

PAGES

MISSING

The Canadian Engineer

WEEKLY

ESTABLISHED 1893

VOL. 18.

TORONTO, CANADA, JANUARY 28th, 1910.

No. 4

The Canadian Engineer

ESTABLISHED 1893.

Issued Weekly in the interests of the

CIVIL, MECHANICAL, STRUCTURAL, ELECTRICAL, MARINE AND MINING ENGINEER, THE SURVEYOR, THE MANUFACTURER, AND THE CONTRACTOR.

Editor—E. A. James, B.A.Sc.
Business Manager—James J. Salmond

Present Terms of Subscription, payable in advance:

Canada and Great Britain:		United States and other Countries:	
One Year	\$3.00	One Year	\$3.50
Six Months	1.75	Six Months	2.00
Three Months	1.00	Three Months	1.25

Copies Antedating This Issue by Two Months or More, 25 Cents.
ADVERTISEMENT RATES ON APPLICATION.

HEAD OFFICE: 32 Church Street, and Court Street, Toronto, Ont.
Telephone, Main 7404 and 7405, branch exchange connecting all departments.

Montreal Office: B33, Board of Trade Building. T. C. Allum, Editorial Representative, Phone M. 1001.

Winnipeg Office: Room 315, Nanton Building. Phone 8142. G. W. Goodall, Business and Editorial Representative.

London Office: 225 Outer Temple, Strand, T. R. Clougher, Business and Editorial Representative. Telephone 527 Central.

Address all communications to the Company and not to individuals. Everything affecting the editorial department should be directed to the Editor.

NOTICE TO ADVERTISERS.

Changes of advertisement copy should reach the Head Office by 10 a.m. Monday preceding the date of publication, except the first issue of the month for which changes of copy should be received at least two weeks prior to publication date.

Printed at the Office of the Monetary Times Printing Co., Limited, Toronto, Canada.

TORONTO, CANADA, JANUARY 28th, 1910.

CONTENTS OF THIS ISSUE.

Editorials:

- What Should an Engineer Know of Law?..... 69
The New Hydraulic and Thermo-Dynamic Laboratories, Toronto University 69

Sanitary Review:

- The Problems of Saskatchewan and Public Health Problems 71

Page of Costs:

- Concrete Boundary Monuments 74
Costs of Concrete Sidewalk 74
Cleaning Land 74

Leading Articles:

- Problems in Applied Statics 75
Report of Annual Meeting of Canadian Society of Civil Engineers 77
The Tate Bifunctional Accumulator Plate 87
Construction News 91
Market Conditions 94

WHAT SHOULD AN ENGINEER KNOW OF LAW?

It is expected of all engineers that they know a little of everything and some one thing well. How much should the engineer know of law?

In this day of specialization, a little knowledge is a dangerous thing, but the engineer ignorant of procedure, the rights of vested interest, or the principle of contracts, is very apt to cause himself and his clients much trouble.

An engineer, himself a specialist, will not attempt to be his own lawyer. But he will know something of common and civil law.

Common law is the crystallization by statutes and court decisions of the customs that relate to the dealing of man with man, and represents the experience of the ages. It establishes the basis for determination of the rights and duties in regard to ownership and contracts.

In addition to a knowledge of these fundamentals the engineer requires specific information as to the legal limits of his authority, duties, liabilities, rights and privileges. Usually, he is an agent, and he should know how far his actions will bind his principals.

In dealing with labor the engineer frequently has to face the problems of conspiracy, injunctions and property protection. In such cases he will not often have an opportunity to consult a lawyer, but must act quickly, and to be accurate he must have knowledge. His university curriculum was too crowded to pay much attention to legal matters. But during the first few years after leaving college he will have an opportunity for reading, and should then improve his knowledge of law. We should not be afraid of growing too learned.

THE NEW HYDRAULIC AND THERMO-DYNAMIC LABORATORIES, TORONTO UNIVERSITY.

The opening of a new building at Toronto University on January 20th was a successful function, but it is very unfortunate that the Board of Governors could not see their way clear to make a grant so that the Faculty of Applied Science and Professor Robert W. Angus might make known to the manufacturers and engineers the kind of instruction they were prepared to give in the departments of Hydraulics and Thermo-dynamics, the extent of their equipment, the opportunities for practical tests and practical instruction, and the endeavor that is being made to give a course for **students in engineering** such as the **engineer and not the schoolmaster** would approve.

A university that for the year ending June, 1909, can spend over six thousand dollars on items that are fairly chargeable to advertising account could surely spare a few hundred for the opening of a large new building. More especially might co-operation be expected

when the building is under the direction of a faculty, whose student and staff members spend annually in advertising the university several hundred dollars of their own private funds. To an outsider it looks as if the tail was expected to wag the dog.

But about this Hydraulic building. The apparatus in the laboratory consists of a new American turbine and a McCormick wheel, both of the reaction type, one of which is arranged for experimental work, the other for examination. There is a wheel made by the Escher-Wyss Company, of Switzerland, which also is set up for experimental work, and which represents the most modern development of the turbine in Europe. Several impulse wheels are available—all of the Pelton type, the small Doble wheel having glass sides so that the action of the water may be well seen.

The water for the experiments is supplied by two high-life turbine pumps, one made by Gwynnes, of London, England, and the other by Escher-Wyss, of Switzerland. These pumps are so arranged that large quantities of water can be obtained for reaction turbine work and smaller quantities and very much higher pressure for the impulse turbine work and for friction experiments in pipes and hose. These two pumps are driven by a Belliss & Morcom engine of 130 horse-power. There is also a long trough in the basement about six feet wide, four feet deep and 112 feet long in which experiments on the rating of Pitot tubes and current meters may be carried out.

The Thermo-dynamic laboratory work taken by the third year Mechanical and Electrical men consists in valve setting, indicator practice with steam and gas engines, the determination of mechanical efficiency of engines, and considerable other work of similar nature. When the laboratory is complete they will also take up work on oil-testing and the determination of the driving power of belts and ropes and other similar devices. The fourth year students taking this option spend their time on the examination of steam and gas engines, boilers, etc., determining the relative effects of cut-off, steam pressure, vacuum, etc., on the economy of the machine. Corresponding experiments are also carried on with gas engines with city and suction gas and with a gasoline engine. The apparatus consists of a Brown engine of 50 horse-power, two-stage air compressor with compound steam side, a tandem engine, small high-speed engine, a steam turbine, vertical Willans engine, two valve-setting engines, two gas engines, gas-producer refrigerating machine, and other similar apparatus, steam being supplied by three Babcock & Wilcox boilers, one of which has a superheater. The engines are all specially arranged for testing, and are set up so that they can be run either condensing or non-condensing as desired. Two surface condensers are available for the former method of running.

Many times has Professor Angus been congratulated upon the work in his departments, which was carried on under difficulties in the old, crowded, quarters. May success in his new surroundings still remain with him, and may he receive the support from the Board of Governors, the Faculty Council and the engineering profession that will enable him to continue in the course he so long has successfully followed—of conducting his work for young men who purpose entering the engineering and business world as distinct from those who may follow academic or scholastic vocations.

EDITORIAL NOTES.

Canadian trade returns for December show an increase of 40 per cent. An increase of over 21 million in the last month of 1909 should indicate an active business year in 1910.

* * * *

The Winnipeg Street Railway earnings for 1909 are above the million dollar mark, the total being \$1,069,782.83. This is an increase of \$170,150.25 over 1908. This increase in earnings indicates the growth both in population and business of the city. In five years the earnings of the street railway have doubled.

* * * *

The production of copper in the year just past reached 1,410,000,000 pounds, says a New York journal. There was 700,000,000 consumed and 675,863,000 exported. The estimated consumption for 1906 was 682,000,000 pounds, while that for 1909 was 700,000,000 pounds; 1907 and 1908 sank to 488,000,000 and 480,000,000. The recovery, then, in 1909 has been complete.

* * * *

In the Canadian Engineer, Vol. 17, and on page 661, there was described the failure of a concrete bridge. Since the bridge was located in the county of York, and Barber & Young are the county engineers for York, some have wondered if the bridge was built from their design. This firm were in no way concerned in the design or construction. If they had been, there would not have been any failure to record.

ENGINEERING SOCIETY NOTES.

Canadian Clay Products Manufacturers' Association.

The annual convention of the Canadian Clay Products Manufacturers' Association concluded at Chatham, Ont., with the election of the following officers: President, W. McCredie; vice-presidents, John T. Miner, Kingsville; J. W. Ball, Mimico; W. S. Odell, Ottawa; secretary-treasurer, D. O. McKinnon, Toronto; assistant-secretary, A. B. Farmer, Toronto; executive, George Crain, David Martin, Oliver Baird, J. F. Ollman, John Wardle.

* * * *

B. C. Land Surveyors.—The fifth annual convention of the corporation of British Columbia Land Surveyors was held in Nelson on January 11th, at the board of trade rooms. The business sessions were held in the morning and afternoon, while the annual banquet was held in the evening. Among those present were E. B. McKay, A. I. Robertson, S. A. Roberts, Victoria; N. Humphreys, E. B. Hermon, F. C. Tupper, C. E. Cartwright, Vancouver; F. M. Kerby, J. A. Coryen, Grand Forks; T. T. McVittie, Fort Steele; J. D. Anderson, Trail; C. Moore, Creston; W. J. H. Holmes, Kaslo; O. R. N. Wilkie, Trout Lake; W. S. Drewry, H. C. C. Black, F. P. Burden, Alfred Green, A. L. McCulloch, Frank Fletcher, F. C. Green, Nelson, E. B. McKay, the surveyor-general, was present on behalf of the government. Officers for the ensuing year were elected as follows: President, W. S. Drewry, Nelson, vice-president, W. S. Gore, Victoria; secretary-treasurer, S. A. Roberts, Victoria; board, E. P. Hermon, E. A. Cleveland, G. H. Dawson, Vancouver; J. H. McGregor, Victoria.

* * * *

American Institute Electrical Engineers., Toronto Section.—The regular monthly meeting of the above society will be held Friday, January 21st, at 8 p.m., in the rooms of the Engineer's Club, 96 King Street West. The following paper will be presented: "Recent Progress in Electrical Engineering," by Mr. P. M. Lincoln, Chairman Sections Committee, A.I.E.E., Consulting Engineer, Westinghouse Electric & Manufacturing Company, Pittsburgh. An informal luncheon will be served at the St. Charles Café at 6.30 p.m. sharp, to which all members are requested to invite their friends.

THE Sanitary Review

SEWERAGE, SEWAGE DISPOSAL, WATER SUPPLY AND
WATER PURIFICATION

THE PROBLEMS OF SASKATCHEWAN AND PUBLIC HEALTH PROBLEMS.

"No by-law providing for the raising of money for the construction, operation or extension of any system of water-works or common sewer or system of sewerage or sewage disposal shall be submitted to the votes of the electors by the council of any municipality until the consent of the commissioner, to the proposed construction, operation or extension has been first obtained under the provisions of Section 21 or 22 hereof, as the case may be; and the preamble to every such by-law shall declare that such consent has been duly obtained. No debentures shall be valid if issued under any by-law passed in contravention of the provisions of this Section."

The above forms Clause 23 of a new public health act recently enacted in the Province of Saskatchewan.

No other public act in the Dominion of Canada contains any such provision as the above. The clause forms an entirely new feature in sanitary legislation. Any municipality whatsoever, is entirely barred from raising a single cent for sanitary engineering works, until such proposals have been properly matured, submitted, and passed by a central government bureau of public health.

The Ontario Provincial Health Act has over and over again been referred to as a dead act, as far as any control exists over sanitary works. The act calls for the submission of plans, but such are often submitted long after the work is completed, when by some accident the Provincial Board of Health learns that they have been installed. For instance, the case of Lindsay Ozone Plant. Here the first knowledge the Ontario Health department had of the existence of any such plant, was in the request of Dr. Amyot to test the work on completion. This led to no end of confusion and dissatisfaction, and meetings between the parties concerned.

As a matter of fact any control which the ordinary Provincial Boards of Health have over sanitary engineering proposals, depends entirely upon the willingness and good nature of the engineer engaged in the work or of the municipality in voluntarily consulting the boards.

Saskatchewan has, however, taken the bit in its teeth, and has enacted such laws, that will make it impossible to spend public money in half-baked water and sewer schemes.

The principal of central authority control is gradually being admitted in this country. The admission of the principal will tend to much saving of public funds in checking the propagation of badly thought out schemes, or schemes boosted and forced upon a community by aldermen who are more willing to listen to the exaggerated talk of patent vendor than to the duly qualified engineer.

The Saskatchewan Public Health Act.

This act essentially differs from most of our provincial public health acts, inasmuch as instead of creating a pro-

vincial board of health, it creates a bureau of public health, with a health commissioner directly responsible to the government. So far it is based on the principal of the New York State Board of Health.

The ordinary layman might find it difficult to discriminate between a bureau and a board; but there is a difference. Let us take an example. In Ontario we have a Provincial Board of Health consisting of several medical gentlemen with a permanent secretary, also a medical man. These gentlemen meet quarterly, judge any plans casually sent to them for examination, pass certain motions of instruction to the secretary and generally pretend to administrate the health affairs of the Province of Ontario. A bureau on the other hand is a government department, consisting of a permanent active staff of experts with a commissioner at the head responsible to no elected board but to the government direct.

If you ask anyone connected with the administration of health matters, he will tell you in a moment that a bureau is much more efficient than a board, this is the essential difference indeed.

Constitution of Bureau.

The Commissioner of Public Health is the head of the Bureau of public health; he has a department of sanitary engineers, sanitary inspectors and can call for all extra assistance required. The commissioner administers health matters with the aid of expert advice, direct to the people without reference to any board. In case of epidemic he can make and issue regulations of a temporary character, and take action of a peremptory character without waiting for the working of any cumbersome machinery.

The Act.

The public health act consists of:

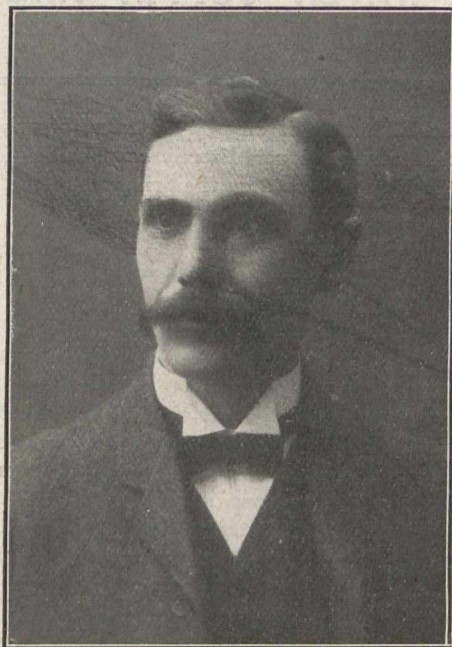
1st. A number of matters covering almost every phase of the public health questions, upon which the commissioner with the approval of the Lieutenant-Governor-in-Council may, when occasion arises, issue regulations and orders.

2nd. It consists in direct enactments affecting questions relating to health, and especially to water supply, sewerage and sewage disposal. Clauses 21 and 22 we give in full as being especially interesting to the sanitary engineer. A perusal of the above clauses, will make it plain, that the Government of Saskatchewan through the Commissioner of Health intend to maintain as far as possible pure water supply and insist on efficient disposal of sewage effluents.

Clause 21.—"Water Supply."

21. When the establishment of a system or the extension of any existing system of water works for the purpose of providing a water supply for public consumption is contemplated by the municipal council of any municipality or by any person or body corporate it shall be the duty of such municipal council, person or body corporate whether incorporated by special or private Act of Parliament or otherwise howsoever

to submit to the commissioner the plans and specifications of the proposed system of water works and an analysis of the water from the proposed source or sources of supply verified by affidavit stating that the plans and specifications so submitted are those to be used and followed in the construction of such proposed system, that the particulars set forth in such analysis are true and that the water analyzed was taken from the proposed source or sources.



The Hon. Walter Scott.

The Hon. Walter Scott, (present Premier of the Saskatchewan Legislature). The first premier of the Provincial House which succeeded the Government of the North-West Territories. It is owing to the broad-minded policy of love and care for the people characteristic of this gentleman that it has been possible to advance health legislation in Saskatchewan.

(2) It shall not be lawful to construct, establish or operate any such system of waterworks or any extension of an existing system of waterworks as aforesaid without first obtaining from the commissioner a certificate certifying that the plans, specifications and analysis so submitted and the proposed source or sources have been considered and approved by him and that the proposed system or extension may, with safety to the public health be constructed, carried out and operated.

(3) If in the opinion of the commissioner alterations are necessary in the plans or in the specifications of such proposed system the commissioner shall notify the municipality, person or body corporate, as the case may be, of the necessity of such alterations and shall specify the same; and the certificate shall not be granted until such alterations have been made in such plans and specifications.

Clause 22.—Sewerage and Sewage Disposal.

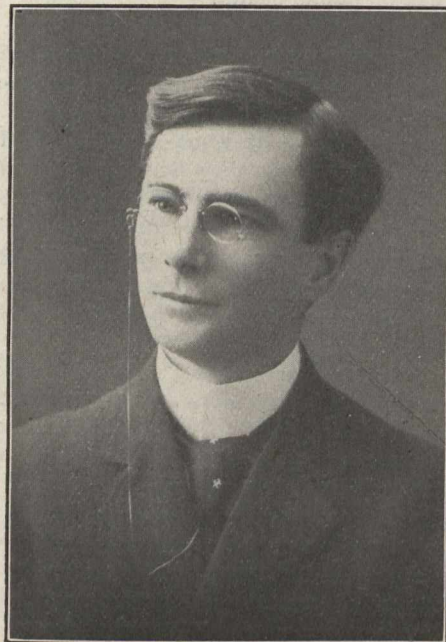
22.—When the construction, alteration, or extension of a common sewer or system of public sewerage is contemplated by the municipal council of any municipality or by any person or body corporate such council, person or body corporate shall submit to the commissioner all plans and specifications in connection with the construction, alteration or extension of such common sewer or system of sewerage and in connection with the purification and disposal of the sewage.

(2) No common sewer or system of sewerage shall be established or continued unless there is maintained in connection therewith a system of sewage purification and disposal which removes and avoids any menace to the public health and the commissioner may call for and any council, person or body corporate shall when requested furnish as soon as may be such information and data in relation to such matters under their control as the commissioner may deem necessary:

Provided that with regard to systems in operation at the date of the passing of this Act the commissioner may dispense with the requirements hereof for a sufficient time in his opinion to permit of compliance therewith.

(3) It shall not be lawful for any such council, person or body corporate to construct, alter, extend or operate any common sewer or system of sewerage or sewage disposal without first obtaining from the commissioner a certificate stating that the proposed construction, alteration or extension may be carried out and the constructed or extended common sewer or system of sewerage and sewage disposal maintained and operated without injury or danger to the public health.

(4) If in the opinion of the commissioner for the purpose of guarding against injury or danger to the public health alterations or additions are necessary in any existing or proposed common sewer or system of sewerage or in the plans or specifications for sewage disposal, or in both the plans and specifications submitted as aforesaid the commissioner shall notify the municipality, person or body corporate, as the case may be, of the necessity of such alteration and shall specify the same and the aforesaid certificate shall not be granted until the alterations and additions specified in the said certificate have been made and adopted. If, in the opinion of the commissioner, the quality of the water of any existing system of water works is of such a character as to be a menace to the public health, such changes or additions shall be made by the Municipal Council of any municipality,



Hon. A. Turgeon, Attorney-General.

The Hon. A. Turgeon, (Attorney-General). To the efforts of this able lawyer is due the fact that the Act was so framed and put before the Legislature, that it received its second reading unanimously by the House. In fact the Opposition have shown a non-partisan interest in the welfare of this Act.

or by any person or body corporate in such manner and within such time as the commissioner with the approval of the minister shall direct.

As far as the sanitary engineer is concerned, the above clauses must prove of interest, inasmuch as they represent a new epoch in the history of sanitary engineering in this country.

Clauses 3 and 4.

As these clauses describe the constitution of the bureau and the duties of the commissioner, it will be of interest to here quote them in full.

3. There shall be a permanent bureau under the minister to be called the Bureau of Public Health, and the Lieutenant-Governor-in-Council may appoint thereto a chief officer to be called the Commissioner of Public Health who shall be a duly qualified medical practitioner and such other officers, clerks and employees as are necessary for the proper conduct of the bureau, whose duties under the direction of the minister shall be to carry out the provisions of this Act and such other duties as are assigned to them by the Lieutenant-Governor-in-Council under this or any other Act.

4. It shall be the duty of the commissioner under direction of the minister:—

- (a) To perform the duties prescribed by this Act;
- (b) To keep a record of the transactions of the council;
- (c) As far as practicable to communicate with all provincial or state boards of health and with the boards of health and health officers within the Province and with the councils of cities, towns, villages, and rural municipalities and other public bodies for the purpose of acquiring or disseminating information concerning the public health;
- (d) To inspect all public and charitable institutions, such inspections to be made in accordance with such rules and regulations as may from time to time be prescribed by the minister;
- (e) To perform such other duties as may be assigned to him by the Lieutenant-Governor-in-Council under this or any other Act.

Some may consider that the powers given to the commissioner are of an autocratic character, but the Act provides for a council who have power to review the acts of the commissioner and report to the minister.

The following are the clauses referring to the constitution of a council:—

5. There shall be a council of public health consisting of the commissioner who shall by virtue of his office be the chairman thereof and three duly qualified medical practitioners and one qualified veterinary practitioner to be appointed by the Lieutenant-Governor-in-Council who shall receive such remuneration as the Lieutenant-Governor-in-Council shall determine.

(2) On the first constitution of the council two of the members other than the commissioner shall be appointed for three years and two for two years; and thereafter each member appointed shall hold office for two years.

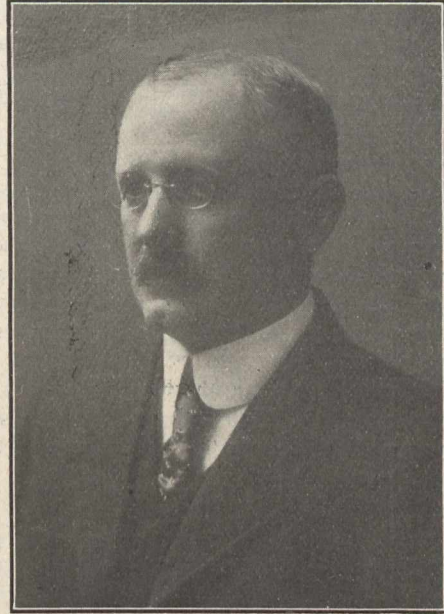
6. Meetings of the council shall be held at such times and places as may be determined by the minister, but at least one meeting shall be held in each calendar year.

7. The council shall at its meetings consider and review all orders, rules and regulations made under the provisions of this Act and shall make a report thereon to the minister with such suggestions and recommendations as to the amendment or cancellation of any such order, rule or regulation or the making and issuing of any new order, rule or regulation as it may deem necessary in the interests of the public health.

8. The council shall also consider such matters as may be referred to it by the minister and may also consider any

matter within the purview of this Act as to it may seem fit and shall report thereon to the Lieutenant-Governor-in-Council.

The Act is under the charge of the Attorney-General, the Hon. A. Turgeon. The first appointed Commissioner of Health is Dr. M. M. Seymour. The engineering department is under the direction of Mr. T. Aird Murray, M. Can. Soc. C.E., consulting sanitary engineer of Toronto. The appointed council are Wm. I. McKay, M.D., C.M., city health officer, Saskatoon; E. E. Meek, B.A., M.D., city health officer, Regina; A. R. Turnbull, M.D., city health officer, Moose Jaw; F. W. Whybra, V.S., Prince Albert.



M. M. Seymour, Commissioner of Health.

M. M. Seymour, M.D., C.M., first Commissioner of Health, Saskatchewan. Graduated at McGill, 1879. Two years connected with City Board of Health, Montreal, along with present Health Officer. In 1881 in medical practice in Winnipeg, acting as chief surgeon to St. Barnabas Hospital, being succeeded by the famous Dr. A. H. Ferguson, at present of Chicago. Appointed surgeon to the 95th battalion Manitoba Grenadiers, served through the rebellion and received medal. In general practice at Fort Qu'Appelle until 1904, when he removed to Regina to specialize in surgery.

Dr. Seymour has for the past four years acted as chief medical officer of health for the Government under the Department of Agriculture. He makes health matters not only a business but a hobby. An old timer and a thorough Westerner, he is, however, well-known at health and medical conferences both in Canada and the States. He combines along with a broad and up-to-date scientific knowledge, a familiarity with Western conditions, which makes him eminently suited to the post of Commissioner of Health.

The character and working efficiency of the public health act are greatly due to the doctor's wide knowledge of the working effects of other acts in other places.

At present the doctor has a great scheme on foot, to obtain a large tract of land in the hills as a settlement for consumptive patients where ranching may be carried on and the people live under ideal conditions for their recovery.

Dr. Seymour as a medical man appeals to the sanitary engineer, as he does not attempt to pose as an engineering expert as so many medical men are apt to do. For this reason he was one of the first medical officers of health in Canada to insist upon the services of a qualified sanitary expert for Government administration.

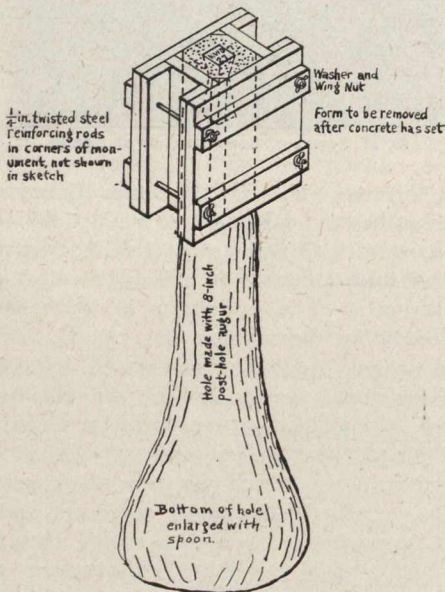
A PAGE OF COSTS

ACTUAL, ESTIMATED and CONTRACTED

CONCRETE BOUNDARY MONUMENTS

Concrete is now generally recognized as a cheap and eminently satisfactory substitute for granite for use as boundary monuments. The following details of construction and cost are therefore of interest. They are drawn from the report of Leonard Metcalf, civil engineer, Boston, to Kennebec Water District, Waterville, Me., and relate to an exceptionally fine piece of work done under Mr. Metcalf's direction in connection with the China Lake Water Supply.

These bounds were built upon the ground in post holes 5 feet or more in depth and in forms, either flush with the ground, in mowing fields or grass lands, or about 1 foot above the surface of the ground, along fence and property lines. The bounds were of the following general form:— Below the ground eight inches in diameter, 5 feet in depth, with the base flared out to from 4 to 6 inches greater diameter; above the surface of the ground, or at the top of the post, 6 inches square for a length of 6 or 16 inches according as the bounds were built flush with or above the surface; in the four corners of the square top and extending to the bot-



Sketch of Concrete Boundary Monument for Kennebec Water District.

tom of the post were bedded bars of 1/4-inch steel bent in U form across the top of the post. In the top of the post was bedded a small iron casting with expanded bottom bearing the letters K.W.D. and the number of the bounds, as for instance: K.W.D. 95. The concrete of which these bounds were made was mixed on the ground in the proportion of one part of Portland cement to two parts of sand to four parts of gravel or broken stone of approximately 1/2-inch diameter. The cost of these bounds erected was considerably less than it would have been for granite bounds, and it is believed that they will prove even more satisfactory, since it seems probable that there will be less danger of heaving by frost; time alone however, can determine whether this is the fact.

The total cost of the bounds in final position averaged about \$4.30 each, including therein the cost of all materials, supplies and forms, and all teaming, labor and supervision.

Cost of Monuments.

	No. Built.	Cost per Month.	Average.
September.....	52	\$211.85	\$4.07
October.....	36	160.25	4.45
November.....	15	65.25	4.35
Total.....	103	\$437.35	\$4.25

This includes \$1.00 per day for 48 days for district horse, but does not include cost of forms, which amounted to between \$4.00 and \$5.00 making the total average cost per bound (in place) \$4.30.

COSTS OF CONCRETE SIDEWALK*

The cost of concrete sidewalks during the past seven years in the City of Kingston, Ontario, has been as follows:

	Cents.
In 1903 the cost per sq. ft. was.....	29.3
In 1904 " " "	17.5
In 1905 " " "	15.6
In 1906 " " "	15.7
In 1907 " " "	17.3
In 1908 " " "	16.9
Exclusive of iron pipes	15.9
In 1909 the cost per sq. foot was.....	13.8
Exclusive of iron pipes	13.1

*From information furnished by H. B. R. Craig, City Engineer, Kingston, Ont.

REMOVING SNOW

The cost of removing snow during December, 1908, and January and February, 1909, from the lines of the Hull Electric Railway was 2.7 cents per car mile. This amounted to 18 per cent. of the total expenses.

COST OF PUMPING WATER

At Waterloo, Ontario, during 1909 the cost of pumping water was \$2.06 per thousand gallons. Per pound of coal used 150 gallons of water was pumped.

CLEARING LAND*

The C. P. R. are clearing about one thousand acres of land on Shaughnessy Heights, Vancouver, B. C. The land is covered with very heavy stumps, most of which are Douglas fir and the land being gravelly their roots go straight down to a great depth.

The work is being carried on under the supervision of Mr. J. A. Johnston.

A gin pole is erected in the middle of a fifteen to twenty-acre tract of land and a sixty horse-power logging engine

*See also Can. Eng. Vol. XVII. Page 68.

is anchored near the outside of the plot. An inch and an eighth cable is passed through the pulley at the top of the gin pole and hitched to the stumps in turn, each of which is hauled to the big pile which soon surrounds the base of the pole. When all the stumps have been drawn to the pile the whole is fired and the small refuse cleaned up and burned before the land is ready for grading.

The cost of operating one machine for a week, during which time an average of four acres is cleared, is as follows:

Engineer, per week	\$ 23.00
Fireman	12.00
Hook tender	24.00
Assistant tender	21.00
Signalman	18.00
Line assistant	21.00
Shovelman ..	12.00
Laborer	12.00
Water team	16.00
Wood, 15 cords at \$3.80	57.00
Powder	200.00
Dynamite	15.00
Fuse	7.00
Caps	1.00
<hr/>	
Total for four acres	\$439.00
Cost per acre, \$109.75.	

Added to the above is the cost of slashing the small growth which is put at \$50 an acre, and the final gleaning which can usually be done for \$10 an acre. This makes a grand total of \$169.75 per acre for making the land ready for grading, or in the case of agriculture, ready for plowing.

About two days is usually taken in moving from one plot of land to another, including the setting up of the gin pole, anchoring and making ready for starting. There is a small cost which should be allowed for burning the piles amounting to nearly ten dollars an acre, but which will probably be covered by the conservative estimates on the other items.

Sixty horse-power donkey engine	\$3,750.00
1,300 feet 1 1/4 in. wire cable	400.00
4,000 feet 5/8 in. haul-back rope	300.00
Other sundries	100.00
<hr/>	
Total	\$4,550.00

ELECTRIC RAILWAY EXTENSION IN 1909.

During 1909 the extensions made on thirteen electric roads in Canada totalled about fifty miles. They are as follows:—

	Miles.
British Columbia Electric Railway	17.00
Calgary Street Railway	5.00
Chatham, Wallaceburg and Lake Erie	4.00
Edmonton Radial	5.20
Hull Electric	2.25
International Transit Co.	0.31
Montreal & Southern Railway	5.00
Montreal Street	1.60
Montreal Park & Island Railway	5.35
Port Arthur & Fort William Railway	2.50
Sarnia Street34
Winnipeg Electric Railway	4.07
York Radials	1.15
<hr/>	
Total	53.77

PROBLEMS IN APPLIED STATICS.

T. R. Loudon, B.A.Sc.

(Registered in Accordance with the Copyright Act.)

This series of problems began in the issue for the week, October 22nd, 1909. It is assumed that the reader either has an elementary knowledge of the subject of Statics, or is in a position to read some text on such theory.

Stress Diagram.

Fig. 128 is the complete Stress Diagram for the left-hand half of the Fink Truss as shown in Fig. 128A. It will merely be necessary to point out the various Vector Polygons in this diagram since the construction of these polygons has been already gone through.

MA, AE, and EM (Fig. 128) evidently form a Vector Polygon for the forces acting at the point MAE. (See Figs. 114 and 115.)

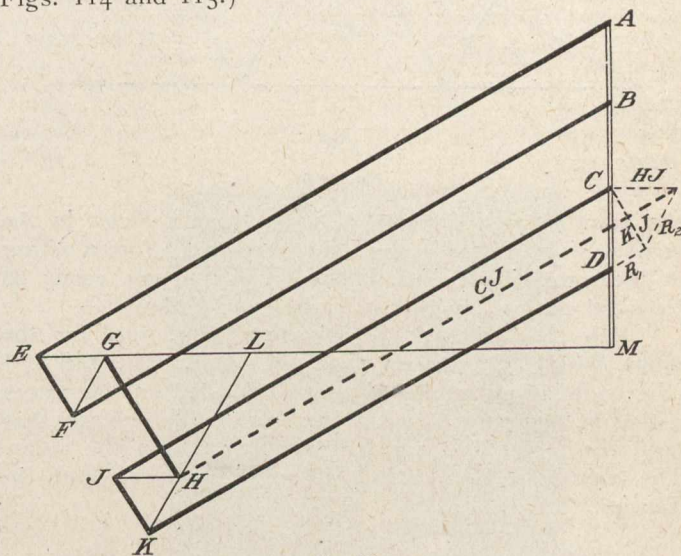


Fig. 128.

Considering the point EABF, the Vector Polygon reads on Fig. 128: EA, AB, BF, and FE. (Compare with Fig. 117.)

Coming next to the point MEFG (see Figs. 118 and 119), ME, EF, FG, and GM (Fig. 128) form a Vector Polygon for the forces acting at this point.

From B, on the line MA, lay off BC to represent the load BC. Then from C, on the same line, lay off CD to represent the load CD.

Consider the point KJCD. Replacing DK and JC by their resultant R₁, it is seen that CD, R₁ (dotted), and KJ (dotted) form the Vector Polygon for the forces indicated in Statical Diagram, Fig. 121.

Following out the same method for the point JKLH, replacing KL and LH by their resultant R₂, which gives a condition indicated in Statical Diagram (Fig. 124), it is evident that JK (dotted), R₂ (dotted), and HJ (dotted) (Fig. 128) form the Vector Polygon for the forces being discussed. (Compare with Fig. 125.)

From a consideration of the forces acting at the point GFBCJH, it is seen that GF, FB, BC, JH (dotted line), CJ (dotted line), and HG (Fig. 128) form a Vector Polygon for the forces being discussed. Bow's Notation, however, could not be fully carried out for reasons already given.

Reconstructing the Vector Polygon for this point so that Bow's Notation may be applied throughout, a poly-

gon which reads GF, FB, BC, CJ (heavy full line), JH (thin full line), and HG (in Fig. 128) is arrived at. (See discussion of Figs. 126 and 127.)

In the discussion of the Graphical Solution previous to this section on the Stress Diagram, the determination of the stress in the truss members was not carried beyond

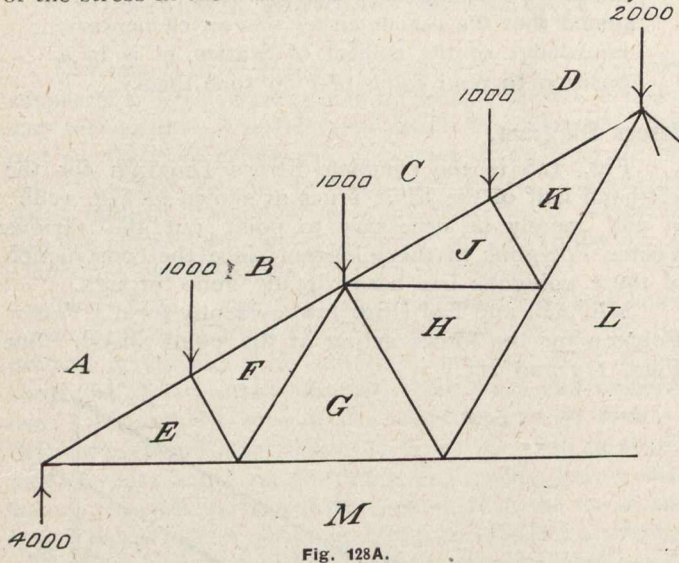


Fig. 128A.

the point GFBCJH, there being nothing difficult in the constructing of the Vector Polygons for the forces acting at the remaining points. These polygons may easily be followed out on the Stress Diagram as follows:—

Referring to Statical Diagram (Fig. 129) for the point MGHL, it is seen that MG, GH, HL, and LM (Fig. 128) constitute a Vector Polygon for the forces acting at this point. It is evident from this polygon that both the forces HL and LM act away from the point. The members HL and LM are, therefore, both in Tension.

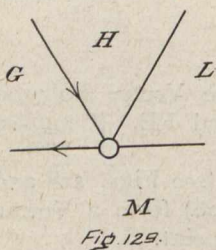


Fig. 129.

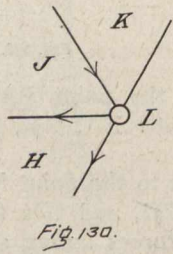


Fig. 130.

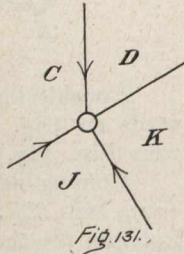


Fig. 131.

Consider the point LHJK (Statical Diagram, Fig. 130). LH, HJ, JK, and KL (Fig. 128) is the Vector Polygon for the forces acting at this point, from which it is seen that the member KL is in Tension.

Coming back, finally, to the point KJCD (Statical Diagram, Fig. 131), evidently KJ, JC, CD, and DK (Fig. 128) form a Vector Polygon for the forces being considered. The force DK is seen to act against the point. The member DK must, in consequence, be in Compression.

Three Forces in Equilibrium.

Three forces in equilibrium must have lines of action which intersect at a common point.

If it were possible, let P, Q, and S (Fig. 132) be three forces in equilibrium. Take moments about the point O, the intersection of the lines of action of P and Q.

$$\begin{aligned} \sum M &= M_P + M_Q + M_S \\ &= P \cdot o + Q \cdot o + S \cdot a \\ &= S \cdot a; \end{aligned}$$

i.e., these forces cannot be in equilibrium, for $\sum M$ must equal zero for a set of forces in equilibrium.

It is evident, however, that if the distance a becomes zero, that is, the line of action of S passes through O, that $\sum M$ would also become equal to zero and the three forces would be in equilibrium, provided, of course, that the other conditions, $\sum X = 0$ and $\sum Y = 0$, were also fulfilled.

(It may be mentioned here that three forces do not have to act at a point in order that $\sum X$ and $\sum Y$ be equal

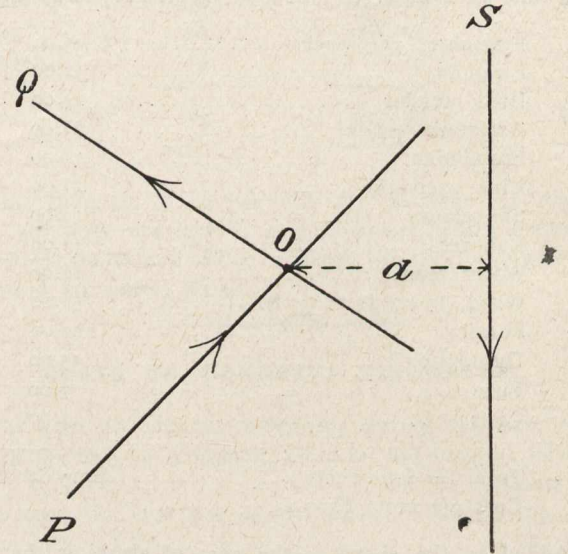


Fig. 132.

to zero. It is merely that $\sum M$ may equal zero for three forces that the above condition must be fulfilled.)

The reader must clearly understand that every set of three forces which acts at a point is not in equilibrium; but if three forces are in equilibrium, they must fulfil the condition enunciated at the beginning of this proposition.

DEATH OF RANDOLPH MACDONALD.

Mr. Randolph Macdonald, of Toronto, a well-known contractor, died at his home there on January 21st, 1910. Mr. Macdonald was born in Drummondville, Ont., on March 30, 1849. His father was the late Angus Peter Macdonald, a Canadian by birth, but of Scotch descent, who represented West Middlesex in the Dominion Parliament for a number of years. Randolph Macdonald was educated at Dr. Tassie's Grammar School in Galt, and at Hellmuth College, London. His connection with railways began early. His introduction was as superintendent and clerk in the construction of the Cleveland and Mahoning Branch Railroad, Cleveland, Ohio. Then he was associated with his father and brother in a railroad contract on the Jamestown & Franklin Railway in Pennsylvania. This work lasted three years. In 1870 he became a partner with his brother, under the firm name of W. E. Macdonald & Company. They built sections of the Intercolonial, sections 1 and 2 of the Lachine Canal, and the Welland Basin, near Montreal, and the Fenelon Falls, part of the Trent Valley Canal. In 1887 Mr. Macdonald was awarded the Don improvement contract by the City of Toronto, and he continued this work in partnership with Alexander Manning, contractor and capitalist, under the partnership name of Manning & Macdonald. From 1891 to 1903 they built the Port Dalhousie harbour works, the Midland Division of the Grand Trunk to Campbellford, Ont., the Esplanade works of Toronto, the Canadian Pacific Railway, section on the Don River, the Toronto Belt Line Railway, section 13 of the Soulanges Canal at Coteau Landing, and section 9 at Coteau-du-Lac, these two sections costing \$1,200,000, and the St. Lawrence River improvements at Cornwall. Mr. Macdonald purchased the Manning interests in the firm and carried out a harbour contract at Three Rivers, Que., and other dredging contracts. Mr. Macdonald was one of the organizers of the Sovereign Bank, and became vice-president of the institution. He was interested in the formation of the Crown Life Insurance Company, and was a director until two years ago.

CANADIAN SOCIETY OF CIVIL ENGINEERS

*Verbatim Report of 24th Annual Meeting, held at Ottawa, January 25-27, 1910.

Report of proceedings of the twenty-fourth annual meeting, held in the council chambers, City Hall, Ottawa, twenty-fifth to twenty-seventh of January, 1910.

The President, Mr. G. A. Mountain in the chair.

10.30 a.m.

THE PRESIDENT: Gentlemen, in declaring the Twenty-fourth annual meeting of Canadian Society of Civil Engineers open for business, I hope it will be our earnest wish and aim that our meetings, our deliberations, and our discussions here may be carried on, on a broad and intelligent basis, with calmness and with thoroughness so that when we depart the younger and older ones among us may feel that we have learned something and that the decisions reached and recommendations made are authoritative, and of value to us in planning and carrying out our work, so that the results may prove satisfactory to ourselves and to those whose interests we serve.

There will be an official welcome by the Mayor at 12 o'clock.

The first business is the reading of the minutes.

The minutes of the last annual meeting, held in Toronto, January 28th, 1909, were read by the secretary.

DR. GALBRAITH: Before the minutes are confirmed I should like a little correction to be made. In speaking of the entertainment given by the Engineering Society of the University, my name is mentioned as president. It was Mr. R. J. Marshall who presided, as president of the Engineering Society of the Toronto University.

The minutes were then confirmed.

MR. LEACH: Mr. President, before the general business is proceeded with, I should like to call attention to a paragraph in the notice of this meeting and to ask whether it has been the custom in years gone by for the council to proceed to the functions contained in Paragraph 33 of the by-laws immediately after the annual meeting of the Society; that is to say to the appointment of committees, officials, and so on?

THE PRESIDENT: That was done at a meeting of the council held immediately after the annual meeting.

MR. LEACH: Then, Mr. President, I wish to raise a very serious question, that a meeting was held for the reception of the reports of scrutineers and concluding the business of the annual meeting—"an informal meeting" of the annually-elected council. I ask you to note particularly the two words "an informal."

THE PRESIDENT: I can answer Mr. Leach by saying that the word "informal" was put in there by me. I hold myself personally responsible for that.

MR. LEACH: This year I notice, that at 3 p.m. or immediately on adjournment of the annual meeting of the society, a meeting of the council is to be held. That gives no opportunity for absent members who are up for election at this annual meeting. They are not given proper notice that they are elected members of the council, and unless a gentleman comes here on the speculation that he is likely to be elected a member of the council, he cannot exercise the functions that he should under By-law 33. If it is necessary, I will ask this meeting to go with me to the extent of saying that it shall be an instruction from this meeting that the new council shall not act under By-law 33, until every member of the new council has been officially notified and given the opportunity to attend a properly summoned meeting.

THE PRESIDENT: In these meetings, Mr. Leach, held immediately after the annual meeting, we get a great many men from different sections of the country, so that it is one of the largest meetings of the year.

MR. LEACH: I grant you that, sir, but I say it is unconstitutional. I am not raising the point with any animus, but simply as a constitutional point. It is not right that a member who is elected should be debarred from exercising his privileges, by reason of inability to attend the annual meeting.

MR. COUTLEE: I think the member is out of order. The first proceeding to-day is the appointment of scrutineers.

THE PRESIDENT: I think Mr. Leach is in order, but I may say to him that the Proceedings are always confirmed by the council at its next general meeting.

MR. LEACH: I have brought this up as a point of order, on the paragraph of the summons by which the meeting is called. It is a wrong way to hold a meeting and transact important business, without the members of council knowing that they are elected and that a meeting is to be held. I stand on that as my solid position.

MR. JOHN KENNEDY: Mr. President, it seems to me that Mr. Leach is a little wrong inasmuch as the results of the ballot are announced before, so that every man who is here knows whether he is elected or not, and, as a matter of fact, that is one of the largest council meetings that is held. That has been my experience, and it is announced in the notice of the annual meeting that the new council will meet at that time. In this way, they have, as a matter of fact, been notified of their appointment, perhaps not weeks before, but hours or minutes, and it is, therefore, in perfect order. As a matter of right, it seems to me that things have gone on well, and as a matter of practice it has worked well.

MR. W. McNAB: Mr. Chairman, I think the point raised by Mr. Leach is in order, but it is a matter for the council to deal with. The council has been elected, and it is its duty to appoint the committees, and the rank and file of the membership have nothing to do with this matter; it is a thing that the members of council may take exception to, but it is not for this meeting.

THE PRESIDENT: If Mr. Leach wishes to bring the matter up for resolution, he may do so, when we come to the consideration of general business.



COL. H. N. RUTTAN, PRESIDENT-ELECT.

APPOINTMENT OF SCRUTINEERS.

THE PRESIDENT: With your approval, I beg to name as scrutineers for ballots, the following:

Officers and Members of Council:

O. P. Schreiber, chairman.
C. V. Johnson.
H. J. Heygate.
H. H. Pinch.

Nominating Committee:

H. V. Brayley, chairman.
W. M. Everall.
J. R. Grant.
F. M. Davis.

Amendments to By-laws:

F. A. Drought, chairman.
H. W. Jones.
F. J. Delaute.
A. R. Ketterson. (Carried).

*A verbatim report of the Ottawa meeting appears in this issue, which was printed in Ottawa. We apologise to our readers for deferring publication one day.

THE PRESIDENT: Perhaps someone will move that the report of council be taken as read, and it will then be open for discussion.

Moved by Mr. MacPherson, seconded by Mr. Dawson, that the report of council be received for discussion. (Carried.)

MR. McNAB: Mr. Chairman, the third paragraph on page 12, states that the council "has suggested to the Citizens' Committee of Montreal, the desirability of naming an engineer as one of the candidates for the board of control. It notes with approval the nomination of Mr. F. L. Wanklyn as one of the committee's candidates." May I ask if the council suggested any particular name to the Citizens' Committee?

THE PRESIDENT: No, no name was suggested.

MR. McNAB: I think it would be in better form to put it that it notes with approval the nomination of an engineer, a member of this society, as one of the candidates. I hardly think it dignified to come down to local politics. We all have great respect for Mr. Wanklyn, but I think it is one thing to recommend that an engineer be a member of this board, without naming a candidate.

THE PRESIDENT: I do not think there is any local politics in it. It is only a nomination—not an election. It simply alludes to the nomination of Mr. Wanklyn, he being a member of this society.

MR. McNAB: If Mr. Wanklyn did not get in, it would be perhaps, a reflection on the council's judgment. All that is required would be done by simply stating, an engineer and a member of this society.

MR. J. KENNEDY: Mr. President, it seems to me that Mr. McNab is right. The report should indicate that it is the appointment of an engineer and a member of the society that is approved of.

MR. McNAB: If it were a matter affecting the weal of the whole Dominion it would be all right, but in this case I understand that what the council wish to do is merely to approve of the appointment of an engineer. I, therefore, move that the name of Mr. Wanklyn be omitted and that the statement be, "the nomination of a civil engineer, a member of this society."

MR. LEOPRED: I agree with Mr. McNab. I do not think the society should endorse the nomination of any particular engineer, and it would never do for the society to become a factor in the political muddle that has occurred in Montreal. It is dangerous ground for the council to endorse the nomination of Mr. Wanklyn or anyone else.

THE PRESIDENT: The council did not recommend any particular man; it simply recommended that an engineer and a member of the Canadian Society should be placed on that board. Now, it has been noted that Mr. Wanklyn was nominated, that is all. Surely it is perfectly plain.

MR. J. KENNEDY: It might be, Mr. President, that another engineer is also a candidate, so that it would be a little indelicate for us to name Mr. Wanklyn. I entirely approve of Mr. Wanklyn's nomination by the Citizens' Committee, but I do not think the society should interfere in that way.

THE PRESIDENT: Are you proposing a resolution, Mr. McNab, to make that change?

MR. McNAB: The resolution I proposed was simply to leave the personality out. Of course, if the council wish to take the onus upon themselves, they may, but if they commit the whole society to this that is another thing.

MR. MACPHERSON: I will second Mr. McNab's motion.

THE PRESIDENT: But you are on the council, Mr. MacPherson.

MR. MACPHERSON: If we have made a mistake, I do not see why we should not rectify it.

MR. J. KENNEDY: I will second it if there is any difficulty about it.

THE SECRETARY: The motion is, then, to amend the report so that it shall read, "notes with approval the nomination of an engineer and member of the society as one of the committee's candidates." (Carried.)

THE PRESIDENT: As there is a great deal of business before the meeting, I will ask you in discussing any subject to bring out all the points possible in one address, so that there shall not be a repetition. Of course, the right of reply will remain.

Moved by Mr. Galbraith, seconded by Mr. Schwitzer, that the report of council be adopted, as far as page 13, of the printed report.

Moved by Dr. St. Laurent, seconded by Mr. W. Kennedy, that the report of the library committee, pages 14 to 22, be adopted. (Carried.)

Discussion of the treasurer's statement.

MR. LEACH: Mr. President, about the end of last year, we had the misfortune of the burning of volume II, of the Transactions for the year. In the treasurer's statement there appears the item "Transactions and Advance Proofs, \$3,030." I would ask whether the second volume of the Transactions and advance proofs which we have not received up to the present have been paid for? Then as to item 5, in previous years, and up to last year, it has been the custom to set out in detail the salaries of the clerical staff and assistants. This year, I notice that it is put down in one lump sum, and that the last year's balance is lumped in the same way. I would like to get the items that compose that sum of \$3,482.15. The reason I ask the question with regard to the first item of \$3,030 is that if volume II of the Transactions has not been paid for and it amounts to the same sum as Vol. I, then that item should practically read \$6,000 odd, and it would be charged to next year's account, the consequence being that instead of having a credit balance in the bank of \$4,146 as against \$3,626 last year, we would have something less than one thousand dollars.

MR. MARCEAU: We are always a volume behind, Mr. Leach.

THE SECRETARY: As a matter of fact, this year we have made some considerable payments in advance, but the account for the volume for the year is still an open account.

MR. T. K. THOMSON: Mr. Chairman, in the American Society of Civil Engineers, with only double the membership, they have about ten times the income, therefore, I think, the only criticism we can make, if our balance is small, is that the members are not charged enough.

MR. J. ARMSTRONG: With regard to the transactions, a very valuable paper by Mr. Swan was issued, and it has a number of fine engravings or photographs, but the details are left out. I would much rather have had the photographs left out and the details brought in. They are the part most interesting to me.

THE SECRETARY: The cartoons were not intended by Mr. Swan for reproduction. He did not send them to the society. I do not know whether he is going to do so for the published volume or not. But up to date they are not in my hands. They were simply sent up as cartoons. I am sure Mr. Swan would be glad to send copies of them for reproduction if it is desired.

MR. MARCEAU: As to the salaries of the office staff, the figures are approximately as follows:

The secretary, \$1,350; Miss Bray, \$900; the assistant stenographer, \$500; the assistant secretary, about \$700. Making approximately the total amount of the item referred to.

MR. McNAB: There is an item "Expenses, Ordinary Meetings, \$97.05." I would ask what extra expenditure is involved beyond what is contained in advance proofs, salaries of office staff, caretaker's wages, water rates and electric light?

THE SECRETARY: That is the stenographer's fees for reporting the meetings.

Moved by Mr. Marceau, seconded by—that the report of the finance committee be adopted. (Carried.)

REPORTS OF BRANCHES.

The secretary read the report of the Toronto branch.

Moved by Dr. J. Galbraith, seconded by Mr. T. C. Irving, that the report of the Toronto branch be adopted. (Carried.)

The secretary read the report of the Quebec branch.

Moved by Mr. Marceau, seconded by Mr. St. Laurent, that the report of the Quebec branch be adopted. (Carried.)

The secretary read the report of the Vancouver branch.

Moved by Mr. Coutlee, seconded by Mr. E. V. Johnson that the report of the Vancouver branch be adopted. (Carried.)

The secretary read the report of the Manitoba branch.

THE PRESIDENT: One of the paragraphs there alludes to the increase of the fees to the branch. That is a point that requires discussion.

DR. GALBRAITH: Is there a recommendation in the report or simply a suggestion? If we adopt the report, do we not simply agree to consider the advisability?

THE PRESIDENT: I think so.

LT.-COL. RUTTAN: Mr. President, the matter is one which will require a great deal of consideration. To save time, I move that the question of increased grants to branches be referred to the council for the coming year, with instructions to look carefully into the matter and report at the next annual meeting.

MR. LUMSDEN: (Seconds this motion.)

MR. DION: I am in favor of the motion, but I should like a recommendation to be made that the council increase the grants to the branches, if it can possibly be done. I should like an expression of opinion from the meeting. The council could reject it if it pleased, but if they were disposed to increase the amount, they would feel that the society was behind them.

MR. MARCEAU: With our present fees the increasing of the amounts to the branches is out of the question altogether. We could not possibly do it unless we increased the fees.

THE PRESIDENT: If I may say a word, perhaps, it might be done in this way. The members of branches have the advantage of libraries and so on, and they might pay the full amount of the membership fee, as paid by resident members in Montreal. They now pay \$2 less than the members in Montreal. Why not pay the same and get perhaps \$2.50 or \$3 back instead of the \$2 we get now?

LT.-COL. RUTTAN: I might point out, Mr. Chairman, that the \$2 received from the parent society does not begin to pay the expenses of the branches.

THE PRESIDENT: We know that by experience here.

MR. SCHWITZER: We are independent in the West, but we feel that it would help things out and be for the benefit of all the branches if the grants were increased. We have arranged with the librarian of the Manitoba University to be present one night a week so that the library will be available to members. This recommendation is not to bind the society to give us an additional grant but we thought we would bring it before the council for consideration. I think the effect would be an increase in membership, if we had an additional appropriation from the main society to all the branches.

LT.-COL. RUTTAN: I could not agree to have my motion changed as proposed by Mr. Dion. There would be a direct conflict of opinion at once. The treasurer of the society says it is impossible to increase the grant. It is a matter that requires a great deal of consideration, and therefore, I think it would be better to let the council take it up in a business way and find out just what they can do, and make a recommendation to this meeting next year.

THE PRESIDENT: Then I think we had better leave this until the general business comes up. Meantime, we might adopt the report of the Manitoba branch.

Moved by Mr. Schwitzer, seconded by Lt.-Col. Ruttan that the report of the Manitoba branch be adopted. (Carried.)

The secretary read the report of the Ottawa branch.

Moved by Mr. W. J. Stewart, seconded by Mr. Perley, that the report of the Ottawa branch be adopted. (Carried.)

THE SECRETARY: It is desired to be announced that a photograph of the members in attendance at the annual meeting will be taken at 3 p.m. on the steps of this building.

THE PRESIDENT: Gentlemen, His Worship, The Mayor of Ottawa, desires to extend an official welcome. We will suspend business of the meeting for that purpose.

MAYOR HOPEWELL: Gentlemen, it is with extreme pleasure that I offer to you a hearty welcome to the city of Ottawa, the Capital city of this Dominion. I myself am not an engineer of any kind, although some people have been cruel enough at times to say that I am. However, I think I would have enjoyed the work of a civil engineer, the making of crooked things straight, high things low and low things high, and so on. I hope you will have an exceedingly pleasant time at your convention here, in the capital; that it will not only be pleasant, but that you shall also find it profitable. I grant you the freedom of the city, if you know what that is. I do not. You may have it if you can find it, and I say this without any reservation whatever, knowing that if you are successful in finding it you will not abuse the privilege, whatever it may be. It is with extreme pleasure that I extend to you heartiest welcome to this, our Capital City, and I may say now that I hope to have the privilege to-morrow evening, at your banquet of saying another word or two there. (Applause.)

THE PRESIDENT: Your Worship, on behalf of the Canadian Society of Civil Engineers, I wish to thank you most sincerely for the very cordial welcome you have given us to this "Fair City with its Crown of Towers." I feel sure that the members will enjoy their sojourn here and will derive much pleasure and benefit from the visits to be made to the industrial centres and scientific bureaus within the vicinity. On a former occasion, one of the society's summer excursions, we all remember how fascinated we were by the beautiful scenery of the Capital and the many points of interest in its surroundings. This is the first time that we have had the extreme pleasure of holding our annual meeting in the city of Ottawa, but I trust that at no distant date we shall return, and I feel sure, Sir, from the words you have just uttered, that we will receive the same warm welcome that we have received at the hands of the chief magistrate to-day.

REPORTS OF COMMITTEES.

Moved by Dr. Galbraith, seconded by Mr. St. Laurent, that the report of the committee on Usefulness of the Society be received. (Carried.)

MR. McNAB: Referring to the third paragraph of the report, I notice that the Railroad Age Gazette, a reputable journal in the United States, says that the meetings of this society are held "usually fortnightly" but the word "irregular" is also used, in its list of societies holding meetings. Other societies are given as "fortnightly, excepting June to August." Ours is put down as "irregular." I would suggest that this be changed.

THE PRESIDENT: Your suggestion will be noted, Mr. McNab.

Moved by Mr. W. Kennedy, seconded by Mr. Perreault, that the report be adopted. (Carried.)

MR. LEOFRED: Mr. President, are there two separate reports? This one only refers to the usefulness of the society. The educational requirements are not mentioned, although last year this subject and its discussion filled six pages of the annual report. I do not see any mention of it.

THE PRESIDENT: This is the whole report of the committee.

Gentlemen, Sir Sandford Fleming is with us this morning. It was his intention to favor us with an address, and we placed it on the programme for 3 o'clock, but owing to other engagements, Sir Sandford prefers to address us this morning, and I am sure we shall be delighted to hear him. (Applause.)

SIR SANDFORD FLEMING: Gentlemen, My words will be very brief. I had hoped to be here in time to follow the mayor with a few words of welcome to the Society, but I found it impossible. I need not tell you what a great satisfaction it is to me to be here to-day. I am afraid I have not been a very good member, for I have been an absent member too often. I desire, on this occasion to bid the Society a warm welcome to Ottawa.

I have been a resident of this city for a great many years—so many that I almost forget the number—since before Confederation, and that is now over forty years. I can go back no less than fifty-five years to my first sight of Ottawa. It had not then even the name of Ottawa; it was called Bytown. I am an old member of this society, and of the sister American society. For nearly half a century I have been a member of the American Society of Civil Engineers. Not quite so long as that a member of this society, for it has not been in existence that length of time. It has been my privilege to witness a great deal of the engineering service which has taken place between the Atlantic and the Pacific, and I think I may be permitted to welcome the younger men to a noble profession. You belong to a profession of the first order. Although it is essentially a practical profession, you will find that its members cannot be too learned. Whatever has been done by engineers in the past, and whatever is doing to-day, I can see a wide field for this profession. There are between the oceans which bound Canada on three sides, great engineering problems which have to be solved in the development of our great inheritance—that

inheritance which has been freely given to us by the great mother of nations for our children and our children's children to occupy and enjoy. With these few brief words, Sir, I have the greatest possible pleasure in giving my humble welcome to the society upon its visit to the Capital of Canada. (Applause.)

TRANSPORTATION.

THE PRESIDENT: I have the honor to be the chairman of the parent committee on Transportation. It is sub-divided into first, a sub-committee on transportation routes, of which Mr. Tye is president. We expect him here to-morrow. Second, a committee on ties. Mr. MacPherson is a member of this committee and is with us. Third, a committee on Rails and Fastenings, of which Mr. Kelley is chairman. Mr. Kelley is here to-day. The fourth, is a committee on Roadbed and Ballasting, of which Mr. Sullivan, assistant chief engineer of the C.P.R. is chairman. He will be here, I think, to-morrow. I will call on Mr. Kelley to present the report on Rails, Fastenings and Tie-plates. This report is of great importance to railway engineers, and Mr. Kelley has taken a great deal of pains with it. He and his associates on that committee are well qualified to handle their subject. Mr. Kelley was president of the American Railway Engineers and Maintenance of Way Association, which includes this kind of work. The committee was continued from last year and has increased its findings. If I may express an opinion, I think they should be continued in office, so that they may go on with their good work.

MR. KELLEY: Gentlemen, the sub-committee on Rails, Fastenings and Tie-plates last year presented a report giving the various standard sections of rails now in use and proposed. In considering a subject of this kind, if we endeavored to cover the whole field in one year we would make a very unsatisfactory report that would require to be changed every year and no one would read it, so the committee has endeavored to take up one subject at a time, that will be of sufficient interest and the report on which will be of sufficient length to afford useful information to the members. The question has been up for a number of years as to the adoption of a different rail section from that commonly used. The American Railway Association, which includes practically all the railways in Canada and the United States, have, through a committee, formulated some rail sections which the various roads proposed to try. The committee therefore, took that subject up as the first for presentation, the rail sections in use and proposed. It seemed to the committee during this year that the next feature proper to present to the association was how those rails would be tested and what would be the result. Unfortunately, in the year that has passed the new sections have not been used sufficiently to give any results which can be formulated into a law. As to the proper section, the railroads that have used the girder section known as "A" are still as strong in their belief that "A" is the one to be used, as the companies that have used "B" are in their belief that it is the one to be used. So that we are unable to give any reports that would afford any information. Early in the year the question came up, How shall we compare the physical characteristics of these rails when no two mills used the same drop-testing machinery? An examination of the drop-testing machines at the different mills would show as many different types as there are mills; therefore, the energy exerted by the drop falling in the mill at Pittsburg was entirely different from the one at Nova Scotia. If the Canadian Pacific and Grand Trunk Railways, with their large mileages in the United States, have rails tested in the United States by one form of machines and others tested in Canada by another form of machine, the results may be confusing. Therefore, after some discussion with the mill men a typical machine was proposed, and several of them said if you can decide upon a machine that will give you satisfactory results, we will adopt it. The old machines had an anvil varying in weight, on a foundation of different characteristics. After it had been used for a few months and it had stood the shock of the weights, the anvil was likely to be loose and out of level, and the results on the same anvil would be different. The machine shown in the diagram accompanying the report was intended to overcome this. At first, it would seem that the result would not be good because the weight of the anvil is supported on springs, but the tests have shown that an anvil supported in this way gives nearly uniform results, and the deflections of the rails from the same trip are greater than with the old anvils. That is rather astonishing, that an anvil supported as described, and taking the blow of a twenty-thousand pound weight falling fifteen or twenty feet would afford a better and more uniform resistance than an anvil supported on solid rock. But that has been the result; the deflections are greater and the results more uniform. So that to-day we feel that the machine shown in this diagram is giving the results that we have sought for and that this association should put itself on record that rails to be tested should be tested under this drop-testing machine. Many of the mills in the United States, in fact nearly all of them, have put this machine in, and I believe the mills in Canada are going to do the same. I do not speak authoritatively, but I believe they will, because they have met us fairly on all the questions we have brought up for the improvement of the rail. (Applause.)

MR. SCHWITZER: I would like to ask Mr. Kelley if that is the same drop-testing machine that has been adopted by the American Maintenance of Way Association?

MR. KELLEY: Yes, it is the same machine. It was adopted by a committee on rails.

Moved by Mr. Schwitzer, seconded by Mr. Schreiber, that the report be adopted and that the committees on Rails, Fastenings and Tie-Plates

be continued in office for another year and congratulated upon their report. (Carried with applause).

THE PRESIDENT: These reports are valuable and I am anxious to have the chairman of committees present when they are discussed. I think pending their attendance we will suspend this part of the work until the afternoon and go on now with general business.

On the request of Mr. Leofred, the secretary read a communication from the Quebec branch with respect to the insertion in the Criminal Code of a clause protecting civil engineers in the performance of their duties in the same manner that land surveyors are protected.

MR. LEOPRED: Mr. President, the provincial land surveyors are applying to the Minister of Justice to get a clause inserted in the Criminal Code for their protection, the same as is afforded to Dominion land surveyors. Before Confederation, there was such a clause in the Law, but after Confederation there was only a reference to it left in the Dominion Lands' Act. There is nothing at all protecting a civil engineer and there is nothing in the Code making it a criminal offence to interfere with a land surveyor in each province. The boards of land surveyors in Ontario and Quebec have taken the matter up and they have had answers from the Minister of Justice that he is considering the subject and will likely insert such a clause, giving the provincial land surveyor the same protection as the Dominion. I think, therefore, that this would be a good time to have a clause inserted protecting the civil engineer. The spirit of the law before Confederation was to protect civil engineers as well as land surveyors. In fact, there were but few civil engineers then, and they worked as surveyors.

Moved by Mr. Schwitzer, seconded by Mr. John Kennedy, that the communication be referred to the incoming council to deal with it as they see fit. (Carried.)

MR. LEOPRED: Another matter that was referred to by the Quebec society was a publication in the Quebec papers reproducing part of a speech by Mr. Warburton of Prince Edward Island, where he compared the salaries paid to engineers in India, Australia and other countries with the salaries paid to engineers employed in Ottawa. His comparison shows that here, they are paid about one-third of what they receive in other countries. The Quebec branch thought it right that the society should bring the matter to the attention of the Government.

Mr. Warburton's speech can be found in Hansard.

THE PRESIDENT: I think the society considers it a very worthy subject. The matter is to be further discussed before many hours are over, and we may, therefore, leave it until later.

MR. LEACH: Mr. President, I will endeavor not to detain the meeting very long, but for the benefit of the members present now who were not here this morning, it might be well to briefly outline the point I raised in regard to the paragraph summoning the meeting. The gist of the argument is that at 10 a.m., on Thursday or as soon afterwards as possible the new Council is elected and at 3 p.m., or as soon as possible afterwards, there is a meeting of the Council. Last year's summons read:

"At 2.30 p.m. an informal meeting of the Council." I take it as a constitutional point that a Council elected by a corporation such as the Canadian Society of Civil Engineers cannot legally meet until every member of that Council has been officially notified of his election and given the opportunity of attending. A member may be in Montreal, Vancouver or Halifax and unless he attends on the speculation that he may be elected to the Council at this annual meeting, he is disfranchised. I claim that it is unconstitutional for the Council to meet and proceed to business until every member has been summoned to attend.

By-law 33 is that the Council shall meet within one week after its election. The spirit of that is that that week is sufficient for the members to be notified of their election. Now on Thursday, ten minutes after the Council is elected they will appoint committees on finance and the other committees and appoint the officials of this society. I claim that they are not entitled to proceed with that business and I will go to the extent of taking the sense of this meeting that it should be an instruction from the annual meeting that the Council shall not proceed to the business of the society until after every member has been notified of his election and summoned in proper order.

MR. TOMLINSON: Seconds this motion.

LT.-COL. ANDERSON: Mr. Chairman, while Mr. Leach may be quite correct technically, it seems to me that he is only splitting hairs. For any advantage he will gain by the adoption of his motion he will lose a great deal more. It is very difficult for any Council of the society to get outside members to attend the meetings. Immediately after the annual meeting is the one opportunity of the year when it is possible to have a good representation of the outside members. (Hear, hear.) I don't quite understand why Mr. Leach brings up this point. Technically he may be right, but in practice the adoption of this motion would be a detriment and not an advantage to this society.

DR. GALBRAITH: I quite agree with Col. Anderson that while Mr. Leach may be right technically or right in the spirit rather of the by-laws, yet I think the practice is quite within the letter of the by-law. There is no by-law to the effect that no meeting of council shall be called unless every member is notified. Nothing is said about notification. Therefore, I think there has been no illegal meeting, and it is true that we have a better chance of getting outside opinion after the annual meeting than at any other time. I think the Council have worked out the by-laws in such a way as to be a benefit to the society, although I admit that Mr. Leach has indicated a point that might be open to abuse, still I do not think that has occurred.

MR. JOHN KENNEDY: Mr. President, I have been on the council for more than half the years of its existence and the practice has worked exceedingly well. For the reasons that have already been given I think it should be continued.

MR. SHERWOOD: Mr. Chairman, could not the objection be overcome by having the election before the annual meeting, with a provision that the incoming council shall not take office until after the annual meeting?

LT.-COL. RUTTAN: Mr. Chairman, I will ask Mr. Leach, if he knows of a specific instance where hardship has occurred from the way council has managed the matter.

MR. MCCALL: Mr. President, the mover overlooks the fact that a member who is nominated has to accept nomination. Therefore, he knows about the meeting and if he can be here he will be. It is the custom in most institutions to hold a meeting of the directors immediately after the annual meeting. If there is anything wrong the better way would be to legalize the present practice by changing the by-law.

MR. FRANCIS: Mr. Chairman, I would ask Mr. Leach if his objection is confined entirely to the words "formal" or "informal." As I understand him the whole matter turns on those two words.

MR. LEACH: Mr. President, I have not anything to add. I notice that last year the words were "an informal meeting of the council" and this year merely "a meeting of the council". I asked for information whether business took place at an informal meeting, I found that it did and consequently I raised a constitutional objection against the council proceeding to business when the members had not been notified. I did not suppose that I would carry the meeting with me but I am still of opinion that the members of the council should have this franchise. It may be that you get a larger meeting, but there are other members who are absolutely disfranchised.

THE PRESIDENT: I would like to say a word with respect to this motion. There is a notice in the programme that there will be a meeting of the newly elected council. If two members were here from Vancouver and a third who has been elected in Edmonton and cannot get here, it would take two weeks to notify him and bring him here; meantime the Vancouver members would not stay, so that we would gain one and lose two. Again at the next meeting the minutes as read will have to be adopted.

MR. SCHWITZER: I agree with what Col. Anderson has said. By having the meeting immediately after the annual meeting we get a larger attendance and get members from a wide territory. If the course proposed is adopted we would have only local members.

THE PRESIDENT: Are you ready for the question?

MR. LEACH: It is not necessary to put the motion, Mr. President. I will withdraw the motion.

MR. IRVING: I would ask, Mr. President, whether the committee dealing with the standardization of specifications has been disbanded?

THE SECRETARY: I think it died a natural death. I do not think it was reappointed at the last annual meeting.

MR. IRVING: I would suggest, Mr. President, that a committee be formed to consider the standardization of cast iron water pipe specifications. Nearly every engineer in this country at some time or other has to do with cast iron water pipe and when he looks into the specifications, he finds that in Canada we have no recognized standards. The result is that he gets up a specification of his own and as a rule it is rather a weird sort of thing. The pipe foundries refer back to him two or three times and he is probably told that they have not this design in stock. Again a standard specification would be a good thing for the foundry because they could stock their pipe and if an engineer wanted pipe in a hurry he could order the Canadian Society specification and get it. There are two or three specifications in use in the States; those of The American Waterworks' Association, the New England Waterworks' Association and the American Society for Testing Material. I think if we standardized the cast iron water pipe specifications in this country, it would be beneficial both to the engineers and the manufacturers. I have spoken to several engineers and they are heartily in favor of it.

MR. LEOPRED: I have often felt the want of such a standard specification. I make a speciality of waterworks and we have always to make our specifications ourselves. Frequently the dealers when they sell you pipes find a way out of their contract because there is no standard specification. I believe it would be advisable to have a committee to investigate the matter and make a specification for Canada.

THE PRESIDENT: I would like to hear Mr. Ker on that if he is here. (Not present).

MR. JOHN KENNEDY: Mr. President, I think we should go very cautiously about standardization, because it means stereotyping. Our profession is essentially one of progress and therefore we should be careful about standardizing. A most instructive lecture has been given on that matter by Prof. Unwin lately. Good specifications have been adopted by the American Waterworks Association and by the New England Association. It is very easy to take one of those and adapt them to particular conditions. I think it would be better to be very cautious about matters of this sort; let us rather get at the underlying principles of a good pipe and then adapt it to the particular work in hand, and not stereotype matters in the form of a standard specification.

MR. DIETRICH: In support of the suggestion I may say that some time ago I had charge of installing quite a large system of water works and we had a great deal of trouble in getting the pipes to suit. I have no doubt that standard specifications would be of use.

THE PRESIDENT: We might form a committee on standard specifications again if Mr. Irving will move that.

MR. IRVING: I would move that the committee deal with water pipe only. If they go into standardizing every kind of engineering material they would have a heavy job. I refer merely to cast iron water pipe specifications. I think that could be done in about two hours. The trouble with committees of this society is that they are steered up against such big propositions that they get overwhelmed.

MR. LEACH: Before we adjourn Mr. President, I have a dim recollection that about four years ago a committee was formed, of which Col. Anderson was a member, and I was appointed a member, under Major Stewart as convener, to consider the question of engineering and military defence. I received a notice of my appointment to that committee but since then there has been an absolute blank. What has become of it?

THE SECRETARY: It died a natural death. The Chairman never did anything whatever in connection with the matter so far as I know.

THE PRESIDENT: It being one o'clock, we will adjourn now to meet again at three p.m.

AFTERNOON SESSION.

THE PRESIDENT: Gentlemen, before adjournment we were discussing the question of standard specifications and Mr. Irving had the floor.

Moved by Mr. T. C. Irving Jr., seconded by E. A. James, that a committee composed of Messrs. R. S. Lea, O. W. Smith, N. J. Ker, and the mover and seconder, be appointed to frame standard specifications for cast iron water pipe and to report to council. Also that the council shall have full power to deal with this report in regard to its adoption, amendment, or otherwise as they deem best.

Carried.

REPORTS OF COMMITTEES.

THE PRESIDENT: The next report is on the establishment of testing laboratories. Mr. Keefer is chairman of that but I am sorry to say he is ill and will not be at this meeting. I will ask Dr. Galbraith who was on this committee to take charge of this report.

DR. GALBRAITH: Mr. President, I am sorry to say that I am not in as close touch with the work of this committee as I ought to have been. A meeting was held with Hon. Mr. Pugsley and the representations that you see here were made to him and nothing more has been done. What the society is interested in is, what further action should be taken. This committee has not done a great deal of work. I do not feel afraid to blame the committee, because in doing so I am blaming myself. What we have to settle is whether we intend to push the question, whether we wish to frame a specification for the work of Government, so to speak; to study the question to such an extent that we could be able to give the Minister an estimate of the cost. It will have to come down to that I think before it is a practical thing at all. Unless we do something of that kind I feel sure that nothing more will be done. The subject is such a large one that I doubt if any single member of the committee had time to go into it. Unless we can get some person who is extremely well qualified for the purpose, to do the work, we are not likely to get much done. It is necessary to come down to details and it is for you to say what further shall be done.

MR. LEOFRED: Mr. Chairman, I think after reading this report that the society cannot say very much as yet, nor the Government either. An estimate of cost is necessary. I think the last part of the report might cause an encroachment on private practice. I do not think the Government should undertake testing work for private parties for pay. I doubt if the Government would be able to collect its pay; probably the collection would be deferred until after the next election. That is the way the laboratory would be carried on. I think there is nothing very practical in this report and certainly nothing that would induce the Minister of Public Works to take any action in the matter.

MR. ST. LAURENT: Mr. President, I think we should see the establishment of a testing laboratory, not for commercial purposes but for the advancement of science and of our technical knowledge. I think the committee should be continued and instructed to go into details if possible. They should be able to give the Government the figures of the expenditure that would be involved for proper quarters for the laboratory, proper equipment and the wages to be paid the staff, and the cost of maintenance. The committee should go into the question of what subjects are to be investigated and what matters tested for the general advancement of our knowledge. If we go to the Government prepared with these details I think we stand a good chance of having a laboratory started.

DR. GALBRAITH: I have a suggestion, Mr. President, that might move us one step forward. I think we might well urge upon the Government to appoint a commission to visit the United States laboratory at St. Louis, which is the one I have the greatest number of reports on. There is another also at Pittsburg. I think it would be proper for the Society to urge the appointment of such a commission and the Government would then be in a position to go on without further expense to this Society.

MR. ARMSTRONG: It might be well that they should enquire into the methods of the German Government as well. Not long ago there was a long article in the Canadian Engineer describing the institutions in Berlin.

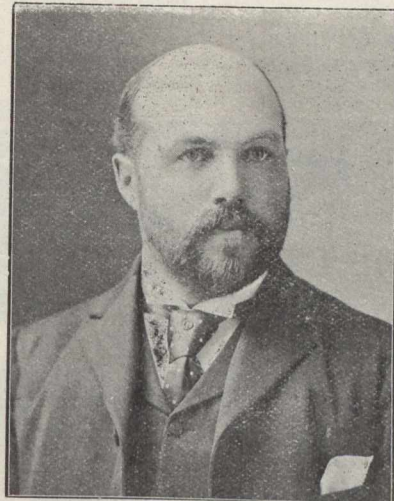
These are very extensive, probably more so than the Dominion is prepared to go into at present, but they are on the lines of education, testing and experiment, that the Government should undertake.

MR. SHERWOOD: Mr. Chairman, in the report of the committee made to the Government I think they omitted to state one rather important point which might have a good deal of weight with the Government, namely, that a great deal of the construction work in Canada was built to the specifications of the Dominion Government and also the Government has the supervising and approval of a great many plans of construction. It would be of great advantage to the Government if they had a means of testing the correctness of these requirements. A testing laboratory and competent staff of scientists would enable the Government to issue their specifications with a confidence they now lack. A suggestion of that sort might add weight to the report.

Moved by Dr. Galbraith, seconded by Mr. Leofred, that the committee on the establishment of testing laboratories be continued, and that they be instructed to urge upon the Government, through the council, the desirability of appointing a commission to visit the United States Government testing laboratories at St. Louis and Pittsburg and also government laboratories in other places, for the purpose of gaining the necessary information precedent to the establishment of a Canadian laboratory.

Carried.

THE PRESIDENT: The next is the report of the committee on Ties. This question was brought up last year. The committee had done a good deal of work and it was reported to the committee on transportation. The committee on transportation failed to do its duty and the sub-committee on ties was continued. They sent in the same report as last year. You will find the report in this year's proceedings at page 42. I will ask Mr. MacPherson, the chairman of the committee, to assist me in this.



GEORGE A. MOUNTAIN, RETIRING PRESIDENT.

MR. MACPHERSON: We were asked to make a report on ties and that is such a large question that we scarcely knew where to begin. Therefore, we took it up in a very general way, as to the reserve of tie material available and how to conserve the supply. We thought the Society would make certain recommendations to the Government, but I do not think any such action was taken. However, the Government have appointed a conservation commission which is taking some of the steps recommended in this report, although the report was not brought to the attention of the Government.

THE PRESIDENT: I would suggest that this committee be continued and that it should go into more details on the kind of ties, their dimensions and so on. I do not think we can put it in any better hands.

MR. KIRBY: I would ask whether, it would not be advisable to go into the question of preservation of ties. I mean the artificial treatment to add to the length of life of the tie.

MR. MACPHERSON: If the committee is continued their instructions should be definite and not cover too much ground.

Moved by Mr. Weller, seconded by Mr. E. J. Walsh that the committee on ties be continued and that it confine its attention more particularly to the matter of the artificial preservation of ties, their size and the timber best suited to the purpose. (Carried.)

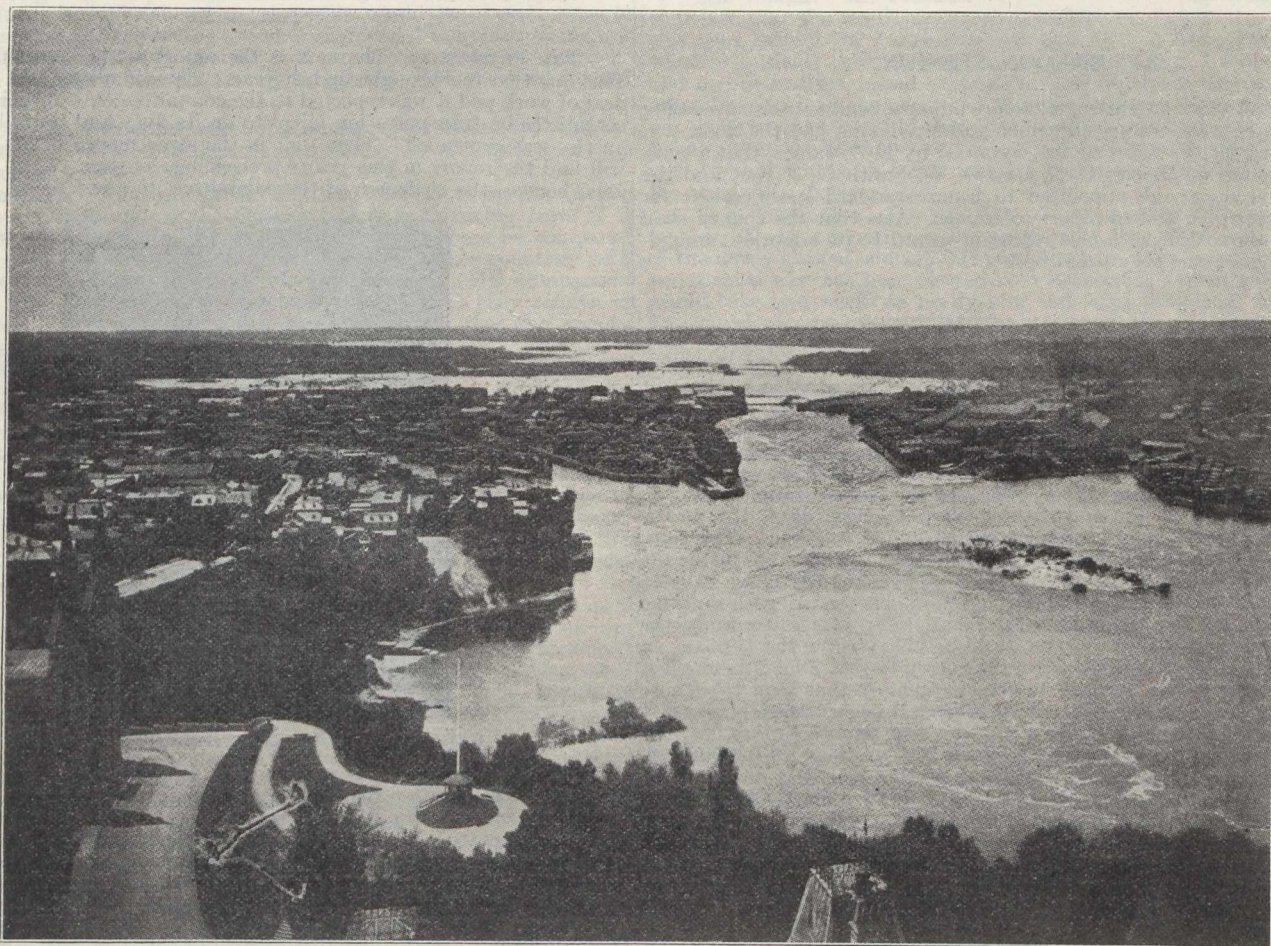
THE PRESIDENT: The next report is that of the committee on road-bed and ballasting, under the chairmanship of the assistant chief engineer of the Canadian Pacific Railway, eastern lines. I regret that he is not present. I expect that he will be here to-morrow, but it may be that we had better not defer these reports. This committee is composed of men who are thoroughly posted on their subject, and I will ask Mr. McNab, if he will come forward and defend their judgment.

MR. McNAB: Mr. President and gentlemen, glancing over the report you will see that it refers to one particular work which this committee had undertaken to do, namely, the preparation of a specification for road-

bed including ballasting. A committee composed of railway men engaged in the hurly burly of railway activity were reviewing a specification covering these points which was already in use in the United States. This review is to be published this spring. Before being published it will have received an overhauling at the hands of probably three or four hundred of the practical engineers of to-day. As the men composing that association are connected with railways in every portion of the North American continent, from the Gulf of Mexico to the Yukon and from the Atlantic to the Pacific, it was felt by this committee that they could very safely wait until they got this specification and if there was anything deficient in it required by the conditions in Canada, then we could supplement it to suit our own country. It is easy to criticise when you have something tangible before you and when this manual of recommended practice comes out I think you will agree with me that it will be very complete. To-day the manual of recommended practice of the maintenance of way association of America is practically a text book, part of the curriculum of the engineering forces in our universities and it is looked upon for the time being as an up-to-date text book upon the subject treated therein. The Society then may safely wait until our next meeting when there will be something definite to present to them in reference to the specification for roadbed and ballasting as applicable to Canada.

tion. This is a very large committee composed not only of eight or ten members of the Society, but they have asked to confer with them the big men on transportation, that is the men controlling steamship lines and all descriptions of railway men in other branches than pure engineering. You will notice a suggestion at the end of the report that this should be a committee of the Society and not a sub-committee of a larger committee on transportation. I think that suggestion should be carried out with regard to each of the sub-committees on transportation. As a matter of fact the sub-committees have had to do their work independently and they should be continued in that way. Mr. Tye only took office in the autumn, but he has done a great deal of work. Still there is a great deal more to do. I think the old committee on transportation routes should be eliminated and the four sub-committees continued as committees of the Society as I have suggested.

MR. ARMSTRONG: Mr. Chairman, at last year's meeting it was suggested that the council should prepare resolutions in regard to these things beforehand. I was in hopes that they would have done so, and that these resolutions would have been appended to the reports so as to facilitate the discussion. With regard to this transportation committee I have sketched a resolution—not that I think it will be best, but so that we may have something before us from the start. I move that the sub-committee



PANORAMIC VIEW OF OTTAWA.

Before sitting down, may I make a suggestion with reference to this report. Referring to the Maintenance of Way Association the words are used, "an international Association, whose president is now a Canadian." That would mean that he was formerly something else. I think that reference to the nationality should be left out.

MR. MACPHERSON: If Mr. McNab's committee are going to get out of their work so easily, why should not the committee on ties do the same thing?

THE PRESIDENT: You have your instructions. It is your own affairs where you get your information.

Moved by Mr. John Kennedy, seconded by Mr. Weller that the report of the sub-committee on roadbed and ballasting be received and the committee be continued. (Carried.)

THE PRESIDENT: The next is the report on transportation routes. I regret that Mr. Tye is not here, but I preceded him as chairman of the committee and know something about it. The committee had a big subject to deal with, but they have gathered a large amount of information. They went into the question of the economical routes from east to west, and not only the rail lines but also rail and water, and water transporta-

on transportation routes be enlarged and that branches thereof shall take up, the one transportation routes and the other terminals thereof, and further resolved that a member of each shall be appointed and given an adequate fee for devoting an extra amount of time for collecting information under instructions from the branches; the reports to be considered by the full committee, and the special members shall finally edit the reports.

Transportation Routes form an immense subject; so also do terminals. They are correlated and necessary, the one to the other. It is necessary to deal with both adequately or nothing special can be accomplished.

THE PRESIDENT: The committee on transportation gathered a great deal of information on terminals, such as Montreal. I have no doubt, it is included.

MR. MCCOLL: Mr. President, private companies are dealing with these questions and paying large sums for information of this kind. I would like to know just what is expected of the transportation committee.

THE PRESIDENT: I do not think they have any definite instructions as to reporting, but they are, no doubt, going into it with the object of reporting on the transportation question, from an economic point of view. Mr. Coutlee is a member of the committee and, perhaps, will assist us.

MR. COUTLEE: I think, I am the only member of the Committee present. The idea has been to investigate on rather new lines the subject of transportation in Canada. We find that the people who make the freight tariffs know nothing about the cost of transportation. That is railway and boat tariffs have grown up on a system of taxing the freight all it will stand. The idea in this investigation has been to go into the physical features of the railway and water routes and their combinations, and get at the actual cost of haulage from two or three different stand-points. Perhaps, the best known system is that of train mileage. Not cost per ton mile; that is very deceptive when the distance is long and, therefore, we are putting it to one side to some extent, although it will be gone into also. As far as railways are concerned we are trying to get it on a basis of cost per train mile. You may have a very good road, with good grade, light curvature, a fair amount of traffic and still the cost per train mile is not less than on the second class roads which have a light traffic. That is supposing it was 90 cents per train mile, you would find it go up to, perhaps, \$1.15 on large roads. There is not a very great margin between the two. We have decided to take it up on that basis and to do that we must get the physical features and that is something on which we wish to appeal to all the members of this Society. We would like to get everything concerning the physical features of the railways. As to most of the traffic in this country the crossing of the isthmus of Ontario presents the first obstacle. You can either boat to the west coast of it and cross it or you can go around by boat. We want to get at, not the tariff charged, but the cost of carrying the present bulk of traffic, and also the cost later on of carrying that traffic when it increases somewhat. The investigation will take a little time, but I think when accomplished it will contain some very valuable information. At least, I hope it will. (Applause.)

MR. JOHN KENNEDY: Any attention paid to water routes?

MR. COUTLEE: Yes, Mr. Kennedy, the water routes are to be taken up also. I merely mentioned railways because the physical features are more easily got at.

MR. SING: I beg to move the adoption of the report, and in doing so, I may say, I have always felt that engineers are qualified in every way to give an expression of opinion on the transportation of any country. The engineer is engaged in transportation from the time he begins to practice, or even in his student days when he carries his pack across a river on a fallen tree. It is the duty of an engineer connected with transportation to make a complete study of it. He has to deal with it in a practical way. Canada has the greatest coast line and water system of transportation in the world undoubtedly. She has a waterway of 6,500 miles with only one land break of 150 miles. The field is a large one and can hardly be comprehensively dealt with in one report. I think the idea of having the branches connected with the parent society, assist in this matter is a very wise one. The branches are scattered from the Atlantic to the Pacific and are all equally interested in this question with yourself, Sir, and the members of the Society. I have much pleasure in moving the adoption of the report. (Applause.)

MR. McCOLL: Mr. President, Mr. Coutlee has explained very fully, but I do not quite understand the practical part of it yet. Do I understand that the committee intend to report the best route for transportation? He said, the first thing was to cross the Isthmus of Ontario. Does he propose that they should select the route or that they shall report the cost of the various methods of transportation? It may be that a report can be got of a practical nature but I cannot quite see yet how it is to be done. Also he spoke of finding the cost per train mile on different classes of railway. Is the report to be in the nature of a paper to be discussed and to give the Government and the people generally an idea of the best method of transportation.

MR. COUTLEE: I think what you have said explains it pretty well. It is more investigation. The results of our investigation will form the report. It will hardly be an advisory report. It will be more an investigation and putting the results at the service of the profession.

MR. LAMB: I have pleasure in seconding the motion.

THE PRESIDENT: You have heard the motion. It carries with it that the sub-committee is to be formed into a committee. (Carried.)

THE PRESIDENT: I have just received a communication from Mr. T. C. Keefer, Jr., grandson of Mr. Keefer. He says that his grandfather feels that he could not face coming up the stairs to this room. He extends his good wishes to the Society, and asks to be relieved from attending you on this occasion. We are glad indeed that Mr. Keefer is still with us in good health, we appreciate the charm of his personality, and the tremendous amount of work he did in the organization of this Society. I will ask Mr. Dodswell to add a few remarks to mine. (Applause.)

MR. DODSWELL: Mr. Chairman, I may say that I regard Mr. Keefer as the grand old man of the profession in Canada and one of the greatest engineers we have had in the country. I had the great honor of being associated with Mr. Keefer in the formation of the Society some 23 or 24 years ago. I was one of the youngest of the original nine, and Mr. Keefer has always been a very great friend of mine, professionally, personally and in every other way. It was with me as my first assistant that his lamented son, Harold Keefer was killed. I was building the bridges at Ste. Anne's and Vaudreuil. I sent Harry Keefer to lay out the bed plates on the piers and he had the misfortune to slip and fall from the pier. He thought at the time he was not seriously hurt, but he sank into unconsciousness

and died. I shall never forget the grief of Mr. Keefer on that occasion, the loss of a splendid son. Although nearly heartbroken then, happily he is still with us and well, although enfeebled. I think he has done more for the profession in Canada than any other man. He was our first president, and no one has deserved more thoroughly the universal respect of the country, not only of the engineers but the whole public. He did noble work in connection with the Paris Exhibition and it was his services there that earned him his well merited C.M.G. I hope that another year, we may still have Mr. Keefer with us, to cheer us on in the work of the Society. As long as he lives we shall respect and love him, and I regret very much that he is not able to be with us to-day. (Applause.)

MR. THOMPSON: The American Society of Civil Engineers has been proud to have Mr. Keefer for their president.

THE PRESIDENT: Gentlemen, the scheduled business of the day is practically over except that I trust some one will move a resolution that the sub-committee on ties, rails and roadbeds shall be made the same as the sub-committee on transportation. That is that they shall report to council only.

MR. T. C. IRVING: Mr. President, Mr. Leach confessed this morning that he was a member of a committee that had never done any work, and, in fact, he did not know whether it was still in existence or not. I would like to read a short extract from the report of the annual meeting of January 9th, 1907. "Mr. Stuart Howard called the attention of the meeting to the desire of the Militia Council to inaugurate an engineering reserve corps and moved the following resolution, which was seconded by Mr. W. McNab.

"That a Committee be named to consider the formation of a Canadian Engineer Reserve for active service, with authority to forward copies of the scheme read to all those connected with the Canadian Society of Civil Engineers, asking those willing to enroll themselves to send in their names, occupation, and place of residence. The list of such men to be sub-divided into districts and forwarded to the Militia Council for further action."

That motion was adopted and it was further resolved to gather information with regard to the proposal, and a committee was formed. I do not know what that committee has done. I have the honor to hold a commission in the Second Field Company of Canadian Engineers, and I think I may say on behalf of the Engineer Corps that we feel the need of some action of this kind being taken by the Society. I would like to call the attention of the committee, if it is still in existence to a circular sent out by the Institution of Civil Engineers, Westminster, dated 1st September, 1908, with regard to a "special reserve of officers, Royal Engineers." The circular sets out the particulars of the formation of this reserve, the qualifications necessary, age limit, courses of training and so on. I think the Canadian Society of Civil Engineers has supplied the greater number of the officers of the Corps of Guides, but I think the Field Engineers are even more worthy of the attention of the Society and I should like very much to see this Committee brought to life again and some action taken in the matter.

MR. COUTLEE: Mr. Chairman, I am bubbling over with Imperialism and patriotism on hearing the very able way in which the last speaker has shown that engineers should do something for their country. I think, we should all join heartily in doing something for our country; the only objection I have is that at my age, I really cannot wear those little pantaloons.

MR. SCHWITZER: Before entering upon this discussion I would move, seconded by Mr. Francis, that the committees mentioned by the President be discontinued as sub-committees, and made committees of council. (Carried.)

THE PRESIDENT: Any further discussion on what Mr. Irving has brought up?

MR. MAUNSELL: As a military engineer, I was rather surprised that the society had not before taken this question up. Looking around the room I see many faces of civil engineers who have had a good training in military engineering; some graduates of the Military College, others who have taken McGill courses where they deal with military engineering, and others from Toronto University. No doubt, in case of war every one will do his best to defend his country, but why should not the Canadian Society of Civil Engineers co-operate with the military engineer in preparation for the defence of Canada? It is rather a pity that the committee has done nothing. Two years ago, Col. Ward and several British officers tried to get something done. The question is one which should be taken up and not lost sight of.

MR. LEOPRED: Mr. Chairman, I think the previous speaker embraced military engineering because he liked it. I hope he will succeed in it as he has always succeeded, but as far as I am concerned, I prefer to follow ordinary civil engineering, without having anything to do with military engineering. I think a great many engineers will feel as I do on this matter. Anyone is at liberty to take up military engineering who chooses; there are several schools for that purpose; but they should not interfere with those who want just to practice common civil engineering and to make their living. We respect the military engineers very much; we admire their success, and we think they are doing very useful work for the country at large, but we are doing our best too, and I feel that we want to be left alone. (Applause.)

MR. LEACH: Mr. President, I do not know whether it was necessary for that committee of which I was named a member to be continued from one annual meeting to another, but had I received a summons to duty on that committee I should have been delighted. As somewhat of a military man—although I never have had the privilege of smelling powder

in earnest—I think it would be a fine idea for the members to give a certain amount of their ability in engineering to the education of the men who are to serve Canada in case of necessity. If that committee is continued I shall be very pleased to do my share of the work in carrying it to a successful issue.

MR. FREELAND: May I ask for information whether the committees wait for suggestions from others, not on the committee? The complaint is that the subjects allotted are so large they have not time to do anything. Do they expect the rank and file to make suggestions?

THE PRESIDENT: Yes, I should think any committee would be pleased to receive any suggestions.

MR. FREELAND: I should think that valuable suggestions might be obtained from the papers that are read before the different branches.

MR. COUTLEE: It must be remembered that this committee work is a labor of love, performed after hours.

MR. LEOFRED: I would ask whether in the formation of the committees the members are asked before their appointment whether they will be able to devote any time to the work. If they are not consulted, it is no wonder that the work often is poor.

THE PRESIDENT: As a rule, Mr. Leofred, they are consulted, and if they are not able to do the work they usually resign, and most of the committees have power to add to their number.

MR. JAMES: May I ask if the committee on cement specifications has reported, and if their report has been adopted.

THE PRESIDENT: I forgot that committee. It is Mr. Thompson's report. He will be here to-morrow, and I think we will leave that over until Thursday morning.

MR. DION: Mr. President, in connection with this committee work, I would like to bring up again the question of whether it is advisable to make appropriations to the committees in order that they may carry on their work. I have had some experience in other societies and I know that it is difficult, if not impossible, to do effectual work without the sinews of war. A committee should be in a position to spend a reasonable amount in the furtherance of its work. I would commend to the incoming council the consideration of this matter. I think, we could not spend the funds of the society very much more usefully. (Applause.)

THE PRESIDENT: In reply to that, there was a long discussion on the subject at the last annual meeting in Toronto and instructions were given to the council to deal with it. If any committee needs means the council has power to deal with it. So far, no case has been brought up.

MR. DION: Perhaps the committees are too shy.

THE PRESIDENT: Oh, no, I should not think so. However, the council are fully empowered to deal with it. (Adjourned until 10 a.m., on Thursday, January 27th.)

Tuesday evening a smoker was held in the city hall at which several addresses were given.

RETIRING PRESIDENT'S ADDRESS.

MR. GEO. A. MOUNTAIN in his address as the retiring president said in part.

CANADA'S great problem to-day is transportation. While the possibilities and even the necessities of water transportation in Canada are great, the problem will, I think, be largely solved by the network of steel which is being rapidly spread over the country.

We have without doubt entered upon one of the greatest years, if not the greatest, of railway development in our country. This is noticeable not only in regard to additional mileage, but particularly in the tremendous increase of motive power now being applied in the operation of railroads. Locomotives have been designed and put into use of a size that a few years ago would not be thought of, and, in addition to this, railway gradients have been reduced at enormous expenditure. These grade reductions are such that they have more than doubled the haulage capacity for a given engine.

In the development of water power, Canada, from one end of the country to the other, has made phenomenal strides. We constantly read of new water power construction and the resulting increase in the industrial development of the country. There has also been great progress made in the electrical transmission of energy from the centres of our water powers. Only a few years ago high tension transmission power lines were operating at a maximum of 30,000 volts, while this year the Hydro-Electric Commission of Ontario is constructing lines carrying 110,000 volts. In the application of electrical construction to railroads, the great improvement and added comfort in travelling is very noticeable, especially in tunnels, where trains are not now detained on account of gases generated by the coal-burning of the locomotives.

In the mining industries of the Dominion great strides have been made by the mining engineer, particularly in the construction and installation of machinery designed to handle in the most economical manner, the riches beneath the soil. These new appliances have made it possible to develop properties which, in the days when only the pick and shovel were used, were without value, owing to the great cost of these old methods. Civil engineers engaged in municipal works have shown great advancement in the construction of waterworks, the proper disposal of sewage, and notably in the construction of roadbeds and pavements of all descriptions of highways.

In bridge engineering the problems which now face us are stupendous. Members of the Society are engaged in the building and construction of

bridges with spans of 1,800 feet, in which also occur some most complex problems in substructure. The strength of bridges has been largely increased; in my own experience, almost threefold. It was said some two years ago that nearly everything had been discovered or invented except the flying machine and the North Pole. Since that statement was made the North Pole has been explored and flying machine construction rapidly advanced. I venture to predict that the progress of scientific engineering will in the next fifty years exceed that of the past fifty, great as that has been. Problems in engineering at which we now stand aghast will come to be matters of every-day practice. * * *

I now wish to say a few words on the subject which, at the present time, is most interesting to me in my professional work. I refer to my connection with the Engineering Department of the Board of Railway Commissioners for Canada, of which I have the honour to be the chief. You are no doubt aware that the Board of Railway Commissioners was formed for the purpose of dealing with matters relating to railway construction, maintenance, operation, and traffic. The Engineering Department of the Board has to deal with construction and maintenance, and it is in regard thereto that I wish to speak specially. After a great deal of care and research, rules and regulations of the Board, specifying the proper method of presenting and filing plans, profiles, and details of all works in connection with railway matters, were drafted and approved. Plans of location of railways are now coming to the Board in great and apparently increasing volume from all parts of the Dominion. The Engineering Department, in examining these plans, has in view the following: That no infringement on other locations is allowed; that the proper location of railways over all streams has been observed; and that there is no interference with adequate drainage of the country. In connection with bridge work, the strain sheets are checked to see that they are in accordance with the standard specifications. After the plans of the bridges have been approved, the completed structures are inspected on the ground to see that the plans have been carried out.

All plans, which are forwarded to the Board with applications of railways for the crossing of highways, are examined to see if the crossing is a proper one, and to endeavour to obtain grade separation in order to carry the railway over or under the highway, as the case may be. In addition to the above, many cases are also submitted, both by railway companies and municipalities, for the purpose of safeguarding the public by the application of grade separation to these thoroughfares.

Great care is taken in the crossing of railways by high power electric transmission lines, in order to protect the public from dangers that might arise by breakage of these power lines. Such accidents are minimized by the construction of cables of reduced spans and greater tensile strength. The construction of all classes of conduits under the railway roadbeds for the conveyance of water, gas, and drainage is also a matter which demands close inspection. All plans of these are carefully looked into, so as not to impair the efficiency of the roadbed in the interests of the safety of the travelling public and trainmen.

The rules and regulations, after several minor amendments, have been thoroughly tested, and have apparently worked with equity to all whose cases have come before the Board for adjustment.

OFFICERS FOR 1910.

PRESIDENT: Col. H. N. Ruttan, Winnipeg.
VICE-PRESIDENTS: W. F. Tye, Montreal; C. H. Rust, Toronto; R. W. Leonard, St. Catharines.

MEMBERS OF COUNCIL: C. R. Coutlee, Ottawa; J. A. Bell, St. Thomas; J. M. R. Fairbairn, Montreal; A. W. Campbell, Toronto; F. L. Wanklyn, Montreal; C. E. W. Dodwell, Halifax; Phelps Johnson, Montreal; Duncan Macpherson, Ottawa; C. N. Monsarrat, Montreal; W. J. Francis, Montreal; A. E. Doucet, Quebec; H. J. Cambie, Vancouver.

GENERAL SECTION: H. G. Kelley and J. G. Sullivan, Montreal
ELECTRICAL SECTION: L. A. Herdt and R. S. Kelsch, Montreal.
MECHANICAL SECTION: R. J. Durlay and H. H. Vaughan, Montreal.
MINING SECTION: J. E. Hardman, Montreal; H. E. T. Haultain, Toronto.

[To be concluded in next issue.]

o o o o o

Consult our Catalogue Index on page 6. We can put you into immediate touch with the principal manufacturers of and dealers in all kinds of engineering and contracting equipment. A postcard to this department will insure the receipt of the desired catalogue.

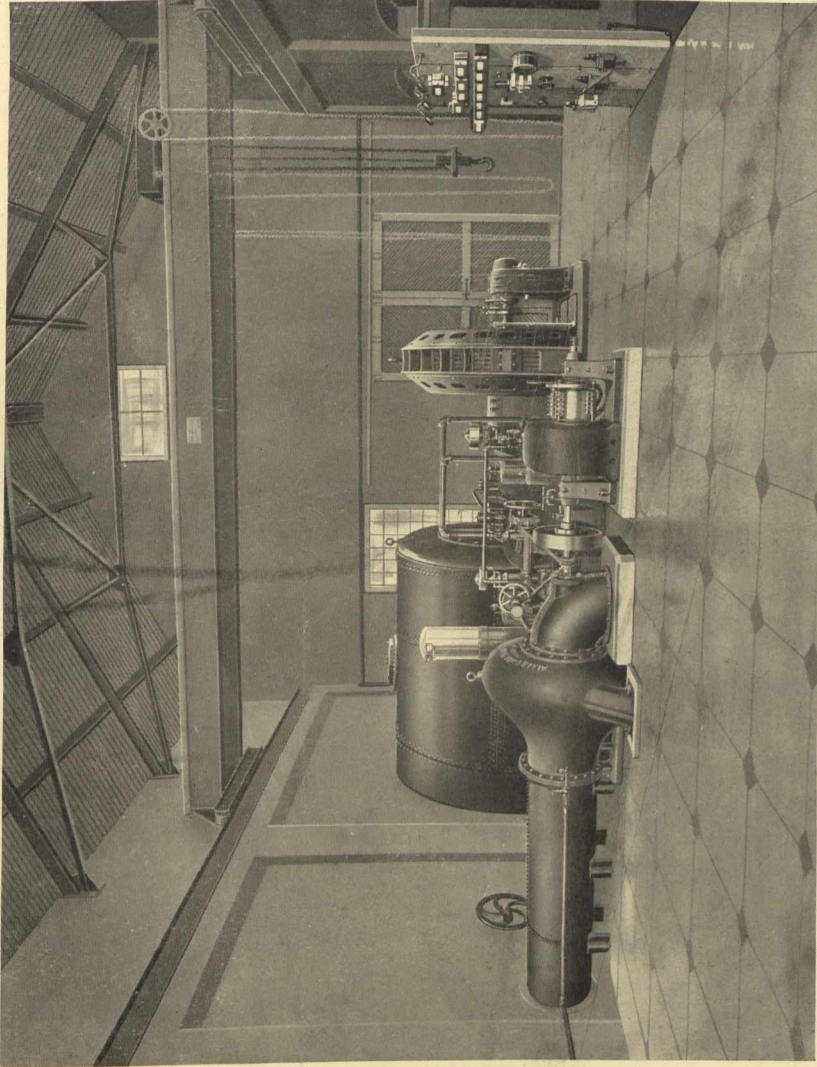
MISSING NUMBERS.

Copies of the Canadian Engineer for June 5th, 1908, and February 5th, 1909, are required. For copies of these issues we will extend your subscription one month. Circulation Department, Canadian Engineer, Toronto.

HYDRO-ELECTRIC POWER MACHINERY

We are the only firm in Canada which builds complete Hydro-Electric Power Plants, including water wheels, generators, motors, switchboards, transformers and other auxiliary apparatus. Both Turbine and Generator are constructed and tested under the supervision of the engineers who designed them and who are thoroughly familiar with the conditions necessary for their successful operation as one unit.

With a given amount of water, WE GUARANTEE a definite electrical output.



This is an illustration of the Hydro-Electric Power Plant of The Mond Nickel Co., Limited, Wabagesick Chute, Vermilion River, including:

Horizontal Twin Turbine, 2200 H.P., 300 R.P.M., 50-ft. head.

Water Wheel Type Alternator, 1500 K.W., 2200 volts, 60 cycle.

Exciter Turbine, 110 H.P., 875 R.P.M.

Exciter Generator, 60 K.W., 120 volts.

Transformers, three 800 K.W., 2200/16500 volts.

Governors, Switchboard and other apparatus.

SINCE THE PHOTOGRAPH WAS TAKEN WE HAVE BEEN AWARDED THE CONTRACT FOR A COMPLETE DUPLICATE OF THIS PLANT.

ALLIS - CHALMERS - BULLOCK, LIMITED

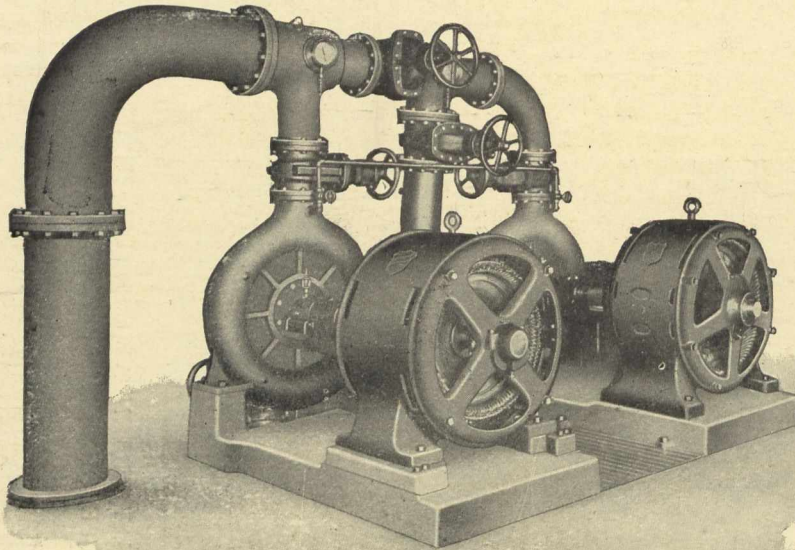
WORKS: MONTREAL

Offices : Montreal - Toronto - Cobalt - Winnipeg - Calgary - Vancouver

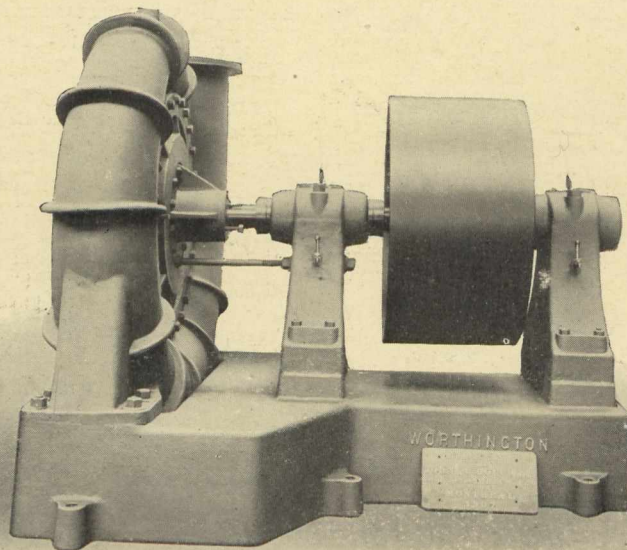
CENTRIFUGAL PUMPS

FOR WATER WORKS PURPOSES

The turbine pump, while operating at constant speed, will maintain a practically constant pressure and deliver a variable amount of water from nothing up to the full capacity of the pump. As the pressure is determined by the speed, and there is no positive flow or delivery, the capacity of the pump depends upon the difference of the pressure maintained at the circumference of the impellers, due to their velocity, and the pressure at the outlet.



This makes these pumps ideal for pumping directly into water mains. On this page is shown a combination for either domestic or fire purposes. It consists of two single stage 8-inch pumps, each driven by a 100 H.P. induction motor, and so arranged that they may be operated in series for domestic or in multiple for fire purposes. Each pump works against 160 lbs. pressure, and is capable of delivering 1,500,000 gallons in 24 hours.



FOR MANUFACTURING PURPOSES

We also design and build centrifugal pumps specially to suit a great variety of manufacturing purposes. The illustration shows a 20-inch volute centrifugal pump, capacity 11,000 gallons per minute, built for handling pulp "stuff" at the Laurentide Paper Co., Grand Mere, Que.

**THE JOHN McDOUGALL
CALEDONIAN IRON WORKS CO.**
LIMITED

Works: Montreal. Sales Offices: Montreal, Toronto, Cobalt, Winnipeg, Calgary, Vancouver

THE TATE BIFFUNCTIONAL ACCUMULATOR PLATE

By Harry H. Morrell.

This novel plate is termed "Bifunctional" because it embraces two functions, positive and negative, and constitutes within itself a complete element. All storage cells heretofore known in practice consist of not less than two plates, each possessing but one function, either positive or negative, and this type may therefore be designated as "unifunctional."

An assembled Tate Bifunctional plate or unit and its constituent parts are shown in the accompanying illustrations, Figs. 1 and 2. Fig. 3 illustrates the method of assembling multiples of these units for the purpose of constructing plates of any desired size and capacity. The constituent parts of a unit, eight in number, consist of:—

(a) An open insulating sectional frame made of celluloid, hard rubber or any suitable material. One end of this frame and the three lateral supports are milled to half their depth and the internal vertical edges are grooved to receive the lead conducting strip. When this strip is drawn into the frame five pockets are formed for the reception of the active materials. These are about one thirty-second of an inch in depth, representing the distance between the surface of the metallic conductor and the outside faces of the frame itself. On one side of the frame the pocket is continuous—on the other it is interrupted by the lateral supports which break the channel into four pockets, and it is provided with a hole at each end to receive the assembling rods.

(b) A lead conducting strip provided with a relatively heavy-holed end to correspond with the hole at the milled end of the insulating frame.

(c) Two perforated insulating and separating shields, one of which is equipped with a series of interrupted, staggered bearings along its internal vertical edges which hold the pair about one thirty-second of an inch apart, provide openings for the admission of the electrolyte and form a continuous vertical channel from bottom to top for the free circulation of the fluid and the escape of nascent gases. These are also provided with end holes to receive the assembling rods.

(d) Two assembling rods on which the constituent parts are threaded top and bottom.

(e) Two side binders made of hard rubber, porcelain or any suitable material.

Assembling.

The heavy ends of the lead conducting strips project about one-half of an inch beyond the sectional frame. In assembling a unit these frames, carrying the conducting strips and applied oxide, are reversed alternately so that one series of projections appear at the top and the other at the bottom of the unit. A pair of perforated insulating shields (c) are threaded between the sectional frames, and the top and bottom metallic projections of the latter are turned down in contact and lead-burned after the assembling rods (d) have been headed on the outside of the binders (e). Thus one alternate series forms the positive and the other the negative sections of the plate. A unit may consist of two or more sections. The standard which has been adopted for all purposes other than work of a very light nature, is a unit consisting of fifty-seven sections—twenty-eight positive and twenty-nine negative (one split negative). The dimensions are: Height 8½ inches, width across the face 9¾ inches, thickness 9/16 inch, and the weight of the unit of four pounds. The capacity on 8-hour discharge rate is 36 ampere hours, and the average voltage for eight hours 1.94. The total watt hour efficiency is 70, watt hour efficiency per pound weight of unit 17½, and total weight efficiency 40 pounds per horse-power hour.

To explain the practical operation of a Tate Bifunctional plate it is necessary first to refer to certain features which characterize the operation of storage cells as heretofore constructed through the medium of unifunctional plates, which have a direct relation to the phenomenon termed "sulphating," which place a limitation upon periods of charge and discharge and through which the life of these cells is defined. These features involve equalization of current density, transmutation of active material, metallic density and mechanical structure, and after discussing them with relation to unifunctional plates their relation to the Tate Bifunctional plate will be shown.

Equalization of Current Density.

There can be no doubt that apart from mechanical structure the most vital feature associated with the efficient operation of an electric storage cell is that relating to the equal distribution of current density over exposed active surfaces. If the oxide surfaces undergoing transmutation are unevenly attacked the appearance of the phenomenon termed "sulphating" is inevitable. In the following discussion of this subject

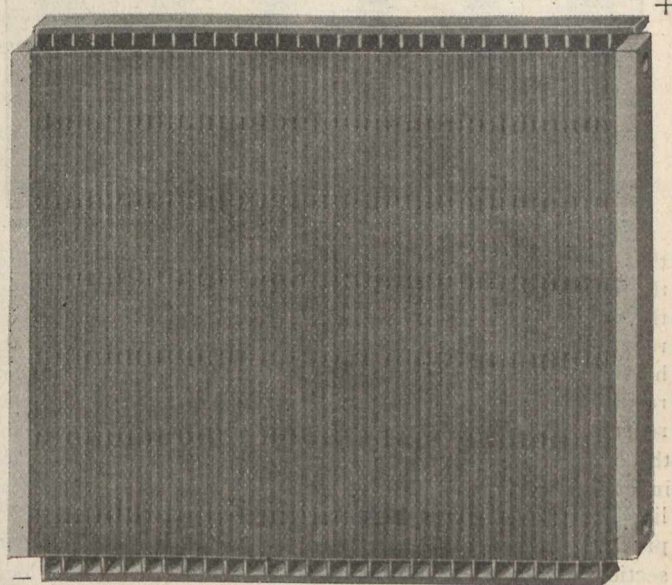


Fig. 1.—Tate Bifunctional Accumulator Plate.

an effort is made to set forth the reasons why equal current distribution can not be achieved through a conducting medium in the form of a plate or grid, more particularly those of relatively large superficial area.

When two unitunctional plates, a positive and negative provided only with upper terminals, are in electrical contact through the medium of the electrolyte the line of least resistance between them follows a path located above their horizontal centres and along their vertical and horizontal edge areas where so-called extraneous stream lines are given off. That is to say, the flow is heavier above than below the horizontal centres in all corresponding parts of the plates. As the vertical central regions are approached, the densities become relatively lighter through the whole length of the plates, for the reason that current flow, somewhat like magnetism, has a tendency to seek the more extreme or outermost sections of such conducting media, a manifestation well defined in the process of electro-plating.

The result of these conditions, encountered universally in the present practice of the art, is that with given current flow the superimposed or pocketed active masses are unevenly attacked and, emphasized with each increase of plate area, they probably represent the major cause of "sulphating" in unifunctional plate cells more especially those of large surface

capacity as employed for electric lighting and peak load regulation.

For the purpose of further elucidating this phenomenon we shall assume a metallic plate of relatively large area wherein the current enters along the upper horizontal edge and finds an exit along the lower horizontal edge. Under

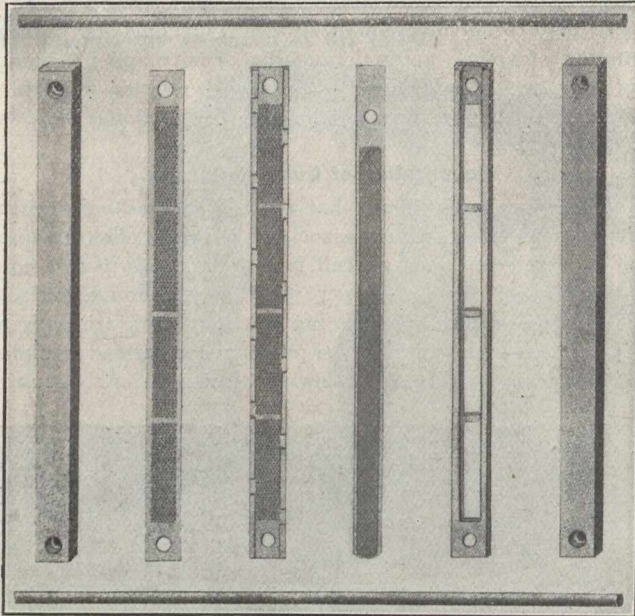


Fig. 2.—Component Parts of the Tate Bifunctional Accumulator Plate.

these conditions the line of potential equalization will follow the exact horizontal centre if metallic resistance throughout the whole of the plate is assumed to be constant; and if current density at one designated section located below the horizontal centre be represented by 10, the density of the corresponding section above the horizontal centre will also be represented by 10. This method of admitting and releasing the current provides for the equalization of current densities in corresponding sections of the plate located in a vertical line above and below the horizontal centre, but it does not provide for the equalization of current densities between plate sections which do not correspond with respect to relative location along the same line. Equalization in this vertical direction is more closely approximated as the distance between the top and bottom of the plate is shortened for the reason that as the horizontal line of equalization is approached potential and, consequently, current density must necessarily diminish to the extent of the progressive expenditure of energy required to overcome the resistance of the conducting medium, and this expenditure is in due proportion to the distance traversed. Thus the shortening of a plate or conductor tends to equalize current density in a vertical direction. Again, as previously stated, as the vertical central regions of the plate are approached these densities tend to become lighter through phenomena resembling somewhat the action of magnetism. Equalization in this horizontal direction is more closely approximated as the distance between the lateral edge areas of the plate is decreased, or in other words as the plate is narrowed. An experiment in the art of electro-plating demonstrating the conditions stated above is fully described and illustrated in the United States Patent No. 926710, June 29th, 1909.

Transmutation of Active Material.

In unifunctional plate cells of the Faure or applied oxide type, and more particularly those of relatively large capacity as employed in electric lighting and peak load service, the active material is applied to the plates or grids in relatively thick masses. Recent investigations appear to have demonstrated that these masses are inactive beyond a certain limita-

tion of depth under ordinary or so-called normal working conditions. In "The Standard Handbook for Electrical Engineers," 1908, Edition Section 9, Page 14, paragraph 16, Messrs. Edward Lyndon and Otis Allen Kenyon, under the caption "Batteries" record the following statement:

"The electrolytic action seldom penetrates to a depth greater than one-sixteenth of an inch at ordinary discharge rates. So that where the thickness of the active material measured from the surface of the electrolyte to the conducting plate exceeds this amount the portion in excess of this thickness is practically useless."

Two results of this condition are obvious. First that the inactive material constitutes a dead resistance to current flow, thus curtailing the useful energy of the cell and second, that it is a constant menace with relation to the obstructive reaction termed "sulphating." In addition to this the depth of the active mass appears to bear a direct relation to the time periods required to effect its transmutation under the action of the current. This transmutation appears to be effected progressively in a direction extending outwardly from the area of contact between the active material and the metallic conductor, or inwardly from the active area in contact with the electrolyte, and current density and time in conjunction seem to be the essential factors in effecting transmutation, the latter being regulated by the depth or thickness of the mass. In other words in the operation of charging, when current flow is raised to the maximum limit of the cell, the element of time enters in and the duration of the charge is proportionate to the depth of the oxide mass. This deduction appears to receive ample confirmation in the process of charg-

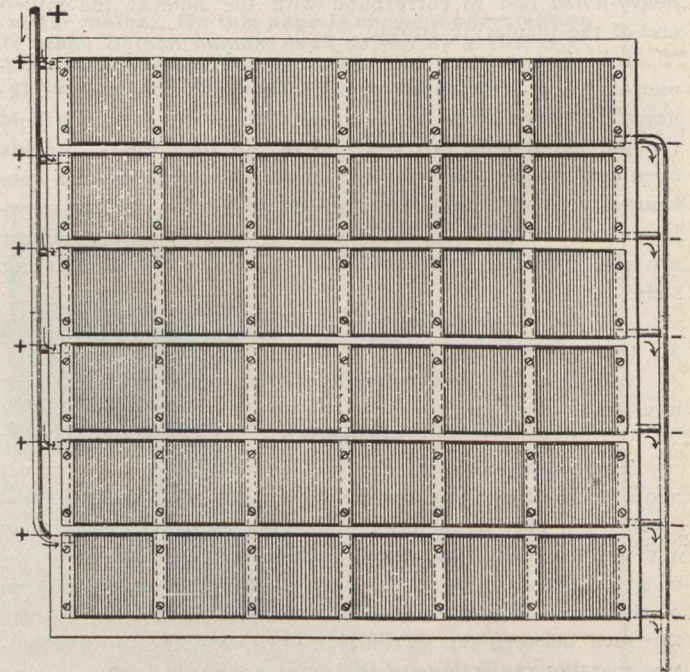


Fig. 3.—Multiple Unit Plate of the Tate Bifunctional Accumulator Showing Connections.

ing a Tate Bifunctional plate wherein the active columns are extremely short and narrow and approximately only one thirty-second of an inch in depth. The details of this process are fully set forth in the continuation of this discussion.

Metallic Density.

It is well understood that there is appreciable variation of density throughout any metallic mass and that when such a structure assumes the form of a plate or grid any increase of superficial area has a tendency to amplify such variation. These metallic irregularities present variations of resistance to current flow and corresponding variations in the density of current delivered to superimposed or pocket-

ed active material and thus contribute towards the hazard of "sulphating." The hazard from this cause, augmented by other causes of unequal current density hereinbefore discussed, is increased proportionately with each increase of conducting area and decreased proportionately as the conducting area is restricted.

Mechanical Structure.

In all electric storage cells as heretofore constructed, of the Faure or applied oxide type, with the exception of those employing porous media which are referred to below, the active material is supported by a metallic plate or grid, and their terms of useful life are determined by the periods which mark the disintegration and displacement of this material. Apart from mechanical jarring and vibration, which may be described as extraneous causes, these disrupting effects are produced by the normal expansion and contraction of the active material more especially on the positive plates or grids in response to the phenomena of electrochemical transmutation under charge and discharge commonly termed "breathing," which have a tendency to loosen and detach the superimposed or pocketed oxide from the supporting plates or grids and this influence is abetted by the scouring action of

feature which must be considered is the difference between the factors of expansion of the active material and the metallic walls which enclose and support it. These factors are wholly dissimilar, and the metal does not expand to compensate for the expansion or "breathing" of the oxide. The result of this condition is that under the influence of heavy current flow on charge or discharge the rapid or sudden expansion or contraction of the oxide has a tendency to expel it from its metallic supports or to produce the distorting phenomenon termed "buckling." This indicates one of the reasons why cells of this type can not be rapidly charged and why they are liable to serious injury through the influence of heavy discharges.

Porous media were used in electric storage cells at the inception of the art, and various kinds of diaphragms have been introduced, with the primary object of retaining the active material in place. Several of these, notably porous clay or porcelain perform this function with mechanical precision but their practical disability rests in their dependence upon capillary or molecular action in effecting the distribution or circulation of the electrolyte. They have a tendency to appreciably insulate the active material from the electrolyte through adhesive contact with the former and to filter the solution by passing the water with greater freedom than the acid.

Both of these conditions operate to curtail the useful energy of the cell; the first by rendering a part of the active material inactive, or semi-active, and the second through the production of high and deleterious acidity at the active surfaces under charge and insufficient acidity under discharge. In other words the specific gravity of the cell does not adjust itself with sufficient spontaneity to the normal and essential requirements of the active material and this condition is heavily emphasized as periods of charge and discharge are reduced. These conditions explain why porous media, originally employed in the earliest types of electric storage cells, were discarded in the subsequent practice of the art. The structural details of the Tate Bifunctional plate have been previously set forth in this paper and they will now be considered in their relation to the various conditions noted in the foregoing discussion.

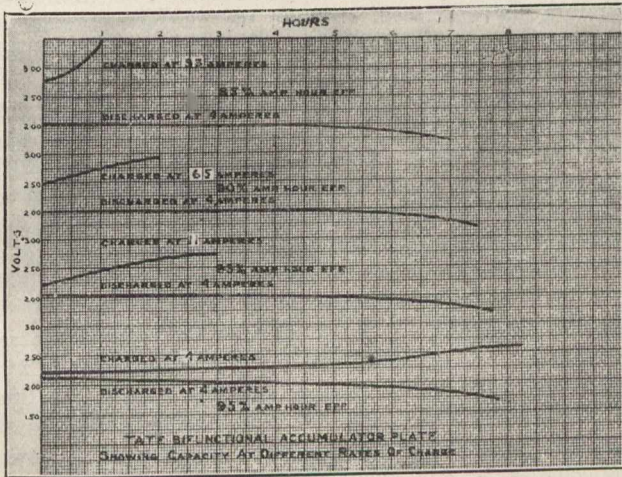


Fig. 4.—Showing Curves of Tests Made on the Tate Bifunctional Accumulator.

the electrolyte produced by circulation. This disintegrating action is continuous and progressive and is a well recognized condition in the art, as practiced to-day, as shown in the report of a stated meeting of the Railway Signal Association published in their journal issued at Bethlehem, Pa. Vol. XI. No. 3, July, 1908, page 141, where it is discussed under the caption "Sediment." The available energy of these cells primarily is directly proportionate to the quantity or weight of active material in place and in action and any loss thereof represents a corresponding loss of energy in the cell. It will therefore be noted that the life of these cells is not determined by the electrochemical exhaustion of the active material, if such be possible, nor essentially through deterioration of the supporting plates or grids but through the mechanical displacement of the material from which the energy of the cell is derived, and which, so displaced, is commonly called "sediment." When unfunctional plate cells reach the point of final exhaustion the quantity of active material present and in place in association with the positive plates or grids is less than the original quantity, and that which has been displaced is irrevocably lost. Renewal can only be effected and the term of life of the cell extended by providing fresh material in the form of new positive plates or grids.

With regard to periods of charge and discharge which involve so-called "overloads," the relation of time to mass in the process of charging has been referred to above. Another

Equalization of Current Density.

In the Tate plate the current finds entrance at the top and exit at the bottom, or vice versa, of a finely subdivided multiple-assembled unit provided with extremely short conductors, these being only eight inches in length, and the line of potential equalization follows, therefore, the exact horizontal centre of the plate. There can be no appreciable variation of current density either above or below this line in a vertical direction as the distance from ends to centre of the metallic conducting strips is only four inches and the drop in potential, therefore, negligible. The width of these conducting strips is seven-sixteenths of an inch. The active columns applied thereto are seven inches long, three-eighths of an inch wide and about one thirty-second of an inch in depth. By thus restricting the width of the metallic conducting media and, correlatively, the active columns applied thereto, the vertical central regions, which in unfunctional plates, as hereinbefore explained, have a tendency to develop lighter current densities than other plate sections, are permanently fixed in close relation to the vertical edge areas of the media with the result that current density is again equalized, this time in a horizontal direction.

It will thus be seen that these extremely short and extremely narrow conducting strips and active columns assembled in close multiple relation achieve the equalization of current density over all the active surfaces of the unit with as great a degree of precision as it is possible to attain in the exercise of practical mechanical art. Furthermore as the

lateral edges of the conducting strips are insulated from the electrolyte by the sectional supporting frames, and as access to the vertical edge areas of the active columns is largely curtailed by the closed bearings of the intervening perforated shields, the extraneous stream lines in a working unit have been reduced to an absolute minimum and current flow confined and concentrated upon those parts (the active columns) from which useful energy is derived. Thus the probable major cause of "sulphating" (unequal current distribution) in electric storage cells as heretofore constructed has been eliminated in these bifunctional plates. The accompanying illustration, Fig. 3, shows how these conditions are maintained throughout all the ramifications of practice.

Transmutation of Active Material.

Reference has been made above to the limitation of depth of active material and to the progressive nature of transmutation involving the element of time. The accompanying curve sheet, Fig. 4, illustrates a progressive series of charges and discharges made by the writer with a Tate Bifunctional plate, about one year old, embracing forty-seven sections, or ten sections less than the present standard with the object of comparing the results of quick and slow charging. The first charge at the rate of thirty-three amperes was effected in one hour. The second at sixteen and one-half amperes in 2 hours. The third at eleven amperes in three hours and the fourth at four amperes in eight hours. All discharges were made at the same rate, four amperes. The ampere hour efficiencies shown by this test are, in the order named above, 85 per cent., 90 per cent., 93 per cent., and 95 per cent., thus demonstrating that the quick charging rate (one hour) effects curtailment of the ampere hour capacity of the unit to the extent only of about 10 per cent. Prior to this test this same unit was several times discharged on dead short circuit in an unsuccessful effort to break it down.

It would appear from this that the depth of the active material bears a direct relation to available charging periods and that the rapidity with which a Tate Bifunctional plate can be charged is due to the film-like nature of the active columns, augmented, without doubt, by the equalization of current density and concentration of current flow. It must further be noted that the active material is not enclosed by metallic walls. It rests against the faces of the conducting media, and means have been provided to effect perfect amalgamation between the metal and the applied columns during the process of "forming." The factor of metallic expansion does not have to be considered. The elasticity of the intervening perforated shields which rest against the faces of the active columns, provides amply for the expansion of the oxide in the positive sections of the plate.

The extreme shortness and narrowness of the metallic conductors in a Tate unit would in themselves reduce to an appreciable minimum the hazard of unequal metallic density but the method of preparing these strips effects a further reduction. They appear first in the form of a continuous lead ribbon half an inch wide and one-sixteenth of an inch thick, formed by forcing the metal through a die. This ribbon then enters the rolls of a specially designed automatic machine in which the conducting strips are formed ready for use, and in which that portion which carries the active columns is reduced in thickness to about .015 inch. These two processes tend to equalize metallic density and eliminate all risk of unequal current distribution through inequality of metallic resistance.

Mechanical Structure.

The Tate Bifunctional plate originally embodied porous separating media in the form of relatively thin diaphragms made of porous clay and various other porous materials. It was in testing these that the obstructive conditions relating to circulation, filtration and non-adjustment of specific

gravity, were encountered and noted, and as these defects are inherent in this form of media they were discarded in favor of the perforated shields described in the first part of this article. The functions of these perforated mechanical separators are threefold. First they constitute shields or retaining walls which permanently support and conserve the active columns; second, they provide unobstructed flues or chimneys for the liberation and ascension of nascent gases and the circulation of the electrolyte; and third they aid, through their closed bearing sections, in cutting off extraneous stream lines thereby concentrating current flow along and over the path lines described by the face areas of the active columns.

The active material shows no tendency whatever to adhere to these shields so that the electrolyte, entering through the perforations, finds a relatively free passage between them and the active faces against which they rest. An exhaustive series of tests has demonstrated that the active material can not, or at least does not, subdivide in particles sufficiently fine to enter and escape through the perforations, while the scouring action of the electrolyte is expended against the exposed faces of these shields and not against the faces of the inclosed and protected active columns. Comparative curves of units equipped with porous media and with the mechanical separators just described, showing the marked improvement effected by the latter, are embraced in the illustrations accompanying Tate's United States Patent No. 926710—June 29th, 1909. This improvement is not alone due to the freer circulation of the electrolyte and the automatic adjustment of specific gravity but must be attributed in part to the elasticity of the perforated shields which permits the active material to expand freely and naturally under all conditions of current flow.

It is well understood that the total efficient energy of an electric storage cell of given size can be increased only by decreasing the internal resistance of the element. In the Tate plate the width of the exposed lateral faces of the sectional frames is only three thirty-seconds of an inch and fifty-seven of these assembled in close multiple relation constitute a standard bifunctional unit. It will thus be seen that the factor of internal resistance has been brought to the lowest point possible of attainment through the application of mechanical methods involving the sub-division and multiple grouping of all those parts which in action are electrically interrelated, and that the capacity of the unit for given weight has been raised to an absolute maximum in so far as mechanical methods are concerned. It will further be noted that in constructing plates of relatively large dimensions and capacity (Fig. 2) the individual units composing it are also assembled in multiple relation, each being independent of the other and readily detachable and replaceable in the event of injury. This is a marked advantage in the case of large installations as the seats of possible trouble through any cause are localized within spaces of about eighty square inches, representing the superficial areas of the individual units.

In view of the permanent conservation of the active material the terms of useful life of these bifunctional plates must be determined in the first instance by the time periods which will mark the deterioration of the anode conducting strips, through oxidation, to degrees that will so impair their conductivity as to render them unserviceable. This oxidation is caused by the process of charging and is progressive with relation to time. When this point of exhaustion is reached the quantity of active material present and in place in association with the anodes is greater than the original quantity for the reason that a portion of the anodes themselves has been raised to an oxide to reinforce the active material originally applied. As this condition is progressive throughout the

(Continued on adv. page 47).

CONSTRUCTION NEWS SECTION

Readers will confer a great favor by sending in news items from time to time. We are particularly eager to get notes regarding engineering work in hand and projected, contracts awarded, changes in staffs, etc. Printed forms for the purpose will be furnished upon application.

TENDERS.

Montreal, Que.—General Manager Franz of the Lake Superior Corporation states that next month they will call for tenders for the extension of the Algoma Central railway. The amount stated to have been appropriated for this purpose is three million dollars. The extension is for a distance of about 200 miles, presumably to connect the Soo with the C.P.R. at Grasset, on the Lake Superior division.

Kingston, Ont.—Tenders will be received up to Saturday, January 29th, for the following supplies required by the City of Kingston: Grates, hardware, lumber, sand, rubble stone. H. B. R. Craig, City Engineer.

London, Ont.—Tenders will be received until February 26th for electrical apparatus, including transformers, motor generator set, voltage regulators, switchboards, lightning protectors, instruments, arc and incandescent street lighting systems. Address E. I. Sifton, city electrical engineer, for further particulars.

Ottawa, Ont.—Tenders will be received until Tuesday, February 15th, 1910, for the supply and delivery of 3,000 lineal feet of 42 inch steel intake pipe. Newton J. Ker, City Engineer. (Official advertisement appears in this week's Canadian Engineer.)

Winnipeg, Man.—Tenders are invited until February 1st for the supply of an automobile for the Street Commissioners' department. Particulars as to style and application may be obtained on application. M. Peterson, secretary, Board of Control.

Winnipeg, Man.—Tenders for the following street cleaning supplies, will be received up to Wednesday, February 2nd:—6 to 8 dump wagons, 4 yards capacity; 250 galvanized iron dust cans; 50 carts to carry same. Specifications and conditions of tender may be obtained at the office of the Street Commissioner.

Saskatoon, Sask.—Tenders will be received until Monday, February 14th, for copper wire and electrical supplies. J. H. Trusdale, City Clerk. (Official advertisement appears in this week's Canadian Engineer.)

Saskatoon, Sask.—Tenders will be received until Monday, February 20th for the construction of overhead foot bridge at 20th Street. Plans and specifications may be seen at City Engineer's office, and also at offices of Canadian Engineer, Toronto, 62 Church Street; Montreal Room B 33 Board of Trade Building; Winnipeg, 315 Nanton Building. J. H. Trusdale, City Clerk. (Official advertisement appears in this week's Canadian Engineer.)

Saskatoon, Sask.—Tenders are invited until February 21st, for the construction of a footbridge over the Canadian Northern Railway. Bids will be received as follows:—

"A"—Foundations.

"B"—Superstructure.

They should be addressed to J. H. Trusdale, city clerk. Plans and specifications may be seen at the office of George J. Clark, city engineer and at the offices of "The Canadian Engineer," 62 Church Street, Toronto; B 33, Board of Trade Building, Montreal, and 315 Nanton Bldg., Winnipeg.

Saskatoon, Sask.—Tenders will be received until Monday, February 14th, for materials required for House Sewer and Waterworks service connections, including sewer pipe, galvanized iron pipe, lead pipe, brass fittings, etc. Geo. T. Clark, City Engineer. (Official advertisement appears in this week's Canadian Engineer.)

Calgary, Alta.—Tenders will be received by the Commissioners of the City of Calgary up to the 9th February, for 400 tons good quality slack coal; 425 cords good poplar wood. H. E. Gillis, City Clerk.

Vancouver, B.C.—Tenders will be received until Tuesday, February 8th, for broken stone. Obtain specifications from W. A. Clement, city engineer.

Vancouver, B.C.—Tenders will be received up to Tuesday, February 8th, for the construction of granitoid, Haslam and cedar block pavements, also bitulithic pavements on concrete base, and on bituminous base, on Georgia, Burrard, Howe, and Beatty streets. W. A. Clement, City Engineer. Wm. McQueen, City Clerk.

Vancouver, B.C.—The time for receiving tenders for the freighting of supplies for the Yukon Telegraph Line in the course of the seasons 1910, 1911 and 1912, is extended to Tuesday, February 15th. Forms of tender and specification may be obtained on application to J. T. Phelan, Superintendent of Government Telegraphs, Vancouver, Wm. Henderson, District Superintendent Government Telegraphs, Victoria, and from the Government Telegraph Agents at Ashcroft, B. C., Quesnelle, B.C., Hazelton, B.C., and Telegraph Creek, B.C. Napoleon Tessier, Secretary. Department of Public Works, Ottawa, Ontario.

TENDERS PENDING.

Fuller information as to these tenders pending may be found in the issues of the Canadian Engineer referred to.

Place and Work.	Tenders close.	Issue of.	Page.
Midland, Ont., electric equipment—	Feb. 1.	Jan. 14.	46
Wetaskiwin, Alta., gas well.....	Feb. 15.	Jan. 14.	46
Winnipeg, Man., electric equipment.	Feb. 15.	Jan. 14.	39
Kenora, Ont., Court House.....	Feb. 1.	Jan. 21.	65
Winnipeg, Man., fence, gates.....	Feb. 28.	Jan. 21.	65
Toronto, Ont., conduits, manholes..	Feb. 8.	Jan. 21.	46
Ottawa, Ont., cement	Jan. 28.	Jan. 21.	46
Kingston, Ont., annual supplies, this issue.			
London, Ont., electrical apparatus, this issue.			
Winnipeg, Man., street cleaning supplies, this issue.			
Saskatoon, Sask., footbridge, this issue.			
Vancouver, B.C., pavements, this issue.			

CONTRACTS AWARDED.

Adamsville, Que.—The Laurentian Construction & Engineering Company, Ltd., have been awarded the contract for the construction of a bridge over the eastern branch of the Yameska River, by this municipality, of which Mr. E. Vanier is town engineer. The tenders submitted follow:

Laurentian Construction & Engineering Co., Ltd...	\$ 9,350
Phoenix Bridge and Iron Works, Ltd.....	9,750
MacKinnon, Holmes & Co., Sherbrooke, Que.....	9,875
Structural Steel Company, Ltd.	10,600

The work will be commenced almost immediately.

Howick, Que.—The Western Bridge & Equipment Co., of Chatham, Ontario, has been awarded contract for steel bridge, with concrete abutments. The price was \$15,548.50; the other tenders ranged from \$16,500 to \$15,400.

Kingston, Ont.—H. Chadwick receives a contract from the city for four thousand barrels of cement at \$1.69 as a result of further consideration by the board of works. The board decided at a previous meeting not to accept any of the tenders, believing they could secure a cheaper supply on the open market.

Ottawa, Ont.—Koenig & Company have been awarded a contract for removing the debris of the Quebec bridge at \$45,000. The anchor pier is to be ready by next April and another main pier by May 15th.

Stratford, Ont.—The Lancashire Dynamo & Motor Company were awarded the contract for pumps and motors, the Water Commissioners selecting the four units clutch coupled on one bed-plate, viz., a 50 K.V.A. syn. motor and a million imp. gallon pump, and a 100 K.V.A. syn. motor and a million and a half pump, all running at 1,500 revolutions per

m., with exciter and switchboards, the power being 2,200 volt, 25 cycle, 3 phase electricity. The complete bids were: A, \$5,185; B, \$5,500, plus bed plate; C, \$6,008, plus bed plate; D, \$9,175; E, \$10,500, 750 revolutions only.

Toronto, Ont.—The Don Construction Company was given the contract for piling at the Wiltón Avenue Bridge. The tender for 1,808 feet of sheet piling is 50 cents per foot, and 18 cents per foot for 16,320 feet of common piling.

Bruce Township council has awarded the contract for the building of reinforced flat arch bridge 54 ft. span over 6th concession Willow Creek to C. S. Wood, Tiverton, Ont. Also reinforced flat arch bridge 25 ft. over the 8th concession to C. S. Wood.

Winnipeg, Man.—The board of works recommends that the tender for wire-fencing and gates for the power transmission line right-of-way be awarded to the Canadian Steel & Wire Company, of Winnipeg, for \$3,348, and the tender for posts for the same line to Weatherby & Eklund, of Winnipeg, for \$3,399.30. The council acted accordingly. The contracts include the supply of about eighteen thousand posts, the manufacture and delivery of about forty-two miles of woven wire fence, and the erection of the fence along the right-of-way of the city's transmission line, between the Brokenhead River and the city. M. Peterson, secretary, Board of Control.

Calgary, Alta.—Contract for the general work in connection with the new plant of the Calgary Power & Transmission Company has been awarded to the Walter Fyshe Co., of Montreal, while the General Electric Mfg. Co., of Sweden, will probably supply four 750 k.w. water-cooled, step-down transformers. Smith, Kerry & Chace, Toronto and Calgary, are the consulting engineers.

Vancouver, B.C.—Evans, Coleman & Evans were awarded the contract for steel pipe required in connection with the waterworks at \$24,400, while Robertson, Godson & Company secured the order for cast iron pipe per April delivery, at \$33.91 a ton. In all there were two hundred and fifty tons of four-inch cast iron pipe required and 3½ miles of 6-inch, one mile of 8-inch, and 2½ miles of 12-inch steel pipe. The next lowest bid for the cast iron pipe was \$38.35 per ton from Messrs. F. Hankin. For the supply of steel pipe Gardiner Johnson was next in order to Messrs. Evans, Coleman & Evans.

Victoria, B.C.—The contract for the sternwheel steamer for the Prince Rupert Skeena Navigation Company to ply between Prince Rupert and Hazelton has been let to the Victoria Machinery Depot, the contract price being \$40,000. The vessel is to be completed by April 20th and will be built in Victoria.

Cohoes, N.Y., U.S.A.—For supplying the motor-driven pumps of its municipal water filtration plant, the City of Cohoes, N.Y., has installed two Westinghouse gas engine driven, direct current, generator sets, using producer gas as fuel. Both engines are of three cylinder type, 15 × 14 inches, and develop 125 horse-power. They are direct connected to two 75 kilowatt, 125 volt Westinghouse direct current generators. The output of these machines furnishes power for the motors driving the pumps of the city water supply, besides several other small motors about the plant, and the local lighting. The producer gas for this installation is derived from two 125 horse-power J-25 Westinghouse gas producers.

RAILWAYS—STEAM AND ELECTRIC.

Halifax, N.S.—It was recently announced here that the Canadian Northern Railway had purchased the Dominion Atlantic Railway from Halifax to Yarmouth.

Montreal, Que.—A newspaper report says financial arrangements have been made which will assure the construction of the Central Railway of Canada without delay. This line goes up the Ottawa River on the north side from Montreal to the Great Lakes, and it is said that Mackenzie and Mann will get running powers from Montreal to Hawkesbury over the projected railway.

Trenton, Ont.—It is expected that construction of the Central Ontario Railway will be resumed on the extension from Lake St. Peter, Ont., to Whitney, 17 miles. J. D. Evans, chief engineer, Trenton, Ont.

Winnipeg, Man.—A branch of the G.T.P. from Biggar

to Battleford will be commenced early in the coming summer. In addition to this branch, a line will be built from a point some twenty miles south of Battleford, and will run westward through the Cut Knife district to connect with the main line at or near Wainwright. A survey party is already in the field, locating the new route of the first mentioned branch, which will be several miles to the westward of the line first proposed last year.

Vancouver, B.C.—Press dispatches state that the C.P.R. has decided to award contracts this spring for the construction of 50 miles of the Kootenay Central.

Vancouver, B.C.—Mr. D. D. Mann recently stated that work on the C.N.R. line in British Columbia would be commenced early in the season.

Vancouver, B.C.—Construction of the extension of the V. V. & E. Railway from Princeton west to Otter Flat, 18 miles, will be carried on simultaneously with the building of the line west of the Hope Mountains between Abbotsford and Hope, on the Fraser River. At the head offices of the Great Northern it was recently announced that both contracts have been awarded to J. W. Stewart & Company, whose personnel is the same as Messrs. Foley, Welch & Stewart, the Grand Trunk Pacific Railway contractors. The grading outfits of the company are now at Princeton, and an immediate start on construction work will be made. The section west of the Hope Mountains will also be the scene of activity as soon as the contractors' outfits can be shipped to Abbotsford and Hope. Previously mentioned.

LIGHT, HEAT, AND POWER

Montreal, Que.—Action has been entered by the City of Maisonneuve against the Royal Electric Company and the Montreal, Light, Heat & Power Company for annulment of their contract on the grounds that the lights furnished for the city do not meet the requirements contracted for. This is by the way of a counter action in the long series of legal disputes between Maisonneuve and the Light, Heat & Power Company over their lighting system. The company claims an exclusive franchise over the streets of Maisonneuve, and started the action by entering suit to enforce its alleged rights by way of seeking an injunction to prevent the Dominion Light, Heat & Power Company from installing its poles and service in that municipality.

Ottawa, Ont.—The Ottawa and Montreal Transmission Company, Ltd., has given notice that it will apply to parliament for extensive powers with regard to laying out water powers and all the necessary appliances for the production of electricity, or other power or energy. The location of its works will be more specially located in the Argenteuil, Deux Montagnes, Laval, counties of Pontiac, Wright, Labelle, Jacques Cartier and Hochelaga. Christie, Greene and Hill, Ottawa, are solicitors for the applicants.

Toronto, Ont.—The Cobalt, Light, Power & Water Company is granted permission to issue bonds to the extent of \$75,000, according to the latest issue of the Ontario Government Gazette.

Victoria, B.C.—Matthew Hutchinson, city electrician, reporting on the street lighting department urges immediate extensions to the lighting plant.

PERSONAL.

Mr. A. S. Balsden has tendered his resignation as manager of the St. Thomas, Ont., Street Railway, which is owned by the city.

Mr. R. E. Chadwick, Toronto, who has been Acting Assistant City Engineer in charge of bridges, was permanently appointed yesterday by the Board of Control.

Mr. Arthur E. Pugsley was this week elected to the position of Warden of York County. For the past six years Mr. Pugsley has been very actively engaged in York County municipal work, having been a Councillor and a Reeve.

Mr. H. C. H. Neville, who has been town engineer of Red Deer, Alta., for the past year, has accepted the position of chief engineer of the Alberta & Great Waterways Railway, with headquarters at Edmonton, Alta.

A. F. Dunlop, R. C. A., having resigned from the Royal Architectural Institution, Mr. F. S. Baker, F.R.I.B.A., has been elected to the vacancy.

A. W. Campbell, Deputy Minister of Public Works for the Province of Ontario, has been appointed to the position of Deputy Minister of Railways and Canals, thus filling the vacancy caused by the retirement of Mr. M. J. Butler. Mr. Campbell was born at Wardsville, Ontario, in 1863. In 1888 became member of the Canadian Society of Civil Engineers, in 1891 Mr. Campbell was appointed City Engineer of St. Thomas, Ontario, and in 1896 was appointed Provincial Commissioner of Highways. In 1902 was promoted to the position of Deputy Minister of Public Works for the Province of Ontario. Mr. Campbell is at the present time President of the Toronto Branch of Canadian Society of Civil Engineers, and is known far and wide for his intense interest in the subject of good roads.

Mr. George McL. Brown has been appointed European manager of the C.P.R., to succeed the late Archer Baker. Mr. Brown has spent most of his life in railroad work. He left Montreal in the last days of 1908 for London to succeed Mr. Allan Cameron as general traffic agent of the C.P.R., Mr. Cameron being transferred to New York. At that time Mr. Brown was general passenger agent of the C.P.R. steamship service. During most of his business career Mr. Brown has been connected with the Canadian Pacific. A son of Mr. Adam Brown, ex-M.P., and now postmaster of Hamilton, Ont., he early entered the railroad service. After filling various less important positions he was sent to Vancouver as executive agent of the company on the Pacific coast. This position he held until 1900, when he was appointed superintendent of the sleeping and dining car service at Montreal. From this he was again promoted as general passenger agent of the Atlantic steamship service. This was just before the Empresses were built by the C.P.R., and with the increase of business that came after these vessels were put in commission Mr. Brown made a good record, which led to his further advancement until he has now secured one of the most coveted positions in the service.

OBITUARY.

Mr. Arthur Baker, general European manager of the Canadian Pacific Railway, died in London, Eng., Saturday, January 15th, at the age of 65 years. He had been suffering from an attack of pneumonia. The late Mr. Baker was the son of Stephen Baker, of York, England. He was born at York on June 21, 1845, being educated at York Grammar School, afterwards coming to Canada. He was appointed accountant of the Brockville and Ottawa Railroad, and also of the Canadian Central. He was afterwards successively secretary-treasurer and general manager of the same companies and general superintendent of the Eastern division of the Canadian Pacific Railway. For some years he held the office of general European manager of the C.P.R. at London, England, and, in the discharge of his duties, he rendered valuable services. Mr. Baker was a brother of W. R. Baker, of Montreal, secretary of the Canadian Pacific Railway. He was a popular official, and his death is sincerely regretted by his colleagues and friends.

SOCIETY NOTES.

Engineering Society, Toronto University.—On Wednesday evening, January 19th, some seven hundred graduates, undergraduates and guests gathered at the twenty-first annual dinner of the Engineering Society of the University of Toronto. It was a most successful affair. The students were at their best, lively in their contributions to the programme and attentive to the various addresses. The distinctive feature of the occasion was the presence of more than seventy-five representatives of the Canadian Manufacturers' Association and their unreserved enthusiasm for the work done by the University as a factor in the industrial development of Canada.

Mr. W. D. Black, the 1909-10 president of the society presided. The toast to "Canada and the Empire," pro-

posed by Mr. A. G. McLeish, who gave voice to the loyal sentiments and aspirations of the students, was responded to by Dr. J. A. Macdonald, who warned against evils and abuses which must be taken out of the way if Canada is to come to its own and if the Empire is to remain united and strong. He emphasized specially the economic waste of natural resources, the social waste of workers, through bad conditions of life and low ideals of service, and the industrial waste which can be cured only through thorough and systematic technical education, and the practical application of the scientific knowledge of the universities to the industries of the country.

President Falconer, responding for the University to a toast proposed by Mr. E. R. Gray, urged the necessity for the work of applied science in developing the natural resources of Canada, and pointed out how not one department alone but the entire work of the University has to do with solving the real problems of Canada. The human resources, the raw materials of immigration, the facts of society and of politics—all these need the University for their development and proper use. He pressed home on the students their duty in justifying by their lives and services the expenditures on the Provincial University.

Mr. A. D. Campbell, in proposing "Canadian Industries," indicated the relation of the University to the various industrial activities. In response, Mr. Louis Simpson, of Ottawa, dealt with the recent progress made in the uses of electricity in smelting, and the economic wealth resulting from the electric treatment of otherwise valueless ores. He also argued for the better industrial education of the farmers, and urged that the foundations be well laid in the public schools. Mr. J. P. Murray, of Toronto, made a plea for the use of the schools in country places and villages for extending industrial education among those who could not attend the University. He illustrated the growing value of scientific knowledge by reference to the textile industry. Mr. P. W. Ellis made a point of the scientific uses of Niagara Falls and water power in Ontario as a substitute for coal.

"The Engineering Profession" was presented by Mr. R. H. Johnson, and responded to by Mr. W. J. Blair, and the honored Dean, Dr. Galbraith.

On all hands the effort to bring the Provincial University into closer touch with all the industrial activities of the country was approved and commended.

Engineers' Club of Toronto.—Members of the Engineers' Club and other local civil engineers met in the new mechanical laboratories of the University of Toronto last Thursday evening, when Professor Robert W. Angus delivered an illustrated address on turbine pumps, following which the laboratories were opened for inspection and experiments, conducted with steam and gas engines, water turbines and pumps. One hundred attended the meeting. Mr. C. M. Caniff presided.

Montreal Builders' Exchange.—At the twelfth annual meeting of the above society, held last Wednesday evening, the following nominations to office were made: President, J. N. Arcand; vice-president, James Ballantyne; board of directors (eleven), E. G. M. Cape, A. Bremner, Frank Pauze, K. D. Church, E. W. Sayer, Joseph Brunet, William Rutherford, W. T. Castle, J. W. Hughes, Thomas Gilday, and T. A. Morrison.

Announcement is made on another page of this issue of the establishment, in this country of the business of Bruce Peebles & Company, Ltd., Edinburgh, Scotland, manufacturers of electrical apparatus, through their Canadian representatives, Messrs. Vandeleur & Nichols, Dineen Building, Toronto. The firm of Bruce Peebles & Company, Ltd., was established in 1866, but it was not until 1897 that the electrical department was added. The business, however, in their electrical specialties has grown so rapidly as to almost eclipse other departments and the works were gradually increased until they now occupy a site covering over ten acres, the location being near Granton, just outside of Edinburgh. The British Government repeatedly places large contracts in their hands, of which mention might be made of H.M. Dockyard, Chatham; H.M. War Office; Watham Abbey Powder Factory; Enfield Small Arms Factory; H.M. India Office equipment for State railways, and the Crown agent, for Natal Government, turbo generators and motor converter sets.

MARKET CONDITIONS.

Following the quotations of the various articles listed in the markets will be found in brackets numbers, thus (10). These numbers refer to the list number of advertisers on page 3 of this issue and will assist the reader to quickly find the name and address of a firm handling any particular article. Buyers not able to secure articles from these firms at the prices mentioned will confer a favor by letting us know.

Montreal, January 25th, 1910.

Reports from the United States would go to show that the sales of pig-iron during the month of January are apt to reach the high figure of 500,000 tons. This compares with about 200,000 tons in January of 1909, and with about 400,000 for the entire first quarter of that year. Consequently, there is every indication of activity in the markets of the United States. The large sales referred to, however, are not being made without some concession on the part of producers. These are rather easier in their ideas respecting the second half of the year, and seem prepared to entertain slightly lower prices. It is reported that sales of steel making iron have taken place within the past few days at a reduction of about 25c. per ton. Some large makers of foundry grades have been accepting prices for the third quarter which they were previously asking for the second quarter and first half. It is believed that 125,000 tons were sold last week. There is also a demand for ore and coke and it would seem that these could be purchased at a slight reduction on previous prices. It now looks as though Connellsville furnace coke will sell in the neighborhood of \$2.25 per ton, at the furnace, for delivery over the second half of the year. A congestion in railway traffic is reported from the eastern portion of the United States, and this is interfering with shipments to some extent.

Scotch and English makers of pig-iron seem to be feeling pretty cheerful regarding the general outlook, the tenor of their demands being constantly upwards. There have been no material changes in price during the past week, and, as a matter of fact, cable offers are subject to reply as soon as received. Apparently, pig-iron producers in both Scotland and England are satisfied that better conditions will prevail during the spring and summer months, and they are therefore asking higher prices the later the deliveries are required. Continental advices are all favorable and the indications are that there will be a fair call from Germany and Italy, and possibly from other parts, for English metal. This is having its influence on makers' views.

There is an active demand in the Montreal market and considerable business has been put through in the past few days. Consumers are not only in receipt of good orders, but are apparently finding a difficulty in securing supplies, the result being that many of them are now taking up the question of securing their requirements for the most of, if not the whole of, 1910. The bulk of the metal being purchased is English or Scotch, as Canadian furnaces are unable to supply any considerable tonnage for delivery within the next six months or so.

Merchants who handle sheets, bars, plates, structural steel and similar lines are in a quandry to know what to make of the situation. Prices have advanced, apparently, in almost all other markets, and demand would seem to be active outside of Montreal. Here, however, dullness continues and it looks as though there was not the slightest chance of getting prices up for some weeks or months to come. Evidently, the supply is still fully equal to requirements and there is fully as much pressure from the selling as from the buying side.

Antimony.—The market is steady at 8 to 8½c. (111).

Bar Iron and Steel.—The market promises to advance shortly. Bar iron, \$1.85 per 100 pounds; best refined horseshoe, \$2.10; forged iron, \$2; mild steel, \$1.85; sleigh shoe steel, \$1.85 for 1 x ¾-base; tire steel, \$1.00 for 1 x ¾-base; toe calk steel, \$2.35; machine steel, iron finish, \$1.90; imported, \$2.20. (111, 119).

Building Paper.—Tar paper, 7, 10, or 16 ounces, \$1.80 per 100 pounds; felt paper, \$2.75 per 100 pounds; tar sheathing, 40c. per roll of 400 square feet; dry sheathing, No. 1, 30 to 40c. per roll of 400 square feet; tarred fibre, 55c. per roll; dry fibre, 45c. (See Roofing; also Tar and Pitch). (164).

Cement.—Canadian cement is quotable, as follows, in car lots, f.o.b., Montreal:—\$1.30 to \$1.40 per 350-lb. bbl., in 4 cotton bags, adding 10c. for each bag. Good bags re-purchased at 10c. each. Paper bags cost 2½ cents extra, or 10c. per bbl. weight. (26, 86, 164).

Chain.—Prices are as follows per 100 lbs.:—¼-inch, \$4.90; 5-16-inch, \$4.40; ¾-inch, \$3.70; 7-16-inch, \$3.50; ½-inch, \$3.25; 9-16-inch, \$3.20; ¾-inch, \$3.15; ¾-inch, \$3.10; ¾-inch, \$3.05; 1-inch, \$3.05.

Coal and Coke.—Anthracite, egg, stove or chestnut coal, \$6.75 per ton, net; furnace coal, \$6.50, net. Bituminous or soft coal: Run of mine, Nova Scotia coal, carload lots, basis, Montreal, \$3.85 to \$4 per ton; cannel coal, \$9 per ton; coke, single ton, \$5; large lots, special rates, approximately \$4 f.o.b., cars, Montreal.

Copper.—Prices are strong at 14 to 14½c.

Explosives and Accessories.—Dynamite, 50-lb. cases, 40 per cent. proof, 15c. in single case lots, Montreal. Blasting powder, 25-lb. kegs, \$2.25 per keg. Special quotations on large lots of dynamite and powder. Detonator caps, case lots, containing 10,000, 75c. per 100; broken lots, \$1; electric blasting apparatus:—Batteries, 1 to 10 holes, \$15; 1 to 20 holes, \$25; 1 to 30 holes, \$35; 1 to 40 holes, \$50. Wire, leading, 1c. per foot; connecting, 50c. per lb. Fuses, platinum, single strength, per 100 fuses:—4-ft. wires, \$3; 6-ft. wires, \$3.54; 8-ft. wires, \$4.08; 10-ft. wires, \$5. Double strength fuses, 4-ft., \$3.75; 6-ft., \$4.29; 8-ft., \$4.83; 10-ft., \$5.37. Fuses, time, double-tape, \$6 per 1,000 feet; explometers, fuse and circuit, \$7.50 each. (83).

Galvanized Iron.—The market is steady. Prices, basis, 28-gauge, are:—Queen's Head, \$4.10; Colborne Crown, \$3.85; Apollo, 10¼ oz., \$4.05.

"FLEUR DE LIS"



Galvanized Iron

Works Well and Wears Well

JOHN LYSAGHT, LIMITED
Makers, Bristol

A. C. LESLIE & CO., LTD.
Montreal

10

Add 25c. to above figures for less than case lots; 26-gauge is 25c. less than 28-gauge, American 28-gauge and English 26 are equivalents, as are American 10¼ oz., and English 28-gauge. (111).

Galvanized Pipe.—(See Pipe, Wrought and Galvanized).

Iron.—The outlook is strong. The following prices are for carload quantities and over, ex-store, Montreal, prompt delivery; No. 1 Summerlee, \$21.50 to \$22 per ton; selected Summerlee, \$21 to \$21.50; soft Summerlee, \$20.50 to \$21; Clarence, \$19.50 to \$20; Carron, No. 1, \$21.50 to \$22, and Carron special, \$21 to \$21.50. (111).

Laths.—See Lumber, etc.

Lead.—Prices are about steady at \$3.55 to \$3.65.

Lead Wool.—\$10.50 per hundred, \$200 per ton, f.o.b., factory.

Lumber, Etc.—Prices on lumber are for car lots, to contractors, at mill points, carrying a freight of \$1.50. Red pine, mill culls out, \$18 to \$22 per 1,000 feet; white pine, mill culls, \$16 to \$17. Spruce, 1-in. by 4-in. and up, \$15 to \$17 per 1,000 ft.; mill culls, \$12 to \$14. Hemlock, log run, culls out, \$13 to \$15. Railway Ties; Standard Railway Ties, hemlock or cedar, 35 to 45c. each, on a 5c. rate to Montreal. Telegraph Poles: Seven-inch top, cedar poles, 25-ft. poles, \$1.35 to \$1.50 each; 30-ft., \$1.75 to \$2; 35-ft., \$2.75 to \$3.25 each, at manufacturers' points, with 5c. freight rate to Montreal. Laths: Quotations per 1,000 laths, at points carrying \$1.50 freight rate to Montreal, \$2 to \$3. Shingles: Cedar shingles, same conditions as laths, X, \$1.50; XX, 2.50; XXX, \$3. (112).

Nails.—Demand for nails is better and prices are firmer, \$2.40 per keg for cut, and \$2.35 for wire, base prices. Wire roofing nails, 5c. lb.

Paints.—Roof, barn and fence paint, 90c. per gallon; girder, bridge, and structural paint for steel or iron—shop or field—\$1.20 per gallon, in barrels; liquid red lead in gallon cans, \$1.75 per gallon.

Pipe—Cast iron.—The market is unsettled and uncertain, as dealers are compelled to meet competition from all sources. Prices are easy and approximately as follows:—\$31 for 6 and 8-inch pipe and larger; \$32 for 5-inch and 4-inch at the foundry. Pipe, specials, \$3 per 100 pounds. Gas pipe is quoted at about \$1 more than the above. (74, 188).

Pipe—Wrought and Galvanized.—Demand is much better and the tone is firm, though prices are steady, moderate-sized lots being: ¼-inch, \$5.50 with 69 per cent. off for black, and 48 per cent. off for galvanized; ½-inch, \$5.50, with 59 per cent. off for black and 44 per cent. off for galvanized; ¾-inch, \$8.50, with 69 per cent. off for black, and 59 per cent. off for galvanized. The discount on the following is 71½ per cent. off for black, and 61½ per cent. off for galvanized; ¾-inch, \$11.50; 1-inch, \$16.50; 1¼-inch, \$22.50; 1½-inch, \$27; 2-inch, \$36; 2½-inch, \$57.50; 3-inch, \$75.50; 3½-inch, \$95; 4-inch, \$108.

Plates and Sheets.—Steel.—The market is steady. Quotations are: \$2.20 for 3-16; \$2.30 for ¼, and \$2.10 for ½ and thicker; 12-gauge being \$2.30; 14-gauge, \$2.15; and 16-gauge, \$2.10. (111).

Rails.—Quotations on steel rails are necessarily only approximate and depend upon specification, quantity and delivery required. A range of \$30.50 to \$31 is given for 60-lb. and 70-lb.; 80-lb. and heavier, being \$30; rails, per gross ton of 2,240 lbs., f.o.b. mill. Re-laying rails are quoted at \$27 to \$29 per ton, according to condition of rail and location. (73).

Railway Ties.—See lumber, etc.

Roofing.—Ready roofing, two-ply, 70c. per roll; three-ply, 95c. per roll of 100 square feet. Roofing tin caps, 6c. lb.; wire roofing nails, 5c. lb. (See Building Paper; Tar and Pitch; Nails, Roofing). (164).

Rope.—Prices are steady, at 9c. per lb. for sisal, and 10½c. for Manila. Wire rope, crucible steel, six-strands, nineteen wires; ¾-in., \$2.75; 5-16, \$3.75; ¾, \$4.75; ¾, \$5.25; ¾, \$6.25; ¾, \$8; ¾, \$10; 1-in., \$12 per 100 feet. (132).

Spikes.—Railway spikes are firmer at \$2.45 per 100 pounds, base of 5½ x 9-16. Ship spikes are steady at \$2.85 per 100 pounds, base of ¾ x 10-inch, and ¾ x 12-inch. (132).

Steel Shafting.—Prices are steady at the list, less 25 per cent. Demand is on the dull side.

Telegraph Poles.—See lumber, etc.

Tar and Pitch.—Coal tar, \$3.50 per barrel of 40 gallons, weighing about 500 pounds; roofing pitch, No. 1, 70c. per 100 pounds; and No. 2, 55c. per 100 pounds; pine tar, \$8.50 per barrel of 40 gallons, and \$4.75 per half-barrel; refined coal tar, \$4.50 per barrel; pine pitch, \$4 per barrel of 180 to 200 pounds. (See building paper; also roofing).

Tin.—Prices are unchanged, at 32½ to 33c.

Zinc.—The tone is steady, at 6 to 6½c.

CAMP SUPPLIES.

Beans.—Prime pea beans, \$1.85 per bushel. (38).

Butter.—September and October creamery, 26c.; dairy, 22 to 23c.

Canned Goods.—Per Dozen.—Corn, 80 to 85; peas, \$1.05 to \$1.15; beans, 75 to 80c.; tomatoes, 82½ to 90c.; peaches, 25, \$1.65, and 35, \$2.65; pears, 25, \$1.60, and 35, \$2.30; salmon, best brands, 1-lb. talls, \$1.87½, and flats, \$2.02½; cheaper grades, 95c. to \$1.65.

Cheese.—Late makes, 11¼ to 11½c.; finest makes, ¼c. more.

Coffee.—Mocha, 20 to 25c.; Santos, 15 to 18c.; Rio, 10 to 12c. (38).

Dried Fruits.—Currants, Filiatras, 5¼ to 6¼c.; choice, 8 to 9c.; dates, 10 to 12c.; raisins, Valentias, 5 to 6c.; California, seeded, 7½ to 9c.; Sultana, 8 to 10c. Evaporated apples, prime, 9¼ to 9½c.