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0320	...	...	...	2	45·1750	·1561	·0826	−86·23
½	72·8382	·8158	·0490	−71·10	½	27·3755	·3441	·0685	−59·46
2	72·4677	...	...	...	2	27·2780	...	...	...
2	54·0522	...	...	...	1	11·7805	·7394	·1120	−82·79
1	53·9207	·8973	·0725	−81·45	2	11·5485	...	...	...
2	45·2925								

Weighted mean	−80·80
V_a	−17·63
V_d	− ·16
Curvature	− ·28
Radial velocity	−98·9

ε HERCULIS 1853.

1908. Aug. 31.
G. M. T. 13h 52m

Observed by / Measured by } W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·0330	...	...	...	1	45·2510	·2530	·0143	+14·93
2	53·9830	·9788	·0100	+11·51	¼	27·4040	·4166	·0040	+ 3·47
2	45·2716	...	...	...	2	27·2340	...	...	...

Weighted mean	+ 11·94
V_a	− 17·63
V_d	− ·16
Curvature	− ·28
Radial velocity	− 6·1

ε HERCULIS 1866.

1908. Sept. 4.
G. M. T. 14h 32m

Observed by J. B. Cannon.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·0286	......	....	....	2	45·2756	....	....	....
1½	53·9682	·9684	·0014	− 2·03	¾	45·2387	·2367	·0020	− 2·09

Weighted mean	− 2·05
V_a	− 17·56
V_d	− ·22
Curvature	− ·28
Radial velocity	− 20·1

ε HERCULIS 1903.

1908. Oct. 1.
G. M. T. 13h 12m

Observed by W. E. Harper.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9627	....	....	....	2	53·0938	....	....	....
½	72·8369	·8850	·0202	+ 29·31	2	45·2707	....	....	....
2	72·3935	....	....	....	½	45·2698	·2727	·0340	35·96
2	54·7217	....	....	....	2	43·5385	....	....	....
½	53·9629	·9891	·0121	13·93	1	43·0812	·0811	·0308	+ 31·38

Weighted mean	+ 28·39
V_a	− 13·58
V_d	− ·23
Curvature	− ·28
Radial velocity	+ 14·3

ε HERCULIS 1903.*

1908. Oct. 1
G. M. T. 13h 12m

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	57·8380	....	....	....	2	54·0527	....	....	....
¼	57·8367	·8255	·0113	− 13·60	½	45·3017	·2673	·0286	+ 31·95
¾	53·0120	·9881	·0183	+ 21·06	2	45·3080	.....	....	....

Weighted mean	+ 22·17
V_a	13·58
V_d	− ·23
Curvature	− ·28
Radial velocity	+ 8·1

* Check measurement.

ε HERCULIS 1905.

1908. Oct. 2.
G. M. T. 12^h 23^m

Observed by / Measured by T. H. PARKER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9333				½	53·9743	·0083	·0385	+44·31
½	72·8133	·8888	·0240	+34·82	2	53·0845			
2	72·3735				2	45·2615			
2	54·7063				½	45·2510	·2631	·0244	+25·47

Weighted mean		+34·86
V_a	16·17	
V_d	− ·19	
Curvature	·28	
Radial velocity		+18·2

ε HERCULIS 1905.*

1908. Oct. 2.
G. M. T. 12^h 23^m

Observed by T. H. PARKER.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0219				1	54·0557	·9920	·0222	+25·55
½	72·9047	·8923	·0275	+39·90	2	45·3540			
2	72·4605				1½	45·3672	·2868	·0481	+50·22
2	54·0925								

Weighted mean		+40·28
V_a	16·17	
V_d	− ·19	
Curvature	− ·28	
Radial velocity		+23·6

* Check measurement.

ε HERCULIS 1906.

1908. Oct. 2.
G. M. T. 13^h 18^m

Observed by / Measured by T. H. PARKER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9878				2	45·2706			
½	72·8491	·8716	·0068	+9·86	1	45·2536		·0179	+18·69
2	72·4218				½	27·4469	·3999	·0127	−11·02
2	54·7350				2	27·2936			
½	53·9915	·9995	·0297	+34·18	½	15·5485	·4771	·0040	+ 2·93
2	53·1029				2	15·4700			

Weighted mean	+12·22	
V_a		−16·17
V_d		− ·23
Curvature		− ·28
Radial velocity		4·4

ε HERCULIS 1906.*

1908. Oct. 2.
G. M. T. 13ʰ 18ᵐ

Observed by T. H. PARKER.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0126	....	....	....	½	45·2729	·2434	·0047	+ 4·81
½	72·8790	·8759	·0111	+16·11	2	45·3031	....	....	....
2	72·4515	....	....	....	½	27·4884	·4016	·0110	− 9·55
2	54·0508	....	....	....	2	27·3237	....	....	....
¾	53·9882	·9662	·0036	− 4·14					

Weighted mean........	+ 1·15	
V_a		−16·17
V_d		− ·23
Curvature		− ·28
Radial velocity		−15·5

* Check measurement.

ε HERCULIS 1917.

1908. Oct. 5
G. M. T. 12ʰ 45ᵐ

Observed by T. H. PARKER.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	53·9338	....	....	....	1	53·9042	·9992	·0204	+33·84

Weighted mean........		+33·84
V_a	−15·21	
V_d	− ·22	
Curvature	− ·28	
Radial velocity........		+18·1

ε HERCULIS 1926.

1908. Oct. 12.
G. M. T. 14ʰ 15ᵐ

Observed by / Measured by: T. H. PARKER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7809	....	....	....	2	45·3392	....	....	....
½	53·0112	·9684	·0014	− 1·61	½	45·2745	·2089	·0298	−31·11
2	53·1586	....	....	....					

Weighted mean........	−16·36
V_a	−12·99
V_d	− ·28
Curvature........	− ·28
Radial velocity	−29·9

ε HERCULIS 1926.*

1908. Oct. 12.
G. M. T. 14^h 15^m

Observed by T. H. Parker.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9282	...	...	...	1	53·9142	·9648	·0050	5·55
¼	72·7570	·8383	·0265	38·47	2	45·2412	...	...	...
2	72·3640	...	...	...	¾	45·1955	·2281	·0106	−11·06
2	53·9777	...	...	...					

Weighted mean .... 11·73
V_a .... −12·99
V_d .... −·28
Curvature .... −·28

Radial velocity .... −25·3

* Check measurement.

ε HERCULIS 1961.

1908. Nov. 13.
G. M. T. 10^h 33^m

Observed by W. E. Harper.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9540	...	...	...	1½	45·1868	·1763	·0725	75·91
½	72·7900	·7980	·0207	−30·08	1	27·4609	·4488	·0394	34·36
2	72·3992	...	...	...	2	27·3340	...	...	...
2	54·0249	...	...	...	½	11·8665	·8626	·1378	−103·76
1	54·9106	·9010	·0556	64·16	2	11·6620	...	...	...
2	45·2941	...	...	...					

Weighted mean .... −62·07
V_a .... 4·70
V_d .... −·23
Curvature .... −·28

Radial velocity .... −67·3

ε HERCULIS 1961.*

1908. Nov. 13.
G. M. T. 10^h 33^m

Observed by W. E. Harper.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9915	...	...	...	2	48·8173	...	...	...
½	72·8067	·8233	·0415	−60·22	½	48·1143	·0670	...	...
2	72·4317	...	...	...	2	45·3301	...	...	...
2	54·7682	...	...	...	1	45·2254	·1689	·0698	72·87
1	53·9192	·8912	·0603	62·42	1	27·4192	·3334	·0792	−67·74
2	53·1417	...	...	...	2	27·3324	...	...	...

Weighted mean .... −66·75
V_a .... −4·69
V_d .... −·25
Curvature .... −·28

Radial velocity .... −71·8

* Check measurement.

ε HERCULIS 1961.*

1908. Nov. 13.
G. M. T. $10^h\ 33^m$

Observed by W. E. Harper.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9300	......	......	......	2	53·0847	......	......	......
½	72·7524	·7849	·0338	−48·11	2	45·2672	......	......	......
2	72·3700	......	......	......	1	45·1730	·1894	·0593	62·09
2	54·7057	......	......	......	½	11·8557	·8791	·1213	−91·95
¼	53·8622	·8807	·0759	87·59	2	11·6345	......	......	......

Weighted mean	−68·24
V_a	− 4·70
V_d	− ·23
Curvature	− ·28
Radial velocity	−73·4

* Check measurement.

ε HERCULIS 1983.

1908. Nov. 26.
G. M. T. $10^h\ 07^m$

Observed by W. E. Harper.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9887	......	......	......	2	53·1422	......	......	......
2	72·4267	......	......	......	2	45·3295	......	......	......
2	57·8410	......	......	......	½	45·2686	·2237	·0250	−26·17
¼	57·8284	·7837	·0210	−25·32	2	27·3610	......	......	......
2	54·7670	......	......	......	2	11·6692	......	......	......
1	53·9637	·9227	·0339	39·12					

Weighted mean	−29·54
V_a	− ·79
V_d	− ·25
Curvature	− ·28
Radial velocity	−30·9

ε HERCULIS 1993.

1908. Dec. 2.
G. M. T. $11^h\ 05^m$

Observed by J. B. Cannon.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0015	......	......	......	2	54·0327	·9273	·0159	18·28
½	72·8197	·7353	·0368	−53·51	2	45·3945	......	......	......
2	72·4371	......	......	......	1	45·3182	·2173	·0416	−43·68
2	54·1072	......	......	......					

Weighted mean	−30·57
V_a	+ 1·12
V_d	− ·28
Curvature	− ·28
Radial velocity	−30·0

ε HERCULIS 2263.

1909. Feb. 8.
G. M. T. 22h 08m

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·8987	......	......	......	1	45·2382	·1897	·0692	79·51
½	72·7145	·7305	·0416	−60·49	½	27·5582	·5058	·0560	49·56
2	72·3414	......	......	......	2	27·4495	......	......	......
2	54·0360	......	......	......	½	12·1170	·1096	·0391	−29·56
1	53·9233	·8891	·0541	62·57	2	11·8145	......	......	......
2	45·3421	......	......	......					

Weighted mean		− 60·54
V_a	+ 17·19	
V_d	+ ·16	
Curvature		− ·28
Radial velocity		− 43·5

ε HERCULIS 2264.

1909. Feb. 8.
G. M. T. 23h

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·8680	......	......	......	1	45·2202	·2118	·0471	−54·12
½	72·6942	·7400	·0321	−46·67	1	27·5152	·5061	·0551	−49·29
1	72·3157	......	......	......	2	27·4062	......	......	......
2	54·0053	......	......	......	1	12·0368	·0711	·0776	−58·66
1½	53·8918	·8878	·0554	−64·07	2	11·7743	......	......	......
2	45·3020	......	......	......					

Weighted mean		− 56·30
V_a	+ 17·19	
V_d	+ ·12	
Curvature		− ·28
Radial velocity		− 39·3

ε HERCULIS 2305.

1909. Feb. 22.
G. M. T. $21^h\ 34^m$

Observed by J. B. CANNON.
Measured by W. E. HARPER

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9872	......	......	......	½	53·9658	·9111	·0321	−37·13
½	72·8275	·7571	·0150	−21·81	2	45·3275	......	......	......
2	72·4233	......	......	......	1	45·2636	·2295	·0294	−30·87
2	57·8428	......	......	......	½	27·4794	·4953	·0665	−58·22
1½	57·8125	·7522	·0303	−36·63	2	27·3812	......	......	......
2	54·0565	......	......	......					

Weighted mean		− 36·09
V_a	+ 17·95	
V_d	+ ·15	
Curvature..............		− ·28
Radial velocity		− 18·2

ε HERCULIS 2306.

1909. Feb. 22.
G. M. T. $22^h\ 36^m$

Observed by J. B. CANNON.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9687	......	......	......	2	45·3155	......	......	......
½	72·8071	·7544	·0177	−25·74	1	45·2637	·2415	·0174	−18·27
1	72·4092	......	......	......	½	27·5020	·5276	·0342	−29·93
1	57·7942	......	......	......	2	27·3725	......	......	......
2	57·8290	·7477	·0348	−42·05	1	11·9835	·0905	·0582	−44·00
2	54·0450	......	......	......	2	11·7002	......	......	......
1	53·9530	·9100	·0332	−38·40					

Weighted mean		− 34·12
V_a	+ 17·95	
V_d	+ ·09	
Curvature..............		− ·28
Radial velocity		− 16·4

ε HERCULIS 2327.

1909. March 2.
G. M. T. 21ʰ 12ᵐ

Observed by J. B. CANNON.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9387	....	....	....	2	45·2988	....	....	....
½	72·8030	·7800	·0079	+11·49	1¼	45·3043	·2991	·0402	+42·21
2	72·3801	....	....	....	½	12·6685	·1891	·0404	+30·54
2	54·0227	....	....	....	2	11·6875	....	....	....
¾	53·9890	·9681	·0249	+28·70					

Weighted mean .... +31·76
V_a .... +17·90
V_d .... + ·14
Curvature .... − ·28

Radial velocity .... + 49·5

ε HERCULIS 2328.

1909. March 2.
G. M. T. 22ʰ 26ᵐ

Observed by J. B. CANNON.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	53·9935	....	....	....	2	45·2644	....	....	....
1	53·9260	·9343	·0091	−10·52	½	45·2350	·2642	·0053	+ 5·56

Weighted mean .... 5·16
V_a .... +17·90
V_d .... + ·05
Curvature .... − ·28

Radial velocity .... + 12·5

ε HERCULIS 2370*.

1909. March 13.
G. M. T, 18ʰ 35ᵐ

Observed by J. S. PLASKETT.
Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	50·9370	....	....	....	½	34·7430	34·7193	·1038	−100·00
1	50·8242	·8081	·0804	−93·05	2	34·6975	....	....	....

Weighted mean .... −95·36
V_a .... +17·44
V_d .... − ·19
Curvature .... − ·30

Radial velocity .... −78·0

* This plate and all following were taken by the new single-prism Spectroscope.

ε HERCULIS 2371.

1909. March 13.
G. M. T. 19h 23m

Observed by J. S. Plaskett.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	58·8462	....	....	....	1	50·8549	·8347	·0538	−62·27
¼	58·7184	·6911	·0741	−94·51	½	34·7589	·7401	·0820	−79·00
2	50·9411	....	....	....	2	34·6926	....	.. ..	....

Weighted mean..........	....	−71·66
V_a...............	+17·44	
V_d.......	+ ·19	
Curvature.................		− ·30
Radial velocity.......		−54·3

ε HERCULIS 2384.

1909. March 15.
G. M. T. 19h 32m

Observed by W. E. Harper.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	58·8228	. . ...	....	....	2	50·9196	....	. . ...	....
¼	58·7768	·7729	·0077	+ 9·82	½	50·9081	·9094	·0209	−24·19

Weighted mean....		−19·40
V_a....		+17·16
V_d......		+ ·18
Curvature.........	− ·30	
Radial velocity...		−36·4

ε HERCULIS 2385.

1909. March 15.
G. M. T. 20h 30m

Observed by W. E. Harper.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	58·8349	....	....	....	1	50·9261	·9091	·0206	−23·84
¼	58·7924	·7764	·0112	+14·29	¼	34·8678	·8413	·0192	+18·50
2	50·9379	....	....	....	2	34·7003	....	....	....

Weighted mean......................		+21·36
V_a......................		+17·16
V_d...		+ ·18
Curvature.........	− ·30	
Radial velocity........... ...		+38·4

ε HERCULIS 2454.

1909. March 21.
G. M. T. 20ʰ 05ᵐ

Observed by } J. B. Cannon.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	58·8306	....	....	....	1	50·9084	·9091	·0206	+23·84
½	58·7836	·7720	·0068	+ 8·67	½	34·7992	·8274	·0053	+ 5·11
2	50·9202	....	....	....	2	34·6456	....	....	....

Weighted mean		+15·34
V_a		+14·93
V_d		− ·06
Curvature	·30	
Radial velocity		+30·0

ε HERCULIS 2455.

1909. March 31.
G. M. T. 20ʰ 39ᵐ

Observed by } J. B. Cannon.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	58·8294	....	....	....	1	50·9111	·9091	·0206	+23·84
½	58·8022	·7917	·0265	+33·80	½	34·7789	·8005	·0216	−20·90
2	50·9229	....	....	....	2	34·6522	....	....	....

Weighted mean		+15·15
V_a		+14·93
V_d		+ ·06
Curvature	− ·30	
Radial velocity		+29·8

OBSERVING RECORD AND DETAILED MEASURES OF η BOÖTIS.

P.—PLASKETT.
P[1].—PARKER.
H.—HARPER.
C.—CANNON.
T.—TRIBBLE.

RECORD OF SPECTROGRAMS.

Star.	No. of Negative.	Camera.	Plate.	Date.	Middle of Exposure (G. M. T.) h.	Middle of Exposure (G. M. T.) m.	Duration.	Hour Angle at end. h.	Hour Angle at end. m.	Temperature. Room. Beg.	Temperature. Room. End.	Temperature. Prism Box. Beg.	Temperature. Prism Box. End.	Slit Width.	Seeing.	Observer.
				1906.	h.	m.	m.	h.	m.	Fahrenheit.		Centigrade.				
η Boötis.	308	1L	Seed 27.	June 25	15	55	35	3	30W.	65 0	64 0	22 7	22 8	·001	Poor...	P
" ..	313	"	" ..	" 27	14	35	35	2	15W.	75·6	74·0	27·1	27·0	·001	Fair....	P
" ..	318c	"	" ..	" 29	14	21	18	2	10W.	77·4	76·2	27·0	27·0	·0009	" ..	P
" ..	326	"	" ..	July 4	14	50	60	3	15W.	62 5	60·9	21·3	21·4	·001	Fair to good ..	P
" ..	333	"	" ..	" 6	15	00	70	3	40W.	71·5	68 0	25·3	25·4	001	Fair....	P
" ..	366	"	" ..	Aug. 6	14	05	70	4	45W.	78·0	74·0	28·8	28·8	·001	Good...	P
" ..	372	"	" ..	" 8	14	15	75	5	10W.	80 8	77·5	29·5	29·3	·001	Fair....	P
				1907.												
" ..	657	"	" ..	Mar. 8	18	45	30		50E.	26·5	25·6	1·3	1·5	·0013	Fair....	P
" ..	670	"	" ..	" 20	18	32	45		10E.	28·6	28·3	2 8	2·9	·0013	Good...	P
" .	691	"	"	Apr. 3	18	02	35		15W.	44·0	40·2	9·8	10·1	·001	Poor...	P
" ..	731	"	" ..	" 19	18	35	10	1	37W.	34·8	34·5	10·4	10·4	·0013	Clouds.	P
" ..	739	"	" .	" 26	17	30	30	1	07W.	42·0	40·4	9·0	9·0	·0013	Fair....	P
" ..	752	"	" .	May 7	14	20	20	1	30E.	50·5	50·0	16·1	16·1	·0013	" ..	H
										Centigrade.						
" ..	760	IIIL	" ..	" 14	17	55	34	2	05W.	11 7	11·7	15·0	15·0	·0012	Very poor..	H
" ..	764	"	" ..	" 20	16	25	55	1	45W.	6·0	5·3	9·2	9·2	·0012	Unst'dy	H
" ..	769	"	" ..	" 22	16	51	47	2	20W.	10·5	10·5	13·2	13 2	·0012	Cloudy.	P
" ..	774	IL	" ..	" 23	14	08	16		37E.	15·5	15·0	17·3	17·3	·0012	Fair....	H
" ..	779	"	" ..	" 24	15	01	12		20W.	11·8	12·0	16·4	16·4	·001	Good...	P
" ..	793	"	" ..	" 29	16	46	27	2	30W.	8 0	8 0	14·5	14·5	·001	Cloudy.	P
" ..	797	"	" ..	" 31	14	54	12		45W.	15·2	15·2	19·0	19·0	·001	Good...	P
" ..	812	"	" ..	June 10	13	35	35	1	48W.	16·6	15·6	18·2	18·0	·0009	" ..	P
" ..	868	"	" ..	" 21	14	27	25	1	40W.	25·4	24·6	28 9	28·9	·001	Hazy ..	P
" ..	891	"	" ..	" 27	14	55	30	2	35W.	22·0	22·0	24·5	24·5	·0012	Fair ...	H
" ..	918	"	" ..	July 8	15	09	18	3	30W.	21·5	21·1	22·4	22·4	·0012	" ...	P
" ..	950	"	" ..	" 18	13	57	26	3	00W.	27·0	26·0	28·5	28·5	·0012	Very hazy..	T
" ..	972	"	" ..	Aug. 1	13	39	25	3	37W.	22·2	21·0	25·2	25·2	·001	Hazy ..	H
" ..	990	IIIL	" ..	" 7	13	58	50	4	30W.	23·1	22·0	24·1	24·1	·0015	Poor...	P
				1908.												
" ..	1231	IL	" ..	Jan. 14	22	00	26	1	10E.	−16·5	−18·0	− 5·2	− 5·5	·001	Hazy...	H
" ..	1294	IIIL	" ..	" 27	20	12	50	1	52E.	−20 0	−18·0	−15·3	−15·3	·0013	Good...	H
" ..	1307	"	" ..	" 29	21	14	62	1	07E.	−25·3	−25·5	−13·7	−13·7	·0013	Unst'dy	P
" ..	1332	"	" ..	Feb. 17	22	30	40	1	45W.	−17·5	−18·0	−10·5	−10·5	·0015	Good...	P
" ..	1357	"	" ..	" 24	19	06	47	1	20E.	−16·5	−15·5	−19·0	−18·6	·0013	Unst'dy	H
" ..	1446	"	" ..	Mar. 30	20	52	40	3	50W.	0·5	0·5	6·0	6·0	·002	Fair....	H
" ..	1513	"	" ..	May 4	18	13	55	2	40W.	8·0	7·0	13·4	13·3	·0017	Good ..	P[1]H
" ..	1553	"	" ..	" 25	15	58	61	1	50W.	21·3	20·5	25·6	25·4	·0016	" ...	P[1]
" ..	1557	"	" ..	" 23	16	00	50	1	45W.	21·5	20·7	25·7	25·6	·0015	Fair....	P
" ..	1621	"	" ..	June 22.	14	10	30	2	35W.	20·0	19·6	24·0	23·8	·0015	" ..	P
" ..	1663	"	" ..	July 6	14	40	80	3	25W.	25·3	24 8	26·8	26·3	·0015	Good...	P
" ..	1710	"	" ..	" 15	14	41	102	4	11W.	19·5	18·0	21·8	21·6	·0015	Cloudy.	C
" ..	1792	"	" ..	Aug. 19	13	18	60	4	47W.	18·8	16·5	24 3	23·8	·0018	Good...	H
" ..	1867	"	" ..	Sept. 7	12	57	65	5	40W.	18·2	17·6	21·4	21·2	·0015	Fair....	P
				1909.												
" ..	2115	"	" ..	Jan. 7	23	23	60		10W.	−20·0	−20·5	−13·6	−13·6	·0016	Fair....	P
" ..	2209	"	" ..	" 30	18	37	45	3	20E.	− 8·3	− 8·5	− 2·8	− 2 9	·0016	Unst'dy	P
" ..	2283	"	" ..	Feb. 17	20	30	62		00	−12·0	−12·0	− 1·3	− 1 3	·0015	Good...	C
" ..	2396	"	" ..	Mar. 20	17	00	60	1	30E.	− 2·3	− 3·3	4·6	4·6	·0015	Fair ...	P

η BOÖTIS 308.

1906. June 25.
G. M. T. 15h 55m

Observed by J. S. PLASKETT.
Measured by J. N. TRIBBLE.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.
3	65·1413	4583·661	.....	.....	.....	....	1⅓	46 0370	4376·165	....	.....	.....	....
2	62·3546	4550·101	·165	·766	·399	+26·28	1½	45·4280	4370·332	·276	·856	420	30·61
1	60·7590	4531·441	·473	·201	272	17·99	1½	41·8841	4337·216	.....	.....	.....	....
1	60·5605	4529·147	·171	·807	·364	24·10	1	39·8944	4319·219	·191	·817	·374	38·64
1½	60·0525	4523·302	·318	·055	·263	17·43	¾	39·7049	4317·527	·503	·068	·435	30·21
2	57·5179	4494·721	.....	.....	.....	....	1⅓	39·4547	4315·298	....	.....	.....	.....
1⅓	54·9606	4466·816	.....	.....	.....	....	¾	39·4909	4315·620	·600	·178	·422	29·33
¾	54·2971	4459·723	·651	·304	·347	23·32	2	37·(639	4294·322	.....	.....	.....	....
1¾	54.2635	4459·366	.....	.....	.....	....	⅔	33·1023	4260·796	·820	·503	·317	22·30
1⅓	53·8823	4455 320	·240	·962	·278	18·71	1	29·7582	4233·629	·685	·462	·223	15·79
¾	51·2524	4427·927	·855	·420	·435	29·45	1	31·9013	4250·924	·972	·643	·329	+23·21
1½	49·0104	4405·271	·199	·951	·320	21·78	2	22·9884	4181·569	.....	.....	.....	....

Weighted mean	+23·08	
V_a		−24·87
V_d		− ·25
Curvature		− ·28
Radial velocity		− 2·3

η BOÖTIS 313.

1906. June 27.
G. M. T. 14h 35m

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.
2	70·0228	4549·704	.....	.....	.....	....	1	58·7715	4425·974	·982	·608	·374	25·31
2	70 0646	4550·199	·143	·766	·377	+24.84	2	57·7472	4415·579	·571	·244	·327	22 20
2	68·8922	4536·420	·408	·965	·443	29·28	2	56·7110	4405·198	·194	·951	·243	16·80
1	68·4773	4531·556	·552	·202	·350	23·13	3S	56·6837	....	.....	.....	.....	.....
1	68·3445	4530·057	·057	·784	·273	18·04	2	55·7498	4395·689	696	·286	·410	27 96
2	68·2790	4529·300	·297	·807	·490	32·38	1	54·5449	4383·928	·970	·720	·250	17·07
3S	68 2356	....	.....	.....	.....	....	1	54 5162	4383·650	.....	....	.....	.....
1	67·7616	4523·337	·345	·855	·490	32·38	1	53·1281	4370·320	·356	·856	·500	31 30
3	65·2295	4494·746	.....	.....	.....	....	1	52·9142	4368·285	·320	·840	·480	32·92
1	64·1575	4482·928	·924	·434	·490	32·88	2	51·2105	4352·272	·312	·006	·366	21·08
1	63·5802	4476·631	·631	·214	·420	28·09	3	48·3264	4325·902	....	.....	.....	.....
2	63·5399	4476·193	.....	.....	.....	....	2	47·8181	1321·348	·368	·992	·376	26·05
1	63·2805	4473·381	·377	·957	·420	28·10	2	47·1641	4315·529	·545	·178	·367	25·46
2	62·6605	4466·698	.....	.....	.....	....	3S	46·3197	....	.....	.....	.....	.....
2	59·7122	4435·639	·654	·184	·470	31·77	1	46·3142	4308·296	·296	·023	·273	18 97
1	58·9422	4427·719	·730	420	·310	20·98	2	46·1418	4306·521	·513	·153	·360	+25·02

Weighted mean		+25 87
V_a	−25·19	
V_d	− ·14	
Curvature	− ·50	
Radial velocity		0·0

η BOÖTIS 318c.

1906. June 29.
G. M. T. 14h 21m

Observed by J. S. PLASKETT.
Measured by J. N. TRIBBLE.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.
2½	65·1913	4584·018	.....	.....	.....	....	1½	46·8204	4383·596	.....	.....	.....	....
2	62·3803	4550·121	·205	·766	·439	+28·93	1½	45·5865	4371·738	·806	·312	·494	29·78
2	62·3321	4549·552	.....	.....	.....	....	1	45·4158	4370·111	·177	·856	·321	22 03
½	60·7998	4531·584	·664	·202	·462	30·59	1	45·2187	4368·238	·302	·840	·462	31·84
1½	60·5480	4528·712	.....	.....	.....	....	¾	42·2886	4340·901	·941	·634	·307	21·20
¾	60·0766	4523·289	·377	·855	·522	31·61	1½	39·4436	4315·255	.....	.....	.....	....
1½	57·5359	4494·635	.....	.....	.....	....	1	38·6660	4308 394	·390	023	·367	25·53
1½	54 2713	4459·185	.....	.....	.....	....	3	37·0462	4294·299	.....	.....	.....	....
1½	53·9012	4455·264	·384	·962	·422	28·40	1	35·7398	4283·122	·106	·721	·385	26·95
1	51·5610	4430·869	·985	·678	·307	20·78	1½	33·0517	4260·643	.....	.....	.....	....
2	50·0623	4415·601	·709	·293	·416	28·25	1	28·9306	4227·475	·463	·010	·453	32·12
1½	50·0089	4415·084	.....	.....	.....	....	1	25·2131	4198·823	·819	·403	.....	+28·78
2	49·0242	4405·227	·331	·951	·380	25·87	2	22·9474	4181·919	.....	.....	.....	....
1	46·8536	4383·917	·001	·720	·281	20·02							

Weighted mean .... + 27·55
V_a .... − 25·31
V_d .... − ·14
Curvature........... − ·28

Radial velocity .... + 1·8

η BOÖTIS 326.

1906. July 4.
G. M. T. 14h 50m

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.
2	47·9535	4321·280	·292	·992	·300	+20·97	1	62·1243	4459·686	·724	·304	·420	28·22
2	72·9821	4584·067	.....	.....	.....	....	2	61·7085	4455·266	·300	·962	·338	22·74
1	72·0410	4572·552	·528	·156	·372	24·32	1	61·3025	4450·975	·097	·654	·443	29·81
2	70·1726	4550 127	·126	·766	·360	23 68	2	59·0672	4427·735	·743	·420	·323	21·86
2S	70·1316	.....	.....	.....	.....	....	2	57·8787	4415·645	·638	·293	·345	23·42
2	68·9985	4536·325	·325	·965	·360	23·79	2	56·8425	4405·249	·251	·951	·300	20·43
1	68·3839	4529·186	·187	·807	·380	25·15	3S	56·8102	.....	.....	.....	.....	....
3	68·3512	4528·807	.....	.....	.....	....	2	55·8790	4395·702	·710	·286	·424	28·91
1	67·8624	4523·173	·165	·855	·310	20·55	3	54·6865	4384·041	·060	·720	·340	23·25
2	65·9783	4501·798	·786	·448	·338	22·47	2	54·6501	4383·688	.....	.....	.....	....
3	65·3427	4494·706	.....	.....	.....	....	2	53·4072	4371·721	·752	·312	·440	30·18
2	63·6949	4476·593	·584	·214	·370	24·75	1	53·0457	4368·273	·300	·840	·460	31·55
2	63·6582	4476·195	.....	.....	.....	....	2	51·3477	4352·284	·308	·006	·302	20·80
2	63·3995	4473·387	·407	·957	·450	30·15	3	50·1222	4340·944	·960	·634	·326	22·49
2	62·7750	4466·648	.....	.....	.....	....	3	48·4705	4325·922	.....	.....	.....	....
1	62·8070	4466·982	·061	·771	·290	19·45	3	47·3080	4315·523	·523	1·78	·345	+23·94
2	62·6324	4465·118	·158	·712	·446	29·92	3S	46·4662	.....	.....	.....	.....	....

Weighted mean .... + 24·70
V_a .... − 25·68
V_d .... − ·21
Curvature.......................... − ·50

Radial velocity .... − 1·7

η BOÖTIS 333.

1906. July 6.
G. M. T. 15ʰ 0ᵐ

Observed by J. S. Plaskett.
Measured by J. N. Tribble.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.
3	65·1677	4584 687	.....	.....	.....	.....	2	49·0105	4405·903	·327	·951	·376	25·60
1	64.2090	4572·978	·370	·156	·214	+14·03	2	49·9783	4415·602	.....	.....	.....	.....
2	62·3521	4550·733	·149	·766	·383	25·23	1½	46·8362	4384·534	·958	·720	.238	16·28
2	62·3108	4550·244	.....	.....	.....	.....	1	46·0199	4376·656	.....	.....	.....	.....
1½	60 7739	4532·258	·690	·202	·488	32·27	2	45·2045	4368·866	·298	·840	·458	31·43
1½	60·5228	4529·354	.....	.....	.....	.....	2	42·2765	4341·509	·949	·634	·315	21·66
2	57·5196	4495·363	.....	.....	.....	.....	1¾	39·4279	4315·792	.....	.....	.....	.....
1½	54·8062	4465·776	·200	·972	228	15·31	2	38·6559	4308·969	425	·023	402	29·97
1	54·5412	4462·942	·366	·977	.389	26·15	2	37·6252	4299·954	.....	.....	.....	.....
1	54·2551	4459·893	.....	.....	.....	.....	1	37·0706	4295·148	·620	·273	·347	24·22
2	53·8852	4455·966	·390	·962	·428	22·07	2	33·0446	4261·155	.....	.....	.....	.....
1	53·4774	4451·659	·079	·597	·482	32·45	2	33·0766	4261 419	·923	·523	.400	28·14
2	51·5374	4431·472	·888	·678	·210	14·21	1¾	28·9090	4227·803	·371	·010	.361	25·59
2	51·2451	4428 473	.893	·420	·473	32·02	2	24·3115	4192·463	·103	·678	.425	+30·37
1½	51·0727	4426·719	·135	·805	·330	22·37	2	22·9368	4182·232	.....	.....	.....	.....
2	50·0457	4416·282	·702	·293	·409	27·76							

Weighted mean............... +24 60
V_a .... −25·76
V_d .... − ·21
Curvature................ − ·28

Radial velocity.................. − 1·7

η BOÖTIS 366.

1906. Aug. 6.
G. M. T. 14ʰ 5ᵐ

Observed by W. E. Harper.
Measured by J. N. Tribble.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.
2½	65·2314	4584·018	.....	.....	.....	.....	1½	46·8746	4383·831	871	·720	·151	10·42
1	64·2565	4572·121	.....	.....	.....	.....	1½	46·8483	4383·577	.....	.....	.....	.....
2	62·4060	4549·971	.039	766	·273	+18·00	1	45.6093	4371·677	·707	·312	·395	27·11
2	62·3706	4549·552	...	...	.....	.....	1½	45 2419	4368·182	·210	·840	·370	25·38
1½	60·8339	4531·583	.495	·202	.293	19·38	1	16·0709	4376·090	.....	.....	.....	.....
1½	60·5846	4528·704	.....	.....	.....	.....	1½	42 3186	4340·924	·936	·634	·302	20·85
½	60·1077	4523·221	·307	·855	·452	29·97	1½	39·4696	4315·255	.....	.....	.....	.....
2	57·5747	4494·670	.....	.....	.....	.....	1½	38·6818	4308·308	·296	·023	·273	18·99
1	53·9251	4455·161	·247	·962	.285	20·18	2	37·0702	4294·292	.....	.....	.....	.....
1	53·5350	4451·047	·131	·597	·534	35·98	2	33·0764	4260·658	.....	.....	.....	.....
1½	54·3107	4459·249	.....	.....	.....	.....	1½	28·9385	4227·371	·349	·010	·339	24·03
1½	51·5845	4430·779	·859	678	·181	12·25	1½	25·2344	4198·838	·830	·403	·427	28·48
2	50.0855	4415·538	·602	·293	·309	21·09	1	24 3315	4192·055	·047	·678	·369	+26·37
1½	50·0371	4415·051	.....	.....	.....	.....	2	22·9657	4181·919	.....	.....	.....	.....
2	49 0520	4405 195	·251	·951	·300	20·42							

Weighted mean............. +23·28
V_a .... −23·23
V_d .... − ·21
Curvature....................... − ·28

Radial velocity.................. − 0·4

η BOÖTIS 372.

1906. Aug. 8.
G. M. T. 14^h 15^m.

Observed by } W. E. HARPER.
Measured by }

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.
2	72·9730	4584·279	.....	.....	.....	.....	2	59·0301	4427·683	·683	·420	·263	17·80
2	71·4967	4566·264	·114	·726	·388	+25·33	3	57·8275	4415·472	·456	·244	·212	14·43
1	71·3535	4564·535	.....	.....	.....	.....	3	56·7962	4405·149	·149	·951	·198	13·48
2	70·6887	4556·559	·539	202	·337	22·14	3S	56·7738	.....	.....	.....	.....	.....
3	70·1445	4550 083	·083	·766	·317	20·85	2	55·8252	4395·551	·567	·286	·291	19·84
3S	70 1072	.....	.....	.....	.....	.....	2	54·6369	4383·963	·995	·720	·275	18 81
2	68·9701	4536·273	·233	·965	·268	17·71	1	54·6080	4383 683	.....	.....	.....	.....
2	68·3516	4529·077	·017	·807	·210	13·90	1	53·3461	4371·570	·602	·312	·290	19.89
3	68·3336	4528·881	.....	.....	.....	.....	1	53·1912	4370·093	·125	·856	·269	18·45
1	68 0462	4525 563	·505	·295	·210	13 95	1	52·9897	4368·180	·210	·840	·370	25·38
2	67·8440	4523·237	·177	·855	·322	21·24	2	52·1188	4359·963	·979	·784	195	13·41
2	65·9487	4501·743	·743	·431	·312	20·74	2	52·0196	4359·033	·050	·732	318	21·87
3	65·3170	4494·693	.....	.....	.....	.....	2	51·2852	4352·180	·180	·006	·174	11 98
2	64·1450	4481 782	·806	·591	215	14 38	3	48·4145	4325·973	.....	.....	.....	.....
3	63·6316	4476·186	.....	.....	.....	.....	2	47·1450	4314·668	·660	·353	·367	21·30
1	63·0377	4470·518	·558	·300	·258	17·28	2	48·4512	4326·302	·270	·939	·331	22·93
2	62·7485	4466·650	.....	.....	.....	.....	3S	46·3963	.....	.....	.....	.....	.....
2	62·7757	4466·943	·983	·771	·212	14·22	2	44·8470	4294·632	·552	·273	·279	19·50
2	62·0833	4459 540	·588	·304	·284	19·08	2	44·8210	4294·409	.....	.....	.....	.....
1	62·0545	4459·233	.....	.....	.....	.....	2	44·1405	4288·580	·500	·134	·366	25·58
2	61·2637	4450·865	·913	·596	·317	21·33	1	42·5767	4275·360	·280	·922	·358	+25·09
2	59·7795	4435·386	406	·184	·222	15·00							

Weighted mean	+18·89	
V_a		−22·83
V_d		− ·28
Curvature		− ·50
Radial velocity		− 4·7

η BOÖTIS 657.

1907. March 8.
G. M. T. 18h 45m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.
2	70·1436	4550·186	...	.....	......	....	1	58·8587	4425·560	·385	·805	·420	28·43
3	70·1197	4549·902	·356	·766	·410	–27·02	3	57·8397	4415·172	·033	·293	·260	17·65
2	68·9542	4536·160	·665	·965	·300	19·86	3	56·8292	4405·001	......	......	.....	....
2	68·5475	4531·415	·982	·202	·220	14·58	3	56·7987	4404·697	·601	·951	·350	23·83
1½	68·4181	4529 911	·489	·849	·360	23·86	2	55 8360	4395·127	·056	·286	·230	16·00
2	68·3585	4529 219	......	......	......	....	2	54·6789	4383·776	......	......	.....	....
2	68·3380	4528·981	·557	·807	·250	16·57	2	54·6412	4383·409	·370	·720	·350	23 94
2	67 8226	4523·022	·625	·855	·230	15·25	2	53·3717	4371·145	·152	·312	·160	10·96
2	65·3575	4495·078	.....	......	......	....	2	53·2120	4369·615	·636	·856	·220	15·07
2	65·3175	4494 631	·270	·550	280	18·67	2	51·3172	4351·693	786	·006	·220	15·14
1½	62·8052	4467 078	......	......	......	....	2	50·0839	4340·245	·364	·634	·270	18·63
2	62 6047	4461·920	·562	·772	·210	14·07	3	48·4987	4325·775	......	......	......	....
2	61·6695	4454 916	·642	·962	·320	21·54	2	47·9197	4320·558	·752	·992	·240	16·63
2	61·2555	4450·527	·257	·597	·340	22 88	3	46·4945	4307·864	......	......	......	......
2	59 0292	4427·311	·130	·420	·290	19·63	3	46·4645	4307·596	·793	·023	·230	–15 98

Weighted mean .... –18·92
V_a .... +13·75
V_d .... + ·09
Curvature .... – ·50

Radial velocity ... . – 5·6

η BOÖTIS 670.

1907. March 20
G. M. T. 18h 32m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.
2	72·9506	4583·964	......	...	......	....	3	56·7806	4404·929	......	......	......	....
2	71·9460	4571·690	·762	·112	·350	–22·92	3	56·7601	4404·724	·721	951	·230	15 68
1½	70·0986	4549·552	....	....	......	....	2	55·7993	4395·209	.....	....	.....	....
3	70·0827	4549·365	·436	·766	·330	21·74	2	54·6290	4383·769	......	......	......	....
2	68·9205	4535·721	·775	·965	·190	12·58	2	54 5986	4383·548	·520	·720	·200	13·68
1	68 5150	4531·010	·062	·202	·140	9·28	1	53·1621	4369 660	·626	·856	·230	15·78
2	68·3215	4528·772	......	....	......	....	2	51·2715	4351·839	·796	·006	.216	14·86
1	68·3066	4528·600	·647	·807	.160	10·61	1	50·0474	4340·514	·474	·634	·150	11·04
1	67·7847	4522·590	·635	·855	·220	14·60	3	48·4494	4325·976	......	......	......	......
1	65·3175	4494·740	......	......	......	....	2	48·4195	4325·707	·659	·939	·280	19 38
1	65·2786	4494·308	·320	·550	·230	15·34	2	47·8720	4320·790	·732	·992	·260	18·00
1	62·7505	4466·699	·551	·771	·220	14·74	3	46·4482	4308·150	......	...	......	....
1	62 7368	4466·540	·592	·772	·180	12·08	3	46·4205	4307·906	·843	·023	·180	12·50
1½	62·5533	4464·583	.....	......	......	....	1½	48·2000	4271·650	·570	·865	·295	20·56
2	61·6272	4454·717	·725	·962	·237	15·93	2	40 8897	4260·744	......	......	......	....
1	58·0902	4427·252	·260	·420	·160	10·83	2	40·8547	4260·455	·370	·640	·270	–18·87
3	57 7921	4415·071	·083	·293	·210	14·26							

Weighted mean .. .. 15·25
V_a .... + 8·78
V_d .... + ·04
Curvature .... – ·50

Radial velocity .... – 6·9

η BOÖTIS 691.

1907. April 3.
G. M. T. 18ʰ 02ᵐ

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.
2	72·9612	4584 046	.....	.....	.....	....	3	56·7745	4404·984	.....	.....	.....	....
1	71 9513	4571·717	·730	·900	170	−11·13	3	56·7572	4404·812	·761	·951	·190	13·62
1	70·6445	4556 013	·022	·202	·180	11·80	2	55·7889	4395·232	·176	·286	·110	7·50
3	70·0995	4549·546	·556	·766	·210	13·84	2	54·6189	4383 808	.....	.....	.....	....
2	70 1085	4549 612	.....		.....	....	2	54 5876	4383 504	·440	·720	280	19·83
1½	68·9195	4535 705	·695	·965	·270	17·87	1	53·3159	4371·275	·202	·312	·110	7·55
1	68 5217	4531·088	·072	·202	·130	8·62	1	53·1540	4369·732	·666	·856	·190	13·03
2	68·3245	4528·809	.....	.....	.....	....	2	51·2648	4351·942	·876	·006	·130	8·96
2	67·7992	4522 765	·735	.855	·120	7·96	1½	50·0325	4340·553	·489	·634	·145	10 00
2	65·3230	4494 834	.....	.....	.....	....	2	48·4305	4325·995	.....	.....	.....	....
1	65·2775	4494·329	·270	·550	·280	18 67	1	47·8566	4320·846	·792	·992	·200	13·88
1	63·3106	4472·793	·737	·957	·220	14 76	2	47·2100	4315·086	·038	·178	·140	9·73
2½	62·7485	4466·737	·612	·772	·160	10·74	3	46·4200	4308·108	.....	.....	.....	....
1½	62·5545	4464·657	.....	.....	.....	....	2	46·4001	4307·932	·883	·023	·140	9 74
2	62·0287	4459·047	·004	·304	·300	20·16	2	40·8496	4260·662	.....	.....	.....	....
1	61·6241	4454·755	·712	·962	·250	16·80	2	40·8220	4260·434	·420	640	·220	15·48
2	61·2216	4450·507	·467	·597	·130	8·76	1	37·8036	4235·956	·962	·112	150	10·62
2	58·9911	4427 357	·320	·420	·100	6·77	1	37 0112	4229·664	·676	826	·150	−10·65
1½	58·8230	4425·639	·605	·805	·200	13·54	1	36·7472	4227·580	.....	.....	.....	....
3	57·7905	4415·163	·113	·293	180	12 22							

Weighted mean .... −12 29
V_a .... + 2·59
V_d .... ·00
Curvature .... ·50

Radial velocity .... −10·2

η BOÖTIS 731.

1907. April 19.
G. M. T. 18ʰ 35ᵐ

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.
1½	72·9712	4584·004	.....	.....	.....	....	2	56·7843	4405·001	.001	·951	·050	+ 3 40
1	71·9874	4571·996	·106	·116	·010	− 0·65	3	56·7769	4404·927	.....	.....	.....	....
2	70·1315	4549·777	·776	·776	·010	+ 0·66	1	55·8147	4395·409	·386	·286	·100	+ 6·83
1½	70·1200	4549·641	.....	.....	.....	....	2	54 6220	4383·766	.....	.....	.....	....
1½	68·9540	4535·965	·965	·965	·000	·00	1½	54 6211	4383·757	·720	·720	·000	·00
1	68·3433	4528·888	·887	·807	·080	+ 5·28	1½	53·1719	4369·837	·806	·856	·050	− 3·43
1	68·3355	4528·798	.....	.....	.....	....	2	48·4312	4325·956	.....	.....	.....	....
1	63·3442	4473·043	·007	·957	·050	+ 3·35	1	48·4336	4325·977	·959	·939	·020	+ 1·38
1½	62·7670	4466·826	.....	.....	.....	....	3	46·4205	4308·075	.....	.....	.....	....
1	62 5922	4464·952	·902	·772	·130	+ 8·74	1½	46·4160	4308·036	·033	·023	·010	+ 0·69
1	61·6492	4454·916	·892	·962	·070	− 4·72	2	40 8494	4260·646	.....	.....	.....	....
1½	58·8439	4425·761	·755	·805	·050	− 3·38	1½	40·8433	4260·595	·590	·640	·050	− 3·50
2	57·8224	4415·399	·393	·293	·100	+ 6·80							

Weighted mean .... + 1·34
V_a .... − 4·57
V_d .... − ·11
Curvature .... − ·50

Radial velocity .... − 3·8

η BOÖTIS 739.

1907. April 26.
G. M. T. 17h 30m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.
3	70·0827	4549·755	·796	·766	·030	+ 1·98	2	57·7755	4415·358	·373	·293	·080	+ 5·43
2	70·0699	4549·604	....	....	....	....	3	56·7328	4404·911	....	....	....	....
1½	68·9152	4536·057	·105	·965	·040	+ 2·65	3	56·7360	4404·943	·961	·951	·010	+ 0·68
1	68·4980	4531·213	·252	·202	·050	+ 3·31	2	55·7610	4395·296	·326	·286	·040	+ 2·73
2	68·2387	4528·736	....	....	....	....	2	54·5687	4383·616	....	....	....	....
1	67·7681	4522·804	·845	·855	·010	− 0·66	2	54·5705	4383·670	·750	·720	·030	+ 2·05
1	65·8880	4501·514	·548	·508	·040	+ 2·66	1	53·1335	4369·862	·926	·856	·070	+ 4·80
2	65·2791	4494·730	....	....	....	....	2	51·2440	4352·066	·126	·006	·120	+ 8·26
1	65·2665	4494·590	·620	·550	·070	+ 4·66	2	50·0165	4340·719	·774	·634	·140	+ 9·66
1	63·6012	4476·313	·334	·214	·120	+ 8·04	2	48·3872	4325·910	....	....	....	....
1½	63·5860	4476·149	....	....	....	....	2	48·3885	4325·922	·969	·939	·030	+ 2·07
1	63·2975	4473·023	·037	·957	·080	+ 5·37	1	47·8422	4321·020	·042	·992	·050	+ 3·46
2	62·7133	4466·729	....	....	....	....	3	46·3798	4308·051	....	....	....	....
2½	61·6094	4454·963	·972	·962	·010	+ 0·67	2	46·3865	4308·110	·133	·023	·110	+ 7·63
2	61·2057	4450·702	·707	·597	·110	+ 7·41	2	40·8133	4260·641	....	....	....	....
1½	58·9633	4427·425	·430	·420	·010	+ 0·67	2	40·8102	4260·612	·610	·640	·031	− 2·11

Weighted mean .... + 3·70
V_a .... − 7·58
V_d .... − ·09
Curvature .... − ·50

Radial velocity .... − 4·5

η BOÖTIS 752.

1907. May 7.
G. M. T. 14h 20m

Observed by }
Measured by } W. E. Harper.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.
1	73·0097	4584·071	....	....	....	....	1	61·2811	4450·747	·807	·597	·210	14·13
1½	72·0492	4572·350	·392	·112	·280	+18·31	1½	59·0410	4427·514	·570	·420	·150	10·15
2	70·1677	4549·830	·866	·776	·100	6·60	3	57·8548	4415·473	·533	·293	·240	16·30
1	70·1520	4549·640	....	....	....	....	3	56·8036	4404·951	·021	·951	·070	4·77
2	69·0077	4536·228	·286	·965	·320	21·18	3	56·7947	4404·863	....	....	....	....
1½	68·5945	4531·433	·492	·202	·290	19·20	2	55·8355	4395·380	·456	·286	·170	11·62
3	68·3596	4528·720	....	....	....	....	2	54·6312	4383·633	·720	·720	·000	·00
1	68·3767	4528·917	·987	·807	180	11·92	2	54·6284	4383·606	....	....	....	....
1½	67·8727	4523·121	·195	·855	·340	22·54	2	53·2125	4370·014	·116	·856	·260	17·84
1	65·7679	4499·332	·399	·129	·270	17·98	1	51·3040	4352·057	·166	·006	160	11·00
1	65·3486	4494·672	....	....	....	....	1	50·0865	4340·815	·934	·634	·300	20·70
½	65·3500	4494·679	·750	·550	·200	13·34	3	48·4356	4325·827	....	....	....	....
1½	63·3679	4472·994	·057	·957	100	6·70	1½	47·8955	4320·987	·122	·992	·130	9·00
1	62·7800	4466·663	....	....	....	....	3	46·4197	4307·917	....	....	....	....
1	62·6280	4465·038	·102	·772	·330	22·11	2	46·4370	4308·068	·223	·023	·200	+13·88
2	61·6907	4455·067	·132	·962	·170	11·44	2	40·8503	....	....	....	....	....

Weighted mean .... +13·07
V_a .... −12·01
V_d .... + ·11
Curvature .... − ·50

Radial velocity .... + 0·7

η BOÖTIS 760.

1907. May 14.
G. M. T. 17ʰ 55ᵐ

Observed by } W. E. HARPER.
Measured by }

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.
2	77 0138	4586·749	....	.....	.....	....	1½	60·3522	4476·077	...	....	.....	....
1½	75·0110	4572·563	·402	·112	·290	−18·96	1	60·3978	4476·358	·438	·214	·224	14·03
1	74·0961	4566·168	·006	·726	·280	18 30	½	59·8743	4473·133	·223	·957	·266	17·84
1	72·7052	4556·546	·426	·202	·224	14·72	1½	51·9075	4425·754	·924	·608	·316	21·39
½	71·7530	4550·028	·906	·766	·140	9·22	1	48·7471	4407·805	·995	·851	·144	9·80
1½	71·7146	4549·767	.....	...	.....	....	3	48·1928	4404·704	.....	.....	.....	....
2	68·5907	4528·772	.....	...	.....	....	1	42·0610	4371·304	·632	·312	·320	+21·95
1½	68·0928	4525·481	441	·295	·146	9·66	1½	38 5042	4352 659	.....	.....	.....	....
1½	67·7272	4523·072	·035	·855	·180	11·92							

Weighted mean .... +15·25
V_a .... − 14 70
V_d .... − ·14
Curvature .... − ·50

Radial velocity......... . ... − 0·1

η BOÖTIS 764.

1907. May 20.
G. M. T. 16ʰ 25ᵐ

Observed by } W. E. HARPER.
Measured by }

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.
2	76 8697	4586·673	·521	·191	·330	+21·52	1	57·5027	4459·583	·604	·304	·300	20 22
1½	76·8647	4586·638	·208	·018	·190	12 39	1	56·0608	4450 947	·967	·597	·370	24 93
1	76·5408	4584·329	·018	·618	·400	26 08	2	53·4276	4435·427	·444	·184	·260	17·57
1	76·2327	4582·137	.. ..	.....	.....	....	2	52·0857	4427·650	·666	·420	·246	16·65
2	76·0296	4580·696	.....	.....	.....	....	1½	51·8037	4426·026	·038	·608	·430	29·11
1	73·6800	4564·218	·149	·939	·210	13.75	2½	49·9630	4415·519	·523	·293	·230	15·62
1½	72·5669	4556·532	·472	·202	·270	17·76	2	49·9173	4415 260	.....	.....	.....	....
1	72·2842	4554·592	·537	·257	280	18·42	2	48·1222	4405 168	·171	·951	·220	15·60
1	72·0388	4552·913	·864	·594	·270	17·76	2	46·3847	4395·539	·539	·286	·253	17·25
2½	71 6337	4550·080	·046	·766	·280	18·42	1½	44·2712	4384·005	·005	·720	·285	20·14
½	71·5812	4549·791	..	...	.....	....	2	43·4159	4379·392	.....	....	.....	....
1	69 5846	4536·314	·295	·965	·330	21·81	1½	41·9670	4371·648	·652	·312	·340	23·30
2	68·4979	4529·079	·077	·807	·270	17·87	2	39·7680	1360·064	·074	·784	·290	19·90
2	67 5990	4522·147	·155	·855	·300	19·89	1½	39·5791	4359·078	·086	·732	·354	24·28
2	65·3760	4508·673	·685	·455	·230	15·30	1	38·4112	4353·015	....	.....	.....	....
1½	64·3050	4501·799	·818	·448	·370	24·64	2	38 2760	4352·317	·336	·006	·330	22·70
2	63·2326	4494·979	·994	·664	·330	22·01	2	36·0640	4340·994	·004	·634	·370	25·53
1	63·1922	4494·724	. ..	.....	.....	....	2	33·0691	4325·962	.....	.....	.....	....
1½	61·1145	4481·693	·710	·400	·310	20·74	1½	33 1252	4326·247	·239	·939	·300	20·76
2	60·2770	4476·506	·524	·214	·310	20·74	2	32·1120	4321·238	·226	·992	·234	16·20
1½	59 7526	4473·277	·297	·957	·340	22·78	1½	30·9360	4315·473	·458	·178	·280	19·40
1	59·1947	4469·856	·876	·520	·356	23·85	2	29·4608	4308·313	·293	·023	·270	18·72
1	58·6782	4466·704	.....	.....	.....	....	2	29·4193	4308·113	.....	.....	.....	....
½	58·4205	4465·137	·162	·772	390	26·13	2	25·2745	4288·450	·424	·134	·290	+20·27

Weighted mean .... +20·26
V_a .... − 16·77
V_d .... − ·10
Curvature .... − ·50

Radial velocity.... .... + 2·91

η BOÖTIS 769.

1907. May 22.
G. M. T. 16h 51m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.
2	72 3751	4554·627	·507	·257	·250	16 17	2	57·5897	4459·591	·644	·304	·340	22·91
1½	72·1497	4553·084	·964	·594	·370	24 38	1	56 8622	4455·219	·272	·962	·310	20·89
3	71·7156	4550·122	·006	·766	·240	16·00	1½	52·1741	4427·666	·720	·420	·300	20·31
1½	71·6651	4549 777	......	......	......	......	2	50·0535	4415·548	·598	·293	·305	20·70
2	6?·6739	4536·338	·255	·965	·290	19·20	2	49·9998	4415·214	......	......	......	......
2	68·5989	4529·180	·107	·807	·300	19·86	1½	48·2070	4405 164	·211	·951	·260	17·73
2	68·5477	4528·841	......	......	......	......	2	48 1555	4404·877	......	......	......	......
2	67·6870	4523·161	·105	·855	·250	16·55	3	43·4978	4379·372	......	......	......	......
1	66·5626	4515·805	·768	·508	·260	17·10	1½	42·0517	4371·654	·702	·312	·390	26·75
1	66·4065	4514·789	·736	·476	·260	17·26	1	41·7560	4370·074	·116	·856	·260	17·85
2	63·3054	4494·898	·894	·664	·230	15·34	1	41·3860	4368·116	·160	·840	·320	21·95
1½	63·2838	4494·762	......	......	......	......	2	38·4841	4352 949	......	......	......	......
1	60·3530	4476·447	·484	·214	270	18·09	1½	38·3357	4352·182	·246	·006	240	16.54
2	59·8426	4473·304	·337	·957	.380	25 46	1	32·1922	4321·209	·292	·992	·300	20·76
1½	59·2733	4469 814	......	......	......	......	2	30·9890	4315·312	·408	·178	·230	+15·92
2	58 4874	4465·024	·062	·772	·290	19·48	2	30 9?43	4315·192	......	......	......	......

Weighted mean.... .... +19·46
V_a.... .... −17·43
V_d.. .... ·14
Curvature....... .... ·50

Radial velocity..... .... + 1·1

η BOÖTIS 774.

1907. May 23.
G. M. T. 14h 08m

Observed by W. E. Harper.
Measured by J. N. Tribble.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.
1	73 3722	4871·911	......	......	......	......	¾	42·5701	4299·750	·726	·277	·247	17 23
2S	73·5307	4875·673	......	......	......	......	1½	40·6425	4272·077	·053	·760	·293	20·56
1½	72 9489	4861·911	·803	·527	·276	+17·03	1½	40·4252	4269·004	......	......	......	......
2	56·7439	4528·932	...	......	......	......	¾	39·8399	4260·771	·747	·640	·107	7 53
1	57 9013	4549 900	......	......	......	......	2	36·5802	4216·114	·102	·897	·105	7·47
1	57·9293	4550·311	·119	·766	·353	23 26	2½	36·1574	4210·469	..	......	......	......
1	52·5304	4455·601	·565	·962	·603	40·65	1½	35·5747	4202·733	·733	·161	·272	17·51
2S	48·8521	4395·386	....	......	......	......	1	35·2917	4198·999	·999	·494	·505	36·07
2½	49·1726	4400·502	......	......	......	......	1½	S35·5345	4202·202	......	......	......	......
1	49·4586	4405·090	·982	·908	·074	5·04	1	30·0803	4132·687	·767	·212	·555	40·29
1	49·2138	4401·162	·162	·138	·424	28·87	1	29·3427	4123·660	......	...	......	......
1½	45·3618	4341·187	......	......	......	......	¾	28·9702	4119·134	·234	·844	·390	28·38
1	45·3471	4340 964	·948	·631	·314	21·82	1	27·5532	4102 111	·218	·000	·218	15·94
1	43·1330	4307·974	·950	·932	·018	1·25	¾	26·7817	4092 974	078	·626	·452	33·13
2	42·5531	4299 503	......	......	......	......							

Weighted mean....... .... +21·29
V_a ... . −17·73
V_d ... . − 03
Curvature... .... − ·28

Radial velocity. . ... + 3·2

η BOÖTIS 779.

1907. May 24.
G. M. T. 15ʰ 01ᵐ

Observed by J. S. PLASKETT.
Measured by J. N. TRIBBLE.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.
2	58·0640	4549·549	......	......	......	....	1½	40·8102	4271·728	·872	·760	·112	7·85
1	58·0817	4549·873	·001	·766	·235	+15·46	2	37·6159	4227·429	......	......	......	....
2	50·2577	4415·039	......	......	......	......	1½	37·5998	4227·211	·331	·904	·427	30·27
1	50·2836	4415·459	·595	·293	·302	20·54	1	36·7625	4215·917	·021	·897	·124	8·82
2½	49·6247	4404·812	......	......	......	....	1	35·4747	4198·795	·907	·403	·505	35·99
1	49·6384	4405·032	·216	·951	·265	18·05	1	33·0716	4167·618	·706	·438	·268	19·27
1½	46·3206	4352·943	......	......	......	....	2	31·1734	4143·682	......	...	......	......
1	46·2767	4352·270	·454	·006	·448	30·86	1	31·1972	4143·979	·051	·914	·137	9·91
1	45·5212	4340·763	·939	·634	·305	20·95	1	29·9036	4127·997	·053	·862	·191	+13·88
2½	40·8015	4271·605	...	...	......	....	2	28·0030	4104·992	......	......	......	....

Weighted mean .... +18·15
V_a .... −18·04
V_d .... − ·21
Curvature .... − ·28

Radial velocity .... − 0·3

η BOÖTIS 793.

1907. May 29.
G. M. T. 16ʰ 46ᵐ

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in Revolutions.	Velocity.
1	61·2267	4613·852	......	...	.....	....	2	47·7600	4379·416	......	......	......	....
2	61·2151	4613·629	·755	·465	·290	+18·76	1½	47·0501	4368·323	·307	·840	·467	32·04
2	60·7801	4605·266	·437	·997	·440	28·51	1	45·2664	4340·948	·954	·634	·320	22·08
2	60·5522	4600·908	·076	·524	·552	35·76	2	44·2835	4326·157	·174	·694	·480	33·22
2	59·7843	4586·340	..	......	......	......	1	43·0857	4308·409	·443	·023	·420	29·15
1	59·6576	4583·954	·150	·796	·354	23·08	2	43·0609	4308·044	...	......	......	....
2	57·8364	4550·173	·308	·766	·542	35·72	1½	40·5687	4272·055	·090	·760	·330	23·20
2	56·6522	4528·720	.....	......	......	....	2	39·7598	4260·611	.....	......	......	......
2	52·7172	4460·183	......	..	......	....	2	39·7727	4260·835	·861	·546	·315	22·14
2	50·0340	4415·682	·783	·293	·490	33·37	1	37·8163	4233·751	·768	·328	·440	31·15
2	49·3967	4405·432	·471	·951	·520	35·46	1½	36·5183	4216·158	·167	·897	·270	+19·17
3	48·7702	4395·409	....	......	......	....	2	35·4705	4202·202	......	......	......	....
2	48·8021	4395·909	·896	·286	·610	41·66							

Weighted mean .... +29·03
V_a .... −19·56
V_d .... − ·15
Curvature .... − ·50

Radial velocity .... + 8·8

η BOÖTIS 797.

1907. May 31.
G. M. T. 14^h 54^m

Observed by J. S. Plaskett.
Measured by C. R. Westland.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9660	....	....	....	2	43·0819	·0711	·0208	21·20
2	72·8399	·8829	·0181	+26·26	2	40·5728	·5560	·0301	29·86
2	72·4047	....	....	....	2	39·7707	·7517	·0249	24·50
2	57·8365	·8410	·0142	17·10	2	39·7551	....	....	....
2	57·8055	....	....	....	1½	37·3501	·3227	·0339	32·51
2	50·0029	....	....	....	2	36·5196	·4893	·0271	25·77
1½	49·3909	·3937	·0263	28·72	1½	35·4969	·4631	0355	33·40
1	48·7877	·7855	·0215	23·53	2	35·4641	....	....	....
2	48·7722	....	....	....	1½	31·6032	·5560	·0151	13·65
1	47·0514	·0483	·0352	37·45	2	30·1736	....	....	....
2	45·2777	....	....	....	2	27·3086	....	....	....
1½	45·2658	·2617	·0230	23·56	1½	26·7220	·6579	·0296	+25·48
2	43·5481	....	....	....	2	26·7084	....	....	....

Weighted mean		+25·50
V_a	−20·10	
V_d	− ·05	
Curvature	− ·28	
Radial velocity		+ 5·1

η BOÖTIS 812.

1907. June 10.
G. M. T. 14^h 10^m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement.	Velocity.
2	72·8854	4864·874	.....	.....	.....	....	2	43·0742	4308·544	·560	·023	·537	37·37
2	72·7643	4862·010	·047	·527	·520	+32·08	2	42·0980	4294·278	.....	.....	.....	....
1½	57·8020	4550·549	·386	·766	·620	40·85	1	41·3355	4283·269	·285	·722	·563	39·00
2	57·7617	4519·811	.....	.....	.....	....	2	40·5595	4272·188	·204	·760	·444	31·12
2	53·0646	4466·768	.....	.....	.....	....	1½	39·7652	4260·968	·987	·527	·460	32·34
1½	52·9887	4465·474	·412	·772	·640	42·94	2	39·7401	4260·615	.....	.....	.....	....
2	52·4071	4455·617	·562	·962	·600	40·32	2	39·0561	4251·055	·067	·643	·424	29·89
2	52·2073	4452·249	.....	.....	.....	....	1½	37·8028	4233·770	·778	·462	·316	22·37
2	49·3623	4405·394	·391	·908	·483	32·84	2	37·3322	4227·356	·364	·010	·354	25·06
2	48·7661	4395·825	·826	·426	·400	27·28	1½	35·2093	4198·927	·924	·494	·430	30·70
2	45·9963	4352·404	·412	·957	·455	31·44	2	34·6878	4192·067	·068	·678	·390	27·70
2	45·2575	4341·177	.....	.....	.....	....	2	31·9631	4156·989	·989	·623	·366	26·35
2	45·2518	4341·089	·099	·634	·465	32·08	2	30·9498	4144·262	·262	·928	·334	+24·11
1½	44·2697	4326·286	·299	·939	·360	24·91	2	27·3112	4099·919	.....	.....	.....	....

Weighted mean		+30·09
V_a	−22.52	
V_d	− ·04	
Curvature	− ·28	
Radial velocity		+ 7·2

η BOÖTIS 868.

1907. June 21.
G. M. T. 14h 27m

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement.	Velocity.
3	59·4917	4580·498	...	...	...	...	2	45·2755	4341·084	...	...	...	...
2	59·0511	4572·262	·308	·758	·550	+35·91	2	44·2785	4326·119	·199	·939	·260	18·00
3	57·8496	4550·094	·156	·766	·390	25·70	2	43·5520	4315·347	·448	·178	·270	18·71
1½	57·8233	4549·613	...	...	...	...	2	42·1004	4294·152	...	...	...	...
3	56·6631	4528·612	...	...	...	...	1	40·5592	4272·120	·270	·760	·510	35·70
1½	56·3594	4523·178	·345	·985	·360	23·80	2	39·7555	4260·816	·947	·527	·420	29·53
1½	53·1004	4466·545	...	...	...	...	2	39·7351	4260·530	...	...	...	...
2	50·9767	4430·966	·138	·678	·460	31·14	1	36·4997	4216·283	·323	·897	·426	30·12
2	50·0392	4415·661	·824	·354	·470	31·96	1½	35·4821	4202·764	·768	·198	·570	40·58
2	50·0050	4415·107	...	...	...	...	2	35·4386	4202·190	...	...	...	...
2	49·4000	4405·349	·498	·908	·590	40·18	1	34·6655	4192·048	·038	·678	·360	25·74
2	48·7697	4395·275	...	...	...	...	1	32·7961	4167·952	·902	·617	·285	20·49
2	47·2771	4371·789	·893	·343	·550	37·62	2	30·1393	4134·712	...	...	...	...
1½	47·1802	4370·281	·387	·867	·520	35·56	1	29·9750	4132·694	·592	·212	·380	+27·40

Weighted mean		+29·89
V_a	−24·46	
V_d	− ·11	
Curvature	− ·28	
Radial velocity		+ 5·0

η BOÖTIS 891.

1907. June 27.
G. M. T. 14h 55m

Observed by } W. E. HARPER.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	57·7980	·8200	·0173	+20·87	2	40·5817	·5833	·0324	32·24
1	57·7762	...	...	...	2	39·7320	·7845	·0300	29·61
2	49·9624	...	...	...	2	39·7102	...	...	...
1	49·3500	·3936	·0279	30·55	1	37·3052	·3613	·0363	35·57
½	48·7547	·7987	·0160	17·41	1	36·4711	·5275	·0262	25·41
2	48·7277	...	...	...	1	35·4539	·5119	·0414	39·54
1½	47·0142	·0602	·0391	41·25	2	35·4170	...	...	...
2	45·2395	...	...	...	1	31·5636	·6300	·0313	28·17
1½	45·2339	·2809	·0322	33·71	2	30·1178	...	...	...
2	43·5028	...	...	...	2	27·2449	...	...	...
2	43·0515	·1009	·0377	38·52	1½	26·6595	·7335	·0272	+24·13
2	42·0723	...	...	...	2	26·6400	...	...	...

Weighted mean		+30·53
V_a	−24·37	
V_d	− ·17	
Curvature	− ·28	
Radial velocity		+ 5·7

η BOÖTIS 918.

1907. July 8.
G. M. T. 15h 09m

Observed by J. S. PLASKETT.
Measured by T. H. PARKER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	59·8099	......	......	......	1	44·2898	·2798	·0206	21·27
1	57·8572	·8620	·0352	+42·38	1	43·5460	......	......	......
1	56·6611	......	......	......	1	43·0888	·0758	·0255	25·98
1	55·1526	·1576	·0324	37·77	1	41·3060	......	......	......
1½	54·7393	......	......	......	1	40·5805	·5615	·0356	35·31
1	50·0034	......	......	......	1	39·7823	·7613	·0264	25·97
1	50·0306	·0296	·0205	22·55	1	37·9860	......	......	......
1	49·4064	·4034	·0360	39·31	1	37·3568	·3308	·0180	46·01
1	49·1127	......	......	......	1½	36·5317	·5047	·0425	40·41
1	48·8040	·8020	·0292	31·68	1	35·4581	......	......	......
1½	48·7675	......	......	......	1	35·2228	·1928	·0438	41·08
1	46·0327	·0257	·0385	40·40	1	31·8048	·7713	·0232	+21·01
1	45·2824	·2744	·0437	45·62	1	30·9164	......	......	......
1	45·2825	......	......	......					

Weighted mean	+31·45
V_a	−25·79
V_d	− ·24
Curvature	− ·28
Radial velocity	+ 8·1

η BOÖTIS 918.*

1907. July 8.
G. M. T. 15h 09m

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1½	59·0510	......	......	......	2	44·3211	·2820	·0228	23·55
1	59·0784	·0634	·0227	+27·74	2	43·5749	......	......	......
2	57·8689	·8520	·0252	30·34	2	43·1211	·0790	·0327	33·32
2	57·8388	......	......	......	2	41·8827	·8380	......	......
1	56·8542	·8352	·0244	29·04	2	41·3385	......	......	......
2	56·6862	......	......	......	2	40·6093	·5590	·0331	32·83
1	55·1704	·1464	·0212	24·72	2	39·8204	·1694	·0345	33·95
2	54·0562	......	......	......	1½	39·7879	......	......	......
1½	52·8790	·8510	·0206	23·40	2	39·1058	·0533	·0370	36·11
2	52·4827	·4547	·0399	45·13	2	38·0112	......	......	......
2	52·2770	......	......	......	2	37·3845	·3295	·0407	39·03
2	50·0586	·0280	·0179	19·69	2	36·5511	·4940	·0318	30·24
2	49·4332	·4012	·0350	38·22	2	35·4884	......	......	......
2	48·8006	......	......	......	1	35·5290	·4706	·0430	40·46
2	45·3140	......	......	......	1½	35·2561	·1973	·0483	+45·06
2	45·3180	·2800	·0113	43·12					

Weighted mean	+33·11
V_a	−25·80
V_d	− ·24
Curvature	− ·28
Radial velocity	+ 6·8

*Check measurement.

η BOÖTIS 950.

1907. July 18.
G. M. T. $13^h\ 57^m$

Observed by J. N. Tribble.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	59·7949	....	....	....	1½	43·5484	·5524	·0192	19.68
1	59·0552	·0672	·0265	+32·36	2	43·0820	·0852	·0451	45·95
1½	57·8347	·8427	·0160	19·26	1½	42·1019	....	....	....
1½	57·8138	....	....	....	2	40·5663	·5655	·0396	39·28
2	53·0966	....	....	....	2	39·7395	....	....	....
1½	52·8357	·8490	·0186	21·1[illegible]	1	39·7719	·7700	·0351	34.54
2	52 4416	·4546	·0398	45·01	1	39·0430	·0385	·0222	21·67
1½	50·0253	·0343	·0241	26·51	2	37·3630	....	....	....
1	49·3917	·3997	0331	36·14	1	37·3251	·3195	·0307	29·44
1½	48·7944	·8010	·0282	30·79	1	36·5090	·5020	·0398	37·85
2	48 7650	....	....	....	3	35·4418	....	....	....
2	45·2671	....	....	....	1	35·4710	·4595	·0319	30·02
½	45 2590	·2654	·0267	27·87	1	35·1990	·1875	·0385	+35·92

Weighted mean......................		+31·38
V_a.....	−25·61	
V_d..........	− ·20	
Curvature	− ·28	
Radial velocity.................. ...		− 5·3

η BOÖTIS 950.*

1907. July 18.
G. M. T. $13^h\ 57^m$

Observed by J. N. Tribble.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	59·8053	....	....	....	1	43·0955	·0835	·0332	33·82
1	59·0690	·0730	·0323	+39·43	1	42·1179	....	....	....
1	57·8528	·8563	·0295	35·51	1½	40·5776	·5621	·0362	35.91
1	57·0777	·0807	·0139	16·58	1	39·7823	·7653	·0304	29·91
1½	56·6654	....	....	....	1	38·0089	·9889	·0278	26·93
1	53·1105	....	....	....	1	37·9769	....	....	....
1	52·8502	·8512	0·208	23·62	1	37·8012	·7822	·0177	17·06
1	52·4460	·4470	0·322	36·41	1	36·5180	·4960	·0338	32·04
1	45·2830	....	....	....	1	35·4775	·4535	·0259	+24·37
1	43·5729	·5619	·0287	29·43	1	35·4548	....	....	....

Weighted mean-	......	+29·23
V_a..................	−25·61	
V_d..................	− ·20	
Curvature......	− ·28	
Radial velocity.......		+ 3·1

*Check measurement.

η BOÖTIS 972

1907. Aug. 1
G. M. T. 13h 39m

Observed by / Measured by } W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	59·8125	......	......	......	1	47·2717	·2733	·0315	33·55
1	59·0699	·0660	·0253	+30·89	1	47·1677	·1693	·0225	23·96
2	57·8529	·8497	·0229	27·57	1	47·0555	·0571	·0409	43·56
2	57·8249	......	......	......	2	45·2721	......	......	......
2	56·6666	......	......	......	1½	45·2731	·2751	·0364	38·00
1	56·3701	·3709	·0347	41·05	2	43·5334	......	......	......
1	55·1626	·1612	·0390	45·47	1	43·0770	·0795	·0332	33·90
2	54·0291	......	......	......	2	40·5588	·5580	·0321	31·84
1½	52·8504	·8494	·0190	21·58	1½	39·7640	·7620	·0352	34·64
1	52·4609	·4600	·0452	51·12	2	39·7388	......	......	......
2	52·2516	......	......	......	2	37·9622	......	......	......
1	50·0488	·0488	·0387	42·57	2	37·3332	·3284	·0396	37·97
1½	49·4090	·4048	·0386	42·57	2	36·5021	·4960	·0338	+32·14
2	48·7684	......	......	......	2	35·4331	......	......	......

Weighted mean		+36·02
V_a	−24·14	
V_d	− ·24	
Curvature	− ·28	
Radial velocity		+ 11·4

η BOOTIS 990.

1907. Aug. 7.
G. M. T. 13h 58m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	77·5311	·3820	·0765	+34·73	2	68·8751	......	......	......
2	77·5065	......	......	......	1½	68·0457	·9557	·0875	37·45
1	77·2249	·0775	·0838	37·88	2	67·6516	·5636	·0768	32·87
1½	75·4840	·3450	·0687	30·91	2	64·6597	·5717	·0641	26·92
2	75·3861	......	......	......	2	61·4950	......	......	......
1½	74·5448	·4108	·0755	33·75	1½	60·5500	·5045	·0777	31·62
2	73·1143	·9873	·0597	26·45	2	58·9771	·9411	·0833	33·57
2	72·8337	·7101	·0719	31·71	1	58·6538	·6200	·0878	35·38
3	72·1565	·0350	·0677	29·79	2	56·4377	......	......	......
2	72·0721	......	......	......	1	50·0635	·0820	·0726	27·66
2	70·0758	·9700	·0879	38·15	1½	48·1930	·2266	·0853	+32·07
2	69·3246	·2233	·0691	29·78	2	46·3541	......	......	......
2	68·9702	·8732	·0867	37·37					

Weighted mean		+32·66
V_a	−23·09	
V_d	− ·28	
Curvature	− ·28	
Radial velocity		+ 9·0

η BOÖTIS 1231.

1908. Jan. 14.
G. M. T. 22h 00m

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	57·8434				1½	44·2401	·2266	·0326	33·67
2	57·8277	·8047	·0221	−26·61	2	41·3012			
1½	54·7647				2	40·5147	·5000	·0259	25·69
2	53·1290				2	39·7496			
1	52·8248	·8048	·0256	29·08	2	39·7099	·6959	·0309	30·40
2	52·3986	·3790	·0358	40·49	1½	39·0059	·9925	·0238	23·23
2	52·2705				2	37·9716			
2	49·9963	·9788	·0313	34·43	2	37·2765	·2630	·0258	24·74
1½	49·3502	·3340	·0334	36·47	1½	36·4496	·4350	·0272	25·87
2	48·7851				2	35·4474			
1½	48·7630	·7470	·0258	28·00	1½	35·4212	·4043	·0233	21·92
2	45·2867				1½	35·1325	·1150	·0340	−31·72
1½	45·2195	·2060	·0327	34·14					

Weighted mean .... −29·76
V_a .... −26·58
V_d .... + ·12
Curvature .... ·28

Radial velocity .... − 3·3

η BOÖTIS 1231.*

1908. Jan. 14.
G. M. T. 22h 00m

Observed by W. E. Harper.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	59·8174				1	44·2521			
1	57·8144	·8084	·0182	−21·91	1	41·2816			
1	56·6735				1	40·4982	·5032	·0227	22·51
1	53·1182				1	39·7312			
1	52·8153	·8133	·0171	19·42	2	39·6870	·6915	·0353	34·73
1½	52·3882	·3872	·0276	31·21	1½	37·9558			
2	52·2605				1	37·2517	·2567	·0321	33·66
1	50·0076				1	36·4308	·4358	·0264	25·00
2	49·9827	·9847	·0254	27·94	2	35·4251			
1	49·3633				1	35·3991	·4041	·0264	24·84
1	49·3360	·3390	·0272	29·70	1	30·8692			
1	49·1028				1	30·8499	·8543	·0213	−19·12
1	48·7675				1	29·9064			
1	48·7445	·7485	·0155	16·81					

Weighted mean .... −25·62
V_a .... +26·58
V_d .... + ·12
Curvature .... − ·28

Radial velocity .... + 0·6

*Check measurement.

η BOÖTIS 1294.

1908. Jan. 27.
G. M. T. 20h 12m

Observed by } W. E. Harper
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	76·7049	...	...	...	2	60·2453	·2668	·0714	29·34
2	76·3139	·3760	·0487	−22·25	2	59·7232	·7437	·0627	25·11
2	74·9780	...	...	...	2	58·3645	·3830	·0767	31·14
2	74·9412	·9966	·0686	31·07	2	57·4642	·4818	·0701	28·32
2	74·0085	·0615	·0691	31·16	2	56·3435	...	...	...
2	73·3760	...	...	...	2	56·7436	·7596	·0669	26·90
2	72·6176	·6656	·0690	30·77	2	56·0215	·0370	·0559	22·36
1½	71·7327	...	...	...	1	50·9975	...	...	...
3	71·6719	·7194	·0628	27·88	2	49·9284	·9324	·0677	26·00
2	69·6070	·6495	·0647	28·27	2	48·0797	·0787	·0806	30·63
2	68·8730	·9130	·0794	34·46	2	46·4398	...	...	...
2	68·5172	·5572	·0705	30·60	2	46·3377	·3310	·0839	31·46
2	68·5312	...	...	...	2	38·2531	·2267	·0794	28·34
2	67·6069	·6431	·0735	31·75	2	36·2270	...	...	...
2	64·2811	·3091	·0754	31·82	2	36·0357	·0027	·0878	30·90
2	61·3235	...	...	...	2	33·1311	·0940	·0779	−26·87

Weighted mean		−29·00
V_a	+25·27	
V_d	+ ·16	
Curvature		− ·28
Radial velocity		− 3·8

η BOÖTIS 1307.

1908. Jan. 29.
G. M. T. 21h 14m

Observed by J. S. Plaskett.
Measured by C. R. Westland.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	76·7556	...	...	...	2	59·7720	·7402	·0662	27·12
1½	76·3539	·3649	·0598	−27·37	2	58·4380	·4030	·0567	23·02
2	75·0276	...	...	...	2	57·5179	·4802	·0715	28·86
2	74·9901	·9980	·0660	29·92	2	56·8023	·7628	·0637	25·59
2	74·0588	·0640	·0666	30·02	2	56·3977	...	...	...
2	73·4219	...	...	...	1	56·0711	·0300	·0629	25·15
2	72·6605	·6620	·0726	32·41	2	50·0571	...	...	...
3	71·7218	·7208	·0614	27·24	2	49·9803	·9258	·0851	32·70
2	69·6614	·6552	·0590	25·81	2	48·1479	·0861	·0685	26·01
2	68·9241	·9159	·0765	33·31	2	46·4998	...	...	...
3	68·5710	·5620	·0657	28·53	2	46·4076	·3415	·0731	27·56
2	68·6280	...	...	...	2	38·3121	·2251	·0810	28·88
2	67·6542	·6427	·0742	32·03	2	36·2864	...	...	...
2	64·3451	·3251	·0594	25·08	2	36·1037	·0107	·0798	28·06
2	61·3704	...	...	...	2	33·1978	·0938	·0781	−26·96
1½	60·2939	·2634	·0748	30·75	2	33·2792	...	...	...

Weighted mean		−28·32
V_a	+24·95	
V_d	+ ·13	
Curvature		− ·28
Radial velocity		− 3·5

η BOÖTIS 1332.

Feb. 17. 1908.
G. M. T. 22h 30m

Observed by J. S. Plaskett.
Measured by C. R. Westland.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	76·7212	....	....	....	2	58·3842	·3982	·0615	24·97
2	76·3188	·3628	·0619	−28·33	2	57·4824	·4954	·0565	22·80
2	74·9946	....	....	....	2	56·7485	·7600	·0665	26·71
2	74·9565	·9982	·0658	29·83	2	56·3452	....	....	....
2	74·0249	·0649	·0657	29·61	1	56·0291	·0393	·0536	21·43
2	73·3885	....	....	....	2	53·4001	·4061	·0624	24·52
2	72·6378	·6756	·0590	26·34	2	49·0003	....	....	....
3	71·6874	·7236	·0586	26·00	2	49·9357	·9359	·0750	28·82
2	69·6200	·6528	·0614	26·86	2	48·0881	·0853	·0696	26·43
2	68·8936	·9251	·0673	29·30	2	46·4381	....	....	....
3	68·5431	·5741	·0536	23·18	2	46·3480	·3422	·0727	27·30
2	68·5930	....	....	....	2	38·2430	·2240	·0821	29·28
3	67·6210	·6505	·0664	28·66	2	36·2164	....	....	....
2	64·2952	·3192	·0653	27·57	2	36·0427	·0202	·0703	24·72
2	61·3281	....	....	....	2	33·1294	·1019	·0700	−24·16
2	60·2510	·2682	·0700	28·78	2	33·2010	....	....	....
2	59·7464	·7629	·0435	17·82					

Weighted mean		−25·21
V_a	+20·45	
V_d	+ ·12	
Curvature		− ·28
Radial velocity		− 5·2

η BOÖTIS 1357.

1908. Feb. 24.
G. M. T. 19h 06m

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity
2	76·7176	....	....	....	½	67·6130	·6450	·0719	30·99
1	76·3250	·3710	·0537	−24·59	½	63·2135	·2395	·0700	29·33
½	74·9671	0101	·0539	24·42	2	61·3207	....	....	....
2	73·3845	....	....	....	1	60·2534	·2750	·0632	25·97
½	72·1053	·1450	·0562	25·06	½	58·3903	·4073	·0524	21·27
1	71·6970	·7365	·0457	20·34	2	56·3395	....	....	....
2	71·1225	....	....	....	½	56·0048	·0208	·0721	28·84
2	68·5883	....	....	....	½	52·0625	·0730	·0528	−20·59
½	68·5422	·5762	·0515	22·35	2	49·9913	....	....	....
½	67·9892	·0212	·0683	29·44					

Weighted mean		−25·27
V_a	+18·26	
V_d	+ ·16	
Curvature		− ·28
Radial velocity		− 7·1

η BOÖTIS 1446.

1908. March 30.
G. M. T. 21h 52m

Observed by / Measured by } W. E. HARPER.

Region.	Settings I. Star.	Settings I. Comparison.	Difference in Revolutions.	Settings II. Star.	Settings II. Comparison.	Difference in Revolutions.	Mean Difference	Velocity.
4	·395	·424	029	·350	324	·026	·275	−12·88
5	·410	·435	·025	·336	·314	·022	·235	10·57
6	·411	·437	·026	·346	·306	040	·280	12·29
7	417	·446	·029	330	·321	009	·190	8·15
8	·441	·465	024	317	·296	·021	·225	9·43
9	·450	·471	·021	·320	·290	030	·255	10·45
10	·435	·475	·040	·304	·276	·028	·340	−13·60

Standard. . . . . . ± ·33
Weighted mean. . . . . −10 72
V_a . . . . + 3·98
V_d . . . . − ·25

Radial velocity. . . . . − 7·0

η BOÖTIS 1446.*

1908. Mar. 30.
G. M. T. 21h 52m

Observed by W. E. HARPER.
Measured by C. R. WESTLAND.

W	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	75·0031	. . . .	. . . .	. . . .	2	58·3770	·4406	·0191	7·75
2	75·0052	·0377	·0263	−11·92	2	57·4580	·5231	·0288	11·62
2	74·0795	·1152	·0154	6·94	2	56·7254	·7917	0348	13·98
2	73·3860	. . . .	. . . .	. . . .	2	56·2921	. . . .	. . . .	. . . .
2	72·6643	·7044	·0302	13·48	1	56·0050	0732	·6197	7·88
3	71·7097	·7522	·0300	13·31	2	49·9236	. . . .	. . . .	. . . .
2	68·9128	·9623	·0301	13·10	1	49·8982	·9763	0346	13·20
2	68·5557	·6061	·0216	9 38	2	48·0465	·1272	0321	12·19
2	68·5760	. . . .	. . . .	. . . .	2	46·3500	. . . .	. . . .	. . . .
2	67·6457	·6970	·0199	9·32	2	46·3083	·3908	0241	9 05
2	61·2856	. . . .	. . . .	. . . .	3	38·1702	·2679	·0382	−13·62
2	60·2494	·3100	·0282	11·59	2	36 0923	. . . .	. . . .	. . . .
2	59·7264	·7878	·0186	7·62					

Weighted mean. −10·94
V_a . . . . + 3·98
V_d . . . . − ·25
Curvature. . . . . − ·28

Radial velocity. . . . . − 7 5

*Check measurement.

η BOÖTIS 1446.*

1908. March 30.
G. M. T. 21h 52m

Observed by W. E. Harper.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions	Velocity.
1	76·7922	....	....	....	1	59·7825	·7820	·0244	10·00
1	76·4392	·4142	·0105	−4·80	1	58·4374	·4384	·0213	8·64
1	75·0585	....	....	....	1	57·5302	·5322	·0197	7·95
1	75·0715	·0465	·0175	7·92	1	56·7981	·8011	·0154	6·19
2	73·4509	....	....	....	1	56·3536	....	....	....
1	72·7325	·7074	·0272	12·13	2	49·9915	....	....	....
2	71·7755	·7505	·0317	14·07	1	49·9582	·9712	·0289	11·09
1	68·9752	·9542	·0382	16·62	1	48·1122	·1272	·0321	12·19
1	68·6257	·6047	·0230	9·98	2	46·4180	....	....	....
2	68·6416	....	....	....	1	46·3655	·3845	·0304	11·43
1	67·7025	·6945	·0224	9·67	1	38·2275	·2595	·0466	−16·63
1	61·3480	....	....	....	1	36·1572	....	....	....
1	60·3231	·3211	·0171	7·02					

Weighted mean		−10·39
V_a	+3·98	
V_d		−·25
Curvature		−·28
Radial velocity		−6·9

*Check measurement.

η BOÖTIS 1513.

1908. May 4.
G. M. T. 18h 13m

Observed by / Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	75·1160	....	....	....	2	63·3747	....	....	....
2	74·2116	·2076	·0087	+3·91	1	63·3747	·3635	·0061	2·55
2	73·4946	....	....	....	1	60·3917	·3785	·0109	4·47
2	72·8120	·8070	·0080	3·55	1	59·8668	·8533	·0189	7·71
1	72·5446	·5394	....	....	2	58·8243	....	....	....
2	72·2822	·2770	·0131	5·82	2	58·5330	·5188	·0112	4·54
2	71·8622	·8567	·0128	5·68	1	56·8700	·8510	·0081	3·24
1½	69·7922	·7857	·0155	6·76	2	56·3934	....	....	....
1	69·0562	·0492	....	....	2	53·9788	....	....	....
1	68·7040	·6967	·0159	6·92	1	52·1672	·1482	·0164	6·36
2	68·6835	....	....	....	1	48·1835	·1620	·0087	+3·30
1	67·7903	·7823	·0150	6·46	2	46·4436	....	....	....
1	65·5145	·5350	·0056	2·37					

Weighted mean	+4·91	
V_a		−11·19
V_d		−·17
Curvature		−·28
Radial velocity		−6·7

η BOÖTIS 1557.

1908. May 23.
G. M. T. 16h 00m

Observed by J. S. Plaskett.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	76·9548	....	....	.... . .	1	68·2353	·2063	·0138	5·93
1	76·9700	·9334	·0152	+ 6·93	2	67·4948	·4461	·0085	3·63
1	76·6302	·5937	·0200	9 10	1	63·4283	... ..	....	... .
1	75·2687	2326	·0273	12 31	1	59 9277	8962	·0339	13 79
2	75·2128	....	.....	....	1	59·3672	·3358	·0362	14·69
2	73·5876	....	...	....	2	56·4245	....	..... .	... .
1	72·9026	·8696	0061	2·84	1	52·7616	·7366	·0308	11 98
1½	71·9679	·9359	·0303	13·36	1	50·0213	...	.... .	.....
1	71 9354	....	.. ... .	....	1½	48·1823	·1643	·0168	6·35
2	69·1577	·1285	·0283	12·25	2	46·4392	·4238	·0315	+11 74
1	68·7609	....	... .	.....	2	46·4258	... .	... .	.. ..

Weighted mean	+ 9 6	
V_a		−17·97
V_d		− 10
Curvature...		− ·28
Radial velocity...		− 8·7

η BOÖTIS 1553.

1908. May 25.
G. M. T. 15h 58m

Observed by / Measured by } T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	76·9679	....	.. ..	....	2	68·7945	·8090	·0225	9·69
1	77·3242	·3499	0444	+20·24	2	68 7714	....	....	....
1	76·6597	·6853	·0371	16·84	2	67·8874	·9004	0322	13 78
½	76·4693	·4923	·0189	8·58	2	64·5208	·5278	·0202	8·46
1	75·2271	... ...	. ...		1	63·4552	·4606	·0371	15·43
2	74·3368	·3568	0215	9 61	2	63·4326	....	... ..	....
2	73 6031	.. ..	.. ..	....	1	61 4657	·4657	·0300	12·30
2	72·3932	·4112	·0210	9·26	2	60·4492	·4482	·0214	8·73
1	71·9847	·0027	·0354	15·57	2	59·9312	·9297	·0394	15·99
2	71·3184	....	.... .		2	59·3758	·3723	·0464	18·83
2	69·8968	·9123	·0302	13·10	2	58·8903	·8853	·0275	11·08
1	69·1583	·1728	·0186	8·03	2	56·4272	... .	....	... .

Weighted mean............	+12 38	
V_a		−18·59
V_d		− ·10
Curvature...		− ·28
Radial velocity......		− 6·6

η BOÖTIS 1553.*

1908. May 23.
G. M. T. 15^h 58^m

Observed by T. H. Parker.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	76·8899	....	....	....	2	68·7225	·8120	·0255	10·99
1	77·2379	·3419	·0364	+16·60	2	68·6957	....	....	....
2	76·5803	·6833	·0351	15·93	2	67·8170	·9050	·0368	15·73
1	76·3967	4997	0263	11·91	2	64·4485	·5294	·0219	9·24
2	75·1498	....	....	....	2	63·3766	·4560	·0325	13·52
3	74·2572	3557	·0202	9·03	2	63·3594	....	....	....
2	73·5255	....	....	....	1	61·3866	·4610	·0253	10·37
2	72·3153	·4103	·0201	8·84	2	60·3764	·4489	·0221	9·02
2	71·9030	·9973	0300	13·20	2	59·8471	·9186	·0283	11·49
2	71·8607	....	....	....	1	59·2900	·3600	·0341	13·78
2	71·2438	....	....	....	2	58·8184	8874	·0296	+11·96
2	69·8265	·9175	·0354	15·36	2	56·3496	....	....	....
2	69·0868	1768	·0226	9·76					

Weighted mean .... −12·16
V_a .... −18·59
V_d .... − ·10
Curvature .... − ·28

Radial velocity .... − 6·8

*Different standard.

η BOÖTIS 1621.

1908. June 22.
G. M. T. 14^h 10^m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity
2	76·8898	....	....	....	2	67·8377	·8610	·0432	18·53
2	76·5947	·6227	·0450	+20·47	2	65·5907	·6127	·0392	16·58
2	74·2843	·3110	·0440	19·71	2	64·4965	·5180	·0514	21·59
2	74·0261	·0526	·0477	21·32	2	63·3773	....	....	....
2	73·5353	....	....	....	2	60·4210	·4413	·0439	17·91
2	72·8694	·8954	·0322	14·30	2	59·8945	·9145	0522	21·24
2	72·5840	·6100	·0353	15·64	2	58·8142	....	....	....
2	72·3438	·3693	·0418	18·47	2	58·8748	·8948	·0620	25·04
3	71·9275	·9528	·0472	20·81	2	58·5401	·5601	·0521	20·37
2	71·2520	....	....	....	2	53·9551	....	....	....
2	69·8502	·8744	·0483	21·01	2	52·1673	·1880	·0505	+19·54
3	68·7500	·7735	·0400	17·28	2	49·9791	....	....	....
2	68·7025	....	....	....					

Weighted mean .... +19·40
V_a .... −24·75
V_d .... − ·17
Curvature .... − ·28

Radial velocity .... − 5·8

η BOÖTIS 1621.*

1908. June 22.
G. M. T. 14ʰ 10ᵐ

Observed by J. S. Plaskett.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	76·9515	....	....	....	3	67·8975	·8633	·0455	20·88
2	76·6545	·6195	·0458	+20·84	2	65·6520	·6150	·0415	17·55
2	74·3483	·3118	·0448	20·07	2	64·5563	·5168	·0502	21·08
2	74·0780	·0418	·0369	16·50	2	63·4410	....	....	....
2	73·5981	....	....	....	2	60·4858	·4438	·0464	18·93
2	72·9294	·8934	·0302	13·40	2	59·9466	·9046	·0423	17·22
2	72·6463	·6103	·0356	15·77	2	58·8764	....	....	....
2	72·4084	·3722	·0347	15·34	2	58·9274	·8859	·0531	21·45
2	71·9888	·9527	·0471	20·77	2	58·5948	·5533	·0453	17·71
2	71·3110	....	....	....	2	54·0116	....	....	....
2	69·9088	·8748	·0487	21·18	2	52·2260	·1960	·0585	+22·64
2	68·8137	·7802	·0467	20·17	2	50·0224	....	....	....
2	68·7675	....	....	....					

Weighted mean	+18·91	
V_a		−24·75
V_d		− ·17
Curvature		− ·28
Radial velocity		− 6·3

*Check measurement.

η BOÖTIS 1663.*

1908. July 6.
G. M. T. 14ʰ 40ᵐ

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Region.	Settings I. Star.	Settings I. Comparison.	Difference in Revolutions.	Settings II. Star.	Settings II. Comparison.	Difference in Revolutions.	Mean Difference	Velocity.
6	·325	·359	·034	·688	·643	·045	·040	+19·04
7	·334	·363	·029	·686	·641	·045	·037	16·98
8	·341	·378	·037	·668	·632	·036	·036	15·95
9	·334	·378	·044	·676	·632	·044	·044	18·92
10	·347	·387	·040	·672	·619	·053	·046	19·14
11	·350	·403	·053	·660	·603	·057	·055	22·11
12	·372	·411	·039	·650	·603	·047	·043	16·65
13	·368	·414	·046	·650	·605	·045	·046	17·30
14	·378	·425	·047	·650	·600	·050	·048	17·47
15	·397	·445	·048	·634	·579	·055	·052	18·30
16	·407	·458	·051	·628	·564	·064	·057	19·49
17	·430	·467	·037	·604	·554	·050	·044	+14·56

Weighted mean	+17·99	
*1519 Standard	+ ·41	
V_s	+18·40	
V_a		−25·77
V_d		− ·17
Radial velocity		− 7·6

η BOÖTIS 1663.*

1908. July 6.
G. M. T. 14h 40m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Region.	Settings I. Star.	Settings I. Comparison.	Difference in Revolutions.	Settings II. Star.	Settings II. Comparison.	Difference in Revolutions.	Mean Difference	Velocity.
5	·021	·970	·051	205	·246	·041	·046	+22·72
6	·009	·975	·034	·201	·250	049	·042	20·00
7	021	·966	·056	·206	·254	·048	·052	23·87
8	021	·965	·056	·212	·251	·039	·047	20 82
9	·009	·967	·042	·213	·253	·040	·041	17·63
10	·995	·958	·037	·220	·266	·046	·011	17 06
11	008	·955	·053	·229	·270	·041	·047	18·89
12	·984	·949	·035	·219	·284	·065	·050	19·41
13	·973	·944	·029	·241	·283	·042	·036	13·54
14	·989	·927	·062	·240	·284	044	·053	19·29
15	·970	·914	·056	·250	·301	·051	·053	18·66
16	·967	·917	·050	·255	·311	·056	·053	18·13
17	·950	·905	·045	·265	319	·054	·048	15·89
18	·931	·890	·041	·285	·324	·039	·040	12·82
19	·942	877	·065	·291	·335	·044	054	+16·74

Weighted mean...........	+18·36	
*1520 Standard........	− ·38	
V_s	−18·74	
V_a		−25·77
V_d		− ·17
Radial velocity........................		− 7 2

η BOÖTIS 1710.

1908. July 15.
G. M. T. 14h 41m

Observed by J. B. Cannon.
Measured by W. E. Harper.

Region.	Settings I. Star.	Settings I. Comparison.	Difference in Revolutions.	Settings II. Star.	Settings II. Comparsion.	Difference in Revolutions.	Mean Difference	Velocity.
6	·435	·396	·039	·456	·405	·051	·045	+21·42
7	·426	·386	·040	·445	·407	·038	·039	17·90
8	·426	·386	·040	·442	·391	·051	·045	19·93
9	·448	·395	·053	·439	·392	·047	·050	21·50
10	·448	·400	·048	·434	·395	·039	·043	17·89
11	·454	·391	·063	·426	·383	·043	·053	21·31
12	·436	·399	·037	·441	·400	·044	·040	15·53
13	·448	·400	·048	·444	·375	·069	·058	21 81
14	·455	·405	·050	·439	·400	·039	·045	16·38
15	·451	·396	·055	·450	·390	·060	·057	20·06
16	·461	·391	·070	·451	·395	·056	·063	21·55
17	·425	·390	·035	·452	·398	·054	·044	+14·56

Weighted mean	+19·15	
1520 Standard............	+ ·38	
V_s	+19·53	
V_a		−25·71
V_d		− ·24
Radial velocity........................		− 6·4

η BOÖTIS 1792

1908, Aug. 19.
G. M. T. 13h 18m

Observed by W. E. Harper.
Measured by T. H. Parker.

Region.	Settings I. Star	Settings I. Comparison.	Difference in Revolutions	Settings II. Star	Settings II. Comparison	Difference in Revolutions.	Mean Difference	Velocity.
5	·802	·817	·015	·718	·690	·028	·022	+10·86
6	·812	·824	·012	·697	·673	·024	·018	8·56
7	·815	·834	·019	·710	·671	·039	·029	13·31
8	·829	·846	·017	·693	·670	·023	·026	11·51
9	·828	·841	·013	·681	·660	·021	·025	10·72
10	·831	·860	·029	·685	·654	·031	·030	12·45
11	·837	·865	·028	·682	·644	·038	·033	13·23
12	·842	·868	·026	·687	·654	·033	·029	11·25
13	·853	·885	·042	·668	·640	·028	·035	13·16
14	·865	·895	·030	·660	·619	·041	·036	13·10
15	·864	·902	·039	·636	·600	·036	·037	13·02
16	·876	·909	·033	·637	·591	·046	·039	+13·29

Weighted mean	+12·04
1519 Standard	+ ·41
V_a	−20·04
V_d	− ·28
Radial velocity	− 7·9

η BOÖTIS 1867.

1908. Sept. 7.
G. M. T. 12h 57m

Observed by J. S. Plaskett.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	76·9031	....	....	....	2	71·8856	....	....	....
1½	77·2356	·2508	·0215	+ 9·80	1	68·7611	·7763	·0428	18·49
1½	76·6039	·6189	·0452	20·61	2	68·7171	....	....	....
1	75·8642	·8777	·0405	18·35	1	67·8216	·8366	·0188	8·06
1½	72·8696	·8798	·0166	7·37	2	63·3916	....	....	....
1½	72·5992	·6116	·0369	16·35	1	60·4216	·4276	·0302	12·35
2	71·9211	·9371	·0315	13·89	½	59·3391	·3441	·0545	22·13

Weighted mean	+14·18
V_a	−13·88
V_d	− ·30
Curvature	− ·28
Radial velocity	− 0·3

η BOÖTIS 2115.

1909. Jan. 7.
G. M. T. 23ʰ 23ᵐ

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	76·6775	....	....	....	2	69·3445	·3612	·0260	11·39
2	76·6430	·6575	·0344	−15·82	2	68·8810	·9002	·0381	16·65
2	76·3060	·3200	·0301	13·79	2	68·5537	....	....	....
2	74·9547	....	....	....	2	68·5247	·5245	·0502	21·80
1	74·9365	·9467	·0464	21·11	2	67·6056	·6244	·0421	18·24
1	74·0052	·0152	·0471	21·29	2	67·2315	·2501	·0393	17·02
2	73·7510	·7610	·0413	18·63	2	65·3890	·4052	·0359	15·30
2	73·3481	....	....	....	1	64·2927	·3075	·0360	15·30
2	72·6167	·6277	·0425	19·08	2	63·2724	....	....	....
2	72·3162	·3279	·0560	25·09	2	63·2091	·2230	·0486	20·41
2	71·6667	·6810	·0394	17·53	2	58·7025	·7188	·0387	−15·79
2	71·0812	....	....	....	2	58·7427	....	....	....
2	69·6012	·6173	·0409	17·91					

Weighted mean..............	−17·88	
V_a		+26·69
V_d		+ ·01
Curvature	·28	
Radial velocity..............................		+ 8·6

η BOÖTIS 2209.

1909. Jan. 30.
G. M. T. 18ʰ 37ᵐ

Observed by J. S. Plaskett.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	81·7544	....	....	....	1	67·6626	·6721	·0448	19·35
1	80·5548	·5772	·0398	−18·75	½	66·5389	·5481	·0351	15·02
2	76·7524	....	....	....	½	64·3381	·3469	·0376	15·87
1	76·7084	·7234	·0440	20·20	2	61·3366	....	....	....
1	76·3728	·3878	·0369	16·90	½	61·1268	·1347	·0458	18·92
½	75·0031	·0159	·0481	21·79	½	59·7626	·7719	·0355	14·55
½	74·0754	·0862	·0444	20·02	1	58·4051	·4151	·0446	18·11
2	73·4156	....	....	....	½	52·0778	·0920	·0338	13·18
1	72·6808	·6896	·0450	20·07	2	49·9854	....	....	....
2	71·7318	·7410	·0412	18·29	1	48·0966	·1130	·0463	−17·59
2	68·6164	....	....	....					

Weighted mean..............	−19·76	
V_a		+25·02
V_d		+ ·20
Curvature	− ·28	
Radial velocity..............................		+ 5·2

η BOÖTIS 2283.

1909. Feb 17.
G. M. T. 20h 30m

Observed by } J. B. CANNON.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	76·7061	....	....	....	1	61·0771	·1522	·0283	11·70
½	76·6704	·7317	·0357	−16·38	1	59·6981	·7740	·0324	13·27
1	74·9769	·0382	·0258	11·70	1	56·7141	·7913	·0342	13·74
½	74·0486	·1100	·0206	9·28	2	56·2824	....	....	....
1	73·0121	·0736	·0474	21·21	½	52·9986	·0808	·0450	17·53
2	73·3628	....	....	....	½	51·6967	·7801	·0303	11·78
1	72·1104	·1739	·0272	12·10	1½	49·8821	·9680	·0321	12·34
2	71·6891	·7546	·0276	12·24	1½	48·0301	·1171	·0378	14·35
1	69·6231	·6925	·0217	9·49	2	46·3428	....	....	....
2	68·5548	....	....	....	1	46·2721	·3617	·0532	19·97
1	68·5298	·6012	·0265	11·51	2	33·0633	....	....	....
½	67·6224	·6945	·0224	9·67	½	31·5776	·6899	·0444	15·19
2	63·2498	....	....	....	1	30·8284	·9422	·0517	17·61
1	63·1931	·2674	·0421	17·65	½	26·4908	·6107	·0196	−16·44

Weighted mean	−13·98	
V_a		+20·25
V_d		+ ·04
Curvature	− ·28	
Radial velocity		+ 6·0

η BOÖTIS 2396.

1909. March 20.
G. M. T. 17h 00m

Observed by J. S. PLASKETT.
Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	77·1341	....	....	....	1	68·6049	·6109	·0168	7·29
1	76·7516	·7465	·0209	−9·59	1	67·6992	·7072	·0097	4·19
½	76·4234	·4178	·0060	2·75	2	61·3222	....	....	....
1	75·0522	·0491	·0149	6·75	1	60·3016	·3269	·0113	4·64
1	74·1209	·1191	·0115	5·19	1	59·7754	·8027	·0037	1·51
2	73·4249	....	....	....	1	58·4149	·4462	·0135	5·48
1	72·7076	·7079	·0267	11·91	2	49·9442	....	....	....
½	72·4306	·4318	·0157	7·00	1	49·9466	·0041	·0068	2·61
2	71·7664	·7688	·0134	5·95	2	30·9059	....	....	....
2	71·1534	....	....	....	1	30·8756	·9795	·0144	−4·91
1	69·7034	·7074	·0068	2·97					

Weighted mean	− 5·59	
V_a		+ 8·52
V_d		+ ·14
Curvature	− ·28	
Radial velocity		+ 2.8

OBSERVING RECORD AND DETAILED MEASURES OF *a* CORONÆ BOREALIS.

RECORD OF SPECTROGRAMS.

P.—Plaskett.
Pl.—Parker.
H.—Harper.
C.—Cannon.
T.—Tribble.

Star.	No. of Negative.	Camera.	Plate.	Date.	Middle of Exposure G. M. T.	Duration.	Hour Angle at end.	Temperature Centigrade. Room. Beg.	Room. End.	Prism Box. Beg.	Prism Box. End.	Slit Width.	Seeing.	Observer.
				1907.	h. m.	m.	h. m.							
a Coronæ Borealis:	784	IL	Seed 27.	May 24	17 43	10	1 20W.	9·0	9.4	16·4	16·4	·001	Fair.. ..	P
〃 ..	790	〃	〃 ..	〃 29	15 14	12	50W.	8·9	9·0	14·5	14·5	·001	〃 ...	P
〃 ..	800	〃	〃 ..	〃 31	17 18	8	1 20W.	13·0	12·8	18·8	18·8	·001	Good...	P
〃 ..	808	〃	〃 ..	June 8	16 28	10	1 05W.	15·4	15·2	17·2	17·2	·001	....	P
〃 ..	813	〃	〃 ..	〃 10	15 23	10	0 00	14·8	14·6	18·1	18·1	·001	......	P
〃 ..	830	〃	〃 ..	〃 11	17 40	10	2 15W.	14·0	14·0	18·9	18·9	·001	Fair....	H
〃 ..	837*a*	〃	〃 ..	〃 12	17 36	12	2 30W.	17·0	16·3	19·0	19·0	·001	〃 ...	P
〃 ..	837*b*	〃	〃 ..	〃 12	17 52	12	2 42W.	16·0	15·6	19·0	19·0	·001	〃 ...	P
〃 ..	845	〃	〃 ..	〃 13	16 32	15	1 30W.	19·8	19·4	25·8	25·8	·0012	〃 ...	H
〃 ..	850*a*	〃	〃 ..	〃 14	16 39	12	1 40W.	21·6	21·4	23·3	23·3	·0012	〃 ...	P
〃 ..	850*b*	〃	〃 ..	〃 14	16 52	5	1 50W.	21·4	21·1	23·3	23·3	·0012	Good...	P
〃 ..	869*a*	〃	〃 ..	〃 21	15 10	15	50W.	24·8	24·8	28·9	28·9	·001	Hazy...	P
〃 ..	869*b*	〃	〃 ..	〃 21	15 42	15	1 20W.	24·8	24·6	28·9	29·0	·001	〃 ...	P
〃 ..	892*a*	〃	〃 ..	〃 27	15 25	10	1 17W.	21·2	20·9	24·5	24·5	·0012	Fair....	H
〃 ..	892*b*	〃	〃 ..	〃 27	15 37	5	1 25W.	20·9	20·9	24·5	24·5	·0012	Cloudy.	T
〃 ..	903*a*	〃	〃 ..	〃 28	14 36	13	33W.	23·8	23·6	26·4	26·3	·0012	Fair ...	P
〃 ..	903*b*	〃	〃 ..	〃 28	14 57	25	1 00W.	23·5	22·8	26·3	26·2	·0012	〃 ...	P
〃 ..	912*a*	〃	〃 ..	July 4	15 38	10	2 00W.	21·0	20·5	29·0	28·8	·0012	Good. .	H
〃 ..	912*b*	〃	〃 ..	〃 4	15 47	5	2 17W.	21·0	20·0	28·8	28·6	·0012	〃 ..	H
〃 ..	917	〃	〃 ..	〃 5	15 20	10	1 45W.	21·0	20·8	26·4	26·4	·0011	....	P
〃 ..	919	〃	〃 ..	〃 8	15 36	22	2 05W.	21·2	21·2	22·4	22·4	·0012	Fair....	P
〃 ..	927	〃	〃 ..	〃 9	14 32	15	1 14W.	23·1	23·1	24·5	24·5	·0012	Good...	H
〃 ..	939*a*	〃	〃 ..	〃 12	16 25	10	4 15W.	22·6	22·4	26·0	26·0	·0012	〃 ...	P
〃 ..	939*b*	〃	〃 ..	〃 12	16 33	2½	4 20W.	22·6	22·4	26·0	26·0	·0012	〃 ...	P
〃 ..	941*a*	〃	〃 ..	〃 13	15 25	10	3 15W.	18·2	18·0	25·2	25·0	·0012	....	T
〃 ..	941*b*	〃	〃 ..	〃 13	15 32	3	3 20W.	18·0	17·8	25·0	25·0	·0012	....	T
〃 ..	944*a*	〃	〃 ..	〃 16	14 37	13	1 42W.	25·5	25·5	26·8	26·8	·0012	Unst'dy	T
〃 ..	944*b*	〃	〃 ..	〃 16	14 49	6	1 53W.	25·5	25·5	26·8	26·8	·0012	〃	T
〃 ..	951*a*	〃	〃 ..	〃 18	14 50	60	2 32W.	26·0	25·0	28·5	28·5	·0012	Very hazy..	T
〃 ..	951*b*	〃	〃 ..	〃 18	15 32	5	2 45W.	22·5	22·5	28·5	28·5	·0012	〃	H
〃 ..	956*a*	〃	〃 ..	〃 20	16 07	14	3 30W.	19·2	18·6	21·6	21·6	·0012	Good...	P
〃 ..	956*b*	〃	〃 ..	〃 20	16 17	2	3 32W.	19·2	18·6	21·6	21·6	·0012	〃 ...	P
〃 ..	963*a*	〃	〃 ..	〃 23	14 32	6	2 05W.	23·2	23·2	26·4	26·4	·0012	〃 ...	T
〃 ..	963*b*	〃	〃 ..	〃 23	14 41	3	2 15W.	22·6	22·6	26·4	26·4	·0012	....	T
〃 ..	973*a*	〃	〃 ..	Aug. 1	14 06	12	2 15W.	21·3	21·0	25·2	25·2	·0008	....	H
〃 ..	973*b*	〃	〃 ..	〃 1	14 18	8	2 26W.	21·0	19·5	25·2	25·2	·0008	.. . ..	H
〃 .	978	〃	〃 ..	〃 3	13 02	8	1 15W.	21·6	20·8	24·1	24·1	·0012	....	P
〃 ..	986	〃	〃 ..	〃 6	16 38	23	5 15W.	19·5	19·4	23·3	23·3	·0012	Poor....	H
〃 ..	1006	〃	〃 ..	〃 12	16 36	12	5 31W.	23·0	22·5	29·0	29·0	·0014	Unst'dy	H
〃 ..	1014	〃	〃 ..	〃 15	15 09	7	4 20W.	22·3	19·5	26·3	26·3	·0014	Very poor..	H
〃 ..	1017	〃	〃 ..	〃 22	15 11	11	4 47W.	18·7	18·5	24·1	24·2	·0014	Fair....	H
〃 ..	1022	〃	〃 ..	〃 23	14 46	62	4 46W.	22·5	21·4	27·0	27·0	·0014	Light clouds.	T
〃 ..	1026	〃	〃 ..	〃 27	12 06	13	2 57W.	18·5	18·5	20·6	20·6	·0014	Fair....	H
〃 ..	1032	〃	〃 ..	Sept. 6	13 43	17	4 15W.	19·0	18·5	21·0	21·0	·0012	Good...	T
〃 ..	1037	〃	〃 ..	〃 12	14 39	18	5 37W.	17·0	16·8	20·9	20·9	·0012	〃 ...	T
〃 ..	1047	〃	〃 ..	〃 18	12 50	30	4 17W.	15·0	15·0	17·1	17·1	·0012	Cloudy.	T
〃 ..	1048	〃	〃 ..	〃 18	13 16	16	4 36W.	15·0	14·2	17·1	17·1	·0012	Fair....	T
〃 ..	1060	〃	〃 ..	〃 20	13 35	20	5 05W.	22·0	22·0	22·9	22·9	·0012	Poor....	H
〃 ..	1061	〃	〃 ..	〃 20	13 58	24	5 30W.	22·0	22·3	22·9	22·9	·0012	〃 ...	H
〃 ..	1083	〃	〃 ..	Oct. 1	13 44	16	5 55W.	10·5	10·4	14·2	14·2	·0014	....	H
〃 ..	1084	〃	〃 ..	〃 1	14 06	27	6 23W.	10·4	10·2	14·2	14·1	·0014	Hazy...	H

RECORD OF SPECTROGRAMS.—(*Concluded*).

Star.	No. of Negative.	Camera.	Plate.	Date.	Middle of Exposure. G. M. T.	Duration.	Hour Angle at end.	Temperature. Centigrade. Room. Beg.	Room. End.	Prism Box. Beg.	Prism Box. End.	Slit Width.	Seeing.	Observer.
				1908.	h. m.	m.	h. m.							
a Coronæ Borealis :	1393	1L	Seed 27.	Mar. 9	22 08	24	55W.	−15·0	−15·0	1·0	1·0	.....	Hazy...	H
" ..	1402	"	" ..	" 16	21 02	10	9W.	−12·5	−13·0	2·3	2·3	.....	Good...	H
" ..	1493	"	" ..	Apr. 15	19 18	8	28W.	− 3·0	− 2·3	7·8	7·7	.....	" ...	P
" ..	1565	"	Seed Process	June 1	18 00	30	2 50W.	15·7	14·6	21·4	21·3	.....	" ...	P- P^{1}
" ..	1566	"	Seed 27.	" 1	18 42	15	3 13W.	14·5	14·0	21·3	21·2	.....	Fair....	P^{1}
" .	1571	"	" ..	" 3	16 32	15	57W.	14·9	15·0	18·4	18·4	.....	" ...	P
" ..	1572	"	" ..	" 3	16 52	15	1 20W.	15·0	14·8	18·4	18·4	.....	" ...	P
" .	1581	"	" ..	" 5	17 31	18	2 04W.	17·5	17·0	24·6	24·6	·0016	Good...	H
" ..	1601	"	" ..	" 12	16 56	12	1 54W.	19·5	19·0	25·0	25·0	·0017	" ...	H
" ..	1608	"	" ..	" 17	13 53	14	50E.	19·0	18·5	23·4	23·3	·0016	" ...	H
" ..	1623	"	" ..	" 22	16 27	14	2 10W.	18·3	18·0	23·7	23·8	·0015	Fair....	P
" ..	1624	"	" ..	" 22	16 43	13	2 25W.	18·0	18·0	23·8	23·8	·0015	Good...	P
" ..	1628	"	" ..	" 24	15 26	18	1 15W.	21·5	21·5	27·5	27·5	·0015	" ...	P
" ..	1629	"	" .	" 24	15 49	15	1 35W.	21·5	21·5	27·5	27·5	·0015	" ...	P
" ..	1638	"	" ..	" 26	15 51	15	1 48W.	21·0	20·5	30·0	30·0	·0016	" ...	H
" ..	1639	"	" ..	" 26	16 04	8	1 57W.	20·5	21·0	30·0	30·0	·0016	" ...	H
" ..	1646	"	" ..	" 27	16 20	10	2 20W.	20·8	20·5	23·8	23·8	·0014	" ...	P
" ..	1647	"	" ..	" 27	16 30	10	2 30W.	20·5	.....	.....	.....	.....	Fair....	P
" ..	1652	"	" ..	July 1	15 15	30	1 30W.	23·6	23·6	25·8	25·8	·0015	Cloudy..	P
" ..	1656	"	" ..	" 3	15 17	13	1 38W.	23·0	21·9	25·5	25·5	·001	Good...	H
" ..	1665	"	" ..	" 6	16 50	10	3 20W.	24·0	23·8	26·4	26·4	·0015	" ...	P
" ..	1674	"	" ..	" 8	15 11	10	1 50W.	19·0	19·3	21·8	21·8	·0015	Fair....	C
" .	1683	"	" ..	" 10	13 34	20	26W.	25·0	24·5	27·5	27·5	·0012	Good...	H
" ..	1684	"	" ..	" 10	13 51	13	40W.	24·5	24·5	27·5	27·5	·0012	" ...	H
" ..	1692	"	" ..	" 11	16 20	10	3 12W.	27·7	27·5	30·1	30·1	·0015	Fair....	P
" .	1697	"	" ..	" 13	15 26	13	2 25W.	20·0	19·9	23·1	23·1	·0015	" ...	P
" ..	1698	"	" .	" 13	15 42	16	2 50W.	19·9	19·6	23·1	23·1	·0015	" ...	P
" ..	1711	"	" ..	" 15	16 24	12	3 30W.	17·5	17·0	21·6	21·6	·0015	Good..	C
" ..	1721	"	" ..	" 24	13 05	15	48W.	24·0	24·0	26·4	26·4	·0012	" ...	H
" ..	1722	"	" ..	" 24	13 21	14	1 03W.	24·0	24·0	26·4	26·4	·0012	" ...	H
" ..	1739	"	" ..	" 29	15 34	12	3 37W.	26·6	26·3	30·2	30·2	·0015	Fair....	P
" .	1748	"	" ..	" 31	13 38	17	2 00W.	23·3	23·1	26·0	26·0	0015	" ...	P^{1}
" ..	1749	"	" ..	" 31	14 00	20	2 20W.	23·0	22·6	26·0	26·0	·0015	" ...	P^{1}
" ..	1764	"	" ..	Aug. 5	15 37	15	4 10W.	22·0	21·6	26·9	26·9	·0015	" ...	P
" ..	1773	"	" ..	" 7	14 25	20	3 05W.	21·5	20·6	23·6	23·6	·0015	Hazy...	P^{1}
" ..	1775	"	" ..	" 7	16 25	10	5 05W.	19·1	19·0	23·6	23·6	·0015	Good...	P^{1}
" ..	1797	"	" ..	" 20	12 51	16	2 21W.	19·2	19·0	23·1	23·1	·0015	Fair.....	H
" ..	1798	"	" ..	" 20	13 05	10	2 32W.	19·0	18·8	23·1	23·0	·0015	Good...	H
" ..	1805	"	" ..	" 21	12 54	11	2 22W.	21·1	20·6	25·8	25·8	·0015	" ...	C
" ..	1809	"	" ..	" 21	15 01	12	4 30W.	18·8	18·4	25·0	25·4	·0015	" ...	C
" ..	1816	"	" ..	" 24	13 17	15	3 03W.	18·5	18·2	23·4	23·4	·0015	" ...	H
" ..	1817	"	" .	" 24	13 32	14	3 17W.	18·2	17·5	23·4	23·3	·0015	" ...	H
" ..	1827	"	" ..	" 25	13 00	14	2 49W.	20·6	19·3	26·0	26·0	·0015	Hazy...	C
" ..	1836	"	" ..	" 27	14 34	12	4 30W.	18·3	18·0	23·2	23·2	·0015	Good...	C
" ..	1842	"	" ..	" 28	13 14	12	3 16W.	18·5	18·2	23·3	23·3	·0015	" ..	C
" ..	1852	"	" ..	" 31	13 17	15	3 30W.	24·0	24·0	28·0	28·0	·0015	" ..	H
" ..	1861	"	" ..	Sept. 3	12 50	13	3 15W.	18·6	18·8	21·2	21·1	·0015	" ...	P
" ..	1865	"	" ..	" 4	13 27	26	4 05W.	20·5	20·3	23·4	23·4	·0015	Poor....	P^{1}
" ..	1882	"	" ..	" 14	12 51	13	4 00W.	18·6	18·4	21·7	21·7	·0015	Fair....	P
" ..	1894	"	" ..	" 19	12 02	13	3 30W.	17·5	17·3	21·2	21·2	·0015	" ...	P
" ..	1895	"	" ..	" 19	12 17	15	3 45W.	17·3	17·2	21·2	21·2	·0015	" ...	P
" ..	1896	"	" ..	" 19	12 32	15	4 00W.	17·2	16·8	21·1	21·1	·0015	" ...	P
" ..	1897	"	" .	" 19	12 50	16	4 20W.	16·8	16·5	21·1	21·0	·0015	" ...	P
" ..	1949	"	" ..	Nov. 1	10 41	17	5 00W.	2·0	0·6	3·8	3·8	·0015	Good...	C
" ..	1991	"	" ..	Dec. 2	10 10	10	6 19W.	− 7·5	− 8·2	−2·0	−2·0	·0015	Windy	C
" ..	1992	"	" ..	" 2	10 21	13	6 30W.	− 8·2	− 8·2	−2·0	−2·0	·0015	" .	C

α CORONÆ BOREALIS, 784.

1907. May 24.
G. M. T. 17h 43m

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected wave length.	Normal wave length.	Displacement in revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected wave length.	Normal wave length.	Displacement in revolutions.	Velocity.
2	72·9951	4891·192	......	....	......	....	1½	27·6301	4105·162	....	......	......	....
2	72·7321	4861·180	·187	·527	·340	−21 00	1	27·3080	4101·318	·440	·890	·450	32·90
½	72·3165	4851·453	......	.....	......	....	1½	27·1825	4099 824	....	.....	......	....
2	47·6461	4379·418	......	......	.....	....	½	15·4180	3969 627	·807	·177	·670	−50·77
2	45·0940	4340·085	·054	·634	·580	−40·02	2	15·3605	3969·034	......	......	......	....
2	44·1555	4325·981	......	....	......	....	3	28·1875	4111·853	......	......	......	....

Weighted mean	−32 78
V_a	− 7·63
V_d	− 07
Curvature	− ·28
Radial velocity	−39·8

α CORONÆ BOREALIS, 790.

1907. May 29.
G. M. T. 15h 14m

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected wave length.	Normal wave length.	Displacement in revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected wave length.	Normal wave length.	Displacement in revolutions.	Velocity.
2	73·2093	4870·229	.....	.....	......	....	2	27·7347	4105·312	....	....	......	....
2	72·8135	4800·908	2·107	1·527	·580	+35·78	1½	27·5259	4102·815	·700	1 890	·810	+59·21
2	63·6051	4661·138	......	.	......	....	3	27·2873	4099·970	......	.....	.....	....
3	48·7335	4395·316	.....	... .	......	....	½	15·64—	3970·820	·797	177	·620	+47·00
1	45·2535	4341·252	.....	.....	......	....	3	15·4860	3969·232	....	......	....	......
2	45·2502	4341·201	·114	0·634	·480	+33·12							

Weighted mean		+41·68
V_a	− 9·22	
V_d		+ ·10
Curvature	− ·28	
Radial velocity		+32·3

α CORONÆ BOREALIS, 794.

1907. May 29.
G. M. T. $18^h 05^m$

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Computed Wave Length	Corrected Wave Length.	Normal Wave Length.	Displacement in revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in revolutions.	Velocity.
2	72·8775	4862·407	·407	1·527	·880	+59·30	1	27·5506	4102·369	·360	1·890	·170	+34·36
1½	63·6559	4661·600	....	.....	.....	....	½	12·111–	3934·713	·795	3·825	·970	+74·01
2	45·3234	4341·403	·388	0·634	·754	+52·02	3	11·6613	3930·276	......	......	......	......
	45·3085	4341·177	...	..	.....	....							
	27·7905	4105·235	...	.....	.....	....							

Weighted mean .... +53·45
V_a .... – 9·22
V_d .... – ·14
Curvature .... – ·28

Radial velocity .... +43·8

α CORONÆ BOREALIS, 800.

1907. May 31.
G. M. T. $17^h 18^m$

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Computed Wave Length	Corrected Wave Length.	Normal Wave Length.	Displacement in revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in revolutions	Velocity.
	73·2965	4871·490	.....	......	......	....	1½	45·3314	4341·634	1·000	0·634	·366	+25·25
	72·8966	4862·058	2·021	1·527	·494	+30·48	2	45·3203	4341·463	......	......	.....	....
1½	63·6950	4662·143	...	...	......	....							

Weighted mean .... +28·24
V_a .... – 9·87
V_d .... – ·09
Curvature .... – ·28

Radial velocity .... +18·00

α CORONÆ BOREALIS, 806*.

1907. May 31.
G. M. T. 17h 18m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected wave length.	Normal wave length.	Displacement in revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected wave length.	Normal wave length.	Displacement in revolutions.	Velocity.
2	73·1662	4870·711	......	....	......	....	½	53·9228	4482·746	156	·400	·756	+[50·57]
2	72·7643	4861·253	·993	·527	·366	+22·58	1½	45·1975	4341·903	..	......	......	....
1	53·9370	4482·990	....	......	... ..	....	2	45·1921	4341·822	·084	·634	·450	+31·05

Weighted mean		+26·82
V_a	−9·87	
V_d	−·09	
Curvature	−·28	
Radial velocity		+16·6

*Check measurement.

α CORONÆ BOREALIS, 808.

1907. June 8.
G. M. T. 16h 28m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected wave length.	Normal wave length.	Displacement in revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected wave length.	Normal wave length.	Displacement in revolutions.	Velocity.
2	73·6301	4880·622	.....	.....	......	....	1½	53·2825	4459·560	.....	.....	......	....
1½	73·2099	4870·635	......	......	......	....	1½	45·2977	4341·340	......	......	......	....
2	72·7779	4860·446	·117	·527	·410	−25·30	1½	45·2356	4340·399	·224	·634	·410	−28·29
1½	54·7247	4494·835	......	......	......	....	½	27·4985	4101·465	·740	·890	·150	−10·97
1	53·9597	4481·558	·400	·400	·000	[0·00]	2	27·3464	4099·648	.....	...	.....	....

Weighted mean	−24·63
V_a	−12·26
V_d	−·07
Curvature	−·28
Radial velocity	−37·2

α CORONÆ BOREALIS, 813.

1907. June 10.
G. M. T. 15h 23m

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected wave length.	Normal wave length.	Displacement in revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected wave length.	Normal wave length.	Displacement in revolutions.	Velocity.
1	72·9500	4864·729	.....	.....	.....	....	1½	45·2570	4340·581	·584	·631	·050	− 3·45
2	72·7916	4860·995	·047	·527	·480	−29·62	1	27·4836	4101·565	·565	·890	·325	−23·76
1	54·0328	4482·605	......	.....	......	....	½	11·9745	3933·225	·505	·825	·320	−23·52
½	53·9933	4481·933	·720	·400	·320	+[21·40]	3	11·6547	3930·072	......	......	......	....

Weighted mean	−19·99
V_a	−12·82
V_d	·00
Curvature	− ·28
Radial velocity	−33·1

α CORONÆ BOREALIS, 813*.

1907 June 10.
G. M. T. 15h 23m

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0019	....	....	.. ..	1	27·4611	·3746	·0380	−33·00
1	72·8452	·8543	·0105	−15·23	2	27·3334	....	....	....
1	72·4360	....	... .	....	½	11·9831	·8494	·0020	− 1·50
2	45·2832	....	....	....	2	11·6415	....	....	....
1½	45·2550	·2404	·0017	+ 1·77					

Weighted mean	−11·33
V_a	−12·82
V_d	·00
Curvature	− ·28
Radial velocity	− 23·4

Check measurement.

α CORONÆ BOREALIS, 830.

1907. June 11.
G. M. T. 17h 40m

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0400	…	…	…	1	27·5388	·4018	·0108	− 9·37
½	72·9005	·8714	·0066	+ 9·57	2	27·3833	…	…	…
2	72·4707	…	…	…	½	15·6378	·4462	·0271	−20·97
2	45·3505	…	…	…	2	15·5903	…	…	…
1½	45·2971	·2202	·0177	−19·31					

Weighted mean	−12·59
V_a	−13·12
V_d	− ·14
Curvature	− ·28
Radial velocity	− 26·1

α CORONÆ BOREALIS, 837 (*a*).

1907. June 12.
G. M. T. 17h 36m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in revolutions.	Velocity.
2	73·2575	4871·377	…	…	…	…	1½	53·2836	4469·109	·260	1·400	·140	− 9·37
2	72·9590	4864·316	…	…	…	…	2	45·2743	4341·034	…	…	…	…
1	72·7939	4860·427	·027	·527	·500	−30·85	2	45·2468	4340·618	·744	·634	·110	+ 7·59
1½	54·7243	4494·565	…	…	…	…	1	27·4500	4101·723	·700	·890	·190	−13·40
1	54·0416	4482·729	·880	1·400	1480	+[99·01]	2	27·2997	4099·937	…	…	…	…
1½	53·9476	4484·109	…	…	…	…							

Weighted mean	− 7·84
V_a	−13·39
V_d	− ·15
Curvature	− ·28
Radial velocity	− 21·7

α CORONÆ BOREALIS, 837 (*b*).

1907. June 12.
G. M. T. 17h 48m

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in revolutions.	Velocity.
2	73·3641	4871·496	....	.....	......	....	1½	45·3637	4340·923	·834	·631	·200	+13·80
1½	73·0748	4864·652	......	......	......	....	1	27·5769	4102·126	·780	·890	110	− 8·74
1	72·9262	4861·152	·417	·527	·080	− 4·90	2	27·4205	4100·265	.....	. .	. . ..	....
2	45·3955	4341 251	.. ..	......	......	....							

Weighted mean.......... + 2·22
V_a .... −13·39
V_d .... ·15
Curvature........................ − ·28

Radial velocity..................... − 11·6

α CORONÆ BOREALIS, 845.

1907. June 13.
G. M. T. 16h 32m

Observed by / Measured by } W. E. HARPER.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected wave length.	Normal wave length.	Displacement in revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected wave length.	Normal wave length.	Displacement in revolutions.	Velocity.
2	73·5911	4875 434	......	......	......	....	½	30·3756	4135·609	·374	......	......	.... ..
2	73·1412	4864·776	......	.....	......	... .	3	30·3142	4134·852	......	......	.... ..	....
1	73·0219	4861·964	·817	·527	·290	+17·89	1	27·6096	4102·126	1·921	·890	·031	+ 2·27
2	45·4418	4341·360	......	.....	......	... .	2	27·4418	4100·132	......	......	......	....
1½	45·4224	4341·068	0·868	·634	·23.4	+16·14							

Weighted mean............ +12·68
V_a .... −13·65
V_d . ... ·10
Curvature.............. − ·28

Radial velocity .... − 1·4

α CORONÆ BOREALIS, 850 (*a*).

1907. June 14.
G. M. T. 16h 39m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected wave length.	Normal wave length.	Displacement in revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected wave length.	Normal wave length.	Displacement in revolutions.	Velocity.
2	73·4113	4875·633	....	.....	......	....	1½	53·9875	4482·586	1·046	·400	·646	+[43·22]
2	72·9635	4865·037	......	...	......	....	1½	53·2781	4470·405	......	.....	......	....
1	72·8279	4861·845	·747	·527	·220	+13·57	2	45·2668	4341·590	......	......	......	....
1½	54·3973	4489·656	....	.....	.....	....	2	45·2482	4341·307	0·879	·634	·245	+16·90

Weighted mean		+15·79
V_a	−13·92	
V_d	− ·12	
Curvature	− ·28	
Radial velocity		+ 1·5

α CORONÆ BOREALIS, 850 (*b*).

1907. June 14.
G. M. T. 16h 52m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected wave length.	Normal wave length.	Displacement in revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected wave length.	Normal wave length.	Displacement in revolutions.	Velocity.
1½	73·4199	4875·835	....	......	......	......	2	45·2684	4341·613	·188	·634	·554	+38·23
1½	72·9691	4865·169	......	...	......	....	1	27·4757	4102·322	2·290	1·890	·400	+29·24
1	72·8446	4862·238	1·997	·527	·470	+29·00	2	27·2770	4099·954	...	.....	......	....
2	45·2666	4341·587	......	...	......	....							

Weighted mean		+33·68
V_a	−13·92	
V_d	− ·12	
Curvature	− ·28	
Radial velocity		+19·4

α CORONÆ BOREALIS. 861 (a).

1907. June 20.
G. M. T. 16h 05m

Observed by, Measured by: W. E. Harper.

Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in revolutions.	Velocity.	Wt.	Mean of Settings.	Computed Wave Length.	Corrected Wave Length.	Normal Wave Length.	Displacement in revolutions.	Velocity.
1	73·2760	4871·450	......	......	......	....	1½	45·2526	4341·493	....	......	......	....
1½	72·9905	4864·720	......	......	......	....	1½	45·2364	4341·249	0·918	0·634	·281	+19·60
1	72·8861	4862·267	2·467	1·527	·940	+58·00	1	27·4436	4102·363	2·320	1·890	·430	+31·43
½	54·0070	4482·788	2·495	1·400	1·095	+[73.25]	1½	27·2416	4099·960	.....	....	.....	....
½	53·2695	4470·164	....	.....	......	....							

Weighted mean		+33.95
V_a	−15·42	
V_d	− ·11	
Curvature	− ·28	
Radial velocity		+ 17·1

α CORONÆ BOREALIS, 869 (a).

1907. June 21.
G. M. T. 15h 10m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·4558	....	....	....	1	53·1220	....	....	....
1½	72.9987	....	....	....	2	45·2828	....	....	....
1	72·8723	·8833	·0185	+26·84	2	45·2626	·2574	·0187	+19·52
1	72·4343	....	....	....	1	27·4687	·4329	·0203	+17·62
1½	54·7447	....	....	....	2	27·2824	....	....	....
½	54·0017	·9962	·0264	+[30·39]					

Weighted mean		+20·88
V_a	−15·65	
V_d	− ·05	
Curvature	− ·28	
Radial velocity		+ 4·9

α CORONÆ BOREALIS, 869 (*b*).

1907. June 21.
G. M. T. $15^h 42^m$

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·4265	...	...	...	1½	53·0887	...	...	...
1½	72·9753	...	...	...	2	45·2563	...	...	...
1	72·8572	·8940	·0292	+42·37	2	45·2497	·2670	·0283	+29·53
1	72·4075	...	...	...	½	27·4248	·4145	·0019	+ 1·65
2	54·7245	...	...	...	2	27·2569	...	...	...
1	54·0007	0197	0499	+[57·42]					

Weighted mean	.....	+29·22
V_a	−15·66	
V_d	− ·07	
Curvature	− ·28	
Radial velocity		+13·2

α CORONÆ BOREALIS, 880.

1907. June 25.
G. M. T. $15^h 43^m$

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	49·3450	...	...	...	½	27·4294	·4144	·0018	+ 1·50
2	45·1892	·2092	·0295	−30·80	1	27·2616	...	...	...
2	44·2398	...	...	...					

Weighted mean	−24·34
V_a	−16·56
V_d	− ·10
Curvature	− ·28
Radial velocity	− 41·3

α CORONÆ BOREALIS, 888.

1907. June 26.
G. M. T. 15h 01m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	48·7894	....	....	....	½	27·5130	·5033	·0168	+13·57
2	45·2958	·2794	·0307	+32·14	1	27·3316	....	....	....
2	45·2880	....	....	....					

Weighted mean........	+28·42
V_a..........	−18·76
V_d..........	− ·05
Curvature.......	− ·28
Radial velocity.........	+11·3

α CORONÆ BOREALIS, 892 (a).

1907. June 27.
G. M. T. 15h 25m

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·9825	....	....	....	2	45·2750	....	....	....
1	72·8545	·8822	·0174	+25·20	½	45·2277	·2363	·0124	−12·98
2	72·4160	....	....	....	2	57·8430	·8237	·0190	+(22·91)*
½	54·0205	....	....	....	1½	57·8172	....	....	....
¼	53·9655	·9603	·0037	+[4·27]					

Weighted mean..........	+12·47
V_a..........	−16·98
V_d..........	− ·09
Curvature..........	− ·28
Radial velocity..........	− 4·9

*Not used.

α CORONÆ BOREALIS, 892 (*b*).

1907. June 27.
G. M. T. 15ʰ 25ᵐ

Observed by W. E. Harper.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0205	......	....	....	2	54·7740	....	....	....
½	72·8582	·8479	·0169	−24·52	1	54·0162	·9814	·0116	+[13·35]
2	72·4540	....	....	....	2	53·1495	....	....	....
2	57·8550	....	....	....	2	45·3208	....	....	....
½	57·8570	·8288	·0020	+(2·41)*	1	45·2668	·2196	·0191	−19·94

Weighted mean .... −21·47
V_a .... −16·98
V_d .... − ·09
Curvature .... − ·28

Radial velocity .... −38·8

*Not used.

α CORONÆ BOREALIS, 912 (*a*).

1907. July 4.
G. M. T. 15ʰ 38ᵐ

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·4621	....	....	....	3	54·0285	·0243	·0545	+[62 73]
1	73 0125	....	....	....	2	53·1130	....	....	....
½	72·8823	·8823	·0175	−25·39	2	45·2818	....	....	....
½	72·4506	....	....	....	1½	45·2930	·2848	·0461	+48·13
1½	54·7496	....	....	....					

Weighted mean .... +43·58
V_a .... −18·30
V_d .... − ·14
Curvature ...... − ·28

Radial velocity .... +24·9

α CORONÆ BOREALIS, 917 (a).

1907. July 5. G. M. T. 15^h 20^m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9847	....	....	....	2	53·1159	....	....	....
1	72·8795	·9040	·0392	+56·38	2	45·2826	....	....	....
1½	72·4219	....	....	....	2	45·2955	·2865	·0478	+49·90
2	54·7410	....	....	....	½	27·4935	·4460	·0334	+28·99
¼	54·022-	·0210	·0512	+[58·93]	2	27·2942	....	....	....

Weighted mean..................		+48·77
V_a..............	−18·45	
V_d..............	− ·10	
Curvature......	− ·28	
Radial velocity..................		+29·9

α CORONÆ BOREALIS, 919.

1907. July 8. G. M. T. 15^h 36^m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9772	....	....	....	1½	45·2712	·2697	·0210	+21·98
1	72·8492	·8372	·0185	+26·88	1	27·5298	·5265	·0300	+34·16
2	72·4058	....	....	....	1	30·9330	....	....	....
2	45·2852	....	....	....	2	27·3256	....	....	....

Weighted mean..................		+26·86
V_a..............	−18·95	
V_d..............	− ·14	
Curvature......	− ·28	
Radial velocity..................		+ 7·5

α CORONÆ BOREALIS, 927.

1907. July 9.
G. M. T. 14h 32m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9662	....	....	....	2	45·2862	....	....	....
1	72·8618	·8562	·0375	+54·48	1½	45·2380	·2354	·0133	−13·92
2	72·4106	....	....	....	½	27·4734	·4889	·0076	+ 1·40
2	54·7306	....	....	....	2	27·3064	....	....	....
1	53·9888	·9833	·0267	+[30·81]	½	57·8628	·8428	·0428	+(51·62)*
2	53·1078	....	....	....	2	57·8178	....	....	....

Weighted mean	+11·43
V_a	−19·09
V_d	− ·08
Curvature	− ·28
Radial velocity	− 8·0

*Not used.

α CORONÆ BOREALIS, 927.**

1907. July 9.
G. M. T. 14h 32m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9680	....	....	....	1	53·9622	·9697	·0131	+[15·12]
1	72·8569	·8503	·0316	+45·91	1½	53·0917	....	....	....
1½	72·4102	....	....	....	2	45·2603	....	....	....
½	57·8736	·8675	·0675	+(81·27)*	1½	45·2267	·2500	·0013	+ 1·36
1½	57·8040	....	....	....	½	27·4465	·4910	·0055	+ 3·20
2	54·7205	....	....	....	3	27·2774	....	....	....

Weighted mean	+16·52
V_a	−19·09
V_d	− ·08
Curvature	− ·28
Radial velocity	− 2·9

**Check measurement.
*Not used.

α CORONÆ BOREALIS, 936.

1907. July 10.
G. M. T. 14h 06m

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity
2	73·4385	.. ..	....	. . ...	2	45·3045	·2916	mean .0317	+33·18
2	72·9873	.. ..	....	....	2	45·2722	·2693		
1	72·8610	·8370	·0183	+26·58	1	27·4904	·5206	0241	+28·99
2	45 2865	. . ....	.. . .	....	2	27·2917	....	.. ..	....

Weighted mean........ .... +30·48
V_a .. .. 19·23
V_d...... .. .. · ·05
Curvature .... ·28

Radial velocity............ .... + 10·9

α CORONÆ BOREALIS, 936*

1907. July 10.
G. M. T. 14h 06m

Observed by J. S. PLASKETT.
Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings	Displacement in Revolutions.	Velocity.
2	73·0197	....	....	.. ..	½	27·5361	4419	·0293	+25·43
½	72·8963	·8854	·0206	+29·89	2	27·3413	....	... .	....
2	72·4588	....	....	....	½	12·0294	·9169	·0655	+49·06
2	45·3296	....	....	....	2	11·6198	.. ..	....	....
1	45 3064	·2504	·0117	+12·21					

Weighted mean.................... ..... +25·76
V_a.................... − 19·23
V_d... .. .. − ·05
Curvature............ − ·28

Radial velocity.... .... + 6·2

*Check measurement.

α CORONÆ BOREALIS, 939 (a).

1907. July 12.
G. M. T. 16h 25m

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9412	....	....	....	1½	45·2344	·2304	·0183	−19·16
1	72·7980	·8200	·0013	+ 1·89	1	27·4394	·4837	0035	− 3·16
2	72·3774	....	....	....	2	27·2776	....	....	.. ..
2	45·2876	... ..	....	.. . .					

Weighted mean........ .... − 8·58
V_a .... −19·52
V_d............. .... ·23
Curvature .... − ·28

Radial velocity.................. .. ... − 28·6 α CORONÆ BOREALIS, 941 (*a*).

1907 July 13.
G. M. T. 15^h 25^m

Observed by J. N. Tribble.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9571	....	....	....	1	53·9164	·9216	·0350	−[36·57]
1	72·7891	·7967	·0220	−31·94	2	45·2737	....	....	....
2	72·3883	....	....	....	2	45·2395	·2494	·0010	+ 1·05
1	54·0101	....	....	....					

Weighted mean .... − 9·95
V_a .... −19·64
V_d .... − ·20
Curvature .... − ·28

Radial velocity .... − 30.1

α CORONÆ BOREALIS, 944 (*a*).

1907. July 16.
G. M. T. 14^h 37^m

Observed by J. N. Tribble.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9844	....	....	....	2	45·2506	·2292	0095	− 9·94
1	72 8686	·8938	·0290	+42·08	¼	27·4712	·4048	·0078	− 6 57
1½	72·4200	....	....	....	2	27·3130	....	....	....
2	45·2950	....	....	....					

Weighted mean .... − ·20
V_a .... −19·98
V_d .... − ·11
Curvature .... − ·28

Radial velocity .... −20·6

α CORONÆ BOREALIS, 944 (*a*)*.

1907. July 16.
G. M. T. 14^h 37^m

Observed by J. N. Tribble.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73 0086	....	....	....	2	53·1311	....	....	....
½	72·8748	·8752	·0104	+15·09	2	45·3033	....	....	....
2	72·4466	....	....	....	1	45·2588	·2290	·0097	−10·12
2	54·7631	....	....	....	½	27·5206	·4520	·0394	+54·20
¼	54·0116	·9915	·0217	+[21·98]	2	27·3153	....	....	....

Weighted mean .... + 7·26
V_a .... −19·98
V_d .... − ·11
Curvature .... − ·28

Radial velocity .... −13·1

*Check measurement.

α CORONÆ BOREALIS, 951 (a).

1907. July 18. Observed by J. N. TRIBBLE.
G. M. T. 14ʰ 50ᵐ Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0275	...	...	...	¼	53·9282	·0274	·0576	+[66·30]
½	72·8907	·8738	·0090	-13·06	2	53·0075	...	...	...
2	72·4593	...	...	...	2	45·1272	...	...	...
2	54·6480	...	...	...	½	45·0922	·2386	·0001	-18·0

Weighted mean	+ 2·53
V_a	-20·16
V_d	- ·14
Curvature	- ·28
Radial velocity	- 18·0

α CORONÆ BOREALIS, 951 (b).

1907 July 18. Observed by J. N. TRIBBLE.
G. M. T. 15ʰ Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0220	...	...	...	1	53·8272	·0264	·0264	-[30·38]
½	72·8730	·8616	·0032	- 4·64	2	52·9927	...	...	...
2	72·4539	...	...	...	2	45·1147	...	...	...
2	54·6277	...	...	...	¼	45·0804	·2395	·0008	+ 8·35

Weighted mean	- 0·31
V_a	-20·16
V_d	- ·14
Curvature	- ·28
Radial velocity	- 20·9

α CORONÆ BOREALIS, 956 (a).

1907. July 20. Observed by J. S. PLASKETT.
G. M. T. 16ʰ 07ᵐ Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9731	...	...	...	2	45·3021	·2932	·0445	+46·59
1	72·8743	·8653	·0418	+65·09	1	27·5473	·5493	·0621	+54·03
1½	72·4128	...	...	...	3	27·3199	...	...	...
2	45·2925	...	...	...					

Weighted mean		+53·08
V_a	-20·37	
V_d	- ·22	
Curvature	- ·28	
Radial velocity		+32·2

α CORONÆ BOREALIS, 963 (a).

1907. July 23.
G. M. T. 14h 32m

Observed by J. N. Tribble.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
½	73·4670	......	....	....	½	54·0566	·0256	·0558	[+64·22]
1	72·8900	·8860	·0212	+30·76	2	50·0472	....	....	....
2	[illegible]·6944	....	....	....					

V_s		+30·76
V_a	−20·59	
V_d	− ·14	
Curvature	− ·28	
Radial velocity		+ 9·8

α CORONÆ BOREALIS, 973 (a).

1907. Aug. 1.
G. M. T. 14h 06m

Observed by / Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Lines.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Lines.	Displacement in Revolutions.	Velocity.
2	72·9868	....	....	....	2	45·2780	....	....	....
½	72·8440	·8210	·0023	+ 3·34	1	45·2568	·2624	·0137	+14·34
2	72·4220	....	....	....					

Weighted mean	+10·67	
V_a		−20·98
V_d		− ·14
Curvature		− ·28
Radial velocity		−10·7

α CORONÆ BOREALIS, 973 (a)*.

1907. Aug. 1.
G. M. T. 14h 06m

Observed by W. E. Harper.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0088	....	....	....	½	53·9750	·9619	·0079	− 9·09
⅛	72·8800	·8807	·0159	+23·07	2	53·1240	....	....	....
2	72·4485	....	....	....	2	45·2885	....	....	....
2	54·7562	....	....	....	½	45·2552	·2402	·0015	+ 1·57

Weighted mean	+ 5·85	
V_a		−20·98
V_d		− ·14
Curvature		− ·28
Radial velocity		−15·5

* Check measurement.

α CORONÆ BOREALIS, 973 (b).

1907. Aug. 1.
G. M. T. 14h 20m

Observed by W. E. Harper.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0342	....	....	....	½	45·2752	·2335	0052	− 5·43
2	45·3153	....	....	....					

V_s	− 5·43
V_a	−20·98
V_d	− ·14
Curvature	− ·28
Radial velocity	−26·8

α CORONÆ BOREALIS, 978.

1907. Aug. 3.
G. M. T. 13h 02m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9938	....	....	....	2	45·2426	·2434	·0054	− 5·65
1	72·8526	·8224	·0037	+ 5·37	1	27·4524	·4800	·0165	− 6·40
2	72·4294	....	....	....	2	27·2940	....	....	....
2	45·2828	....	....	....					

Weighted mean	− 3·08
V_a	−20·98
V_d	− 08
Curvature	− ·28
Radial velocity	−24·4

α CORONÆ BOREALIS, 986.

1907. Aug. 6.
G. M. T. 16h 38m

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9297	....	....	....	2	54·6972	....	....	....
1	72·8025	·8363	·0176	+25·57	1½	53 0647	....	....	....
1½	72·3657	....	....	....	2	45·2377	....	....	....
1	53·9672	·0000	0434	+[50 08]	1	45·2437	·2877	·0390	+34·00

Weighted mean	+29·78
V_a	−20·96
V_d	− ·27
Curvature	− ·28
Radial velocity	+ 8·3

α CORONÆ BOREALIS, 986.*

1907. Aug. 6.
G. M. T. $16^h\ 38^m$

Observed by / Measured by } W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9624				1	54·0154	54·0019	·0553	+[63·93]
1	72·8494	72·8504	·0317	+46·06	2	45·2934			
2	72·3988				1½	45·2948	45·2850	·0363	+38·00
1	54·0288								

Weighted mean .... +41·22
V_a .... −20·96
V_d .... − ·27
Curvature .... − ·28

Radial velocity .... +19·7

*Check measurement.

α CORONÆ BOREALIS, 1006.

1907. Aug. 12.
G. M. T. $16^h\ 36^m$

Observed by / Measured by } W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·8216				1	53·9092	53·9903	·0205	+[23·66]
½	72·6801	72·8664	·0016	+ 2·32	2	45·2372			
2	72·2641				½	45·2140	45·2504	·0117	+12·25
2	53·9477								

Weighted mean .... + 7·28
V_a .... −20·76
V_d .... − ·28
Curvature .... − ·28

Radial velocity .... −14·0

α CORONÆ BOREALIS, 1014.

1907. Aug. 15.
G. M. T. $15^h\ 09^m$

Observed by / Measured by } W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9915				2	53·9737	53·9813	·0115	+[13·24]
½	72·8396	72·8573	·0075	+10·88	2	53·1065			
2	72·4290				2	45·2707			
2	54·7321				½	45·2197	45·2226	·0161	+16·81

Weighted mean .... +13·84
V_a .... −20·58
V_d .... − ·24
Curvature .... − ·28

Radial velocity .... − 7·3

α CORONÆ BOREALIS, 1017.

1907. Aug. 22.
G. M. T. 15h

Observed by } Measured by } W. E. Harper.

Wt.	Mean of Settings	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1½	45·7844	....	....	. . . .	¼	45·7576	45·2448	·0061	+ 6·37

V_s		+ 6·37
V_a		19·90
V_d		− 20
Curvature		− 28
Radial velocity		−14·0

α CORONÆ BOREALIS, 1022.

1907. Aug. 23.
G. M. T. 14h 46m

Observed by J. N. Tribble.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	56·6754	....	....	....	2	45·2730	....	....	....
1	54·0042	53·9960	·0262	+[30·16]	½	45·2628	45·2634	·0247	+25·78
2	53·1214	....	....	....					

V_s		+25·78
V_a	−19·80	
V_d	− ·24	
Curvature	− ·28	
Radial velocity		+ 5·5

α CORONÆ BOREALIS, 1026.

1907. Aug. 27.
G. M. T. 12h 06m

Observed by } Measured by } W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0220	....	....	....	2	45·2880	....	....	....
⅛	72·9344	72·9232	·0584	+84·74	⅛	27·4870	27·4500	·0281	+32·50
2	72·4630	....	....	....	2	27·2840	....	....	....
2	54·0444	....	....	....	⅛	45·2840	45·2696	·0310	+32·36
⅛	54·0000	53·9844	·0146	+[16·80]					

Weighted mean		+49·87
V_a	−19·35	
V_d	− ·19	
Curvature	− ·28	
Radial velocity		+30·0

α CORONÆ BOREALIS, 1032.

1907. Sept. 6.
G. M. T. 13ʰ 43ᵐ

Observed by J. N. Tribble.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0155	......	......	......	2	45·2322	......	......	......
¼	72·8710	72·8631	·0017	− 2·46	1	45·1848	45·2273	·0114	−13·05
2	72·4595	......	......	......	½	27·3558	27·4204	·0078	+ 6·77
2	54·7134	......	......	......	2	27·1818	......	......	......
½	53·9360	53·9634	·0064	− [7·36]	¼	11·7425	11·8493	·0021	− 1·57
2	53·0852	......	......	......	2	11·4098	......	......	......

Weighted mean	− 4·50
V_a	−17·34
V_d	− ·25
Curvature	− ·28
Radial velocity	− 22·4

α CORONÆ BOREALIS, 1037.

1907. Sept. 12.
G. M. T. 14ʰ 40ᵐ

Observed by J. N. Tribble.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9383	......	......	......	1	45·1575	45·2878	·0491	+51·20
1½	72·8230	72·8950	·0302	+43·82	½	27·3467	27·5090	·0964	+83·52
2	72·3715	......	......	......	2	27·0843	......	......	......
2	45·1433	......	......	......					

Weighted mean		+52·93
V_a	−16·20	
V_d	− ·28	
Curvature	− ·28	
Radial velocity		+36·2

α CORONÆ BOREALIS, 1047.

1907. Sept. 18.
G. M. T. 12ʰ 50ᵐ

Observed by J. N. Tribble.
Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·1431	......	......	......	2	45·3762	......	......	......
1	72·9930	72·8596	·0052	− 7·55	1	45·3585	45·2560	·0173	+18·06
1½	72·5787	......	......	......					

Weighted mean	+ 5·25	
V_a		−14·94
V_d		− ·25
Curvature		− ·28
Radial velocity		−10·2

α CORONÆ BOREALIS, 1048.

1907. Sept. 18.
G. M. T. 13h 16m

Observed by J. N. Tribble.
Measured by W. E. Harper and J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0030	....	....	....	½	53·9418	53·9718	·0020	+ [2·30]
½	72·8640	72·8695	·0047	+ 6·82	2	53·0866	....	....	....
2	72·4433	....	....	....	2	45·1702	....	....	....
2	57·8023	....	....	....	1	45·1457	45·2339	·0048	− 5·00
1	57·7850	57·7895	·0373	− (44·91)	¼	27·3310	27·3870	·0256	− 22·22
2	54·7113	....	....	....	2	27·1905	....	....	....

Weighted mean..........	− 4·09
V_a..........	− 14·94
V_d..........	− ·28
Curvature..........	− ·28
Radial velocity..........	− 19·6

α CORONÆ BOREALIS, 1060.

1907. Sept. 20.
G. M. T. 13h 35m

Observed by W. E. Harper.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0090	....	....	....	2	53·0627	....	....	....
¼	72·8367	72·8376	·0272	− 39·46	2	45·2140	....	....	....
2	72·4435	....	....	....	1	45·1690	45·2286	·0101	− 10·54
2	54·6952	....	....	....	½	27·3412	27·4192	·0066	+ 5·73
¼	53·8872	53·9352	·0346	− [39·82]	2	27·1682	....	....	....

Weighted mean..........	− 10·02
V_a..........	− 14·52
V_d..........	+ ·02
Curvature..........	− 28
Radial velocity..........	− 24·8

α CORONÆ BOREALIS, 1083.

1907. October 1.
G. M. T. 13ʰ 44ᵐ

Observed by W. E. HARPER.
Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0679	...	...	...	2	45·3609	...	...	...
¼	72·9652	72·9078	·0430	+62·39	½	45·3694	45·2857	·0470	+49·07
2	72·5002	...	...	...	¼	27·5686	27·4492	·0366	+31·77
2	54·8129	...	...	...	2	27·3664	...	...	...
½	54·0989	54·0261	·0563	+[64·80]	1	12·0432	11·9027	·0513	+38·42
2	53·1867	...	...	...	2	11·6482	...	...	...

Weighted mean		+43·25
V_a	−12·21	
V_d	− ·28	
Curvature	− ·28	
Radial velocity		+30·5

α CORONÆ BOREALIS, 1084.

1907. Oct. 1.
G. M. T. 13ʰ 56ᵐ

Observed by W. E. HARPER.
Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9948	...	...	...	2	45·2968	...	...	...
¼	72·8698	72·8852	·0204	+29·60	½	45·2912	45·2680	·0293	+30·59
2	72·4285	...	...	...					

Weighted mean		+30·27
V_a	−12·21	
V_d	− ·28	
Curvature	− ·28	
Radial velocity		+17·5

α CORONÆ BOREALIS, 1393.

1908. March 9.
G. M. T. 22ʰ 08ᵐ

Observed by } W. E. HARPER.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·8725	...	...	...	2½	27·5088	27·4056	·0070	− 6·08
1½	54·0542	53·9269	·0429	−[49·38]	3	27·3499	...	...	...
2	53·2361	...	...	...	1½	11·9342	11·8522	·0008	+ 0·60
3	45·3847	...	...	...	3	11·5892	...	...	...
2	45·3252	45·2141	·0216	−25·68					

Weighted mean	−10·94	
V_a		+16·98
V_d	− ·05	
Curvature	− ·28	
Radial velocity		+ 5·7

α CORONÆ BOREALIS, 1393*.

1908. March 9.
G. M. T. 22h 08m

Observed by W. E. Harper.
Measured by C. R. Westland.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity
2	54·7344	....	.. ..	....	1	27·3712	27·3992	·0134	−11·63
2	53·9241	53·9316	·0382	−[43·97]	2	27·2184	....	....	....
2	53·1045	....	....	....	1	11·7835	11·8301	·0213	−15·95
2	45·2517	....	....	....	2	11·4603	... .	....	....
2	45·1867	45·2087	0300	−31·32					

Weighted mean ... −22·55
V_a ... +16·98
V_d ... − ·05
Curvature ... − ·28

Radial velocity ... − 5·9

Note.—(Mg. line omitted). * Check measurement.

α CORONÆ BOREALIS, 1393. *

1908. March 9.
G. M. T. 22h 08m

Observed by / Measured by } W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7502	....	....	....	1½	45·2112	45·2051	·0336	−35·08
1	53·9539	53·9413	·0285	−[32·80]	1	27·3758	27·3827	·0299	−25·95
2	53·1290	....	....	....	2	27·2397	....	....	.. ..
2	45·2797	.....	....	....					

Weighted mean ... −31·43
V_a ... +16·98
V_d ... − ·05
Curvature ... − ·28

Radial velocity ... − 14·8

* Check measurement.

α CORONÆ BOREALIS, 1402.

1908. March 16.
G. M. T. 21h 02m

Observed by } W. E. HARPER.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	54·7845	....	....	....	1	27·5345	27·3875	·0251	−21·79
1	53·9802	53·9412	·0286	−[32·92]	2	27·3906	....	....	....
1	53·1475	....	....	....	1½	11·9963	11·7940	·0574	−43·00
1	45·3466	....	....	....	2	11·7098	....	....	....
1	45·2690	45·1960	·0427	−44·58					

Weighted mean		−37·39
V_a	+20·74	
V_d		·00
Curvature		− ·28
Radial velocity		− 16·9

α CORONÆ BOREALIS, 1493.

1908. April 15.
G. M. T. 19h 18m

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	45·2842	....	....	....	2	15·5026	....	....	....
1	45·2361	45·2254	·0133	−13·88	½	15·5417	15·4377	·0356	−27·55
1	27·4702	27·4039	·0087	− 7·55	1½	11·9500	11·8426	·0088	− 6·59
2	27·3135	....	....	....	2	11·6149	....	....	....

Weighted mean		−13·89
V_a	+ 5·85	
V_d		− ·04
Curvature		− ·28
Radial velocity		− 8·4

α CORONÆ BOREALIS, 1493.*

1908. April 15.
G. M. T. 19h 18m

Observed by J. S. PLASKETT.
Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9717	....	....	....	2	45·2267	45·2191	·0196	−20·46
1½	72·8300	72·8678	·0030	+ 4·35	1½	27·4633	27·4012	·0114	− 9·89
2	72·4080	....	....	....	2	27·3090	....	....	....
2	45·2812	....	....	....					

Weighted mean		− 9·85
V_a	+ 5·85	
V_d		− ·04
Curvature		− ·28
Radial velocity		− 4·3

*Check measurement.

α CORONÆ BOREALIS, 1565.

1908. June 1. Observed by T. H. PARKER.
G. M. T. 18h Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9938	....	....	....	2	45·3014	....	....	....
1½	72·8490	72·8648	·0000	± 0·00	1	27·4890	27·4251	·0125	+10·85
2	72·4310	....	....	....	2	27·3107	....	....	....
2	54·7550	....	....	....	½	15·5442	15·4528	·0105	− 8·13
1	54·0110	53·9920	·0222	+[25·56]	2	15·4900	....	....	....
2	53·1370	....	....	....	2	11·9275	11·8338	·0176	− 9·13
2	45·2605	45·2355	·0032	− 3·34	2	11·6009	....	....	....

Weighted mean	− 2·59
V_a	10·43
V_d	− ·20
Curvature	− ·28
Radial velocity	−13·5

α CORONÆ BOREALIS, 1566.

1908. June 1. Observed by } T. H. PARKER.
G. M. T. 18h 42m Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	45·2929	....	....	....	½	27·4641	27·4107	·0019	− 1·64
2	45·2461	45·2267	·0120	−12·52	2	27·3000	....	....	....
2	43·5585	....	....	....					

Weighted mean	−10·34
V_a	10·43
V_d	− ·20
Curvature	− ·28
Radial velocity	− 20·2

α CORONÆ BOREALIS, 1571.

1908. June 3. Observed by J. S. PLASKETT.
G. M. T. 16h 32m Measured by W. E. HARPER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0427	....	....	....	1	27·4899	27·4253	·0127	+11·02
1	72·9099	72·9760	·0112	+16·25	2	27·3115	....	....	....
½	72·4822	....	....	....	½	15·5378	15·4464	·0269	−20·82
2	45·2815	....	....	....	2	15·4900	....	....	....
2	45·2437	45·2358	·0029	− 3·03					

Weighted mean	+ 2·40	
V_a		−11·02
V_d		− ·07
Curvature		− ·28
Radial velocity		− 9·0

α CORONÆ BOREALIS, 1572.

1908. June 3.
G. M. T. 16^h 52^m

Observed by J. S. Plaskett.
Measured by C. R. Westland.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7690	....	....	....	2	27·3380	....	....	....
½	53·9965	53·9706	·0008	+ [1·16]	½	15·5674	15·4394	·0339	−26·24
2	53·1417	....	....	....	2	15·5266	....	....	....
2	45·3179	....	....	....	2	11·9767	11·8434	·0080	− 5·99
2	45·2866	45·2423	·0036	+ 3·76	2	11·6410	....	....	....
½	27·4982	27·4073	·0053	− 4·60					

Weighted mean	− 3·98
V_a	−11·02
V_d	− ·08
Curvature	− ·28
Radial velocity	− 15·4

α CORONÆ BOREALIS, 1572 *.

1908. June 3.
G. M. T. 16^h 52^m

Observed by J. S. Plaskett.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
½	53·9962	53·9677	·0021	−[2·41]	2	27·3409	....	....	....
2	54·7700	....	....	....	1	15·5560	15·4260	·0473	−36·61
2	45·3195	....	....	....	2	15·5286	....	....	....
1	45·2856	45·2396	·0009	+ 0·93	2	11·9830	11·8501	·0013	− 9·74
2	43·5855	....	....	....	2	11·6401	....	....	....
2	27·5096	27·4153	·0027	+ 2·34					

Weighted mean	− 8·41
V_a	−11·02
V_d	− ·08
Curvature	− ·28
Radial velocity	− 19·8

* Check measurement.

α CORONÆ BOREALIS, 1581.

1908. June 5.
G. M. T. 17^h 31^m

Observed by } W. E. Harper
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9780	....	....	....	1	27·3975	27·4026	·0100	− 8·68
1	72·8406	72·8688	·0040	+ 5·80	2	27·2433	....	....	....
2	72·4202	....	....	....	1	11·8584	11·8491	·0023	− 1·72
2	45·2545	....	....	....	2	11·5145	....	....	....
2	45·2387	45·2578	·0191	+19·94					

Weighted mean .... + 7·06
V_a .... −11·62
V_d .... − ·14
Curvature .... − ·28

Radial velocity .... − 5·0

α CORONÆ BOREALIS, 1601.

1908. June 12.
G. M. T. 16^h 56^m

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9665	....	....	....	2	53·0720	....	....	....
1	72·8330	72·8678	·0030	+ 4·35	2	45·2242	45·2568	·0181	+28·18
1	72·4060	....	....	....	2	45·2410	....	....	....
2	54·7068	....	....	....	1½	27·4228	27·4370	·0244	+21·27
½	53·9350	53·9725	·0027	+ [3·11]	2	27·2322	....	....	....

Weighted mean .... +20·58
V_a .... −13·59
V_d .... − ·12
Curvature .... − ·28

Radial velocity .... + 6·6

α CORONÆ BOREALIS, 1608.

1908. June 17.
G. M. T. 13h 53m

Observed by / Measured by } W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	72·9809	......	......	......	2	45·2620	......	......	......
1	72·8361	72·8662	·0014	+ 2·03	2	45·2390	45·2506	·0119	+12·42
2	72·4112	......	......	......	1	27·4892	27·4739	·0613	+53·21
2	54·7169	......	......	......	2	27·2621	......	......	......
1	53·9506	53·9716	·0018	+ [2·07]	1	11·9270	11·8964	·0450	+33·70
2	53·0941	......	......	......	2	11·5379	......	......	......

Weighted mean............... ...		+23·76
V_a...............	−14·85	
V_d...............	− ·07	
Curvature...............	− ·28	
Radial velocity...............		+ 8·6

α CORONÆ BOREALIS, 1623.

1908. June 22.
G. M. T. 16h 27m

Observed by J. S. Plaskett.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7556	......	......	......	1	27·4580	27·4130	·0004	+ 3·47
2	53·9719	53·9559	·0139	−[16·00]	3	27·2899	......	......	......
2	53·1320	......	......	......	1	11·9219	11·8454	·0060	− 4·49
2	45·2819	......	......	......	2	11·5853	......	......	......
1	45·2571	45·2511	·0124	+12·93					

Weighted mean............	+ 3·97	
V_a...............		−16·16
V_d...............		− ·16
Curvature...............		− ·28
Radial velocity...............		−12·

α CORONÆ BOREALIS, 1623.*

1908. June 22. Observed by J. S. Plaskett.
G. M. T. 16h 27m Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0044				2	45·3000			
1	72·8548	72·8598	·0050	− 7·25	1	45·2624	45·2364	·0023	− 2·40
2	72·4483				1	27·4675	27·4195	·0024	2·08
2	54·7536				3	27·2952			
2	53·9681	53·9531	·0167	−[19·22]	1	11·9274	11·8594	·0080	+ 5·99
2	53·1381				2	11·5790			

Weighted mean . . . . − 1·44
V_a . . . . −16·16
V_d . . . . − ·16
Curvature . . . . − ·28

Radial velocity . . . . −18·0

*Check measurement.

α CORONÆ BOREALIS, 1624.

1908. June 22. Observed by J. S. Plaskett.
G. M. T. 16h 40m Measured by W. E. Harper.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity
2	54·7898				½	27·4840	27·4175	·0049	+ 4·34
1	54·0178	53·9700	·0002	±[0·00]	2	27·3131			
2	53·1597				1½	11·9423	11·8612	·0098	+ 7·34
2	45·3251				2	11·5883			
1½	45·2880	45·2365	·0023	− 2·40					

Weighted mean . . . . + 4·02
V_a . . . . −16·16
V_d . . . . − ·16
Curvature . . . . − ·28

Radial velocity . . . . −12·6

α CORONÆ BOREALIS, 1628.

1908. June 24. Observed by J. S. Plaskett.
G. M. T. 15h 26m Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7838				1	27·4598	27·4158	·0032	+ 2 7
½	53·9417	53·9000	·0698	−[80·33]	2	27·2908			
2	53·1536				1½	11·9065	11·8705	·0191	+14·30
2	45·3060				2	11·5432			
1	45·2751	45·2436	·0049	+ 5·12					

Weighted mean . . . . + 8·38
V_a . . . . −16·65
V_d . . . . − ·07
Curvature . . . . − ·28

Radial velocity . . . . − 8·6

α CORONÆ BOREALIS, 1629.

1908. June 24.
G. M. T. 15h 49m

Observed by J. S. Plaskett.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0846	....	....	....	2	45·3268	....	....	....
½	72·9449	72·8698	·0050	+ 7·26	1	45·2795	45·2263	·0121	− 12·95
1	72·5206	....	....	....	½	27·4625	27·4000	·0126	− 10·93
2	54·7999	....	....	....	2	27·3093	....	....	....
1½	54·0511	53·9939	·0241	+ [27·74]	1	11·9286	11·8711	·0197	+ 14·77
2	53·1682	....	....	....	2	11·5643	....	....	....

Weighted mean	0·00
V_a	− 16·66
V_d	− ·11
Curvature	− ·28
Radial velocity	− 17·0

α CORONÆ BOREALIS, 1638.

1908. June 26.
G. M. T. 15h 51m

Observed by W. E. Harper.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0800	....	....	....	1½	45·3098	45·2238	·0149	− 15·56
1	72·9496	72·8476	·0172	− 24·96	2	45·3565	....	....	....
1	72·5498	....	....	....	2	27·4673	27·3933	·0193	− 16·80
2	54·8334	....	....	....	3	27·3236	....	....	....
1	54·0511	53·9601	·0097	− [11·31]	2	11·9232	11·8627	·0113	+ 8·46
2	53·2007	....	....	....	3	11·5652	....	....	....

Weighted mean	− 10·00
V_a	− 14·50
V_d	·11
Curvature	− ·28
Radial velocity	− 24·9

α CORONÆ BOREALIS, 1639.

1908. June 26th.
G. M. T. 15h 51m

Observed by W. E. Harper.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0632	....	....	....	2	53·1470	....	....	....
1	72·9112	72·8562	·0086	− 12·48	2	45·3037	....	....	....
1	72·5014	....	....	....	1½	45·2656	45·2376	·0011	− 1·15
1½	54·7831	....	....	....	1½	27·4499	27·4169	·0043	+ 3·73
1	54·0126	53·9776	·0078	+ [8·98]	2	27·2799	....	....	....

Weighted mean	− 2·40
V_a	− 14·81
V_d	− 11
Curvature	− ·28
Radial velocity	− 17·6

α CORONÆ BOREALIS, 1646,

1908. June 27.
G. M. T. 16h 20m

Observed by J. S. Plaskett.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings	Corrected Star Settings	Displacement in Revolutions.	Velocity.
1½	73·0138	....	....	....	1	45·2252	45·2282	·0105	−10·95
½	72·8550	72·8552	·0096	−13·92	2	45·2694	....	....	....
1½	72·4403	....	....	....	1½	27·4472	27·4290	·0164	+14·23
2	54·7419	....	....	....	3	27·2648	....	....	....
1	53·9706	53·9751	·0053	+[6·17]	2	11·8531	11·8231	·0283	−21·19
2	53·0627 (?)	....	....	....	3	11·5348	....	....	....

Weighted mean	− 7·79
V_a	−14·98
V_d	− ·11
Curvature	− ·28
Radial velocity	− 23·2

α CORONÆ BOREALIS, 1646*.

1908. June 27.
G. M. T. 16h 20m

Observed by J. S. Plaskett.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0388	....	....	....	2	45·2924	....	....	....
½	72·8666	72·8466	·0182	−26·41	1½	45·2510	45·2325	·0062	− 6·41
1½	72·4615	....	....	....	1½	27·4381	27·4092	·0034	− 3·05
2	54·7608	....	....	....	3	27·2754	....	....	....
½	54·0203	54·0038	·0340	+[39·13]	1	11·9032	11·8575	·0061	+ 5·29
2	53·1283	....	....	....	3	11·5531	....	....	....

Weighted mean	− 4·91
V_a	−14·98
V_d	− ·11
Curvature	− ·28
Radial velocity	− 20·3

* Check measurement.

α CORONÆ BOREALIS, 1646.*

1908. June 27.
G. M. T. 16h 20m

Observed by J. S. Plaskett.
Measured by W. E. Harper.

Wt.	Mean of Settings	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
	72·9272	....	....	....	2	45·1872	....	....	....
	92·7747	72·8581	·0067	− 8·72	2	45·1430	45·2294	·0093	− 9·71
1	73·3578	....	....	....	1	27·3550	27·4286	·0160	−13·89
	54·6545	....	....	....	2	27·1731	....	....	....
½	53·8697	53·9617	·0081	−[9·32]	1	11·7667	11·8341	·0173	−12·96
	53·0153	....	....	....	2	11·4398	....	....	....

Weighted mean	− 5·44
V_a	−14·98
V_d	− ·11
Curvature	− ·28
Radial velocity	− 20·8

* Check measurement.

α CORONÆ BOREALIS, 1647.

1908. June 27.
G. M. T. 16h 40m

Observed by J. S. Plaskett.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0577	....	....	....	2	45·3388	....	....	....
½	72·9089	72·8589	·0059	− 8·56	1	45·3041	45·2387	·0000	± 0·00
1	72·5000	....	....	....	1	27·4771	27·3891	·0235	− 20·40
2	54·7978	....	....	....	2	27·3349	....	....	....
1	54·0373	53·9793	·0095	−[10·93]	1	11·9502	11·8522	·0008	− 0·60
2	53·1731	....	....	....	2	11·6053	....	....	....

Weighted mean	− 6·59
V_a	−14·03
V_d	− ·16
Curvature	− ·28
Radial velocity	−21·1

α CORONÆ BOREALIS, 1652.

1908. July 1.
G. M. T. 15h 15m

Observed by J. S. Plaskett.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	....	....	....	....	1	45·0548	45·3038	·0651	+67·96
½	72·6304	72·8917	·0269	+38·03	2	45·0254	....	....	....
1	72·1836	....	....	....	1	27·2466	27·4801	·0675	+58·59
2	54·4896	....	....	....	2	27·0134	....	....	....
½	53·7812	53·0387	·0689	+[79·30]	1	11·7141	11·9391	·0877	+64·69
2	52·8512	....	....	....	2	11·2829	....	....	....

Weighted mean		+60·07
V_a	−17·78	
V_d	− ·07	
Curvature	− ·28	
Radial velocity		+41·9

α CORONÆ BOREALIS, 1656.

1908. July 3.
G. M. T. $15^h 17^m$

Observed by W. E. HARPER.
Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
½	54·7645	....	....	....	½	27·4941	27·4806	·0680	+59·02
1½	54·0431	54·0196	·0498	+[57·32]	2	27·2599	....	....	....
1	53·1362	....	....	....	½	11·8955	11·8895	·0381	+28·54
1	45·2983	....	....	....	2	11·5115	....	....	....
½	45·3190	45·2943	·0556	+58·05					

Weighted mean		+48·53
V_a	−18·18	
V_d	− ·11	
Curvature	− ·28	
Radial velocity		+30·0

α CORONÆ BOREALIS, 1657.

1908. July 3.
G. M. T. $15^h 30^m$

Observed by W. E. HARPER.
Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
½	54·6727	....	....	....	1	45·2097	45·2817	·0430	+44·89
½	53·9471	54·0011	·0313	+36·03	2	44·1900	....	....	....
½	53·0497	....	....	....	1	27·3961	27·4586	·0460	+39·93
1	45·2008	....	....	....	2	27·1843	....	....	....

Weighted mean		+42·41
V_a	−18·18	
V_d	− ·14	
Curvature	− ·28	
Radial velocity		+23·8

α CORONÆ BOREALIS, 1665.

1908. July 6.
G. M. T. $16^h 50^m$

Observed by T. H. PARKER.
Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	72·9602	....	....	....	1½	45·2173	45·2668	·0281	+29·34
½	72·8398	72·8876	·0228	+33·08	2	45·2240	....	....	....
1	72·3996	....	....	....	1	27·4083	27·4290	·0164	+14·24
2	54·6898	....	....	....	2	27·2265	....	....	....
¼	53·9145	53·9715	·0017	+ [1·96]	1	11·8914	11.9154	·0640	+47·93
2	53·0501	....	....	....	2	11·4830	....	....	....

Weighted mean		+31·18
V_a	−18·72	
V_d	− ·16	
Curvature	− ·28	
Radial velocity		+12·0

α CORONÆ BOREALIS, 1673.

1908. July 8.
G. M. T. 14ʰ 59ᵐ

Observed by } J. B. Cannon.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	72·9993	....	....	....	2	45·2746	....	....	....
½	72·8626	72·8721	·0073	+10·60	1	45·2392	45·2382	·0005	− 0·52
1	72·4371	....	....	....	½	27·4564	27·4227	·0065	+ 5·64
2	54·7314	....	....	....	2	27·2810	....	....	....
½	53·9855	53·9920	·0222	+[25·55]	1½	11·9283	11·8883	·0369	+27·63
2	53·1071	....	....	....	1	11·5472	....	....	....

Weighted mean.................... +14·01
V_a .... −19·07
V_d .... − ·11
Curvature.................................. − ·28

Radial velocity.............................. − 5·4

α CORONÆ BOREALIS, 1674.

1908. July 8.
G. M. T. 15ʰ 11ᵐ

Observed by } J. B. Cannon.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7242	....	....	....	1	27·4496	27·4334	·0208	+18·05
1	53·9536	53·9711	·0013	+[1·50]	2	27·2631	....	....	....
2	53·0947	....	....	....	1½	11·8926	11·8651	·0137	+10·26
2	45·2616	....	....	....	2	11·5351	....	....	....
1	45·2583	45·2703	·0316	+32·99					

Weighted mean.................... +18·98
V_a .... −19·07
V_d .... − ·11
Curvature.................................. − ·28

Radial velocity.............................. − 0·5

α CORONÆ BOREALIS, 1683.

1908. July 10.
G. M. T. 13ʰ 34ᵐ

Observed by W. E. Harper.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0309	....	....	....	2	53·1334	....	....	....
½	72·8884	72·8694	·0046	+ 6·67	2	45·3129	....	....	....
1	72·4603	....	....	....	½	45·2667	45·2274	·0113	−11·79
2	54·7682	....	....	....	1	27·4832	27·4112	·0014	− 1·22
1	54·0451	54·0211	·0513	+[59·04]	2	27·3188	....	....	....

Weighted mean.................... − 1·89
V_a .... −19·38
V_d .... ·00
Curvature.................................. ·28

Radial velocity.............................. − 21·5

a CORONÆ BOREALIS, 1684.

1908. July 10. Observed by W. E. HARPER.
G. M. T. 13h 57m. Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0327	....	....	....	2	45·3003	....	....	....
½	72·8947	72·8737	·0089	+12·91	1	45·2694	45·2421	·0034	+ 3·54
1	72·4598	....	....	....	1½	27·4744	27·4221	·0095	+ 7·81
2	54·7653	....	....	....	2	27·2995	....	....	....
½	53·9629	53·9399	·0299	−[34·41]	½	11·9048	11·8363	·0151	−11·30
2	53·1347	....	....	....	2	11·5759	....	....	....

Weighted mean	− 4·59
V_a	−19·38
V_d	− ·04
Curvature	− ·28
Radial velocity	−15·1

a CORONÆ BOREALIS, 1697.

1908. July 13. Observed by J. S. PLASKETT.
G. M. T. 15h 36m. Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	72·9735	....	....	....	2	45·2596	....	....	....
½	72·8268	72·8608	·0040	− 5·80	1½	45·2284	45·2424	·0037	+ 3·86
1	72·4159	....	....	....	1½	27·4218	27·3975	·0151	−13·11
2	54·7199	....	....	....	2	27·2712	....	....	....
1	53·9583	53·9828	·0130	+[14·96]	1	11·8656	11·8236	·0278	−20·82
2	53·0846	....	....	....	2	11·5495	....	....	....

Weighted mean	− 8·35
V_a	−19·79
V_d	− ·19
Curvature	− ·28
Radial velocity	−28·6

α CORONÆ BOREALIS. 1698.

1908. July 13
G. M. T. 15^h 42^m

Observed by J. S. PLASKETT.
Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0061	...	...	...	2	45·2766	...	...	...
½	72·8661	72·8691	·0043	+ 6·24	1½	45·2388	45·2358	·0029	− 3·03
1	72·4437	...	...	...	1½	27·4391	27·4144	·0018	+ 1·56
2	54·7384	...	...	...	2	27·2716	...	...	...
1	53·9504	53·9544	·0154	−[17·72]	1	11·8994	11·8619	·0105	+ 7·86
2	53·1069	...	...	...	2	11·5450	...	...	...

Weighted mean	+ 1·84	
V_a		− 19·79
V_d		·16
Curvature		− ·28
Radial velocity		− 18·4

α CORONÆ BOREALIS, 1711.

1908. July 15.
G. M. T. 16^h 24^m

Observed by }
Measured by } J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0341	...	...	...	1½	45·2779	45·2420	·0033	+ 3·44
½	72·8891	72·8647	·0001	− ·15	1	27·4705	27·4115	·0011	− ·95
2	54·7729	...	...	...	2	27·3061	...	...	...
1½	54·0318	53·9990	·0292	+[33·61]	1	11·9256	11·8468	·0046	− ·34
2	53·1470	...	...	...	2	11·5865	...	...	...
2	45·3094	...	...	...					

Weighted mean	+ 3·79	
V_a		− 20·03
V_d		− ·22
Curvature		− ·28
Radial velocity		− 16·7

a CORONÆ BOREALIS, 1721.

1908. July 24. Observed by W. E. HARPER.
G. M. T. 13h 05m Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0620				2	45·3273			
½	72·9251	72·9711	·0063	+ 9·14	1	45·3040	45·2503	·0116	+12·10
1	72·5018				1½	27·5037	27·4317	·0191	+15·57
2	54·7950				2	27·3187			
½	54·0282	53.9742	·0044	+ [5·06]	1	11·9502	11·8812	·0298	+20·97
2	53·1587				2	11·5759			

Weighted mean	+15·25	
V_a		20·68
V_d		− ·04
Curvature		− ·28
Radial velocity		− 5·7

a CORONÆ BOREALIS, 1722.

1908. July 24. Observed by W. E. HARPER.
G. M. T. 13h 21m Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0441				2	45·3021			
½	72·9200	72·8872	·0224	+32·50	1½	45 3022	45·2738	·0351	+36·64
1	72·4735				1	27·4681	27·4298	·0172	+14·93
2	54·7704				2	27·2830			
¼	54·0159	53·9881	·0183	+[21·06]	1	11·9141	11·8766	·0252	+18·87
2	53·1390				2	11·5446			

Weighted mean		+26·25
V_a	−20·68	
V_d	− ·04	
Curvature	− ·28	
Radial velocity		+ 5·25

α CORONÆ BOREALIS, 1739.

1908. July 29. Observed by J. S. PLASKETT.
G. M. T. 15h 34m Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0080	....	....	....	2	45·2276	....	....	....
½	72·8406	72·8439	·0209	−30·33	½	45·1618	45·2078	·0309	−32·26
2	72·4370	....	....	....	½	27·3167	27·3607	·0519	−45·14
2	54·7106	....	....	....	2	27·1926	....	....	....
1	53·9688	54·0038	·0340	−[39·13]	¼	11·7853	11·8623	·0109	+ 8·16
2	53·0733	....	....	....	2	11·4290	....	....	....

Weighted mean	−29·78
V_a	−20·68
V_d	− ·24
Curvature	− ·28
Radial velocity	−50·0

α CORONÆ BOREALIS, 1739.*

1908. July 29. Observed by J. S. PLASKETT.
G. M. T. 15h 34m Measured by T. H. PARKER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0854	....	....	....	2	45·3015	....	....	....
½	72·9133	72·8398	·0250	−36·27	1	45·2452	45·2173	·0214	−22·34
2	72·5142	....	....	....	¼	27·3747	27·3581	·0545	−36·29
2	54·7789	....	....	....	2	27·2632	....	....	....
½	54·0256	53·9903	·0205	+[25·59]	1	11·8647	11·8697	·0183	+13·70
2	53·1456	....	....	....	2	11·5022	....	....	....

Weighted mean	−18·01
V_a	−20·91
V_d	− ·22
Curvature	− ·28
Radial velocity	−39·4

*Check measurement.

α CORONÆ BOREALIS, 1748.

1908. July 31.
G. M. T. 13h 38m

Observed by T. H. PARKER.
Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0081	....	....	....	2	53·1007	....	....	....
½	72·8616	72·8641	·0007	−10·15	2	45·2666	....	....	....
1	72·4501	....	....	....	1	45·1969	45·2039	·0348	−36·33
2	54·7326	....	....	....	1½	27·3938	27·3994	·0132	−11·45
1	53·9342	53·9445	·0250	−[28·77]	2	27·2521	....	....	....

Weighted mean	−19·53
V_a	−20·98
V_d	− ·14
Curvature	− ·28
Radial velocity	−40·9

α CORONÆ BOREALIS, 1749.

1908. July 31.
G. M. T. 13h 38m

Observed by T. H. PARKER.
Measured by J. B. CANNON.

Wt.	Mean of Settings	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0321	....	....	....	2	45·2724	....	....	....
½	72·8767	72·8559	·0089	−11·91	1½	45·2269	45·2281	·0106	−11·07
1	72·4611	....	....	....	1	27·4144	27·4088	·0038	− 3·30
2	54·7470	....	....	....	2	27·2523	....	....	....
1	53·9854	53·9816	·0118	+[13·58]	1	11·8314	11·8384	·0160	− 11·98
2	53·1145	....	....	....	2	11·4999	....	....	....

Weighted mean	− 9·46
V_a	−20·98
V_d	− ·14
Curvature	− ·28
Radial velocity	− 30·9

α CORONÆ BOREALIS, 1761.

1908. Aug. 5.
G. M. T. 15h 15m

Observed by J. S. Plaskett.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0055	....	....	....	2	45·2722	....	....	....
¼	72·9250	72·9281	·0633	+91·85	1½	45·2899	45·2913	·0526	+54·91
1	72·4451	....	....	....	½	27·4955	27·4728	·0602	+52·25
2	54·7359	....	....	....	2	27·2595	....	....	....
1	54·0637	54·0699	·1002	+[115·33]	1	11·9402	11·9365	·0851	+63·74
2	53·1055	....	....	....	2	11·5107	....	....	....

Weighted mean .... +58·42
V_a .... −20·96
V_d .... ·23
Curvature .... −·28

Radial velocity .... +37·0

α CORONÆ BOREALIS, 1773.

1908. Aug. 7.
G. M. T. 14h 25m

Observed by T. H. Parker.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7903	....	....	....	½	27·5854	27·5087	·0961	+83·41
1	54·0770	54·0281	·0583	+[67·10]	2	27·3236	....	....	....
2	53·1613	....	....	....	½	12·0157	11·9397	·0883	+66·14
2	45·3261	....	....	....	2	11·5833	....	....	....
1½	45·3538	45·3013	·0626	+65·35					

Weighted mean .... +69·12
V_a .... −20·91
V_d .... −·19
Curvature .... −·28

Radial velocity .... +47·7

α CORONÆ BOREALIS, 1775.

1908. Aug. 7. Observed by T. H. PARKER.
G. M. T. 14h 40m Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0279	....	....	....	2	45·3045	....	....	....
¼	72·9227	72·9056	·0408	+58·20	1½	45·3313	45·3004	·0617	+64·41
1	72·4568	....	....	....	1	27·5296	27·4692	·0566	+49·13
2	54·7633	....	....	....	2	27·3107	....	....	....
1	54·0103	53·9888	·0190	+[21·87]	1	12·0051	11·9305	·0791	+59·25
2	53·1363	....	....	....	2	11·5821	....	....	....

Weighted mean		+58·54
V_a	−20·91	
V_d	·19	
Curvature	− ·28	
Radial velocity		+37·5

α CORONÆ BOREALIS, 1798.

1908. Aug. 20. Observed by T. H. PARKER.
G. M. T. 13h 05m Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0365	....	....	....	2	53·1332	....	....	....
½	72·8789	72·8528	·0120	−17·41	2	45·2876	....	....	....
1	72·4693	....	....	....	1	45·2516	45·2376	·0011	−1·15
2	54·7634	....	....	....	½	27·4337	27·4011	·0115	−9·98
1	54·0031	53·9821	·0123	+[14·16]	2	27·2794	....	....	....

Weighted mean	− 7·42
V_a	−20·11
V_d	− ·16
Curvature	− ·28
Radial velocity	−28·0

α CORONÆ BOREALIS. 1798 *

1908. Aug. 20.
G. M. T. 13^h 05^m

Observed by T. H. Parker.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings	Displacement in Revolutions.	Velocity.
2	73·0592	....	....	....	2	45·3184	....	....	....
½	72·9039	72·8549	·0099	−14·36	1	45·2919	45·2471	·0084	+ 8·76
2	72·4926	....	....	....	1	27·4682	27·4132	·0006	+ 0·52
2	54·7899	....	....	....	2	27·3016	....	....	....
½	54·0289	53·9824	·0126	+[14·50]	1	11·9196	11·8679	·0165	+12·36
2	53·1569	....	....	....	2	11·5585	....	....	....

Weighted mean	+ 4·13
V_a	−20·11
V_d	− ·16
Curvature	− ·28
Radial velocity	− 16·4

* Check measurement.

α CORONÆ BOREALIS, 1809.

1908. Aug. 21.
G. M. T. 15^h 01^m

Observed by / Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions	Velocity.
1	73·0208	....	....	....	2	45·2855	....	....	....
½	72·8951	72·8835	·0187	+27·13	1	45·2607	45·2488	0101	+10·54
1	72·4582	....	....	....	½	27·4744	27·4424	·0298	+25·87
2	54·7565	....	....	....	2	27·2787	....	....	....
½	54·0087	53·9964	0266	+[30·62]	1	11·9107	11·8762	·0248	+18·58
2	53·1219	....	....	....	2	11·5418	....	....	....

Weighted mean	+ 18·54
V_a	−20·00
V_d	− ·25
Curvature	− ·28
Radial velocity	− 2·00

α CORONÆ BOREALIS, 1816.

1908. Aug. 24.
G. M. T. 13h 12m

Observed by W. E. Harper
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7497	....	....	....	1	45·3087	45·2922	·0535	+55·85
½	54·0267	54·0182	·0484	+[55·71]	½	27·5152	27·4672	·0546	+47·38
2	53·1212	....	....	....	2	27·2950	....	....	....
2	45·2902	....	....	....					

Weighted mean .... +53·03
V_a .... −19·63
V_d .... − ·20
Curvature.............. − ·28

Radial velocity .... + 32·9

α CORONÆ BOREALIS, 1817.

1908. Aug. 24.
G. M. T. 13h 27m

Observed by W. E. Harper.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings	Displacement in Revolutions.	Velocity.
1	73·0283	....	....	....	2	45·2794	....	....	....
½	72·9461	72·9283	·0635	+92·13	1	45·2977	45·2920	·0533	+55·64
1	72·4579	....	....	....	½	27·5221	27·5085	·0959	+83·24
2	54·7488	....	....	....	2	27·2603	....	....	....
1	54·0279	54·0227	·0529	+[62·66]	½	11·9477	11·9257	·0743	+55·65
2	53·1145	....	....	....	2	11·5295	....	....	....

Weighted mean .... +68·45
V_a .... −19·63
V_d .... − ·20
Curvature.............. − ·28

Radial velocity .... + 48·3

α CORONÆ BOREALIS, 1827.

1908. Aug. 25.
G. M. T. 13h

Observed by / Measured by } J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·6765	....	....	....	1	45·2167	45·2857	·0470	+49·06
1	53·9543	54·0213	·0515	+[59·28]	½	27·4307	27·4547	·0421	+36·54
2	53·0434	....	....	....	2	27·2226	....	....	....
2	45·2046	....	....	....					

Weighted mean .... +46·56
V_a .... −19·51
V_d .... − ·17
Curvature.............. − ·28

Radial velocity .... + 26·6

α CORONÆ BOREALIS, 1836.

1908. Aug. 27. G. M. T. 14h 34m

Observed by } Measured by } J. B. CANNON

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0226				2	45·2911			
½	72·8899	72·8770	·0122	+17·70	1	45·2916	45·2741	·0354	+36·95
1	72·4579				½	27·4900	27·4623	·0497	+43·13
2	54·7549				2	27·2740			
1	53·9889	53·9763	·0065	+[7·48]	½	11·9036	11·8701	·0187	+14·00
2	53·1241				2	11·5409			

Weighted mean		+29·74
V_a	−19·21	
V_d	−·28	
Curvature	−·28	
Radial velocity		+10·0

α CORONÆ BOREALIS, 1841.

1908. Aug. 28. G. M. T. 13h

Observed by } Measured by } J. B. CANNON

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0259				¼	27·5064	27·4684	·0558	+48·43
½	72·8870	72·8701	·0053	+7·69	2	27·2849			
1	72·4641				1	11·9382	11·8832	·0318	+23·82
2	45·2921				2	11·5626			
1	45·2848	45·2663	·0276	+28·81					

Weighted mean		+24·94
V_a	−19·03	
V_d	·19	
Curvature	−·28	
Radial velocity		+5·4

α CORONÆ BOREALIS, 1842.

1908. Aug. 28.
G. M. T. 13h 14m

Observed by } J. B. CANNON
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings	Corrected Star Settings	Displacement in Revolutions.	Velocity.
1	73·0092	....	....	....	2	45·2878	....	....	....
¼	72·8733	72·8738	·0090	+13·06	1	45·2838	45·2696	·0309	+32·26
1	72·4448	....	....	....	⅓	27·4705	27·4412	·0286	+24·82
2	54·7462	....	....	....	2	27·2762	....	....	....
¼	54·0117	54·0051	·0353	+[39·63]	¼	11·9601	11·9223	·0709	+53·10
2	53·1214	....	....	....	2	11·5452	....	....	....

Weighted mean		+30·60
V_a	−19·03	
V_d	− ·20	
Curvature	− ·28	
Radial velocity		+11·1

α CORONÆ BOREALIS, 1852.

1908. Aug. 31.
G. M. T. 13h 17m

Observed by W. F. HARPER.
Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0311	....	....	....	1	27·4462	27·4423	·0297	+25·78
½	72·8743	72·8536	·0112	−12·89	2	27·2515	....	....	....
1	72·4637	....	....	....	¼	11·8686	11·8702	·0188	+14·08
2	45·2785	....	....	....	2	11·5056	....	....	....
1½	45·2366	45·2317	·0070	− 7·31					

Weighted mean	+ 3·66	
V_a		−18·53
V_d		− ·22
Curvature		− ·28
Radial velocity		−15·4

α CORONÆ BOREALIS, 1852*.

1908. Aug. 31.
G. M. T. 13h 17m

Observed by W. E. Harper.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0047	....	....	... .	½	27·4278	27·4397	·0271	+23·52
½	72·8550	72·8598	·0050	− 7·25	2	27·2347	....	....	....
1	72·4409	....	....	......	½	11·8520	11·8750	·0236	+17·68
2	45·2570	....	....	....	2	11·4840	....	....	....
1	45·2188	45·2354	·0033	− 3·45					

Weighted mean	+ 4·05
V_a	−18·53
V_d	− ·22
Curvature	− ·28
Radial velocity	− 15·0

* Check Measurement

α CORONÆ BOREALIS, 1861.

1908. Sept 3.
G. M. T. 12h 50m

Observed by J. S. Plaskett.
Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0328	....	....	....	½	27·4429	27·4029	·0097	− 8·42
½	72·8769	72·8535	·0113	−16·40	2	27·2866	....	....	....
1	72·4697	....	....	....	1	11·8911	11·8395	·0119	− 8·91
2	45·2913	....	....	....	2	11·5592	....	....	....
1	45·2442	45·2265	·0122	−12·74					

Weighted mean	−11·35
V_a	−18·03
V_d	− ·21
Curvature	− ·28
Radial velocity	− 29·9

α CORONÆ BOREALIS, 1865.

1908. Sept. 4.
G. M. T. 13h 27m

Observed by T. H. PARKER.
Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	73·0201	......	......	......	2	45·2962	......	......	......
½	72·8801	72·8693	·0045	+ 6·53	1	45·2687	45·2461	·0074	+ 7·73
1	72·4571	......	......	......	¼	27·4456	27·3976	·0150	−10·02
2	54·7639	......	......	......	2	27·2919	......	......	......
1	53·9634	53·9411	·0287	−[33·03]	¼	11·9038	11·8461	·0053	− 3·97
2	53·1346	......	......	......	2	11·5651	......	......	......

Weighted mean	+ 3·75	
V_a		−17·87
V_d		− ·27
Curvature		− ·28
Radial velocity		− 14·7

α CORONÆ BOREALIS, 1882.

1908. Sept. 14.
G. M. T. 12h 51m

Observed by J. S. PLASKETT.
Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity
1	73·0319	......	......	......	2	45·3247	......	......	......
½	72·9093	72·8867	·0219	+31·78	1	45·3219	45·2708	·0321	+33·51
1	72·4692	......	......	......	½	27·5253	27·4463	·0337	+29·25
2	54·7787	......	......	......	2	27·3257	......	......	......
¼	54·0006	53·9646	·0052	−[5·99]	1½	12·0035	11·8975	·0451	+33·78
2	53·1472	......	......	......	2	11·6135	......	......	......

Weighted mean		+32·77
V_a	−15·95	
V_d	− ·23	
Curvature	− ·28	
Radial velocity		+ 16·3

α CORONÆ BOREALIS, 1883.

1908. Sept. 14.
G. M. T. 13h 07m

Observed by J. S. PLASKETT.
Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7551	......	......	......	2	27·2799	......	......	......
½	54·0166	54·0060	·0362	+[40·57]	¼	15·5465	15·4985	·0252	+19·50
2	53·1201	......	......	......	2	15·4467	......	......	......
2	45·2864	......	......	......	1	11·9188	11·8737	·0223	+16·70
1	45·2824	45·2696	·0309	+32·26	2	11·5523	......	......	......
¼	27·4653	27·4323	·0197	+17·10					

Weighted mean		+22·85
V_a	−15·95	
V_d	− ·23	
Curvature	− ·28	
Radial velocity		+ 6·4

α CORONÆ BOREALIS, 1894.

1908. Sept. 19.
G. M. T. 12h 02m

Observed by J. S. PLASKETT.
Measured by J. B. CANNON.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0180	......	......	......	2	45·3163	......	......	......
½	72·8619	72·8515	·0133	−19·30	½	45·2773	45·2346	·0041	− 4·28
2	72·4620	......	......	......	½	27·4673	27·4000	·0126	−10·94
2	54·7725	......	......	......	2	27·3142	......	......	......
¼	53·9865	53·9545	·0153	−[17·51]	½	11·9190	11·8336	·0178	−13·33
2	53·1454	......	......	......	2	11·5926	......	......	......

Weighted mean	−11·96
V_a	−14·58
V_d	− ·22
Curvature	− ·28
Radial velocity	− 27·0

α CORONÆ BOREALIS, 1895.

1908. Sept. 19. Observed by J. S. Plaskett.
G. M. T. 12h 17m Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0038	....	....	....	2	45·2814	....	....	....
½	72·8573	72·8633	·0015	−2 18	1	45·2429	45 2351	·0036	3·76
2	72·4388	....	....	....	½	27 4293	27·4118	·0008	− 0·69
2	54·7388	....	....	....	2	27·2643	....	....	....
½	53·9565	54·9580	·0118	−[13·58]	1½	11·8895	11 8595	·0081	+ 6·07
2	53·1120	....	....	....	2	11·5373	....	....	....

Weighted mean................	+ 1·26
V_a	−14·58
V_d	− ·22
Curvature.....................	− ·28
Radial velocity...............	−13·8

α CORONÆ BOREALIS, 1896.

1908. Sept. 19. Observed by J. S. Plaskett.
G. M. T. 12h 30m Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7526	....	....	....	1½	45 2619	45·2371	·0016	− 1·67
½	53·9992	53·9889	·0191	+[21·98]	1	27·4389	27·3969	·0157	−13·63
2	53·1219	....	....	....	2	27·2889	....	....	....
2	45·2984	....	....	....					

Weighted mean................	− 6·26
V_a	−14·58
V_d	− ·22
Curvature.....................	− ·28
Radial velocity...............	−21·3

α CORONÆ BOREALIS, 1897.

1908. Sept. 19. Observed by J. S. Plaskett.
G. M. T. 12h 42m Measured by J. B. Cannon.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0197	....	....	....	2	45·3094	....	....	....
½	72·8669	11·8573	·0075	−10·88	1½	45·2797	45·2439	·0052	+ 5·43
2	72·4537	....	....	....	1	27·4750	27·4097	·0029	− 2·52
2	54·7572	....	....	....	2	27·3122	....	....	....
½	53·9924	53·9731	·0033	+[3·80]	1	11·9309	11·8492	·0022	− 1·65
2	53·1352	....	....	....	2	11·5892	....	....	....

Weighted mean................	− 0·37
V_a	−14·58
V_d	− ·22
Curvature.....................	− ·28
Radial velocity...............	−15·5

α CORONÆ BOREALIS, 1949.

1908. Nov. 1.
G. M. T. 10h 41m

Observed by } J. B. CANNON.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	72·9672	....	....	....	1	45·3092	....	....	....
½	72 8800	72·9220	·0572	+82·99	1	45·2928	45·2928	0185	+19·31
1	54 7508	....	....	....					

Weighted mean . . . . +39·88
V_a . . . . − ·38
V_d . . . . − ·27
Curvature . . . . − ·28

Radial velocity . . . . +38·9

α CORONÆ BOREALIS, 1950.

1908. Nov. 1.
G. M. T. 10h 58m

Observed by } J. B. CANNON.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	48·7674	....	....	....	2	27 3286	....	....	....
1	45·3178	45·3118	·0631	+65·87	½	12·0368	11.9236	·0722	+54·07
½	27·5393	27·4850	·0724	+62·84	1	11 6326	....	....	....

Weighted mean. . . . . +63·40
V_a . . . . − ·38
V_d . . . . − ·27
Curvature . . . . − ·28

Radial velocity . . . . +62·5

α CORONÆ BOREALIS, 1951.

1908. Nov. 1.
G. M. T. 11h 14m

Observed by } J. B. CANNON.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	45·3028	....	....	....	1	45·3170	45·2878	·0491	+51·26

Velocity . . . . +51 26
V_a . . . . − ·38
V_d . . . . − ·27
Curvature . . . . − 28

Radial velocity . . . . +50·3

OBSERVING RECORD AND DETAILED MEASURES OF δ AQUILÆ.

P.– PLASKETT.
H.– HARPER.
C.– CANNON.
P^1.– PARKER.
T.–TRIBBLE.

RECORD OF SPECTROGRAMS.

Star.	No. of Negative.	Camera.	Plate.	Date.	Middle of Exposure, G. M. T.		Duration.	Hour Angle at end.		Temperature. Room. Beg.	Room. End.	Prism Box. Beg.	Prism Box. End	Slit Width.	Seeing.	Observer.
				1906.	h.	m.	m.	h.	m.	Fahrenheit.		Centigrade				
δ Aquilæ . .	368	. .	Seed 27.	Aug. 6	17	35	85	2	55W.	71·0	69·4	27·7	28 0	·001	Good . .	H
" . .	377	. .	" R.	" 15	15	40	70	1	07W.	68·2	66·0	25·6	25·6	·001	" . .	H
" . .	382	. .	" . .	" 24	15	45	90	2	15W.	61·0	62·1	22·8	22 9	·001	Fair	H
" . .	390	. .	" . .	Sept. 10	15	30	60	2	50W.	69·0	67·0	26·7	26·7	·001	Good . .	H
" . .	399	. .	" . .	" 27	14	45	60	3	15W.	60 0	59·6	21·8	21·8	·001	" . . .	H
" . .	413	. .	" 27	Oct. 23	13	45	90	4	10W.	50·3	46·2	15·1	15·3	·001	Dancing	H
				1907.						Centi grade						
" . .	803	1L	" . .	May 31	19	04	25		35E.	12·6	12·6	18 7	18·7	·001	Good . . .	P
" . .	818	"	" . .	June 10	19	13	20		15W.	12 4	12 1	17·8	17·8	·0012	" . . .	P
" . .	904	"	" . .	July 2	18	12	24		40W.	13·5	14·0	17·0	17·0	·0014	" . . .	H
" . . .	923	"	" . .	" 8	18	02	25		55W.	20 2	20 1	22·3	22·2	·0012	Poor to fair. . .	P
" . .	930	"	" . .	" 9	16	33	30		30E.	21·5	20·9	25·0	25·0	·0012	Good . . .	H
" . .	938	"	" . .	" 10	16	30	30		28E.	22 6	22·4	24·5	24·5	·0012	Fair to poor. .	P
" . .	966	"	" . .	" 25	16	30	60		48W.	21 5	21 5	28·0	27·8	·0014	Poor. . . .	H
" .	980	"	" . .	Aug. 3	14	40	30		45E.	19 5	19·5	24·0	24·1	·0012	. . . . . .	P
" .	982	"	" . .	" 5	16	39	28	1	10W.	17·6	17·6	21 0	21 0	·0012	Fair to poor. .	P
" .	1034	"	" . .	Sept. 6	15	44	41	2	35W.	18·3	18·0	21·0	20·5	·0012	Fair	T
" .	1049a	"	"	" 18	13	56	47	1	42W.	14·0	12·5	17·1	17·1	·0014	"	T
" . .	1049b	"	"													
				1908.												
" . .	1543	"	" . .	May 18	20	06	30	0	00	15 5	15·0	23·4	23·4	·0016	Hazy . . .	H
" . .	1550	"	" . .	" 22	20	34	42		39W.	19·0	19·0	25·0	25·0	·0017	Fair	H
" . .	1575	"	" . .	June 3	20	01	40		45W.	13·0	12·5	18·3	18·3	·0015	"	H
" . .	1584	"	" . .	" 5	20	35	40	1	30W.	14·0	14·3	24·4	24·4	·0016	Notgood	P^1
" . .	1633	"	" . .	" 24	18	31	37		40W.	19·0	19·0	27·5	27·5	·0015	Good. . .	H
" . .	1642	"	" . .	" 26	18	52	55	1	20W.	17·6	17·5	30·2	30·0	·0016	" . . .	P^1
" . .	1650	"	" .	" 27	18	09	35		30W.	19·5	19·1	23·6	23·4	·0014	. . .	P
" . .	1660	"	" . .	July 3	18	35	50		25W.	20·5	20·1	25·1	25·1	·0016	Fair	HP^1
" . .	1678	"	" . .	" 8	18	10	40	1	15W.	17·0	17·5	21·6	21·6	·0015	Good . . .	C-H
" . .	1690	"	" . .	" 10	18	35	45	1	55W.	21·1	20·5	27·5	28·0	·0016	" . .	P^1
" . .	1695	"	" . .	" 11	18	27	35	1	45W.	26·0	25·4	29 8	29·7	·0015	Fair	P
" . .	1703	"	" . .	" 13	18	52	45	2	25W.	18·2	18·0	23 0	23·0	·0015	Good . . .	P^1
" . .	1753	"	" . .	" 31	16	41	32	1	10W.	19·5	19 5	26·0	25·9	·0015	" . . .	P^1
" .	1754	"	" .	" 31	17	17	34	1	48W.	19·5	19·0	25·9	25·6	·0015	" . . .	H
" . .	1768	"	" . .	Aug. 5	18	05	40	2	55W.	20·8	20·5	26 7	26·5	·0015	. . . .	P-C
" .	1783	"	" . .	" 15	17	38	30	3	05W.	18·0	17·6	22·5	22·4	·0015	Fair	P
" . .	1837	"	" . .	" 27	15	03	35	1	20W.	18·0	17·0	23·2	23·0	·0015	Good . . .	C

δ AQUILÆ 368.

1906. Aug. 6.
G. M. T. 17ʰ 35ᵐ

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Computed Wave Lengths.	Corrected Wave Lengths.	Normal Wave Lengths.	Displacement.	Velocity.
3	S 68·3790	4528·798	...	...	...	...
3	65·3512	4494·626	...	·738	...	...
1	64·1176	4480·972	·000	·400	·400	−26·76
2	63·6677	4476·194	...	·185	...	...
2	62·7948	4466·791	...	·727	...	...
½	61·5939	4454·023	·973	·552	·579	39·63
3	S 56·8011	4404·927	...	...	...	...
2	54·6445	4383·756	...	·720	...	...
3	50·0285	4340·237	184	·634	·450	31·05
3	48·4614	4325·992	...	·939	...	...
3	S 46·4500	4308·081	...	...	...	...
1	45·4172	4299·044	...	·074	...	...
3	44·8605	4294·217	...	·301	...	...
2	44·3248	4289·601	·642	032	·390	−27·22

Weighted mean	−31·16
V_a	−10·00
V_d	− ·16
Curvature	− ·50
Radial velocity	−41·8

δ AQUILÆ 377.

1906. Aug. 15.
G. M. T. 15ʰ 40ᵐ

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Computed Wave Lengths.	Corrected Wave Lengths.	Normal Wave Lengths.	Displacement.	Velocity.
2	S 70·1969	4549·642	...	...	...	...
2	70·1460	4549·039	·039	·642	·603	−39·73
½	68·8403	4533·723	·753	·168	·415	27·43
3	68·4118	4528·757	...	·798	...	...
2	65·4082	4494·722	...	·738	...	...
2	64·1638	4481·013	·953	·400	·447	29·90
2	63·7291	4476·277	...	·185	...	...
½	63·0706	4469·152	·062	·545	·485	32·36
2	62·8551	4466·835	...	·727	...	...
½	58·1412	4417·700	·670	·038	·368	24·95
3	S 56·8682	4404·927	...	...	...	...
2	54·6973	4383·606	...	·720	...	...
3	50·0813	4340·115	184	·634	·450	31·05
3	48·5181	4325·926	...	·939	...	...
3	S 46·5100	4308·081	...	...	...	...
2	44·9317	4294·348	...	·301	...	...
1	44·9073	4294·138	...	·301	...	...
1	44·3830	4289·632	·590	·032	·442	−30·85

Weighted mean	−30·89
V_a	−13·62
V_d	− ·19
Curvature	− ·50
Radial velocity	−45·2

δ AQUILÆ 382.

1906. Aug. 21.
G. M. T. 15h 15m

Observed by / Measured by } W. E. Harper.

Wt.	Mean of Settings.	Computed Wave Lengths.	Corrected Wave Lengths.	Normal Wave Lengths.	Displacement.	Velocity.
2	70 1122	4549·520	....	·642	....	....
1	70·1029	4549·410	·530	·905	·375	-24·71
3	S 68 3400	4528·798	....	....	....	....
1	67·7987	4522·566	·558	·855	·297	19·69
1	65·9371	1501·472	....	·505	....	....
2	65·3329	4494·735	....	·738	....	....
1	64·0791	4480·926	·930	·400	·470	31·44
2	63·6431	4476·176	....	185	....	....
2	62·7647	4466·688	....	·727	....	....
½	59·7630	4435·058	078	450	·372	25·14
2	S 56·7937	4404·927	....	....	....	....
1	56·3165	4400·188	·188	·738	·550	37·45
½	55·7715	4394·808	·804	·286	·482	32·87
2	54·6357	4383·715	....	·720	....	....
½	53·7124	4374·809	·821	·103	·282	19·31
2	50 0145	4340·120	·134	634	·500	34·50
2	48·4534	4325·930	....	·939	....	....
1	47·9225	4321·164	....	....	....	....
2	S 46·4482	4308·081	·164	....	....	....
2	44·8650	4294·280	....	·301	....	....
½	44·8327	4294·002	·018	·301	·283	19·78
½	44·3189	4289·578	·596	032	.436	−30·52

Weighted mean	−27·54
V_a	−16·98
V_d	− .12
Curvature	− ·50
Radial velocity	−45·1

δ AQUILÆ 390.

1906. Sept. 10.
G. M. T. 15h 30m

Observed by / Measured by } W. E. Harper.

Wt.	Mean of Settings.	Computed Wave Lengths.	Corrected Wave Lengths.	Normal Wave Lengths.	Displacement.	Velocity.
1	65·2901	4494·811	....	·738	....	....
1	64·0719	4481·396	·360	·400	·040	− 2·67
1	63·6037	4476·296	....	·185	....	....
2	54·5817	4383·730	....	·720	....	....
½	49·9026	4339·632	·620	·640	·020	− 1·38
3	48·3953	4325·945	....	·939	....	....

Weighted mean	− 2·00
V_a	−22·26
V_d	− ·19
Curvature	− ·28
Radial velocity	−25·0

δ AQUILÆ 399.

1906. Sept. 27.
G. M. T. 14h 45m

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Computed Wave Lengths.	Corrected Wave Lengths.	Normal Wave Lengths.	Displacement.	Velocity.
3	70·1090	4549·618		·642		
1	68·7305	4533·425	·432	·419	·013	+ 0·85
	S 68·3316	4528·798				
3	65·3312	4494·755		·738		
2	64·7742	4488·581	·573	·495	·078	+ 5·21
1	64·1215	4481·405	·405	·400	·005	+ 0·33
3	63·6427	4476·178		·185		
3	62·7675	4466·710		·727		
1	62·3372	4462·093	·109	·165	·056	− 3·75
2	62·0765	4459·309		·301		
1	61·1665	4449·662	·676	·785	·109	− 7·33
1	58·0743	4417·705	695	·884	189	−12·81
	S 56·8037	4401·927				
1	55·8229	4395·202	·210	·201	·009	+ 0·61
1	54·6449	4383·677		·720		
1	53·6987	4370·905		·144		
2	50·0504	4340·559	564	·634	070	− 4·83
2	48·4750	4325·930		·939		
	S 46·4725	4308·081				
2	44·8957	4294·319		·301		
2	44·3930	4289·984	·964	·032	·068	− 4·75
½	42·1961	4271·329	·305	·325	·020	− 1·40

Weighted mean	− 2·68
V_a	−25·74
V_d	− ·22
Curvature	− ·50
Radial velocity	− 29·0

δ AQUILÆ 413.

1906. Oct. 23.
G. M. T. 13h 45m

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Computed Wave Lengths.	Corrected Wave Lengths.	Normal Wave Lengths.	Displacement.	Velocity.
1	70·1315	4549·642	·642	·642	·000	0·00
1	S 70·1315	4549·642				
2	68·3595	4528·840		·798		
1	65·3580	4494·715		·738		
2	64·1318	4481·159	·190	·400	·210	−14·04
1	63·6731	4476·145		·185		
3	S 56·8482	4401·927				
2	54·6954	4383·707		·720		
1	53·7352	4374·423	·439	·628	·189	−12·94
1	50·1309	4340·528	·540	·640	·100	− 6·90
3	48·5299	4325·938		·939		
3	S 46·5280	4308·081				
½	46·4975	4307·813	·813	·023	·210	−14·61

Weighted mean	−10·04
V_a	−26·88
V_d	− ·25
Curvature	− ·50
Radial velocity	− 37·7

δ AQUILÆ 803.

1907. May 31.
G. M. T. 19h 01m

Observed by J. S. Plaskett.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	57·8154	....	....	....	½	45·9607	·9592	·0280	29·45
1	57·7707	·7847	·0421	−50·68	2	45·2762	....	....	....
2	54·7232	....	....	....	1	45·1958	·1938	·0449	46·87
1	53·9416	·9516	·0182	20·94	2	43·5392	....	....	....
2	53·1061	....	....	....	2	37·9741	....	....	....
2	48·7682	....	....	....	1	37·2332	·2192	·0696	66·73
1	48·6938	·6958	·0682	75·36	1	27·3962	·3422	·0704	−61·10
1	47·4378	·4383	·0321	34·34	2	27·2954	....	....	....

Weighted mean		−47·92
V_a	+18·24	
V_d	+ ·07	
Curvature		− ·28
Radial velocity		−29·9

δ AQUILÆ 818.

1907. June 10.
G. M. T. 19h 13m

Observed by J. S. Plaskett.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	57·8253	....	....	....	1	45·9704	·9304	·0568	59·75
1	57·7820	·7780	·0488	−58·75	2	45·3146	....	....	....
2	54·7558	....	....	....	1	45·2333	·1923	·0464	48·44
2	48·8030	....	....	....	2	43·5841	....	....	....
1	48·7360	·7034	·0606	65·75	1	27·4760	·3520	·0606	−52·60
1	47·4522	·4162	·0542	57·99	2	27·3713	....	....	....

Weighted mean		−57·21
V_a	+14·68	
V_d	0·00	
Curvature		− ·28
Radial velocity		−42·8

δ AQUILÆ 904.

1907. July 2.
G. M. T. 18h 12m

Observed by / Measured by W. E. Harper.

Wt.	Mean of Settings.	Computed Wave Lengths.	Corrected Wave Lengths.	Normal Wave Lengths.	Displacement.	Velocity.
3	72·9426	4864·756		·943		
2	72·7683	4860·608	·837	527	·690	−42·57
2	72·3857	4851·637		·686		
1	57·8055	4550·333		·642		
1½	57·7888	4550·031	·332	·642	·310	20·43
1½	54·0165	4483·099		413		
1½	53·9383	4481·751	·050	400	·350	23·41
2	52·2394	4452·897		·180		
3	48·7760	4396·316		·382		
1	48·7398	4395·740	820	·286	·466	31·78
1½	47·4590	4375·754	774	107	·333	22·88
2	45·2878	4342·183		·162		
1	45·2205	4341·168	·108	·634	·526	36·29
	42·1262	4295·425		·290		

Weighted mean		−24·85
V_a	+5·63	
V_d		−·04
Curvature		−·28
Radial velocity		−19·5

δ AQUILÆ 923.

1907. July 8.
G. M. T. 18h 02m

Observed by J. S. Plaskett.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7604				2	45·3152			
1	53·9708	·9458	·0240	−27·62	1	45·2452	·2042	·0345	36·01
2	53·1390				2	38·0093			
½	52·4227	·3947	·0201	22·73	1	37·3176	·2651	·0237	22·72
2	52·2767				2	35·4883			
2	48·8029				1	27·4678	·3798	·0328	−28·47
1	45·9830	·9440	·0400	42·08	2	27·3349			

Weighted mean		−30·63
V_a	+2·96	
V_d		−·07
Curvature		−·28
Radial velocity		−28·0

δ AQUILÆ 930.

1907. July 9.
G. M. T. $16^h 33^m$

Observed by W. E. Harper.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	57·8333	....	....	....	1	48·7412	·7360	0280	30·40
1	57·8169	8129	·0139	–16·73	1	47·4795	·4670	0034	03·63
2	54·7487	....	....	....	2	45·2875	...	....	....
1	53·9750	·9680	·0018	02·07	1	45·2244	·2104	·0283	29·54
2	53·1198	....	....	....	2	37·9870	......	....	....
2	48·7812	......	....	....	1	37·2898	2620	·0268	–25·70

Weighted mean		–17·98
V_a	+ 2·54	
V_d	+ ·08	
Curvature		– ·28
Radial velocity		– 15·6

δ AQUILÆ 938.

1907. July 10.
G. M. T. $11^h 30^m$

Observed by J. S. Plaskett.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	59·8376	....	....	....	2	42·1585	......	....	....
½	58·6448	·6188	·0209	+25·41	1	41·8098	7538	·0778	–78·26
2	57·8525	....	....	....	2	38·0165	......	....	....
1	57·8362	8107	·0161	–19·38	½	36·5035	·4365	·0597	–56·77
2	54·7745	....	....	....	2	35·4998	....	....	....
2	48·8114	....	....	....	2	30·9556	....	....	....
½	47·4796	·4351	·0353	–38·47	½	30·8842	·8082	0674	–60·52
2	45·3240	......	....	....	1	27·4150	·3270	·0856	–74·30
1	45·2632	·2128	0255	–26·62	2	27·3430	....	......	....
1	44·2754	·2239	0148	–15·28	2	22·6567	....	......	....
2	43·5880	....	....	....	½	22·6152	·5153	·0791	–65·49

Weighted mean		–20·40
V_a	+ 2·18	
V_d	·00	
Curvature		– ·28
Radial velocity		–18·5

δ AQUILÆ 966.

1907. July 25.
G. M. T. 16ʰ 39ᵐ

Observed by W. E. HARPER.
Measured by T. H. PARKER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	57·7993	....	....	....	2	45·2612	....	....	....
1	57·7957	·8227	·0041	−04·93	½	45·2242	·2252	·0135	14·09
2	54·7201	....	....	....	2	43·5371	....	....	....
1	53·9306	·9601	·0097	11·16	½	27·4259	·3856	·0267	−23·17
2	53·0970	....	....	....					

Weighted mean	−11·57
V_a	− 4·63
V_d	− ·02
Curvature	− ·28
Radial velocity	−16·5

δ AQUILÆ 980.

1907. Aug. 3.
G. M. T. 14ʰ 40ᵐ

Observed by J. S. PLASKETT.
Measured by T. H. PARKER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	59·8416	....	....	....	½	46·0142	·3765	·0100	−10·52
½	59·0484	·0185	·0222	−27·10	2	45·3113	....	....	....
2	57·8562	....	....	....	1	45·2599	·2222	·0168	17·55
1	57·8448	·8178	·0090	10·83	½	44·2852	·2468	·0130	13·42
2	54·7701	....	....	....	2	43·5768	....	....	....
1	53·9962	·9672	·0026	02·99	1	41·8349	·7965	·0387	38·93
2	48·8045	....	....	....	½	27·4712	·3986	·0124	−10·76
1	47·5163	·4803	·0099	−10·59					

Weighted mean	−16·87
V_a	− 8·53
V_d	− ·04
Curvature	− ·28
Radial velocity	−25·7

δ AQUILÆ 982.

1907. Aug. 5.
G. M. T. $16^h\ 36^m$

Observed by J. S. PLASKETT.
Measured by T. H. PARKER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	57·8462	......	......	......	1	45 2591	·2231	.0156	−16·28
½	57·8389	·8221	·0047	−05·65	2	44·2644	·2274	·0318	32 84
1	56·9690	·9515	·0140	16·68	2	43·5747	......	......	......
1	56·6945	......	......	......	2	42·1445	......	......	......
2	48·8009	......	......	......	1	41·8297	·7872	·0441	44 36
1	47·5019	·4698	·0006	−00·64	2	30 9363	......	......	......
1½	46·0152	·9812	·0060	+06·31	1	30·8976	·8317	·0439	−39·42
2	45·3083	......	......	......					

Weighted mean	−19·60
V_a	− 9·42
V_d	− ·09
Curvature	− ·28
Radial velocity	− 29·4

δ AQUILÆ 1034.

1907. Sept. 6.
G. M. T. $15^h\ 44^m$

Observed by J. N. TRIBBLE.
Measured by T. H. PARKER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	59 8664	......	......	......	2	43·5443	......	......	......
1½	57·8788	·8313	·0045	+05·42	1	43·4850	......	......	......
1	57·8768	......	......	......	2	37·9634	......	......	......
2	54·7733	......	......	......	1	37·2692	·2682	·0196	−18·79
1	54·0167	·9887	·0189	+21·75	2	35·4242	......	......	......
2	48·7842	......	......	......	1½	35·1650	·1650	·0160	+15·00
1	48·7878	·7736	·0096	+10·42	2	30·8659	......	......	......
2	45·2868	......	......	......	1	30·8385	·8425	·0331	−29·72
1	45·2454	·2322	·0065	−06·78	1	27·3874	·3944	·0182	−15·79

Weighted mean	− 3·84
V_a	− 21·09
V_d	− ·16
Curvature	− ·28
Radial velocity	−25·4

δ AQUILÆ 1049 (*a*).

1907. Sept. 18.
G. M. T. 8ʰ 56ᵐ

Observed by J. N. TRIBBLE.
Measured by T. H. PARKER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	59·8694	....	....	....	2	41·3069	....	....	....
1	57·8779	·8279	·0011	+01·32	2	37·9839	....	....	....
2	57·8775	....	....	....	1	37·2896	·2646	·0242	−23·20
1	57·6237	·5757	·0189	+22·68	1	30·8967	....	....	....
½	55·1806	·1351	·0099	+11·54	1	30·8663	·8403	·0353	−30·69
1	54·0309	·9859	·0161	+18·56	1	27·4422	·4182	·0056	+04·86
2	53·1554	....	....	....	2	27·2681	....	....	....
2	45·3054	....	....	....	2	24·8642	....	....	....
1½	45·2848	·2508	·0121	+12·63	1	24·8329	·8136	·0316	−26·78
2	43·5724	....	....	....	2	22·5796	....	....	....
1	41·8318	·8078	·0238	−23·94	½	22·5650	·5412	·0146	−12·08

Weighted mean	− 3·66
V_a	−24·00
V_d	− ·09
Curvature	− ·28
Radial velocity	−28·0

δ AQUILÆ 1049 (*b*).

1907. Sept. 18.
G. M. T. 8ʰ 56ᵐ

Observed by J. N. TRIBBLE.
Measured by T. H. PARKER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	59·8589	....	....	....	1	42·5064	·4794	·0314	−31·80
1	57·8824	·8409	·0141	+16·97	2	42·1333	....	....	....
2	57·8709	....	....	....	½	41·8333	·8073	·0243	−24·44
1	57·6069	·5659	·0091	+10·92	2	41·3082	....	....	....
½	55·1507	·1142	·0110	−12·82	2	37·9828	....	....	....
¼	54·0154	·9804	·0106	+12·20	½	37·3204	·2984	·0096	+09·20
2	45·3012	....	....	....	2	24·8630	....	....	....
1	45·2860	·2575	·0188	+19·62	½	24·8351	·8173	·0279	−23·63
2	43·5663	....	....	....					

Weighted mean	− 1·58
V_a	−24·00
V_d	− ·09
Curvature	− ·28
Radial velocity	−25·9

δ AQUILÆ 1543.

1908. May 18.
G. M. T. $20^h\ 06^m$

Observed by W. E. Harper.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	59·8118	....	....	....	2	45·2857	....	....	....
1	59·6115	·6090	·0655	−80·56	1	45·1924	·1819	·0568	59·29
1½	57·7867	·7867	·0401	48·28	1	44·2082	·1967	·0625	64·56
½	56·9378	·9388	·0267	31·82	2	43·5501	....	....	....
2	56·6665	....	....	....	1	39·9986	·9811	·0352	34·35
½	55·0793	·0793	·0459	53·51	½	37·2334	·2134	·0754	72·30
1	53·9367	·9352	·0346	39·82	2	37·9775	....	....	....
2	53·1154	....	....	....	2	30·8437	·8107	·0649	58·27
1½	52·3898	·3868	·0280	31·66	½	27·3944	·3544	·0582	−50·50
1	51·6895	·6860	·0715	80·22	2	27·2870	....	....	....
2	48·7751	....	....	....					

Weighted mean .... −43·49
V_a .... +21·88
V_d .... + ·01
Curvature .... − ·28

Radial velocity .... − 21·9

δ AQUILÆ 1550.

1908. May 22.
G. M. T. $20^h\ 31^m$

Observed by W. E. Harper.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	59·8566	....	....	....	2	43·5800	....	....	....
1	53·9680	·9260	·0438	−50·41	1	43·5040	·4590	·0742	75·90
2	53·1527	....	....	....	½	42·4743	·4268	·0840	85·09
½	52·4092	·3682	·0466	52·70	2	37·3817	....	....	....
1	51·7194	·6799	·0796	89·31	1	37·3052	·2552	·0336	32·22
2	50·0548	....	....	....	½	30·8480	·7940	·0816	73·26
2	45·3223	....	....	....	1	27·4542	·3942	·0184	−15·97
1	45·2179	·1724	·0663	70·54	2	27·3097	....	....	....

Weighted mean .... −60·57
V_a .... +20·77
V_d .... ·00
Curvature .... − ·28

Radial velocity .... − 40·1

δ AQUILÆ 1575.

1908. June 3.
G. M. T. $20^h\ 01^m$

Observed by W. E. Harper.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	59·8247	....	....	....	2	50·0325	....	....	....
1	58·9976	·9581	·0581	−71·11	1	48·7496	·7236	·0404	43·95
2	57·7944	·7574	·0473	57·04	2	45·3116	....	....	....
2	57·8347	....	....	....	½	45·2466	·2206	·0281	29·12
1	56·9377	·9027	·0426	50·86	1	44·2465	·2215	·0508	52·62
2	56·6840	....	....	....	2	43·9300	·9060	·0345	35·60
½	55·1020	·0700	·0391	45·70	2	41·3243	....	....	....
1	53·9550	·9250	·0316	36·22	1½	37·3066	·2946	·0301	−29·24

Weighted mean		−45·35
V_a	+16·94	
V_d		− ·04
Curvature		− ·28
Radial velocity		− 28·7

δ AQUILÆ 1575.

1908. June 3.
G. M. T. $20^h\ 01^m$

Observed by } W. E. Harper.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	57·7480	....	....	....	2	45·2208	....	....	....
2	57·7020	·7562	·0475	−57·28	1	45·1452	·2080	·0307	32·14
1	56·8536	·9100	·0353	42·15	1	44·1533	·2163	·0560	58·02
2	56·5944	....	....	....	½	42·3660	·4300	·0406	41·29
1	55·0194	·0796	·0295	34·48	2	42·0584	....	....	....
2	54·6613	....	....	....	1	41·2210	·2860	·0337	33·83
1½	53·8672	·9287	·0279	32·20	2	39·6969	....	....	....
2	53·0411	....	....	....	1	38·6841	·7516	·0318	31·07
1	52·2948	·3573	·0479	54·27	1	37·2157	·2842	·0408	39·25
2	52·1800	....	....	....	2	30·8595	....	....	....
2	48·7090	....	....	....	1½	30·7894	·8774	·0585	52·77
½	48·6414	·7039	·0601	65·39	2	22·5580	....	....	....
1	45·8895	·9522	·0430	45·36	1	22·4961	·5909	·0619	−51·56

Weighted mean		−44·84
V_a	+16·94	
V_d		− ·04
Curvature		− ·28
Radial velocity		− 28·2

δ AQUILÆ 1584.

1908. June 5.
G. M. T. $20^h 35^m$

Observed by } T. H. PARKER.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
1	59·8185	....	....	....	1	45·1990	·1958	·0429	44·78
1	59·6231	·6140	·0605	−74·41	2	37·9604	....	....	....
1	57·7645	7645	·0623	75·00	½	37·2349	·2404	·0484	46·41
2	56·6595	....	....	....	2	36·1205	·4255	·0707	67·23
1	53·9346	·9376	·0322	37·06	1	35·1146	·1186	·0304	28·51
2	53·1106	....	....	....	2	35·4265	....	....	....
1	52·3912	·3908	·0240	27·14	1½	30·8236	·8176	·0580	52·08
½	51·7052	·7022	·0553	62·04	1	27·3774	·3664	0462	40·10
1½	50·9223	·9183	·0348	38·69	1	27·2576	....	....	....
1	50·0435	....	....	....	½	18·8335	....	·0441	−35·23
1	48·7062	·7012	0618	67·10	1	18.8776	....	....	....
2	45 2770	....	....	....					

Weighted mean.......................... −51·40
V_a.......................... +16·22
V_d.......................... − 09
Curvature.......................... − ·28

Radial velocity.......................... −35·5

δ AQUILÆ 1633.

1908. June 24.
G. M. T. $18^h 31^m$

Observed by W. E HARPER.
Measured by T. H. PARKER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	59·8112	....	....	....	1	45.2090	·2005	·0382	39·88
1	57·7871	·7941	·0327	−39·37	2	44·2642	....	....	....
2	57·8218	....	....	....	2	41·2960	....	....	....
½	55·4842	·4887	·0353	41·33	1	40·4965	·4875	·0385	38·09
2	54·7384	....	....	....	2	35·4349	....	....	....
1	53·9350	·9365	0333	38·32	1	35·3907	·3857	0419	39·42
2	53·1133	....	....	....	½	27·3962	·3792	·0334	−28·99
2	45·2822	....	....	....	2	27·2636	....	....	....

Weighted mean.......................... −37·91
V_a.......................... + 8·74
V_d.......................... ·00
Curvature.......................... − ·28

Radial velocity.......................... −29·5

δ AQUILÆ 1642.

1908. June 26.
G. M. T. 18ʰ 52ᵐ

Observed by } T. H. PARKER.
Measured by }

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	59·8137	....	....	....	2	43·5225	....	....	....
1	59·4942	....	....	....	½	42·6036	·6166	·0230	23·34
½	58·9788	·9748	·0659	−80·46	2	42·1050	....	....	....
1	58·5962	·5922	·0057	6·93	½	41·7834	·7807	·0352	35·41
2	57·8290	....	....	....	1	40·4726	·4755	·0413	40·96
1	57·7667	·7637	·0631	75·97	2	39·7305	....	....	....
3	56·6748	....	....	....	2	37·9465	....	....	....
1	53·9205	·9215	·0483	55·59	1½	37·6986	·7096	·0451	43·47
3	53·1059	....	....	....	½	37·2113	·2218	·0670	64·25
1	51·6633	·6683	·0892	100·08	2	35·4224	....	....	....
2	48·7623	....	....	....	2	30·8643	....	....	....
1	48·7182	·7272	·0368	39·94	1	30·7867	·7907	·0849	80·64
3	45·2623	....	....	....	1	27·3707	·3691	·0434	−37·67
1	45·1842	·1967	·0420	43·84	2	27·2482	....	....	....
1	44·1888	·2018	·0574	59·29					

Weighted mean		−47·30
V_a	+7·87	
V_d		−·09
Curvature		−·28
Radial velocity		−39·8

δ AQUILÆ 1650.

1908. June 27.
G. M. T. 18ʰ 09ᵐ

Observed by J. S. PLASKETT.
Measured by T. H. PARKER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	59·8350	....	....	....	1	40·5070	·4860	·0400	39·68
2	57·8130	·7880	·0388	−46·71	2	39·7571	....	....	....
2	57·8512	....	....	....	1½	39·6936	·6736	·0532	52·34
1	56·9804	·9559	·0096	11·40	1	38·7283	·7123	·0400	48·70
2	56·6977	....	....	....	3	37·9723	....	....	....
1	55·1051	·0841	·0411	47·92	1	37·2502	·2362	·0526	50·44
2	54·7645	....	....	....	1	36·4397	·4257	·0715	67·28
1½	53·9517	·9337	·0361	41·55	2	35·4463	....	....	....
3	53·1253	....	....	....	2	30·9004	....	....	....
1	51·6990	·6860	·0715	80·22	1½	30·8548	·8248	·0508	45·70
½	49·3733	·3583	·0091	10·21	1	27·3920	·3600	·0526	45·65
2	48·7901	....	....	....	2	27·2785	....	....	....
1	48·7440	·7270	·0370	40·14	½	24·8214	·7912	·0554	46·86
2	45·2955	....	....	....	1	24·1079	·0789	·0543	45·12
2	45·2045	·1835	·0552	57·62	2	24·8754	....	....	....
1	44·2292	·2077	·0515	53·19	2	22·5904	....	....	....
2	43·5514	....	....	....	1	22·5118	·4782	·0786	65·08
2	42·1240	....	....	....	1	18·8332	·7823	·0609	−48·65
1	41·2768	·2558	·0414	41·40	2	18·8943	....	....	....
½	40·7092	·6882	·0610	60·79					

Weighted mean		−48·20
V_a	+7·54	
V_d		−·04
Curvature		−·28
Radial velocity		−41·0

δ AQUILÆ 1660.

1908. June 27.
G. M. T. 18h 09m

Observed by J. S. Plaskett.
Measured by T. H Parker

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	59·8256	....	....	.. ..	2	45 2745	....	... . .	. .. .
1	57·7919	·7829	·0070	− 8.42	1½	45·2107	·2097	0290	39 27
2	57·8327	....	....	....	1	44·2220	·2215	0377	38·94
½	56·9519	·9499	·0206	24.55	1	41·7726	7741	0575	57 84
2	56·6750	....	....	....	2	41 2848	.... ..	... .	....
2	54·7459	....	... .	. . ..	2	41·2964	....	....	......
1	53 9418	9398	·0300	31·53	1	39·0028	·9838	0325	31·75
1	53·7200	7215	·0360	40·39	2	37·9669	....	....	....
1	48·7544	7579	0079	8·57	1	37·2796	·2726	·0162	−15·53
2	48·7663	....	....	....	2	35 4331	....	....	....

Weighted mean...........		−29 35
V_a....	+ 7 66	
V_d	·00	
Curvature........		− ·28
Radial velocity..................		− 21·9

δ AQUILÆ 1678

1908. July 8.
G. M. T. 18h 10m

Observed by J. S. Plaskett.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	59·8005	... .	....	....	2	43·5657	....	....	....
½	58·9967	·0037	·0370	−45·21	2	41·8142	·7845	·0471	47 38
½	58 5482	·5552	·0427	51·88	2	41·3185	....	....	....
1	57·7767	·7837	·0431	51·89	2	37 9962	....	....	....
2	57·8125	....	....	... .	1½	37·7667	·7297	·0250	24·10
1	56·9345	.9415	0240	28·60	1½	37·2799	·2429	·0459	44·01
2	56·6620	....	....	....	2	35·4685	... .	.. . .	... .
1	53·9232	·9322	0376	43 27	2	30·9250	... .	....	....
2	53·1017	....	....	....	1	30·8610	·8064	0692	62·14
2	53·1317	....	....	....	1	27·4311	·3611	0515	44·70
1	51·7239	·7039	·0536	60·13	2	27·3166	....	....	... .
1	48·7590	·7370	0270	29·29	2	24·9101	....	....	....
2	48·7919	....	....	....	1½	24·8730	·8080	·0372	31·50
1	47·4680	4434	0270	28·89	2	22·6292	....	....	....
2	45·3027	.. ..	....	....	1½	22·5788	·5063	·0505	41 81
1½	45·2398	·2138	·0249	25·99	2	18·9394	....	....	.. ..
1	44·2427	·2157	·0435	44·93	½	18·9059	·8099	·0335	−26·76

Weighted mean..........................		−38 83
V_a.....................	+ 2·80	
V_d....		− ·09
Curvature.....................		− ·28
Radial velocity.......		− 36·4

δ AQUILÆ 1690.

1908. July 10.
G. M. T. 18h 37m

Observed by } Measured by } T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	59·8492	....	....	....	½	45·2276	·2066	·0321	33·51
1	57·8233	·7873	·0395	−47·55	2	44·2779	....	....	....
2	57·8653	....	....	....	½	44·2522	·2336	·0256	26·44
½	55·1478	·1183	·0069	8·04	2	43·5578	....	....	....
2	53·9789	·9519	·0179	20·60	1	43·5248	·5053	·0279	29·59
2	54·7702	....	....	....	2	39·7623	....	....	....
1	53·6528	·6260	·0415	47·60	1	38·7677	·7407	·0116	11·29
2	53·1388	....	....	....	1	37·7768	·7483	·0161	−15·52
1	47·4598	·4377	·0327	34·98	2	37·9904	....	....	....
2	45·2945	....	....	....					

Weighted mean		−27·41
V_a	+1·71	
V_d		−·12
Curvature		−·28
Radial velocity		−26·1

δ AQUILÆ 1695.

1908. July 11.
G. M. T. 18h 27m

Observed by J. S. Plaskett.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	59·8527	....	....	....	2	45·3050	....	....	....
1	59·6739	·6354	·0391	−48·13	½	45·2435	·2215	·0172	17·95
½	59·0715	·0335	·0396	48·39	2	44·2905	....	....	....
1	57·8545	·8185	·0083	11·19	½	44·2539	·2224	·0368	37·97
2	57·8587	....	....	....	2	42·1319	....	....	....
½	56·9778	·9428	·0233	27·77	1½	41·8032	·7749	·0567	57·04
2	56·7102	....	....	....	2	39·7632	....	....	....
1	55·1281	·0941	·0311	36·26	1	38·7665	·7405	·0118	11·49
2	54·7768	....	....	....	2	30·9112	....	....	....
1	53·9813	·9473	·0225	25·89	½	30·8476	·8146	·0610	54·74
2	53·1442	....	....	....	1	27·4370	·3990	·0136	11·80
1	52·4120	·3790	·0358	40·48	2	27·2825	....	....	....
1	51·7425	·7085	·0490	54·97	2	18·8835	....	....	....
2	48·8042	....	....	....	1	18·8525	·8124	·0310	−24·8
1½	47·4810	·4485	·0219	23·43					

Weighted mean		−35·50
V_a	+1·26	
V_d		−·12
Curvature		−·28
Radial velocity		−34·6

δ AQUILÆ 1703.

1908. July 13.
G. M. T. 18h 52m

Observed by / Measured by } T. H. PARKER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	59·8090	....	....	....	2	37·9609	....	....	....
½	57·7842	·7832	·0436	−52·49	1	37·2499	·2469	·0419	40·18
½	56·9494	·9484	·0171	20·38	2	30·8901	....	....	....
2	54·7423	....	....	....	1	30·8531	·8331	·0425	38·15
2	45·2766	....	....	....	1	27·4061	·3769	·0357	30·98
½	45·1916	·1896	·0491	51·26	2	27·2758	....	....	....
2	43·5362	....	....	....	2	22·5816	....	....	....
1	43·4567	·4587	·0745	76·36	1	22·5331	·5083	·0485	39·77

Weighted mean .... −43·25
V_a .... + 0·36
V_d .... ·16
Curvature .... ·28

Radial velocity .... −43·3

δ AQUILÆ 1753.

1908. July 31.
G. M. T. 16h 41m

Observed by / Measured by } T. H. PARKER.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	30·8945	....	....	....	2	22·5725	....	....	....
1	30·8828	·8588	·0168	−15·08	1	22·5388	·5231	·0387	32·04
½	27·4102	·3822	·0304	26·38	2	18·8774	....	....	....
2	27·2757	....	....	....	1	18·8637	....	·0137	−10·94

Weighted mean .... 22·81
V_a .... − 7·60
V_d .... − ·09
Curvature .... ·28

dial velocity .... −30·7

δ AQUILÆ 1754.

1908. July 31.
G. M. T. 17h 17m

Observed by W. E. Harper.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7652	......	......	......	2	43·5520	......	......	......
2	53·9794	·9574	·0124	14·27	2	37·9742	......	......	......
2	53·1334	......	......	......	1	37·2646	·2496	·0402	38·55
2	48·7862	......	......	......	2	30·8961	......	......	......
1	47·4588	·4418	·0286	30·60	1	30·8566	·8346	·0420	37·71
1	45·9683	·9533	·0307	32·29	1	27·4200	·3950	·0176	−15·27
2	45·2930	......	......	......	2	27·2709	......	......	......
1	45·2278	·2128	·0259	27·03					

Weighted mean	−26·25
V_a	− 7·61
V_d	·12
Curvature	− ·28
Radial velocity	−34·2

δ AQUILÆ 1754.*

1908. July 31.
G. M. T. 17h 17m

Observed by W. E. Harper.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	54·7189	......	......	......	1	45·1899	·2129	·0258	26·93
1	53·9370	·9575	·0123	−14·15	½	44·2025	·2255	·0337	34·81
2	53·0936	......	......	......	2	43·5112	......	......	......
½	52·3557	·3772	·0376	42·52	2	37·9405	......	......	......
2	48·7477	......	......	......	1	37·2294	·2504	·0384	36·82
½	48·6932	·7212	·0428	46·48	½	27·3766	·3883	·0240	−20·84
½	47·4122	·4352	·0352	37·66	2	27·2349	......	......	......
2	45·2530	......	......	......					

Weighted mean	−36·05
V_a	− 7·61
V_d	·12
Curvature	− ·28
Radial velocity	−44·0

*Check measurement.

δ AQUILÆ 1768.

1908, Aug. 5.
G. M. T. 18h 05m

Observed by J. S. Plaskett.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	59·8186	...	...	...	1	45·9871	·9876	·0036	+ 3·78
1	57·8102	·8077	·0191	−22·99	2	45·2749	...	...	...
2	57·8271	...	...	...	1	45·2148	·2168	·0219	−22·86
2	54·7437	...	...	...	1	44·2346	·2376	·0216	22·31
½	53·9784	·9784	·0086	+ 9·89	2	43·5328	...	...	...
2	53·1097	...	...	...	1	41·7874	·7921	·0392	39 43
½	52·4313	·4303	·0155	+17·53	2	41·2791	...	...	...
2	52·2541	...	...	...	2	30·8758	...	...	...
2	48·7696	...	...	...	½	27·3845	·3779	·0361	−31·33
1	48·7376	·7361	·0279	−30·29	2	27·2532	...	...	...

Weighted mean	−19·51
V_a	9·77
V_d	− ·19
Curvature	− ·28
Radial velocity	−29·7

δ AQUILÆ 1783.

1908. Aug. 15.
G. M. T. 17h 38m

Observed by J. S. Plaskett.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	57·8126	...	...	...	2	45·2802	...	...	...
1	57·8193	·8023	·0245	−29·49	1	45·2457	·2404	·0020	+ 2·08
2	54·7335	...	...	...	½	44·2265	·2205	·0387	−39·97
1	53·9473	·9573	·0125	14·38	2	43·5434	...	...	...
2	53·0995	...	...	...	1	41·3061	·2951	·0021	2·10
½	52·4002	·4072	·0076	8·58	½	40·5358	·5258	·0021	2·08
2	52·2469	...	...	...	2	37·9743	...	...	...
½	51·7060	·7120	·0455	51·05	1	37·2659	·2499	·0389	37·30
1	49·3467	·3487	·0213	23·25	2	30·9025	...	...	...
1	48·7663	...	...	...	1	29·8983	·8643	·0105	9·31
½	48·7345	·7360	·0280	−30·38	½	27·4506	·4116	·0010	− 0·86
1	47·4838	·4828	·0124	+13·26	2	27·2858	...	...	...
½	45·9813	·9773	·0073	− 7·67					

Weighted mean	−14·85
V_a	−13·84
V_d	− ·22
Curvature	− ·28
Radial velocity	−29·2

δ AQUILÆ 1837.

1908. Aug. 27.
G. M. T. 15h 03m

Observed by J. B. Cannon.
Measured by T. H. Parker.

Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.	Wt.	Mean of Settings.	Corrected Star Settings.	Displacement in Revolutions.	Velocity.
2	73·0183	....	....	....	2	45·2880	....	....	....
½	72·8513	·8430	·0218	−31·63	1	45·2372	·2232	·0155	−16·18
2	72·4532	....	....	....	1	44·2395	·2264	·0328	33·91
2	59·8129	....	....	....	2	43·5517	....	....	....
1	57·8288	·8283	·0015	+ 1·80	1	41·8079	·7949	·0367	−36·92
2	54·7500	....	....	....	1	37·9771	....	....	....
1	53·9747	·9667	·0031	− 3·56	1	37·3070	·2925	·0037	+ 3·54
2	53·1197	....	....	....	2	30·9079	....	....	....
½	51·7273	·7173	·0402	−45·10	½	30·8756	·8386	·0370	−33·22
2	48·7819	....	....	....	1	30·4141	·3751	·0375	−32·55
1	47·4976	·4846	·0142	+15·19	2	30·2857	....	....	....
½	46·0043	·9915	·0041	+ 1·31					

Weighted mean	−20·95
V_a	−18·18
V_d	·09
Curvature	−·28
Radial velocity	−39·5

APPENDIX 3.

REPORT OF THE CHIEF ASTRONOMER, 1909.

MERIDIAN WORK AND TIME SERVICE

BY

R. M. STEWART, M.A.

CONTENTS.

ILLUSTRATIONS.

APPENDIX 3.

REPORT OF R. M. STEWART, M.A., ON MERIDIAN WORK AND TIME SERVICE.

OTTAWA, March 31, 1909.

W. F. KING, Esq., LL.D., C.M.G.,
Chief Astronomer,
Department of the Interior,
Ottawa.

SIR,—I have the honour to report as follows on the work carried out under my charge during the past fiscal year.

A great part of the year has been taken up with work in connection with the fitting up of the Transit Annex, including the reconstruction of the piers, and with tests and alterations of the Meridian Circle. As will be seen below, the latter has proved to be defective in many respects, necessitating a great deal of work in the alterations required before it can be made to perform creditably; among the most important and laborious of the operations were the renewing of the pivots and the truing up of the planes of the circles; further alterations still remain to be made. The usual amount of observation and computation has been done for determination of clock error, more particularly in connection with the operations carried on in the field for determination of longitudes. The question of personal equation was considered, and a special series of observations made in an attempt to discover the laws which it followed. The differences of personal equation found were in some cases comparatively large; the personal equations of at least two of the observers appeared to be due to a tendency always to set the movable wire asymmetrically with respect to a star image when estimating a bisection; in the case of one observer this error of bisection amounted to over a second of arc. The time service has been maintained as in the past, and has been extended to include the Mint and the Archives Building. An analysis was made of the rate of the Standard Sidereal Clock; an account of this is given in Appendix A below.

THE TRANSIT ANNEX.

The Transit Annex, which is located at the western end of the main building, consists of two rooms, the Transit Room and the Meridian Circle Room. The former is connected to the main building by two doors, one opening into the Chronograph Room, and through it into the Time Room, the other communicating with the main hall-way. In it are situated two piers for the portable astronomical transits belonging to the Observatory, the western one of which is also provided with two collimator piers. The inside dimensions of this room are 21 ft. 4 in. in the meridian by 21 ft. 9 in. in the prime vertical. The Meridian Circle Room, situated to the west of the former, communicates with it by two doors. It is 34 ft. 3 in. by 15 ft. 6 in., and contains the piers for the Meridian Circle and its two collimators; the instrument is situated somewhat to the south of the centre of the room.

The walls of the building are of stone, containing a number of louvred windows to allow circulation of air between the outside walls and the inner lining. The latter is of galvanized iron, and covers the whole of the outer walls except the observing slits. The roof is a flat concrete one; between it and the galvanized iron ceiling is an air-space of about two feet, through which the outer air circulates freely by means of a number of small louvred openings. Ventilation of the room itself, when the observing slits are closed, can be controlled by a number of shafts which pierce the walls, terminating just above the floor in registers which may be opened or closed as desired. The observing slits, which extend downward to within three feet of the floor, are three feet in width; they are closed by vertical doors in the walls, and by shutters on the roof. The opening mechanism for these, which was installed during the past winter, is described below.

As mentioned in my last report, the Meridian Circle piers had suffered upheaval during the winter of 1907-8, shortly after the instrument had been mounted. During the period between the early part of January and the end of March the level error changed from about ten seconds to nearly six minutes of arc. During the next two weeks it rapidly decreased to about two and a half minutes, and thereafter continued decreasing with a gradually diminishing rate; by the middle of May it had reached a value of about one minute. As the graduated circles had been returned to the makers for repairs there was no convenient means of measuring the change of nadir point, *i.e.*, the angular displacement of the piers in the meridian; it also, however, was no doubt considerable. The collimator piers were also displaced by a number of minutes. The two field-transit piers and the two collimator piers in the Transit Room fared even worse, having all been broken across in the basement a few feet above the floor.

The trouble was evidently due to the action of frost; if further confirmation were needed, it was supplied by an examination of the earth beneath the basement of the Transit Room, which was found to have been saturated with water and frozen. A drain had been provided to carry away surplus water, but the system of drainage was not sufficiently thorough. It was also evident that the foundations of the piers were not sufficiently protected. It was decided that the only satisfactory remedy lay in the reconstruction of all the piers, sinking their bases several feet deeper into the earth, and providing a system of drainage as thorough as could be installed. The matter was taken up by the Department of Public Works, and the demolition of the old piers—an undertaking of considerable magnitude in itself—was begun in May.

It had been previously decided that the azimuth marks for the Meridian Circle should depend on the same principle as those designed by Sir David Gill for the Cape Observatory, the primary marks consisting of lenses fixed some distance underground to ensure stability, while above would be movable marks capable of being adjusted accurately over the optical centres of the underground lenses. A similar arrangement would be required in the case of the collimator piers, to ensure the stability of the long-focus collimating lenses which form a part of the azimuth-mark system. As the original collimator piers had not been designed with this end in view, the necessity of reconstruction afforded an opportunity of so altering the design as to facilitate the introduction of this principle. It was necessary also in this connection to consider the disposition of the collimators. If these were placed in a horizontal line it was found that it would be impossible to obtain a line of sight under them upon azimuth marks at a sufficient distance; nor was it considered advisable to raise the azimuth marks to the horizontal line and, by rendering them intervisible, use them as collimators, on account of the height to which it would then be necessary to build the azimuth piers. It was decided finally to do away with the south collimator, using the azimuth mark in its place, and placing a mounting for the other collimator on the north pier, above the collimating lens of the north azimuth mark. This was also advantageous in another respect, since the southern pier, being required only for the long-focus collimating lens, need not extend so far towards the Meridian Circle, thus increasing the range of reflection observations towards the south; the north collimator would not interfere with those towards the north, on account of its greater distance from the telescope. It is possible, however, that the north collimator may also finally be dispensed with;

if, as seems likely, the azimuth marks should prove sensibly stable for considerable periods, it will be possible to control the collimation by readings on them, in conjunction with occasional reversals of the Meridian Circle. Determinations of flexure might also be made by means of the azimuth marks, by an interchange of eye and object ends of the telescope. Should this arrangement prove possible it will be of advantage; the lenses of the collimators being of only 4½ inches aperture, the full aperture of the Meridian Circle is not made use of in readings upon them, and it is perhaps doubtful whether the line of collimation so obtained will coincide exactly with that depending on full aperture.

The footings of the reconstructed piers extend 16½ feet below the level of the floor. Beneath the transit room is a basement with a concrete floor, which lies 10 feet below the upper floor, so that the transit piers extend 6½ feet underground; the Meridian Circle and collimator piers, on the other hand, are surrounded with earth to a height of about 10 feet. All the piers are surrounded at the base by drains of broken stone. It was my wish to have these drains continued to within a few inches of the surface, so that there could be no doubt as to the thorough drainage of the piers throughout their whole height; the Public Works Department, however, decided that drainage around the bases would be sufficient, and it was so done.* On account of the depth to which the piers were sunk, it was impossible to lead these drains to the sewage system; accordingly a special concrete cistern of about 1,000 gallons capacity was built below the level of the piers and the drains were led into this; a pipe leading from the cistern to a motor pump serves to empty it as often as necessary. A float connected to a light rod has been so arranged that the top of the rod may be flush with the basement floor when the cistern is empty; the length of rod projecting through the floor gives a measure of the depth of water in the cistern. The amount of water which collects in the cistern at certain seasons is remarkable; on several occasions this spring, immediately after or during a prolonged heavy rain, it has been filled overnight; this circumstance, coupled with the fact that during periods of dry weather comparatively little water is collected, points to surface water as the source of the accumulation. It would appear that the surface drainage flows down beside the outside walls of the building and so under the foundations, often in considerable quantities; this being the case, there would appear to be serious danger not only of finally blocking up the broken stone drains by accumulated silt, but also of undermining the foundations of the Transit House. This danger could probably be avoided by building a suitable drain to surround the three exposed walls of the building.

The parts of the two collimator piers below the floor are similar. The footings are nine feet by six, the longer side being in the east-west direction. The western part of each pier is penetrated by a vertical pit three feet square, to allow access to the underground lens which will serve as the fixed mark; this part of the pier terminates some six feet below the level of the floor of the Meridian Circle Room, and the opening is covered by two hatchways, between which is packed mineral wool. The main part of the pier tapers upwards to the floor, where it measures three and a half feet in the meridian by two and a half in the prime vertical. Through the centre of this is a vertical shaft about six inches in diameter, extending down to the level of the pit previously mentioned, into which it opens by a small arch. At the bottom of the arch the underground lens will be fastened firmly to the concrete, with space underneath for a basin of mercury. Access is had to these when necessary by the pit at the side, while the necessary readings are taken from above through the small shaft.

Above the floor the piers are dissimilar. The northern one, which is intended to support both collimator and long-focus azimuth lens, is built with an overhang to the north, so as to allow as much space as possible to the south for observation of stars by reflection; the dimensions of the top are 5 ft. 4½ in. by 2 ft. 4 in. The southern pier,

* This has since proved to be inadequate.

which will ultimately be required only for the long-focus lens, tapers from the floor to a size of 20 inches by 28 inches at the top. It will also be necessary, however, to fasten a temporary frame-work to the southern pier to support a collimator until the azimuth mark piers shall have been built.

The foundations of the main telescope piers are intended also to carry a pier which rises to the level of the floor, to support the carriage upon which rests the mercury horizon for observation of stars by reflection. In the original pier this had not been included, but it was found that the cement floor was not sufficiently free from vibration to serve the purpose. This part of the pier is, at the floor level, 10 ft. 6 in. in length by 1 ft. 10½ in. in width, extending 3 feet south of the axis of the Meridian Circle, and 7 ft. 6 in. to the north. The foundation is in the form of a cross, with an extreme length of 13 feet, and width of 10 ft. 6 in., tapering upwards to within a foot of the floor, where the size is 10 ft. 6 in. by 8 ft. The two columns supporting the bed-plates of the instrument are 2 ft. 3 in. square at the floor, tapering to 1 ft. 4 in. at the top, which rises to a height of 6 ft. 2 in. from the floor. The inner faces of the piers, which are vertical, are at a distance of 3 ft. 6 in.

In the Transit Room, the two transit piers and the two collimator piers, the latter forming part of the system of the western transit equipment, extend to the same depth as the Meridian Circle piers; as stated above, however, owing to the basement which underlies this part of the building, they are surrounded with earth to a height of only 6½ feet; the concrete cistern above referred to lies immediately to the south of the eastern transit pier. A floor plan of the Meridian Circle Room and Transit Room, showing the positions of the various piers is given in Fig. 1; sections of the piers are shown in Fig. 2 and Fig. 3.

All the piers are protected above the level of the floor by a layer of thick felt; surrounding this, with the interposition of an air-space, is a casing of wood. These casings, as well as the piers themselves, are of course free from the floor; the space between piers and floor, instead of being vacant, is filled with felt. To promote cleanliness, as well as for increased comfort during the winter months, the original concrete floor has been covered by a wooden one.

To exclude snow from the spaces between the inner and outer walls and above the ceiling it was necessary to have winter coverings for the louvred openings. These were made in the fall of 1908 and have worked satisfactorily during the past winter. They consist of frames to fit on the outside of the openings, covered with copper wire gauze of a fairly fine mesh; for protection against accidents this is covered by a somewhat heavy galvanized iron mesh. It has been found that these, while affording a reasonable circulation of air, exclude the greater part of the snow; if a little snow drifts through, it is caught by the louvres and prevented from penetrating to the space inside the walls. To ensure a freer circulation of air during the summer, the frames are removed in the spring.

The roof shutters for covering the observing slit are divided into three sections in the case of the Meridian Circle, and into two in the case of each of the transit slits. An opening mechanism had previously been applied to the central section in the Meridian Circle Room; that for the other six sections was installed during the past winter. The mechanism works on the same principle as that at Greenwich; each section of the shutter is supported by the outer ends of two curved arms which are fastened by keyways on a shaft hung in bearings parallel to the slit; the other ends of these arms carry counterpoises approximately equal in weight to the shutter. Keyed on the shaft is another arm extending horizontally nearly to the wall, and connected by another nearly vertical jointed arm to a winch on the wall, which serves to open or close the shutters by turning a handle. The joint between every two sections is covered by an independent flap, which is raised by either shutter indifferently; the flap is prevented from falling back when open by a flat curved spring which presses against it near the hinge, and starts it down with the shutter when the latter is being closed.

The vertical wooden wall-shutters, six in number, have been made in two sections, closing respectively the lower and upper halves of the observing slits in the walls. Both sections open outwards; either the upper section alone, or both, may be opened: the lower section, however, can not be opened alone; in general only the upper section need be open, except for reading on azimuth marks. The upper section is controlled by a rod bent at right angles near its upper extremity, and fastened by a flexible joint nearly in the centre of the shutter; when closed the horizontal part of the rod passes over a hook on the shutter and the vertical part springs into place between two hooks on the casement, holding the shutter firmly closed; when open it is held in a similar manner.

The difference of longitude between the middle of the observing slit in the Meridian Circle Room and the pier in the old transit hut was measured January 20, 1909. A theodolite was set up to the south of the old hut and set on the transit wires; the azimuth of a point on the wall of the transit annex was measured from this point and the distance chained. The resulting longitudes of the Meridian Circle and of the centres of the two transit piers, referred to the old pier, are as follows:—

Meridian Circle,	214·9 ft.	·201 sec.
Western transit pier,	199·9 ft.	·187 "
Eastern transit pier,	188·65 ft.	·176 "

The approximate latitude of the Meridian Circle, as obtained from a few pairs of stars observed in August, 1908, is 45° 23′ 37″·6; this may be in error by several tenths of a second.

The positions of the azimuth marks for the Meridian Circle were laid down in the early part of last summer. The line of sight to the north mark passes through the pinery immediately to the north of the Observatory; the pier will be situated just beyond the top of a ridge running in the east-west direction, and within about 30 feet of the road which forms the southern boundary of the city; its distance from the collimating lens will be about 250 feet. It was originally intended to have the south azimuth mark, if possible, at a distance of about 300 feet, situated on the other side of the driveway which runs in a northwest-southeast direction past the western end of the Observatory. As this ground belonged to the Department of Agriculture it was necessary to have its consent to the erection of the mark, and this unfortunately proved impossible. It was therefore necessary to locate the mark on the grounds of the Observatory; as the line of sight of the Meridian Circle crosses the above-mentioned driveway at an angle, the greatest distance obtainable was about 160 feet.

The piers and the buildings to protect them have been planned, but no provision has as yet been made for their erection.

THE MERIDIAN CIRCLE.

No observations were made with the Meridian Circle during the period covered by this report. The year has been occupied with the many alterations which were found necessary before the instrument could be got into condition to do creditable work. There is scarcely an essential part of the instrument which has not required alteration in at least some detail. Much of this work has been done; much still remains to do. It is hoped, however, if the repairs which still remain can be completed in the workshop in time, to be able to begin regular work in both right ascension and declination about the beginning of 1910.

The graduated circles, which had been returned to the makers for repair of damages sustained in shipping, were received in June. They were immediately mounted and their planeness tested by the same method as used previously, as described in my last report. It was found that the extreme deviation of the fixed circle from a true plane at right angles to the axis was now about ·001 inch; that of the movable circle was, however, ·006 inch, a quantity large enough to throw the microscopes very slightly out of focus at the extreme points. It was also discovered that on reversing the instrument the microscopes were no longer in focus; in fact, the circles were unsymmetrically fixed on the axis by about one twenty-fifth of an inch; it developed later that this was at least partly due to the fact that in truing up the fixed circle, not only had the band carrying the graduations been turned down but also a cut had been taken off the bearing on the other side of the circle, without any compensating alteration on the movable circle.

To rectify the latter point, it would appear to be immaterial whether the circle were set farther out on the axis, or the end of the pivot shortened, or, what amounts to the same thing, the other pivot lengthened; the desideratum being that the distance from plane of graduations to end of pivot should be the same for both ends. Accordingly, as being the easiest undertaking, a bushing of hardened steel was made to fit into the hollow of the pivot corresponding to the movable circle, carrying a disc of the required thickness which fitted against the end of the pivot. This worked fairly satisfactorily, but as will be seen below, another alternative was adopted later.

With regard to the other error of the circles, which we may for brevity designate the deviation from mean plane, it may be composed of two parts—(1) a divergence of the average plane of the graduations from true perpendicularity to the axis; (2) a deviation of the graduated band itself from the true plane form; the former may be remedied by alteration of the bearing surfaces between circles and axis, the latter only by re-graduation. If p be the perpendicular distance of the object glass of any microscope from the graduated band, and d the distance of the graduation set upon from the centre of the field, then the measured angle will be

$$\theta = \frac{d}{p}\cdot$$

Differentiating with respect to θ and p

$$\delta\,\theta = -\frac{d}{p^2}\,\delta\,p = -\,\theta\,\frac{\delta\,p}{p}\cdot$$

Hence the error in the angle measured by one microscope is proportional to that angle and to $\delta\,p$, which is the deviation from mean plane of the circle at that point. The maximum effective value of θ, provided settings of the telescope are made without regard to the position of the division marks in the field of the microscopes, and provided also that only one division mark is set on for each setting of the telescope, will be the same as the interval between successive graduations, in this case 5′; also the value of p is 2·7 inches. Thus if p be ·001 inch, the maximum error arising from this source of an angle measured by one microscope will be ·11″. Further, this will be practically a constant error for any particular star, except as influenced by reversal of the instrument and more particularly by alterations of the position of the circle on the axis. If, however, as is practically always the case, angles be measured by a pair of opposite microscopes, the part of this error due to lack of perpendicularity of graduated band and axis will be eliminated, p being of opposite sign for the two microscopes. That part, however, which depends on deviations of the graduations from a true plane, will still remain; if the deviations are due to a simple bend of the circle along a diameter the effect will be reduced, though not eliminated, by reading four microscopes. It may be noted here that the error $\delta\theta$ varies inversely as p; hence the advantage of long focus microscopes; those on this instrument are probably too short.

All errors arising from deviation from mean plane may be eliminated by setting exactly on division marks, throwing the brunt of the measurement on the declination micrometer. In this case it is sufficient if the circles are nearly enough true that the graduations may be always in focus. This must, however, be qualified by the recollection that focal lengths, &c., vary with temperature; hence it is desirable even in this case that the circles should be as true as possible, in order that the necessity of refocussing may be reduced to a minimum.

Having regard to these facts, it was decided in the first place to attack the adjustment of the movable circle, as being the one most requiring it; it was also decided that the only feasible method lay in scraping the bearings between circle and axis, in conjunction with tests by a surface-plate. In order to save time, since the reconstruction of the piers in the meridian circle room was being proceeded with, it was decided to erect temporary piers outside for the necessary tests, and to shelter them by a wooden hut. In the meantime a special surface plate in the form of a ring was constructed, in order to make the necessary tests for flatness of the bearing on the axis against which the circle was clamped.

As before, the lower southern microscope on the western pier was replaced by a steel rod sliding in bearings, one end of which could be brought into contact with the graduations when desired. A mark on this was set on with the microscope, which had been mounted with its axis perpendicular to the rod. Readings were taken at every 30° around the circle; the latter was then shifted 90° on the axis and the process repeated; the same was done for positions of the circle 180° and 270° from its initial position.

Assume in the first instance that the graduations all lie in one plane; also that the bearing surface on the circle and that against which it engages on the axis are true planes. Let the angle between the axis of the telescope and the normal to the surface of the bearing on the axis be a'', and let the plane containing these two lines intersect the position of the lower southern microscope when the pointer reading on the fixed circle is φ. Also let the normals to the plane of the graduations and the plane of the circle bearing (on the movable circle) include an angle b'', and, for the initial position of the movable circle, let χ be the pointer reading on the fixed circle when the plane containing these two normals cuts the lower southern microscope. Then, for the position of the telescope corresponding to a pointer reading θ on the fixed circle, the displacement from its mean position of the graduated band (on the movable circle), as measured by the microscope, will be

$$a \cos(\theta - \varphi) + b \cos(\theta - \chi).$$

Taking a series of readings at intervals of 30° around the circle, and diminishing each by the mean of all, we shall have twelve equations of the form,

$$a \cos(\theta - \varphi) + b \cos(\theta - \chi) = m,$$

θ having the values 0°, 30°, 60°, &c. For the second position of the circle we have twelve equations of the form

$$a \cos(\theta - \varphi) + b \cos\left(\theta + \frac{\pi}{2} - \chi\right) = m',$$

and similarly for the two remaining positions. From these 48 equations we may determine a, b, φ and χ with considerable accuracy, thus obtaining a complete knowledge of the magnitude and location of the errors considered. Further, by substituting the values so found in the observation equations, we may from an examination of the residuals determine by how much the circle departs from the plane form.

The first test with the new surface plate showed a high spot at one point on the axis bearing; when this had been scraped off the deviation of the circle was considerably lessened. The first set of measurements after this had been done gave a value of 9″ for a and about 4″ for b; in one position of the circle on the axis this corresponds to a variation of over ·002 inch, exclusive of irregularities. It was found also that the circle was distorted by the pressure of the screw collar which holds it against the axis, so that when the collar was forced home the irregularities reached a value of 7″ on each side of the mean, as against about 4″ when it was only moderately tight; this was found to be due to the fact that the circle bearing was not a plane; the same was true of the face of the screw collar and the face on the circle against which it bore.

For these latter, since the only requirement was that they should be plane, one scraping, in conjunction with tests by a surface plate, was sufficient; in the case of the bearings between circle and axis, however, on account of the difficulty of knowing just how much was taken off at a time, it was necessary to proceed by trial, taking care that both surfaces should always be plane when measurements were taken. In this way, after some half dozen trials, the values of a and b were each reduced to about 1″.

Some preliminary measurements had previous to this been made for determination of pivot error; it had been assumed without testing that the pivots were hardened; it was accidentally discovered, however, about the end of August, while the adjustment of the circles was still going on, that this was not the case. Such a serious defect as this had not been anticipated, though considering the many other imperfections of the instrument it should perhaps not have proved surprising.

After consideration, it was decided to turn the pivots down to a smaller size, and to force over them hardened steel bushings of the original diameter (4 inches). We were much handicapped by lack of previous experience in such operations, and by the lack of machines large enough to accommodate the axis, but after several failures have finally succeeded in obtaining pivots which give every promise of being satisfactory.

As the lathe at the Observatory was not large enough for the purpose, the axis was taken to a machine shop in the city, and the original pivots turned down to a diameter of about 3½ inches; they were then carefully ground with a very slight taper, to facilitate the forcing on of the bushings. Here again difficulty was encountered, as nowhere in the city was there a grinder capable of accommodating the instrument; inquiries in Montreal and Toronto were equally unavailing. The grinding was finally done in a lathe, by fastening a small portable motor-driven cutter-grinder in the tool-post of the lathe. The first bushings were made from forgings obtained from a local firm; after turning, boring and hardening these, they were ground inside to the required taper, and outside to very nearly the finished size, and then forced over the ground surfaces on the axis. They were then reground, and finished by using flour emery in a circular lap of gun-metal. Not until this final process was reached was it discovered that the metal was permeated by minute flaws which made the attainment of a perfect surface impossible.

At this stage Messrs. Warner and Swasey, the well known instrument makers of Cleveland, were communicated with; in their reply they very kindly gave a complete description of the processes they employed in finishing pivots. The details of the process were practically the same as had been followed here, with the exception that they advised making the bushings not from forgings, but from blocks cut out of bar steel, to insure as far as possible homogeneity and freedom from strains and flaws. Accordingly a bar of steel was obtained and new bushings made from it; on this occasion the use of the workshop at the Royal Mint, where large lathes were available, was very kindly offered by Mr. Cleave, and was thankfully accepted. Trouble was again experienced with the lapping, it being found impossible to get a satisfactory surface. The Observatory mechanician, Mr. Mackey, who has had long practical experience in all kinds of machine work, finally gave it as his opinion that the difficulty arose from the small inequalities left in the surface by the portable grinder employed, the machine not having sufficient rigidity to ensure an even surface; as a matter of fact this proved in the end to be the case.

One of the machines at the Mint is a large grinder, sufficiently long to carry the meridian circle axis, but capable of swinging only fourteen inches, while the largest diameter of the axis is eighteen inches. This machine Mr. Cleave very readily permitted to be altered by raising the centres to a sufficient height; in fact the work in connection with the alteration was all performed at the Mint, and nearly all by his own workmen. When this had been done, the pivots were re-ground in it, and no further trouble was experienced in the lapping. At the same time, the tapered bearings on which the circles fit, were trued up, as a slight eccentricity with respect to the new pivots had been introduced; this made it necessary also to turn a corresponding amount off the faces against which the circles are clamped. During the process a small cut was also taken off the end of one pivot, to eliminate the asymmetry mentioned above in the positions of the circles.

In this connection I wish to express my appreciation of the very great kindness of Mr. Cleave in practically placing his whole workshop at our disposal. Had it not been for his generous offer the work could hardly have been done in Canada.

As stated above, a great deal of work still remains to be done on the instrument. The two bearings on the axis, against which the circles are clamped, will doubtless require to be scraped, as will also the bearing on the fixed circle; this alone will require considerable time. The counterpoises are very unsatisfactory; a weight of about 350 pounds is at present counterpoised through a lever system by 10 pounds; with such a multiplication factor, especially with the arrangement used, the friction is so great as to prohibit effective control of the weight resting on the pivots: new counterpoises will require to be made. The right ascension micrometer, or rather the eye-piece slide driven by it, does not work freely, and will require overhauling. Several of the micrometer slides in the circle microscopes do not work freely; the springs in these are also unsatisfactory. The double spider lines in right ascension and declination micrometers and circle microscopes are at unsuitable and varying distances, and will require to be renewed. Besides these, there are many other details which require attention. The necessary alterations can best be made at the Observatory, where personal supervision will be possible; as, however, the machine shop is always overcrowded with work, it may take considerable time.

The observing couch, which was ordered some time ago, has been received. It is of somewhat different design from the ordinary form, and is intended to afford facility for quick setting in any desired position, together with the possibility of easy adjustment after the observer has taken his place upon it. Four wheels, running upon the same tracks as the reversing carriage, carry a wooden frame-work which in its turn supports a central transverse axis. On the latter is pivoted a light steel frame, which is also supported near one end by two screws connected with the wooden frame-work; by rotating these the frame may be tilted through a small angle in either direction. On the same axis are mounted two movable leaves; each of these is supported near its outer end by two rack sectors which engage pawls fastened to the steel frame; the pawls engage in the racks by their own weight, but may be released by a conveniently placed handle. The slow-motion screws are connected by means of a sprocket chain and bevel gears with two hand-wheels mounted one at each end of the transverse axis. The leaves of the couch can thus be quickly set in the approximate position required by means of the sectors, and after the observer has taken his place upon the couch he can tilt the whole upper frame into the proper position by means of the hand-wheels, which are always within easy reach. This slow motion has been found in practice to be a great convenience.

TRANSIT OBSERVATIONS.

Observations with the portable Cooke transit were conducted during the greater part of the year, as heretofore, in the temporary transit shed at the eastern end of the Observatory. About the end of January, however, the instrument was moved to the new Transit Room and set up on the western pier, where it has since remained. The difference in longitude between the new pier and the old is 199·9 feet, or ·187 sec.

Observations were made on 142 nights, involving 281 determinations of clock error, as well as some observations for other purposes; on a number of nights two, and sometimes three, observers worked simultaneously, for determination of personal equation. The observations throughout the summer were principally for the purpose of longitude determinations at different points. As clock exchanges were frequently required with two different stations on the same night, sometimes at intervals of an hour or two, it would have been troublesome to arrange the observing so that it would not conflict with the exchanges. For this reason the two features were kept independent throughout the season, a separate chronograph being used for the exchanges; the latter were held at the hours most convenient to the field observers, irrespective of observations or weather conditions at Ottawa; whenever possible two determinations of clock error were made on every night, preferably, but not necessarily, about the time at which the exchanges were held; for nights on which no observations were obtained the clock error was interpolated from the two adjacent nights. This arrangement, which is of course permissible only with a clock of demonstrated reliability, has proved quite sufficiently accurate for all ordinary purposes; in the case of very important stations the interpolation from night to night might perhaps not be advisable; the independence of observations and exchanges is of advantage, especially on nights broken by clouds, in that it frees the observer from the interruptions and delay inseparable from an exchange. The number of exchanges was 156, occupying 116 nights; the observing was divided among Mr. Nugent, Mr. Smith and myself, the greater part being done by the two former. A first computation of the observations was made by Mr. Tobey; they were then recomputed by the observers, and a final check including occasional recomputations was made.

The accuracy of determinations of level error during the summer was not up to standard. Early in the season the tip was broken off the level vial belonging to the transit; as no other good vial was available, and as several months were required before delivery of a new one, it was necessary to seal up the old one and continue using it. Though the mean value of a division was practically unaltered, it was found that the bubble had become rather sluggish and uncertain in its action, and considerable trouble was experienced with measurements of level error during the whole summer. The apparent probable error of a complete determination of level (comprising usually six independent measurements) was ·011 sec.; that for 1907 was ·006 sec., and for the spring of 1909, after renewal of the vial, ·005 sec. This difference has probably quite an appreciable effect on the accuracy of the work.

The fluctuations in azimuth throughout the summer were reasonably small; adjustments in level were, however, frequently necessary; another peculiarity of the level error was its tendency to progressive change during the evening's work, the western end of the instrument usually rising as the evening progressed; usually a compensating change took place in the opposite direction during the day, though the general tendency of movement throughout the summer was in the former direction. The average rate of elevation of the western pivot was ·017 sec. (of time) per hour; the rate varied between − ·016 sec. and 073 sec. per hour, being negative on 16 nights out of 89. There was no apparent connection between change of level and change of temperature during the hours of observation.

The method of observation was that described in my last report; a set consisted of seven or eight southern stars well up towards the zenith, combined with three or four north stars between 70° and 80° declination; the telescope was reversed during the observation of each star; as a rule only one group of observations on each star was taken in each position of the instrument. The star-list used contained all the stars in Newcomb's Fundamental Catalogue between 10° and 40° and between 70° and 80° declination; the places of the Berliner Jahrbuch were used for all stars contained therein; for the other stars the places were taken from the Nautical Almanac, the Connaissance des Temps and the American Ephemeris without the application of any systematic correction; as the number of such stars was not very large, and as substantially the same list was used for the field observations, any resulting errors in the longitudes deduced would be small.

In the same way as described in my last report, the average discordance between two sets observed on the same night (after allowing for clock-rate) was used as a measure of accuracy; from this quantity the probable error of a single set may be deduced as follows:—The chance of an error x occurring in the first set on any particular night is

$$\frac{h}{\sqrt{\pi}} \cdot e^{-h^2 x^2} \cdot \delta x,$$

where h is the measure of accuracy, and δx is the smallest quantity measured. Similarly the chance of an error $x + z$ occurring in the second set is

$$\frac{h}{\sqrt{\pi}} \cdot e^{-h^2 (x+z)^2} \cdot \delta x.$$

The chance of both errors occurring on the same night is the product of these quantities; if we take into account the case where an error $x + z$ occurs in the first set and an error x in the second the chance is doubled. Hence the number of pairs of errors x and $x + z$ occurring in N nights is

$$2N\frac{h^2}{\pi} \cdot e^{-h^2(2x^2+2xz+z^2)} \cdot \delta x \cdot \delta x.$$

Hence the number of discordances z (irrespective of sign) occurring in N nights is

$$2N\frac{h^2}{\pi} e^{-\frac{h^2 z^2}{2}} \cdot \delta x \int_{-\infty}^{+\infty} e^{-h^2(\sqrt{2}\cdot x + \frac{1}{\sqrt{2}}\cdot z)^2} \cdot \delta x$$

$$\text{or } Nh\sqrt{\frac{2}{\pi}} \cdot e^{-\frac{h^2z^2}{2}} \cdot \delta x.$$

Hence the sum of all discordances is

$$Nh\sqrt{\frac{2}{\pi}}\int_0^{\infty} e^{-\frac{h^2z^2}{2}} \cdot z\, d\, z = \frac{N}{h}\sqrt{\frac{2}{\pi}},$$

and if the average discordance be denoted by Δ we have

$$\Delta = \frac{1}{h}\sqrt{\frac{2}{\pi}}.$$

But the probable error $r = \frac{\cdot 4769}{h}$; hence $r = \cdot 5978\ \Delta$.

In the third column of Table I. are given the clock corrections obtained from each set throughout the summer; the fifth column gives the discordance (after allowing for clock rate) in every case where two sets were taken by the same observer on a single night; the average of all the discordances is ·033 sec., being practically the same for all three observers; the probable error deduced from this is ·0197 sec. The value of Δ deduced in my last report for the old method of observation was ·039 sec., corresponding to a probable error of ·0233 sec.; as the weight, or efficiency, is inversely proportional to the square of the probable error, the increase of efficiency indicated is 40 per cent; and presumably this has arisen from the alterations in methods of observation and grouping of stars.

As stated above, however, the probable error of the measurement of level was ·011 sec. in 1908 as against ·006 sec. in 1907 and previous years. If we assume that this effect enters for its full value in the observations of 1908, we should, for a proper comparison, reduce the probable error of a set for the latter year accordingly; that is, we would have a probable error of ·0174 sec. for 1908, as against ·0233 sec. for previous years, an increase in efficiency of about 80 per cent.

TABLE I.—TRANSIT OBSERVATIONS IN 1908.

Date.	Time.	△ T	Observer*	Discordance.	△ T_o
	h m	s			s
May 14	14 50 17 10	2·434 2·478	N N	·033	2·355 2·399
" 15	12 50 14 40	2·466 2·488	C S C S	·013	2·466 2·488
" 18	13 10 14 55	2·761 2·793	C S C S	·024	2·761 2·793
" 20	14 45 16 30	2·960 3·026	C S C S	·058	2·960 3·026
" 22	13 25 16 25	3·270 3·287	S C S		3·304 3·287
" 27	12 50 14 40	3·843 3·878	C S C S	·026	3·843 3·878
June 1	13 20	4·960	C S		4·960
" 2	13 30 16 05	5·110 5·102	N N	·014	5·031 5·023
" 3	14 30 16 40	5·017 5·055	C S C S	·033	5·017 5·055
" 4	14 15 15 45	5·250 5·270	N N	·017	5·171 5·191
" 5	13 40 15 55	5·231 5·278	C S C S	·042	5·231 5·278
" 6	14 25	5·336	N		5·257
" 8	13 45	5·323	C S		5·323
" 9	17 05 19 00	5·553 5·519	N N	·037	5·474 5·440
" 10	13 55 15 30	5·478 5·480	S S	·001	5·512 5·514
" 11	13 50 15 45	5·639 5·639	N N	·003	5·560 5·560
" 12	13 55 15 20	5·559 5·549	S S	·012	5·593 5·583
" 17	14 25 15 40	5·722 5·773	S S	·049	5·756 5·807
" 18	15 05	5·856	N		5·777
" 20	16 00 17 55	5·913 5·995	N N	·079	5·834 5·916
" 21	14 40 16 30	6·149 6·128	N N	·026	6·070 6·049
" 22	14 45 16 05	6·120 6·151	C S C S	·028	6·120 6·151
" 24	14 25 16 00	6·302 6·228	C S C S	·077	6·302 6·228
" 25	14 35 16 20	6·418 6·416	N N	·006	6·339 6·337

TABLE I.—TRANSIT OBSERVATIONS IN 1908—*Continued.*

Date.	Time. h.	m.	T s	Observer.*	Discordance.	T s
June 26	15	40	6·408	C S	·019	6·408
	17	00	6·430	C S		6·430
" 27	17	20	6·632	N		6·553
" 28	15	00	6·649	S	·045	6·683
	16	15	6·607	S		6·641
" 29	14	55	6·740	C S		6·740
" 30	15	05	6·910	N	·009	6·831
	17	00	6·906	N		6·827
July 1	16	00	6·869	C S	·019	6·869
	17	50	6·855	C S		6·855
" 3	15	15	6·963	C S	·024	6·963
	16	35	6·990	C S		6·990
	18	50	6·944	S	·014	6·978
	20	00	6·961	S		6·995
" 5	15	05	7·066	S		7·100
" 6	17	50	7·110	C S		7.110
" 8	15	30	7·261	C S	·036	7·261
	17	10	7·229	C S		7·229
" 9	15	05	7·371	N	·025	7·292
	17	00	7·401	N		7·322
10	15	10	7·388	C S	·062	7·388
	16	40	7·330	C S		7·330
" 11	17	25	7·489	N	·051	7·410
	18	35	7·441	N		7·362
" 12	15	40	7·423	S	·049	7·457
	18	05	7·380	S		7·414
" 13	18	10	7·533	N	·022	7·454
	19	25	7·514	N		7·435
" 14	15	15	7·553	C S	·058	7·553
	16	30	7·498	C S		7·498
" 15	15	35	7·604	C S	·000	7·6[illegible]4
	18	00	7·610	C S		7·610
" 16	15	55	7·670	N	·077	7·656
	17	35	7·593	N		7·579
" 20	17	55	7·644	C S		7·644
" 24	16	35	7·593	C S	·038	7·593
	17	55	7·631	C S		7·631
" 25	16	45	7·547	S	·011	7·581
	18	10	7·534	S		7·568
" 26	16	05	7·508	C S	·008	7·508
	17	30	7·498	C S		7·498
" 28	17	05	7·341	N	·051	7·327
	19	05	7·286	N		7·272
" 29	17	15	7·271	C S	·008	7·271
	18	40	7·263	C S		7·263

TABLE I.—TRANSIT OBSERVATIONS IN 1908—*Continued.*

Date.	Time. h.	m.	△ T s	Observer.*	Discordance.	△ T_0 s
July 30	16	35	7·289	N	·018	7·275
July 30	18	20	7·271	N		7·257
" 31	16	50	7·258	C S	·065	7·258
" 31	18	20	7·323	C S		7·323
Aug. 2	17	25	7·370	S		7·404
" 5	17	55	7·665	C S	·088	7·665
" 5	19	15	7·756	C S		7·756
" 6	20	50	7·701	N	·030	7·687
" 6	22	15	7·733	N		7·719
" 7	18	25	7·767	C S	·044	7·767
" 7	19	25	7·813	C S		7·813
" 9	17	40	7·986	S	·050	8·020
" 9	19	15	7·940	S		7·974
" 11	17	40	8·156	N	·040	8·142
" 11	19	00	8·119	N		8·105
" 13	18	20	8·280	N	·002	8·266
" 13	19	55	8·286	N		8·272
" 15	18	55	8·336	N		8·322
" 17	18	50	8·404	C S	·005	8·404
" 17	20	05	8·411	C S		8·411
" 18	19	40	8·427	N		8·413
" 19	18	05	8·576	N	·069	8·562
" 19	19	20	8·509	N		8·495
" 20	20	05	8·546	C S	·045	8·546
" 20	21	10	8·591	C S		8·591
" 21	18	00	8·616	C S	·007	8·616
" 21	19	20	8·625	C S		8·625
" 22	18	30	8·620	N	·042	8·606
" 22	19	45	8·664	N		8·650
" 23	21	20	8·608	S		8·642
" 24	17	45	8·683	C S	·067	8·683
" 24	19	05	8·752	C S		8·752
" 25	18	15	8·793	N	·005	8·779
" 25	19	25	8·790	N		8·776
" 26	20	10	8·789	C S		8·789
" 27	18	00	8·826	N	·018	8·812
" 27	19	20	8·810	N		8·796
" 28	19	00	8·803	C S	·006	8·803
" 28	20	05	8·811	C S		8·811
" 30	18	30	8·833	S	·062	8·867
" 30	19	40	8·773	S		8·807
" 31	18	10	8·859	C S	·032	8·859
" 31	19	20	8·893	C S		8·893

TABLE 1.—TRANSIT OBSERVATIONS IN 1908.—*Continued.*

Date.	Time. h.	Time. m.	△ T s	Observer.*	Discordance.	△ T₀ s
Sept. 3	18	15	8·986	N	·031	8·972
	19	40	9·019	N		9·005
" 4	18	05	9·070	C S	·037	9·070
	19	15	9·035	C S		9·035
" 5	19	40	9·076	N	·029	9·062
	21	00	9·107	N		9·093
" 6	18	30	9·030	S	·032	9·064
	19	40	9·064	S		9·098
" 7	19	40	9·110	N	·059	9·096
	21	05	9·171	N		9·157
" 8	19	55	9·199	C S	·015	9·199
	21	05	9·186	C S		9·186
" 11	20	15	9·388	C S	·011	9·358
	21	35	9·379	C S		9·379
" 12	19	05	9·419	N	·036	9·405
	20	50	9·386	N		9·372
" 14	19	05	9·453	C S	064	9·453
	20	25	9·519	C S		9·519
" 16	19	10	9·561	C S	·064	9·561
	20	15	9·499	C S		9·499
" 19	19	10	9·676	N	035	9·662
	20	30	9·713	N		9·699
" 20	19	25	9·616	S	·048	9·650
	20	50	9·570	S		9·604
" 21	19	50	9·616	S		9·650
" 25	20	45	9·706	C S		9·706
" 29	20	25	9·813	S	·033	9·847
	21	25	9·782	S		9·816
Oct. 1	20	50	9·906	C S		9·906
" 2	19	55	9·994	C S	·040	9·994
	22	10	9·958	C S		9·958
	22	10	9·910	S		9·944
" 3	20	25	9·939	S	·008	9·973
	21	35	9·933	S		9·967
" 5	21	10	10·060	C S	·023	10·060
	22	40	10·040	C S		10·040
	22	40	10·017	S		10·051
" 6	20	35	10·073	N	·023	10·059
	22	05	10·099	N		10·085
" 7	21	00	10·076	C S	·002	10·076
	22	20	10·081	C S		10·081
" 9	19	40	† ·366	C S	049	† ·366
	20	45	·417	C S		·417
" 11	21	00	276	S		·310

TABLE I.—TRANSIT OBSERVATIONS IN 1908.—*Continued.*

Date.	Time.		ΔT	Observer.*	Discordance.	$\Delta T'$
	h.	m.	s.			s.
Oct. 12	20	40	·400	C S	·002	·400
	22	25	·401	C S		·401
	20	40	·336	S	·024	·370
	22	25	·363	S		·397
" 13	20	45	·454	N	·086	·440
	22	25	·371	N		·357
	22	25	·390	S		·424
" 14	21	50	·444	N		·430
	21	50	·456	S		·490
" 15	21	30	·591	N		·577
	21	30	·520	S		·554
Nov. 21	0	55	2·291	S	·088	2·325
	2	35	2·382	S		2·416
	0	55	‡2·260	N	·016	
	2	35	2·247	N		
" 26	23	50	2·952	N		
	23	50	2·988	C S		2·988
" 29	0	30	3·253	S	·002	3·287
	2	20	3·259	S		3·293
	0	30	3·307	C S	·002	3·307
	2	20	3·309	C S		3·309
Dec. 2	0	20	3·664	C S	·056	3·664
	1	50	3·611	C S		3·611
	1	50	3·516	N		
" 5	23	05	3·981	S	·009	4·015
	0	55	3·994	S		4·028
	23	05	3·864	N	·041	
	0	55	3·827	N		
Mean Discordance	..	..	....	....	± ·033	

* The letters used to denote the observers are as follows:—R. M. Stewart, S; D. B. Nugent, N; C. C. Smith, CS.

† On Oct. 9, owing to a blown-out fuse, the winding circuit of the clock failed for a few minutes; though the pendulum continued to swing uninterrupted, the reading of the clock-face was changed.

‡ The personal equation of N had changed between Oct. 15 and Nov. 21; hence the observations of N are not entered in the last column after Nov. 21.

PERSONAL EQUATION.

An examination of the values of clock error for successive days, as given in the third column of Table I., shows that the differences of personal equation are not negligible. This was very clearly seen on plotting the results in a curve, using different coloured inks for each observer; it was also quite noticeable that the personal equation of N had suffered a sudden change between July 13 and July 16. To determine the values of the personal equations the summer was broken up into periods during which the curve appeared most regular; then for any one period the mean of the observations on each night was represented by the observation equation

$$a + bt + ct^2 + e = \Delta T,$$

t being the interval from a fixed epoch, a, b and c arbitrary constants, ΔT the observed clock error, and e the personal equation of the observer referred to the standard observer. It will be seen that this amounts to assuming that the clock-rate, during the period considered, varied uniformly with the time; the periods were so chosen, by inspection of the curve, that this condition should be approximately fulfilled; even if this were not the case the deduced values of e would still be trustworthy, provided the work of each observer were distributed fairly uniformly over the whole period. After combining the observation equations and deducing the values of e for N and CS, referred to S as standard, and also of a, b and c, these values were substituted in the observation equations and the residuals formed. As the average of the residuals for those parts of the summer included in the periods considered was ·022 sec., the largest being ·06 sec., it follows that the observations are fairly well represented by the formula. The relative personal equations derived for each period, with their probable errors, are given in Table II. From these figures it would appear that during June and July the personal equation of CS underwent a gradual progressive change; from a consideration of the observations as a whole, however, and considering the fact that, especially in the first period, the observations of CS were not distributed over the whole period, it was decided to treat the personal equations of CS and of S as constant throughout the season, and to assume (as was evidenced by the clock-curve) a sudden change in that of N about July 15. Combining the results for the whole season on this assumption, the values of personal equation derived are as follows:—

$CS - S$ ·034 sec.

$N - S$ ·113 sec. up to July 15; afterwards ·048 sec.

As will appear below, it seemed likely from some later developments that the absolute personal equation of CS was nearly zero; for this reason the above results were altered so as to make his observations the standard; the corrections to be applied to the clock errors of each observer were then as follows:—

S ·034 sec.

N – ·079 sec. up to July 15; afterwards – ·014 sec.

CS ·000 sec.

These corrections have been applied to form the last column in Table I.

To obtain the personal equations of the two field observers M* and J†, some additional observations were made, the field observers occupying a hut immediately to the south of the one in which the home observations were taken. The observations with M extended from September 14 to October 14; those with J, who did not return from the field until later, from November 21 to December 5. During a part of this time two of the home observers frequently observed together, in order to strengthen the determination both of their own personal equations and of those of the field observers. This was rendered possible by the fact that the transit used (Cooke I) was fitted with an attachment which caused it to record over every alternate four revolutions (of the micrometer screw) throughout the field; one observer would follow the star over a group of contacts at a considerable distance from the centre of the field, the other over a group somewhat closer; after reversal the same series of observations was repeated in the reverse order; thus the observations of each observer were complete in themselves; the groups of contacts made by each observer were interchanged for alternate stars. Each observer also took an independent series of level readings; as it was found, however, that there was no systematic difference in this regard, the mean of all the level readings was taken in making the reductions.

The observations for M's personal equation are collected in Table III.; those for that of J in Table IV. It is evident from Table IV. that for the November and December observations the personal equation of N had again suffered a decided change; those of S and CS, however, appear to have remained relatively unchanged; consequently in obtaining the personal equation of J only the observations of S and CS have been used.

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* F. A. McDiarmid.
† W. C. Jaques.

The values of personal equation obtained above for the five observers engaged were applied throughout in the computations for longitude. Though perhaps not as accurate as might be desired, the agreement of the longitudes derived on different nights has been in general improved by their application, and there is at least no doubt of the real existence of personal differences of about the magnitudes indicated. It follows that it is never safe to assume the absence of personal equation with the transit micrometer, as was the tendency for some time after its introduction; though some of the differences involved above are small enough to be neglected except in the most refined work, several of them are of quite appreciable magnitude. They are, however. much smaller than the personal equations ordinarily occurring in key observations.

In considering *à priori* the question of personality with the transit micrometer, it would appear that there are two factors capable of affecting the result. On account of the motion of the star, there may be a tendency always to keep the moveable wire either ahead of or behind the star, irrespective of its apparent direction of motion; the distance between star and wire, expressed in angular measure, might be expected to be somewhat less for the more slowly moving stars, but this tendency would be, to some extent at least, counterbalanced by the greater value (expressed in time) of any particular angular interval for the latter class of stars; thus the tendency would be for the record to be made either too soon or too late by a quantity which might be sensibly the same for stars of all declinations; this is a personal equation of the same kind as the so-called 'reaction-time' in observations by eye and ear or with the telegraphic key, but it might be expected to be smaller. The second factor is the personal error of bisection, by virtue of which an observer may tend always to set the wire either to the right or left of the centre of the star-image which he attempts to bisect; this effect would change sign with the direction of apparent motion, and its absolute value would be proportional to the secant of the declination, changing sign at the zenith and at the pole; it might also be expected to vary with the magnitude. This error is also present in the case of estimation of transits across fixed wires; there is, however, so far as the variation with magnitude is concerned, the difference that in the latter case the tendency is usually to estimate the bisection of a bright star sooner than that of a faint one, irrespective of the direction of motion, while in the case of the transit micrometer, differences of magnitude will presumably simply have the tendency to increase or diminish the error of bisection.

Errors of the first class arise from the motion of the star, but are independent of its direction; those of the second class do not arise from the motion, but (when expressed as corrections to the time of transit) change sign with its apparent direction; the former will affect the time, but not the azimuth; the latter both, but more markedly the azimuth.

It had long ago been noticed by the writer that, for his own observations, it was impossible satisfactorily to combine observations of south stars with those of north stars at both upper and lower culmination; this for the reason that the stars at upper culmination, when combined with the south stars, gave values of clock error and azimuth consistently differing from those derived from the stars at lower culmination. This circumstance was explicable by supposing that the observations were affected by a systematic error of bisection, and by no other hypothesis except that of systematic catalogue error; it was found that the observations could be reconciled by supposing that the wire was set always to the left of the star by somewhat over a second of arc.

During the summer of 1908 it was decided to make some special observations to test, qualitatively at least, the validity of this hypothesis. In order to obtain as many independent tests as possible, several methods of observation were devised. The most obvious of all, the observation of transits of zenith stars facing alternately north and south, was impracticable with the telescope used, since the standards interfered with the proper manipulation of the micrometer wheels. The first method used was the measurement of zenith distances; as the telescope was fitted with an erecting diagonal eye-piece, this was comparatively simple. After setting on a star at some distance from the zenith, preferably a slow-moving north star (the micrometer head having been previously turned so that the moveable wire was horizontal), the diagonal eye-piece was turned in either direction about 45° from the vertical plane; on looking into it with the line joining the eyes horizontal, the micrometer wire appeared vertical, the direction of increasing zenith distance being towards the right or left according to the direction in which the eye-piece had been turned. By making a number of settings with eye-piece alternately right and left the error of bisection was readily found. In this method the question is not complicated by the motion of the star, which appears to move *along* the wire, the motion in any case being very slow if high polars be chosen; thus the result is practically the simple error of bisection for a stationary object. By combining the results from different stars the variation depending on magnitude may also be found. The stars principally used were Polaris and λ Ursæ Minoris; with the latter as many as a hundred settings could easily be made at one culmination. Several other stars of high declination were also used, the total number of bisections made being about 400. Observations of a similar kind on Polaris and λ Ursæ Minoris were also made by C. C. Smith.

The other methods used, which were three in number, all depended on the observation of transits. They were as follows:—

I. Observations of the same star (over different parts of the field) were made with the ordinary diagonal eye-piece (erecting), and also with a simple eye-piece of about the same magnifying power; as the apparent direction of motion is altered by interchanging the eye-pieces, the difference in times of transit (reduced to the meridian) was taken to be double the error of bisection. In this case the observations are not made under exactly similar conditions; with the direct eye-piece a movement of the hand-wheels appears, to an observer accustomed to the erecting eye-piece, to move the wire in the wrong direction, and there is no assurance *à priori* that this will not alter the 'lag' effect, if this exists. The definition is also somewhat better with the direct eye-piece, which might tend to diminish the error of bisection in that case; the result might also be affected by the difference in the observer's position. On account of the use of the direct eye-piece, observations were not possible within 35° of the zenith; stars were observed near the equator and near the pole, both above and below. When reduced to equatorial interval it was found that the error of bisection was practically the same for polar and equatorial stars, the difference in times of transit being, as was expected, of opposite sign for north stars at upper culmination. Care was taken to have the magnitudes varied enough to determine the magnitude equation. The whole number of stars observed was 45.

II. Observations of a few equatorial stars were made in the ordinary way, and also with the diagonal eye-piece turned through 180°, so that the observer faced upwards at an angle in looking into it. As before, the error of bisection was taken to be one-half the difference in the reduced times of transit. Theoretically this method is free from objection, as the conditions of observation are the same in both cases; practically, however, the difficulty of observing with the eye-piece down, without a suitable reclining chair, was found to be a very serious objection; only twelve stars were observed.

III. As in the case of the zenith distance observations above, the star was observed with eye-piece both left and right, and also (over another part of the field) in the ordinary way. With eye-piece left the apparent motion of the star was upward, the wire appearing horizontal; with eye-piece right the motion was downward; the mean of these two observations was taken to be free from error of bisection; hence the error for the ordinary observation was derived. The number of stars observed was 43.

In the several methods described above the results are independent of catalogue places, and include both the absolute value of the error of bisection and its variation with magnitude. Computations were also made from the residuals of the southern Berliner Jahrbuch stars occurring in the ordinary observations to determine the magnitude equation in the case of both S and CS; this involves the assumption that the B. J. places are free from magnitude equation, which is probably very nearly the case. The residual of each B. J. star in a set was diminished by the mean of all; the same was done with the magnitudes; there results for each star an observation equation of the form $b\ m = v$, m being the magnitude of the star diminished by the mean magnitude for the set, v the residual diminished in the same way, and b the unknown magnitude equation; the reduction to this form enables stars from different sets to be combined indifferently to obtain the value of b. 170 stars were used in deducing the magnitude equation of S, 143 for that of CS.

From the observations by S and CS in October and November, on the nights on which the two observers worked simultaneously with the same instrument, a computation was made of their difference of personal equation and its variation with magnitude, on the supposition that it was wholly due to bisection error. This supposition appeared extremely probable from the fact that of 19 north stars (at upper culmination) and 43 south stars, every one of the north stars gave a negative difference in the sense $S - CS$, and every one of the south stars a positive difference. The signs of the differences for the north stars having been changed, each star furnished an observation equation of the form $a + bm = v \cos \delta$ for the determination of difference of bisection error, a and b being the quantities to be determined, m the magnitude, and v the observed difference. The 62 equations were combined by least squares, and a and b evaluated.

The results of all the observations and computations described above are collected in Table V. In the case of the zenith distances the bisection errors, for the sake of uniformity, have been reduced to their equivalents in time; all the results are expressed in equatorial interval; the bisection error has throughout been considered positive when the wire is set to the apparent left of the star. The inter-agreement of the means is no doubt much closer than might have been expected from the varied nature of the observations and their comparatively limited number. The results, however, point very strongly to the reality of a large bisection error for the observer S, and to its variation with magnitude; the agreement for the two observers points to the probability that their personal equations arise almost wholly from this cause. For a set observed at the latitude of Ottawa (45° 24′), composed of north stars of magnitude 5·5 at declination 77° and south stars of magnitude 4 at declination 25°, which is about the average composition, the personal equation between S and CS due to error of bisection, assuming the latter to be ·074 sec. − ·0129 $(m - 4)$, would be ·036 sec.; the actual value as obtained directly above was ·034 sec. The closeness of this agreement is, however, no doubt partly attributable to chance.

The observations of N in October, on the three nights when he worked simultaneously with S, appear to follow a similar law, the differences being all negative for the north stars, and nearly all positive for the south stars; for his observations in November and December, however, after the second change in his personal equation, this is not the case. The observations were considered too few to make a definite analysis; his magnitude equation during the early part of the summer, as deduced from the residuals, was − ·0019 sec. per magnitude, a practically evanescent quantity.

It may be remarked that transits of stars near the zenith, observed with a broken type telescope, will be free from error of bisection when the telescope is reversed during the observation of each star. For an ordinary telescope the condition of elimination, so far as effect on the deduced clock-error is concerned, is that the sines of the mean zenith distances of south and of north stars should be proportional to the errors of bisection corresponding to their respective mean magnitudes, provided that the zenith distances and magnitudes of individual stars do not differ widely from these means. As, however, the fulfilment of this condition, even approximately, would be extremely difficult in actual practice, and as the resulting error varies fairly rapidly with changes in the conditions, the only practical remedy would appear to be the measurement by each observer of his bisection error and the correction of each separate observation for it if large. Observations of both Polaris and λ Ursæ Minoris at a single culmination, by the method outlined above, would be sufficient to determine whether the error and its variation with magnitude were sufficiently large to be taken into account; if so, further observations of the same kind could be made if desired.

In the measurement of azimuth by the transits of close circumpolars, the clock error being supposed known, the error of bisection enters for more than its full value into the deduced azimuth. In this case the error might either be measured directly as above, and a correction applied, or it might be eliminated by observing with eyepiece alternately left and right as described under III. above.

TABLE II.—PERSONAL EQUATIONS OF HOME OBSERVERS.

Period, 1908.	CS—S	N—S	
	s	s	
June 1–20	− ·011 ± ·021	·098 ± ·016	Preliminary.
June 21–July 15	·025 ± ·014	·099 ± ·015	Preliminary.
Aug. 2–31	·046 ± ·014	·057 ± ·015	Preliminary.
Sept. 3–29	·056 ± ·018	·077 ± ·019	Preliminary.
Oct. 1–7	·050 ± ·016	·061 ± ·022	Preliminary.
May 14–July 15	·034 ± ·007	·113 ± ·009	Adopted.
July 16–Oct. 15		·048 ± ·009	Adopted.

TABLE III.—PERSONAL EQUATION OF F. A. McDIARMID.

Date.	Time.	Clock Corrections.				Personal Equation of M.		
		M	S*	N†	C S	S–M	N–M	C S–M
1908.	h. m.	s	s	s	s	s	s	s
Sept. 14	19 00	9·444			9·453			·009
	20 25	9·424			9·519			·095
" 16	19 10	9·505			9·561			·046
	20 20	9·493			9·499			·006
" 19	19 10	9·619		9·662			·043	
	20 10	9·562		9·699			·137	
" 20	19 20	9·565	9·650			·085		
	20 35	9·540	9·604			·064		
" 21	20 05	9·656	9·650			− ·006		
" 25	20 45	9·684			9·706			·022
" 29	19 50	9·812	9·847			·035		
	21 15	9·844	9·816			− ·028		
Oct. 1	20 05	9·918			9·906			− ·012
" 14	22 00	0·522	0·490	0·430		− ·032	− ·092	
Means						·020	·029	·028
Weighted mean							0·025	

*With personal equation + ·034 sec. applied.
†With personal equation − ·014 " "

TABLE IV.—PERSONAL EQUATION OF W. C. JAQUES.

Date	Time.	Clock Corrections.				Personal Equation of J.		
		J.	S*	N†	C S	S—J	N—J	CS—J
1908.	h m	s	s	s	s	s	s	s
Nov. 21	0 55	2·319	2·325	2·246	....	·006	– ·073	
" 26	23 50	2·988	....	2·938	2·988	....	– ·050	·000
" 29	0 30	3·259	3·287	....	3·307	·028	....	·048
	2 20	3·210	3·293	....	3·309	·083	....	·099
Dec. 2	0 20	3·516	....	....	3·664	....	....	·148
	1 50	3·586	....	3·502	3·611	....	– ·084	·025
" 5	23 05	3·947	4·015	3·850	....	·068	– ·097	....
	0 55	3·920	4·028	3·813	....	108	– ·107	....
Means						·059	– ·082	·064
Weighted mean from observations of S and C S, 0·061 sec.								

* With personal equation + ·034 sec. applied.
† With personal equation – ·014 sec. applied.

TABLE V.—ERRORS OF BISECTION.

Method.	Observer.	Bisection Error.	
		s	s
Zenith Distance	S	·074	– ·0119 (m—4)
Transits I	S	·101	– ·0091 (m—4)
" II	S	·066	– ·0088 (m—4)
" III	S	·151	– ·0252 (m—4)
Residuals	S		– ·0118 (m—4)
Zenith Distance	C S	·033	+ ·0000 (m—4)
Residuals	C S		– ·0038 (m—4)
Direct Differences	S—C S	·074	– ·0129 (m—4)
Means.	S	·098	– ·0134 (m—4)
	C S	·033	– ·0019 (m—4)
	S—C S	·074	– ·0129 (m—4)

TIME SERVICE.

The ordinary work in connection with the Time Service has consisted, as in the past, of the necessary attention to the up-town service, the sending out of time-signals to the telegraph company, dropping of the time-ball on Parliament Hill, supplying of mean and sidereal time by telephone to those requiring it, occasional rating of chronometers, testing of aneroid barometers, &c., together with the maintenance of the clocks and apparatus at the Observatory.

In addition to the daily time-signals to the telegraph company, the beats of the mean-time clock were on one occasion sent to a member of the Geological Survey staff at Blackwater, B.C., several hundred miles north of the main line of the Canadian Pacific Railway. On this occasion the transcontinental copper wire of the Canadian Pacific Telegraph was used as far as Vancouver; the signals were received at Blackwater satisfactorily.

During the winter season, unless required for special purposes, observations for time were taken usually not oftener than once a week, and occasionally at slightly longer intervals. When required only for ordinary time-keeping purposes (the clock error not being required more accurately than to within one or two-tenths of a second) this is found amply sufficient with our Riefler Standard Clock.

Some trouble has been experienced with the maintenance of a perfectly uniform pressure within the case of the Sidereal Standard. During May, 1908, a leak at the rate of several millimetres per month developed; by careful resealing this was reduced, though not entirely eliminated; throughout the whole summer and the ensuing winter a practically uniform leak of one millimetre per month persisted; as, however, the leak was uniform, it did not interfere seriously with the performance of the clock; no attempt was made to keep the pressure at its original value by periodical exhaustion, as it was considered that this would interfere with the continuity of rate. In March, 1909, the electric seconds-contact failed; the necessity of dismounting the clock was taken advantage of to have it cleaned and oiled, after which it was again mounted and exhausted to a pressure of 688 millimetres. An analysis of its rate from June to October, 1908, is given in Appendix A below.

Reference was made in my last report to the proposed extension of the Time Service to the Printing Bureau, the Mint and the Archives Building. It was, however, later decided by the Public Works Department not to equip the Printing Bureau at present. A switch-room to contain the apparatus for serving the two remaining buildings was obtained in the Mint, and was fitted up under my supervision by the electricians of the Public Works Department; this work was completed on September 18. The master-clock for operating the dials was the one which had been formerly used in the basement of the Supreme Court Building as primary for the experimental system installed in 1902. For use as a secondary master-clock it required to be fitted with a minute-contact and a synchronization magnet, as well as with the cut-out described in my last report. This was done in the Observatory workshop, and the clock was set up in the switch-room at the Mint for regulation of rate on August 11. On September 19 at noon the dials in the Mint and Archives Building were started; the master-clock was not put under direct control from the Observatory until some little time later.

In the other departmental buildings there have, as usual, been changes and some additions to the dials in operation. The necessary attention to the system has in the main, as heretofore, devolved upon Mr. Robertson; Mr. Nugent has also frequently assisted in this work. Below is a list of the number of clocks in operation in the city and at the Observatory:—

	Mar. 31, '09.	Mar. 31, '08.
Minute dials—Parliament Building	49	46
East Block	36	35
West Block	63	61
Langevin Block	48	48
Post Office	20	20
Thistle Block	2	2
Ottawa Electric Co.	1	1
Mint	16	..
Archives	7	..
Observatory	28	28
Tower clocks	2	2
Program clock	1	1
Seconds dials	3	2
Total electrically driven clocks	276	246

	Mar. 31, '09.	Mar. 31, 08.
Secondary Master-clocks..	8	7
Primary clocks..	4	4
Total..	288	257

I have the honour to be, sir,
Your obedient servant.

R. M. STEWART.

APPENDIX A.

RATE OF THE STANDARD CLOCK OF THE DOMINION OBSERVATORY.

R. M. STEWART.

The construction of astronomical clocks has arrived at such a degree of perfection that, for the present at least, it is probably useless to look for much improvement in this direction. Attention requires to be directed more especially to the conditions under which the clock operates, with a view to keeping these as constant as possible. There are three main factors which influence the performance of a clock: (1) rigidity of mounting and freedom from vibration; (2) compensation for or elimination of variations in atmospheric pressure; (3) compensation for temperature.

The Sidereal Standard of the Dominion Observatory (Riefler No. 75) is of Riefler's well known primary type. The whole clock is enclosed in an air-tight glass cylinder to eliminate all changes of air pressure; it may be remarked here that the rate-variation due to barometer, if not eliminated, is very considerable, amounting in the present case to nearly half a second per day per inch change of barometer. The pendulum rod is of the particular composition of nickel-steel known as invar, whose temperature coefficient of expansion is very small. The temperature compensation is effected by a short compound cylinder of brass and steel, upon which the pendulum-bob is supported. The escapement is of Riefler's own type, one of the principal characteristics being that the impulse to the pendulum is given through the suspension spring; it combines many of the advantages of the two best fundamental types, the 'free' and 'gravity' escapements. The winding is electrical, and is operated automatically at intervals of 20 to 30 seconds.

Though the temperature-compensation of a good pendulum is sufficiently accurate for all ordinary purposes, the refinements of astronomical observations make it necessary in addition to keep the temperature to which it is subjected as constant as practicable. It is considered by many authorities that a variation of a degree or two is not attended by any appreciable effects, but in our case the principle has been followed of aiming at a fairly high degree of refinement in temperature control. The temperature of the clock-room as a whole is kept nearly constant by means of a thermostat controlling an electric heater, while a fan keeps the air in constant circulation throughout the room. This, however, was not found to give the refinement desired, and a separate case was built around the clock. The temperature within the case is maintained slightly above that of the room by a Callender Electric Recorder, which controls a small electric heater, the air being kept in circulation as above by a small fan; the maximum variation is of the order of a tenth of a degree centigrade.

A good test of the rate of the clock is given by the longitude operations of the summer of 1908. Observations for clock error were made on every clear night for four and a half months, from the beginning of June* up to the middle of October; in general at least two independent determinations were made on each night; the total number of nights was 91; three observers took part in the work, two of them observing usually on alternate nights, and the third less frequently.

Owing to the continuity of the work and the accurate running of the clock, it was found possible to compute the relative personal equations of the observers from the regular observations. To do this, the season was broken up into convenient periods, averaging about a month in length, and a rigorous least square computation of the relative personal equations obtained for each; these separate values were combined with the results of some special observations for personal equation, and final values adopted. The application of these quantities to the observations gave clock errors presumably free from relative personal equation. The general rate showed great uniformity throughout the season, with the exception of the latter part of July; as the rate in this period was so evidently anomalous, it has been left out of consideration in what follows.

In computing clock-rates the effect of errors of observations must not be neglected; where the observations from which the rate is computed are separated by only a short interval, the apparent effect of such errors may be considerable; this, however, decreases as the interval is increased. For this reason the rates in Table I. have been computed, as shown, for intervals of five days, so far as the observations would permit. The second column shows the observed daily rate in seconds for each period, the third the difference between each of these observed rates and their mean, the average difference being ± ·015 sec. per day. Assuming a constant change of rate with the time and solving by least squares the rate-formula obtained is $^{s}{\cdot}0500 - {}^{s}{\cdot}00023\ (T - \text{Aug. } 8)$; the rates computed from this formula are given in the fourth column, while the fifth gives the differences between these and the observed rates, the average deviation being ± ·013 sec.

For the sake of comparison with another clock of the same kind, and to show the effect of temperature-control, Table II. gives a similar analysis of the rate of the United States Naval Observatory clock (Riefler No. 70) for a period of three months in 1904, as published by Prof. Eichelberger†; in this case one period of ten days is omitted; the average interval between observations is 4·2 days. As the variation of temperature during this test was considerable, a temperature-term is introduced in the computed rate. It will be observed that the mean deviation from computed rate is almost the same for both clocks; this may be taken to mean that the ideal performance (that is, the best performance of which the clock is capable) is practically the same in both cases; this is of course to be expected from two clocks of the same type and manufacture. So far as actual performance goes, however, they are to be judged by the residuals from mean, and not computed, rate, and here the Ottawa clock has a very decided advantage, its actual performance being reasonably close to the ideal one. The reason is not far to seek; it lies in the absence of temperature-variations and their disturbing effects. It would not be fair to close this comparison without stating that the United States Naval Observatory has now a new clock room, where, I believe, greater attention is paid to temperature control.

As mentioned above, the interval between observations for clock error will influ-

* The observations made in May were not considered in this paper, because the rate was affected by several changes of pressure and a certain amount of direct disturbance due to adjustments and re-sealing.

† Science, 1907, p. 451.

ence the accuracy of the deduced rate, owing to the effect of errors of observation. In general, the residual rate V (observed minus computed) will consist of three parts:—(1) the actual variation of clock rate v_1, (2) an apparent part v_2 depending on errors of observation and interval, (3) another apparent part v_3 due to error in the personal equation employed (if the observations have been made by different observers). Hence

$$V = v_1 + v_2 + v_3$$

and, as may easily be shown, if the number of intervals considered be large,

$$[V^2] = [v_1^2] + [v_2^2] + [v_3^2];$$

or denoting the corresponding probable errors by R, r_1, r_2 and r_3.

$$R^2 = r_1^2 + r_2^2 + r_3^2.$$

Now if r denote the probable error of a single determination of clock-error, and if, on two nights separated by an interval of N days, there be made respectively n_1 and n_2 determinations of clock error, we shall have for that particular interval

$$r_2^2 = \frac{\frac{1}{n_1} + \frac{1}{n_2}}{N^2} \cdot r^2.$$

The value of r for the observations considered, obtained by an independent method, is ·020 sec. Substituting this value and deducing that of r_2^2 for each of the intervals in Table I., and taking the mean, the result is

$$r_2^2 = (\cdot 0046)^2.$$

Again, if r^1 denote the probable error of the value of personal equation employed, we have

$$r_3 = \frac{1}{N} \cdot r^1;$$

the value of r^1 is ·008 sec.

Also, the value of R obtained from the residuals in Table I. is ·012; hence $r_1 = \sqrt{R^2 - r_2^2 - r_3^2} = \pm \cdot 011$ sec.; this is the probable value of the actual accidental change in (daily) rate from one period of five days to the next.

Proceeding in exactly the same way, but using, instead of five-day intervals, all the observations available, the average interval being 1·47 days, the values of the quantities are as follows:—

$R = \cdot 025$ sec.
$r_2 = \cdot 0183$ sec.
$r_3 = \cdot 0054$ sec.
and hence $r_1 = \cdot 016$ sec.

Hence it appears that a clock is liable to small irregular fluctuations of rate from day to day, it being in the present case an even chance that such fluctuations shall lie within the limits $\pm$ ·016 sec.; when, however, the interval is increased, the fluctuations tend to counterbalance one another.

It would appear also that the clock is liable in addition to anomalous changes of rate for longer or shorter periods; from July 16 to July 31 the average rate was − ·022 sec., as against ·050 sec. for the remainder of the summer. It has been suggested that this is a peculiarity of invar pendulums, due to some not well understood irregularities in the interval constitution of the material; similar effects have been noticed in other Riefler clocks, but the question can hardly be considered definitely settled as yet. Such changes in rate are, however, for astronomical purposes, less objectionable than the irregular ones (here eliminated) due to irregular variations in temperature and pressure.

TABLE 1.—DOMINION OBSERVATORY CLOCK.

Date.	Daily Rate.	O – M	Computed Rate.	O – C
1908.	s.	s.	s.	s.
June 1-6	·059	·009	·065	– ·006
" 6-11	·061	·011	·064	– ·003
" 11-17	·037	– ·013	·063	– ·026
" 17-21	·069	·019	·062	·007
" 21-26	·072	·022	·060	·012
" 26-31	·088	·038	·059	·029
July 1-6	·049	– ·001	·058	– ·009
" 6-11	·055	·005	·057	– ·002
" 11-16	·046	– ·004	·056	– ·010
Aug. 0-5	·083	·033	·051	·032
" 5-9	·072	·022	·050	·022
" 9-15	·054	·004	·049	·005
" 15-20	·049	– ·001	·048	·001
" 20-25	·042	– ·008	·047	– ·005
" 25-30	·012	– ·038	·046	– ·034
" 30-35	·043	– ·007	·044	– ·001
Sep. 4-8	·034	– ·016	·043	– ·009
" 8-14	·049	– ·001	·042	·007
" 14-19	·039	– ·011	·041	– ·002
" 19-25	·004	– ·046	·040	– ·036
" 25-31	·033	– ·017	·038	– ·005
Oct. 1-6	·033	– ·017	·037	– ·004
" 6-11	·048	– ·002	·036	·012
" 11-15	·061	·011	·035	·026
Mean.	·050	± ·015		± ·013
Range.		·084		·068

Computed rate = $\overset{s.}{\cdot 0500}$ – ·00023 (T – Aug. 8).

TABLE 11.—U. S. NAVAL OBSERVATORY CLOCK.

Date.	Daily Rate.	Mean Temp.	O – M	Computed Rate.	O – C
1904.	s.	C.	s.	s.	s.
Feb. 8-11	·019	28·3°	·003	·009	·010
" 11-15	–·014	28·5	–·030	–·006	–·008
" 15-20	·005	28·3	–·011	–·002	·007
Mar. 1-4	–·026	28·2	–·042	–·012	–·014
" 4-9	–·010	28·2	–·026	–·016	·006
" 9-16	–·022	28·1	–·038	–·018	–·004
" 16-18	–·043	28·1	–·059	–·022	–·021
" 18-22	–·022	28·0	–·038	–·021	–·001
" 22-25	–·029	28·0	–·045	–·024	–·005
" 25-28	·002	27·7	–·014	·014	·016
" 28-34	–·007	27·7	–·023	–·018	·011
Apl. 3-5	·017	27·4	·001	–·009	·026
" 5-13	·002	26·9	–·014	·014	–·012
" 13-16	·026	26·5	·010	·021	·005
" 16-19	·034	26·3	·018	·027	·007
" 19-22	·002	26·4	–·014	·020	–·018
" 22-31	·029	25·0	·013	·077	–·048
May 1-4	·113	24·3	·097	·103	·010
" 4-7	·082	24·1	·066	·109	–·027
" 7-12	·161	24·0	·145	·109	·052
Mean.	·016		±·035		±·015
Range.			·204		·100

Computed rate = ·0161$^{s.}$ – ·00103$^{s.}$ (T – Mar. 29) – ·0456$^{s.}$ (t – 27°·0).

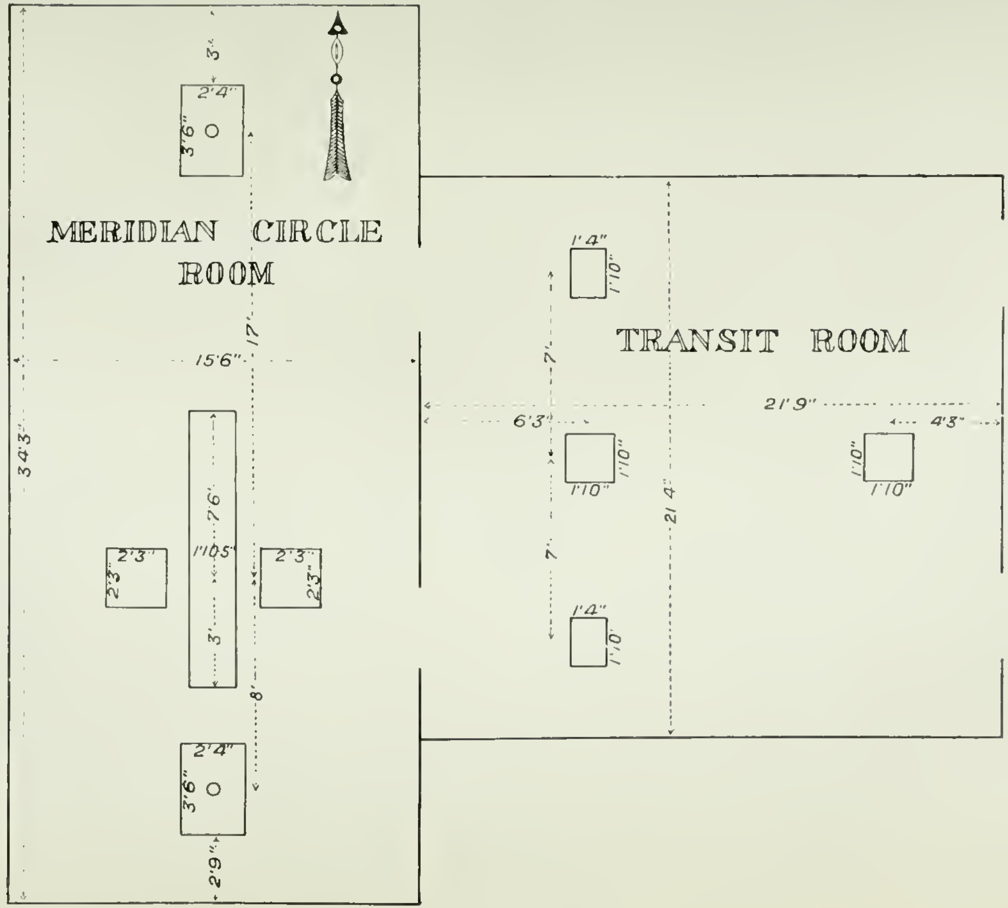

Fig. 1—Floor Plan of Transit Annex

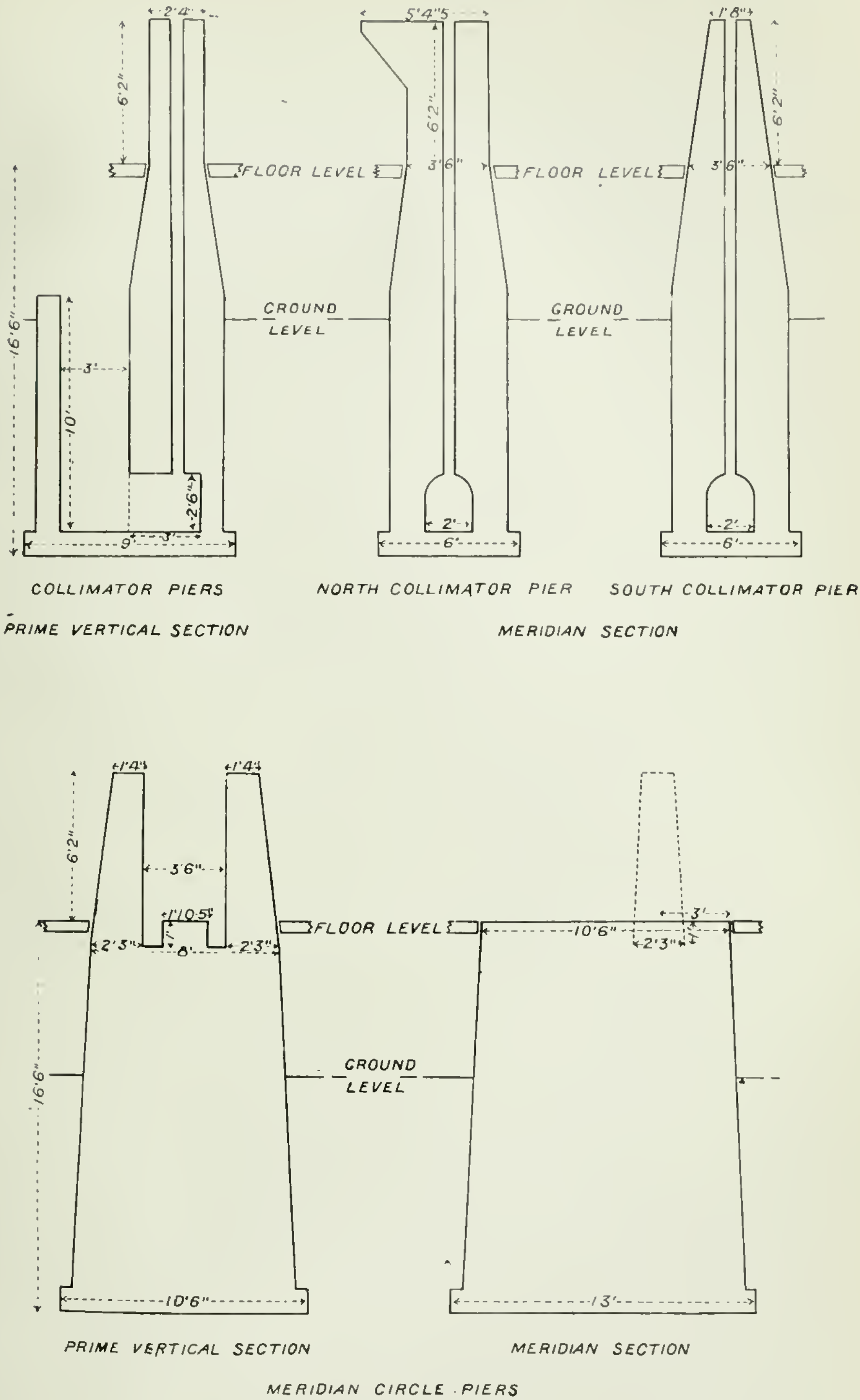

Fig. 2 Piers in Meridian Circle Room.

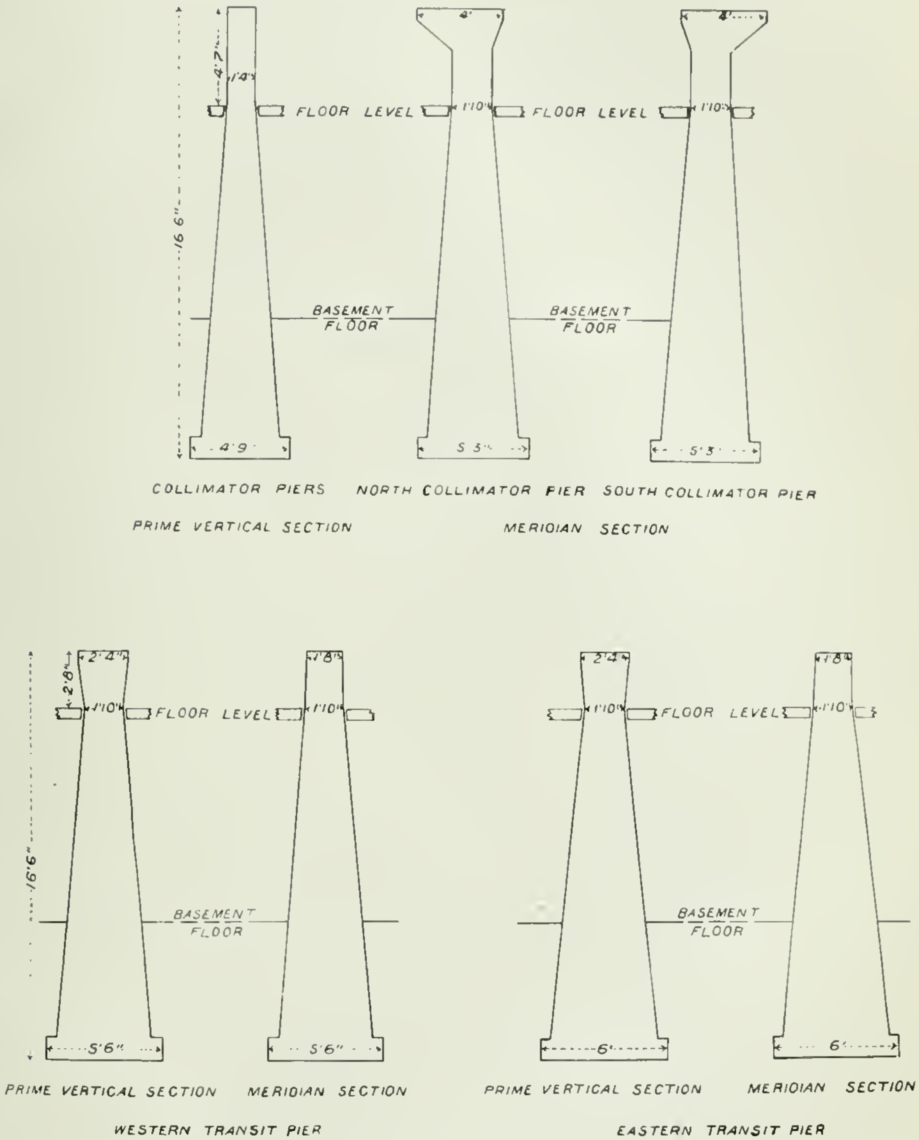

FIG. 3—Piers in Transit Room.

APPENDIX 4.

REPORT OF THE CHIEF ASTRONOMER, 1909.

TABULAR STATEMENT OF LONGITUDE AND LATITUDE OBSERVATIONS.

BY

J. MACARA.

CONTENTS.

MAP.

APPENDIX 4.

TABULAR STATEMENT OF LONGITUDE AND LATITUDE OBSERVATIONS.

DOMINION ASTRONOMICAL OBSERVATORY,
DEPARTMENT OF THE INTERIOR,
OTTAWA, CANADA, March 31, 1909.

W. F. KING, Esq., LL.D., C.M.G.,
Chief Astronomer,
Ottawa.

SIR,—I have the honour to transmit herewith a tabular statement of the differences of longitude and the latitude results of stations observed in 1908. Annexed thereto is also a description of the stations occupied. A synopsis of the statement giving the longitude and latitude of the various stations will be found on page 619.

The accompanying map shows the position of the various astronomical stations established up to the date of this report.

I have the honour to be, sir,
Your obedient servant,

J. MACARA.

DIFFERENCE OF LONGITUDE BETWEEN GATEWAY, B. C. AND SEATTLE.

Date.	Difference of Chronograph.		Clock Correction.		Difference of Longitude.				Time of Transmission.
	Western Signals.	Eastern Signals.	Western Station.	Eastern Station.	Western Signals.	Eastern Signals.	Mean.	r.	
1908.	m. s.	m. s.	s.	s.	m. s.	m. s.	m. s.	s.	s.
April 27	28 51·293	28 51·122	1·729	−13·715	28 39·307	28 39·136	28 39·222	·023	·086
" 28	28 50·397	28 50·210	1·932	−13·073	28 39·256	28 39·069	28 39·163	·036	·094
" 29	28 49·112	28 48·924	2·899	−12·698	28 39·313	28 39·125	28 39·219	·020	·094
May 3	28 45·358	28 45·149	7·078	−13·142	28 39·294	28 39·085	28 39·190	·009	·105

Observers: { West—W. C. Jaques. East—F. A. McDiarmid.

	h.	m.	s.
$d\lambda$		28	39·199
λ Seattle	8	09	20·274
λ Gateway	7	40	41·075

DIFFERENCE OF LONGITUDE BETWEEN BOUNDARY (WANETA) B.C. AND SEATTLE.

Date.	Difference of Chronograph.		Clock Correction.		Difference of Longitude.				Time of Transmission.
	Western Signals.	Eastern Signals.	Western Station.	Eastern Station.	Western Signals.	Eastern Signals.	Mean.	r.	
1908.	m. s.	m. s.	s.	m. s.	m. s.	m. s.	m. s.	s.	s.
May 13	20 11·550	20 11·400	−12·552	−1 34·781	18 49·321	18 49·171	18 49·246	−·043	·075
" 16	20 14·271	20 14·126	−12·815	−1 37·742	18 49·344	18 49·199	18 49·271	·018	·072
" 22	20 19·838	20 19·671	−13·851	1 44·258	18 49·431	18 49·265	18 49·347	·058	·082
" 25	20 22·901	20 22·747	−15·025	−1 48·534	18 49·392	18 49·238	18 49·315	·026	·077
" 26	20 23·732	20 23·565	−15·338	−1 49·722	18 49·348	18 49·191	18 49·265	−·021	·074

Observers { West—W. C. Jaques.
East—F. A. McDiarmid.

	h.	m.	s.
$d\lambda$		18	49·289
λ Seattle	8	09	20·274
λ Boundary	7	50	30·985

DIFFERENCE OF LONGITUDE BETWEEN ST. JOHN, N.B., AND DOMINION OBSERVATORY, OTTAWA.

Date.	Difference of Chronograph.		Clock Correction.		Difference of Longitude.				Time of Transmission.
	Western Signals.	Eastern Signals.	Western Station.	Eastern Station.	Western Signals.	Eastern Signals.	Mean.	v.	
1908.	m. s.	m. s.	s.	s.	m. s.	m. s.	m. s.	s.	s.
May 13	38 51·225	38 51·124	+2·277	13·112	38 35·836	38 35·735	38 35·785	·001	·050
" 14	38 52·305	38 52·202	+2·377	14·092	38 35·836	38 35·733	38 35·785	·001	·052
" 15	38 54·299	38 54·213	+2·477	16·005	38 35·817	38 35·731	38 35·774	·010	·043
" 16	38 55·284	38 55·193	+2·577	16·911	38 35·796	38 35·705	38 35·751	·034	·046
" 18	38 57·052	38 56·959	+2·777	18·404	38 35·871	38 35·778	38 35·825	·041	·047

Observers: { West—D. B. Nugent, C. C. Smith. / East—C. A. French.

	h.	m.	s.
$d\lambda$		38	35·784
$L\lambda$ Ottawa	5	02	51·797
$L\lambda$ St. John	4	21	16·013

DIFFERENCE OF LONGITUDE BETWEEN SPRAGUE, MAN., AND DOMINION OBSERVATORY, OTTAWA.

Date.	Difference of Chronograph.		Clock Correction.		Difference of Longitude.				Time of Transmission
	Western Signals.	Eastern Signals.	Western Station.	Eastern Station.	Western Signals.	Eastern Signals.	Mean.	r.	
1908.	h. m. s.	h. m. s.	m. s.	s.	h. m. s.	h. m. s.	h. m. s.	s.	s.
June 5	1 12 30·467	1 12 30·201	7 05·961	+5·255	1 19 41·683	1 19 41·117	1 19 41·550	·019	·133
" 7	1 12 25·618	1 12 25·337	7 10·843	+5·290	1 19 41·751	1 19 41·470	1 19 41·610	·011	·140
" 9	1 12 24·998	1 12 24·712	7 11·214	+5·157	1 19 41·669	1 19 41·383	1 19 41·526	·013	·113
" 11	1 12 23·721	1 12 23·436	7 12·375	+5·560	1 19 41·656	1 19 41·371	1 19 41·514	·055	·113
" 12	1 12 21·451	1 12 21·127	7 11·767	+5·588	1 19 41·806	1 19 41·182	1 19 41·644	·075	·162

Observers: { West—F. A. McDiarmid.
{ East—C. C. Smith, D. B. Nugent, R. M. Stewart.

	h.	m.	s.
$d\lambda$	1	19	41·569
λ Ottawa	5	02	51·797
λ Sprague	6	22	33·366

DIFFERENCE OF LONGITUDE BETWEEN RAINY RIVER, ONT., AND DOMINION OBSERVATORY, OTTAWA.

Date.	Difference of Chronograph.		Clock Correction.		Difference of Longitude.				Time of Transmission.
	Western Signals.	Eastern Signals.	Western Station.	Eastern Station.	Western Signals.	Eastern Signals.	Mean.	τ	
1908.	h. m. s.	h. m. s.	s.	s.	h. m. s.	h. m. s.	h. m. s.	s	s
June 16	1 14 42·762	1 14 42·490	– 35·753	+ 5·743	1 15 24·258	1 15 23·986	1 15 24·122	– ·050	·136
" 19	1 14 36·517	1 14 36·262	– 41·862	+ 5·826	1 15 24·206	1 15 23·951	1 15 24·079	– ·007	·128
" 20	1 14 34·599	1 14 34·327	– 43·661	+ 5·875	1 15 24·135	1 15 23·863	1 15 23·999	·073	·136
" 23	1 14 27·302	1 14 27·004	– 50·737	+ 6·200	1 15 24·237	1 15 23·939	1 15 24·088	– ·016	·149

Observers { West—F. A. McDiarmid.
{ East.—R. M. Stewart, D. B. Nugent, C. C. Smith.

	h.	m.	s.
$d\lambda$	1	15	24·072
λ Ottawa	5	02	51·797
λ Rainy River	6	18	15·869

DIFFERENCE OF LONGITUDE BETWEEN MONCTON, N.B., AND DOMINION OBSERVATORY, OTTAWA.

Date.	Difference of Chronograph.		Clock Correction		Difference of Longitude.				Time of Transmission.
	Western Signals.	Eastern Signals.	Western Station.	Eastern Station.	Western Signals.	Eastern Signals.	Mean.	r	
1908.	m. s.	m. s.	s	s	m s	m s	m s	s	s
May 21	43 12·893	43 12·741	+ 3·145	+ 32·371	43 42·119	43 41·967	43 42·043	010	·076
" 22	13 14·338	43 14·182	+ 3·296	+ 31·090	43 42·132	43 41·976	43 42·054	·001	·078
June 23	43 40·951	43 40·804	+ 6·200	+ 07·334	43 42·085	43 41·938	43 42·012	− ·041	·073
" 25	43 18·735	43 18·575	+ 6·338	+ 29·762	43 42·159	43 41·999	43 42·079	+ ·026	·080
" 26	13 08·121	43 07·956	+ 6·419	+ 40·495	43 42·197	43 42·032	43 42·114	+ ·061	·082
" 27	43 10·311	43 10·185	+ 6·553	+ 38·319	43 42·077	43 41·951	13 42·014	− ·039	·063

	h	m	s
$d\lambda$		43	42·053
λ Ottawa	5	02	51·797
λ Moncton	4	19	09·744

OBSERVERS { West—R. M. STEWART.
West—C. C. SMITH.
West—D. B. NUGENT.

" { East—C. A. FRENCH, in May.
East—W. C. JAQUES, in June.

DIFFERENCE OF LONGITUDE BETWEEN FORT FRANCES, ONT., AND DOMINION OBSERVATORY, OTTAWA.

Date.	Difference of Chronograph.		Clock Correction.		Difference of Longitude.				Time of Transmission.
	Western Signals.	Eastern Signals.	Western Station.	Eastern Station.	Western Signals.	Eastern Signals.	Mean.	v	
1908.	h m s	h m s	s	s	h m s	h m s	h m s	s	s
June 24	1 10 53·779	1 10 53·544	+15·209	+6·265	1 10 44·835	1 10 44·600	1 10 44·717	·020	·117
" 25	1 10 52·468	1 10 52·230	+13·949	+6·338	1 10 44·857	1 10 44·619	1 10 44·738	·041	·119
" 26	1 10 50·306	1 10 50.055	+11·973	+6·419	1 10 44·752	1 10 44·501	1 10 44·627	·070	·126
" 27	1 10 47·587	1 10 47·306	+ 9·227	+6·553	1 10 44·913	1 10 44·632	1 10 44·772	·075	·140
" 28	1 10 45·209	1 10 44·967	+ 7·120	+6·662	1 10 44·751	1 10 44·509	1 10 44·630	·067	·121

Observers { West—F. A. McDiarmid.
{ East—R. M. Stewart, D. B. Nugent, C. C. Smith.

	h	m	s
dλ	1	10	44·697
λ Ottawa	5	02	51·797
λ Fort Frances	6	13	36·494

DIFFERENCE OF LONGITUDE BETWEEN TRURO, N.S., AND DOMINION OBSERVATORY, OTTAWA.

Date.	Difference of Chronograph.		Clock Correction.		Difference of Longitude.				Time of Transmission.
	Western Signals.	Eastern Signals.	Western Station.	Eastern Station.	Western Signals.	Eastern Signals.	Mean.	r.	
1908.	m s	m s	s	s	m. s.	m. s.	m. s.	s.	s.
June 29	50 07·859	50 07·692	+6·740	−14·346	49 46·773	49 46·606	49 46·690	·064	·084
" 30	50 09·048	50 08·858	+6·829	15·427	49 46·792	49 46·602	49 46·697	·057	·095
July 1	50 10·786	50 10·610	+6·862	−16·976	49 46·948	49 46·772	49 46·860	·106	·088
" 4	50 08·093	50 07·900	+7·044	−14·182	49 46·867	49 46·674	49 46·771	·017	·097

Observers { West—R. M. Stewart, D. B. Nugent, C. C. Smith.
East—W. C. Jaques.

	h	m	s
$d\lambda$		49	46·754
λ Ottawa	5	02	51·797
λ Truro	4	13	05·043

DIFFERENCE OF LONGITUDE BETWEEN NORTH LAKE, ONT., AND DOMINION OBSERVATORY, OTTAWA.

Date.	Difference of Chronograph.		Clock Correction.		Difference of Longitude.				Time of Transmission.
	Western Signals.	Eastern Signals.	Western Station.	Eastern Station.	Western Signals.	Eastern Signals.	Mean.	*e*.	
1908.	m. s.	m. s.	s.	s.	m. s.	m. s.	m. s.	s.	s.
July 1	58 10·942	58 10·741	42·692	+6·862	59 00·196	59 00·295	59 00·395	·088	·100
" 2	58 10·603	58 10·390	−42·885	+6·920	59 00·408	59 00·195	59 00·302	−·005	·107
" 3	58 09·864	58 09·653	−43·529	+6·977	59 00·370	59 00·159	59 00·265	−·012	·106
" 3	58 09·547	58 09·327	−43·843	+6·987	59 00·377	59 00·157	59 00·267	−·040	·110

Observers { West—F. A. McDiarmid.
East—C. C. Smith, R. M. Stewart.

	h.	m.	s.
$d\lambda$		59	00·307
λ Ottawa	5	02	51·797
λ North Lake	6	01	52·101

DIFFERENCE OF LONGITUDE BETWEEN NIPIGON, ONT., AND DOMINION OBSERVATORY, OTTAWA.

Date.	Difference of Chronograph.		Clock Correction.		Difference of Longitude.				Time of Transmission.
	Western Signals.	Eastern Signals.	Western Station.	Eastern Station.	Western Signals.	Eastern Signals.	Mean.	*r.*	
1908.	m. s.	m. s.	m. s.	s.	m. s.	m. s.	m. s.		s.
July 6	45 57·114	45 56·886	4 07·202	+7·110	50 11·126	50 11·198	50 11·312	....	111
" 7	45 55·976	45 55·755	−4 08·217	+7·178	50 11·101	50 11·180	50 11·291		111
" 8	45 51·340	45 51·093	−4 09·833	+7·215	50 11·418	50 11·171	50 11·295		121

Observers { West—F. A. McDiarmid.
{ East—C. C. Smith.

	h.	m.	s.
$d\lambda$		50	11·299
λ Ottawa	5	02	51·797
λ Nipigon	5	53	03·096

DIFFERENCE OF LONGITUDE BETWEEN JACKFISH, ONT., AND DOMINION OBSERVATORY, OTTAWA.

Date.	Difference of Chronograph.		Clock Correction.		Difference of Longitude.				Time of Transmission.
	Western Signals.	Eastern Signals.	Western Station.	Eastern Station.	Western Signals.	Eastern Signals.	Mean.	r.	
1908.	m. s.	m. s.	s.	s.	m. s.	m. s.	m. s.	s.	s.
July 11	45 32·453	45 32·289	+38·013	+7·386	45 01·826	45 01·662	45 01·744	·015	·082
" 12	45 31·514	45 31·294	+37·117	+7·436	45 01·833	45 01·613	45 01·723	·006	·110
" 13	45 30·882	45 30·650	+36·491	+7·444	45 01·835	45 01·603	45 01·719	·010	·116

Observers: { West—F. A. McDiarmid.
{ East —D. B. Nugent, R. M. Stewart.

	h.	m.	s.
$d\lambda$		45	01·729
λ Ottawa	5	02	51·797
λ Jackfish	5	47	53·526

DIFFERENCE OF LONGITUDE BETWEEN HALIFAX, N.S. AND DOMINION OBSERVATORY, OTTAWA.

Date.	Difference of Chronograph.		Clock Correction.		Difference of Longitude.				Time of Transmission.
	Western Signals.	Eastern Signals.	Western Station.	Eastern Station.	Western Signals.	Eastern Signals.	Mean.	ε.	
1908.	m. s.	m. s.	s.	m. s.	m. s.	m. s.	m. s.	s.	s.
July 23	50 38·372	50 38·124	+7·622	−2 03·501	48 27·246	48 26·998	48 27·122	·009	124
" 24	50 39·629	50 39·434	+7·612	−2 04·785	48 27·232	48 27·037	48 27·134	·021	097
" 26	48 37·904	48 37·715	+7·503	03·220	48 27·181	48 26·992	48 27·087	−·026	095
" 28	48 39·992	48 39·806	+7·299	05·475	48 27·218	48 27·032	48 27·125	·112	093
" 29	48 40·655	48 40·495	+7·267	06·211	48 27·177	48 27·017	48 27·097	·016	080

Observers: West—C. C. Smith, D. B. Nugent, R. M. Stewart.
East—W. C. Jaques.

	h.	m.	s.
$d\lambda$		48	27·113
λ Ottawa	5	02	51·797
λ Halifax	4	14	24·684

DIFFERENCE OF LONGITUDE BETWEEN MATHESON, ONT., AND DOMINION OBSERVATORY, OTTAWA.

Date.	Difference of Chronograph.		Clock Correction.		Difference of Longitude.				Time of Transmission.
	Western Signals.	Eastern Signals.	Western Station.	Eastern Station.	Western Signals.	Eastern Signals.	Mean.	v	s
1908.	m s	m s	m s	s	m s	m s	m s	s	s
July 22	20 16·678	20 16·573	+1 21·351	+7·633	18 59·957	18 59·852	18 59·901	·038	·052
" 23	20 14·991	20 14·809	+1 22·712	+7·622	18 59·901	18 59·719	18 59·810	·056	·091
" 24	20 13·231	20 13·016	+1 20·883	+7·612	18 59·960	18 59·775	18 59·868	·002	·093
" 25	20 11·010	20 10·861	+1 18·585	+7·575	18 60·000	18 59·854	18 59·927	·061	·073
" 26	20 08·557	20 08·389	+1 16·157	+7·503	18 59·903	18 59·735	18 59·819	·017	·081

Observers: West—F. A. McDiarmid.
East { C. C. Smith.
R. M. Stewart.

	h	m	s
$d\lambda$		18	59·866
λ Ottawa	5	02	51·797
λ Matheson	5	21	51·663

DIFFERENCE OF LONGITUDE BETWEEN NEWCASTLE, N.B., AND DOMINION OBSERVATORY, OTTAWA.

Date	Difference of Chronograph.		Clock Correction.		Difference of Longitude.				Time of Transmission.
	Western Signals.	Eastern Signals.	Western Station.	Eastern Station.	Western Signals.	Eastern Signals.	Mean.	r	
1908.	m s	m s	s	s	m s	m s	m s	s	s
Aug. 3	40 35·246	40 35·107	+ 7·506	+ 6·129	40 33·869	40 33·730	40 33·800	·051	·070
" 9	40 45·090	40 44·932	+ 7·997	− 3·209	40 33·884	40 33·726	40 33·805	·059	·079
" 10	40 46·185	40 45·993	+ 8·061	− 1·361	40 33·763	40 33·571	40 33·667	− ·079	·096
" 11	40 47·287	40 47·113	+ 8·124	− 5·335	40 33·828	40 33·651	40 33·741	− ·005	·087
" 15	40 52·983	40 52·794	+ 8·322	− 10·794	40 33·867	40 33·678	40 33·773	·027	·095
" 16	40 53·190	40 52·995	+ 8·365	− 11·037	40 33·788	40 33·593	40 33·691	− ·055	·098

Observers: West—R. M. Stewart, C. C. Smith, D. B. Nugent.
" East—W. C. Jaques.

	h	m	s
$d\lambda$		40	33·746
λ Ottawa	5	02	51·797
λ Newcastle	4	22	18·051

DIFFERENCE OF LONGITUDE BETWEEN MEGANTIC, QUE., AND DOMINION OBSERVATORY, OTTAWA.

Date.	Difference of Chronograph.		Clock Correction.		Difference of Longitude.				Time of trans-mission.
	Western Signals.	Eastern Signals.	Western Station.	Eastern Station.	Western Signals.	Eastern Signals.	Mean.	v	
1908.	m s	m s	s	m s	m s	m s	m s	s	s
Aug. 4	18 26·404	18 26·271	+7·608	+1 00·937	19 19·733	19 19·600	19 19·677	·048	·077
" 7	18 34·469	18 34·348	+7·790	53·136	19 19·815	19 19·694	19 19·754	·029	·060
" 8	18 36·718	18 36·650	+7·893	51·000	19 19·825	19 19·757	19 19·791	·066	·034
" 9	18 39·347	18 39·204	+7·997	48·432	19 19·782	19 19·639	19 19·710	·015	·071
" 10	18 41·573	18 41·438	+8·060	46·245	19 19·758	19 19·623	19 19·691	·034	·068

Observers: West—R. M. Stewart, C. C. Smith, D. B. Nugent.
East—F. A. McDiarmid.

	h	m	s
$d\lambda$		19	19·725
λ Ottawa	5	02	51·797
λ Megantic	4	43	32·072

DIFFERENCE OF LONGITUDE BETWEEN BLACK LAKE, QUE., AND DOMINION OBSERVATORY, OTTAWA.

Date.	Difference of Chronograph.		Clock Correction.		Difference of Longitude.				Time of Transmission.
	Western Signals.	Eastern Signals.	Western Station.	Eastern Station.	Western Signals.	Eastern Signals.	Mean.	v	
1908.	m s	m s	s	s	m s	m s	m s		s
Aug. 11	18 30·886	18 30·761	+8·124	−55·479	17 27·283	17 27·158	17 27·221	−·009	·063
" 14	18 36·997	18 36·838	+8·295	−61·370	17 27·332	17 27·173	17 27·252	·022	·079
" 15	18 38·713	18 38·571	+8·322	−63·085	17 27·306	17 27·164	17 27·235	·005	·071
" 16	18 39·541	18 39·422	+8·365	−63·905	17 27·271	17 27·152	17 27·212	−·018	·060

Observers: West—D. B. Nugent, C. C. Smith.
East—F. A. McDiarmid.

	h	m	s
$d\lambda$		17	27·230
λ Ottawa	5	02	51·797
λ Black Lake	4	45	24·567

DIFFERENCE OF LONGITUDE BETWEEN FOSTER, QUE., AND DOMINION OBSERVATORY, OTTAWA.

Date.	Difference of Chronograph.		Clock Correction.		Difference of Longitude.				Time of Transmission.
	Western Signals.	Eastern Signals.	Western Station.	Eastern Station.	Western Signals.	Eastern Signals.	Mean.	r.	
1908.	m. s.	m. s.	s.	s.	m. s.	m. s.	m. s.	s.	s.
Aug. 17	13 34·669	13 34·598	+8·408	-33·484	12 52·777	12 52·706	12 52·742	·011	·036
" 18	13 36·332	13 36·250	+8·413	35·147	12 52·772	12 52·690	12 52·731	·000	·041
" 19	13 37·618	13 37·546	+8·529	36·332	12 52·757	12 52·685	12 52·721	−·010	·036

Observers: West—C. C. Smith, D. B. Nugent.
East—F. A. McDiarmid.

	h.	m.	s.
$d\lambda$		12	52·731
λ Ottawa	5	02	51·797
λ Foster	4	49	59·066

DIFFERENCE OF LONGITUDE BETWEEN BOIESTOWN, N.B., AND DOMINION OBSERVATORY, OTTAWA.

Date.	Difference of Chronograph.		Clock Correction.		Difference of Longitude.				Time of Transmission.
	Western Signals.	Eastern Signals.	Western Station.	Eastern Station.	Western Signals.	Eastern Signals.	Mean.	*v.*	
1908.	m. s.	m. s.	s.	s.	m. s.	m. s.	m. s.	s.	s.
Aug. 20	37 27·414	37 27·220	+8·569	−08·003	37 10·842	37 10·648	37 10·745	− 044	·097
" 21	37 27·398	37 27·220	+8·610	−07·916	37 10·872	37 10·694	37 10·783	·006	·089
" 23	37 29·741	37 29·560	+8·642	−10·154	37 10·945	37 10·764	37 10·854	065	·090
" 24	37 30·028	37 29·882	+8·718	−10·464	37 10·846	37 10·700	37 10·773	016	·073

	h.	m.	s.
$d\lambda$		37	10·789
λ Ottawa	5	02	51·797
λ Boiestown	4	25	41·008

Observers: West—D. B. Nugent, C. C. Smith, R. M. Stewart.
East—W. C. Jaques.

DIFFERENCE OF LONGITUDE BETWEEN WOODSTOCK, N.B. AND DOMINION OBSERVATORY, OTTAWA.

Date.	Difference of Chronograph.		Clock Correction.		Difference of Longitude.				Time of Transmission.
	Western Signals.	Eastern Signals.	Western Station.	Eastern Station.	Western Signals.	Eastern Signals.	Mean.	r.	
1908.	m. s.	m. s.	s.	m. s.	m. s.	m. s.	m. s.	s.	s.
Aug. 23	28 32·513	28 32·280	+8·642	+1 09·928	32 32·899	32 32·666	32 32·783	·005	·117
" 24	28 33·234	28 33·028	+8·717	+1 08·377	32 32·891	32 32·688	32 32·791	·013	·103
" 25	28 33·843	28 33·620	+8·778	+1 07·806	32 32·871	32 32·648	32 32·760	·018	·112

Observers: { West—R. M. Stewart, C. C. Smith, D. B. Nugent.
{ East—F. A. McDiarmid.

	h.	m.	s.
d λ		32	32·778
λ Ottawa	5	02	51·797
λ Woodstock	4	30	19·019

DIFFERENCE OF LONGITUDE BETWEEN ST. HYACINTHE, QUE. AND DOMINION OBSERVATORY, OTTAWA.

Date.	Difference of Chronograph.		Clock Correction.		Difference of Longitude.				Time of Transmission.
	Western Signals.	Eastern Signals.	Western Station.	Eastern Station.	Western Signals.	Eastern Signals.	Mean.	v.	
1908.	m. s.	m. s.	s.	m. s.	m. s.	m. s.	m. s.	s.	s.
Aug. 27	12 37·653	12 37·580	+8·804	−1 21·387	11 07·462	11 07·389	11 07·426	·031	·037
" 28	12 38·816	12 38·748	+8·807	1 22·530	11 07·479	11 07·411	11 07·445	·012	·034
" 30	12 42·103	12 42·036	+8·837	1 25·733	11 07·533	11 07·466	11 07·499	·012	·033

Observers: West—D. B. Nugent, C. C. Smith, R. M. Stewart.
East—F. A. McDiarmid.

	h.	m.	s.
$d\lambda$		11	07·457
λ Ottawa	5	02	51·797
λ St. Hyacinthe	4	51	14·340

DIFFERENCE OF LONGITUDE BETWEEN FREDERICTON, N.B., AND DOMINION OBSERVATORY, OTTAWA.

Date.	Difference of Chronograph.		Clock Correction.		Difference of Longitude.				Time of Transmission.
	Western Signals.	Eastern Signals.	Western Station.	Eastern Station.	Western Signals.	Eastern Signals.	Mean.	e.	
1908.	m. s.	m. s.	s.	s.	m. s.	m. s.	m. s.	s.	s.
Aug. 28	36 24·603	36 24·438	+8·807	+2·544	36 18·310	36 18·175	36 18·258	·040	·083
" 29	36 25·485	36 25·327	+8·822	+1·597	36 18·260	36 18·102	36 18·181	·037	·079
" 30	36 26·489	36 26·370	+8·837	+0·615	36 18·267	36 18·148	36 18·207	·011	·059
" 31	36 27·449	36 27·300	+8·876	0·335	36 18·238	36 18·089	36 18·161	·054	·075
Sept. 1	36 28·746	36 28·598	+8·914	1·469	36 18·363	39 18·215	36 18·289	·071	·074
" 3	36 31·437	36 31·304	+8·989	4·171	36 18·277	36 18·144	36 18·211	·007	·067

Observers: West—C. C. Smith, D. B. Nugent, R. M. Stewart.
East—W. C. Jaques.

	h.	m.	s.
$d\lambda$		36	18·218
λ Ottawa	5	02	51·797
λ Fredericton	1	26	33·579

DIFFERENCE OF LONGITUDE BETWEEN SOREL, QUE., AND DOMINION OBSERVATORY, OTTAWA.

Date.	Difference of Chronograph.		Clock Correction.		Difference of Longitude.				Time of Transmission.
	Western Signals.	Eastern Signals.	Western Station.	Eastern Station.	Western Signals.	Eastern Signals.	Mean.	r.	
1908.	m. s.	m. s.	s.	s.	m. s.	m. s.	m. s.		s.
Aug. 31	10 35·736	10 35·677	+8·876	2·701	10 24·159	10 24·100	10 24·130	....	·030
Sept. 1	10 37·509	10 37·467	+8·914	4·473	10 24·122	10 24·080	10 24·101	....	·031
" 2	10 39·562	10 39·513	+8·951	6·494	10 24·117	10 24·068	10 24·093	....	·025
" 3	10 40·755	10 40·733	+8·989	7·661	10 24·105	10 24·083	10 24·094	....	·011

Observers: West—C. C. Smith, D. B. Nugent.
East—F. A. McDiarmid.

	h.	m.	s.
$d\lambda$		10	24·107
λ Ottawa	5	02	51·797
λ Sorel	4	52	27·690

DIFFERENCE OF LONGITUDE BETWEEN ST. JEROME, QUE., AND DOMINION OBSERVATORY, OTTAWA.

Date.	Difference of Chronograph.		Clock Correction.		Difference of Longitude.				Time of Transmission.
	Western Signals.	Eastern Signals.	Western Station.	Eastern Station.	Western Signals.	Eastern Signals.	Mean.	r.	
1908.	m. s.	m. s.	s.	s.	m. s.	m. s.	m. s.	s.	s.
Sept. 4	7 13·199	7 13·091	+ 9·052	−12·194	6 51·953	6 51·845	6 51·899	·084	·054
" 5	7 14·187	7 14·070	+ 9·078	−13·087	6 52·022	6 51·905	6 51·963	·020	·058
" 6	7 16·010	7 15·890	+ 9·081	−14·781	6 52 148	6 52·028	6 52·088	·105	·060

Observers: West—C. C. Smith, D. B. Nugent, R. M. Stewart.
East —F. A. McDiarmid.

	h.	m.	s.
$d\lambda$		06	51·983
λ Ottawa	5	02	51·797
λ St. Jerome	4	55	59·814

DIFFERENCE OF LONGITUDE BETWEEN RIVIERE DU LOUP STATION, QUE., AND DOMINION OBSERVATORY, OTTAWA.

Date.	Difference of Chronograph.		Clock Correction.		Difference of Longitude.				Time of Transmission.
	Western Signals.	Eastern Signals.	Western Station.	Eastern Station.	Western Signals.	Eastern Signals.	Mean.	r.	
1908.	m. s.	m. s.	s.	s.	m. s.	m. s.	m. s.	s.	s.
Sept. 8	24 57·951	24 57·827	+ 9·192	− 03·086	24 45·673	24 45·549	24 45·611	−·024	·062
" 9	24 58·218	24 58·117	+ 9·256	− 03·237	24 45·725	24 45·624	24 45·674	·039	·050
" 10	25 00·319	25 00·211	+ 9·320	− 05·236	24 45·763	24 45·655	24 45·709	·074	·054
" 11	25 01·650	25 01·557	+ 9·383	− 06·574	24 45·693	24 45·600	24 45·647	·012	·047
" 12	25 02·291	25 02·175	+ 9·388	− 07·258	24 45·645	24 45·529	24 45·587	−·048	·058
" 13	25 03·561	25 03·428	+ 9·437	− 08·478	24 45·646	24 45·513	24 45·580	−·055	·067

Observers: West—D. B. Nugent, C. C. Smith.
East—W. C. Jaques.

	h.	m.	s.
$d\lambda$		24	45·635
λ Ottawa	5	02	51·797
λ Rivière du Loup Station	1	38	06·162

DIFFERENCE OF LONGITUDE BETWEEN EDMUNDSTON, N.B., AND DOMINION OBSERVATORY, OTTAWA.

Date.	Difference of Chronograph.		Clock Correction.		Difference of Longitude.				Time of Transmission.
	Western Signals.	Eastern Signals.	Western Station.	Eastern Station.	Western Signals.	Eastern Signals.	Mean.	e.	
1908.	m. s.	m. s.	s	s.	m. s.	m. s.	m. s.	s.	s.
September 19	29 46·621	29 46·516	+9·680	03·297	29 33·647	29 33·539	29 33·593	·073	·054
" 20	29 44·051	29 43·950	+9·627	−00·708	29 33·716	29 33·615	29 33·665	·001	·050
" 22	29 42·765	29 42·696	+9·661	+00·621	29 33·722	29 33·653	29 33·687	·021	·034
" 23	29 42·736	29 42·645	+9·678	+00·706	29 33·761	29 33·673	29 33·718	·052	·045

Observers: West—D. B. Nugent, R. M. Stewart, C. C. Smith.
East—W. C. Jaques.

	h.	m.	s.
$d\lambda$		29	33·666
λ Ottawa.... ...	5	02	51·797
λ Edmundston.....	1	33	18·131

DIFFERENCE OF LONGITUDE BETWEEN PERCÉ, QUE., AND DOMINION OBSERVATORY, OTTAWA.

Date.	Difference of Chronograph.		Clock Correction.		Difference of Longitude.				Time of Transmission.
	Western Signals.	Eastern Signals.	Western Station.	Eastern Station.	Western Signals.	Eastern Signals.	Mean.	v.	
1908.	m. s.	m. s.	s.	s.	m. s.	m. s.	m. s.	s.	s.
October 5	46 00·841	46 00·632	+10·050	+8·512	45 59·303	45 59·094	45 59·199	·017	·105
" 6	46 00·161	45 59·955	+10·072	+9·215	45 59·304	45 59·098	45 59·201	·019	·103
" 7	45 59·666	45 59·456	+10·078	+9·664	45 59·252	45 59·042	45 59·147	·035	·105

Observers: West—C. C. Smith, D. B. Nugent.
East—W. C. Jaques.

	h.	m.	s.
$d\lambda$		45	59·182
λ Ottawa	5	02	51·797
λ Percé	4	16	52·615

DIFFERENCE OF LONGITUDE BETWEEN CAMPBELLTON, N.B., AND DOMINION OBSERVATORY, OTTAWA.

Date.	Difference of Chronograph.		Clock Correction.		Difference of Longitude.				Time of Transmission.
	Western Signals.	Eastern Signals.	Western Station.	Eastern Station.	Western Signals.	Eastern Signals.	Mean.	v	
1908.	m s	m s	s	s	m s	m s	m s	s	s
Oct. 10	36 42·680	36 42·550	+ 42·351	+ 9·842	36 10·171	36 10·041	36 10·106	− ·057	·065
" 12	35 56·874	35 56·700	00·392	+ 13·711	36 10·193	36 10·019	36 10·106	− ·057	·087
" 13	35 54·320	35 54·149	00·407	+ 16·122	36 10·335	36 10·164	36 10·250	·087	·086
" 14	35 53·985	35 53·808	00·400	+ 16·753	36 10·278	36 10·101	36 10·189	·026	·088

Observers: West—C. C. Smith, R. M. Stewart, D. B. Nugent.
East.—W. C. Jaques.

	h	m	s
$d\lambda$		36	10·163
λ Ottawa	5	02	51·797
λ Campbellton	4	26	41·634

LONGITUDE AND LATITUDE OF STATIONS OBSERVED IN 1908.

Place.	Difference of Longitude.	To	Longitude.	Longitude	Latitude.
	h. m. s.		h. m. s.	° ′ ″	° ′ ″
Gateway	28 39·199	Seattle	7 40 41·075	115 10 16·13	48 59 58·45
Boundary (Waneta)	18 49·289	"	7 50 30·985	117 37 44·78	49 00 00·55
St. John	38 35·784	Dominion Observatory	4 24 16·013	66 04 00·20	45 16 35·04
Sprague	1 19 41·569	" "	6 22 33·366	95 38 20·49	49 02 05·10
Rainy River	1 15 24·072	" "	6 18 15·869	94 33 58·04	48 43 22·80
Moncton	43 42·053	" "	4 19 09·744	64 47 26·16	46 05 02·21
Fort Frances	1 10 44·697	" "	6 13 36·494	93 24 07·41	48 36 48·59
Truro	49 46·754	" "	4 13 05·043	63 16 15·65	45 21 47·32
North Lake	59 00·307	" "	6 01 52·104	90 28 01·56	48 08 28·77
Nipigon	50 11·299	" "	5 53 03·096	88 15 46·44	49 00 43·75
Jackfish	45 01·729	" "	5 47 53·526	86 58 22·89	48 47 44·84
Halifax	48 27·113	" "	4 14 24·684	63 36 10·26	44 40 07·52
Matheson	18 59·866	" "	5 21 51·663	80 27 54·95	48 32 07·23
Newcastle	40 33·746	" "	4 22 18·051	65 34 30·77	47 00 11·37
Megantic	19 19·725	" "	4 43 32·072	70 53 01·08	45 34 32·80
Black Lake	17 27·230	" "	4 45 24·567	71 21 08·51	46 02 44·59
Foster	12 52·731	" "	4 49 59·066	72 29 45·99	45 17 14·63
Boiestown	37 10·789	" "	4 25 41·008	66 25 15·12	46 27 18·52
Woodstock	32 32·778	" "	4 30 19·019	67 34 45·29	46 08 33·28
St. Hyacinthe	11 07·457	" "	4 51 44·340	72 56 05·10	45 37 15·28
Fredericton	36 18·218	" "	4 26 33·579	66 38 23·69	45 57 41·30
Sorel	10 24·107	" "	4 52 27·690	73 06 55·35	46 02 19·59
St. Jerome	6 51·983	" "	4 55 59·814	73 59 57·21	45 46 33·29
Riviere du Loup Station	24 45·635	" "	4 38 06·162	69 31 32·43	47 49 23·48
Edmundston	29 33·666	" "	4 33 18·131	68 19 31·97	47 22 06·65
Percé	45 59·182	" "	4 16 52·615	64 13 09·23	48 30 52·05
Campbellton	36 10·163	" "	4 26 41·634	66 40 24·51	48 00 31·33

LOCAL POSITIONS OF ASTRONOMICAL STATIONS.

Gateway.—The pier is on the international boundary line 189·4 feet due east of boundary monument No. 244, and is 541·3 feet west of United States survey post No. 25104 on boundary line.

Boundary (*Waneta*).—The pier is 21·5 feet due east of monument No 181 on the international boundary line.

St. John.—The pier is 82 feet north and 174 feet west of the northeast corner of Lombard and Southwork streets. Reference point is southeast corner of I.C.R. grain elevator. Reference angle 188°·44 right from meridian at centre of pier to reference point. Distance, 196·8 feet.

Sprague.—The pier is 670·7 feet west and 1·4 feet north of the southwest corner of the Canadian Northern Railway station house.

Rainy River.—The pier is 111.2 feet north, and 51·3 feet west of the southwest corner of 3rd street and Atwood ave.

Moncton.—Reference point is the northwest corner of the Intercolonial Railway blacksmith shop. N. 52° 16′ E. from meridian through centre of pier. Distance, 4·378 chains.

Fort Frances.—The pier is 9·7 feet north and 189·2 feet east of the northeast corner of 4th street and Cornwall ave.

Truro.—The pier is 49·49 feet east and 64·13 feet south of gas-pipe marking the boundary of the I.C.R. yard at head of Miller street and Mr. Fraser's gate.

North Lake.—The pier is 272·5 feet east and 15·5 south of 'frog' lying between the Port Arthur and Duluth Railway main line and the southwest leg of the 'Y.'

Nipigon.—The pier is 47·8 feet west and 82·4 feet north of the northwest corner of the Canadian Pacific Railway station house.

Jackfish.—The pier is 228·5 feet north and 82·9 feet west of the southwest corner of the Canadian Pacific Railway station house.

Halifax.—The pier is 127·26 feet east and 90·38 feet north of the southeast corner of Creighton & Co.'s grocery store. It is also 63·23 feet east and 54·04 feet south of the gas pipe marking the boundary of the I.C.R. yard. Direction of said pipe from pier being 54° 15′ from the meridian measured from the north through the west.

Matheson.—The pier is on the right of way of the Timiskaming and Northern Ontario Railway, and is 153·5 feet south and 178·0 feet east of the northeast corner of 5th ave. and Railway street.

Newcastle.—The pier is 14·16 feet east and 90·66 feet south of the intersection of Station and Gene streets.

Megantic.—The pier is 172·5 feet east and 72·6 feet north of the southwest corner of Maple ave. and McCauley street.

Black Lake.—The pier is 111·1 feet east and 190·8 feet north of the northwest corner of Whitney ave. and the private way of the American Asbestos Company.

Foster.—The pier is 181·5 feet north and 480·3 feet west of the middle point of the crossing of the Boltôn Road and the Canadian Pacific Railway main line (Foster crossing). The pier is about 80 feet north of the Canadian Pacific Railway station house.

Boiestown.—The pier is 41·63 feet east and 90·87 feet north from the northeast corner of T. Lynch & Co.'s supply store.

Woodstock.—The pier is 132·5 feet east and 100 feet south of the northeast corner of George and Main streets.

St. Hyacinthe.—The pier is 85 feet east and 516 feet north of the middle point of the crossing of Broadway Road and the Canadian Pacific Railway main line, and is about 400 feet from the station house.

Fredericton.—The pier is on the river front 52·15 feet north and 67·0 feet west of the northwest corner of Lamont's furniture warehouse at the corner of Regent and Campbell streets.

Sorel.—The pier is 194·9 feet west and 34·2 feet north of the southeast corner of Ray and Victoria streets.

St. Jerome.—The pier is 412·0 feet east and 102·4 feet south of the southeast corner of St. Antoine and St. Anne streets. It is on the Canadian Pacific Railway right of way about 400 feet south of the station house.

Rivière du Loup Station.—The pier is 511·5 feet from the southeast corner of the I.C.R. machine shop. Angle from the north through the west 41° 54′.

Edmundston.—The pier is 148·30 feet east and 12·04 feet north of the northeast corner of Temiscouata Railway station.

Percé.—The pier is 84·63 feet west and 72·28 feet south of the southwest corner of Abraham Lenfesty's house.

Campbellton.—The pier is 18·27 feet east and 12·41 feet south of the southeast corner of the post office building.

Dominion Observatory.—The reference point of the longitudes observed in 1908 is a temporary transit house, the meridian of which is $0^s\cdot12$ east of the centre of the dome of the Observatory.