



Thomas Devine
D.S.G.

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PROCEEDINGS
OF THE
ASSOCIATION OF
PROVINCIAL LAND SURVEYORS
OF ONTARIO,

AT ITS FOURTH ANNUAL MEETING HELD AT TORONTO,
ON FEBRUARY 26TH, 27TH AND 28TH,

1889.

*Fifth Annual Meeting will be held in Toronto, on Tuesday,
25th of February, 1890.*

PRINTED FOR THE ASSOCIATION
BY
C. BLACKETT ROBINSON, 5 JORDAN STREET,
TORONTO



Thomas Penn
D.D.

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PATRONIZE OUR ADVERTISERS.

NOTICES.

The attention of the members is called to the list of Standing Committees as given on page 6. Each member should assist the Standing Committees as much as possible.

Each member is requested to add to his business card the following:
"Member of the Association of Provincial Land Surveyors of Ontario."

Members can be supplied with copies of the Proceedings for 1887 and Proceedings for 1888 by remitting fifty cents to the Secretary.

Copies of the Constitution will be sent upon receipt of three cent stamp.

PATRONIZE OUR ADVERTISERS.

PREFACE.

To the Members of the Association of Provincial Land Surveyors of Ontario :

THE Proceedings of the Association at its Fourth Annual Meeting, held in Toronto, in February last, are herewith presented.

This meeting was the most successful yet held, the registered attendance was greater than at any preceding meeting, and great interest was taken in the subjects discussed, while the discussions were more to the point than at any former meeting.

Much of the success of this meeting is to be attributed to the exertions of the Entertainment Committee, the drive around the city and the sumptuous dinner being fully appreciated by the visiting members.

We regret to say that a few, but a very few, of the active members of our profession are not members of our Association, although reaping the benefits of the legislation passed at the instance of the Association. We hope each member will consider it a part of his duty to convince non-members of their egotistical folly in not becoming members, and that this year we may see enrolled every Surveyor worthy of the name. We are endeavouring to "promote the general interests and elevate the standard of the profession"—a task which would become much easier if all Provincial Land Surveyors were members of this Association.

Respectfully submitted on behalf of the Executive Committee.

WILLIS CHIPMAN,
Secretary.

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ASSOCIATION OF
PROVINCIAL LAND SURVEYORS
OF ONTARIO.

ORGANIZED 23RD FEBRUARY, 1886.

Officers for 1889-90.

PRESIDENT.

Alexander Niven, P.L.S., Haliburton.

VICE-PRESIDENT.

Villiers Sankey, P.L.S., City Hall, Toronto.

SECRETARY-TREASURER.

Willis Chipman, B.A.Sc., Brockville.

COUNCILLORS.

Elihu Stewart, Collingwood.

John McAree, 237 Parliament Street, Toronto.

P. S. Gibson, Willowdale.

BANKERS.

Bank of Montreal.

STANDING COMMITTEES.

LAND SURVEYING.—M. Gaviller (Chairman); H. J. Browne, R. B. Rogers, G. B. Kirkpatrick, H. B. Proudfoot, C. T. Aylsworth.

DRAINAGE.—James Robertson (Chairman); D. S. Campbell, H. W. Selby, Jas. Kirk, C. F. Miles.

ENGINEERING.—W. M. Davis (Chairman); A. W. Campbell, C. G. Hanning, H. J. Bowman, T. H. Jones.

LEGISLATION.—W. R. Aylsworth (Chairman); J. Dickson, G. B. Kirkpatrick, W. Chipman, Wm. Ogilvie.

INSTRUMENTS.—J. W. Tyrrell (Chairman); E. Bray, W. R. Burke, B. J. Saunders.

PUBLICATION.—H. L. Esten (Chairman); H. D. Ellis, T. P. Speight, John McAree.

ENTERTAINMENT.—A. J. VanNostrand (Chairman); V. Sankey, H. D. Ellis, G. B. Abrey, F. L. Foster, C. Murphy.

PROGRAMME OF THE
Association of Provincial Land Surveyors of Ontario

AT ITS FOURTH ANNUAL MEETING HELD IN TORONTO,
FEBRUARY 26TH, 27TH, AND 28TH, 1889.

PROGRAMME.

Tuesday, February 26th—Morning, 10 o'clock.

Meeting of Executive Committee.
Meeting of Standing Committees.

Afternoon, 2 o'clock.

Reading Minutes of Previous Meeting.
Appointment of Scrutineers of Ballots of 1888.
Reading of Correspondence.
Report of Secretary-Treasurer.
Appointment of Auditors.
President's Address.
Report of Committee on Land Surveying, E. Stewart, P.L.S.,
Chairman.
Discussion of Proposed Amendment in Survey Act.

Evening, 8 o'clock.

Paper—"Original Land Marks," Maurice Gaviller, P.L.S., C.E.
Paper—"Cadastral Surveys in the Province of Quebec," J. P. B.
Casgrain, P.L.S.
Amateur Photography.
Report of Committee on Boundary Commissioners, V. Sankey,
P.L.S., Chairman.

Wednesday, February 27th—Morning, 10 o'clock.

Report of Scrutineers of Ballots of 1888.
Report of Committee on Drainage, L. Bolton, P.L.S., Chairman.
Paper—"City Surveys," T. B. Speight, P.L.S.
Paper—"Descriptions," O. J. Klotz, D.T.S.
Paper—"Timber Exploring," W. R. Aylsworth, P.L.S.

Afternoon, 2 o'clock.

Report of Auditors.

Report of Committee on Engineering, T. H. Jones, B.A.Sc.,
Chairman.

Paper—"Awards and Plans under Ditches and Watercourses
Act," Lewis Bolton, P.L.S.

Paper—"Railway Right of Way Surveys," C. G. Hanning, C.E.,
H. J. Browne, P.L.S., Jno. Davis, P.L.S., H. D. Ellis, P.L.S.

Paper—"Brantford Water Works," T. H. Jones, B.A.Sc.

Paper—"Wooden and Composite Bridges," H. K. Wicksteed,
B.A.Sc.

Thursday, February 28th—Morning, 10 o'clock.

Report of Committee on Legislation, W. R. Aylsworth, P.L.S.,
Chairman.

Report of Committee on Publication, T. B. Speight, P.L.S.,
Chairman.

Report of Committee on Instruments, John McAree, D.T.S.,
Chairman.

Paper—"The Transit," John McAree, D.T.S.

Paper—"Reproduction of Plans."

Paper—"Decimal *vs.* Duodecimal Measures," V. Sankey, P.L.S.
Volunteer Papers.

Afternoon, 2 o'clock.

Report of Committee on Entertainment, A. J. VanNostrand,
P.L.S., Chairman.

Unfinished Business.

Election of Associate Members, Junior Members, and Honorary
Members.

Nomination of Officers.

Appointment of Scrutineers—Ballot of 1889.

New Business.

Adjournment.

Full discussion after each Paper and each Report.

ASSOCIATION OF
PROVINCIAL LAND SURVEYORS
OF ONTARIO.

MINUTES OF THE FOURTH ANNUAL MEETING.

FEBRUARY 26TH, 27TH AND 28TH, 1889.

The Association met at 2 p.m. on February 26th, in the Library of the Canadian Institute, 46 Richmond Street East, Toronto.

The Association was called to order by the President, Alexander Niven, Esq.

Moved by Willis Chipman, seconded by D. L. Sanderson: That the Minutes of the last meeting, as printed in the Proceedings, be taken as read. Carried.

Moved by V. Sankey, seconded by M. Gaviller: That C. F. Aylsworth and O. McKay be appointed Scrutineers to examine ballots for 1888-89. Carried.

The Secretary-Treasurer, Willis Chipman, then presented his report, which, upon motion, was received and adopted.

Moved by V. Sankey, seconded by C. F. Miles: That J. A. Paterson and D. L. Sanderson be appointed Auditors, to audit accounts for year 1888, and report to-morrow at 12.30 p.m. Carried.

The President then read his annual address. (See page 37.)

The Report of the Committee on Land Surveying was then presented by the Chairman, E. Stewart, which, after discussion, was received and adopted. (See page 20.)

The Committee on Entertainment here notified the meeting that on Wednesday, 27th, at 3 p.m., the Reception Committee of the City Council would take the members of the Association for a drive about the city, visiting the Don improvements, city waterworks, Rosehill reservoir, and other places of interest about the city.

The paper on Wooden and Composite Bridges was read by the Secretary, in the absence of the writer, H. K. Wicksteed.

Moved by G. B. Abrey, seconded by H. J. Browne: That H. J. Browne, E. Stewart, A. Niven, M. Gaviller, T. B. Speight, C. F. Myles and J. P. B. Casgrain, be a Committee to consider, and report to this meeting before its close, on a table of Tariff of Fees for adoption by surveyors. Carried.

The proposed amendments to the Survey Act were then discussed by the meeting. (See page 23.) Moved by E. Stewart, seconded by J. Kirk: That the proposed amendments be referred to the Committee on Legislation, to report as soon as possible. Carried.

Meeting adjourned at 5.30 p.m.

EVENING SESSION, 8 P.M.

President in the Chair.

M. Gaviller read his paper on "Original Landmarks." (See page 39.)

J. P. B. Casgrain then read his paper on "Cadastral Surveys in the Province of Quebec," illustrated by plan and book of reference. (See page 46.)

Committee on Boundary Commissioners presented their report. (See page 32.)

Moved by V. Sankey, seconded by H. L. Esten: That the paper read by Mr. Casgrain be referred to the Land Surveying Committee, with instructions to report on same, particularly with regard to how the provisions mentioned in the same may be applied to Section 68 and Subsections of our Act. As at present the details of preparing compiled plans are left entirely to the ideas of individual surveyors, and are not regulated by law as they should be. Carried.

Meeting adjourned at 10 p.m.

WEDNESDAY, FEBRUARY 27TH, 10 A.M.

Communications were read from David Boyle, Esq., Curator of the Canadian Institute, cordially inviting the members of the Association to visit the Archaeological Museum of the Institute, and from W. B. McMurrich, Esq., Vice President of the Amateur Photographic Association, of Toronto, inviting the members to visit the rooms of their Association on Thursday afternoon at 5 p.m.

Moved by L. Bolton, seconded by D. S. Campbell: That the Report of the Committee on Drainage not being at present ready for reading, on account of the absence of several of the members of the Committee, it be handed into the Secretary of the Association in time to be published in the Report of Proceedings. Carried.

The Report of the Committee was then read by the Secretary in the absence of the Chairman.

The Report was received and adopted.

T. B. Speight then read a paper on "City Surveys."

Mr. Sanderson, of Toronto, then exhibited "Tate's Patent Arithmometer," explained its mechanism, and gave examples of what problems in the simple rules could be performed by the machine.

Moved by T. Fawcett, seconded by C. F. Miles: That the thanks of this meeting be tendered to Mr. Sanderson for exhibiting this improved Arithmometer, and for his explanations in the working of the same. Carried.

The Scrutineers of Ballots for officers for 1888-89 presented their report which was adopted.

O. J. Klotz then read his paper on "Descriptions."

The paper of T. H. Jones on "Brantford Waterworks" was taken as read and ordered to be printed in the Proceedings.

L. Bolton then read his paper on "Awards and Plans under the Ditches and Water Courses Act."

The papers on "Railway Right of Way Surveys" were then called for by the President.

Moved by J. Davis, seconded by C. R. Wheelock: That in view of the fact that a great deal of business remains to be got through with in the very short time at our disposal, that the paper on "Railway Right of Way Surveys," by John Davis, be taken as read. Carried.

H. D. Ellis read his paper on "Right of Way Surveys."

Meeting adjourned at 1 p.m.

No meeting was held in the afternoon of Wednesday, 27th, the members accepting the invitation of the Reception Committee of the City Council for a drive around the city. (See Report of Committee on Entertainment.)

THURSDAY, FEBRUARY 28TH, 10 A.M.

Paper on "Timber Exploring," by W. R. Aylsworth, was read by the Secretary in the absence of Mr. Aylsworth.

In absence of the Chairman, the Committee on Legislation made no report.

Report of Committee on Publication was then presented by T. B. Speight, Chairman.

Report of Committee on Instruments was then presented by Jno. McAree, Chairman.

The paper on "The Transit" was then read by J. McAree, the writer.

Moved by Mr. Stewart, seconded by Mr. Ogilvie: That the President and Messrs. Proudfoot, Abrey, McAree and the mover be a Committee to urge on the Ontario Government the desirability of carrying out, in connection with the Surveys Branch of the Crown Lands Department, a system of explanatory surveys in the new territory. Carried.

Mr. Stewart: My object in moving this is to bring the matter before you. I think it would be well for the Government to have a permanent staff of surveyors for this purpose. There are large tracts of land in Ontario which we know nothing about, especially timber lands, and it would be much to the advantage of the Government to know what is on these lands before they sell the limits. Very often the timber men have the lands surveyed and know all about them when the Government do not know what is on the lands. My idea is that there might be a Mining Engineer along with the surveying party and they could make rough traverses and be able to report where the good timber and farm lands are also.

Mr. Abrey: I suppose that is a matter which the Geological Department should take up, they might be combined with the Surveyors' Department. If surveyors had been sent out with the mining engineers it would have been a good idea, and could have been done at a very small expense.

Mr. Stewart: I think it would be greatly in the interests of the Province, and if the Commissioner of Crown Lands would consider it and adopt it, he would be able to know what valuable timber there is in the Province. I do not think there should be any conflict with the Geological Survey. This is just a supplement. We have just lately acquired a very large territory, and we know very little about it. The Province would only be consulting her own interests in appointing such a survey party.

Mr. Gibson. I think it is a good suggestion both in the interests of the Province and of the surveyors. It is well known that large timber men make it their business to find out about these pineries and the Government know nothing about it. Those large timber men employ a large staff.

Chairman: With regard to the matter I may say that I have explored, to some extent, the land to the north of the Ottawa River, and I think something like this suggestion is desirable. An exploration party is sent out to survey, but they have no time to give the country that examination which is necessary. They might be passing over very rich minerals and know nothing about it. There should be some one with the party who has a knowledge of mining industries. I think the suggestion is in the right direction. It certainly could do no harm to have the matter talked over with the Government.

The Committee on Tariff then reported.

Moved by P. S. Gibson, seconded by Mr. Gaviller: That the tariff recommended by the report of the Committee be received and adopted. Carried.

Moved by E. Stewart, seconded by C. F. Miles: That a circular showing the tariff adopted by this Association be printed and one or more copies forwarded by the Secretary to every practising surveyor in the Province. Carried.

Moved by Willis Chipman, seconded by G. B. Abrey: That if at any time it be ascertained that any Provincial Land Surveyor be charging any less fees than those adopted by this Association in their "Minimum Tariff of Fees," that it be considered the duty of any member cognizant of the fact to report the same to the Executive Committee of this Association, and the Executive shall then take such action as they consider proper.

Lost on the following division—

Yeas—W. Chipman, C. F. Aylsworth, A. J. Van Nostrand, J. Kirk, R. H. Coleman, H. R. McEvoy, W. Galbraith, G. B. Abrey, E. Bray, J. W. Tyrrell, R. Sherman—11.

Nays—E. Stewart, P. S. Gibson, H. L. Esten, C. J. Murphy, H. W. Selby, M. Gaviller, C. F. Miles, F. L. Blake, Wm. Ogilvie, C. R. Wheelock, J. F. Whitson, A. Niven—12.

AFTERNOON SESSION, 2 P. M.

V. Sankey then read paper on "Decimal vs. Duodecimal Measures."

Moved by A. J. Van Nostrand, seconded by V. Sankey: That the Report of the Committee on Entertainment be taken as read and be printed in the Proceedings. Carried.

Moved by Willis Chipman, seconded by V. Sankey: That any omissions or clerical errors in the Record of the Proceedings of this meeting, now in the hands of the Secretary and the Stenographer, be corrected by the Committee on Publication before being printed. Carried.

Moved by E. B. Abrey, seconded by V. Sankey: That the sum of \$40.00 be granted to the Secretary-Treasurer for his services during the past year. Carried.

ELECTION OF ASSOCIATE MEMBERS, JUNIOR MEMBERS AND HONORARY MEMBERS.

Mr. Chipman: I have received no applications for associate or junior members. I would suggest that the Association take a recess of five minutes to talk over business before we proceed to the nomination of the officers.

Chairman: I think the suggestion of Mr. Chipman a good one. Let us adjourn.

NOMINATION OF OFFICERS.

Mr. Aylsworth: As our former President was in for two years, I think it would be right that the present President should be in again. I consider he has been a very efficient officer and has discharged his duties with great credit.

Mr. Kirk: I have much pleasure in seconding the motion.

Mr. Sankey: I think that this nomination should be made unanimous. Our worthy President has filled the chair with a great deal of satisfaction and I think we cannot do better than ask him to serve as President for another year. I think this should be a unanimous election.

Mr. Gibson: I suppose if there are no nominations in against it it will be unanimous.

Chairman: My feeling in this matter is that the officers should be changed every year. A number of gentlemen have asked me if I would take it for another year. I would therefore not care about taking it unless it is really the unanimous wish of the members. My opinion is that it would be better to change the officers yearly.

Mr. Abrey: We can do that after the present year.

Chairman: Gentlemen, as it appears to be your wish that I should hold the position another year, I accept it on the understanding that it is the unanimous feeling. At the same time I would have been better satisfied to have allowed some one else to get it. I feel very thankful to you for the honour you have conferred upon me and for the assistance you have given me in carrying out all the business of the meeting, and I shall endeavour through the present year to advance the interests of the Society; I would do that even although I was a full private. Accept my thanks, gentlemen, for electing me to hold the position for another year.

ELECTION OF VICE-PRESIDENT.

Chairman: I must say I think you have made a very good choice, and before the meeting closes we should have something else to move as to Mr. Sankey.

Mr. Sankey: I do not know exactly how to express my feelings in this matter. I take it as a very great honour to be elected for a second term as Vice-President. I agree with what our President has said about changing officers. I believe that in an association of this kind a change is beneficial. It ought to be our aim to aspire to office. As each year comes round I always feel that I have not done enough.

ELECTION OF SECRETARY-TREASURER.

Mr. Abrey: I beg to move, seconded by Mr. Fawcett, that Mr. Willis Chipman be re-elected Secretary-Treasurer. Of course the question of changing officers from year to year does not come in here.

Chairman: I am sure that I agree with your choice in the matter. I have thought that whoever is changed we should not change our

Secretary so long as we can keep him. We might say "Men may come and men may go, but Mr. Chipman goes on forever."

Mr. Chipman: I thank you for the honour in electing me, but I may also state that the work of the Secretary is not quite so easy as you might imagine. It is not difficult, but it takes considerable time. I am afraid that after this year some other aspiring young member will have to accept the office. I thank you.

ELECTION OF COUNCILLORS TO FORM EXECUTIVE.

Chairman: It is now necessary to elect three Councillors who shall constitute the Executive Committee.

The following were nominated: Mr. Stewart, Mr. Gaviller, Mr. P. S. Gibson, Mr. J. P. B. Casgrain, Mr. McAree, Mr. Unwin.

Moved by R. H. Coleman, seconded by M. Gaviller, that B. J. Saunders, H. L. Esten and A. J. Van Nostrand be scrutineers of ballots for 1889. Carried.

NEW BUSINESS.

Moved by V. Sankey, seconded by T. Fawcett: That the Committee on the Boundary Commission be permitted to report again as it is not yet able to bring a definite report on the matter. Carried.

Mr. Sankey: In last year's Report a Committee was appointed, of which I was the Chairman, about the Boundaries Commission Scheme, as suggested by Mr. Ogilvie. We have not been able to bring before the Association a full report of what we would suggest. We have now Mr. Ogilvie with us and I would ask the Association to re-commit the matter to us. Mr. Ogilvie will be of great assistance to us.

Moved by V. Sankey, seconded by G. B. Abrey: That a committee of three, consisting of T. Fawcett, and the mover and seconder, be appointed to consider the question of the decimal *vs.* duodecimal systems, as referred to in the paper by Mr. Sankey, and prepare a short statement to be printed and sent to our sister associations and others likely to be interested, the publishing of this statement to be under the direction of the Publishing Committee. Carried.

Mr. Sankey: The reason I make this motion is because the matter is rather a hobby of mine. It is a matter that this Association ought to take up. It is one that will certainly bring no discredit on our Association. It may take two or three years to get it to a conclusion, but it is interesting to know what the public at large think of it.

Mr. Abrey: I may say that, as every one knows, it would simplify our work very much and lessen the risk of error. It is a great advantage. With the other system there is a great deal of risk and it is tedious. I do not know that there would be much trouble in getting this system adopted.

Mr. Gibson: I think if the matter was brought before the Minister of Education, it would help us. It should also be brought before the manufacturers.

Moved by Mr. Van Nostrand, seconded by Willis Chipman: That this Association urgently request that Mr. Gibson prepare a paper for our next meeting on "Compiled Plans." Carried.

Chairman: Under the head of new business, Mr. Coleman has a question that he would like discussed shortly.

The difficulty Mr. Coleman had he explained to the Association by diagrams.

Moved by E. Stewart, and seconded by Lewis Bolton: That a vote of thanks be hereby tendered the Toronto City Council for their very great kindness and attention to the members of this Association on their present visit to the city. And that a committee, consisting of Mr. Ogilvie, and the mover and seconder, be appointed to draft a resolution to be forwarded to said Council. Carried.

Moved by Mr. Esten, seconded by Charles Murphy: That a vote of thanks be tendered to the exhibitors at this meeting: Rice, Lewis & Co., The Harris Paint & Colour Co., Hart & Co., Mr. Sanderson and Mr. Sankey; that the Secretary signify the vote to them. Carried.

The fourth annual meeting adjourned at five o'clock.

After adjournment many of the members visited the rooms of the Amateur Photographers' Association and spent an interesting half hour examining their collection of photographs, and the latest and most approved apparatus for securing negatives.

VOTE OF THANKS.

TORONTO, Feb. 29th, 1889.

To the Mayor and Aldermen of the City of Toronto:—

GENTLEMEN,—By a unanimous vote of the members of the Association of Provincial Land Surveyors in convention to-day it was resolved that a hearty vote of thanks be tendered your honourable body for the kind reception and hospitality shown the Association on their present visit to your city; and that the undersigned Committee should convey the same to you. In addition to this we would say, on behalf of the Association, that as a body we are greatly pleased with the appearance of your city, which through your kindness we were enabled to view to great advantage. We were pleased, not only at viewing the immense progress your city is making in enlarging its bounds and increasing its population, but also that you are keeping pace with the age in providing for the health and also for the conveniences of life of its rapidly increasing numbers. In conclusion we may say that our Association, embracing members from all parts of

the Province, all wish the greatest prosperity to the City of Toronto, the capital of our Province. And thanking you again, gentlemen, we have the honour to be your obedient servants,

E. STEWART,
WM. OGILVIE,
LEWIS BOLTON.

MEMBERS IN ATTENDANCE AT THE TORONTO
ANNUAL MEETING.

Abrey, G. B.	Fawcett, Thos.	Ogilvie, Wm.
Aylsworth, C. F.	Foster, F. L.	Paterson, J. A.
Blake, F. L.	Galbraith, Prof. J.	Proudfoot, H. B.
Bolger, T. O.	Galbraith, Wm.	Robertson, Jas.
Bolton, Lewis.	Gaviller, Maurice.	Rogers, R. B.
Bray, Edgar.	Gibson, P. S.	Sanderson, D. L.
Browne, H. J.	Hanning, C. G.	Sankey, Villiers.
Browne, Wm. A.	Kirk, Jos.	Selby, H. W.
Campbell, D. S.	Kirkpatrick, G. B.	Sherman, Ruyter.
Casgrain, J. P. B.	Klotz, O. J.	Speight, T. B.
Chipman, Willis.	McAree, John.	Stewart, Elihu.
Coleman, R. H.	McEvoy, H. R.	Tyrrell, J. W.
Davis, John.	McKay, Owen.	Unwin, Chas.
Deans, W. J.	Miles, C. F.	VanNostrand, A. J.
Ellis, H. D.	Murphy, C. J.	Wheelock, C. R.
Esten, H. L.	Niven, Alex.	Whitson, J. F.

CIRCULAR NO. 22.

RESULT OF ELECTIONS.

President Alexander Niven (by acclamation).
Vice-President Villiers Sankey (by acclamation).
Secretary-Treasurer Willis Chipman (by acclamation).

Councillors.

Elihu Stewart 44	Charles Unwin 29
John McAree 35	M. Gaviller 18
P. S. Gibson 35	J. P. B. Casgrain 13

I therefore declare the following Councillors elected:—Elihu Stewart, John McAree and P. S. Gibson.

WILLIS CHIPMAN,
Secretary-Treasurer.

Examined and found correct.

(Signed) B. J. SAUNDERS,
Scrutiniser of Ballots.

REPORT OF THE SECRETARY-TREASURER.

MR. PRESIDENT :—The undersigned herewith submits the following report on the business of the Association for the year 1888 :—

Our membership remains where it was a year ago ; 118 paid up members.

The following Counties have no representatives on our list : Gleggarry, Stormont, Grenville, Prescott, Russell, Lanark, Prince Edward, Addington, Lennox, Wentworth, Welland, Haldimand and Norfolk. All the towns of importance and all the cities are now represented.

A group of Counties at the extreme east end of the Province, and a group west of the Niagara frontier are the chief ones not represented.

Two meetings of the Executive were held in Toronto during the year, which were well attended.

The following circulars have been issued by the Executive since our last meeting :—

No. 15—Result of elections.

“ 16—Notice to pay fees.

“ 17—Notice of issue of “ Survey Act ” and other Acts in pamphlet form.

There are some members of the profession who neglected to pay their fees even after receiving several notices that they were due. The business of this Association is conducted upon a strictly cash basis, and any surveyor who considers that he does not get full value for his subscription fee should, of course, withdraw ; but if any of very old members were so situated that they could not remit, according to notice, and found that their names have been omitted from the list of members, we may state that by remitting at any time they can again become members, as according to our Constitution there is no initiation fee, and there are no back fees or fines imposed.

The Secretary begs to acknowledge the great assistance given the Executive by the members of the Committees on Entertainment and Publication in the work of the year.

Your attention is again called to the fact that those who advertise with us should be better patronized than they have been in the past.

Our Association exchanged Proceedings during the year with the following Societies : Michigan Engineering Society, Ohio Society of Surveyors and Civil Engineers, Indiana Society of Civil Engineers and Surveyors, Illinois Society of Engineers and Surveyors, and the Arkansas Society of Engineers, Architects and Surveyors.

Copies of our Proceedings were sent to all libraries and scientific institutions that applied for them.

We now have in stock about 100 copies each of our Proceedings for 1887 and for 1888 ; the Proceedings for 1886 are now out of print.

The usual reduced rates have been extended to the members of the Association by the railway companies.

The financial condition of the Association is about the same as last year.

A statement of receipts and expenditure of the Association from January 1, 1888, to January 1, 1889, is appended.

All of which is respectfully submitted.

WILLIS CHIPMAN,
Secretary-Treasurer.

STATEMENT OF RECEIPTS AND EXPENDITURES OF THE ASSOCIATION OF PROVINCIAL LAND SURVEYORS OF ONTARIO FOR THE YEAR 1888.

1888.		RECEIPTS.	
To Balance for 1887.....			\$64 90
" Fees, 113 Active Members at \$3.....	\$339 00		
" " 2 Junior Members at \$3.....	6 00		
" " D. Beatty	2 00		
			<hr/> 347 00
" Advertisements, 1887.....	3 50		
" " 1888.....	84 00		
			<hr/> 88 00
" Proceedings sold.....			1 85
			<hr/>
* Total.....			<u>\$501 75</u>
1888.		EXPENDITURE.	
By Postage and Telegrams		\$51 89	
" Stationery, etc.....		5 00	
" Rental of Rooms and tables		15 00	
" Printing Circulars, Programmes, etc.....		49 03	
" " Proceedings.....		161 20	
" Engraving, Lithographing, etc.....		45 48	
" Express, Cartage, Freight, Duty, etc.....		29 15	
" Amount granted Stenographer.....		50 00	
" " " Secretary-Treasurer		40 00	
" Balance		55 00	
			<hr/>
Total.....			<u>\$501 75</u>

REPORT OF SCRUTINEERS.

MR. PRESIDENT,—We find upon examining the ballots that the following members were elected as officers for 1888-89:—A. Niven, President; V. Sankey, Vice-President; W. Chipman, Secretary; John McAree, H. B. Proudfoot, W. R. Aylsworth, Councillors.

C. F. AYLSWORTH, JR.,
OWEN MCKAY.

Scrutineers.

REPORT OF AUDITORS.

The undersigned Auditors beg to report as follows:—We have examined the books of the Secretary-Treasurer, and have annexed a statement showing the amounts of receipts and expenditure, which shows a balance on hand of \$55. We found vouchers for all accounts except postage.

All of which is respectfully submitted.

JAS. A. PATERSON,
D. L. SANDERSON.

Auditors.

REPORT OF COMMITTEE ON LAND SURVEYING.

MR. PRESIDENT,—Your Committee beg to report as follows:—

I. They would recommend a reconsideration of the Act relative to Town and Village surveys, with a view to amending the said Act.

II. A careful consideration of the amendment to the Act suggested by Mr. Niven last year in his Paper on Practical Surveying relative to running division lines in certain townships on the given astronomical course.

III. They would also suggest the advisability of endeavouring in some way to have brought before the Association at its annual meeting any difficult question that any of its members may at any time during the year experience in practice. It has been thought that the most effectual way to accomplish this would be for the chairman of your Committee to receive all such questions at any time during the year, and then at some date shortly before the regular annual meeting of the Association to call his Committee together and thoroughly consider and pronounce on such questions and report their decision to the Association.

Respectfully submitted.

E. STEWART.

Chairman.

DISCUSSION.

Mr. Stewart—I may say before moving the adoption of the Report with regard to the last clause it seems to me if we were to agree to the idea here we would make our meetings much more interesting than they are at present. We have come here to-day with scarcely anything definite for us to do. For two or three years we had a question drawer and some very interesting questions came up before us. The proposal made here is a good one and I think it would add

greatly to the interest of the Association if we would carry out this idea. My own idea with regard to this is, supposing any surveyor had a difficult question coming up in his practice, before it passed out of his mind let him submit it to the Chairman of the Committee, he would submit it to the Committee and they would consider it and when they came here they would be better able to give an opinion. Such an opinion should be worth as much as the decision of our Courts.

The Chairman—I would like to hear the views of any member who would like to express them. I would also like the Committee on Drainage to take up this matter in the same way. With regard to the suggestion here to take the place of the question drawer it has been suggested that any one having a difficulty in his practice during the year should send it to the Chairman of the Committee and the Chairman should send it to the Committee, and before the annual meeting they should compare their views and give their opinion then. I certainly think that would be a very good way of disposing of the matters, and an opinion of that kind would certainly have some weight and should be a good opinion, equal to some of the Courts and at all events better than some lawyers.

Mr. Aylsworth—The suggestion is a good one. If we had those question drawers and these difficult matters laid before them we would get some enlightenment. I have had a case where I have made a difference of half a rod in the measurements.

Mr. Sankey—With regard to the proposal it is a remarkably good one. We would get opinions worth something. Another point is unless we take down the suggestions made in these papers they have slipped our memory when the paper is read. The suggestion in that view is I think a very valuable one. Probably it would be well to put the matter in a definite form before this meeting closes and make it one of the rules of our Association.

REPORT OF COMMITTEE ON DRAINAGE.

This Committee had nothing to report.

REPORT OF COMMITTEE ON ENGINEERING.

MR. PRESIDENT,—The Committee on Engineering beg to report as follows:—

Pursuant to notice a meeting of the Committee was called in Toronto in December last.

Owing to some of the members being absent from home, and others residing at a long distance from the Queen City, only two

members of the Committee were present. The results of the work of the Committee is shown however by the number of Papers on engineering subjects prepared for this meeting.

As there is no precedent in our annual reports as to the line of work this Committee should pursue, we would beg to suggest an outline for the future.

We think the work might be divided into Railway Engineering, Municipal Engineering (including Drainage, City Water Supply, and Electrical Engineering), Bridge Engineering, and Mining Engineering, or such other divisions as the Committee should see fit; and that each member should have charge of one of these branches, and should be responsible for one or more papers in his branch of the subject. We would suggest that the above division be borne in mind when the members of this Committee are appointed. Each member should also prepare a short report bearing on his branch of the subject to be embodied in the general report of the Committee.

These reports might follow the outlines given in the report of the Engineering Committee of the Illinois Society for 1888, which is as follows:—

I. Call attention to important engineering works begun, finished, or contemplated during the year; giving reference to such plans and descriptions of the same as have been published.

II. Discuss briefly such topics of general interest to the engineer as call for a general expression of opinion, or a concert of action among engineers as a body.

III. Call attention to new publications and papers read before the various societies, which are of especial interest to the profession.

IV. Call attention to any general progress made in engineering methods or work.

V. Call attention to branches of engineering in which improvement in methods or work is badly needed.

VI. Call attention to failures of engineering works or projects.

T. HARRY JONES,
Chairman.

REPORT OF COMMITTEE ON LEGISLATION.

GENTLEMEN,—Your Committee on Legislation begs leave to report that they have had under consideration the proposed amendment to Surveyors' Act,—Circular 18; and also Mr. Sankey's notice of motion in respect to Registration of Field Notes of surveys for private parties, defining boundaries of lots in townships, villages, towns and cities; but your Committee is not at all unanimous as to the advisability of either of these matters being recommended for legislation.

Hence, your Committee would respectfully suggest that the same be brought up at our next annual meeting for the consideration and decision of the Association.

All of which is humbly submitted on behalf of your Committee by

WM. R. AYLSWORTH,
Chairman.

[Circular No. 18.]

PROPOSED AMENDMENTS TO SURVEYORS' ACT.

1st Amendment,—"The 46th, 47th, 48th, 49th, 50th, 51st, 52nd and 59th sections of this Act shall not apply to the survey of division or side lines of lots in those townships surveyed after the year 18....; but a surveyor, when called upon to run any division or side line between lots in any township surveyed after the year 18...., shall run such division or side line on the astronomical course given in the original survey thereof, as shown on the Plan and Field Notes of Record in the Department of Crown Lands."

Read last three paragraphs on page 49, and first two on page 50 (Practical Surveying) Proceedings of Association of Provincial Land Surveyors of Ontario, 1888.

You are requested to forward your opinion on above proposed amendment, to the President, Alex. Niven, Haliburton, on or before February 20th, 1889.

2nd Amendment,—"That in view of the fact that there are no adequate means whereby the field notes of surveys made for private parties on concession lines, side lines or other lines defining the boundaries of lots in townships, cities, towns or villages can be registered, and that in consequence much valuable information is lost, this Association therefore suggests that the following means be adopted:—

"Surveyors shall prepare and draw up concise field notes of such surveys, with a plan, if necessary, and shall deposit same in the Registry Office for the county. The surveyor to be paid a reasonable fee by the Registrar, who shall charge the same in the expenses of his office. A fee shall be charged to all inspecting said field notes, a percentage of which (to be fixed) to be paid to the surveyor."

Will you kindly give the above your careful consideration, and be ready to give the Association the benefit of your advice.

If possible bring with you some field notes such as the above refers to, so that the probable size of such may be arrived at.

DISCUSSION.

The Chairman—I will read the answers I received to the Circular No. 18, we sent out. The following were in favour of the proposed amendment:—(1) F. Bolger, Penetanguishene; (2) W. R. Burke,

Ingersoll ; (3) Chas. E. Fitton, Orillia ; (4) Jesse N. Bolton, Albion ; (5) Peter Burnet, Orillia ; (6) James Warren, Kincardine ; (7) Jos. Kirk, Stratford ; (8) T. Harry Jones, Brantford ; (9) W. E. Yarnold, Port Perry. Against it : (1) C. F. Aylsworth. Neutral : (1) Lewis Bolton, Listowel.

Mr. Stewart—I think the proper way would be to refer this to the Legislation Committee, and let them report on it. I think after we have their opinion it would be a great benefit to the Association in arriving at a conclusion.

Mr. Sankey—I do not know whether my motion is an amendment. I do not suppose that this should become part of our regulations unless the Legislation Committee had something to do with it. I think it would be well that a sub-committee be appointed to look into the letters just read and bring up the matter again before we adjourn, so that the members will have it before them.

Mr. Aylsworth—In reference to the amendment, I understand from one of the letters that all you had to do was to go to the post and get your meridian. I do not think this is so.

Mr. Kirkpatrick—Most of us approve of the idea of just going direct to the point and making an astronomical observation and running the line. But it would be found in nine out of ten cases that the posts are not on the corner of the lots. One often finds that in a few years a great number of the distance posts are gone. A fatal objection is that when taking an astronomical observation you would not be able to command the elements. You would have sometimes to wait two or three days until the weather gets fair. How is this going to pay you? When we go to the Legislature with a Bill they will see that this is more expensive and will throw out the Bill. The object of all legislation is to cheapen it to the public. I think it is better to leave well alone.

Mr. Chipman—I think the meeting is losing sight of two or three facts. One is that we should endeavour to do our work in the most scientific way possible—not the cheapest way. Cheapness should not be the greatest element in favour of a system. Although it might be expensive to wait for the elements, yet Science may often tell us what kind of weather we are going to have. Another thing, you have not got to stay up all night to take observations. I have not taken a night observation for five or six years. I take them in the day time. A modern surveyor can take observations just as well during the day as at night.

Mr. Stewart—It would be far more work than the old system. There is one way that suggests itself to me. That is where the lines are run at right angles, the right angles might be run off the concession line. The side lines would be correct also.

The Chairman—In reply to the remarks of Mr. Kirkpatrick as to the elements, Mr. Chipman has stated that the observations could be made during day, still the majority of us stick to the night yet. While there is some truth in what they say about waiting for an

observation, it does not often happen and we can very often know what the weather is going to be. I was employed one time by a poor man settled in rear of Lots 18 and 19 in the 3rd Concession, and the first thing I did was to go to the side road between 15 and 16 and run across that mile and half to get the bearings. The land was rocky and some places 200 or 300 feet high. I took a day and a half with a gang of men to do this. I had to charge \$15. That was a hardship. If the Amendments had been in force I could have gone at night and made the observation and could have run the line next morning, or, perhaps, living in that neighbourhood, I would not require to take an observation on every concession. A surveyor in practice in the neighbourhood will have after a while a great number of observations, so that it will become only necessary to make observations about once in six surveys. The object I had in view was to save time, trouble and expense. It took me two and a half days to do what could under the new Amendment be done in a few hours.

Mr. Aylsworth—You might have two or three people interested, so that would bring the price down to a reasonable figure. Then again, to recognize your Survey System, where you had to charge \$15, you might have to go into the back country and take two or three days as you might have a cloudy evening, so that you would have to charge him \$15 or \$18, the same as what you did charge in the other case.

The Chairman—In the majority of cases it would be better. As I understand the Act these lines are all to be run on the Astronomical course.

Mr. Foster—In the case of Surveys in Townships they do not take observations on each line; they run them on such a line as to give them a certain bearing. That line is run not from Astronomical observation. It is mathematically correct, but if run out could not be run out correctly. It would not entirely agree with it.

The Chairman—I understand what Mr. Foster means. As the law stands now those lines are to be run on the same course as the side line. It frequently happens that that line is on the course N. 20° 51' 40" W. and that there might be a difference of twenty chains or greater. If you were to produce a line here you might cross that line two or three times before you got over to the next concession. I have seen the lines in one concession 4° different from the lines in the other one, and producing a line here with a view of striking that line, I would not guarantee that you would come on it. I have often been tempted to run them on an astronomical bearing.

SECOND AMENDMENT TO SURVEYORS' ACT.

Mr. Sankey—I will further make this proposal. I may say that for some time past I have been of the opinion that surveyors are locking up in their vaults a lot of information that may or may not be worth something to us all. It depends if parties requiring surveys happen to go to those surveyors or not. The subject of permitting surveyors' field notes to be brought into a Court of Law as evidence

of a survey has been taken up before now at meetings of this Association. I understand that the principle of admitting a surveyor's field notes as evidence when the surveyor is dead is a principle that lawyers will not admit. From the information we have of how those field notes are sometimes got up the objection is well taken. The surveyor goes out and takes a lot of notes that really have no bearing on what he is going to do, and having taken a lot of notes and spent a day or two in connection with the survey, he on mature deliberation practically does something that the leading evidence of the field notes will not warrant when he gets back to his office. And the field notes as such are not a proper or concise record of what he did but are only a preliminary that led him to a conclusion. As regards surveys the public lose all trace unless there is some means adopted of putting the field notes on record. If a surveyor practises for some time he gets a local reputation and parties go to him and get him owing to the fact that he has certain field notes. If that surveyor dies these field notes are publicly lost and his family lose any value that the field notes might have had. A surveyor leaving a locality takes his field notes with him and they are of no value at all. The proposal is that after the survey is made the surveyor should make out a precise record of what he has done. Two or three sheets of foolscap would be enough. A little plan would be sufficient to illustrate what he is driving at. The surveyor should have a reasonable remuneration for the time he takes to draw up the field notes besides what he gets from the man who employs him. He ought to get this from the Registrar just the same as the Registry fees for registering documents; this fee might easily be included in that charge. The surveyor gets so much for his work, apart from that he reaps nothing from the field notes and any other surveyor goes to the Registry Office and at the cost of \$1 finds out what was done and the Registrar could charge so much (of which 50 or 60 per cent. or something like that should go to the surveyor), so that so long as the surveyor is alive he reaps the benefit from his work. I understand in Quebec for a certain number of years after the death of a surveyor the public have to pay a certain fee for the use of his field notes. It certainly is a matter well worthy of our attention, but there is no use discussing these matters till we put it in more practical shape perhaps. I shall be glad to hear from the members of the Association who are practising in the country.

Mr. Stewart—How is the Registrar to be reimbursed?

Mr. Sankey—Charge it in the expenses of his office.

Mr. Chipman—The Registrar is to be reimbursed by people coming and looking at the surveyor's field notes.

Mr. Stewart—You say all surveyors are to be compelled to take these notes to the Registrar and he is to pay them for it.

Mr. Casgrain—If we are called upon to run a boundary line in Quebec we must give the Government a concise report and say whether it was with the consent of the parties, etc., etc. There is a sort of deed drawn up by the surveyor and it is signed by the parties.

The surveyor is paid for it, over his day's work. He gets \$1 a copy for it if not more than 100 words. Whenever that report is wanted they go to the surveyor and get another copy. If the surveyor leaves the country he is obliged to leave his reports in the Court House, and one can get a copy there by paying for it. If the Surveyor cannot be found then a copy of the report can be produced. With that system any boundary can be put right. Field notes would of course not be of very much use to a party not in the business, but such a report as this can be used.

Mr. Stewart—The Surveyor does not receive in that case anything from the authorities.

Mr. Casgrain—Not a cent. By our Act we are not obliged to give any man a report.

Mr. Aylsworth—With reference to Mr. Sankey's idea of supplying field notes, supposing he deposits them in the Registry Office, a surveyor has to do all the work over again. What use would the field notes be unless locating the posts? I do not believe in supplying other surveyors with information about posts.

Mr. Stewart—I think the way it is done in Quebec is a good way. In some respects I think their law is ahead of ours.

Mr. Sankey—There is no question about it that those field notes are of value. In many cases surveys made between five and ten years ago cannot be retraced by a surveyor, whereas by this new method one would only have to go to the Registry Office and find the old field notes of the last survey. I think a private individual if he finds a surveyor had traced the lines before, would go to him because he would think he would get the survey easier and cheaper. The principal point is:—"Is it the opinion of this Association that it is advisable to preserve a legal record of surveys?" If it is found that it is necessary the details can easily be settled.

The Chairman—One or two points suggest themselves to me in this discussion. It frequently happens that a person is running a line a long way from the Registry Office. It would be practically impossible for the surveyor to go to that Registry Office and examine these notes. There would be more or less expense. Suppose you apply this in the City of Toronto, any number of surveyors make the same survey. Has every surveyor to record his notes. If so, the Registry Office would soon be full of notes. You say in your proposal the Registrar is to charge these in the expense of his office. I do not understand what is meant by that.

Mr. Sankey—The Registrar, as I understand it, pays his own assistants, and he takes all the fees that are collected in the office up to a certain figure. I do not see that there can be much greater difficulty in charging \$1 or \$2 for each survey than paying an amount for registering a deed.

REPORT OF COMMITTEE ON INSTRUMENTS.

MR. PRESIDENT,—Your Committee on Instruments have very little to report as regards their official labours since our last meeting. The Toronto firms of instrument makers were waited on and invited to make an exhibit of their goods at this meeting, but they declined on the plea that they had nothing novel to shew in addition to what was shewn last year. They thought it not worth while to exhibit the same things over again.

Messrs. Hart & Co. responded to the invitation by making an exhibit of draughtsmen's supplies, books of tables, etc.

No attempt was made to secure an exhibition of instruments from American makers, as the attempts in this direction made by a former Committee disclosed the fact that the customs regulations between the two countries stood in the way.

This incidental mention of the customs duty on Surveyors' instruments will serve as an introduction to a few remarks on this subject which your Committee desire to make. We cannot forbear to record our opinion that the duty on Surveyors' and Engineers' instruments is altogether too high, and that a combined effort by the different Surveyors' Associations and the Engineers' Society of the Dominion should be made to have a change made in the tariff. From the larger instruments the duty should be removed altogether, and on all others it should be reduced to not more than 15 per cent. at the highest; at present the duty is 30 per cent. We shall not go into a long argument in support of the change we have suggested, but will say briefly that the duty is, pure and simple, a tax on the Surveyors and engineers of the country.

It is a prime article of belief in the fiscal creed of the advocates of protection that the heaviest duties should be laid on those things which can be profitably produced at home in order to develop the manufacturing interests of the country, while a nominal duty, or the lightest duty, should be placed upon articles of importation which from natural or exceptional circumstances must come chiefly from abroad.

Now, surveyors' and engineers' instruments come under the latter category; it is no disparagement to native talent and enterprise to say that for an indefinitely long time to come these instruments, especially those of the more expensive class, must be imported. In the first place the whole Dominion, even, is too small a constituency to support even one establishment for the manufacture of high-class instruments; such makers as Troughton and Simms, and some of the German artists, sell their instruments all over the civilized world, not excepting the United States, where there are several excellent makers protected in the patronage of fifty millions of people by a duty of 40 per cent. Our Canadian dealers will find it more profitable to sell the work of the English and German or American manufacturers than to attempt to produce the home-made. Again, it stands to reason that the older

and more populous and more wealthy countries must outrival the newer and less populous and poorer countries in the production of works of art; every one knows that this holds in regard to the fine arts of painting and sculpture and music, and it holds also in respect to the production of the finest class of mathematical instruments, which are the highest achievement of mechanical constructive art.

The fact that our instruments are on the customs list described as "manufactures of brass" is in itself sufficient to shew the ignorance of the customs department in regard to the surveying and engineering professions, and is an indication of the urgent necessity that exists for us to assert ourselves and secure our rights. But every member of the surveying and engineering profession in the Dominion is, I am sure, convinced that the duty on our instruments should be greatly reduced, and the practical consideration which your committee desire to insist on is that in their opinion this injustice can be lifted from us if the various associations throughout the Dominion whose interests are affected will only unite and bring the matter before the customs authorities, and your committee hope that during this present session of our Association some steps will be taken towards communicating with the kindred societies in the Dominion to ask their coöperation in an attempt to remove the common hardship.

Your committee beg to direct attention to the fact that there is not, so far as they are aware, a really good book of mathematical tables for field use. All of the books, while they are too bulky by reason of their containing irrelevant matter, are at the same time deficient in matter that would be most useful. One essential in such a fieldbook should be a Traverse Table, calculated to every minute of the quadrant. With such a table the position of points on a traverse survey of any kind could be found as readily by computation as they are now by the usual method of plotting, and angles could be plotted by the method which is capable of greater precision than any other.

Another book which, in the opinion of your committee, is needed by many members of our profession is a text book of map lettering. Any of the books at present in print are comparatively useless to the ordinary surveyor, the letters of nearly all the alphabets which they give being difficult to draw an account of the number of curves. The *block letter* is the one on which the average draughtsman depends for expressing the titles of his plans. A manual which would give the various modifications of the block letter with a similar development of the small Roman would be really useful to the majority of us who have any lettering to do, and this is a great deal more than can be said of the works now on sale.

Such a manual, besides giving the alphabet should give examples of combinations of the letters of the different alphabets, as they would appear in a well-designed title on a map.

In conclusion your committee observe that the work which the various committees of our Association can accomplish from one annual meeting to another can only reach its highest point of efficiency through the coöperation of all the members of the Association. If any member meets with anything in his practice, or in his

reading, or in any way that would be likely to prove of interest to the profession, or if he has any suggestions to make on any of the various matters which concern us, he should feel it to be his duty to communicate his information or his ideas to the chairman of the appropriate committee who would thus be furnished with data for accomplishing the object for which his committee existed.

All of which is respectfully submitted.

JOHN McAREE,
Chairman.

DISCUSSION.

Mr. McAree—In moving the adoption of this report I would like to hear the opinions of the surveyors on this question. We will have to assert ourselves. I think the duty is too high on our instruments. The practical point is that we ought to combine with the Engineers' Association when we will likely be able to have our rights vindicated.

Mr. Aylsworth—We might have some difficulty in getting the duty off as it is the Americans who pay it.

The Chairman—With regard to Mr. Aylsworth's remarks I know I had occasion to have an instrument repaired in the States and I know that the Americans did not pay the duty on it.

Mr. Gibson—Our trouble is this, we have a pretty big debt in our Dominion and money has to be raised to pay it. I bought an instrument the other day for \$225 and had to pay \$67 duty. I think the suggestion is a good one. We surveyors should look after our own interests. I think the duty is excessive. Thirty per cent. is very high. I think the Secretary of our Association should correspond with the Secretary of the Engineers' Association, and we should have combined action.

Mr. Abrey—I think if we want a first class instrument we have to go away from Toronto for it, but for repairs I have had good satisfaction and new ideas carried out here well and cheaply. Certainly this large duty on instruments is a tax on knowledge. I think we have to pay too much for both our scientific books and instruments. I do not think it is fair that the users should pay all the taxes on this sort of thing.

REPORT OF COMMITTEE ON PUBLICATION.

MR. PRESIDENT,—There were 900 copies of our report printed and the members having got 800 copies there are still 100 copies in the hands of the Secretary for sale, the others were given to the sister societies in exchange for their copies. There was also a list of members printed by the committee and sent round with the Manual issued by the Crown Lands Department which was sent to all the municipalities in the Province.

Prof. Carpmael has prepared a paper which we thought would be read to the members at this meeting. The cost of this is \$25, and printing about \$10, and it will be for the Committee to say whether the Society will be able to publish this annually. I do not think our funds will permit us to publish this and pay \$30 or \$40. This, however, is for the next year's Committee to decide.

T. B. SPEIGHT,
Chairman.

REPORT OF COMMITTEE ON ENTERTAINMENT.

MR. PRESIDENT AND GENTLEMEN,—Your Committee on Entertainment beg leave to report as follows :—

A standing arrangement having last year been made with the Canadian Institute for the use of its rooms, no trouble was met with in regard to our place of meeting, and we have reason to congratulate ourselves on the ample and comfortable accommodation afforded us. The attendance at this, our fourth annual meeting, was greater than that at any previous one.

On the afternoon of the second day the members of the Association assembled at the City Hall, in response to an invitation from the Civic Reception Committee, and were welcomed to the city by Alderman Frankland, in a neat little speech. Ten sleighs were placed at our disposal, and the members were then given a drive about the city, chaperoned by Alderman Graham and the Secretary of the Reception Committee.

The Don Improvement, Gerrard Street Bridge, Rose Hill Reservoir, the new Parliament Buildings, Water Works and other places of interest were visited during the drive. At the Reservoir luncheon was prepared for the members and was duly appreciated by them.

Liberty having been given your Committee to add to its members, it was decided to invite all the members of the Association resident in Toronto to assist in making our annual dinner more attractive than those of previous years, and the additional entertainment afforded was due to the Toronto members as a body.

In the evening, after the drive, the annual dinner took place at the "Reform Club." and at 7.30 o'clock, about fifty members and guests gathered around the board. Justice having been done to the good things provided the following toasts were proposed :—

- "The Queen,"—Followed by all joining in singing "God Save the Queen."
- "The Ontario Legislature,"—Responded to by Aubrey White, Esq. and Kivas Tully, Esq.
- "The Toronto City Council,"—Responded to by Alderman McDougall, and Chas. Sproatt, Esq., City Engineer.

"The Canadian Society of Civil Engineers."—Responded to by Messrs. H. Smith, H. W. P. Armstrong, W. H. Merritt and William Armstrong.

"The Association of Dominion Land Surveyors,"—Responded to by Messrs. William Ogilvie, O. J. Klotz, Thomas Fawcett and J. P. B. Casgrain.

Mr. White then proposed "The Association of Provincial Land Surveyors," which toast was responded to by the President, the Secretary and Prof. Galbraith.

An adjournment was then made to the ante-room of the Club for the following entertainment:—

SONG..... "Sleep, My Lady."F. L. Foster.
 SONG.. "Never take the Horse-shoe from the Door." ..Capt. Manley.
 SONG..... "The Low-Backed Car."Kivas Tully.
 SONG..... "Bonnie Dundee."A. Niven.
 CHORUS..... "Rule Britannia."
 SONG..... "Pat O'Hara,"Villiers Sankey.
 STORY..... "The Yukon Miner."W. Ogilvie.
 SPEECH..... "Amateur Photography."H. Neilson.
 SONG..... "Schweizer Heinrich"O. J. Klotz.
 SONG..... "Annie Laurie."A. Niven.
 PIANO SOLO.....O. J. Klotz.
 SONG..... "Just Before the Battle, Mother." ..Capt. Manley.
 CHORUS..... "Auld Lang Syne."
 CHORUS..... "God Save the Queen."

Thus ended our annual dinner for 1889, and with it the duties of your Entertainment Committee.

Signed on behalf of Committee,

A. J. VAN NOSTRAND,
Chairman.

REPORT OF COMMITTEE ON BOUNDARY COMMISSIONERS.

MR. PRESIDENT,—With regard to this commission it is a matter that requires a very great deal of investigation and detail before the report can be brought out. We are not in a position to make such a report to-night. We wish to discuss with Mr. Gaviller some matters. The principal difficulty we have found in the way is the conflict that may occur as to the legal powers of such a commission:

1. Whether the court would be a final court.
2. Whether the powers of a County Judge could extend to questions which are at present only decided by the Chancery Division.

But still the Commission might be a sort of court of enquiry. They could take evidence and report on the facts to the higher Judge.

A court such as Mr. Gaviller suggests would no doubt be a very useful and practicable one. The head of the court should be a legal gentleman, and for that reason the matter is one that would require a great deal of care.

We do not want to bring this matter forward and have it thrown out on account of some little alteration. It is better to go slow.

Any suggestions you have to make in regard to what the powers of such a court should be would be most acceptable. I think there was a case decided recently in which the Canada Company were interested where the boundary commission would have been very useful. In that case, after a great deal of litigation and expense, the court found that a sufficient survey had not been made, and the whole case had to be begun over again at great cost.

V. SANKEY,
Chairman.

DISCUSSION.

Mr. Stewart—It may be well, as a compromise, to have such a commission appointed, and when a case came before one of the courts to have this commission as a sort of reference court to which cases could be referred the same as to arbitration. The first question is whether its decision would be final or should be open to appeal. My view is that it would be almost useless if we allowed an appeal. We might have a sort of commission of reference when it was just a question of survey. I do not think we should have such a radical change all at once.

REPORT OF COMMITTEE ON PROPOSED TARIFF OF
CHARGES.

Not less than \$6 per day to be charged for field and office work.

First assistant \$3, 2nd \$1.50 per day.

Not less than one-half day to be charged.

Days to be eight hours, including time going to and returning from the work.

No description to be drawn for less than \$1.

Services at registry office and at consultations not less than \$1 per hour, and no charge to be for less than one hour.

NOTE.—Extra copies of the "Tariff" will be sent to any member upon sending three cent stamp to the Secretary.

Single city lots not less than \$6 unless previous surveys have been made of adjoining lots on same plan, then \$5 to be charged.

All expenses, such as railway fare, hotel, conveyance of any sort, posts, etc., to be charged for as extra.

H. J. BROWNE,
C. F. MILES,
M. GAVILLER,
E. STEWART,
A. NIVEN,
T. B. SPEIGHT,
J. P. B. CASGRAIN.

DISCUSSION.

Mr. Aylsworth—Surveyors had been accustomed to charge \$4 a day when I went down to practise. When I started I charged \$6, but they would not pay it. I approve very much of that tariff; it is just the charges I have been accustomed to make always.

The Chairman—I started out over twenty-five years ago, and I adopted \$6 a day, and have never worked for less. You can get \$6 a day just as well as you can get \$4; I would rather see it \$8.

Mr. Abrey—The fee for a first assistant is intended for a man who is able to use the transit. As for \$6 a day, I have never since I practised seen a case where less was charged. Then the charge for meetings and consultations, etc., is low enough—\$1 an hour. We have to travel all over to make our field notes, file them, etc. Then our office rents are high in the city. I pay \$300 a year for a room. We must have a tariff to cover these small things. There is some difficulty in fixing a tariff to suit both the city and country, but I think by a consultation and talk we might arrange it better.

Mr. Chipman—I think this the most important discussion we have had. Every other profession has a tariff. We have to blame ourselves. I think there might be a difference between charges in the country for surveys and the town, but in the country a surveyor generally furnishes his own conveyance. I charge a man for making the plan I file and for the field notes. I charge \$6 a day for an assistant when he has charge of the survey. I have a considerable number of field notes. I have a hobby for buying field notes. They have cost me \$1,000, and I charge well for a reference to these notes. Take a surveyor who gets \$5 a day in the city, who has an office but no assistant. He does not get work every day, perhaps 250 days in the year. That would be \$1,500 a year. His office expenses will be \$500 a year, leaving \$1,000 for living expenses, and I think \$1,000 is too little for a professional man to exist on in Toronto. It may be enough in a village. I think the tariff should be increased fifty per cent., and if the Toronto surveyors will stick together, and not play a three-handed euchre game all the time, we will carry our point.

Mr. Gaviller—The feeling among the farmers is that they are very shy about having an assistant sent out. If the assistant is out along

with his principal we do not put him higher than say \$3. When the pupils are sent out alone we charge \$5 a day.

The Chairman—I know the country that Mr. Aylsworth practises in, and I know he can get \$6 a day just as well as \$4.

Mr. Robertson—How would you get at those who are charging lower figures? In township work some send in applications at a certain figure, and some are lower. The township always give it to the man who is going to do it cheapest. How will we arrive at this?

The Chairman—My opinion about that is that every member of the Association should be bound by the opinion of the Association to carry it out. The man living in the neighbourhood who charges the best prices will be most thought of in the end. I think if the members will carry out the tariff strictly and honourably, we will have no difficulty in getting the whole of Ontario under the one tariff. As far as townships are concerned there is no use in paying any attention to them; they would get it done for \$1 if they could.

Mr. Aylsworth—I know cases where the township council have employed men who were not engineers, and these men got into a mess, and the township had to fall back on a proper engineer at last.

Mr. Gibson—I think that tariff is a fair one, but there are some districts where the people cannot afford it.

Mr. Aylsworth—I see you are to charge \$6 for the first plan. It might take you three or four days to make the first survey.

Mr. Abrey—That is not for an original survey. If you are surveying four or five lots you are not bound to charge more than \$4 or \$5 each lot. Would you charge \$11 for two lots for the same man?

Mr. Browne—No, we would not.

Mr. Stewart—I think there should be copies of this tariff sent to all the surveyors in the Province.

Motion by Mr. Chipman, seconded by Mr. Abrey, regarding any Provincial Land Surveyor charging less than Tariff Rates.

Mr. Abrey—I feel that we must have some way of enforcing our opinions, or else they would be no good. That is my reason for supporting this motion.

Mr. Gaviller—I think the motion is rather premature, and puts us in the position of reporting our brother. We know that this tariff is a new thing, and we have had no rule, and we will have to get the public into the way of understanding what this tariff is. If we make this a case of reporting we will be tied down to this tariff, and will not be allowed more.

Mr. Stewart—We cannot get more than the legal fee.

Mr. Gaviller—That is for attending the Court.

Mr. Gibson—There is a difference between an Engineer and a Land Surveyor. There are persons appointed who are not engineers, but they compete with engineers. I consider surveying business requires a great deal of skill and ability. I understand this tariff is only for Provincial Land Surveyors. I would not vote for the second

resolution. I think this matter should be put in the same way as the lawyers' fees, then we would have a chance. I do not think there is anything gained by pressing a heavy fee where people are poor and unfortunate.

Mr. Chipman—I do not think we can go to the Legislature and ask for legislation unless we are united. I do not think that the surveyor works for the poorer classes of the community—not poorer than the lawyers. Doctors charge their fees all the same whether the people are poor or not, but in some cases where the people are unfortunate they let them off, through charity. We could do that also.

Mr. Ogilvie—It is so long since I have done any provincial work that I do not know that I can say much on the subject. When I practised in Ottawa I know we charged so much for all our work. I remember one instance where I made \$96 in one week. Next week I worked harder, and made \$16, and have only got half of it yet. We sometimes had \$6, and sometimes \$10 a day. There was no regular tariff, and everybody got all he could. I remember once in Ottawa a man asked me what I would charge to do some surveying for him. I said \$12. He said, "What do you think I could have got it done last winter for? For \$4," he said. I asked him why he did not let the other man do it, and he replied that he did not want to have to pay twice for it.

Mr. Coleman—In moving around the country I have learned this much, that the Association are making a mistake in making it a "Surveyors' Association." We all know that in the west part of the Province a large number of the Surveyors are Drainage Engineers, and if you do not intend to give them protection by this tariff a large constituency of the Association is lost. I know a large number of the Engineers west have taken offence at what has happened here; they think they have been slighted. The man who is making his living from drainage engineering ought to have the same protection as we have. I would like to know this: Do you intend, or do you not, to include the Drainage Engineers?

Mr. Stewart—As a member of the Committee I beg to say that the Tariff of Fees is established for the surveys of Land Surveyors, whether they are Engineers or not. It covers any Surveyor engaged in taking levels in connection with the Water Course Acts and Drainage Acts.

Mr. Gibson—Sometimes in working for a municipality you have sometimes to work for less than \$6, but you get more other times as an engineer.

The Chairman.—I think the intention of the Tariff is that those are the minimum charges. If any one wants to charge more it is all right. Sometimes the surveyor has the field notes of all the country round about, and does not require to go out, but he is entitled to charge all the same.

A division was then taken on Mr. Chipman's motion, and it was declared lost.

Mr. Chipman asked that the Yeas and Nays be taken.

PRESIDENT'S ADDRESS. .

GENTLEMEN OF THE ASSOCIATION OF PROVINCIAL LAND SURVEYORS OF ONTARIO,—I have much pleasure in extending to you a hearty welcome to this our Fourth Annual Meeting :

Under a kind Providence we have been permitted to follow our avocations since last we met, without, to my knowledge, the removal by death of any of our members.

We have been reminded of our mortality, however, by the death of one formerly connected with our profession, and who, for thirty-three years held a position in the civil service of our country. I refer to the late Thomas Devine, Deputy Surveyor-General of the Province of Ontario, whom many of us know and who passed away on the 14th of November last.

Coming to Canada in 1846, Mr. Devine shortly afterwards entered the service of the Department of Crown Lands. In 1872, the Ontario Government conferred on him the title of Surveyor-General, a position he held until 1879 when he retired from the service and returned to Ireland, his native country. After a few years' residence there he returned to Montreal, where he resided until his death.

Canada is much indebted to him for many beautiful maps brought out from time to time while in the employ of the Government. His services were recognized by the Royal Geographical Society which elected him a Fellow. He was also a corresponding member of the Geographical Society of Berlin and of the American Geographical and Statistical Society.

Our membership now stands at 118, a decrease of four since our last annual meeting. I believe that, by a united effort, we could largely increase our numbers—we want with us the *busy* men and those who take a pride in their profession. Let us hope that our membership may increase, and that our meeting together annually may have the effect of improving and elevating the profession.

The Survey Act was, during the Session of 1887 of the Ontario Legislature, very much improved, and further improvements are much needed. In fact a re-cast of the Act relative to Town and Village Surveys seems to be a necessity, and will be dealt with by the Committee on Land Surveying.

Other purposed amendments to the Act will come before the meeting for discussion.

The question drawer should bring before us many points that may be profitably discussed, and the discussion of these points is just what we want at our meetings—we want to combine the practical with the scientific. We should learn much from the experience of others and an interchange of ideas must result in good. During the past year the different Acts governing surveyors, printed in pamphlet form, under the reading of "Acts, Ordinances and Regulations Respecting Crown Lands in Ontario," has been issued from the Department of Crown Lands, and a list of members of this Association has been sent

out with this pamphlet to various quarters, as suggested by our friend, Mr. Kirkpatrick, in his address to you last year.

By reference to the programme, it will be seen that quite a number of papers are to come before us, and I trust that we may have a pleasant and profitable meeting, and that as time rolls on these annual gatherings may be looked forward to by the members as a short respite from our labours when, for a few days, pleasure may be combined with improvement, to the advantage of all connected with our Association.

Before closing I may be permitted to refer to a matter that should probably take form in the Land Surveying Committee, I mean that of a tariff of charges by which the surveyors of Ontario should be governed. It appears to me that something of the kind should be agreed upon. The members of the legal and medical profession have a tariff or scale of charges by which they are governed, and why should not surveyors?

I trust some one may, before the close of the meeting, bring in a motion upon the matter, and so give one and all an opportunity of expressing their views thereon.

The question of Incorporation is also one that should engage the attention of our Association as a number of our members feel that incorporation would be for the benefit of the profession.

I thank you, gentlemen, for the kind attention you have given me, and I now invite your consideration of the further business of the session.

A. NIVEN,

President.

February 26th, 1889.

PAPERS.

[*This Association is not responsible as a body for any opinions expressed in its Papers by Members.*]

ORIGINAL LAND MARKS.

By MAURICE GAVILLER, P.L.S.

WHEN we consider that volumes might be written upon the subject I have taken for my paper, I can only hope that if by this short essay some points are raised for discussion, and others incited to give us the benefit of their knowledge and experience in subsequent papers, that as an introduction to this most important subject a good result shall be attained.

DEFINITION OF AN ORIGINAL.

What is an original?

A post, monument or boundary placed or defined in the first survey, or subsequent survey (for re-subdivision or completion), done under proper authority by a properly qualified person.

See R. S. O. chap. 25, 50 Vic., 1887, sections 34 to 40, and subsections and sections 60, 62.

TO FIND AN ORIGINAL.

The authority given a surveyor to obtain evidence as to the knowledge of existence of an original boundary is defined in R. S. O. chap. 25, sections 71 and 72; but the manner of hunting up on the ground and compiling the affidavit must be governed by the circumstances of the case in hand, and the experience of the surveyor.

To quote from Bellow's and Hodgman's Manual of Land Surveying, "The thing to find out is, not where the corner or line ought to have been, but where it actually was." And again from same: "Do not give up a corner as lost while any means of finding its exact location are left untried."

PLANTING ORIGINALS.

How the measurements are to be made; material and manner of putting down original monuments for surveys done for the Government are given in the instructions issued for the survey; but the material and manner of placing boundary marks at street corners are still a fruitful subject for discussion.

Great care should be taken by the surveyor in following out instructions given by the Government. To quote again from same manual as above: "Want of due care and precaution in making permanent land marks upon the ground at the time of the original survey is the fruitful cause from which arises most of the litigation about boundary lines."

The durability of different woods when used as land marks ascertained by actual experience from seeing them in different kinds of ground; also, the ages of trees as defined by growth rings, are subjects upon which our space will not permit us to touch. I am sure all of us would like to have more information on these points.

TAKING EVIDENCE AS TO POSITION OF ORIGINALS.

In cases where the original survey has been only some few years made, the clearings are not extensive, and as in late surveys of townships bearing-trees have been marked, the task of getting up evidence is comparatively easy. In old settled townships it often requires the exercise of much care and patience to ascertain the position of the *nearest* original.

In a case of this kind, the oldest inhabitant of the vicinity should be inquired for. Often we are told that he is too weak to come and point out the spot, or "getting simple." It is as well to see him if possible. I have often acquired information in this way that brought to the recollection of the younger residents the position of the point required, and was able to compile an affidavit confirming the old man's description, and to satisfactorily establish the starting points. Endeavour to write down the words used by the person making the affidavit, asking questions when necessary, but avoiding as much as possible "leading questions." To quote Skeels in Michigan Report, 1865:

"Wherefore I will take what they say in spirit and in letter,
Mankind should be, like rivers, free—the less they are damned the better."

THE R'S.

All surveyors are aware of the importance of defining the number and position of the *R*s, as in many cases one or more of the marks may have been obliterated by decay. If a post, when first seen by the person giving evidence, it may have been turned around, if a tree, fallen down; besides there is a strong inclination to recollect the *R*, being so placed as to extend the lot boundaries as much as possible.

In such cases try and find out if your informant saw the blazed line for road before the road was cut out, and, if so, on, or on which side of the line the post stood when first seen by him. I recollect a case in which a surveyor located a side road, from the position, as sworn to him, of the *R*s that had been on a decayed tree, taking it as centre of the road. It was afterwards ascertained that a blazed line had been run for this side road, record of which, in the original field notes, was in the Crown Land Department, and noted as having been

run from the original tree, between the adjacent lot and the side road allowance.

This, of course, changed the position of the original point to one side of the road allowance, which caused much dissatisfaction to an adjacent owner. I was employed by the township council to investigate the case. I took some six or eight affidavits as to the marks that had been on the tree; not one agreed either as to the number or position of the *Rs*. It was evident that all the settlers acquainted with the point considered that the position of the road depended upon the *Rs* marked upon the tree.

Without saying for what purpose, I got in same affidavits accurate evidence as to the old blazed line, then mostly cleared off. That there had been only one blazed line at that place, running towards the north, and that the old fence, some of which still remained, had been built where the line had been cleared away, and by that means settled the dispute.

REMOVED ORIGINALS.

Where an apparent original post is found, an affidavit is often necessary to determine the length of time this post has been seen standing in the same place, and also as to the probability of its not having been moved from one place on the line to another, and become, to use the expression of an old D. P. S., "A perambulating original." I have come across several cases of this kind. One in particular, in a township in the County of Hastings, noted for its iron ore and peculiarly mixed condition of its concession lines. Two of these lines met on a convenient island, leaving a space nearly equal in width to two concessions for some three miles from end of lake to boundary of township. The lumberman came in, the farmer after him, and myself to locate the latter, having been referred to the "walking boss" of the lumberman for information. I was informed by him of the location of a concession line. On this line, he said, I would find a squared maple tree, marking the position where an original post stood, this post being in a crevice of the rock close by. The post I found an undoubted original, point decayed off, lot numbers visible, but concession number obliterated. The original survey had been made some forty years. The blazes of the asserted concession line looked suspicious as to age. I cut out and tested a number of them. The asserted concession line was only some twelve years old. Some original line had lost one of its original posts.

COMPILING AFFIDAVIT.

It is important, also, in many cases to include in the affidavit a statement as to what the party giving evidence *has not seen* as well as what he *has seen*. I have had a man state so positively, that neither he or anyone he knew of had seen a blazed line in a certain locality, that I did not include in his evidence anything to that effect, concluding that the point could not come up. This same man afterwards made an affidavit to another surveyor that he had seen an old blazed line at that place.

USE OF COMPASS.

The ordinary surveyor's compass, the use of which, as an instrument for defining new boundaries has almost been abandoned, is most useful in tracing up old partly obliterated lines, that were in the first place run with that instrument.

BLAZING.

Where the compass is used the line run should be blazed on the two sides of the tree, in the direction of the line only.

Where a transit line is run the blazes should be on three sides, two as on former line, and one on side of tree next the line.

MARKING.

I have known an undoubted original abandoned as such because the marks on it had been made with a knife, the probable loss of the marking iron at the time of its being planted not having occurred to the surveyor investigating.

REGISTERED MARK.

Would it not be practicable and useful for each Provincial Land Surveyor to have a registered private mark to be put on important monuments marking boundaries established by them? They might be similar in design to the registered "brands" of the cattle ranches in the North-West.

LOCATING ORIGINALS.

When locating originals it is important to have on the ground a copy of the original field notes showing the topography in the vicinity. Ascertain by chaining and noting, topography of the line, the distances between some well defined streams or hills as near the desired point as possible. Compare these with distances given in original field notes, making allowance for apparent difference in length of chain (which is often detected) and check to the point as sworn to, or that it is intended to examine by digging. Michigan Report, 1885, gives an excellent method of proceeding to search the ground, from which I make a short extract:—

"In seeking for the stake remove carefully all debris not connected with the search that may be upon the ground sufficiently to have a good opportunity for investigating. Next remove the sods, if any; then carefully hoe away, or remove with the spade or shovel, the surface earth an inch or so in thickness, and remove it further than would be necessary if all things were recorded correctly; proceed in this manner to the desired depth, and usually if you have properly located the spot, you will either find the stake, or observe as you proceed deeper and deeper the discolouration imparted to the earth by the decayed stake, or possibly the hole with only the web-like fibres of the long since decayed stake."

PRESERVATION OF POSITION.

To preserve the knowledge of the position of original land marks original methods have been employed. In England we are told the custom prevailed in many parishes of what was termed "beating the bounds." A number of youngsters, accompanied by their elders, who were well acquainted with the boundaries of the parish, being armed with switches, beat around the bounds. In fact it is even asserted that at intricate points the switches were applied to the persons of the boys themselves to make a lasting impression upon their memories. So lately as in December, 1888, we find an illustrated account in the London *Graphic* of "walking the parish bounds" at Bisley, in Surrey: "On Ascension day of that year the rector, wearing a cap and gown, and carrying the parish map, was followed by two boys with flags, and others, some with spades for use when required. Several of the party were successively bumped according to the traditional idea that this would fix the boundary line in their memories, and some resisted the ordeal so strongly as to return minus several buttons. The rector came in for his share with the rest, but took matters more philosophically, submitting quietly to being bumped against an old barn door."

PRESERVATION OF POSITION OF ORIGINALS.

In this country, as the old settlers who located their lots by the original land marks hewed their clearings out of the forest, and did settlement duty to open the way for the ancient corduroy, are fast dying out, the difficulty of getting evidence as to the position of old land marks is increasing yearly. As a rule we find that the present generation, where the boundary fences have been long built, has paid but little attention to the original corners. I remember a case in which the original marks had been cut off a tree, and for safety deposited in the garret of the magistrate's house. The house was burned, and the chips with it. The stump of the tree remained in position, but trouble began as to location on the stump of the removed marks. When staking out the Crookshank Common that formerly existed on Bathurst Street of this city, I had taken some time to locate a street corner, and driven the post one evening. On my return next morning the post was gone and the hole obliterated. A man living near by came up and informed me that an old man and woman had gone along the street, collected many lot stakes in a bag, and carried them off. "But," he said with an air of triumph, "I have got that post you took such trouble to plant; it is up in my house."

To stow away with the intention to preserve the original post for lot corner in a farm house is not such an uncommon occurrence, the remark being made, "Oh, it was decaying away!" But the importance of accurately marking the place where it stood seldom seems to have occurred to the careful ones.

LEGISLATION FOR PROTECTION OF ORIGINALS.

In Ohio Report, 1886 (J. D. Varney), are these remarks, which, I submit, apply well to us in this country: "Accepted land marks become more and more valuable each time a recorded measurement is made from them. We need legislation to protect us from the careless moving of them. Our criminal laws are adequate to punish intentional moving with a purpose to do wrong. . . . The legislation we need is to provide against the excuse, 'I did not know there was a monument in that place.' The first step in legislation should be a public record of the location of monuments, as will be easily accessible and readily understood, and then that such record should be a legal notice to all people, so that the removal, without proper provision for preserving the point, shall be *prima facie* a criminal act, to be punished with a penalty as shall impress people with the fact that monuments are sacred things—surveyors' idols, if you please, to be removed only by due formality if not without ceremony."

RECORDING POSITION OF ORIGINALS.

Our Surveyors' Act provides that affidavits as to boundaries shall be filed in the Registry Office; but there is no provision for marking or recording on the ground the position of a decayed original monument, so that it can be known as such by others coming after. It has been too much the case that the knowledge as to the position of an original point has been treasured up by surveyors, kept to themselves, and used in court as a surprise to break up a survey made by another. When requested to plant a stake or stone in place of a decayed original, or at an established point, it is as well to make a practice, when possible, to have two or more young men, resident in the vicinity, present on the occasion as witnesses that the correct point has been established, and to record their names in the note book entry of the transaction.

In conclusion, I would say to the members of our fraternity, carefully establish your points, and true record keep of the same, not only for your own information and benefit, but consider yourselves placed in a position that affords you the highest opportunity to be peace-makers between neighbours, and thereby be benefactors to generations to come.

DISCUSSION.

The Chairman—I think Mr. Gaviller made many good points. The paper is written in a very practical way. Many of us, no doubt, could recall instances, similar to those mentioned, in our own history. With regard to the point that one should take negative evidence, I remember a case in the Township of Blanchard, where there had been an extensive law suit over a line. The story was that a man who was then in the States was in possession of certain information which would change the whole course of affairs. Having occasion to make a

survey, I went out to the Township, and this man having returned from the States, I asked him to come and give me the information. He would not come. I had to apply to the proper authority and get a judge's order to compel him to attend and make affidavit. When he came he told me he knew nothing about it. I took his affidavit that he did not know anything, so that he could not come in afterwards and say he did. With regard to information being in the hands of a surveyor, which he keeps back so that he may drop upon some brother in a law suit, I do not think it advisable for a man to keep all this information to himself. He should give it to his neighbour. It is similar to a man dying with the information; he could just as well not have been in the country as not impart it to any one.

Mr. Kirkpatrick—That was a very good point about surveyors putting their own mark to their posts. I know that I could always swear to the posts placed by the man I served my time with. He had a mark of his own on them. I remember coming across one about twenty years after it was placed. It had his special mark upon it, and I recognized it at once. I always myself put a special mark so that I would recognize mine again even fifty years afterwards.

[This Association is not responsible as a body for any opinions expressed in its Papers by Members.]

CADASTRAL SURVEYS IN THE PROVINCE OF QUEBEC.

By J. P. B. CASGRAIN, P.L.S.,
Morrisburg.

OUR genial and obliging secretary, Mr. Willis Chipman, has been good enough to invite me to read a paper before this meeting on "Cadastral Surveys in the Province of Quebec." I responded cheerfully to his call, because I believed this subject to be new to many of my Ontario *confrères*, but I must crave your indulgence for my many shortcomings as an English reader.

INAUGURATION OF THE CADASTRE.

This work was commenced in 1866 under the supervision of the Honourable Alexander Campbell, then Commissioner of Crown Lands, now Sir Alexander Campbell, Lieutenant-Governor of Ontario, and in virtue of Chapter 37 of the Revised Statutes of Lower Canada. This great geodesic work has now cost the Province of Quebec over six hundred thousand dollars. This large sum, which has been expended on surveys and in the preparation of plans and books of reference, has to a great extent been distributed amongst the land surveyors of the Province.

Operations were carried on from year to year, and now that they are almost completed, in the permanent records of the Crown Lands Department at Quebec may be found every particular lot or parcel of land in the Province shown on a plan and numbered, and in the official book of reference, opposite the corresponding number, the owner's name, and a correct description, with measurements, of this same lot or parcel of land. A somewhat similar book exists in England, called the "Doomsday Book."

THE OBJECT OF THE CADASTRE.

The operations of the Cadastre in the Province of Quebec were undertaken with a view of furnishing the registrar of each registration division with a correct designation of all the landed properties in the cities, towns and townships forming a registration division, in order to follow with regularity all the mutations and mortgages which take place therein.

The duties of a surveyor engaged on Cadastral work consist in the preparation of a plan showing all the landed properties in a certain

territorial division, and of a book of reference giving a correct and separate description of each and every lot or parcel of land in such division.

OPERATIONS IN THE FIELD.

The usual mode adopted for the operations in the field has been to make an accurate traverse by circuits of the public highways, railroads and rivers, noting the intersection of the concession lines and of all the dividing lines as indicated on the ground by fences, etc., or other visible boundary marks. Careful inquiries are made on each lot, so as to enter in the field book between the divisional lines of a property the owner's name, the approximate area, the figuration, etc. When a lot or parcel of land does not run the full length of a concession its depth must be ascertained, but in regular concessions the depth as found on the side line roads can be taken as correct for this purpose. In ascertaining the dimensions of each property, only those sub-divisions which are actually recognized or existing on the ground are entered in the field book. The Cadastral surveys are given by contract at a fixed rate of one dollar for each designation. The Government leave a great deal of latitude to the surveyor in the mode of performing his work in the field. The sole aim of the Department is to obtain an accurate plan, on which no dimensions are shown, the only information being the number given to each lot or parcel of land, which number it will bear for ever.

OFFICIAL PLAN.

In rural districts where the lots are comparatively large the official plan is plotted to a scale of twenty chains to one inch, and drawn on Whatman's antiquarian drawing paper. The plan shows clearly the divisions of each property by a clear, firm line, each parcel bearing within its figured limits the number given to it distinctly printed.

The concessions preserve their original name or number. The primitive subdivision and the original number of the lots are also preserved on the Cadastral plan, and are shown by red lines and red figures, and all the parcelling which has taken place since the township was opened for settlement is indicated by black lines. So that one can realise at a single glance the original laying out of the land and the existing minor subdivisions at the time of the Cadastral survey.

It is useless to emphasize on the immense advantages derived from this system, which clears up, every day, many vexed and intricate questions, which without this plan might have remained obscure and uncertain even after having entailed a large expenditure.

The original numbers being preserved and marked in red, the minor subdivisions, say of lot 5, range 2, Township of York, will be numbered thus in black, *5a*, *5b*, *5c*, *5d*, etc., if the parcelling does not exceed one alphabet. Should the parcels in one lot exceed the number of the letters in the alphabet, as it will frequently occur for lots in or near towns or villages, then a series of numbers instead of letters will be used, thus: 5-1, 5-25, 5-45. etc. The roads are

coloured in raw sienna, the rivers and lakes are tinted in blue, and the railroad lines in pink. Astronomical and magnetic meridians are drawn on the plan, the angle between them giving the declination of the needle. Not to mar the clearness of the lines indicating the limits of the parcels, it is preferred that no topography of the mountains, hills or buildings should be shown on the plan. In case of an agglomeration of certain parcels too small on a scale of twenty chains to one inch to insert thereon the number designating them, then a small plan is drawn on the margin on a scale of four chains to one inch, on which the numbering may be more intelligibly shown.

The title of the plan is as follows: "Official plan of the Township of Clifton, in the County of Compton, made in conformity with the provisions of Chap. 37 of the Revised Statutes of Lower Canada."

It is advisable to leave around the plan a sufficient margin so as to be able to insert thereon any omission or correction. The plan, after having been dated and signed by the surveyor, is transmitted to the Crown Lands Department at Quebec, where it remains as a permanent record: A copy of it is made and forwarded to the registration office of the division to which it belongs.

THE PLAN IN CITIES, TOWNS AND VILLAGES.

Landed properties in cities, having a greater value in proportion to their extent than those in the rural districts, and being also more subject to numerous subdivisions and frequent mutations, require that the Cadastral plan should be prepared on a large scale and with great accuracy. The scale adopted for the city of Montreal is of one hundred feet to one inch, and this has been found to be the most suitable scale for large cities. For the purpose of the Cadastre and to expedite the carrying into effect of the Registration Act, each ward in a city is considered a distinct municipality. It has its own series of numbers, and the Cadastre, within its limits, can be put into force on the issuing of a proclamation by the Lieutenant-Governor as soon as the plan and book of reference of a ward are completed.

Every subdivision of land generally known under the designation of building lot, every landed property distinguished or divided from another by a wall, a fence, hedge, or delimited by established boundaries or pickets planted on the spot by a Provincial Land Surveyor to mark such subdivision, or any beach or deep water lot granted by letters patent, is considered for this purpose a Cadastral lot, and receives a Cadastral number, and each of these lots is distinctly measured, so as to be designated and numbered in sequence, although they may be contiguous and belong to the same proprietor.

The measurements in cities are taken with a metallic tape, and the angles of the streets carefully measured with a transit, and generally all necessary precautions are used to ensure the accuracy of so important a work.

The breadth of all streets, squares, passages and lanes are also carefully noted, and it is ascertained whether they cover public or private property. If on private property streets, squares, passages

or lanes are considered as lots and numbered and designated as such.

When a ward of a city is too considerable to be represented on a single sheet, it is laid down on different sheets and numbered as follows: Plan of the centre ward of the City of Montreal, 1st sheet, 2nd sheet, etc. Each sheet is dated and signed by the surveyor before its transmission to the Department of Crown Lands.

OFFICIAL BOOK OF REFERENCE.

The form adopted for the official book of reference is always the same, and it can only vary in the title, the paper being prepared, ruled and printed, is furnished by the Department. The book of reference is divided into four columns. The first contains the number of the lot on the official plan. The second column gives the name of the owner of the lot, as ascertained by the surveyor by information taken on the ground, or by research at the registration office, or by examination of the assessment roll, a copy of which a surveyor always takes for his own personal use, in the preparation of the book of reference, as the quantities given in the roll will generally agree closely enough with the measurements taken on the ground to prevent any serious mistake, and enable him to identify the name of the owner. The third column headed "general description" contains, firstly, the name or number of the concession at the top of each page, then a description by metes and bounds, giving all the Cadastral numbers adjoining the lot, and if it is of irregular form the width, depth and area. When the lots are of irregular form the area alone is given.

For example, for a regular lot the entry should be made as follows :

OFFICIAL BOOK OF REFERENCE.

Nos. Indicated on Plan.	Names of Proprietors.	GENERAL DESCRIPTION. Township of Clifton—County of Compton.	REMARKS.
5a	Peter Smith.	Forming part of lot No. 5 of the 2nd range of the primitive subdivision of Clifton, bounded on the north by the line between the 1st and the 2nd range, on the east by No. 5d, on the south by the line between the 2nd and 3rd ranges, and on the west by No. 5c, measuring five chains in front by eighty chains in depth, containing an area of forty acres (40 acres O. O.).	

The fourth column is reserved for remarks and all that may complete the designation of the parcel. It also serves for the entry of all the amendments to the description opposite. The book of reference, like the official plan, before being transmitted to the Department, is signed and dated by the surveyor.

INSPECTION OF PLAN.

When the Cadastral plan of a locality is completed the Commissioner of Crown Lands, after being notified of the fact by the surveyor, causes official notices to be posted up in the division and inserted in the public press, if any, in, or in the vicinity of the division, to the effect that the plan of the Cadastre shall, on a certain date, be on exhibition at the town-hall, or at some other suitable building, for the examination of the interested proprietors of the respective landed properties. The Inspector of the Cadastre, himself, is present during this examination, and he notes all the complaints that may be made by the proprietors, and if they prove to be founded he orders the Surveyor to make the required alterations. The owners are shown on the rough plan their landed properties, and they are requested to give beside their own name, in full, that of their neighbours, and the Inspector can at once verify whether these names have been correctly entered by the surveyor. The width, depth and area of any lot is also given to the proprietors, and if these dimensions disagree materially with their statements the Inspector may either verify the plan by looking through the field notes of the survey, or make the surveyor measure again the particular lots. The Inspector then makes his report to the Department, and if it is favourable the Commissioner of Crown Lands orders the

VERIFICATION.

Instructions are given by the Department to a Provincial Land surveyor, of recognized ability in his profession, to proceed to the locality where the inspection has taken place, and there to make a second traverse of some of the roads or lines already surveyed in the original Cadastral operations. This traverse is plotted on the same scale as the first plan, and a tracing of it is forwarded to the registration branch office of the Crown Lands. This tracing is placed upon the plan furnished by the surveyor who made the Cadastral operations. If the two plans do not agree within a reasonable limit of accuracy, the work is gone over again by the first surveyor, who, if his part of the work proves to be correct, may claim damages or re-imburements from the surveyor who made the verification. With this system in force the Government is justified in assuming that the plan forwarded to the registrar is correct.

On the reception of the official plan and book of reference the registrar prepares an Index to Immoveables. A special book is opened under the above title, and a full page is left for each Cadastral number, on which page every transaction concerning that particular number is entered. When the registrar has completed his part of the work, and has sent an acknowledgment of the receipt of all the official plans and book of reference to the Department of Crown Lands, the Government issues a proclamation in the Official Gazette of the Province of Quebec, putting the Cadastre into force in this registration division. A period of two years is allowed for the re-registration of all claims against any of the lots where the Cadastre has been pro-

claimed in force; after which time, any claim not registered loses its priority.

SUB-DIVISION OF CADASTRAL LOTS.

After the Cadastre is in force in a locality, when a proprietor wishes to sub-divide his land into building lots or otherwise, he is bound, under a penalty of one hundred dollars for each and every lot he might sell over six lots, to have the desired parcelling marked out by a Provincial Land Surveyor, whose name appears on the list of the members of the Corporation of Land Surveyors for the Province of Quebec, and one who has paid his annual dues to the said corporation. The surveyor thus retained prepares a plan on a suitable scale, showing the lots laid out by himself, and a book of reference, giving a correct description of each lot. Two tracings of this plan of sub-division and two copies of this book of reference must be made by a Provincial Land Surveyor. One of these copies is to remain as a permanent record in the Department of Crown Lands, and the other is to be deposited with the registrar of the division to which it belongs. Each copy, after having been signed and dated by a surveyor, is signed by the proprietor of the land, and countersigned by the Commissioner of Crown Lands. In the "Index to Immoveables" a full page is given for each of these sub-divisions in a special book kept for this purpose. The Government is recouped for its outlay by the sale of registration stamps, which have to be affixed to deeds when recorded. This shows that those who are taxed for Cadastral purposes are those only who have occasion to benefit by its operations.

This short paper can only give a very imperfect idea of the numerous advantages derived daily from the workings of this system to the Government, the legal profession, freeholders and Provincial Land Surveyors.

DISCUSSION.

Mr. Chipman—From the paper just read I am of opinion that the land surveyors of Ontario have a good deal to learn yet. This paper is just what we want at the present time, when we are thinking of registering our field notes and plans. There are several points that ought to be brought out clearly. Are there any dimensions shewn on any of the plans?

Mr. Casgrain—No; no numbers on the plans, excepting the numbers of the lots. The lots are so irregular that we could not give the dimensions. The plans are only for registration purposes.

Mr. Chipman—People, I suppose, settled on these lots and held them by right of possession, and things got in such a shape that you had no record?

Mr. Casgrain—In the Province of Quebec the original number of the lot is preserved. In Quebec, take a man named "John Smith," and look up his name, there would be any amount of John Smiths,

but the lot is numbered, and in the book we have the number and a full page showing the parties in the possession of the lot. By paying fifty cents we can go to that book and find out all that is entered against the lot.

Mr. ——— —What would you do in the case of lot numbers where the old lots are also numbered?

Mr. Casgrain—The old numbers are kept, but with new sub-divisions. The original numbers are kept and a series of new figures added.

Mr. ——— —But supposing the lot was originally No. 10.

Mr. Casgrain—It would be the same.

Mr. Stewart—I understand this "Cadastral Survey" corresponds with our "Original Survey," and was commenced in Quebec in the old parishes that were never properly surveyed?

Mr. Casgrain—It was at first so intended, but afterwards, when they found the system working so well, they have used it for the newly surveyed Townships. You just take the visible mark on the ground. When you want it subdivided you run a boundary line and establish your points.

Mr. Sankey—I think this Cadastral Survey is one from which we in Ontario can reap a good many pointers. We have something similar in Ontario, the Compiled Plans of Incorporated or Unincorporated Villages. There is a section in our Act which at first sight appears to be an omission in our legislation. Amongst surveyors in Ontario a good deal of doubt has arisen as to what a surveyor is, and what his responsibilities are in regard to a compiled plan of a village. The Act says the registrar or any one interested can give notice to the head of the municipality, in writing, that within a certain time, if the plan is not approved of, a fine can be levied on the municipality. This plan is to show how the land is owned. Surveyors say, "Am I bound to go to the Registry Office and look over every man's deed? And am I bound to go to every man's land and stake out the distances?" This is becoming very important in Ontario, and it is a question which in the future will be much looked into. In some cases, perhaps, the registrar has given notice that such a plan must be supplied. The expense attending such a plan is very considerable, and the municipalities do not care about expending that amount of money. We should get some definite knowledge of the facts, and see how this can be improved. There is a great deal of difficulty in Toronto in hunting up old lots. I would draw your attention to lands between Front Street and the Esplanade. The original grants came under three different patents. Some warehouses on Front Street stand on ground granted by three different patents. If the Cadastral system were here the plan would be in the Registry Office instead of there being three different patents. This Cadastral System would do us a great deal of good if we could get the legislation to put it in force so as to be of use to the public. This is a matter for the public good. There are lots of people who have to pay hundreds of dollars into

lawyers' pockets to get their title put right, and a certificate that their title is all right, and after all this the certificate is often not worth the paper it is written on. This certificate is only the lawyer's opinion. Within the last few years we have the "Land Titles Act" in force in Toronto, and it appears to act very well, but I know that the expenses attendant upon it are working very seriously against it. Some people thought the Land Titles Act was the best system, and put their lands under it, but their experience was that the expense was so heavy that they would not have anything to do with it again. Once lands are put under the Land Titles Act it is useful and effective, but the first cost works against its success. I should be glad to see the Association take the matter up. Our Acts should state exactly what steps a surveyor should take. There is nothing in the Act as to what certificate should be put on the plans. In Ontario, if you are making a plan you have to show other lots surveyed by other surveyors. This is not right. When we get together it is a good thing to discuss this matter.

Mr. Stewart—There are one or two remarks Mr. Sankey has just made that seem peculiar to me. Is there not a plan in the Crown Lands Department showing these lots in the water front? If there are three patents for these lots there should be three plans in the Crown Lands Office.

Mr. Sankey—I can answer by giving you the facts relating to the water fronts. Sometime prior to 1818 a piece of land was granted by the Crown on the west side of Berkeley Street east of Peter Street on the south side of Front Street, Palace Street and Front Street again, with an allowance for roads. There is a reference in the patent as shown in the plan of the Town of York, but which lot is mentioned there I have not discovered. In 1840 two other patents were issued to the City of Toronto, which contain thirty-two descriptions, the descriptions in the first sixteen taking the water lots from the original shore lots. In some cases in the plan the distance from Front Street to the bank was not more than a chain; the general distances were 132 feet, covered by two patents, and there are many warehouses extending over 132 feet. The lawyers go back to the patents, and have to satisfy themselves that the land is properly described in the three patents. The plan has to be certified to by a land surveyor before the patent issues. This plan was made by Mr. Thomas Yonge, an architect, who was not a surveyor at all, and it is not used at all.

Mr. Stewart—Where we are laying out a portion of a village and have to put in other portions, we colour the portions and say in the certificate that the portions coloured are what the certificate covers.

Mr. Sankey—The Act says the plan shall be certified by a surveyor, but it does not say what the words of the certificate shall be.

Mr. Aylsworth—I have prepared plans partly from actual survey and partly from plan.

The Chairman—I think the paper we have just heard read is a very important one, and I think the surveyors of Ontario may very well take it up and apply it to many parts of this Province. With reference to the question of the compiled plan referred to by Mr. Sankey, I know of a town in this Province where very great difficulty has arisen in that way. We were asked to compile a plan of the town, and we took perhaps twenty different plans, and you could not fit them together; some would overlap. I think the Act is defective in that respect, and I think that it would be well for the land surveyors to consider that with the view of carrying it out in some part of the Province.

Mr. Kirkpatrick—A short time ago we had a letter from the Minister of the Interior about some of the old lands on West Pelee Island in Lake Erie. It was surveyed after the people had settled on it, and it was most amusing to see some of the descriptions. One was known as "the farm that John cleared," "the store-house farm," etc. On this plan there were just the numbers that Mr. Casgrain says, and all sorts and shapes of descriptions. It was settled by people who had vineyards, and surveyors went on afterwards and surveyed on the old titles, and the plans were made out in that way.

Mr. Aylsworth—I made an attempt to get up an amendment to the surveyor's certificate, and I gave it up in despair. I wanted the certificate to read that the compiled part was in one colour and the survey in another. There should be two surveys.

Mr. Stewart—There is another thing we should take up. It is known that the municipalities need not take over any plans unless the streets are sixty-six feet wide, but this is now avoided by calling them lanes. Registrars say there is nothing in the Registry Act about it. It is only in the Municipal Act that it is found.

[This Association is not responsible as a body for any opinions expressed in its Papers by Members.]

CITY SURVEYING.

By T. B. SPEIGHT, P.L.S.

A GLANCE at the map of almost any of our older cities shows us one or more points from which winding roads of various widths run in different directions and are intersected by others at different angles. As the distance from these centres increases a nearer approach to uniformity is reached, but unfortunately this is only an approach.

Looking back to the early days, we can easily trace the origin of this irregularity. A cart trail or colonization road connects one trading post with another. At a certain point, selected for various reasons, a few houses are erected by settlers and a hamlet is begun. From this point, new roads are opened to distant objective points, and these roads become the property of the public.

As settlement advances the necessity for building lots becomes apparent, and these are laid out with what appears at the time to be the best means of access to these lots, without any thought for the convenience of future generations.

In course of time the land in the vicinity falls into the hands of different owners in parcels of all sizes and shapes. When the needs of increasing population, or the possibilities of speculation arise, these parcels are subdivided by their respective owners, each with an eye single to individual personal profit, and with no regard for the convenience of the public at large.

It is probable that when just about this period in the history of the future city is reached the surveyor becomes a recognized necessity in the community, and he commences his operations with a compass of doubtful reliability, and a chain which age has attenuated. The diagrams which set forth measurements of the chain aforesaid are considered "good enough," if an occasional measurement is recorded to serve as collateral evidence of the scale to which the sketches are alleged to be drawn.

From this view of the growth of cities it is not difficult for us to understand why such lack of symmetry is to be seen on all sides.

In more modern times our newer territories present a different state of affairs.

Railways are the great factors in the creation of towns and cities. An enterprising speculator pioneers abreast, or in advance of, a proposed railway, decides on a point where the physical features of the surrounding country indicate an eligible site, and says within himself, "Here will I build me a city," or in other words, "Here will I establish a squatter's right, and await the tide of immigration, which

brings wealth to the first comer." If his selection has been well made, and circumstances warrant it, the science of surveying is next called into requisition, and usually a large tract of land is at once laid out into regular blocks.

In such cases there would seem to be no excuse for the irregularity or want of system such as is met with in older cities, where holdings are so numerous and interests so varied.

But what we have now to deal with is not so much the past as the present and future. Some of the errors of our ancestors are now being corrected in the extending and widening of streets, by expropriation, but at what a cost! With the details of the system of expropriation as now carried on in our various cities, and the fairness or unfairness of its workings in regard to holders of improved properties, we, as surveyors, have nothing to do, but we may, with all due modesty, venture suggestions as to how the necessity for costly expropriations in the districts yet unsubdivided may be avoided. Before commencing to prepare this paper, I wrote to the heads of the Engineering Departments of some of the more progressive American cities, and in every instance received a courteous reply, with more or less complete details of the surveying branches in the respective cities.

Through the kindness of the officials in charge of matters relating to our profession in Philadelphia, Detroit, Buffalo, Rochester, Providence and Baltimore, I have had an opportunity of examining and comparing the various systems in force in those cities, and think that we may learn much from our American cousins.

Take, for example, Philadelphia. In that city the main thoroughfares, about 400 feet apart, are projected in advance of improvements, and marked on the ground by stone monuments; and plans—showing names and widths of streets, block distances, intersection angles, topography and profiles—are made and filed in the Bureau of Surveys, open to public inspection. These plans are then advertised for one month, in order to give all interested parties sufficient opportunity of examining them and entering their objections previous to their confirmation by the Board of Surveyors. By the confirmation of these plans the public are given notice of the location of streets, building thereon is prevented, and thus both the city and property owners are saved subsequent loss, and the system rendered uniform and continuous. Within the boundaries of these thoroughfares the owners are allowed to locate streets as they may desire, but of a width not less than thirty feet, and extending from one principal street to another. The widths of principal streets are regulated by their locality and vary from fifty to one hundred and twenty feet.

This system appears to give satisfaction in all respects to the property owner and the public, and there seems to be no reason why, with the modifications necessary to suit our different forms of municipal government, it could not be adopted by Canadian cities with great advantage to all concerned. The lands included in the projected streets would be available to the owner until such time as it might be deemed necessary to open the streets. The owner should be notified say from three to six months in advance of the opening, and the only

compensation he could in justice claim would be for loss occasioned by blocks too shallow for building lots being left between the street lines and the boundaries between different owners.

The price of such blocks at the time of projection would probably be small in comparison to their value at the time of opening, and their use for cultivation, etc., in the meantime would not be interfered with.

The assessment of damages would, of course, be done in the usual manner. The advantages to the public of a layout of streets systematic as to width and location is apparent and requires no explanation. It may be urged that much of the irregular style of subdivision is done and established long before the property is included within city limits; but could not city corporations be empowered to exercise jurisdiction over suburban districts for the purpose of projecting streets or else to incorporate these districts and assess the same as farm property?

There may be insurmountable difficulties in the way of such schemes as these, but we feel confident that at some future day the people of Canada will realize that streets are intended for highways for the public and not simply as a means of deriving the greatest possible profit for the land speculator.

Under the present system of subdivision a great injustice is sometimes done to a purchaser, who, after paying for his lot, finds to his cost that a street shown on a registered plan is not necessarily under the care of the corporation, owing to its not having been accepted by the Council. I think an improvement to this would be to make it necessary for all plans affecting streets to be submitted to the Municipal Council for sanction before being accepted by the registrar. This sanction might be withheld where the proprietor had ignored existing adjacent streets.

Another want much felt is that of durable monuments to define street corners. The planting of substantial stone or iron monuments to define street line intersections should be made compulsory to owners of properties when subdividing. The cost of this would be trifling when we consider that in most of American cities the cost of grading streets must be borne by the owner before being accepted by the corporation. The registration plan should show whether such monuments are planted at exact street line intersections or at certain offsets from intersections.

I would like to hear the opinion of members of this Association in reference to the certificate to be placed on registration plans.

The certificate now required renders a personal survey necessary, but there is nothing in it to show whether or not the subdivision has been staked out.

Could we not have an additional certificate setting forth the facts as they are, to serve as a guide in after years as to what stakes are originals?

In this short paper I have endeavoured to call the attention of our members to some much-needed improvements in city surveying, and should it be in any way instrumental in inaugurating a movement in the directions suggested, I shall feel that it has not been written in vain.

DISCUSSION.

Mr. Gibson—I think the paper we have heard read is in the right direction. But the trouble comes in here. Surveyors generally have to make a bargain with the man who employs them, and the lawyer or land agent generally wants the plan at once. In Toronto there are hardly any boundaries that are governing points. On King and Yonge Streets I suppose all my father's old posts have been taken up long ago. During last summer I made a compiled plan of a village to cover all the registered plans and all properties subdivided and sold under subsequent descriptions I made profiles of. These profiles are filed with the township clerks and parties have to conform to them. The streets were properly graded and left buildings in a very bad condition, and naturally the parties who owned them had claims for damages. All our villages have the power to regulate these streets, etc. In Hazelton Avenue I was employed by the authorities to lay it off. I found it was irregular, and I wanted it to be laid out correctly, and I had to explain my views very fully, and even then I had to take my own way against the wishes of a great many in the neighbourhood. In preparing these plans I search up every registered plan and get the dimensions of thirty or forty lots and put them all on the plan. Where there is a street or lane the Registry Act provides for that and the man is paid for it. In townships there are a great many subdivisions. The trouble is to get a proper system to be used all over. The United States system of divisional survey makes no provision for roads. There is a certain reservation in Algoma district for roads.

Mr. Browne—Disputes are arising every day about the grade of the streets. The city comes on and block paves and raises the street three or four feet and there are often claims of damages against city. It is often found that the original grade of the street was not known. I think the matter should be brought up and the profile registered when the plan is registered so that no one could have a claim of damages against a corporation. As to the monuments it is often very difficult to get them. If they are placed at the corner of the street, when the buildings are being put up, they are obliterated, and if they are placed in the centre they are dug up when the drains are being dug. I do not know if there is really any place in the street where a monument would be safe.

Mr. Gibson—I think about a foot and a-half from the corner.

Mr. Browne—Well, that would not be safe, as it would likely be removed when they dug up the cellars. I think the profile is very important. We must trust to ourselves to keep the monuments.

The Chairman—I think the suggestion made by Mr. Speight as to the profile of the Streets is a very good one, and the paper might be referred to the Committee on Engineering.

Mr. Gibson—I understood from Mr. Sankey that there is a possibility of the City of Toronto taking the matter up. There should be specific instructions given as to the making of these plans.

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DESCRIPTIONS.

By OTTO J. KLOTZ, D. T. S.

THE subject of descriptions is very important to the surveyor and more so to the public, and I do not think that that attention has been bestowed upon it that the subject deserves. For without proper descriptions of the land to be conveyed the refinements of survey that are now gradually aimed at will not bear their full usefulness, in fact may be totally lost by a poor or indefinite description.

To my knowledge there is no work or treatise extant from which the young aspiring surveyor can obtain any information on the subject. Frequently the master with whom he serves takes little trouble in instructing him in this or any other subject, but lets the pupil grope for himself and pick up as best he can.

The public pays dearly for the services of a surveyor who can not make proper descriptions, I may say far more so than if the surveyor had made a poor survey. A survey can be changed if improperly or carelessly performed, a description embodied in an instrument under seal and registered stands for all time.

Under improper and inaccurate descriptions I do not include gross blunders as the giving of the wrong number to the lot, etc.

When a surveyor is called upon to make a description he should, before he attempts the same, thoroughly understand the description of the land, as given in the deed of which the parcel to be conveyed forms a part, and must distinctly know what is to be conveyed—then he is prepared to put his thoughts to paper and make an intelligent and proper description.

As every province or country has its own peculiar forms and phraseology for documentary matters the surveyor should apply the same in making his descriptions so that every word that he has written may be inserted into the deed and not require remodelling by the conveyancer or lawyer.

Never put into a description any more words than necessary—overdescribing land—because you are apt to impair rather than improve it thereby.

In documentary phraseology there are no three words more abused and improperly applied than "more or less." My experience in extensive searches in registry offices revealed to me the fact that this abuse is of a chronic nature and of a malignant type. It seems as if in the past surveyors and conveyancers thought it an impossibility for a person to buy a definite quantity in linear or superficial measurement; like a spectre, "more or less" haunts every crevice and cranny in the old indentures.

The words "more or less" are full of meaning and are very significant if properly applied, and the reverse if not so applied, and may in fact destroy the very essence of what is intended to be conveyed by deed.

This will be illustrated later on by examples.

For elucidation of various cases that come up in practice I will give the following:—

CASE I.

Mr. A. owns lot number one in the second concession of the Township of Derby, in the County of Wentworth and Province of Ontario, and sells to Mr. B. the easterly half of the lot.

In the patent from the Crown for this lot its area is given as 200 acres, more or less. In the Crown Lands Office the original plan shows this lot to be rectangular and eighty chains by twenty-five chains, the bearing of the former as N. 10° E. and of the latter N. 80° W.

A description of the part to be conveyed would be:

"All and singular that certain parcel or tract of land situate lying and being in the Township of Derby, in the County of Wentworth and Province of Ontario, containing by admeasurement one hundred acres, be the same more or less, and being composed of the easterly half of lot number one in the second concession in said township."

In this description it is desired to draw attention to two points: Firstly; as the part sold is an aliquot part of the original lot, and all original lots have their areas "more or less" (the boundaries thereof being a matter of evidence more than of survey) hence the aliquot part must have its area "more or less" also. Secondly; being a recognized legal subdivision of the original lot, and the boundaries of such lot fixed either on the ground or by statute, the boundaries of such half must be fixed also without any particular description by metes and bounds being given.

No description by metes and bounds in this case would establish the boundaries any better than without such metes and bounds, in fact the probability is that they would conflict with the description—the easterly half of lot number one.

In Dominion Lands legal subdivisions of sections are specified by statute and comprise multiples of one-sixteenth of the section. In Ontario I know of no statutory legal subdivision although halves and quarters are recognized as such.

CASE II.

Taking the same lot, A sells to B a field lying along the easterly boundary of the lot; the westerly boundary of the field to be the fence (supposed to be straight) then standing. The surveyor is called to make the survey and from it the description.

The judgment and discretion of the surveyor here come into play.

When the surveyor arrives on the field he will soon learn whether the fence is merely a side to complete an area or whether there is

something particular to be included by the present position of the fence—as a valuable spring or building close to the fence—in short, something of a comparatively permanent character; I say comparatively, for alas, nothing material is permanent, only the abstract—truth.

The buyer generally pays for the land at so much per acre, and if a lump sum be paid it must for farm land be based on a certain value per acre according to the producing power of the land; hence, area is the guiding principle as frontage is in city property.

He will know that if in his description he refers to the fence, that fifty years hence it will be gone, probably replaced by another one, and then the position of that boundary (westerly one) will be a matter of evidence primarily and not of survey, and this means frequently litigation.

It will be observed that we have, in this case, the easterly, southerly and northerly boundaries of the field as original boundaries with the westerly one to be defined by description.

Let the surveyor carefully establish the above original boundaries, then measure from the south-east angle of the lot along the southerly boundary to the centre of the fence (as division fences in fields in Ontario are mostly rail fences there is an unavoidable margin of one or two or even three links in assuming the centre), do similarly along the northerly boundary from the north-east corner of the lot, besides measuring the easterly and westerly sides of the field, although these last two measurements are not absolutely necessary for the description as far as metes and bounds are concerned, but are taken for computation of area and to have uniformity in the description.

He is now prepared to make his description. Assuming the fence to be merely a side to complete an area we have for a description as follows:—All and singular that certain parcel or tract of land situate lying and being in the Township of Derby, in the County of Wentworth and Province of Ontario, containing by admeasurement twenty-seven and one-half acres, be the same more or less, being composed of a part of lot number one in the second concession in said township and which parcel may be more particularly described as follows, that is to say:—Commencing at the south-east angle of said lot thence westerly along the southerly boundary of said lot ten chains and thirty-two links, thence northerly in a straight line twenty-five chains and five links more or less to the point on the northerly boundary of said lot distant eleven chains and sixty-eight links westerly from the north-east angle of said lot, thence along said northerly boundary easterly eleven chains and sixty-eight links to the north-east angle of said lot, and thence southerly along the easterly boundary of said lot twenty-five chains, more or less, to the place of beginning.

It will be seen that the lengths given for the easterly and westerly boundaries of the field are really not necessary in the description but as before stated are given for uniformity as the other two boundaries are given.

Some may ask why I do not give a bearing for the westerly boundary, the others having original bearings. This opens up the whole subject of bearings.

Nearly all the bearings in Ontario are magnetic, only of late years are the astronomic bearings being introduced, but as original boundaries and new division lines often abut, the surveyor who desires to do more accurate work and use astronomic bearings must give for an original boundary its original magnetic bearing also to preserve the identity of the line and thereby simplify searching documents for title. Some surveyors have been in the habit of using the compass and combining one line with present bearing with another possibly of ten years date, and lastly with an original boundary whose bearing was taken seventy-five years ago. This makes a nice jumble, and it is not a rare occurrence either.

To every practitioner it is well-known that the ordinary bearings given are not nearly as reliable as the linear measurements. Astronomic bearings are definite and unalterable.

Had I given a bearing for the westerly boundary in the last description, if it meant anything at all, it meant that that line ran in one particular direction and no other, and hence must intersect the northerly boundary in some particular point, but from my hypothesis that point must be eleven chains and sixty-eight links from the north-east angle of the lot; these two conditions for one and the same point are highly improbable of being simultaneously fulfilled. Hence I have to choose between giving a bearing for the line or a definite distance along the northerly boundary. As the latter is more readily determined and tends to preserve the area (the guiding principle here) in case of a resurvey, I chose it, and thereby avoid explaining, in case a bearing had been given, whether such bearing is astronomic, present magnetic or made to conform with the original bearing of one of the other boundaries.

Professor Johnson, in his admirable work, "Theory and Practice of Surveying," which should be in the library of every surveyor, discusses the relative merits of linear and angular measurements, and concludes with "It thus appears that when the side lines of lots are located perpendicular, or at any other angle with the street upon which the lot fronts, it is susceptible of more accurate location than by two (front and rear) measurements, unless the usual limit of error can be greatly reduced." In short he gives preference to the theodolite compared with the chain or steel tape. Theoretically, using the instruments quoted, such preference is unassailable; however, its conclusive application (angular measurements) practically is confined to triangulations in geodetic work. In practice, lots are generally laid out with an even number of feet or links, frontage and depth. This is intelligible to the public, who know nothing of bearings; and where there are gores or oblique lines, I think that, in the large majority of cases, the course is computed from the linear measurements. It would be a mere accident if such a course would end in even minutes, and a minute being the limit of refinement in ordinary surveying, it follows that the course given will not be mathematically consistent with the distance given. Hence more weight should be given to the latter than to the former.

In another place he says, "With the transit to define directions of courses, and the chain still to measure distances, such a maxim (distances govern courses) would not have voiced the results of experience, but would have been sheer nonsense." I am confident that at the present day, in the vast majority of cases, "distances do govern courses." A line can be measured independent of any other line, a course can undoubtedly also be determined independent of any other course, but, practically, is this done? No, the course is made dependent upon some other course, that on another, and so on, until we finally arrive at the basal course, possibly established by Polaris. Now I would like to ask, if not in our city surveys, the surveyor will give the preference to linear measurements in most cases as against angular measurements as deduced from the courses or angles given on the plans, for determining a point or line.

Linear measurements shown on plans have, as a rule, been actually made, whereas courses are deduced or computed and seldom astronomically observed.

The Professor puts the question, "Shall division lines be located by an angle with the street on which the lots front or by distances from the next cross street," and then gives an example—a rectangular block of nine lots, each fifty by one hundred and fifty feet. Required to locate lot 9. He assumes the maximum error of chaining to be 1 in 5,000, and when chaining the front and rear of lots 1 to 8 inclusive (400 ft.) to produce opposite signs, that is the error of the division line between lots 8 and 9 to be .16 ft., equivalent for the distance of 150 ft. to $3\frac{3}{8}$ minutes of arc, a quantity undoubtedly larger than permissible in a transit, but it must be borne in mind that even when using the transit one distance (400 ft.) must be measured, involving one half of the above error, to say nothing of the error arising from imperfect setting, adjustment and pointing. Furthermore, it may be necessary to set up the instrument twice to ensure parallelism of the lot lines between lots 8 and 9 and of lot 1, and finally it may be impossible, where the actual dimensions of the block differ from the intended ones, that the transit can be used at all, but that by chaining the relative width of each lot be determined.

Let us put this example to a practical solution, under the favourable assumption that the block and its lots have actually their proper distances and bearings. Let the rectangular block of lots be on Yonge Street, Toronto, where there is a steady pour of pedestrians and vehicles, or even on a less frequented street. How many surveyors would take offsets (for it is not probable that the instrument could be set on the lot line on account of fence or building) from the line of the front of the lots, set up the transit to turn off the angle for lot 9, instead of expeditiously measuring with a steel tape 400 ft. from the front and rear of lot 1?

If a surveyor could just place his transit where he chose, could keep all disturbing influences distant, could depend upon his assumed base, then he could probably more accurately define a point by angular measurement (intersection) than by linear, but at an expense of time.

The above pertains especially to city surveying, and is given under that heading in the book referred to.

If in the country, where the ground is more or less broken, it were required to run a long line parallel to and a considerable distance from another one, I would certainly prefer the transit to the chain.

Reverting now to Case II., we will see that it would have been impracticable to have given a course for the westerly boundary of the part sold. For that course is subject to the position of the fixed distances 10.32 chains and 11.68 chains, which in turn are dependent upon the position of the southeast and north east corners respectively of the lot. The change of position of these corners (original ones), as may arise from conflicting evidence given to two surveyors, necessarily changes the position of the south-west and north-west corners of the parcel, too, without however causing a material difference in area. This difference of area dependent upon the position of said south-east and south-west corners would be greater were we to give a definite bearing for the westerly limit of the parcel.

I am an admirer of fine instrumental work, but think that for some time to come yet in ordinary surveying "distances will govern courses."

The second part of Case II., of less frequent occurrence, is where the fence is to include something close to it and of a comparatively permanent character, in which case there must be no uncertainty of such being included.

Our description—the latter part thereof—would then be: "Commencing at the south-west angle of said lot, thence westerly along the southerly boundary of said lot ten chains thirty-two links more or less to the point distant, fifty links due west from the astronomic meridian passing through the north west corner of the limestone dwelling-house (being the only stone building on said parcel), thence north twenty degrees and seventeen minutes west (astronomic) twenty-five chains and five links more or less to the northerly boundary of said lot, thence along said northerly boundary easterly eleven chains and sixty-eight links more or less to the north-west angle of said lot, and thence along the easterly boundary thereof southerly twenty-five chains more or less to place of beginning."

According to the above description, no future survey could deprive the purchaser of the limestone dwelling-house, although the position of the south-east and north-east corners of the lot may be subject to change, as their position is mostly a matter of evidence as to their original position as designated by posts, or as deduced from other original corners where evidence is similarly required.

A sketch showing the position and dimensions of the building, and signed by the surveyor, might advantageously be attached to the deed for future identification in case additions to the building or other changes occur.

When the words "more or less" are used the "stopping" point must always be, or be referred to, some fixed point, never a wooden stake. An original corner is always a "fixed" point, although it may be shifted about by surveyors, depending upon the evidence upon

which they base their work. Stone buildings, iron or other metallic bolts set in rock may also serve as points of reference. "More or less" should hence only be used in giving the distance between two fixed points.

In the foregoing descriptions the apparent want of definiteness in not giving bearings is what really makes the description definite and without ambiguity.

CASE III.



Let the accompanying diagram be a copy of part of a registered plan.

Mr. A owns lots numbers one, two and three. On lots numbers one and two he has erected a brick block, which is supposed to have a frontage of fifty feet on Logan street, and adjoins Chester street the full depth of the lot.

Mr. A sells the brick block to Mr. B. A surveyor is called to make the survey for making the necessary description. He carefully determines the boundaries of the lots and determines the distance that the brick block extends into lot number two, and from his data he makes the following description :

"All and singular that certain parcel or tract of land and premises situate, lying and

being, in the town of Hope, in the county of Wentworth and Province of Ontario, containing by admeasurement seventy-five hundred square feet, be the same more or less, being composed of lot number one and a part of lot number two, both lots adjoining Logan street and being in Block A, as shown on the plan entitled 'Plan of subdivision of township lot number seventeen, third concession, township of Derby, county of Wentworth,' under date June 11th, 1875, signed by James Duncan, P.L.S., and filed in the registry office for said county of Wentworth, and which parcel may be more particularly described as follows, that is to say:—Commencing at the south-west angle of said lot number one, being at the intersection of the northerly side of said Logan street with the easterly side of Chester street; thence easterly, along the southerly limits of said lots numbers one and two, fifty feet, more or less, to the line of the easterly side of the brick block now erected on said lots; thence northerly, along said line of easterly side of said brick block, one hundred and fifty feet,

more or less, to the southerly limit of the registered lane twenty feet wide; thence, along said southerly limit of lane, westerly fifty feet, more or less, to the north-west angle of said lot number one, being on the easterly side of said Chester street; and thence, along said side of Chester street, southerly one hundred and fifty feet, more or less, to the place of beginning."

Notes on the above.

As the position of the streets or lots depends primarily on evidence where the original lot posts stood, it would be imprudent to give a bearing for the frontage of the block or for any of the other sides. To say, for instance, "thence, along Logan street, south seventy-six degrees fourteen minutes, east, etc.," is a questionable statement, being a dual statement, for S. 76° 14' E. means a certain course, and "along Logan street" possibly and probably another, hence I avoid giving the course. Although the south-west corner of the brick block was intended to be co-incident with the south-west corner of lot number one, and may have been found so by the surveyor, yet another surveyor might find it out one or more inches, and possibly on the street, hence it would be wrong to begin the description, "at the south-west corner of the brick block."

Similarly the block is intended to be on the line of the northerly side of Logan street, but for similar reasoning the frontage that A can convey does not necessarily extend to the south-east angle of the brick block, but only to the line of the easterly side of the said block. If the block is anywhere on the street, that is a matter for the municipality to deal with, but Mr. A can certainly not convey what he does not own. In this case we have two definite points defining the frontage—the south-west angle of lot number one and the intersection of the line of the easterly side of the brick block with the northerly side of Logan street, hence the distance between the points must be more or less; and likewise for the other sides of the parcel. It would be absolutely wrong to express the frontage definitely as so many feet, no matter how accurately the measurements be made and how definite and undisputed the south-west angle of lot number one may be. For there is in this world no absolute measurement, for we can only hope, by the most accurate and refined measurements, to increase the approximation to truth. Furthermore, we may put as an axiom in practical surveying, that bearings and definite linear measurements of an enclosed area are incompatibles.

CASE IV.

(Using the Diagram of Case III.)

Mr. B buys from Mr. A twenty feet frontage of lot number one, the frontage extending from Chester street along Logan street, and the parcel bought to have a uniform width to the rear thereof.

For the description no survey is necessary, but as Mr. B. desires to know the limits, especially the eastern limit of his parcel, the surveyor is called upon. In this case the accuracy of the survey is of

far more importance than in Case III., there is no "more or less" about the frontage, and as Mr. B will probably want to build up to his line, no pains nor care should be spared in giving him the most accurate measurement attainable.

When Mr. A comes to sell the remainder of the lot, the description for it will start: On south limit of lot number one, at a distance of twenty feet (no "more or less") easterly from the south-west angle of said lot number one, etc. So that if Mr. B has built one inch beyond the twenty feet he will find himself in trouble, and often very expensive trouble. In this way surveyors may be generous towards their legal brethren although detrimental to themselves. The description for the parcel will be: "All and singular that certain parcel or tract of land situate, lying and being, in the town of Hope, in the county of Wentworth and Province of Ontario, containing by admeasurement three thousand square feet, be the same more or less, being composed of a part of lot number one, on the northerly side of Logan street and on the easterly side of Chester street, and being in Block A, as shown on the plan entitled, 'Plan of subdivision of township lot number seventeen, third concession, township of Derby, county of Wentworth,' under date June 11, 1875, signed by James Duncan, P.L.S., and filed in the registry office for the county of Wentworth, and which parcel may be more particularly described as follows, that is to say:—Commencing at the south-west angle of said lot number one, being the intersection of the northerly side of Logan street with the easterly side of Chester street; thence, along said side of Logan street, easterly twenty feet; thence northerly, parallel to the westerly limit of said lot, one hundred and fifty feet, more or less, to the southerly limit of the registered lane, twenty feet wide; thence westerly, along said limit of lane, twenty feet, more or less, to the north-west angle of said lot number one; thence, along the westerly limit of said lot, southerly, being along the easterly side of Chester street, one hundred and fifty feet, more or less, to place of beginning.

Notes on Above.

There is probably only one point that needs explanation in the above,—and that is why I say twenty feet more or less for the rear of the lot when I have twenty feet definite on the front.

From the hypothesis or condition of sale the east and west limits are to be parallel, that is the parcel is to have a uniform width, measured parallel to the frontage of twenty feet. As the front and rear of the lot are original boundaries, and, although they were intended to be parallel, yet may not be found so on the ground, in which latter case the definite distance of twenty feet at the rear might destroy the parallelism of the east and west limits of the parcel, hence the words "more or less" are used.

CASE V.

It is seldom required to give a description wherein it is desired to have a definite area, that is a person buys so many square feet or acres and no "more or less."

If such be required, one or two lines will probably be given in position. For instance, the half of the front of the lot and the adjoining lot boundary, a further condition will likely be given that the parcel is to be a parallelogram. With these data the description can be so worded as to include a definite area although the measurement of the sides may not be definite, but in such event the one will be made dependent upon the other,—for example—so many chains more or less along the southern boundary of lot from the south-east corner thereof to the point midway between the south-east and south-west corners of said lot, thence northerly and parallel to the eastern boundary of said lot to such distance that the parallelogram contained by the two described lines and the two opposite and equal ones, each to each, shall contain ten acres, thence easterly parallel to the southern limit of said lot — chains more or less to the eastern boundary of said lot and thence along the same southerly — chains more or less to place of beginning.

I have in some of the above cases inserted distances that are not absolutely necessary for defining the land, but have added them simply as circumstantial evidence, but without impairing the definiteness of the description itself. All such measurements are naturally "more or less."

It will be noticed that in none of the above descriptions save one have any definite bearings been given. One reason for such omission has already been advanced and that is, as a bearing means some definite course—a particular direction, it is thereby in practice generally incompatible with the linear measurements given.

Argument might advance the circumstantial evidence plea of "more or less" that was granted to distances, but this is objectionable and for two reasons,—firstly, it is totally without precedent to say for example—thence north about fifteen degrees thirty-seven minutes west; secondly, and the greater reason, it is highly probable that the circumstantial evidence of bearings would differ from that of linear measurements, and instead of being corroborative in assisting towards a solution, would confuse matters.

As before stated, linear measurements are found by experience to have far more weight than angular measurements and hence should be given the preference in descriptions.

There are numerous cases, however, where both bearings and distances must be given.

CASE VI.

Mr. A. sells off his township lot, an irregular parcel, probably with numerous sides.

One, generally two sides of the parcel, will be co-incident with original lot sides.

The description should begin at one of the corners of the original lot or some other established or well-defined point. The irregular sides, if I may so term them, that is those not forming part of any original lot line, should be given in bearing and distance, the former preferably astronomic, but care must be taken to have all bearings on

the same basis, not give the original magnetic bearings of the lot lines for these lines, and the rest astronomic; and when making them all astronomic, the original bearings for the lot lines should be given in parenthesis for these lines and following the astronomic bearings given therefor.

In such a description at least one course must have its distance "more or less" for "closing."

If there are any permanent boundaries such as a stone building marking any corner, the distance thereto must also be "more or less" as given under Case III.

A word about descriptions in old deeds. These instruments frequently contain errors, impossibilities and nonsense. Under the last may be classed "commencing at a stone in the corner of the field where a post has been planted"—; "Thence N. 10° W. 12 c. 50 more or less" (to where?); "Commencing at the south-east angle of said parcel where a post has been planted;" and so on.

Under impossibilities we may cite those cases where bearings and definite distances are given, which on computation are found to be far from possible.

Errors arise mostly through the interchange of the words—north, south, east and west; as an instance of this I will give the following I met in my own practice years ago:—

The description of the parcel was as follows: "Commencing at the distance of thirty-seven chains eighty-two links from the south-west angle of said lot number seventy-nine in a course therefrom north twenty-five degrees thirty minutes west, thence north seventy-six degrees east eighteen chains and six links, thence north sixty-five degrees east ten chains eighty-three links, thence north twenty-five degrees thirty minutes west three chains forty-seven links, thence south sixty-five degrees west ten chains eighty-three links, thence south seventy-six degrees west eighteen chains six links more or less to the western boundary of said lot, and thence south twenty-five degrees thirty minutes east three chains fifty-four links more or less to place of beginning."—Containing by admeasurement ten acres, be the same more or less.

The southern boundary the farmer wanted defined.

I had not run very far from the south-west angle of the parcel when he said, "You are shooting into my neighbour's." I continued and found when I reached the established eastern boundary my measurement fell short nearly four chains, making it apparent that something was wrong.

Obtaining the deeds of the adjoining lands, I soon discovered the error. The course of the southern boundary should have been north seventy-six degrees west instead of south seventy-six degrees west.—South had been through a slip written for north.

Even with the corrected description, the area was in error; the parcel contained according to metes and bounds 8.67 acres instead of 10 acres. The person who made the description having evidently simply multiplied length by breadth without observing that the

breadth at one end was not at right angles with the adjoining parallel sides.

The question now comes, what is the surveyor to do under these or similar circumstances, either in making a survey or descriptions comprising parts of such lands.

The law certainly does not constitute the surveyor Judge in such matters. But law is intended to be the incarnation of common sense, and on the strength of this I would suggest that the surveyor use common sense and make his survey and description accordingly. In the last cited parcel I certainly would have no hesitation in making a description of that parcel or its southern part if sold, by inserting the bearing intended and not the one given in the old deed.

It can not, however, be made too imperative that the greatest caution be exercised in doing anything inconsistent with the original document, although the latter may be inconsistent in itself.

By means of deeds of correction errors may be eliminated, but with old indentures where the legal representatives may be spread over two or three generations, it is next thing to an impossibility, and connected with a great deal of expense to obtain a deed of correction.

By the Statute of Limitations a person may claim land by adverse possession, but he can not legally sell such land until his claim has been ratified by the courts, a procedure that may cost more than the land is worth.

Many of the older surveyors well know that the good offices of the surveyor as mediator and peace-maker have often been exercised when neighbours were at strife about some boundary, and that through his just and good counsel harmony has been restored where litigation was brewing.

And finally look upon the making of a description as upon a problem, something definite is to be done—no ambiguity, no uncertainty. Have the proposition and data clearly in your mind—then go ahead—and there will be no difficulty in making a proper description.

A word to the younger surveyors. In making a description always express numbers in writing, the corresponding figures may be added in parenthesis. Never use abbreviations and always keep a copy of every description you make, preferably using a letter press for copying and a book specially for descriptions. A good legible hand is also imperative.

Before closing I wish to answer a question that is sometimes put by lawyers to surveyors, and generally with a patronizing air:—"Can't you measure the exact distance between two points?" "No man can measure the absolute distance between two points" is the answer.

To begin with there is only one measure of absolute length in the Dominion of Canada, it is the "Standard Yard" "A," deposited in the Department of Inland Revenue. It is intended to be of the same length as the "Imperial Yard," but this does not make its length absolute"; however, by Act of Parliament, 42 Vic., Chap. 16, it is made "absolute" for the Dominion. All other linear measures, and hence measurements, are dependent upon it.

It is impossible to make an absolute copy of that standard yard, and it is also impossible to make an absolute comparison between that yard and any other measure—say a chain—which shall be an even multiple of that yard, hence all measures (except the standard) are affected by error, although that error may approach the infinitesimal. Hence no absolute distance can be measured, as it is impossible to have an absolute measure for determining the same.

Another reason for answering the question in the negative, and independent of the first one, is that the operation or act of measurement between the two points is not perfect. It would be a mere coincidence if two or more measurements of a certain line were absolutely concordant. However, a careful surveyor will do his work in such a manner that discordances arising from re-measurement are kept within such limits as to be practically inappreciable.

We find in trigonometric surveys, where the greatest care and the highest refinements are applied, that the length of a base line on which the triangulation rests is always given with its probable error. The following example from Wright's "Adjustment of Observations" will illustrate this latter, in fact the whole question:—"In the measurement of the Massachusetts' base line, consisting of 2,165 boxes, the probable error of a box, as derived from comparison with the standard meter, was $\pm 0^m.0000055$, the probable error from instability of microscopes in measuring a box was $\pm 0^m.000127$, and the probable error of the base from temperature corrections was $\pm 0^m.0332$. Show that the probable error of the base arising from these independent causes combined is $\pm 0^m.0358$."

In short, gentleman, the distance between two fixed points is always "more or less."

I append verbatim a description of a mining claim in British Columbia, obtained by me last spring. It is simply an ordinary specimen of that class of documents in that Province.

MINING CLAIM—HAPPY FIND.

"Kootenay, near Illecillewaet, July 5th, 1886. Recorded in favour of D. W. Corbin, No. 25492, and J. P. Kennedy, No. 25493, and C. W. Wood, No. 24623, one mineral claim of 1,500 feet long, by 600 feet wide on a ledge, lode or mineral deposit. First stake commencing up the north fork of the Illecillewaet River about twelve miles from its fork on the west side of a gulch running in an easterly direction, 1,500 feet to third stake situate on the face of a bald mountain to be called the Happy Find claim, said claim has been duly staked and notices posted up according to Mineral Act, 1884, and the amendments of 1886, and recorded subject to clause 23 of Mineral Act, 1884."

Those unfamiliar with mining claims will probably feel inclined to smile at this description, which act would certainly be pardonable. The definiteness of the description shows most decidedly that the land in question is possibly not in Africa, but in mitigation it may be stated

that mining is nearly always done in a very rough, rocky and mountainous country where it is impossible to parcel out the land beforehand checker-board style.

Surveys are only necessitated through the discovery of minerals, and the above description is only intended to hold until a patent is to be issued when a surveyor is despatched to locate and define the lands.

In the above description, however, I think it would have been well if it had been stated on which side of the river the gulch is on, and save trouble in finding the bald mountain. Furthermore, one would naturally infer that a gulch "running in an easterly direction" would have one of its sides designated by north or south instead of west.

DISCUSSION.

The Chairman—I was very much interested in the paper. It is a very important matter and one which should receive every consideration from practitioners.

Prof. Galbraith—I listened with great pleasure to Mr. Klotz's paper. Although it is some years now since I have had to practise, I have not lost interest in such matters. It seems to me he has brought out the use of the words "more or less" very clearly. It is in the experience of every surveyor who has had to work much by descriptions that he finds what Mr. Klotz says to be true; the words "more or less" are used without any rule at all. It occurred to me that an endeavour should be made to reduce the use of these words to some rule. The principle governing them has been clearly stated by Mr. Klotz, but the practice has been very irregular. The terms "more or less" used in the measurements are only intended as a descriptive measurement. I think, whether measurement be the lineal or angular measurement, both methods of measuring should be used. As far as the surveyor is concerned, if the the description is properly made the "more or less" is of no value, such measurements from the description show the intention. There is this trouble, that it is at present difficult to say whether the words "more or less" in descriptions are explanatory or absolute. If one left out the words "more or less" altogether the description would be more intelligible. The absolute description in most cases is just as clear to the layman as to the surveyor. I think where practice shows defects it is just as well to alter it.

Mr. Stewart—I want to ask a question: Where the magnetic bearings are given in deeds years ago, are you going to hunt these up? Very frequently we say so many chains "to a post." Are you to hunt up that post, or are you to disregard it? I think it is better without a post.

Mr. Gaviller—When you have a distance given to a post, if you cannot find that post you take the distance to the post "more or less." If you find the post you take the distance in the description.

Mr. Gibson—Compasses are used more than some surveyors imagine. I look up generally the first deed, and that will very likely

give me the first survey. You get the old line from the original survey and get your compass fixed from published reports of the Magnetic Observatory. I put down the magnetic bearings and the date. When you measure along the north side of a lot your course is fixed. I find the magnetic courses are the best run by transit. If the point can be found, it governs; if not, then the distance governs. I simply put in the distance to a limit. I do not say anything about more or less. We can put in the course and distance in the deed. I think also you should put the bearings in your sketch. My practice is: I take the bearings of the governing line of the property, then run the line with a transit, and all my calculations are made from that. That is recommended by the Land Titles Act. My practice is to put the magnetic course, and put in also the patent course and say what they are.

Mr. Abrey—I may say, in reference to lawyers, that they will not put this "more or less" in if they can help it. I always put in "more or less" and fight it out with them. I find it awkward to use the magnetic bearings, true bearings and patent bearings all on one piece of land; they do not always agree.

Mr. Chipman—The main point is to try and reduce the drawing up of descriptions to a scientific basis. It is very senseless for men of intelligence to use the words "more or less" so generally in descriptions. Mr. Klotz's method of describing property and taking bearings is the proper way. One point this Association should protest against is the servility of our profession to the legal profession. I think it is a disgrace to allow them to interfere in matters in which we should be authorities. I do not believe in a lawyer or judge or anyone else interfering with me about a description. We should draw the descriptions as scientifically as we can and stick to them.

Mr. Sankey—I agree that we should not be dictated to by the lawyers about our descriptions. I find that here the lawyers tell you they want a plan. You ask for the original survey, and say you will have to go to the registry office for it. The lawyer will say, "Oh, never mind the original plan; just go on to the ground and make the plan." When you bring the description to the lawyer he says, "I could have done just as well myself; you have no bearings on it," and "You have 'more or less.' I can write a description well enough myself, but I do not understand about these bearings." (Laughter.)

The Chairman—I would suggest that this be taken up by the Land Surveying Committee and attended to next session.

[*This Association is not responsible as a body for any opinions expressed in its Papers by Members.*]

RIGHT OF WAY SURVEYS.

By H. J. BROWNE, P.L.S.

I SEE by the programme that this subject has assumed unusual importance, and that four papers are to be read upon it, so I trust, that amongst us it will receive full elucidation.

What is commonly known as a "Right of Way Survey" is in connection with railway work, but the same sort of survey is occasionally made for the purpose of obtaining the definite position of an ordinary road, but I believe the former is that upon which I am asked to write. The field work is not of a deep scientific character, but certainly requires good judgment and some experience in such work, especially in cities and villages. The object of the survey is to find the quantity of land taken from each owner, and, in order to obtain this, the surveyor must be given the ordinary width required, with all extra widths and the stations between which these are to be taken, of course in starting the position of the located line should be fixed from some well-known point, and, at least, at the commencement and end of every tangent afterwards, and, if necessary, for the purpose of drawing descriptions at intermediate points on both tangents and curves; it is not always necessary to chain the line as the stations may fairly be assumed to be correct, and I have always found them to be the regulation 100 feet apart, but care must be taken that no broken stations, as they are called, are passed over as being of the ordinary length. These broken stations are most commonly found at the commencement or end of a curve and are generally caused by a change of line having been made which has either lengthened or shortened the first line, and, instead of re-numbering all the stakes upon the line, the overplus or deficiency is all put into the distance between the last station on the new line and the nearest station on the old line.

In township lots should there be any doubt about the position of the fences, I have, if possible, got the two adjoining owners to agree upon a division line, for right of way purposes, this, of course, does not deprive them of the luxury of a lawsuit, if so inclined, over the remainder of the line, and I expect we all know what a pleasure it is to some people to have some cause, no matter how slight, to enable them to commence a lawsuit. When the division line is obtained, the customary way is to measure the plus or minus to the nearest station, the angles at which these lines cross the located line will then be taken; this, of course, is not necessary at each division line; the greatest care is requisite in small town lots, especially where they

are not enclosed, and, as is often the case, a large irregular subdivision or town plot is crossed diagonally by the railway, with only here and there an original post to be found; these are some of the difficulties the surveyor has to encounter in the field work, and it is in these and similar cases that good judgment will be required, but I would strongly advise any novice in such work, to examine carefully a plan of right of way, before commencing his survey, for, in my own case, a previous knowledge of these plans enabled me to make the survey much more expeditiously.

The plan should show the numbers or other designations of town or township lots—the concessions, owners, with the area of each parcel to be taken, with the length along the located line of such parcel, the ordinary width need not be separated at each line, but all extra widths should be given at each end; of course the bearings of tangents and the radii of curves should be given.

In a short paper it is difficult to describe all the minutiae of the field work and plan, but if, in the foregoing explanations of right of way work, I have drawn attention to the principal points, both in the field and plan, my object will be attained.

By JOHN DAVIS, P.L.S.

A RAILWAY right of way survey has for its object the determining of the position of the lands required for railway purposes, with reference to certain fixed points, the determination of their areas, and such general information as shall facilitate their transfer from the owners to the railway company, and their re-location if necessary. Such information so gained is embodied in a plan, known as the right of way plan, and it is accompanied by a table of particulars, known as the book of reference.

Before referring to the survey proper it may be well to briefly outline the manner of defining the centre line, as finally located by the party on location.

Such centre line is marked out on the ground by a single row of stakes, numbered consecutively from zero, and usually placed one hundred feet apart. In some cases, especially on sharp curves, they may be placed at a less distance apart, thus facilitating very much the labours of the right of way surveyor when such curves intersect lot lines. Hubs driven in the ground with a tack to mark the centre line are placed at the beginning and end of curves, and also at the intersection of the tangents, unless in cases where running to intersection has been found impracticable, or has been omitted for other reasons. Hubs are also placed at other points along the line where a change of position was necessary on the part of the transitman. Wherever a hub occurs, be it at the beginning or end of curves, or at other points on the line, a stake standing near shows the chainage, the extra number of feet over the chainage marked on the preceding station stake being indicated as plus.

As the location party proceeds in thus marking out the centre line, a record is kept of all angles taken, all data regarding curvature, tangent distances, etc., together with the chainage on the centre line, where it intersects lot lines that can be readily seen by the party as they pass along, and also giving distances to the nearest lot angles. From the information so recorded in the field books a plan is prepared, and where possible lot lines are accurately laid down thereon. It is seldom, however, that this plan can be prepared with any degree of accuracy, as in the hurry of location time is not taken to make the necessary inquiries regarding lot lines and angles, and accurately fix all intersections. A copy of this plan, however, gives the party making the right of way survey a pretty general idea of what is required, as all lands required for the purposes of construction and operation of the railway will have been indicated thereon, so far as then known, with the widths given as extending a certain distance from the centre line, measured at right angles therefrom.

It now remains for the right of way surveyor to carefully ascertain the exact position of such centre line, noting the chainage on the centre line where it intersects lot lines, and also the angle of intersection of such lot lines and tangents.

We will suppose him to be in possession of all information that may be obtained from the engineer's office pertaining to the location of the centre line and boundaries of lands required. He should, of course, thoroughly acquaint himself with the system of survey under which the lots were originally laid out, and have copies of all necessary plans. In the case of town property these plans will be indispensable, as in many instances monuments cannot be found, and whole blocks will often have to be re-surveyed to re-locate a corner of a lot from which a measurement will be required to the centre line, or the boundary of the lands required, as the case may be.

The true dimensions should be given of all town lots through which the line passes, and measurements made along the lot lines intersected by the centre line, such measurements to be from the angles of the lots to the boundaries of the lands required, and also measurements from such boundaries to the centre line along the same lot lines.

In cases where small portions of lots remain outside the limits of lands actually required, it will be well to ascertain their area and all other necessary particulars to facilitate their transfer, as in many cases such lands, though not needed for railway purposes, can be bought to advantage by the railway company, the owners holding that such remnants, if isolated, would be valueless to them.

The angles formed by the intersection of the centre line with street or lot lines should be carefully measured where such lines are crossed by tangents, and where crossed by curves such street or lot lines should be referred to the tangents to ensure accuracy in plotting. To obtain the distance of the centre line from lot angles, where the lot line is thus crossed by a curve, due attention must be paid to the correct ordinate for that part of the curve the chord of which extends between the nearest station stakes, one being on each side of the lot line.

The chainage on the centre line where it intersects the street or lot lines must be ascertained by measuring from the preceding station stake, and entered as the number on such stake, plus the distance so measured.

In cases where whole lots are included in the right of way, the actual measurements of the boundaries should be ascertained, and the correct area calculated, regardless of any areas or measurements given on registered plans of the property, as in many cases such areas and measurements as given will be found incorrect, and will involve dispute and difficulty where lands are purchased at a certain rate per acre.

Great care should be exercised in dealing with lands owned by different parties, that boundaries legally established through lapse of time be not interfered with, and that such owner is duly credited with any lands affected, legally held by him. The writer has in view a case where the centre line of a railway was laid out parallel to the division line between the east and west halves of a certain lot, and at the distance of thirty-three feet therefrom. It was afterwards found that the fence, as built by the owners a great many years before, was not on the true line, and was less than thirty-three feet in many places from the centre line. It transpired that the owner of the land beyond the fence had to be settled with at considerable expense, and the conveyance to the other owner had to be altered to meet the altered circumstances.

The manner of conducting a right of way survey in the country, where the line passes through township lots, is very similar to that applying to town lots, described above; and very little further need be said as to the work to be performed or the methods employed. All intersections, however, are to be carefully noted, and the distances from the lot angles along the lot lines to the centre line carefully ascertained.

We have seen that in the case of town property measurements are made from the lot angles to the boundaries of the lands required, but in the country we may omit such measurements to the boundaries, and confine ourselves to defining the position of the centre line alone, from the fact that the boundaries can be referred to as being at a certain distance from such centre line; all measurements as to width being made at right angles to it. This will obviate the necessity of determining the distance by calculation or otherwise along the lot lines from the centre line to the limit of the lands required in cases where the centre line crosses lot lines obliquely. Cases will arise where lot lines cannot be readily found, either from the fact that they have not been run or all traces of them lost, and to re-run such lines from the concession line to their intersection with the centre line, through perhaps rough and wooded districts, would involve the expenditure of much time and money. This difficulty can often be effectually met by running a line parallel to such line at some place where it can be readily run—say through a neighbouring clearing—noting the distance along the concession line from the lot angle to where such line leaves the concession line, and referring the line back

by measurement, thus obtaining the true point of intersection with the railway line.

THE RIGHT OF WAY PLAN.

Having obtained all needful information in the field for accurately laying down the line on paper, thus preparing a permanent record, the surveyor will now proceed to the preparation of the right of way plan, and its accompanying document, the book of reference.

Little need be said with reference to the preparation of this plan. It is a simple record of the field operations. The paper should be of good quality, and if mounted on cloth all the better, as right of way plans are subjected to much handling. The scale should be large enough to permit of all distances and other information being clearly set forth. The centre line should be in a separate colour, well defined and distinct, and the bearings of all tangents and lot lines given, also the degree of curvature of all curves, with the chainage on the centre line where such curves begin and end and where lot lines are intersected, the distance of the centre line or boundaries, as the case may be, from the angles of the lots, the areas of lands required, and any other information that would assist in clearly expressing the meaning intended. The lands required should be tinted with some lasting and distinct colour.

THE BOOK OF REFERENCE.

As is set forth in the Railway Act, the book of reference should contain a general description of the lands required, the names of the owners or occupants thereof as far as they can be ascertained, and everything necessary for the right understanding of the map or plan. It may be prepared by ruling a sheet of paper into vertical columns, with headings as follows: No. of deed, Name of owner or occupant, Description of lands required, Lot No., Concession No., Township, County, Acreage of land required, with a concluding column for Remarks. In giving the names of owners care should be taken to ascertain the correct names, for in the event of an omission or error in entering a name special and troublesome means have to be employed to have the correction made if the plans have been filed. A very apparently insignificant error is often sufficient to set aside legal proceedings for getting possession of lands required, and give rise to vexatious delays. Hence the necessity of extreme care being taken and close attention given to all matters connected with the work.

In this paper I have endeavoured to confine my remarks to the mere method of carrying on the work, so far as such was possible, and for all particulars as to statutory requirements would respectfully refer the surveyor to the Railway Act, such requirements being more fully set forth therein than is possible within the limits of a brief paper on this important subject.

By H. D. ELLIS, P.L.S.

[*Extract from Dominion Railway Act.*]

"SECTION 123 of the Dominion Railway Act provides that surveys and levels shall be taken, and maps and profiles made, of the course and direction of the railway, showing the lands intended to be passed over and taken as far as then ascertained, and that a book of reference shall be made which shall set forth a general description of the lands.

"The names of the owners and occupiers thereof as far as they can be ascertained, and everything necessary for the right understanding of such map or profile.

"Section 124 states that these plans and profiles may be made in sections and are to be deposited in the Department of Railways and Canals.

"The same Act further states that these plans, profiles, and reference books are to be examined and certified by the Minister or his Deputy, and that duplicates shall be deposited in the Department of Railways and Canals, and copies of such parts as relate to each district or county through which the railway passes shall be deposited in the office of the Registrar for such counties or districts.

"Section 135 provides that the scale and paper may from time to time be designated by the Minister, and that the plans, profiles and reference books are to be certified by the President or Engineer of the Company."

SURVEYS—PARTY.

In making the surveys for these plans, after the preliminary surveys for the railway are completed, it is usual to send out a party in charge of an Engineer consisting of a transitman, leveller, and sometimes a topographer, with, of course, the necessary assistance in the form of chainers and axemen, varied as far as numbers are concerned as the country is wooded or cleared.

You are probably all more or less familiar with the duties of the different members of the party, and it is sufficient for me to say that they place stakes every 100 feet, and locate the position of the "centre line," in accordance with previous instructions given by the Chief Engineer, and make such local changes as the nature of the country may require.

DUTIES OF A P.L.S. ON PARTY.

Generally a Provincial Land Surveyor is employed in addition to those already mentioned, and it is with his duties that we are more immediately concerned. He has to trace up the lot lines, ascertain the correct position of the located centre line upon the various lots, after the line has been staked out by the Engineers, and find out to whom the different properties belong, which are cut by the projected line of railway, also make sufficient notes to compile the plans and books of reference.

In doing this work the surveyor should make very full and copious field-notes, especially where the lots are broken into small subdivisions, or the land held by different owners, in order to be able to calculate the exact area taken from each owner.

CHAINAGE.

The chainage where the "centre line" crosses every fence, or lot line should be carefully taken by the surveyor, and he can check his work at night with the notes taken by the Engineer's chainers, who should be instructed to note these points when they can do so without delaying their work.

All changes in the direction of the centre line should be noted and the magnetic bearing of each tangent taken as a rough check on the transitman, who, like all of us, is occasionally liable to error. If, however, the curves are being run in on the ground, and the tangents run to their intersections, this is unnecessary; as he then checks his own angles in a more certain way than can be done by any compass.

The bearings or angles at which each road allowance or public highway, as well as lot lines, cross the "centre line," should be taken, and measurements made along them to posts or well defined boundaries as frequently as possible.

In burnt and wild lands it is often a very difficult matter to find the posts or boundaries as they are sometimes entirely obliterated, and where the owners are non-resident and no fences to be found, the surveyor must govern himself to the best of his abilities under the circumstances. I can fully sympathise with any one who has tramped on a hot day over a rocky and burnt country, trying to follow the traces of an old line, perhaps for several miles, and then to find no clue wherewith to get a starting point for his measurements, then to have to walk back, and probably with the same result, on the other side of the "centre line."

BUSH AND CLEARED LAND.

It is often useful to note the chainage at those points where the line enters and leaves bush or cleared land, and also whether the stumps are still standing, and if the land is under cultivation. Occasionally a different price is paid by railway companies for cleared and bush lands, and if not measured on the location survey, it would be difficult to determine the relative arrears and the different amounts to be paid for each class, without going on the ground a second time. This takes very little extra time, and often saves the delay and expense of a re-measurement.

A rough pencil plan is usually platted every evening on cartridge paper by the transit man, and the right of way man should make memoranda of any omissions which may have occurred in the previous work and supply them during the following day when practicable.

FIELD NOTES.

Whilst on this subject, let me impress upon those who may be called upon to make surveys of this kind for the first time, the advantages of

taking notes of everything they can find time to whilst they are in the field.

Additional measurements to barns, dwellings and buildings of all kind in proximity to the "centre line" are sure to come in useful, if not for the actual right of way, perhaps in reference to the location of the centre line, which is always subject to revision until constructed. I have never yet found I had made too many notes, whilst very often I have wished additional ones had been made, and many things which seemed of little importance at the time have afterwards become important factors, owing, perhaps, to some slight changes of the original location.

DISTRICT MAPS.

A pocket-map on a conveniently small scale, say 2,000 feet to the inch with the approximate position of the line laid down on it, will be found of great service while searching for boundaries and save many a useless walk. Government maps of each township should be taken as a matter of course.

In order to obtain the names of non-resident owners, and often to get the correct names of the various holders of property along the line of railway, a visit to the assessor is usually needful, and from this official the surveyor will generally get much useful information about local peculiarities in the surveys of the municipality. I do not mean by this to take him as an absolute authority, but only that one can often get hints and suggestions which give him some idea where to search for more accurate information.

Where another railroad crosses the line of location it is necessary to make a survey of it for at least a mile on each side of the crossing point. The angle of crossing should be accurately taken because, if on the level, plans for the diamond have to be made.

PLANS FOR REGISTRATION.

After the completion of the survey plans for filing and registration have to be prepared, and it is more especially in this particular that the hand of the novice is recognized.

The Act states that plans and profiles are to be made, but to my mind it does not state very definitely what particulars should be placed on them.

The Minister of Railways and Canals usually requires that certain information shall be embodied in every map or plan made for filing. With the profiles we have nothing to do, they are prepared by the leveller.

For the assistance of those not familiar with Right of Way work I may here say that every map or plan of right of way should contain the following information, and as it is desirable that a certain amount of uniformity should be followed in this respect, I will give what has been my own practice, and with few exceptions, the system adopted by others with whom I have been associated.

OWNERS' NAMES—BEARINGS.

The names of the owners of each separate parcel of land should be shown in black. The bearings of all tangents should be in blue, and should be calculated from a fixed bearing by the intersection angles which are measured by the transitman. This will not give the true bearing either magnetically or astronomically, but it will give the correct angles at which the tangents cut one another and from which the curves are calculated and run. A good plan is to take an astronomical bearing at each end of the work and magnetic ones in between. These help to locate any mistake which may occur in the transitman's angles if he has been running in his curves without carrying his tangents out to their intersection points.

CHAINAGE.

The chainage of the located line should be in red and should be placed on every lot line; also on either side of road allowances and travelled roads.

CURVES.

The beginning and end of every curve should be marked on the plan, thus, B.C. 560+49 E.C. 569+60. The radius and degree of curvature (it is better to put on both) should be marked in red inside each curve, and if it is a compound one, the point of change should be marked P.C.C. and the chainage given at that place.

All breaks in the chainage of the "centre line" should be shown on the plan giving both chainages thus $760 + 10\frac{1}{2} = 2,070 + 59\frac{3}{4}$.

DISTANCES.

The distance across each lot measured on the "located centre line" should be given in addition to the chainage, and should be in red.

WIDTH OF RIGHT OF WAY.

The distances from the located line to the corners of lots should be in black; this prevents them being mistaken for the width of the right of way which is usually shown in red. This width is defined by Section 103 of the Dominion Railway Act as not to exceed 33 yards in breadth excepting in places where the railway is raised more than five feet higher, or cut more than five feet lower than the surface of the line, or where offsets are established and then additional widths may be taken as right of way. Where stations or depots are intended to be established 650 yards by 100 yards in breadth is allowed or more if the Minister will sanction it, which you perceive gives the Railway Company a good deal of latitude.

EXTRA WIDTHS.

The fact of these extra widths not being accurately shown on the original plan will not however prevent the Company obtaining them

ultimately; but additional plans and books of reference of the extra land required will have to be made. These have to be filed in the same manner as those of the located line, so that it is preferable, when possible to place them on the original plan of the location.

CENTRE LINE.

Where it is intended to lay double tracks it is usual to place the first track with its rails equally distant from the "located centre line" and then the distances from the "centre line" to the boundaries of the right of way will be 43 feet on the one side and 56 feet on the other; that is for tracks with 13 feet centres. Where it is only intended to build a single track it is customary to place it in the centre of the right of way, the rails being laid equally distant on each side of the "located centre line." In making subsequent surveys it is therefore very necessary to ascertain which track was originally laid in order to know the position of the "centre line" as originally laid down, and I have known a good deal of trouble and annoyance caused by surveyors assuming that the "centre line" of a railway means a line half way between its tracks or in the centre of the right of way.

ACREAGE.

The acreage taken from each owner for right of way purposes should be shown on every parcel owned by that person in red and the areas of all extra lands taken for station grounds, borrow-pits, sidings or road diversions should also be shown on the plan in red, and independently of the right of way areas. This is often neglected and causes a good deal of extra work if the land is not taken which is sometimes the case because it is not compulsory on a Railway Company to purchase all lands shown on their original plan. Sometimes extra widths are shown which are disallowed by the Minister at Ottawa, and often when the line is being built some extra widths are found unnecessary and therefore not bought. In cases of this kind the extra area has only to be struck out, but if it has been included with the area of the right of way the amount has to be recalculated.

COLOURS.

The lot lines and numbering of lots should all be in black, and the various townships and concessions should be clearly indicated.

It is usual to colour all lands intended for the use of the Railway Company in red, and to show the centre line in red.

The general rule is to show the centre lines of all projected railways in red, and all those constructed in blue.

Where the centre line crosses another railway the foreign road should be shown on the plan together with its right of way for at least a mile on each side of the location and the angle of crossing should be stated on the plan.

RIGHT OF WAY LIMITS.

The right of way boundaries are usually outlined in red, excepting where the boundaries happen to coincide with lot lines, in which cases they are in black.

MILEAGE.

The Mileage is sometimes placed on these plans, chiefly for reference in the office.

TITLE.

The Title should embody the name of the Railway and the Townships and County through which the road runs.

SIZE.

The plan should not embrace more than one Registration district for convenience in filing, and all plans should be in triplicate. These when completed and signed by the Chief Engineer are sent to the Minister at Ottawa, and after being examined and certified by him one plan is deposited in the Department, one is filed in the Registry Office for the Municipality through which it is intended to build the road, and the third is kept for use in the Chief Engineer's office.

SCALE.

The scale for plans through farm lands is usually 400 feet to the inch, and in towns and cities from 50 to 200 feet to the inch according to the sizes of the lots to be shown, but the Minister at any time may give instructions to have the plans drawn to any scale to suit his ideas.

REFERENCE BOOKS.

Reference Books are easily compiled and are generally on printed forms, with blank spaces left for the name of the County and Township. They are divided into columns, in which the following particulars should be entered. Names of land owners—names of persons occupying or renting the property. The numbers of lots and concessions, and the different areas.

A column is usually left for such remarks as may be necessary to indicate for what purpose additional lands have been taken.

These books should be made in triplicate and signed and filed in the same manner and at the same time as the right of way plans.

ARBITRATIONS.

There is another duty of the right of way surveyor, and a very important one which I will briefly touch upon here, viz.: preparing plans and descriptions in reference to lands upon which the Railway Company and the owners cannot agree as to price.

After the expiration of ten days from the deposit of the plan and book of reference in the Registrar's office for the municipality in

which the land is situated, and after notice has been given by advertisement in newspapers published in the county through which the railway runs, application may be made to the owners of lands and agreements may be entered into with them, in reference to the amounts to be paid for their properties and any damages sustained.

Should the Company and owners be unable to agree the Act provides that the amount may be settled by arbitration.

Before coming to this however certain formalities have to be gone through.

A notice has to be served upon the party by the Company containing a description of the lands to be taken or of the use intended to be made of them.

A declaration of readiness to pay a certain sum or rent as compensation, and the name of some person to be appointed as arbitrator.

Accompanying this should be a certificate signed by a P.L.S., or by an Engineer; that the land is required for the railway, or is within the limits of deviation allowed by the Act.

That he knows the land, or the amount of damage likely to arise from its use, and that the sum so offered is sufficient and fair compensation for the land and damages.

Under the head of "description of lands taken" a description by metes and bounds accompanied by a sketch showing the lands in question, coloured pink is attached to the notice. These are prepared by the engineer or surveyor who signs the certificate.

After this is done without the surveyor is called as a witness in the arbitration the matter passes into the hands of the Company's solicitors, and its ultimate fate depends entirely on which side can produce the best witnesses.

REMARKS.

Before closing I wish to draw your attention to the Dominion Railway Act which does not require, even in cases of arbitration (Sec. 147), the plans to be signed by a Provincial Land Surveyor, but only by the Engineer or President of the Company, neither of whom can possibly be in a position to state whether the lot lines are shown in their correct places. I think this to be a mistake and that the correctness of the plans as far as the lot lines are concerned should be certified by the P.L.S. I regret however to say I have seen specimens of right of way plans signed by surveyors, which were greatly inferior to many made by men who were not, chiefly because they were defective in the information given. Engineers generally make it their business to be thoroughly posted in all requirements of the Railway Act, whilst many surveyors seem to think that the Survey Act and possibly the Drainage and Municipal Acts embody all that is necessary for them to read. Surveyors have allowed legislation to be passed on this subject without making sufficient protest, and if we do not assert our rights no one is likely to stand up in our behalf. I think a change respecting the law in this particular might be obtained without very much opposition, and I suggest that the Committee on Legislation be empowered to take up the matter.

The C.P.R. and G.T.R. I believe usually employ surveyors, when locating new lines, to make the right of way surveys, and the G.T.R. keep surveyors among their permanent staff to attend to all questions of survey distinct from engineering work. A Railway Company can save a great deal of time and money by having its real estate attended to in this manner. Extra lands purchased when a new line is built are apt to be lost sight of after the railway is in running order and in the hands of the permanent staff. Every road should keep a surveyor, whose special business should be to define, and keep defined their proper boundaries, and to keep all field notes relating to the right of way entered up and in such order that they can readily be found when required. Engineers on construction occasionally omit to fence in all the property purchased by the Railway Company; this is the case more especially when corners of lots are purchased, as those who have charge of this work are seldom surveyors, and of course are often at a loss to know how to stake out the property according to the descriptions in the deeds, and in accordance with the Survey Act.

There is another point I should like to hear discussed at this meeting and that is as to the degree of accuracy a surveyor should attain in right of way surveys across farm lands. Of course we ought to be absolutely correct when it is possible, but I do not believe that the Act intends that the Railway Company should run out the lines between every farm lot. The existing fences, if any, I think should be taken and accepted unless the owner of the land disputes their position, in which case, he may be fairly called upon to define his own property, and then the right of way surveyor can make his measurements for the Railway Company. It would be impossible to run out even half the doubtful boundaries, over say 100 miles of country, without entailing an enormous and unnecessary expenditure on the part of the Railway Company, and taking a useless amount of time and trouble; with the probability of having the majority of your surveys disputed by the owners who are always dissatisfied.

In cities and towns where land is much more valuable and is generally more correctly defined, the course of a railway across the various properties should be ascertained with the greatest exactness, and the more carefully the first surveys and plans are made the easier it will be to make changes and alterations in the alignment, should they be found necessary, when the road is in course of construction.

In the foregoing paper I have confined my remarks entirely to surveys made for railways acting under Dominion Charters. I did this to avoid occupying too much of your time in going over ground a second time, as I saw by the programme that there were to be other papers on right of way surveys, and I thought they would in all probability make an attack upon the Ontario Act.

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TIMBER EXPLORING.

By W. R. AYLSWORTH, P.L.S.

THE best time is when there is good snow-shoeing the latter part of winter or early spring.

When the limit is small and not very far from a settlement one good man at least should always accompany the examiner, but when the limit is large and remote from civilization such equipment as will enable the examiner to keep himself fairly comfortable must be provided and such a number of assistants as will be sufficient to keep the camp and equipment in places required.

No examiner should travel alone in any large woods for even one day and much less for weeks and months. Life is too precious to be thrown away by any trifling accident that might prevent the examiner from travelling unless helped.

The examiner should have proper food and a place to rest comfortably at night, or his mind and report will likely be tinged with the blues.

A good square cotton tent that will close tightly for the winter with a sheet iron stove eighteen inches square and two and one-fourth feet long, small stove pipes that will all pack in the stove with one elbow so as to run the pipe out of the gable of the tent to prevent sparks falling on and burning the tent. Blankets and cooking utensils, one large and one small axe and a coarse whetstone will constitute a serviceable outfit.

If the boundaries of the limit are defined be sure you find the right ones; but if no boundaries are run you must fix them some way either by blazed lines or broken twigs, snow-shoe tracks or otherwise so that they will not readily be crossed without being seen. Having the outside boundaries marked, then if the limit is not divided into thousand acre blocks or other convenient sections by natural boundaries, such as lakes, creeks or mountains, it should be divided by lines into describable portions.

Travel one section or portion until familiar with the timber on it, select an acre, or part of an acre, that is an average of the whole section; count, measure and estimate the quantity on this average piece and multiply this quantity by the number of times this piece

must be taken to equal the whole section or part and then repeat this for each section or portion. If the limit is small and the timber large and valuable, count and measure each tree thereon.

The foregoing will give proper results when the timber is sound, but when the trees are unsound—that is, affected by punk, black knots, shake or other defects,—the estimate will be right or wrong according to the experience, skill and judgment of the examiner.

DISCUSSION.

The Chairman—That is a very short practicable paper ; so far as my knowledge goes he has hit the nail directly on the head. If these suggestions are carried out I have no doubt it is one of the most practicable methods of getting at a timber limit.

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AWARDS UNDER DITCHES AND WATER COURSES ACT, 1883.

By LEWIS BOLTON, P.L.S.

THIS subject will no doubt be interesting to a great many of you, but I do not consider myself capable of writing a paper on this subject or any other worthy of being read before this Association. When I was called upon in 1883, the year in which this Act was passed, having had but little experience in draining before, I took as little time as I could in making the survey of locating the drain, as I knew farmers were very much afraid of expense and would make considerable talk and create more or less unpleasantness at least. I placed in stakes 100 feet apart, commencing at the point where the party who gave me the requisition desired an outlet, I took the levels from which I made a profile to accompany the award. I took no bearings of the lines, nor did I locate the starting point. The first appeal I had. When the matter came before the judge he asked me where my plan was to show the location of the drain. I said that I had not prepared one, that I had made the survey of the drain spending as little time as possible in order to keep down the expense, as the general complaint was that the costs of the awards were too much. The judge sent me back to make whatever additional work that would be necessary to complete a plan, advising me to take my time and charge enough to pay me well for my time since that time. I have taken my time in making the surveys, but I don't think that I have followed the judge's advice about charging, as it is not very pleasant every time you meet a man on the road to hear him say that your charges in that drain matter were exorbitant, and perhaps using somewhat stronger language. To give you the manner in which I treat a case under this Act, I have copied one of my awards made in A.D. 1887, it being about the first one that I turned to in my book. In this case one, E. Broughton, the owner of lot No. 11, in the 16th concession of Elma, filed his requisition. His farm being a very level one required underdraining, as also did the farms between his and the outlet at that time opened out. At their preliminary meeting they considered it advisable to bring on the Engineer, as they had but little faith in carrying out an agreement amongst themselves. On the day appointed I made the survey in the usual way. I prepared a plan on rough paper in pencil, showing the location of the drain on the lots, giving the owners names, also containing a table giving the distances and bearings of the lines as located for the drain. From this rough plan I copied one on tracing linen, keeping the rough one on file for reference, and the one on tracing linen to accompany the award. Instead of making a profile I made a schedule, showing the depth of drain at each

stake, width of bottom, grade and slope of sides, also specifications and any remarks thereon that I thought necessary to make the matter clear to all parties interested. On the margin of the schedule I marked each man's portion, so that the clerk of the township could easily make out each man's portion without having to read over the award. I keep a large copying book in which I copy, by letter press, all my awards and correspondence, etc., in reference to any drain matter, which I find not only useful to myself, but in case any of the papers while in the possession of the clerks of the township get destroyed, I will be in a position to give certified copies or duplicates which would be of great service to the corporations and remunerating to myself. I have annexed to this paper a copy of the award and plan in the above cited case of Mr. E. Broughton; it is nothing more than a copy. There may be some things in it worthy of comparison with others. I think that an exchange of ideas on any subject interesting to our profession would be beneficial to the Association, and would suggest that each member of the Association be required to furnish something for each meeting.

REPORT.

I, Lewis Bolton, the Engineer appointed by the municipality of the township of Elma, in the county of Perth, under the provisions of the Ditches and Water Courses Act, 1883, and amendments thereto, having by the requisition of Edward Broughton, owner of lot number eleven in the sixteenth concession of the township of Elma, filed with the clerk of the said municipality, representing that he required a ditch or drain in said lot, and that it would be necessary to continue the ditch or drain through the following lands:—On lot number ten in the sixteenth concession of the township of Elma, owned by James Blair; on lot number nine in the sixteenth concession of Elma, owned by John Rutherford, and along the allowance for road between concessions fifteen and sixteen in the said township of Elma, owned by the municipality of said township; on lot number nine in the fifteenth concession of Elma, owned by Charles Kreger, David Keeler and Harry Weiben; on lot number eight in the fifteenth concession of Elma, owned by Richard Ross; on lot number seven in the fifteenth concession of Elma, owned by Henry Runnaberg; on lot number six in the fifteenth concession of Elma, owned by Thomas Robbie, and across or along the road allowance, being the side road between lots numbers five and six in the fifteenth concession of Elma, owned by the said municipality, into a ditch already dug under the award of the Engineer for said township—did attend at the time and place named in the said notice, and having examined the locality of said ditch or drain, and heard the parties and their witnesses (if any), find and award as follows:—That lot number eleven in the sixteenth concession of the township of Elma would be benefited by, and requires a ditch or drain (or the deepening and widening of the present ditch or drain) to enable the proper cultivation or use of the said land, and I find that said ditch or drain will require to be extended across the land of the municipality of the township of Elma, being the road allowance between lots number ten and eleven in the sixteenth

concession of Elma, and across the land of James Blair, being lot number ten in the sixteenth concession of Elma, and across the land of John Rutherford, being lot number nine in the sixteenth concession of Elma, and across the land of the municipality of the township of Elma, being the road allowance between concessions fifteen and sixteen in said township, and across the land of Charles Kreger, being part of lot number nine in the fifteenth concession in the township of Elma, and across the land of David Keeler, being part of lot number nine in the fifteenth concession of Elma, and across the land of Harry Weiben, being part of lot number nine in the fifteenth concession of Elma, and across the land of Richard Ross, being lot number eight in the fifteenth concession of Elma, and across the land of Henry Runnaberg, being lot number seven in the fifteenth concession of Elma, and across the land of Thomas Robbie, being lot number six in the fifteenth concession of Elma, and across the land of the municipality of the township of Elma, being the road allowance between lots numbers five and six in the fifteenth concession of said township, into a ditch or drain already constructed under the award of the Engineer for said municipality. And I award the making of said ditch or drain, or the deepening and widening, as the case may be, as follows:—

Edward Broughton shall commence at stake marked A, situate on the westerly limit of lot number eleven in the sixteenth concession of Elma as shown on the annexed plan, and shall open up and maintain a ditch or drain of the dimensions, etc., set forth on the annexed schedule—N. $57^{\circ} 30'$ W. (Mag.) twelve feet more or less to the easterly limit of grade for road. Thence northerly along said limit of grade for road one hundred and eighty-eight feet more or less to stake number two; and said portion shall be made and completed within eleven months from date hereof.

That the municipality of the township of Elma shall commence at stake number two as above described, and shall open up and maintain a ditch or drain of the dimensions set forth on the annexed schedule, northerly along the easterly limit of grade for road thirty-six feet; thence N. $57^{\circ} 30'$ W. (Mag.) fifty-four feet more or less to the easterly limit of lot number ten in the sixteenth concession of Elma, and said portion shall be made and completed within ten and a-half months from date hereof.

That James Blair shall commence at the easterly limit of lot number ten in the sixteenth concession of Elma as above described, and shall open up and maintain a ditch or drain of the dimensions set forth on the annexed schedule, N. $57^{\circ} 30'$ W. (Mag.) six hundred and fifty-five feet; thence N. $32^{\circ} 30'$ E. (Mag.) three hundred and forty-nine feet; thence N. $57^{\circ} 30'$ W. (Mag.) two hundred and forty-six feet; thence N. 15° W. (Mag.) five hundred and seventy-two feet more or less to the division line between lots numbers nine and ten in the seventeenth concession of Elma, and said portion shall be made and completed within ten and a-half months from date hereof.

That John Rutherford shall commence at the division line between lots number nine and ten in the sixteenth concession of Elma as above described, and shall open up and maintain a ditch or drain of the dimensions, etc., set forth on the annexed schedule, northerly along

the division line between lots numbers nine and ten in the sixteenth concession of Elma, two hundred and ninety-three feet to the southerly limit of grade for road at station number seven as shown on the annexed plan, and said portion shall be made and completed within ten months from date hereof.

That the municipality of the township of Elma shall commence at station number seven as above described, and shall open up and maintain a ditch or drain of the dimensions set forth on the annexed schedule, westerly along the southerly limit of grade for road one hundred and eighty-one feet; thence N. $32^{\circ} 30'$ (Mag.) across grade of road forty feet; thence westerly along the northerly limit of grade for road one hundred and sixty feet; thence N. 18° E. (Mag.) twenty feet more or less to the southerly limit of lot number nine in the fifteenth concession of Elma, and said portion shall be made and completed within ten months from date hereof.

That Charles Kreger shall commence at the southerly limit of lot number nine in the fifteenth concession of Elma as above described, and shall open up and maintain a ditch or drain of the dimensions set forth on the annexed schedule N. 18° E. (Mag.), two hundred feet. Thence N. 43° W. (Mag.) six hundred and sixty feet more or less to the easterly limit of the five acres, being part of lot number nine in the fifteenth concession of Elma owned by David Keeler, and shown on the annexed plan, and said portion shall be made and completed within ten months from date hereof.

That David Keeler shall commence at the easterly limit of the five acres as above described, and shall open up and maintain a ditch or drain of the dimensions set forth on the annexed schedule—N. 43° W. (Mag.) two hundred and sixty-four feet more or less to the division line between lots numbered eight and nine in the fifteenth concession of Elma. Thence northerly along said division line three hundred and eighty feet more or less to the northerly limit of the said five acres; and said portion shall be made and completed within nine and three-fourths months from date hereof.

That Charles Kreger shall commence at the northerly limit of the said five acres, as above described, and shall open up and maintain a ditch or drain of the dimensions set forth on the annexed schedule northerly along the division line between lots numbers eight and nine in the fifteenth concession of Elma one hundred and ninety-two feet more or less to the north-westerly angle of that portion of lot number nine in the fifteenth concession of Elma owned by the said Charles Kreger, and the said portion shall be made and completed within nine and a-half months from date hereof.

That Henry Weiben shall commence at the north-westerly angle of that portion of lot number nine in the fifteenth concession of Elma owned by Charles Kreger, and shall open up and maintain a ditch or drain of the dimensions, etc., set forth in the annexed Schedule, northerly along the division line between lots numbers eight and nine in the fifteenth concession of Elma one hundred and ninety-five feet more or less to stake No. 48, and said portion shall be made and completed within nine and a-half months from date hereof.

That Richard Ross shall commence at stake No. 48, as above

described, and shall open up and maintain a ditch or drain of the dimensions, etc., set forth on the annexed schedule, northerly along the division line between lots numbers eight and nine as above described one hundred and thirty-six feet. Thence N. $57^{\circ} 30' W.$ (Mag.) thirteen hundred and thirty-four feet more or less to the division line between lots numbers seven and eight in the fifteenth concession of Elma, and said portion shall be made and completed within nine and a-half months from date hereof.

That Henry Runnaberg shall commence at the division line between lots numbers seven and eight in the fifteenth concession of Elma as hereinbefore described, and shall open up and maintain a ditch or drain of the dimensions, etc., set forth on the annexed schedule, N. $57^{\circ} 30' W.$ (Mag.) thirteen hundred and twenty-five feet more or less to the division line between lots numbers six and seven in the fifteenth concession of Elma, and said portion shall be made and completed within nine months from date hereof.

That Thomas Robbie shall commence at the division line between lots numbers six and seven in the fifteenth concession of Elma, as above described, and shall open up and maintain a ditch or drain of the dimensions, etc., set forth on the annexed schedule, northerly along said division line between lots six and seven four hundred and five feet. Thence N. $57^{\circ} 30' W.$ (Mag.) thirteen hundred and twenty feet more or less to the westerly limit of lot number six in the fifteenth concession of Elma, and said portion shall be made and completed within eight and a-half months from date hereof.

That the municipality of the township of Elma shall commence at the westerly limit of lot number six, as above described, and shall open up and maintain a ditch or drain of the dimensions, etc., set forth on the annexed schedule—N. $57^{\circ} 30' W.$ (Mag.) twenty feet more or less to the easterly limit of grade for road. Thence southerly along said easterly limit of grade for road seven hundred and eighty-five feet more or less to a certain ditch or drain already opened up under an award of the engineer under the provisions of the Ditches and Watercourses Act, 1883, and amendments thereto, and said portion shall be made and completed within eight months from date hereof.

That my costs attendant upon the examination and making of this award are twenty dollars, and shall be borne and paid as follows, viz. :—

Edward Broughton	\$3 00
James Blair	2 00
John Rutherford	1 00
Charles Kreger	2 00
David Keeler	1 00
Henry Weiben	2 00
Richard Ross	3 00
H. Runnaberg	3 00
Thomas Robbie	3 00
Total	\$20 00

Dated this 12th day of November, A.D. 1887.

Witness,

(Sgd.) E. D. BOLTON.

(Sgd.) LEWIS BOLTON,
Engineer for Elma.

SCHEDULE

To accompany Award affecting Lots Nos. 6, 7, 8, and 9, Concession XV., and Lots Nos. 9, 10, and 11, Concession XVI., Township of Elma.

—	Stakes.	Depth.	Width on Bottom.	Grade.	Specifications, etc.
Broughton.....	A	3.00 feet	1 foot	0'.056 per	All dirt taken out of drain to be spread.
	1	2.40 "	"	100 feet.	
Elma Corporation.	2	2.40 "	"	"	No dirt, timber, or brush to be left within 2½ feet of edge of drain.
	3	2.70 "	"	"	
	4	3.10 "	"	"	
	5	3.55 "	"	"	
	6	3.15 "	"	"	
	7	3.20 "	"	"	
	8	2.90 "	"	"	Slope of sides of drain to be 1 foot to 1 foot.
	9	2.45 "	"	"	
	10	2.70 "	"	"	
	11	2.85 "	"	"	
	12	2.80 "	"	"	
James Blair	13	2.90 "	"	"	All angles of the drain to be turned with a regular curve.
	14	3.15 "	"	"	
	15	3.05 "	"	"	
	16	3.10 "	"	"	
	17	3.10 "	"	"	
	18	2.95 "	"	"	
	19	2.80 "	"	"	
	20	2.95 "	"	"	
	21	2.65 "	"	"	
	22	2.90 "	"	0'.10 per	
	23	2.60 "	"	100 feet.	
	24	2.90 "	"	"	
	25	3.05 "	"	"	
	26	2.65 "	"	"	
27	3.70 "	"	"		
28	2.80 "	"	"		
29	3.95 "	"	"		
Kreger	30	2.80 "	"	"	
	31	2.75 "	"	"	
	32	2.95 "	"	"	
	33	2.75 "	"	"	
	34	2.95 "	"	"	
	35	2.95 "	"	"	
	36	4.00 "	"	"	
	37	3.30 "	"	0'.08 per	
	38	3.50 "	"	100 feet.	
	39	2.80 "	"	"	
Keeler.....	40	3.10 "	"	"	
	41	2.65 "	"	"	
	42	2.75 "	"	"	
	43	3.10 "	"	"	
Kreger	44	2.15 "	"	"	
	45	2.70 "	"	"	
Weiben.....	46	3.05 "	"	"	
	47	3.35 "	"	"	
	48	3.40 "	"	"	

SCHEDULE—*Concluded.*

	Stakes.	Depth.	Width on Bottom.	Grade.	Specifications, etc.
Richard Ross ...	49	3.90 feet	1 foot	0'.08 per	(Same as previous page.)
	50	3.95 "	"	100 feet.	
	51	3.75 "	"	"	
	52	3.15 "	"	"	
	53	3.20 "	"	"	
	54	3.20 "	"	"	
	55	3.20 "	"	"	
	56	3.20 "	"	"	
	57	3.00 "	"	"	
	58	3.20 "	"	"	
	59	2.80 "	"	"	
	60	3.20 "	"	"	
	61	3.40 "	"	"	
	62	3.15 "	"	"	
Runnaberg	63	3.35 "	"	"	
	64	2.70 "	"	"	
	65	3.25 "	"	"	
	66	2.95 "	"	"	
	67	2.85 "	"	"	
	68	2.60 "	"	"	
	69	3.00 "	"	"	
	70	2.80 "	"	"	
	71	2.60 "	"	0'.05 per	
	72	2.60 "	"	100 feet.	
	73	2.35 "	"	"	
	74	2.25 "	"	"	
	75	2.95 "	"	"	
	76	2.35 "	"	"	
77	2.20 "	"	"		
Robbie	78	2.35 "	"	"	
	79	2.40 "	"	"	
	80	2.65 "	"	"	
	81	2.40 "	"	"	
	82	2.70 "	"	"	
	83	2.80 "	"	"	
	84	2.55 "	"	"	
	85	2.85 "	"	"	
	86	2.90 "	"	"	
	87	2.75 "	"	"	
	88	2.40 "	"	"	
	89	2.10 "	"	"	
	90	1.85 "	"	"	
	91	2.70 "	"	"	
92	2.25 "	"	"		
Elma Corporat'n.	93	2.30 "	"	"	
	94	1.55 "	"	"	
	95	1.40 "	"	"	
	96	2.654 "	"	"	
	97	No Stake	"	"	
	98	2.50 feet	"	"	
	99	.65 "	"	"	
	100	1.20 "	"	"	
	101	2.40 "	"	"	
	102	2.10 "	"	"	
B	103	2.60 "	"	"	

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BRANTFORD WATER WORKS.

By T. HARRY JONES, B.A.Sc.

THE Grand River takes its rise in the southern part of the County of Grey at the distance of less than thirty miles from the shores of the Georgian Bay. In its meandering course of one hundred and thirty miles to Lake Erie it, with its tributaries, waters the greater portion of the Counties of Wellington, Perth, Waterloo, Oxford, Brant, Wentworth, Haldimand, and Monck, and drains an area of twenty-six hundred square miles.

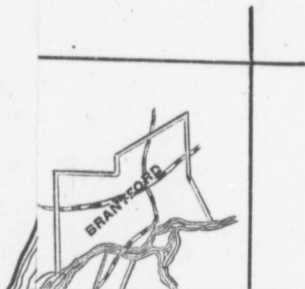
On this river, about fifty-five miles from its mouth, the City of Brantford is beautifully situated. The surrounding hills, to which the city extends on the north, rise one hundred and fifty feet above the level of the river, and ninety feet above the business and main part of the city.

Brantford has a population of about 14,000. It has always ranked among the healthiest cities of the province, and according to the death rate during the past year stands third in this respect.

In the year 1870 the Brantford Water Works Company was formed. The water was forced by direct pressure, the supply being derived from a spring creek, which flows from the hills in the northerly part of the city; but owing to the fact that it drained a large area of the city in its course, the water became very impure before reaching the pumping house, and consequently was not in demand for drinking purposes.

In this system there are about nine miles of mains varying in diameter from four to eight inches. The total cost of the works has been about \$63,000, the city having authorized construction to the value of \$48,000, and having paid for its water supply interest upon this amount, originally at the rate of eight per cent., which latterly has been reduced to six per cent. Last year 72,000,000 gallons were pumped, and water supplied to 150 consumers, who paid \$4,400, the railway companies alone contributing \$1,900 of this amount. The City Council having decided to extend the present works, and obtain a new source of supply, tenders were called for in the fall of 1887. Only two tenders were considered, one from Messrs. Moffatt, Hodgkins & Clark, of Watertown, N. Y., who proposed to take the water from D'Aubigne Creek (see accompanying map), and erect a stand tower on the hill to the north of the city; and the other from the Brantford Water Works Company, who proposed to obtain their supply by means of driven wells to be located in the Holmedale, where the new works are now being built.

orks.



city

inches in diameter, and having
upon the top and sides of the pipe, laid side by side two feet from

... ..
where the new works are now being built.

The Council of 1887 failing to agree as to the merits of these two systems, the new Council employed John A. Cole, C.E., of Chicago, to decide upon the source and location of the new supply, and prepare plans and specifications for the construction of the new works. Mr. Cole having reported to the Council, tenders were called for in June last, resulting in the Waterous Engine Works Company, Limited, of this city being awarded the contract for the new work, the price being \$106,278. In the event of a by-law providing for the city building the works being defeated, an agreement had been entered into with the Brantford Water Works Company to assume the works, the city paying for their supply five per cent. interest per annum on the full capital invested for the first five years, and four and a-half per cent. for the next five years, with the privilege of buying the works at cost price at the end of the ten years.

The average earnings of the water works in the cities of Ottawa, Kingston, Toronto, Hamilton, Brantford, Stratford, and London, have been about nine and a-half per cent. per annum on the capital invested, and the dividends declared by the Brantford Company for several years past having been ten per cent., a strong public feeling existed that the city should own the works.

Accordingly when the by-law making provision for the city buying the existing works and building the new ones was submitted to the ratepayers it was carried by a large majority.

Twenty acres of land have been purchased for the water works by the city in the Holmedale, to the west of the city limits, it being thought desirable to secure enough to prevent the supply becoming contaminated when the city extends in that direction. The new system of water works as designed by Mr. Cole, may be generally described as consisting of *Water Works Buildings, a Reservoir, a Pump Well, Collecting Gallery, Pumping Machinery, Inlets and Connecting Pipes, and System of Discharge Mains.*

The *main building* is situated 100 feet to the south of the mill race, and 200 feet to the north of the Holmedale Creek, and contains the engine-room, boiler-room and coal room; while a short distance to the east is the engineer's residence—a two-story building. The reservoir is to be formed by constructing a dam across the Tail Race or Holmedale Creek (an inlet of the river) to the south of the buildings, having a capacity of two million gallons. The *Pump Well* is located directly to the west of the engine-room. The walls of brick masonry 18 inches in thickness, laid in cement mortar, excepting the two courses of bricks above the clay, which are laid with openings to admit of the flow of the water into the well. The surface of the ground at the well is 26 feet above city datum (the level of the river below the city), and the inside of the bottom of the well 4 feet above datum, the clay being $6\frac{1}{2}$ feet above datum. The bottom of the well is of concrete one foot in thickness. A cast iron special, with valve attachment, connects the well with the pipes in the collecting gallery. The *Collecting Gallery*, consisting of two rows of vitrified tile pipe 15 inches in diameter, and having perforations $\frac{1}{2}$ of an inch in width upon the top and sides of the pipe, laid side by side two feet from

centres in a trench excavated to the surface of the clay for a distance of 750 feet in a south-westerly direction from the pump well. The pipes to be covered with screened gravel for two feet around the sides and above their tops.

The *Pumping Machinery* to consist of one Gaskill Horizontal Compound Pumping Engine, manufactured by the Holly Manufacturing Company of Lockport, New York, and one of Worthington's Compound Condensing Pumping Engines, manufactured by Henry R. Worthington, of New York. Each engine to be capable of pumping 2,000,000 gallons in 24 hours, with a piston speed not exceeding 90 feet per minute, against a water pressure of 60 lbs. per square inch, and capable of working satisfactorily under any water pressure not exceeding 150 lbs.; and so arranged as to run together or separately. Three boilers in connection with the engines, each 63 inches in diameter, and 14 feet long.

A cast iron pipe fourteen inches in diameter to be laid between the reservoir and the pump well, each end bending down with inlet and outlet respectively one foot above the bottom of the reservoir, and one foot above the bottom of the well.

A wrought iron pipe one inch in diameter to be laid between air pump of condenser and the highest part of this main in order to create a vacuum and secure its action as a syphon. This main also to be connected direct with the suction of one of the pumps, three fourteen inch valves being set in said lines to admit of pumping from reservoir or from well.

Valves to be set upon all pipes in the pump well, so arranged that water can be admitted from any one or be entirely shut off.

A fourteen inch pipe to be laid from the mill race where there is to be a suitable inlet of masonry covered by a screen to the pump well.

There are about *nine miles of mains* in connection with the new system, varying from fourteen inches to six inches in diameter; sixty-five double nozzle hydrants, and fifty valves. Two mains, one fourteen inches and the other ten inches in diameter are to be laid from the engine house to connect with the present system. All hydrant connections are to be made with six-inch pipes.

Before locating the source of supply twenty test wells were driven by the writer in the Holmedale, extending up the river from the present new buildings for about a mile, and covering an area half a mile in width. Observations extending over a period of three months were made, and the depth and variation of the water in the wells and river, the character of the strata and the depth of the clay were noted. The level of the water in the different wells was found to rise on an average about one foot in three hundred going northerly from the river to the hills, whilst the water in the wells going up the river driven to the south of the mill race rose about one foot in five hundred.

It was found that when through any cause the water in the river rose the wells were affected in a like manner, although often it was not until the following day that the change of level occurred in them.

From the data thus collected it was determined to locate the works in their present position. The greatest abundance of pure water was

found there and a fine bed of gravel extending in many places from the clay to the surface of the ground. When the work ceased last fall the pump well had been built to within three feet of the surface of the ground, and the collecting gallery pipes laid for a distance of thirty feet westerly from the well. It was found that although the pipes had been laid for only this short distance they were then capable of supplying the well with over two million gallons per day. When the collecting gallery is extended, if this rate of supply continues constant there is every indication that the reservoir will not be needed as a supplementary source of supply. The depth of the water above the clay at the well will average about seven feet and at the westerly end of the collecting gallery about three feet. The average cut in the collecting gallery will be about sixteen feet, the clay being six feet higher at the westerly end of the gallery than at the well.

It was found that when the centrifugal pump, used during the construction of the well, was discharging water from the well at the rate of two million gallons per day the water level one hundred feet up the collecting gallery was lowered only one foot; whilst at the westerly end of the gallery the water level remained constant. The following extract from the analysis of water taken from a well where the present supply is located, made by Prof. W. H. Ellis, of Toronto, shows the purity of the water:—

	<i>In parts per 100,000</i>	
Chlorine9
Free Ammonia004
Albuminoid Ammonia		traces.
Oxygen absorbed from Permanganate of Potash at 80° F. in 4 hours027
		Clarke's Scale.
Permanent hardness	8	5.6°
Temporary hardness	12	8.4°
Total hardness	20	14°

The works are being constructed under the superintendence of the writer, Mr. Cole being retained as consulting engineer. The terms of the contracts call for the completion of the works by the first of October next.

Wooden and Composite Bridges.

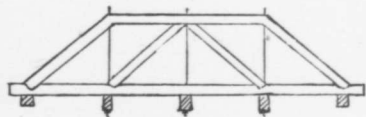


FIG. 1

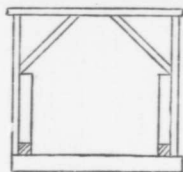


FIG. 2

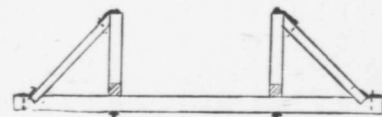


FIG. 3

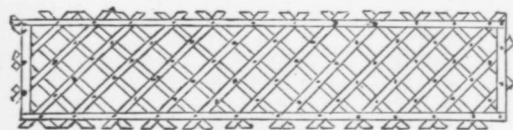


FIG. 4

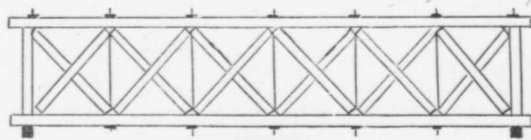


FIG. 5

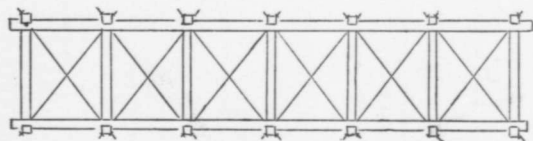


FIG. 6

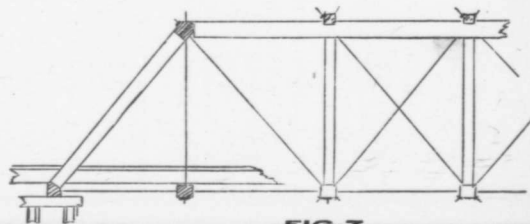


FIG. 7

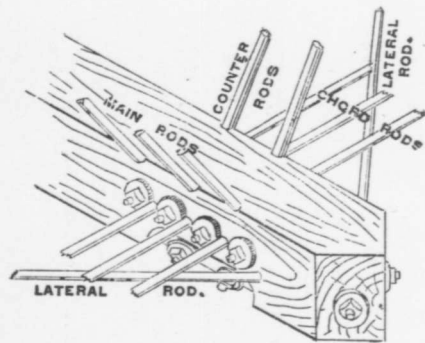


FIG. 7A

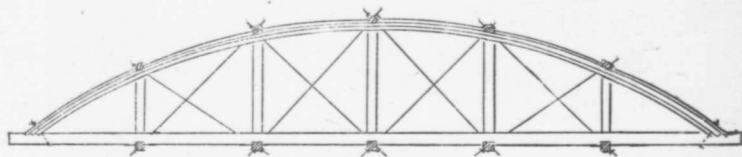


FIG. 8

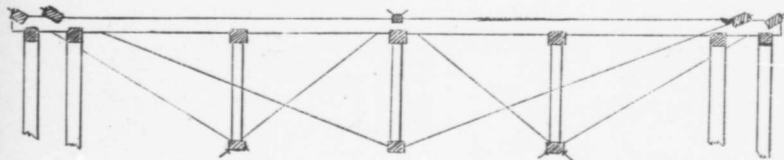
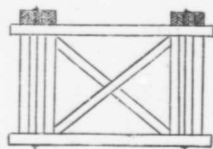


FIG. 9



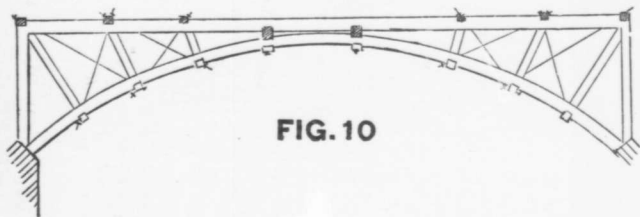


FIG. 10

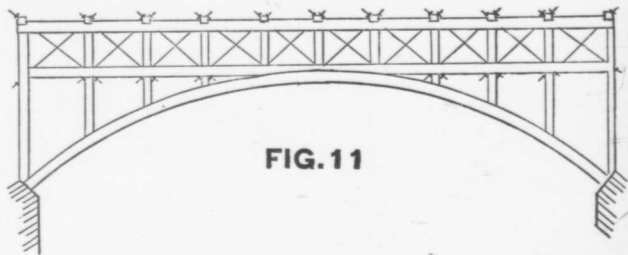


FIG. 11

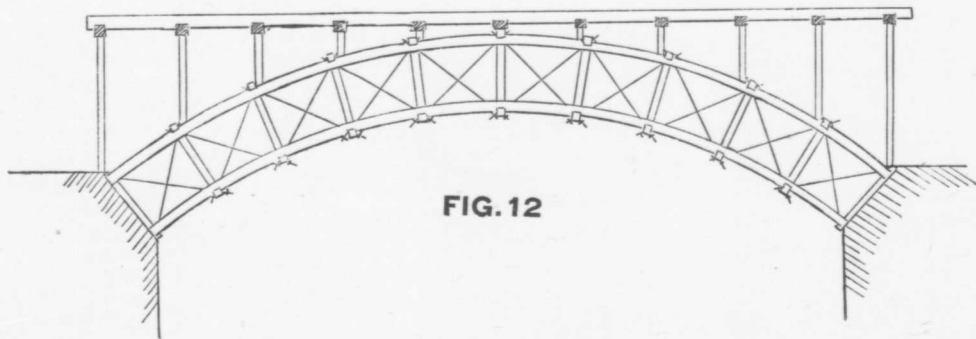


FIG. 12

[This Association is not responsible as a body for any opinions expressed in its papers by Members.]

WOODEN AND COMPOSITE BRIDGES.

By H. K. WICKSTEED, B.A.Sc.

I HAVE seen it stated more than once, and the idea seems to be gaining ground, that the wooden bridges, for railways at any rate, are a thing of the past—that their day is nearly over. This may be true, perhaps, of the older and more settled districts of Canada and the United States, but how about our backwoods regions in Muskoka and Algoma, in Eastern Quebec and British Columbia, where timber can be had often within a few yards of the bridge sites, and where it would cost a small fortune in transportation alone to erect iron structures? Wooden bridges are going up daily, and will continue to go up for many years to come; and perhaps in no department of engineering practice is there a better field for ingenuity and research than in the design and erection of these wooden structures. Haupt, Trautwine and Vose have given us examples and ideas on the subject in their books of ten years ago, but since then there has been little or nothing written about them, and little or no improvement in them. Either our best and most thoughtful engineers have accepted the above statement as true, or they think the subject of wooden-trussing not worth their attention. In my opinion, the old timber structures we see around us, and many of which have stood wonderfully the attacks of time and the heavy strains to which they have been subjected, and were undoubtedly fine creations for their day, are by no means as good as we can produce now. And yet we copy them time after time, and year after year, without trying to devise something better, utterly ignoring that mathematical investigation and iron working and production have all made great progress, and given us a new and different light by which to study out the true economy of design in composite bridges, just as the cheaper production of steel has revolutionized metal bridging, and rendering easy now feats which were out of the question ten years ago.

Some of the earlier railway bridges, for instance, were fastened together with wooden tree-nails, because iron was too costly at the time to be used, and great ingenuity was shown in devising a form of truss to suit the requirements and the material. The lattice truss was the result, giving an immense number of inter-sections, which could be pinned, and the aggregate was as strong as with a fewer number of metal fastenings. Being now able to obtain iron bolts and rods even in the backwoods, at moderate cost, it seems absurd to stick to the old designs, yet it is done much more frequently than would be sup-

posed; the copies being, however, much more timid in conception, owing to their being the production of servile imitators instead of bold and original thinkers, such as were the American engineers of the last generation. With iron growing still cheaper and timber dearer we are justified in putting in more of the former and less of the latter in our bridges than we could do ten years ago with economy, but, I think, in many cases we are by no means justified in jumping without any intervening step from the clumsy Howe truss of that time to the costly structure of steel of the present day. I propose in the present paper to discuss some of the forms of wooden and composite bridges in ordinary and rare use, and to point out the direction in which, I think, progress should tend. First, and perhaps the most common of all, is the king and queen post truss (Fig. 1), most often seen in road bridges of thirty or forty feet span. In its original form, as a roof truss with fairly equally distributed loading, it is excellent, but a careful analysis of the strains under a moving load will very often show that owing to the absence of counterbracing these trusses are often strained daily beyond the safe limit by the introduction of a cross-breaking stress on the bottom member in addition to the normal one of tension for which it is intended.

The designs, too, are often defective in the proper distribution of sectional and shearing area, and there is nearly always some one part of the structure which would give way long before the strain on others had approached the safe limit. It is common, too, to see sway-bracing inefficiently introduced or left out altogether, and I have in my mind's eye, at the present moment, a bridge in which the timbers are firm and sound, but which is going to ruin by the trusses falling over sideways, owing to its absence. One way of introducing this is by "gallows frames" overhead, and another and rather neater one by extending a couple of the floor beams outside the truss and staying the upper or compression member by diagonal braces from the end of these. (Figs. 2 and 3).

In the eastern townships a common form of truss is the lattice, formed of numerous diagonal pieces of timbers pinned together at their inter-sections. (Fig. 4). This was evidently copied from the older American bridges. Many of these have been roofed in and stood for a long term of years. Their great merit is the simplicity of the design and uniformity of parts, but the timber being used to take the tensile as well as compressive strains throughout, with only the bolts to transmit it to the chords or opposite diagonals, it is obvious that there must be a large amount of surplus material and useless weight somewhere. Another failing is the absence of any device for adjusting them, and they generally show more or less sag in the centre. The small amount of iron, and the readiness with which they may be put together, almost without tools, render them particularly applicable to some situations, and in extreme cases even the bolts may be done away with and oak treenails substituted.

The Howe truss (Fig. 5) shews a great advance in some ways. It is susceptible of a certain amount of adjustment, and is counter-braced throughout, and has been further perfected by the introduction of cast

iron prisms on which to rest the ends of the main and counter braces, having pipe-like attachments, or rather parts which run through between the chord pieces to take the strain of the vertical rods, and to do away with side compression on the former. Some excellent examples of this form of truss are given in Vose's "Manual for Railway Engineers," some of them being originally built or designed for highway bridges, and inserted in the book merely on account of the ingenuity displayed in the arrangement of details. It is the (in the opinion of the writer erroneous) custom, to make the main braces and counters almost the same in section for every panel, although the strain on the main is of course greater in the ends than in the centre, and the reverse on the counters. The defence is that the heavier loads on the ends are more steady and more slowly applied than those on the centre, due to rolling load, and also the uniformity and interchangeability of posts. The last argument, certainly, has some weight, but the former certainly does not justify the centre pair of main braces, being succeeded in the next panel by a single counter, having to carry the most suddenly applied load of all. In my own practice I have always been accustomed to proportion the sectional area of the members to the actual strain with good results, and I can see no reason for treating an iron or steel bridge mathematically, and a wooden one by rule of thumb.

One great objection to the Howe truss for backwoods work is the amount of cast iron involved. Castings are often ugly things to transport, and very apt to be brittle and defective. Under a steady load, too, they may be very strong, while under the constant vibration to which a bridge is subjected they are apt to fail under very moderate strain. Wrought iron, on the contrary, in the form of rods and bars, is easily handled and almost indestructible, and in my own practice I have devoted much attention to the elimination of complicated castings. In scheming for this end I have found the Pratt or Whipple truss (Fig. 6) to lend itself far more readily than the Howe. In the Pratt the shorter or vertical members of the web are struts, and the longer diagonals ties. This is as it should be; the length of a tie rod does not affect its strength in any appreciable degree, while the length of a strut does, and many a compression member, whose sectional area is ample to resist crushing, will fail by cross-breaking if made too long. For this reason this system has become the most popular with modern builders of steel and iron bridges of long span in America, and it seems to me almost inexplicable that it should so long have been almost overlooked by builders of similar structures in wood in favour of the Howe. Not only for the reasons just given is the system a better one in general principle, but I have, as I said before, also found it much easier to work the details into a shape better adapted for use, in out-of-the-way places at any rate, and to the exclusion of intricate castings. In a highway bridge, designed for a locality near London, Ontario, with a span of one hundred feet, I introduced the somewhat uncommon feature of a wrought-iron lower chord formed merely of rods, multiplied in number in the different panels in proportion to the strain. The connections were made by the floor beam,

each set of rods extending only the length of its own panel, and those in the adjacent panel coming through the floor beam from the opposite side and alternating with the first lot. The diagonals came through the same beam, between these again; and the whole was managed without the introduction of a single piece of cast iron except the washers. This truss (Fig. 7) has now been standing three years or more, and as far as I can learn is giving good satisfaction. The upper chord pieces were spaced rather wider apart than is usual, and the posts were carried through between them to take the downward component of the strain induced by the diagonals on the oak block carrying their ends, thus doing away with the side compression of the chord before alluded to. I found also that the vertical posts enabled me to work in the sway and lateral bracing (which was on the same system) more simply and effectively than I could in the Howe. The inclined posts at the ends and the consequent shortening of the upper chords saved a considerable amount of material, without that I can see any loss in efficiency.

The "Bowstring" truss (Fig. 8) is almost too well known to need illustration, even if the term were not self-explanatory. Its characteristic of having a constant maximum compression in the bow and an equal tension in the string throughout their length, and the consequent possibility of making these of equal section all through without loss in strength or weight, makes it a very enticing form to the theorist. The objections are the practical ones that the braces in the web are constantly varying in length and the angle at which they meet the chord, and hence few pieces are alike in pattern, and, secondly, that the varying height and curved form of the bow make it difficult to bring in the sway and lateral bracing effectively. Consequently the type is seldom met with, except in old bridges where the objections I have mentioned are usually very apparent. In iron girders with a plate web, in which a great many of these objections do not apply, it is a very common and effective form, and as a roof truss, where the lateral and swaying strains are provided for by the stiffness of the roof skin itself, and where, owing to the permanency and uniformity of the load, the web members become scarcely more than a matter of form, the Bowstring is deservedly popular, not only on account of the economy in material, but also owing to the beauty of its form.

Passing over the Post, Warren and Bollman systems as having little to recommend them to our attention when building of wood or of wood and iron, we come to the last and perhaps the most perfect of all the truss systems for our materials, and yet except in its very simplest forms the least known and used. This is the Fink truss. As applied to a composite structure of moderate span it possesses so many and great advantages, that I must ask your patience for a little while to allow me to discuss it at greater length than I have any of the preceding types. Fig. 9 shows the general arrangement for a truss of eighty feet span, designed by the writer to carry a railway. The extreme simplicity of the design will be noticed at a glance, as also the readiness with which the strains may be calculated by a person possessed of very ordinary knowledge of the commonest principles of

mechanics and the resolution of forces. In fact, most of the latter work can be done graphically with a pencil, scale, straight edge and set square without the intervention of mathematics at all. All the wooden members are in compression and the iron in tension, doing away with all the keying and splicing necessary with the wooden lower chords in the preceding types, and with a uniform load we get the maximum strain which can come on any member. The lateral and sway bracing falls into its place naturally and economically, and the whole is extremely light and effective, so light that it can often be swung into its place without the intervention of false work and trestling. I remember on one occasion putting together a forty foot truss of this description, and being so well pleased with it that I thought it a pity to pull it to pieces again, so I mounted it on two railway trucks and sent it bodily one hundred miles by rail to its destination. It was skidded into its place immediately on its arrival, and in twenty-four hours the ties and rails were laid and the trains running over it.

From that day to this, some eight or ten years, it has not cost the company \$5 for repairs. One great reason for this is that the changes in the lengths of the rods, due to corresponding changes in temperature, do not rack and strain the structure as they do in the other systems, owing to the contraction and expansion being greater in the iron than in the wood. The only effect of them is to throw a little more camber into the truss in warm weather, and let it down again in cold, and to bend the chord piece to a quite un hurtful extent. For this reason, if for no other, it is peculiarly well adapted to our climate, with its excessive and often sudden changes from hot to cold and back again. Every bridge man and roadmaster knows the constant attention and screwing-up and slackening of nuts that is necessary in order to keep the ordinary Howe truss in order, how very difficult of access these nuts often are, and how grave are the consequences of inattention and carelessness. A cold day comes, the rods shorten and the braces are pressed against the prisms and the washers squeezed into the wood. If the thing goes too far the prism often breaks under the strain, and the vibration of a passing train, if not, the braces are compressed enough to be slack when the warm weather comes round again, and the whole structure is loose and rickety, and perhaps some of the brace-ends shake out of place altogether and are not "there" when the next train comes along.

I venture to say that many a truss has come down, and its failure been attributed to faulty design and insufficient strength, where it was really only due to want of attention and care. Either a prism has broken or a brace fallen out, or some of the nuts, under the vibration, have worked loose and left on one or two rods a strain which should have been borne by several in company. We cannot do away with occasional adjustment in the Fink, but we can place the nuts or swivels in places where they are readily accessible by the trackmen, and leave them no excuse for inattention; and we can render the effects of temperature innocuous. This is almost true also of Fig. 7, in which the only injurious effect of a sudden contraction or expansion

would be felt in the two centre counter-braced panels; the elasticity of the oak blocks would probably be sufficient to provide for this. A heavy rubber washer under the washer of the counter-brace rods would probably make things certain, as the strain on this last is never very great. One disadvantage the Fink truss has is that it is only applicable to a "deck" bridge, and where the headway underneath is limited we are debarred from using it. Where there is ample headway I know of no system so satisfactory and economical for moderate spans, say up to eighty feet for railways and one hundred feet for highway bridges, in ordinary everyday situations. Beyond these spans we have to multiply the panels and at the abutments get such a number of rods coming up at different angles that practical considerations of simplicity and uniformity of parts would probably make the Pratt the more acceptable.

The construction of the Forth and other large bridges has called much attention to the cantilever principle in bridging. It is seldom that the ordinary railway or road engineer meets with conditions which render such large spans desirable or necessary. And when he does he will probably call to his aid some expert and build of steel instead of wood. But there are often met with cases in which false work, owing to the depth of a ravine or the swiftness of the current in some river, is enormously expensive and difficult. In such cases it is well for the engineer to bear in mind that the cantilever principle is applicable to wooden trusses as well as to iron, and that we may make use of it temporarily in order to erect the bridge, or part of it, without being obliged to proportion and arrange the parts so as to bear the cantilever strains permanently; and further, that these strains will be those due only to the weight of the structure itself. Suppose, for example, a deep, rapid river, which can be spanned by a truss of 150 feet, and that the slopes of the gorge will admit economically of another pair of 150-foot spans, one on each side. By erecting the two side spans first, and providing for a temporary tension in the upper and compression in the lower chords, we may continue to build them on out towards the centre until they meet. The chords are cut over the piers and the trusses become simple ones. The Forth and other large cantilevers have been so much talked of that this application of the cantilever has been rather lost sight of. The Frazer River, St. John, Poughkeepsie and numerous other cantilevers were so designed, not because the span was enormous, but because, for one reason or another, false work was inexpedient or inadmissible. And the principle might be made use of perhaps in this connection much more frequently than it is to advantage and with economy.

Take away the string from the "bowstring" truss, and secure the ends of the bow to abutments capable of withstanding the thrust, and we have remaining a timber arch, capable of carrying quite a load, if that load be properly distributed. To prevent distortion under a rolling load, we may carry a horizontal beam over the crown and introduce spandril bracing, as in Fig. 10, or we may carry a light truss across from end to end, carried on vertical stays, as in Fig. 11. A very fine form of timber-arch is shown in Fig. 12, where it is formed

of two members united by trussing of Howe or Pratt type. This combination can be worked into graceful structures of very long span. A fine example in metal is Captain Ead's bridge over the Mississippi, at St. Louis, with arches of 520 feet span. If my memory serves me, a wooden bridge on this last principle stands, or was standing a few years ago, in one of the Eastern States of over 300 feet span. The usual method of forming the arch is by bending planks, one over the other, and spiking and bolting them together; but a better way is to cut each plank into segmental form and lay them side by side, making a stiffer construction, with the additional advantage that where bracing is introduced the prism block bears on all the component members, instead of being dependent on the spikes and bolts to transmit its thrust from the outside laminæ to the others. In the first case the stiffness of the whole is estimated by some eminent authority, Rankine, I think, to be that of a solid beam of the same dimensions as 1 is to the number of laminæ, in the last to be equal to that of a solid beam having the same depth and the thickness reduced by that of one lamina.

In the Burr truss an attempt was made to combine the truss and arch, but it was found difficult to get the two systems to work in unison and the type is almost obsolete.

Distinct from the trusses themselves we have the bridge-seats and supports and sometimes the bridge approaches. Here we do find a great improvement of late years. Instead of great blocks of cribwork settling and rotting year by year, we find a casing of cribwork dropped for protection around a cluster of piles as a bearing seat. If the bridge be very high we find a neat, firmly braced trestle on top of this, or better still we have a pier or abutment of masonry rising to at least a little above high water mark. And in the trestle approaches a marked advance has been made in many things; in the substitution of cluster posts for large single ones rendering renewals easier, and of a number of overlapping parallel stringers for large single ones butt-jointed over the caps and requiring a clumsy corbel to fish the joint. In railway trestles we find the wide decking and closely laid ties displacing the old fashioned eight-foot decking with a two-foot space for a car wheel to drop into, and we find a substantial guard-rail notched over the ties and bolted down holding them firmly in their position instead of a simple plank spiked on to their ends. We see, too, more attention paid to foundations of trestles. Instead of dumping a sill into a trench we lay it on piles or on solid blocks of masonry. But in the wooden truss, as I said before, there is great field for improvement in proportion of parts to strain and in the perfection of little details; and still more room is there for the composite bridge, which, as Mr. Butler told you two years ago, is almost unknown, though he was wrong in saying it had not been introduced at all into the province. It appears from his remarks that I have been the first to introduce the system. Wood is an excellent material in compression and will stand a large amount of tension also, but the great difficulty is to get a grip of it—keys and notches weaken the member terribly, and when it is spliced the joints are always pulling open little by

little and letting the camber down. The difficulty in the way of the substitution of iron tension members is chiefly the different coefficient of expansion possessed by the two different materials. I have shewn that there is one form of truss in which this different coefficient works no harm, and I have pointed out a way in which it may be met in another. It is to be feared that many wooden bridges have failed and been replaced by iron and steel, not because of any fault in such structure inherent in the material or because the cost would not have been much less in wood, but because the design and erection and maintenance of the wooden structure were in the hands of unskilled and careless men. And whereas it is customary with men who are contemplating the erection of a costly piece of work, to call in to advise them a man of the highest attainments and knowledge, where the work is small and cheap they do not consider it worth while. This is to a certain extent natural and reasonable, yet the failure of the small bridge may cause the loss of just as many lives as that of the large, and from a pecuniary point of view it must be a very paltry piece of work indeed which it is not worth while to have studied out by some competent man and adapted to its locality and its loads. And it is well for us all, young and old, wise and otherwise, to remember that copying is not design, and that however able the man whose works we would imitate he is fallible like ourselves, and that the conditions under which he worked may have been different. Copy general principles if you will, and as a check upon your work observe all you can, but work out your strain and your areas for yourselves to suit the materials you are using; and remember further, that good design is not shewn in a structure ten times stronger than it need be, even though the extra material may cost very little, nor on the other hand, by a cheap structure barely able to do the work it is intended for. Good design consists in making a structure to fully meet its requirements and in doing so at the least expenditure of money; and such a structure will always have a beauty of its own even to the uninitiated. If a little more money is on hand use it not to pile unnecessary extra material into some one part, the weight of which will merely cause an extra strain on some other part, but to improve its appearance, to dress the surfaces or to put on an extra coat of paint or a few more cubic yards of riprap around the abutments.

"The whole is no stronger than its weakest part" is an axiom which should be kept in mind by every engineer in every class of work, but more especially is it applicable in bridge work, where an excess of strength means an excess of weight, and this excess of weight has to be carried to the abutments through other members. Hence it is not only as it would be in other works, a mere waste of material, having its justification perhaps in the increased dignity and massiveness of the work, it is a positive detriment and harm. If we had a cable stretched, so long that it would barely carry its own weight, and that of the traveller to run on it, we should consider it worse than useless to put in a few links or a short length of heavier and stronger line. Yet what I am speaking of is a precisely analogous course and one which is very common indeed.

If a fraction of the study and thought which has been bestowed by able professional men to devising formulæ for the determination of the exact thickness of the keystone of a stone arch, or the saving of a few pounds of metal in some enormous structure, such as not one engineer in one hundred ever gets a chance to build, were directed to the consideration of ordinary everyday problems in bridge work, we should see fewer enormities in wood and iron going up about us, schemed by ignorant mechanics without mathematical knowledge, by artistic architects without practical ability, or, worse still, copied by some man who has the knowledge and ability, but is too careless and indolent in many cases even to grasp the salient points in his copy, or to investigate for himself.

If wooden bridges were as well designed as the majority of iron, we should see less distrust on the part of railway men and the public at large of wood as a constructive element, we should be less often shocked on picking up our morning paper by the blood-curdling details of some fearful accident, and we should save money to equip our roads and our railways better in other respects. It is customary to say that it is better to put in an iron bridge at once if it is possible to raise the money, because the removal of the wooden bridge every few years will come to more than the extra cost of the iron. Suppose the iron one will last forever and that it will cost \$4,000, and the composite one, \$2,000 (not by any means an unfair assumption, I think) we have saved \$2,000. The composite one, according to Mr. Butler, will last at least twenty years, and I think he is quite right. Put this \$2,000 out at compound interest at 5 per cent., and what will it amount to in that time? I hate arithmetic, and I would gladly dodge the problem, but I make it something over \$5,000, enough to renew the bridge in iron then, and leave a good margin, or better, perhaps, to put the composite structure back again and put masonry under it.

I have no wish to overrate wood as a constructive element, or to underrate iron, I merely wish to give my reasons for the faith that is in me, that in good hands, and with careful study, wood might often be used to-day with perfect safety and sound economy in many places where mistaken prejudice is compelling iron and steel. I have given no formulæ, and few details. Of the former, the student can find all he needs in Trautwine, Vose, Haupt and other books, and in some others he will find enough to frighten him away from the subject altogether. Vose has reduced the calculations of Strains to a very simple tabulated form, which may be used by anyone with a knowledge of arithmetic, the algebraic signs, and a little trigonometry. For the true *raison d'être* of the formulæ and the power to do without them, or to frame them for himself, he must know something of mechanics besides, but not much.

For details, he will also find suggestions in Trautwine and Vose. And in both theory and detail he will get a great deal of valuable help from Mr. Campbell and Mr. Butler's excellent papers embodied in the transactions of the Society, in 1887 and 1888. I can add to Mr. Butler's list of authorities, Unwin's Iron Bridges and Roofs, Shield's Strains on Structures of Iron Work, and others; but why? He has

plenty to wade through, more than enough, if he takes an interest in the subject and reads understandingly, and I, for one, will let him alone, merely cautioning him, that in details, good white oak, helped, if necessary, by boiler plate, and wrought iron straps, can be worked into almost anything by the nearest carpenter and blacksmith, and will be generally found more reliable and satisfactory than complicated castings from a foundry one hundred miles away.

In answer to Mr. Galbraith's enquiry last year for a book on wooden highway bridges, I know of none wholly devoted to the subject, but he will find Vose's discussion of wooden bridging generally eminently plain and practical, and the examples, excellent. I have only one fault to find with Mr. Campbell's paper, which is, that the Howe truss he figures is very oldfashioned in style, and strikingly deficient in depth. I am afraid it was designed by some engineer of iron plate girder experience. The average of the best practice in wooden trussing will give a proportion of length to depth of between 5 and 6 to 1. The lower chord is the hardest part of the bridge to work in economically, consequently he should increase the depth, in order to lessen the strain on it and the upper chord, which is the next weakest part.

AN EPHEMERIS OF STARS IN THE VERTICAL OF "POLARIS."

By F. L. BLAKE, P.L.S.,

Astronomical Assistant, Toronto Observatory.

THE compilation of an ephemeris of eighty-four fixed stars in the vertical of *Polaris* for the purpose of finding the time and azimuth more readily than by the old methods in use has occupied my attention some considerable time, and I think, by my method, I have succeeded in making the observation very simple, and the tables in as compact and concise a form as can be accomplished in this method of finding azimuths. The tables in the ephemeris are calculated for latitude 45, and the position of the stars are taken from the *Berliner Jahrbuch*. Of the few stars that are not in that almanac the positions are from the *American Nautical Almanac*.

In calculating the sidereal time when the *Time Stars* are in the vertical of *Polaris* the following formulæ of approximation by Chas. Carpmæl, Esq., M.A., Director of the Observatory at Toronto, was used:

δ and δ' declination of *Polaris* and *Time Star*.

a and a' right ascensions of *Polaris* and *Time Star*.

$(a' - a)$ = angle $A P B$.

P = pole.

Z = Zenith.

p = perpendicular from Pole on the Vertical $C B$.

θ = angle $C P A$.

h = hour angle of *Polaris* $A P Z$.

h' = hour angle of time star *Sirius* $Z P B$.

ϕ = latitude of place of observation.

In triangle $A P C$ $\cos \theta = \tan p \tan \delta$ (I).

In triangle $C P B$ $\cos (a' - a + \theta) = \tan p \tan \delta'$ (II).

= $\tan \delta' \cot \delta \cos \theta$ (III.) by substituting value of $\tan p$ in equation (I).

In triangle $Z P C$ $\cos (h + \theta) = \tan p \tan \phi$ (IV).

= $\cot \delta \cos \theta \tan \phi$ (V).

Therefore $h = (h + \theta) - \theta$ (VI).

$h' = (a' - a) - h$ (VII).



By assuming a value for θ in equation (III) we can approximate its value to any degree of precision necessary by substituting the new values of θ in each successive approximation, and generally speaking by mere inspection we can fix a value for θ so that its true value may be found to the nearest second in two approximations; take the example given to illustrate the use of the tables we have T = Time interval of 150 seconds between the setting on *Polaris* and the transit of the time star *Sirius*.

The angle $A \ P B = (a' - a - T)$
 $a' = 6^h.40^m.16^s.18$
 $a = 1. 17. 62. 05$

$$\begin{array}{r} (a' - a) = 5. 22. 14. 13 \\ T = \quad \quad 2. 30. \end{array}$$

Assume $\theta = 9^\circ 46' 20''$

$$\begin{array}{r} (a' - a - T) = 5. 19. 44. 13 \\ \quad \quad \quad 79^\circ.56'. 2'' \\ \cot \delta = 8.3489257 \\ \tan \delta = 9.4734726 \end{array}$$

$$\begin{array}{r} \quad \quad \quad 7.8223983 \\ \cos \theta = 9.9936524 \end{array}$$

$$\begin{array}{r} \cos (a' - a - T + \theta) = 7.8160507 = 90.22.30 \\ \quad \quad \quad 79.56. 2 = (a' - a - T) \end{array}$$

10.26.28 = θ 1st approx.

$$\begin{array}{r} \quad \quad \quad 7.8223983 \\ \cos \theta \text{ (new value)} = 9.9927486 \end{array}$$

$$\begin{array}{r} 7.8151469 = 90.22.28 \\ \quad \quad \quad 79.56. 2 \end{array}$$

10.26.26 = θ 2nd approx.

$\cos (h + \theta) = \cot \delta \cos \theta \tan \phi$

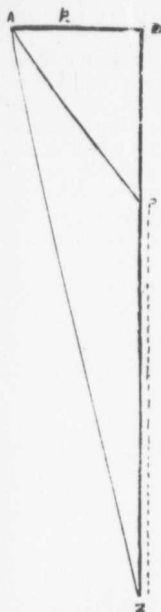
$$\begin{array}{r} \cot \delta = 8.3489257 \\ \cos \theta = 9.9927494 \\ \tan \phi = 0.1165897 \end{array}$$

$$\begin{array}{r} 8.4582648 = 88^\circ.21'.14'' \\ \theta = 10. 26. 26 \end{array}$$

$$\begin{array}{r} h = 77. 54. 48 \\ (a' - a - T) = 79. 56. 2 \end{array}$$

$$\begin{array}{r} h' = 2. 1. 14 \\ h' = 0^h.8^m.4^s.23 \\ a' = 6.40.16.18 \end{array}$$

$S \ T = 6 \ 33.11.25$



The azimuth formulæ is as follows :

- A = position of *Polaris*.
 P = pole.
 Z = Zenith.
 ZC = meridian.
 AC = perpendicular on meridian from *Polaris*.
 Az = Azimuth angle AZC .
 h = hour angle APC .
 $p = AC$.
 n = portion of meridian intercepted between P .
 and foot of perpendicular p on meridian.
 ϕ = latitude of place.
 δ = declination of *Polaris*.

$\cos h = \tan n \tan \delta$ (I.), $\sin p = \sin h \cos \delta$ (II.),
 $\sin (\text{colat} + n) = \tan p \cot Az$. (III.) from which the
 Azimuth is found.

The latitude corrections to the *S. T.* and *Az.* are based upon a mean position for each star and t t' a and a' are the necessary corrections for the other days and are applied directly to the *S. T.* and *Az.* columns by simply changing their signs which is already done in the tables; b and c are corrections for the time interval and are simply direct interpolations.

EXPLANATIONS.

The Sidereal Times and Azimuths of *Polaris* are rigorously calculated to the nearest second of arc for every 20th day of the year for the 45th degree of north latitude, and the corrections for other latitudes are very close approximations, in fact sufficiently close for almost any kind of time and azimuth work ordinarily required of the surveyor or engineer.

In the first column, under Z , will be found the zenith distance of the time star followed by the dates.

t and t' are corrections of decimals of a second of time for each degree of latitude differing from 45, and to be applied with its proper sign to the *S. T.* after multiplying by the difference in latitude. t being used for latitudes south of 45 and t' for places north of 45. a and a' are similar corrections to be applied to the Azimuth.

LATITUDE CORRECTIONS.

Column L is for the latitude.

S. T. and *Az.* are corrections to be applied to the Sid. Time and Azimuth according to their signs.

b contains the corrections to be applied for the interval of time between the observations on *Polaris* and the time star. They are decimals of a second and require to be multiplied by the interval in seconds. c are similar corrections for the Azimuth.

These corrections require the interval between the observations not to be extended much over two minutes.

METHOD OF OBSERVATION.

The best method of observing would be to select your stars beforehand and make the necessary interpolations, getting your instrument into position a few minutes before the time required, sight on *Polaris* and then swing the telescope to the time star and wait till it appears in the field of view, turn on to *Polaris* again, clamp and bisect accurately by means of tangent screw, noting the time by watch and again revolving the telescope to the time star, note the time of its crossing the wire. The observation is then complete, and the time interval corrections can then be applied and you have the *Sidereal Time* and *Azimuth* of *Polaris*, which may be used in determining the deviation of any line you may be running by noting the readings of the azimuth plate of the instrument at the time of observation.

EXAMPLE.

Jan. 20th, 1889.—At a place in latitude $52^{\circ} 36'$ and longitude 90° west. *Polaris* was supposed to be observed at 10^{*h.*} 33^{*m.*} 30^{*s.*} watch time, and *Sirius* at 10^{*h.*} 36^{*m.*} 0^{*s.*} in the same vertical plane—require the watch error and azimuth of *Polaris*.

Time interval, 150 seconds.

Difference of latitude from 45 is $7^{\circ}.6$.

$$t' = +0.093 \times 7.6 = +0''.71$$

$$b = +0.007 \times 150 = +1.05$$

Jan. 20th, 1889	S. T. =	6	33	43.58
Cor. S. T. for Lat. $52^{\circ} 36'$	=	—	93.93	
Cor. t'	=	+	0.71	
Time interval Cor. b	=	+	1.05	

Sidereal Time	=	6.	32.	11.41
Sidereal Time, M. Noon, 20th Mer.	=	20.	1.	12.25

Sidereal interval from Noon	=	10.	30.	59.16
Retardation Table IV.	=		1.	43.37

Standard Time, 20th Mer.	=	10.	29.	15.79
Watch Time	=	10.	36.	0.

Watch Fast	=	6.	44.21	
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AZIMUTH CALCULATION.

$$a' = -1.08 \times 7.6 = -8''.2$$

$$c = -0.102 \times 150 = -15.3$$

<i>Az.</i>	=	1 ^{<i>o</i>}	47.	0''. ^{<i>00</i>}
Cor. <i>Az.</i> for Lat. $52^{\circ} 36'$	=	+	17.	43.0
Cor. a'	=	—	0.	8.2
Time interval cor. c	=	—	0.	15.3

<i>Az.</i> <i>Polaris</i>	=	2.	4.	19.5 W
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A rigid solution gives

$$S. T. \dots\dots\dots = 6. \overset{h}{32} \overset{m}{11.5}.$$

$$Az. \dots\dots\dots = 2^\circ 4' 20'' W$$

1889. Z. 61° 34' S.	a CANIS MAJORIS (Sirius).					
	S. T.			Az. W.		
	6 ^h 33 ^m .			1° 46'.		
	<i>t.</i>	<i>s.</i>	<i>t'.</i>	<i>a.</i>	<i>"</i>	<i>a.</i>
Jan. 0.	-.067	43' 46	+.087	+ '60	60	-1'00
" 20.	'067	43' 58	'093	'60	60	1.08
Feb. 9.	'060	43' 13	'080	'50	64	'93
Mar 1.	'047	42' 38	'073	'42	70	'85
" 21.	'033	41' 41	'053	'30	79	'62
Apr. 10.	'027	40' 62	'040	'24	87	'46
" 30.	'020	39' 82	'013	'18	95	'15
May 20.	'013	39' 36	'007	'12	101	'08
June 9.	'007	39' 04	000	'06	104	'00
" 29.	'000	39' 14	'000	'00	103	'00
July 19.	'007	39' 60	'013	'06	100	'15
Aug 8.	'020	40' 45	'020	'18	93	'23
" 28.	'027	41' 46	'040	'24	84	'46
Sep. 17.	'040	42' 60	'060	'36	75	'70
Oct. 7.	'060	43' 85	080	'54	64	'93
" 27.	'073	45' 04	'107	'66	54	1'24
Nov. 16.	'087	46' 18	'120	'78	44	1'39
Dec. 6.	'093	47' 09	'140	'84	37	1'62
" 26.	-100	47' 60	+ '147	+ 90	32	-1'70

LATITUDE CORRECTIONS.

L.	b.	S. T.	Az.	c.	L.	b.	S. T.	Az.	c.
"	<i>s.</i>	<i>"</i>	<i>"</i>	<i>"</i>	"	<i>s.</i>	<i>"</i>	<i>"</i>	<i>"</i>
28	+ '003	+142'73	-1287	- '069					
29	'003	135'80	1238	'070					
30	'003	128'80	1186	'071					
31	'003	121'67	1131	'072	45	+ '006	- 0'00	+ 0	- '083
32	'003	114'33	1074	'073	46	'006	10'80	116	'086
33	'004	106'87	1014	'073	47	'006	22'07	238	'088
34	'004	99'20	951	'074	48	'006	33'33	367	'091
35	'004	91'40	884	'075	49	'006	45'80	503	'093
36	'004	83'34	815	'076	50	'007	58'47	647	'096
37	'004	75'14	741	'077	51	'007	71'60	799	'098
38	'004	66'68	664	'078	52	'007	85'33	961	'101
39	'005	58'00	583	'078	53	'007	99'67	1131	'103
40	'005	49'08	497	'079	54	'008	114'73	1313	'106
41	'005	39'87	407	'080	55	'008	130'53	1506	'108
42	'005	30'33	313	'081	56	+ '008	-147'07	+1711	-1'111
43	'005	20'60	214	'082					
44	+ '005	+10'47	-110	- '083					

Polaris Z. Dist = 44° 45'.

[This Association is not responsible as a body for any opinions expressed in its Papers by Members.]

THE TRANSIT.

By JOHN McAREE, D.T.S.

It was thought that we should have a short paper on the surveyor's transit, and to me was assigned the duty of writing it. Though no better qualified than others, I cheerfully accepted the task, as being desirous of contributing something to the success of our annual meeting. I find a difficulty, however, in treating the subject. I do not know just what I should say. The transit now being universally the surveyor's instrument, with which every surveyor is of necessity familiarly acquainted, it seems almost an impertinence for me to stand up before this Association and gravely to offer a paper about it. Therefore, I do not propose to give a description of the instrument or to speak directly of its adjustments in a formal way, but rather to attempt to speak of the qualities of a good instrument, and enumerate the tests which it should stand. I propose thus to treat it as a *genus* rather than as a *species*, and I shall direct my attention especially to the ordinary surveyor's transit.

Much information about the transit, as about other surveying instruments, may be got from the descriptive catalogues of the instrument makers. I have seen only those of the American makers, and the best that I have seen are those of Buff & Berger, of Boston, and Fauth & Co., of Washington. The present paper is much indebted to the two mentioned, especially the first one, for the form, though in a lesser degree for the substance, of what it contains. I have to acknowledge my indebtedness to G. B. Abrey, P.L.S., also, for some valuable suggestions. We shall begin with the

TELESCOPE.

The telescope should, without the aid of the clamp, and when equipped with the sunshade, and using the inverting eyepiece, balance itself in any position, and should reverse by revolving between the standards. It should come sharply into focus, and a very little movement either way of the focussing screw should cause the image to blur. When it is sharply focussed, covering any part of the object-glass without altering the focus should not alter the sharpness of definition, but merely cut off light; if it stands this test it shows that the object-glass is of the same form throughout, since all its parts have the same focal length. The image of a star should be a mere point of light, free from wings or spurs. The pencil of light which enters the object-glass should come out at the eye end. To ascertain this, see whether a pointer which you place just in contact with the edge of the object-

glass can be wholly seen in the small disc of light which you will notice at the eye end when you draw your head back some inches from the telescope when the latter is pointed towards the sky. If the pointer cannot be seen up to the very edge, then the maker has inserted a diaphragm to cut off the light transmitted by the outer part of the object-glass. The diaphragm is a device to remedy the imperfectly corrected spherical aberration of the object-glass, by intercepting the rays that traverse its rim, and which, having a different focus from the central rays, would, if not stopped, cause a blurring of the image. In this case the real aperture of the telescope found by moving the pointer over the object-glass until its point is just visible, and measuring from the inner edge of the brass cell, holding the object-glass, to the pointer; twice this distance subtracted from the distance between the two edges of the brass cell, will give the actual or clear aperture of the telescope. This clear aperture divided by the diameter of the small circle of light at the eye end when the telescope is focussed on a distant object, will give the magnifying power of the telescope. A glass is corrected for achromatism if on focussing on a bright object, and then pushing the eyepiece nearer to the objective, a ring of purple surrounds the image and a ring of green appears when the eyepiece is pulled out. Veins or striæ in a glass are very injurious. They can be detected by viewing a bright object, like the moon or a flame, without the eyepiece. If the glass is evenly illuminated it shows that there are no such veins, and that the glass is homogeneous.

The best eyepieces are the Kellner and the Steinheil; they are achromatic combinations and are preferable on account of the absence of colour and the greater flatness of field which they give. The Kellner consists of a plano-convex, or sometimes a crossed field lens and an achromatic eye lens. The Steinheil consists of two achromatic lenses; it gives a beautiful field of moderate size but absolute flatness.

For the following table and accompanying remarks I am indebted to Mr. Abrey:—

“For average eyes the lowest powers available are = 5 × diameter of aperture of objective in inches, and generally the power should not be so low as this or nearly 5% greater. For the highest powers that are available under the most favourable circumstances for ast. purposes makers would not recommend greater than about 100 for a 2" aperture, and as the light is proportioned to the sq. of the dia., the power for smaller sizes will be nearly in the same proportion. Below is about the proportion:—

1"	lowest 7	highest 41
1½"	" 8	" 45
1¾"	" 9	" 51
1½"	" 10	" 57
1¾"	" 11	" 64
1½"	" 12	" 71
1¾"	" 13	" 79
1½"	" 14	" 88
2"	" 15	" 100."

The magnifying power of a telescope and the sensitiveness of its level should correspond to each other. The least motion of the level

bubble should be accompanied by a visible displacement of the cross wires on the field. For astronomical work the highest magnifying powers may be used, but for terrestrial work with the ordinary transit a magnifying power of from 24 to 30 is about right.

THE CENTRES.

The centres should fit each other exactly, so that the one may turn freely within the other without any lateral motion whatever. Both axes must be exactly concentric with the centre of the graduated horizontal circle and the centre of the horizontal axis of the telescope in any position of the instrument. The most sensitive level about the instrument should not shew any displacement during a complete revolution of the two plates—clamped together—round their vertical axis or while either one of the plates is held and the other revolved. In the case of instruments with a chamfered edge to the horizontal limb the vernier should have smooth and easy but close contact with the surface of the limb over which it moves, and the faces of the limb and vernier should form one continuous surface; and where the limb is not chamfered the vernier and limb should revolve in the same plane to avoid parallax when reading, and the space between the limb and vernier should have the appearance of a uniform fine black line. All graduation should be solid silver and the finer and cleaner cut they are, especially at the ends where contact is made between the limb and vernier the more perfect is the workmanship. For railway work it is convenient to have the graduations of the horizontal limb numbered both ways, right and left. The vernier should be the proper length, *i.e.*, the distance between the extreme lines should be equal exactly to a whole number of divisions on the limb. Every circle should be read by two verniers to eliminate the effect of eccentricity; the verniers should be lettered or numbered.

Graduations may be degrees divided sexagesimally or decimally. The former is in accord with custom but the latter is much more convenient when several verniers are read and the means required. Each vernier ought to be double, graduated both ways from its centre.

SPIRIT LEVEL.

The spirit levels as regards their sensitiveness need not be in strict keeping with the optical power and the graduations of the instruments, but the quality should be the best. The surface under which the bubble moves should be of continuous curvature so that as the level is gradually inclined to the horizon the bubble moves uniformly from end to end without jerking at any point, and no matter what its length it should move quickly without any of the hitching which is usually caused by a little dirt introduced when it is filled; in change of temperature the bubble should lengthen symmetrically each way from the centre. A first-class level should not only have the curve regular, but it should be perfectly symmetrical, that is, one end of it should have the same width as the other, otherwise the length of the

bubble in changes of temperature will change unequally at the ends. The longer the bubble the more sensitive the level, hence in the best levels there is a chamber at one end which acts as a reservoir in regulating the quantity of the fluid in the phial at any time, and consequently regulates the length of the bubble.

The level attached to the telescope should be sensitive enough for ordinary levelling, such as good railway work. Of the two levels on the alidade plate the one perpendicular to the plane of collimation should be the longer. The test of fitness of the various levels for the capacity of the instrument should lie in this—that after carefully bisecting an object in the field of view in such a position of the instrument that all the levels can be read and then throwing them all slightly out of level by means of the levelling screws the bisection shall be accurately regained by restoring the bubbles to the exact position they before occupied by the levelling screws alone.

Level bubbles should be ground throughout on their internal surface and when mounted in their tubes should be graduated on their upper surface so as to read easily to at least to one-half of the smallest arc shown by the vernier or micrometer for vertical angles.

LEVELLING SCREWS.

The levelling screws should fit closely in their sheaths; the heads should be of large diameter and coarsely milled so as to admit of manipulation when mittens are worn. As to the fineness of the thread thirty-two to the inch is perhaps about right; they should not be finer than this for ordinary instruments and not much coarser.

There are certain accessories, as they may be called, with which a complete transit is provided. There should be an eyepiece for observing stars of small zenith distance; a prism is better than a mirror for this; the telescope should have a sunshade. Some would consider a hollow axis for illumination of the field at night to be indispensable. Buff & Berger say:—"A rain and dust guard for the object slide is now furnished with all of our telescopes, and the graduations of the horizontal circle, the centre and such other important parts, that are liable to injury by the action of dust and water in the field use of our instruments are entirely protected." Reflecting shades attached to the verniers to throw an even light on the graduations are a great convenience. Stadia wires in the telescope are very useful in some branches of surveying. An American maker, Mr. J. Holmes, places the stadia wires in his telescope at a different focus from the ordinary cross-wires so that the two sets cannot be confounded.

Tangent screws should work against an opposing spring to avoid all lost motion; the spring should "follow" the tangent screw as far as it is likely to be screwed out in actual use.

The dark glasses used for the solar work should fit easy to admit of being put on and taken off without deranging the instrument. All instruments that may be used for astronomical work should have a striding level which should be so constructed as to remain on the instrument while an observation is made.

A compass on a transit is sometimes a convenience; the box should be water-tight and the covering glass should be made of homogenous plate or ground glass.

English instruments are as a rule more highly finished and are heavier than American; they are cheaper too. Some of the special features of American instruments would improve the English instruments if adopted on them.

In the writer's opinion the best transit is that whose line of collimation can be made the most nearly to trace out a vertical plane; this is the most important operation and at the same time the most difficult which has to be performed by the instrument. In the majority of ordinary instruments the readings of the graduated circle as to accuracy and precision are of a quality much superior to that of the manner in which the instrument is mounted upon the tripod and of the character of the tripod itself. It is an absurdity to have a circle reading to twenty seconds say, standing on the narrow base which usually accompanies the use of four levelling screws, and the ordinary unframed tripod. A circle reading to less than a single minute should stand on the broad base which can be obtained by the use of the three levelling screws and should have a framed tripod. The most difficult property to obtain in perfection in a transit is stiffness. A tripod needs frequently to be overhauled—always after a journey—to see that all the screws and bolt heads are tight; the shoes, especially on instruments that have been long in use, need to be looked after to see that they are firmly attached to the wood.

In conclusion I would say that in seeking a good instrument the safest way is to get one that has been made by a reputable maker.

DISCUSSION.

The Chairman—I am sure we have all been very much interested with the practical points brought out in this paper. I should like very much to have a discussion on this paper.

Mr. Abrey then explained what he considered the best kind of tripod and the one he generally used. He explained that symmetry was a very important element in this instrument.

Mr. Chipman—I have discarded the round tripod; the truss tripod is much better. If you tighten it once every six months it is quite sufficient.

Mr. Abrey—These framed tripods I have carried over the rocks, and they have been none the worse. It can be made smaller and so be more easily carried. Small object glasses are the best. In the North-West I used 10, 15 and 20 diameters and had no trouble with refraction. When you have higher parts you cannot use them well in the light.

[This Association is not responsible as a body for any opinions expressed in its Papers by Members.]

DECIMAL vs. DUODECIMAL MEASUREMENTS.

By VILLIERS SANKEY, P.L.S.,

City Surveyor, Toronto.

IN all things it is necessary now-a-days to look for what is useful, convenient and practical. This is more especially the case in things that require accuracy. It is no longer now an argument of any weight to say, "I was taught so," or, "My father did things thus." In matters such as I am going to refer to, no sentimental notion can be permitted to interfere, when common sense points out what is the most useful means to attain a desired end. For a long time I have been considering the question of the great advantage it would be, not only to surveyors and engineers, but also to the community at large, if some convenient method of expressing measurements similar to the system at present in use in the matter of our currency were adopted.

At our last annual meeting I determined to bring the matter before this Association, and to urge it to use all its influence in bringing about the necessary change. You may imagine, therefore, how greatly pleased I was, on reading the valuable paper on this subject by J. P. Bates, C.E. in our exchange of the *Arkansas Society of Engineers, Surveyors, etc.*, vol. 1, November, 1887.

I need not dwell at length, when addressing an Association like this, upon the great benefits to be derived by such a change. They are so self-evident that I will merely state the proposals I would suggest, and discuss a few of the results which are likely to follow. Simply stated then, I desire to express all measures of length, breadth and thickness in terms of feet and decimals. Probably the best way to bring this before you is, first, to draw your attention to the regulations which now govern us. And, for a reason which I will refer to later on, I will first take up the subject of the Dominion standards of measures.

49 Vic., chap. 104, sect. 3, enacts that the bronze bar and the platinum weights as thereafter described shall be the Dominion standards of measure of weight.

Sections 9, 10 and 11 read as follows:—

DOMINION MEASURES OF LENGTH.

9. "The straight line or distance between the centres of the two gold plugs or pins (as mentioned in the first schedule to this Act) in the bronze bar, by this Act declared to be the Dominion standard for determining ^{Standard yard defined.}

the Dominion standard yard, measured when the bar is at a temperature of sixty-one degrees and ninety-one hundredths of Fahrenheit's thermometer, and when it is supported on bronze rollers, placed under it in such manner as best to avoid flexure of the bar, and to facilitate its free expansion and contraction from varying temperatures, shall be the legal standard measure of length, and shall be called the Dominion standard yard, and shall be the only unit or standard measure of extension from which all other measures of extension, whether line or superficial or solid, shall be ascertained." 42 Vic., chap. 16, sect. 10.

Standard foot,
inch, rod,
chain, link,
furlong, and
mile.

10. "One third part of the Dominion yard shall be a foot, and the twelfth part of such foot shall be an inch; and the rod, pole or perch, in length, shall contain five such yards and a half; and the chain shall contain twenty-two such yards, and the link shall be the one-hundredth part of the chain; the furlong shall contain two hundred and twenty such yards; and the mile, one thousand seven hundred and sixty such yards." 42 Vic., chap. 16, sec. 11.

Standard rood
and acre.

11. "The rood of land shall contain one thousand two hundred and ten square yards, according to the Dominion standard yard; and the acre of land shall contain one hundred thousand square links, being four thousand eight hundred and forty such square yards, or one hundred and sixty square rods, poles or perches." 42 Vic., chap. 16, sect. 12.

With regard to section 9, I do not propose to make any alteration. I, for one, am satisfied to retain the one described as the standard. I cordially endorse what Mr. Bates, in his paper, says about running after false gods. Our standard will answer fully as well for all practical purposes as though it were derived from a quadrant of the meridian of the earth. No doubt, in fact, it is derived from either the proverbial barley-corn or from the length of the feet of the first sixteen men coming out of church on a Sunday morning.

Sections 10 and 11 are the ones in which I should suggest a change. The first I would make to read thus:—"The third part of a Dominion standard yard shall be a foot, the 10th part of such foot shall be a tenth, and the 100th part of said foot shall be a hundredth, and so on for thousandths, etc. The mile shall contain 2,580 feet, equal to 1,760 yards."

Section 11, I would change thus:—"The acre of land shall contain 43,560 square feet, equal to 4,840 square yards." Thus, I would practically make the foot the unit of measurement, as by doing this, little difficulty will be experienced in adapting this method to the existing system.

Let us now consider some of the results which will follow this change. 1st. What effect will it have on surveyors, engineers, etc. ?

They will simply go on using the chains or tapes they now have, but express the results of their measurements in feet and decimals, and when they are worn out or broken get a new one divided into tenths and hundredths. With regard to our scales, they are now decimally divided, and no difficulty will arise in plotting surveys made in feet and hundredths with them. Of course, as they wear out or break, supply their places with ones divided in tenths instead of inches. We would then use the expression on our plans, "1 tenth equals 50 feet," or as the case may be. The surveyor who is also an engineer should welcome the change with rapture, from the fact that all measurements for length are now made in feet and tenths, so he will not have to carry two tape-lines with him.

We now come to the subject of calculations under this system. First, as to measures of length now expressed in inches, etc., it may be said that mechanics generally use inches and eighths, and to convert them into feet and hundredths would be too much trouble. The following rule I have found to be quite close enough for practice:—"First express the inches and eighths in eighths. Place this number to the right of the decimal point. In the tenths or hundredths place according as the number of eighths is tens or units. Multiply the number by four and place the product below in the hundredths, thousandths, or tens of thousandths, place as the case may be. The sum will be the required decimal of a foot."

Thus, express $6\frac{1}{8}$ inches in decimals of a foot:—

$$\begin{array}{r} 6\frac{1}{8} \text{ inches} = \frac{49}{8} \qquad \cdot 49 \\ 49 \times 4 = \qquad \qquad \qquad \frac{196}{\quad} \\ \qquad \qquad \qquad \qquad \qquad \qquad \cdot 5096 \end{array}$$

Should be $\cdot 5104$.

Again, as to converting square feet into acres and hundredths, 43,560 is a big divisor. But the figures are easily multiplied, and for ordinary purposes where a few acres only are in question, multiplying square feet by 2 and cutting off the last six figures will give a sufficiently close result.

I cannot think that any difficulty will arise when foot-rules, divided as I suggest, are placed in the hands of the workmen. The reason that I have taken up the Dominion standard before the standard which we, as Ontario surveyors, are bound to verify our chains by, is this:—That, in my opinion, the Ontario standard is only binding on us when making surveys under the authority of the Commissioner of Crown Lands. But when making surveys for private individuals, who are selling their land by the acre or by the foot, the Dominion standard is the one by which we are governed. Another reason is this:—The Dominion standard is very much more accurate. The changes due to temperature have been carefully observed, and means for making these observations are provided for, whereas, in the Provincial standard the means are not so accurate. Let me read to you the legal description of the former:

PART I.—DOMINION STANDARDS.

"The Dominion standard for determining the length of the Dominion standard yard is a solid square bar, thirty-eight inches long and one inch square in transverse section, the bar being of bronze or gun metal (known as Baily's metal); near to each end a cylindrical hole is sunk (the distance between the centres of the two holes being thirty-six inches) to the depth of half an inch; at the bottom of each hole is inserted in a smaller hole a gold plug or pin, about one-tenth of an inch diameter, and upon the surface of each pin are cut a fine line transverse to the axis of the bars, and two lines at an interval of about one-hundredth of an inch parallel to the axis of the bar; the measure of length of the Dominion standard yard is given by the interval between the transverse line at one end and the transverse line at the other end, the part of each line which is employed being the point midway between the longitudinal lines; and the said points are in this Act referred to as the centres of the said gold plugs or pins, and such bar is marked "Mr. Baily's Metal," standard yard, "A," "Troughton & Simms, London." There are also on the upper side of the bar, two holes for the insertion of the bulbs of suitable thermometers for the determination of the temperature."

This bar is standard at a temperature of $61^{\circ}.91$ Fahrenheit.

The Ontario standard may be described thus:—A metal bar of rectangular form and about a yard in length, across which lines are cut to denote feet and links. There is no provision for inserting thermometers, and the divisions are coarse. It is supposed to be standard at about 60° Fahr. I will not discuss the subject of deriving a standard for weights and measures from the lineal standard, though I think the connection would be most advisable. With regard to angular measurements, the benefit of dividing the degree decimally, and having our instruments similarly divided, needs no comment. In conclusion I hope this paper will have the effect of inducing this Association to take the matter up with such energy that the matter may become an actual fact and not remain a visionary theory.

DISCUSSION.

Mr. Gibson—What steps do you suggest we should take?

Mr. Sankey—I think we would not require legislation. The way is to go slow. If all the surveyors would start to make their measurements in hundredths I think there would be no difficulty in carrying the matter out. The public would soon understand it, there would be no difficulty in that. The advantages would be so great and the disadvantages so small. The metric system is law in Canada. Mr. Bates, of Arkansas, advocates that system. The metric system would be difficult to bring into common use. The only way would be for some fairy to obliterate the feet and inches and for us to waken up some morning and find the metric system in vogue.

Mr. Abrey—That same question came up in the meeting in Ottawa. I think the way we are now fixed the decimal system is the best.

Mr. Gibson—I use the system Mr. Sankey talks of. In length measures I reduce them at once to decimals, and the same in acres. In using this system on the construction of a viaduct I had some difficulty; the trouble was, all the mechanics had their rules divided into 1 inch, $\frac{1}{8}$ inch, $\frac{1}{4}$ inch, $\frac{1}{2}$ inch, etc.; they did not understand the hundredths. It required the greatest accuracy in building a viaduct. When you hand your profile to the foreman it is in tenths, and you have to reduce it to sixteenths. There are tables prepared by Buchanan for finding areas. We all use the decimal system. If we could get the mechanics to use the decimal system we would not have so much trouble. We ought to have it taught in schools.

Mr. Sankey—In answer I would say the mechanics are just as well educated in dollars and cents, and when you put the new rule in their hands they will easily learn it. This matter is one of public importance, and as manufacturers are generally the first people to move in such a matter I think it would be advisable to send round a little treatise to the manufacturers, etc.

Mr. Aylsworth—I have had some experience. Good mechanics have used the rule divided into eighths and you cannot make them use tenths.

APPENDIX.

LIST OF EXHIBITS.

V. Sankey, Esq., P.L.S., showed some samples of Keuffel and Esser's new process of photographing from tracings, called the Nigroetine Process. It differs from the Blue Process, in giving black lines on white ground. In their circular, Keuffel and Esser say of it :— " This process is nearly as simple as the Blue Process, but differs from it chiefly in that it requires a chemical developer added to the water bath. The great advantages of this process are, that it gives a permanent *facsimile* of the original drawing, permanent black lines on a permanent white ground, and the half tones as such. This also overcomes the drawback of shaded blue prints, which always show light, and shade reversed." For prices, etc. address Keuffel & Esser, 127 Fulton Street and 42 Ann Street, New York.

Messrs. Hart & Company, the well-known firm of stationers, had an interesting exhibit of materials necessary for the use of surveyors and civil engineers, consisting of tracing linen, tracing paper, Whatman's hand-made paper, profile and cross-section paper; also samples of transit, record, cross-section and field books, besides many other needful sundries, including a selection of the more useful grades of Faber's Siberian Graphite pencils, as well as those of cheaper qualities. There was also a collection of private and office stationery quite in keeping with the reputation of this firm, as fine and general stationers. Mention might also be made of the specimens of fine printing, engraving and embossing which were shown, as this class of work is receiving much more attention than formerly, both by professional and business men.

Mr. Sanderson exhibited a Calculating Machine. It was, he said, an improvement on all previous calculators. It was invented by Mr. Tate, and was called Tate's Patent Arithmometer. It is the latest calculator in existence, the older machines were more difficult to work. Mr. Sanderson then proceeded to show how the machine worked, and gave the following illustration :—

$$P + 2 \ 89987888 + 98998788$$

$$P - 2 \ 89689 - 43642$$

$$P + 2 \ R \ 98998898 + 9897688 \times 654321$$

$$P - 2 \ R \ 9998999989998889 - 8998978 \times 65473$$

$$\frac{P}{2} \ 898464 \div 5432$$

$$P \ 2 \times R \ S \times T \ M$$

$$898976 \times 4323 + 9878 \times 4365 + 78965 + 43231$$

Rice Lewis & Co., Toronto, exhibited some of Chesterman's steel band chains, which they keep in stock.

BIOGRAPHICAL SKETCH

OF

THE LATE THOMAS DEVINE, F.R.G.S.

MR. DEVINE entered the Department of Crown Lands July 11th, 1846, and was attached to the Upper Canada Surveys Branch, as Surveyor and Draughtsman. He had previously been admitted on June 11th, 1846, a Provincial Land Surveyor. In 1857, on the appointment of the late Andrew Russell to be Assistant Commissioner of Crown Lands, Mr. Devine was made Head of Surveys for Upper Canada. About the same time, on the resignation by Mr. Russell of his seat on the Board of Examiners of Land Surveyors, Mr. Devine was appointed to the vacant seat, which he held until his resignation in 1879. On the eve of his departure, the Board of Examiners passed the following resolution:—

OFFICE OF BOARD OF EXAMINERS OF
LAND SURVEYORS FOR ONTARIO,

TORONTO, October 7th, 1879.

The members of the Board, in session assembled, desire to express to their Chairman, Thomas Devine, Esq., F.R.G.S., on the eve of his departure for Europe, their cordial good wishes for himself and family; they cannot but feel, that their labours have been lightened by his uniform urbanity, and the ability and zeal displayed by him in promoting the best interests of the profession, and in co-operating with them in the desire to elevate the standard of scientific acquirements.

(Signed) F. F. PASSMORE,
Chairman pro tem.

HUGH WILSON,
P. S. GIBSON,
GEO. B. KIRKPATRICK,
Secretary of Board.

Mr. Devine was a native of the County Westmeath, Ireland, studied his profession under the Royal Engineers, and was employed on the Ordnance Survey of Ireland. He then came to Canada, and, in 1846, was appointed to a position in the Survey Branch of the Crown Lands Department. In 1872, the Ontario Government conferred upon him the title of Deputy Surveyor-General, which position he held until the end of 1879, when, feeling the necessity of rest and

relaxation, he retired, after completing thirty-three years of faithful service.

While a resident in Toronto, he took an active interest in educational matters, was a member of the Toronto Separate School Board, and, during his last term of office, was chairman of that body.

On his resignation, he returned to his native country and spent several years there, residing principally in Dublin. He returned to Canada and settled in Montreal, where he continued to reside until his death. He was ill for only a few weeks, and his death was quite unexpected. He died in Montreal on Wednesday, the 14th November, 1888. A widow and two sons survive him.

As a topographer, Canada is much indebted to Mr. Devine for many valuable and beautiful maps which he brought out from time to time while in the employ of the Government. The principal ones, covering the whole of Canada, were published while the Hon. Messrs. Cauchon, Vankoughnet and Scott were in charge of the Department of Crown Lands, and were universally admired. His services in this line were recognized by the Royal Geographical Society of London, which elected him a Fellow. He was also a corresponding member of the Geographical Society of Berlin, and of the American Geographical and Statistical Society.

LIST OF MEMBERS.

ACTIVE MEMBERS.

NAME.	OCCUPATION.	ADDRESS.
Abrey, George Brockitt	17 Arcade,	Yonge Street, Toronto.
*Apsey, John Fletcher	47 Gloucester Street,	Toronto.
Aylsworth, Wm. Robert		Deseronto. Engineer for Tyendinaga, Engineer for Bay of Quinte Railway, etc.
Aylsworth, Charles Fraser, Jr.		Madoc. Engineer for Madoc and Townships of Madoc, Rawdon & Hungerford.
Baird, Alexander		Leamington.
*Bazett, Edward		Midland.
Beatty, David		Parry Sound.
*Bell, James Anthony	City Engineer.	St. Thomas.
Berryman, Edgar, M. Can. Soc. C.E.	17 Place d'Armes Hill,	Montreal. Chief Engineer Great Eastern Railway.
*Blake, Frank Lever		Toronto. Astronomical Assistant at Observatory.
*Bolger, Thomas Oliver	City Engineer.	Kingston.
Bolger, Francis		Penetanguishene.
*Bolton, Jesse Nunn		Albion.
*Bolton, Lewis		Listowel. Engineer for Townships of Elma, Grey, Morris, Town of Listowel and Village of Drayton.
*Booth, Charles Edward Stuart, A. M. Can. Soc. C.E.,	393 Division Street,	Kingston.
*Bowman, Arthur Meyer, Grad. S.P.C., Toronto		Berlin.
Bowman, Clemens Dersteine		West Montrose.
Bowman, Herbert Joseph, Grad. S.P. Sc. (Toronto);		A.M. Can. Soc. C.E. Berlin. Superintendent B. W. W.

NAME.	OCCUPATION.	ADDRESS.
*Bowman, Isaac Lucius		Berlin.
Bray, Edgar		Oakville.
Browne, Harry John	17 Toronto Street,	Toronto.
Browne, Wm. Albert	17 Toronto Street,	Toronto.
Burke, Wm. Robert	Engineer for County of Oxford.	Ingersoll.
*Burnet, Peter		Orillia.
Burt, Frederick Percy	Chief Draughtsman "Engineering News,"	New York City.
Campbell, Archibald Wm., A. M. Can. Soc. C.E.		St. Thomas.
Campbell, David Suter	Engineer for five Townships.	Mitchell.
Casgrain, Joseph Philip Baby, A. M. Can. Soc. C.E.		Morrisburgh.
Cavana, Allan George	Engineer for Townships of Rama, Mara and Dalton.	Orillia.
Cheesman, Thos.		Mitchell.
Chipman, Willis, B.A.Sc. (McGill); M. Am. Soc. C.E.; M. Can. Soc. C.E.	City Engineer.	Brockville.
Coad, Richard		Glencoe.
*Coleman, Richard Herbert	Engineer for Canada Company.	Toronto.
Cozens, Joseph	Town Engineer, Sault Ste Marie.	Sault Ste. Marie.
Davidson, Walter Stanley		Petrollea.
Davis, John	Engineer Guelph Junction Railway.	Guelph.
Davis, Wm. Mahlon, Grad. R. M. C. (Kingston); A. M. Can. Soc. C.E.	Town Engineer, Woodstock.	Woodstock.
Deans, William James		Osh: wa.
Decker, Edwin Stanton		St. Thomas.
De Morest Watson	136 N. Lisgar St.,	Toronto.
De Gursé, Joseph	Chief Engineer, Lake Erie, Essex & Detroit River Railway.	Windsor.

NAME.	OCCUPATION.	ADDRESS.
Dickson, James.....	Inspector Crown Lands Surveys.	Fenelon Falls.
Doupe, Joseph, C.E. (McGill).....		7 Princess Street, Winnipeg, Man.
*Drewry, Wm. Stewart, A. M. Can. Soc. C.E.....	Engineer for Townships of Sidney and Thurlow.	Box 386, Belleville.
Ellis, Henry Disney.....	Assistant Engineer O. & Q. Railway (Don Branch).	74½ St. Patrick Street, Toronto.
Esten, Henry Lionel.....		30 Adelaide Street East, Toronto.
Evans, John Dunlop M. C. Soc. C.E.....	Chief Engineer Central Ontario Railway, Engineer Weddell Bridge and Engine Works. Engineer Canadian Copper Company.	Trenton.
Fawcett, Thomas, D.T.S.....	Dominion Government Surveys.	Gravenhurst.
Fitton, Charles Edward.....	Engineer Wahnapatæ Mining Company.	Orillia.
Flater, Frederick William.....		Chatham.
Foster, Frederick Lucas.....		176 Argyle Street, Toronto.
*Franks, Cecil Bushe, M. Can. Soc. C.E.....	Assistant Engineer G. T. R.	Box 116, Hamilton.
Galbraith, John, M.A.; Assoc. M. Inst. C.E., D.T.S.....	Professor of Civil Engineering, School of Practical Science.	Toronto.
Galbraith, William.....		Bracebridge.
Gardiner, Edward.....	Engineer County of Lincoln.	St. Catharines.
Gaviller, Maurice, C.E. (McGill).....		Barrie.
Gibson, Peter Silas, B.Sc.; C.E.; M.Sc. (Univ. of Mich) ..		Willowdale.
*Gilliland, Thomas B.....		Eugenia.
Hanning, Clement George, C.E. (Trinity College, Dublin, Ireland).....		135 Bloor Street East, Toronto.
*Henderson, Eder Eli.....	Engineer on International Railway, Maine.	Brownville, Me.
Johnston, R. T., 131 Wellington St. W.....		Toronto.
*Jones, Charles Albert.....	Engineer for Townships of London, Delaware and West Nissouri.	215 Dundas Street, London.
*Jones, Thomas Harry, B.A.Sc. (McGill).....		Brantford. City Engineer, Engineer for Townships of Burford, Brantford and South Dumfries.

NAME.	OCCUPATION.	ADDRESS.
*Keefer, Thos. Coltrin, C.M.G. ; M. Inst. C.E. ; Pres. A. Soc. C.E. ; Can. Soc. C.E.		Ottawa.
Kirk, Joseph.	Engineer for Townships of Mornington, South Easthope, North Easthope and Village of Melverton.	Stratford.
Kirkpatrick, George Brownly	Chief Clerk Survey Branch, Department of Crown Lands.	Toronto.
Klotz, Otto Julius, D.T.S. ; C.E. (University of Michigan) ..	Astronomer for Department of Interior.	Preston.
Laird, Robert, Grad. S. P. C., Toronto ..		771 King St. W., Toronto.
Lendrum, Robert Watt		Vankleek Hill.
Low, Nathaniel E.		Wiarton.
Lumsden, Hugh David, M. Inst. C.E. ; M. Can. Soc. C.E.	Engineer for Atlantic & North-West and International Railways.	Sherbrooke, Q.
McAree, John, Grad. S.P.S. ; D.T.S. ..		237 Parliament St., Toronto.
McCulloch, Andrew Lake, Grad. S. P. C., Toronto	Engineer for Town of Galt, Townships of Beverly and North Dumfries.	Galt.
*McDonell, Augustine		Chatham.
*McEvoy, Henry Robinson		St. Mary's.
McGeorge, Wm. Graham	Engineer County of Kent.	Chatham.
McGrandle, Hugh		Huntsville.
McKay, Owen	Assistant Engineer L. E. E. & D. R. Ry.	Windsor.
McKenna, John Joseph		Dublin.
McPhillips, George		Windsor.
*Maddock, Junius Arthur		Gladstone, California.
*Manigault, Wm. Mazyck	Engineer for Townships of Caradoc, East Williams, Adelaide and Town of Strathroy.	Strathroy.
Miles, Charles Falconer	Engineer Minto, Normanby, Carrick, Brant, Greenock, Bruce, Arain and Town of Wingham.	Walkerton.
Moore, John McKenzie	Engineer for four Townships.	London.

NAME.	OCCUPATION.	ADDRESS.
Morris, James Lewis, C.E. (Toronto University), A. M. Soc. C. E.	Engineer County of Renfrew.	Pembroke.
Murphy, Chas. Joseph	30 Adelaide Street East,	Toronto.
Niven, Alexander	Outline Surveys, Crown Lands Department.	Haliburton.
Ogilvie, William, D.T.S.	Exploration Survey Alaskan Boundary.	Ottawa.
Patten, Thadeus James		Little Current.
*Paterson, Jas. Allison, M. C. Soc. C.E.	Engineer on C. P. R.	26 St. Mary St., Toronto.
*Proudfoot, Hume Blake, C.E. (University of Toronto)	Engineer for eleven Townships.	Toronto.
Purvis, Frank	Engineer for Townships of Bromley and Wilberforce.	Eganville.
*Ritchie, Nelson Thomas		Kincardine.
Robertson, James, Grad. S. P. Sc.	Engineer for several Townships.	Glencoe.
Rogers, Richard, Birdsall; B.A.Sc. (McGill)	Superintending Engineer Trent Canal.	Peterboro'.
Russell, Alexander Lord		Port Arthur.
*Sankey, Villiers	City Surveyor.	City Hall, Toronto.
Saunders, Bryce Johnston, B.A.Sc. (McGill)		Brockville.
Sanderson, Daniel Leavins		Courtice.
Scane, Thomas.	Engineer for Townships of Orford and Done, and Town of Ridgetown.	Ridgetown.
Selby, Henry Walter	Engineer for Townships of Nottawasaga, Sunnidale and Floss.	Stayner.
Sewell, Henry DeQuincy, Assoc. M. Inst. C.E.		Port Arthur.
*Smith, Henry, M. Can. Soc. C.E.	Superintendent of Colonization Roads in Ontario.	Toronto.
Speight, Thomas Bailey		Arcade, Yonge Street, Toronto.
*Sproatt, Charles, M. Can. Soc. C.E.	City Engineer.	Toronto.

NAME.	OCCUPATION.	ADDRESS.
Stewart, Elihu		Collingwood.
Traynor, Isaac		Dundalk.
	Engineer for Townships of Egremont, Proton, Melancthon and Osprey.	
Tyrrell, James Williams, Grad. S.P.S.....		Hamilton.
Unwin, Charles	17 Toronto Street,	Toronto.
Van Nostrand, Arthur Jabez	Arcade, Yonge Street,	Toronto.
Vicars, John		Cannington.
	Engineer for Township of Brock and Village of Cannington.	
Warren, James		Kincardine.
	Engineer for the Townships of East Wawanosh, Ashfield and Culross.	
Weatherald, Thomas		Goderich.
Webb, Adam Clark		Brighton.
*West, Robert Francis		Orangeville.
*Wheeler, Arthur Oliver		Ottawa.
	Department of Interior.	
Wheelock, Chas. Richard		Orangeville.
	Engineer for Counties of Wellington, Dufferin and Peel.	
*Whitson, James Francis		North Bay.
	Engineer for six Townships.	
Wicksteed, Henry King, B.A.Sc. (McGill), M. C. Soc. C. E. .		Ottawa.
	Chief Engineer Brantford, Waterloo & Lake Erie Railway.	
*Willson, Alfred		Toronto.
	Chief Engineer Canada Company.	
*Wilson, Hugh, F.G.S	433 Carlton Street,	Toronto.
Yarnold, William Edward		Port Perry.
	Engineer for Townships of Reach, Scugog, Mariposa and Georgina.	

JUNIOR MEMBERS.

Rathbun, Edward Walter, Jr.	Desoronto.
	Assistant Engineer N. T. & Q. Ry.
Sherman, Ruyter	Brantford.

HONORARY MEMBER.

Carpmael, Charles, M.A.....	Toronto.
	Superintendent of Meteorological Service.

