

**PAGES**

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# The Canadian Engineer

WEEKLY

ESTABLISHED 1893

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## The Canadian Engineer

ESTABLISHED 1893

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

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### THE REPORT.

The long looked for report on the Quebec Bridge disaster has been presented. There is no mistaking the Commissioners finding. They state clearly and emphatically the conclusions to which they have arrived. The task has been a difficult one. The information that had to be collected was

voluminous, plans had to be studied, stress sheets checked, methods of manufacture and construction inquired into, nothing spectacular, but persistent plodding, and six long months of keen application and steady grind.

Their findings will be generally accepted and the Commissioners are to be commended in that they state definitely on whose shoulders rest the blame for the collapse of the structure and for the death of the workmen.

From an engineering standpoint the two important findings were that the "professional knowledge of the present day concerning the action of steel columns under load is not sufficient to enable engineers to economically design such structures;" and that "a bridge of the adopted span will unquestionably be safe can be built." If a discussion, profitable to engineers, is to be entered into in reference to this report it seems to us it must be in reference to the phase of the question suggested by these two clauses. If the discussion is focused on this section of the report good may come out of it.

It will not be worth while wasting paper trying to prove that the Commission were not severe enough on the Government for being so careless in inspection where they had such a large financial interest. Of course they were to blame, but Government Commissions don't censure Governments. For years Governments have been lax in the inspection of bonded and public works. They have granted millions of dollars and accepted miles and miles of railways after the most perfunctory, inconsistent and unsystematic inspection. Why should they be more careful over a bridge?

That the Quebec Bridge and Railway Company were penny wise and pound foolish is more remarkable. Large corporations are usually more careful. That they had not on the work an engineer of wide experience in large bridge work, a man capable of detecting faulty design and with courage to insist on correction was a grievous fault. To much trust was placed in their consulting engineer, and the glamour of his past success seems to have dimmed the eyes of that otherwise clear-sighted engineer, the venerable consulting engineers of the Canadian Department of Railways. If Mr. Schreiber had only insisted on Mr. Douglas' recommendation being carried out, but if—

The bridge fell, after six months, we know who to blame, but are we any wiser as to economic suitability of the design? What information have our Commissioners secured that will assist in the speedy completion of the bridge?

The Quebec Bridge is of the past, but is yet of the future. Its erection is not impossible. Engineers have not lost confidence in themselves, nor have the Canadian people lost confidence in the ability and resourcefulness of civil engineers. The clear complete report of the Quebec Bridge Commission should be a splendid guide by which to locate the steps to be avoided in planning the second Quebec Bridge.

### THE UNSUCCESSFUL.

Every now and then some unsuccessful tenderer states his tale of woe to the public. Occasionally this is wise, but only when he can follow it up with information such as will lead the public to see the justice of his claim.

Sometimes the engineer responsible for the selection of machinery or material does not recommend that the contract be granted to the lowest tenderer. When an engineer does that you may be sure he has made the recommendation after mature deliberation, and having regard to the available in-



formation. Engineers are not in the habit of selecting the higher tender except for good and sufficient reasons. When they do the unsuccessful lower tenderer only advertises the defects of his material when he gives publicity to fact that he was beaten. Time and energy expended in complaining of unfair treatment would be much better spent in improving the design, method of construction and reliability of output.

Nor do we think much is gained, but complaining against outside competition. It is the profits, or supposed profits, that encourage competitors. If they do not come from outside places they will soon develop at home. One may, for a time, by special legislation secure some advantages, but they will not be lasting. The man or the company who follows sound business methods, giving value for money received, keeping in touch with recent designs and improvements, will be so busy filling orders that he will not have time to do anything more than congratulate his successful competitor.

### EDITORIAL NOTES.

With this week's issue we add another section, the Winnipeg markets, to our Market Condition page. This week the list furnished is small, but it will be added to from time to time. We will be pleased to receive suggestions from our Western readers as to what items should be added to this list.

\* \* \* \*

We are told the Quebec Bridge Commissioners were unanimous in their findings. The daily press are not unanimous in their reading of the report. One section says the "Government is responsible," the other "they were not."

### ELECTRIC POWER SUPPLY IN LONDON.

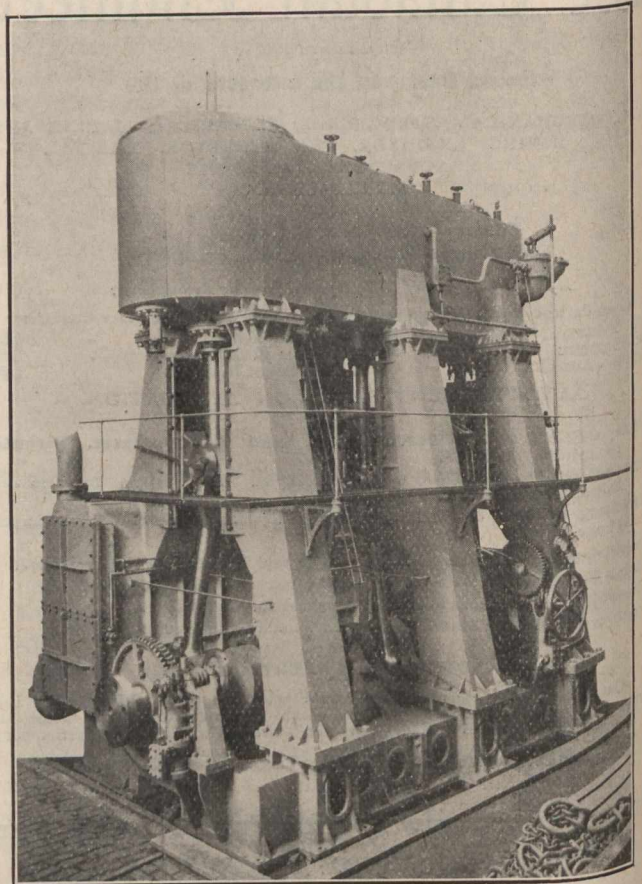
An important proposal will come before Parliament this session dealing with the long drawn out electric power supply question as it affects London. As I have already pointed out, peculiar conditions prevail in the Metropolis, such as are to be found in no other city certainly in Great Britain, nor do I believe many of the great countries of the world. Owing to the division of the County of London into some thirty local governing bodies, with strictly defined areas, the supply of electrical energy has been equally subdivided, a condition of affairs which has been a great handicap both to the supply authority and to the consumer. A further anomaly has been that a company or local authority supplying in one area was forbidden to supply a company or local authority in the next area, even in case of emergency. In view of these circumstances, no surprise has been expressed at the efforts made by outside promoters to get Parliamentary powers overriding those of the existing authorities. Fortunately for the supply authorities already in existence these efforts have been frustrated by some means or other, and at last a scheme has been evolved for putting the whole of the multifarious electric supply undertakings now serving London, under one control and management. The scheme provides for an extended franchise until 1932 or 1952, with modified powers of control by the London County Council, and for the purchase of the joint undertakings by a special authority to be nominated by Parliament.

The little town of Minnedosa, on the Yorkton branch of the C.P.R., is the latest exponent of an ambitious and practicable power scheme to secure local industries. It is stated that the town has entered into an agreement with eastern capitalists to instal power plant of a minimum 600 horse-power, which is to be in operation during the present year for the supply of light and power to the citizens at fixed rates. It is also stated that the Power Company has deposited \$500 as a guarantee of their good faith, and have agreed to purchase the franchise and plant of the Minnedosa Light Company. The timber required for the construction is already on the ground, and it is understood that operations will start immediately on the Little Saskatchewan, where a dam will be formed 1,600 feet long, 25 feet high, flooding an area of 4½ miles. The Provincial Government have ratified the contract made between the city and the company. This makes it possible to carry out the agreement at an early date.

### TRIPLE EXPANSION 3,000 HORSE-POWER VERTICAL ENGINES.

The accompanying illustration shows a high power vertical triple expansion set of engines, constructed at Sunderland, England, for the recently launched steel screw steamer "Rotterdam," operating between Baltimore and Rotterdam.

It will be noted that the go-astern and go-ahead guides are carried on independent back and front columns, and it is stated that the crankshaft is in three interchangeable parts and made of ingot steel. This set of triple expansion en-



gines, with cylinders 28 inches, 46 inches and 77 inches in diameter, respectively, for the high, intermediate and low pressure, has a stroke of 54 inches, and the all-round reversing gear and the turning gear are operated by independent engines.

The steam is supplied from three boilers, each having three furnaces. The boilers are over 15 feet in diameter and 11½ feet long, the nine furnaces to be equipped with forced draught of the Howden system. The steam is taken by the high pressure cylinders of the engines at 180 pounds pressure, and 3,000 horse-power is obtained when operating at a speed of 68 revolutions per minute.

Developing this power the steel screw steamer "Rotterdam" makes 12¾ knots per hour. She is 435 feet long, and has a cargo carrying capacity of eighteen million pounds. It is stated that 2,000 tons of water ballast is carried in a cellular bottom, with a large deep tank, and after peak. Steam steering gear is employed, steam windlasses, as well as an electric plant for supplying current for lighting and small auxiliary motors for ventilating, pumping, and other light service.

The Montreal Board of Trade, having in mind the welfare of the port of Montreal, is petitioning the Government to refuse the building of any bridge across the St. Lawrence below the city which would not have a clearance of 190 feet. The board thought that the original height of the Quebec bridge, 150 feet, was sufficient for any steamer which could safely navigate the river at its present depth, but does not want the Government to permit the building of any bridge in future which would place a limit on the size of ships which the channel may be made to accommodate. The board is of opinion that 190 feet in height may be attained by the funnels of ships which the channel may be made to accommodate in future, and mentions that height as the least the Government should allow.

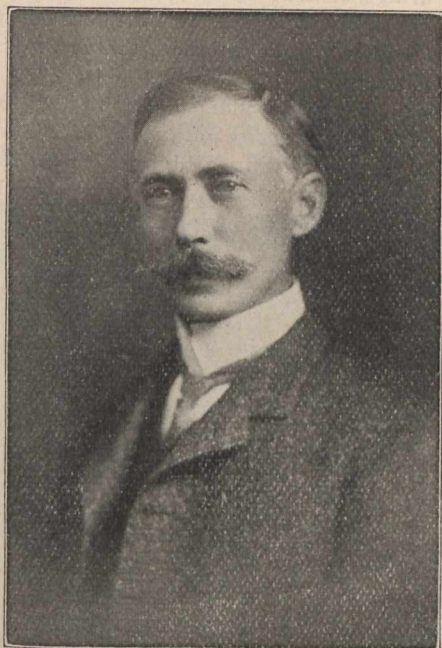


**THE QUEBEC BRIDGE COMMISSION.**

When in August last the whole of Canada—in fact the whole Anglo-Saxon world was startled by the news of the fall of the Quebec Bridge, the first question was who is to blame? Where lies the fault?

It was not to be expected that some one was to voluntarily accept blame—that is not human nature. The Canadian Government felt with the Canadian people that this was a national disaster, and that the first step in the repair was to locate the weakness and have it authoritatively decided whether it was a matter of insufficient and unsatisfactory specifications, faulty design, or poor construction. It was decided to appoint a Commission, and when the names of the commissioners were announced the selection met with general approval, and it is with the object of informing our readers what manner of men these were to whom was intrusted the task of taking evidence, digesting it, and making recommendations that this article has been prepared.

Henry Holgate, C.E., a member of the firm of Ross and Holgate, Chairman of the Royal Commission of Enquiry into



**Mr. Henry Holgate.**

the Quebec Bridge, was born at Milton, Ont., on September 14th, 1863. In 1878 he became apprenticed to the Northern Railway of Canada, under the late Col. F. W. Cumberland. Six years later he was acting in charge of the engineering department of the united Northern Railway and the Hamilton and North Western Railways. In 1888 these roads were absorbed into the Grand Trunk System, and Mr. Holgate continued to occupy his position under the new management until 1892, when he became engineer of the Central Bridge Company, of Peterboro, Ont. During the years 1894 and 1895 he was engineer in charge of construction for the Royal Electric Company, Montreal, and during the two following years was engineer and manager; and engineer of the Montreal Park and Island Railways. In 1898 he left for Jamaica, as engineer and manager of the West India Electric Company. This position he filled for two years, returning to Canada in 1900, and entering into private practise. The following year he entered into partnership with Mr. Robert A. Ross, himself an engineer of wide experience, particularly electrical, under the title of Ross and Holgate, as consulting and supervising engineers. During the past seven years, this firm has taken a leading position among the engineering firms of Canada, and has been connected with a large number of the most important developments from the Atlantic to the Pacific. This broad experience in construction and operation, extending over 28 years, naturally gave Mr. Holgate a grasp of the practical as well as the technical features of affairs. This, added to his reputation for independence of mind, has brought his services as arbitrator or advisor into much demand and made his appointment upon the Commission of value to the Government. In his capacity as chairman of that Commis-

sion he has spared no efforts to obtain all available evidence touching the cause of the disaster and to assimilate it so as to reach a correct conclusion. The fact that this enormous investigation has been carried on without occasioning criticism, and has been pushed to a conclusion with the least possible delay, is to no small degree due to his able chairmanship.

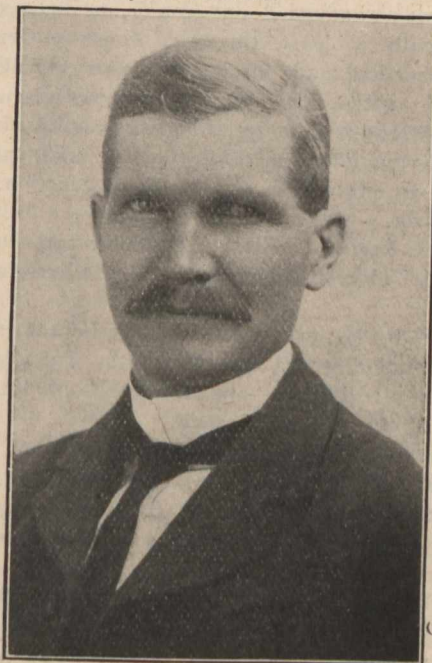


**Mr. John Galbraith.**

Associated with Mr. Holgate were John Galbraith, LL.D., Dean of the Faculty of Applied Science, of Toronto University, and J. G. G. Kerry, B.Sc., of Smith, Kerry and Chase, Toronto.

Mr. Galbraith is an engineer of wide experience as well as a college professor. A Canadian by birth, educated in Canadian schools and colleges, he has given years of service for his home-land.

In 1868 he completed his university course, graduating as Gold Medallist in Honor Mathematics, and Prince's Prize-man at the University of Toronto.



**Mr. John C. G. Kerry.**

At this time Canada was in the midst of a period of expansion and growth. The Intercolonial Railway was under construction, the Canadian Pacific surveys were being projected. It was but natural that the young graduate, with his love of large affairs, should choose railroad engineering.

From 1868 to 1871 Dr. Galbraith was articled to Geo. A. Stewart, O.L.S., and Chief Engineer of the Midland Railway. After a short experience as contractor's engineer on the Intercolonial, he returned to the Midland Railway as Resident Engineer, being shortly afterwards made Division Engineer.



From the Midland he transferred to the Georgian Bay Branch of the Canadian Pacific, but in 1878 the "call of the wild" lost its hold and he allowed himself to be appointed Principal of the School of Practical Science and Professor of Engineering, and for thirty years continuously he has devoted his energies to academic work.

In numbers, the growth of the School during that period, has been phenomenal. From a staff of two it has grown to a staff of over fifty, and from a school of a dozen it has grown to a college of over seven hundred. New departments have been added, new methods have been adopted, the field of an engineering college has enlarged, the demand for and the requirements of technically trained men has during that period vastly increased, yet John Galbraith has kept abreast of every forward move. His council has been followed in the opening of new departments—and his wisdom is seen in the success.

He does not look for reward or commendation, yet both are his. The devotion of the graduates is a tribute to his strong personality and manly character, their confidence and success the result of a good college training attributable alike to sound pedagogical methods and thorough professional knowledge on the part of the Dean.

Although Mr. Galbraith has refused repeatedly to act in a professional capacity while associated with college work, yet he has occupied positions of honor and responsibility in various organizations. This year he was elected President of the Canadian Society of Civil Engineers, and previous to this had been Vice-President of the Engineering Section of the British Association for the Advancement of Science; Vice-President of the Engineering Section of the American Association for the Advancement of Science. It would not surprise one to learn that he values these honors more highly than the degree of LL.D., conferred on him by both Toronto and Queen's University.

The announcement of his selection as one of the Commissioners was received with much satisfaction, both by the engineering profession and the public, and his fellow-commissioners will be among the first to acknowledge the large part he did in preparing the report.

The selection of a well-balanced commission cannot be an easy task, but when the composition of the Quebec Bridge Commission was announced one could not help remarking that, theoretically at least, this was a model Commission.

One member had made his mark as a successful construction engineer, another had spent thirty years discussing the theory of the strength of material and the composition of materials of construction, the third member had spent about equal time as an engineer in charge of construction, and as a college professor.

John G. G. Kerry is an Honor Graduate and Gold Medalist of McGill University, graduating in civil engineering in 1886.

From 1886 to 1893, except during 1889, he was engaged on railway construction work. First with the Canadian Pacific from their Montreal office, and afterwards on location and construction of the Algoma Branch.

During parts of 1888 and 1889 he was attached to the engineering staff of the Montreal Harbor Board as assistant engineer. In 1890 he went to the Southern States and for three years was Resident Engineer on construction on heavy work in Virginia and Carolina.

From 1893 to 1907 Mr. Kerry was connected with the teaching staff of McGill College, first as lecturer in surveying and afterwards as Associate Professor in Surveying, and lecturer in Railroad Engineering.

McGill College does not require that their professors give all their time to academic work, and during this period Mr. Kerry found time to act, in a consulting capacity, for several corporations and individuals, more particularly the East Liverpool Bridge Company, and the Grand Trunk Railway, working generally under directions from Mr. F. H. McGuigan, fourth vice-president. In 1907 became a member of new engineering firm of Smith, Kerry and Chase.

His wide and varied experience as a construction engineer, his high academic standing, together with the orderly

and logical method of thought and expression in which he trained himself as a college professor, has made Mr. Kerry an invaluable member of the Commission.

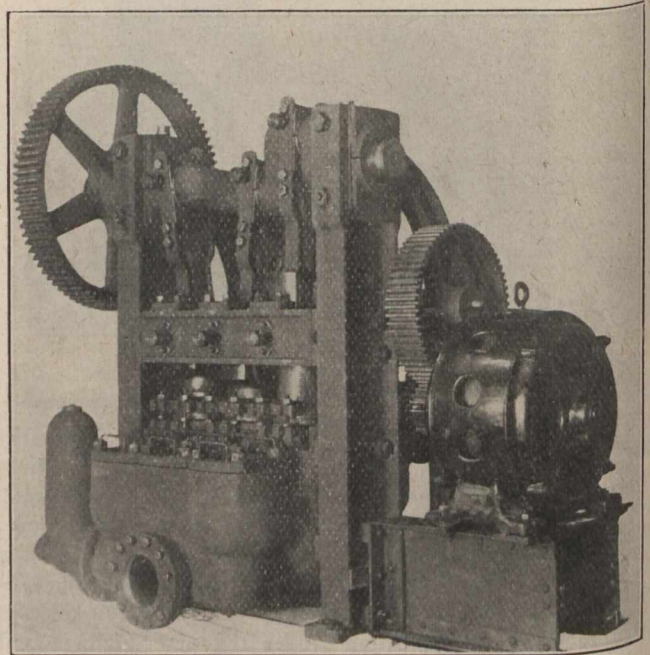
### A UNIQUE ELECTRIC PUMP.

By Frank C. Perkins.

The accompanying illustration shows the Aldrich motor-driven vertical triplex pump, which has been designed and built at the Allentown Rolling Mills. The pump was designed for the capacities up to 500 gallons, and for lifts up to 300 feet.

It will be noted that the crank shaft is maintained in a rigid manner by a journal which is entirely separated from the vertical standards, and held in position by key bolts, taking the work in shear. By means of a wedge underneath the journal the pump can be adjusted while in motion. A similar device also permits the complete regulation of the bronze adjustable bearings with which the connecting rods are fitted under the same conditions. The working barrels and guides are supported with a parabolic brace, the vertical standards being entirely separate.

It is claimed that the fundamental condition of economy in pumping is a slow velocity of water. If the valve and water areas are small, causing a high velocity, the loss is great, for the reason that the friction increases as the square of the velocity. The Aldrich triplex pump, it is held, has been designed to meet these conditions, the valve areas being



built so that the speed of the water, as it passes through the pump, is about three feet per second. It is maintained that there is approximately 13 per cent. variation in volume of water passing through a pump; consequently, the suction and discharge pipes of these pumps are fitted with chambers which equalize the flow to a uniform speed.

It will be seen that the suction valve is located on one side of the working barrel, while the discharge valve is on the other. These valves are so constructed that they are accessible through covers held in position by heavy stud bolts. The interior of the working barrel is of circular or spherical section.

The vibration in the gearing is reduced to a minimum and the life of the pump lengthened, the ring oil as bearings are supported by a heavy bracket on the vertical standards, giving them a substantial support on the pinion shaft.

The induction motors, shown in the illustration, used to drive this pump where alternating current is available, is of Allis-Chalmers construction. Electric pumps are now being utilized very extensively for auxiliary service, where steam pumps were heretofore almost universally employed.



# CORRESPONDENCE

[This department is a meeting-place for ideas. If you have any suggestions as to new methods or successful methods, let us hear from you. You may not be accustomed to write for publication, but do not hesitate. It is ideas we want. Your suggestion will help another. Ed.]

## VALUE OF RED CEDAR.

### Makes Rapid Growth Under the Most Unfavorable Conditions.

Sir,—In June, 1864, I was detailed with one hundred men to build a small fort on the high bluff of the Appomattox River, some five or six miles below Petersburg, and about half way between Fort Spring Hill, where a pontoon bridge crossed to Point of Rocks on the Bermuda Hundred front, and Fort McGilvery, where the right of our lines around Petersburg rested on the river. The fort was ordered for eight thirty-two pound Parrot guns, but only five were mounted, the other three embrasures being filled up. It was on a



level tongue of land between a deep ravine that came in and the bluff. The ground had been cultivated and was devoid of trees with the exception of one peach tree that came within the circle of the fort and under which I spread my blanket and made my headquarters day and night till the work was done, the guns mounted and first shots exchanged. There were a few trees growing along the ravine and on the face of the bluff; they were mostly pine, sweet gum, and here and there a red cedar. The trench made about the fort was twelve feet wide and eight or ten feet deep, and the loose gravelly soil was thrown up into the parapets of the fort. The guns were in use night and day until the close of the war, and then the grounds were made into a hog yard. On these earth works trees are now growing. There are forty or fifty red cedars, six pines, one buckeye, and a few sweet gum. The cedars are all healthy, straight, and tall (averaging about fifty feet and from six inches in diameter up to eight, ten, twelve, and the largest one sixteen inches. Two of the pine are larger, but the largest one and two of the smallest ones are dead and the tops had rotted off; evidently they could not stand a dry season on these banks of loose gravel.

The buckeye and the sweet gum trees are not so large as the best of the cedars. The time that has elapsed since the dismantling of the fort at the close of the war is forty-three and one-third years. I cannot tell how long after the war the grounds were used as a hog yard, and tree growths then kept back; neither do I know when the seed of these trees fell on these embankments, nor the vicissitudes of the young trees as they grew on this dry, loose soil to a size strong enough to stand for themselves. The lesson to be learned in

forestry from these and which I want to impress is:—First, the vitality of the seed of the red cedar and the tenacity of life of these young plants and their persistency of growth under adverse conditions; second, their power to stand a soil absolutely dry at times where even the white pines failed as evidenced by the dead stumps of one-half of them; third, the size, health, and beauty of the trees and the number grown on the small space of ground, showing the amount of timber possible to be grown on an acre; and fourth, the value of red cedar for many industrial purposes. All these points show it to be a profitable tree for planting in waste and desolate places as a commercial investment. Lastly, there is the exceeding beauty of the individual tree growing singly or in clusters about our homes, along our roadsides, or in our fields, showing that it has no equal for landscape effect and should be used a great deal more for this purpose than it has been. The cedar is hardy, growing naturally around our northern lakes, both in Canada and the United States, I have seen them growing on the drifting sand dunes at Port Frank, on the east shore of Lake Huron, but they do better on good rich soil.

In the picture, the large cedar to the left is fifty-six inches in circumference.

Yours,  
L. B. Rice.

Port Huron, Michigan.

## POINT OF FROG.

Sir,—“C. R. S.” might try the following method, I have used it with some satisfaction, although it allows very little latitude in moving the point of frog to avoid cutting rails.

Required:—To find the point on the curve which will be the width of the gauge distant from the main line, this will be the point of frog.

Let R = Radius of Curve.

D = Degree of Curve.

g = gauge = 4.708.

d = angle subtended by x the distance from the B.C. to the point required.

$$\text{Vers } d = \frac{g}{R}$$

$$x = \frac{100 \times d}{D}$$

Yours,  
Transit.

March 5th, 1908.

## DEPOSITS REQUIRED.

Sir,—The letter of “Contractor” in your issue of the 28th ult., calls attention to the large deposit exacted from tenderers for work, and the severe conditions subsequently imposed in connection with such deposit.

I cannot help thinking that a majority of engineers, who have had much to do with public works will agree that there is a good deal of reason in Contractor’s letter. I have carried through, in recent years, two large works, in which a free hand was given me in the letting of contracts and the general progress of the work, and in no case was a deposit of any kind required from a tenderer. It is true the contracts were individually small, but the work was none the worse for that, and I am confident that it was done cheaper than is usually the case.

The exaction of heavy deposits was originally designed to head off dishonest collusion between tenderers,—but there



is no law that cannot be evaded, and as the conditions imposed upon tenderers became harder, the ingenuity of such contractors, as were of dishonest purpose, became sharper, and large contracts have of late years tended to be more and more restricted to wealthy firms.

If this custom did secure the exclusion of dishonest parties nothing need be said against it, but it does not, and that is easily seen from the majestic scale on which robberies are now perpetrated and the genius for petty detail by which they are bolstered up.

I have never been a contractor nor anything but a plain engineer, and my sympathies naturally lean to that side, but I do recognize that contractors are human beings like the rest of us, and that no agreement can be ultimately satisfactory to either party unless it be based on mutual terms of equity. It is only injurious to keep piling on one prohibition after another. The best way to secure bona fide tenders, and honest contractors, is to open the door to the widest competition, and give the broadest publicity to every thing. Then be definite and reasonable in framing specifications, and use proper judgment in awarding contracts,—not necessarily giving it to the lowest tenderer. I have long gone on this theory, and my principals have never had a lawsuit with a contractor.

Engineer.

Ottawa, March 9th, 1908.

#### FINENESS OF CEMENT.

Sir,—In your edition of the 31st ult., I read with interest the article on Cement:—viz., the difference in using 2 per cent. and 17 per cent. of plaster of paris, and going further on was glad to see the question of fineness taken up by the writer.

This in my estimation is a very important factor, I think I may venture a step further by saying (the most important factor in manufacturing an ideal Portland Cement). Permit me to remark on this point. Firstly, all raw materials (rock or marl) should be ground to a fineness of from 94 per cent. to 97 per cent., on a 100 x 100 mesh screen. The aim being to bring about thorough incorporation. This is a very simple matter, and can be easily accomplished by a competent miller. In both cases the composition must be pulverized to a fineness as stated above so as to ensure thorough incorporation, and again by this being done, the percentage of lime can go into a thorough mix with the other ingredients; "and if a high tensile strength is required by specification it can be given by raising the percentage of lime a point or two if needs be, and then feeling absolutely safe." The lime question is very important, and working in conjunction with the fineness; which if taken up by our Canadian cement makers would be found the cause of the trouble of slurry not being sufficiently fine is the absence of not using a tube mill before the slurry passes into the storage tanks.

Further, the writer remarks on "Air Separators." This also I am in favor with, as: the material when penetrated by the air caused by the machine is of such a uniform fineness that no fear need be entertained in using a good make of separator, as any competent miller can operate these machines with ease, lastly the material after passing the "Air Separator" is sufficiently cool and ready for the market.

Yours,

John H. P. Wood.

#### COMMERCIAL MOTOR SHOW.

Preparations are now proceeding for the second International Commercial Motor Vehicle and Motor Boat Exhibition, organized by the Society of Motor Manufacturers and Traders, to run at Olympia, London, from March 26th to April 4th, both days inclusive. Judging by the applications for space and the names of the firms applying, this show will eclipse in size and importance that of last year. The Prince of Wales has accorded his patronage, and a most successful exhibition is anticipated.

#### ENGINEERING SOCIETIES.

CANADIAN RAILWAY CLUB.—President, W. D. Robb, G.T.R.; secretary, James Powell, P.O. Box 7, St. Lambert, near Montreal, P.Q.

CANADIAN STREET RAILWAY ASSOCIATION.—President, E. A. Evans, Quebec; secretary, Acton Burrows, 157 Bay Street, Toronto.

CANADIAN INDEPENDENT TELEPHONE ASSOCIATION.—President, J. F. Demers, M.D., Levis, Que.; secretary, F. Page Wilson, Toronto.

CANADIAN SOCIETY OF CIVIL ENGINEERS.—413 Dorchester Street West, Montreal. President, J. Galbraith; Secretary, Prof. C. H. McLeod. Meetings will be held at Society Rooms each Thursday until May 1st, 1908.

QUEBEC BRANCH OF THE CANADIAN SOCIETY OF CIVIL ENGINEERS.—Chairman, E. A. Hoare; Secretary, P. E. Parent, P.O. Box 115, Quebec. Meetings held twice a month at Room 40, City Hall.

TORONTO BRANCH OF THE CANADIAN SOCIETY OF CIVIL ENGINEERS.—96 King Street West, Toronto. Chairman, C. H. Mitchell; Secretary, T. C. Irving, Jr., Traders Bank Building.

WINNIPEG BRANCH OF THE CANADIAN SOCIETY OF CIVIL ENGINEERS.—Chairman, H. N. Ruttan; Secretary, E. Brydone Jack. Meets first and third Friday of each month, October to April, in University of Manitoba.

ENGINEERS' CLUB OF TORONTO.—96 King Street West. President, J. G. Sing; secretary, R. B. Wolsey. Meeting every Thursday evening during the fall and winter month. March 18th, M. T. S. Griffiths, "Steel Rail Manufacture."

CANADIAN ELECTRICAL ASSOCIATION.—President, R. S. Kelsch, Montreal; secretary, T. S. Young, Canadian Electrical News, Toronto.

CANADIAN MINING INSTITUTE.—413 Dorchester Street West, Montreal. President, W. G. Miller, Toronto; secretary, H. Mortimer-Lamb, Montreal.

NOVA SCOTIA SOCIETY OF ENGINEERS, HALL-FAX.—President, R. McColl; Secretary, S. Fenn, Bedford Row, Halifax, N.S.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, TORONTO BRANCH.—W. G. Chase, secretary, Confederation Life Building, Toronto; March 13th, M. J. E. Fries, "Distribution Voltage for Central Stations."

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—29 West 39th Street, New York. President, H. L. Holman; secretary, Calvin W. Rice.

#### SOCIETY NOTES.

Engineers' Club.—On March 5th, 1908, Mr. W. H. Breithaupt read a paper on "River Regulation." He suggested two methods, reforestation and large dams. We hope to publish next week the paper in full.

A. B. Barry, who presided at the meeting, announced that the committee appointed to look into the matter of new quarters had arranged to extend the lease of the present club rooms for another year. During this time the committee will look about for other quarters.

#### REPORT OF THE MEETING OF THE EXECUTIVE COMMITTEE OF THE FOUNDRY SUPPLY ASSOCIATION, HELD IN TORONTO.

By order of the president, Mr. E. H. Mumford, a meeting of the Executive Committee of the Foundry Supply Association was called for Monday and Tuesday, March 2nd and 3rd, in Toronto.

The meeting was held in the King Edward Hotel, there being present the following members:—E. H. Mumford, W. S. Quigley, J. S. McCormick, F. N. Perkins, U. E. Kanavel, J. S. Smith, E. J. Woodison, George Rayner, H. M. Lane.

Mr. Somerville, chairman of the Reception Committee at Toronto, and Mr. L. L. Anthes, vice-president of the Am-



erican Foundrymen's Association, who has charge of the entertainment to be furnished at Toronto, together with several members of the Manufacturers' Association and others interested in the success of the Convention and Exhibit, were also present to assist in the planning for that event.

The fine large exhibit buildings were inspected and all of the members were much pleased with the facilities furnished.

Two new applications for membership were received during the meeting, making a total of six new members within a week. A considerable number of applications have also been received thus early for exhibit space, both in the power section and in the Process Building.

One interesting feature was the fact that Mr. DeClercy, of Montreal, presented his application for membership, and offered to exhibit one of his French cupolas in operation, so as to furnish molding machine exhibitors with iron for pouring molds. This is the first time that the Association has had melted iron available at the Convention.

The space rates this year were fixed as follows:—25c. per square foot for the first 100 feet, 20c. per square foot for the second 100 square feet, and 15c. per square foot for all additional space. This charge includes light and power from shafting where this is necessary.

Special arrangements will be made where firms desire extra illumination in the way of electric signs or electric display. Intending exhibitors will kindly note the fact that the building now contains a large number of booths, so that most, if not all, of the exhibitors can be provided at least with railings; also that the floors are of such a nature that they require no extra floors upon them, as was the case at Philadelphia. This makes it possible to exhibit much more cheaply than heretofore.

Among the rules passed by the committee for the guidance of the secretary for this year are the following:—

No exhibits can be received for installation in the buildings until freight and other charges have been paid.

A payment of 25 per cent. of the space charge is to be made within ten days of the time of allotment, and the balance paid not later than ten days previous to the Convention.

No space shall be allotted to a given firm or person until all dues and other accounts due the Association from such firm or person shall have been paid in full.

Non-members of the Association shall be charged an admission fee of 25c. to the Exhibit, Association members being admitted by badge.

The matter of co-operation with the local Toronto Entertainment Committee was discussed, and it was voted to make a definite subscription of \$500 to their entertainment fund, and in addition to give the Toronto Entertainment Committee \$40 from the initiation fee and dues of each new member joining the Association from Canada and taking part in this year's Convention and Exhibit.

### CANADIAN MINING INSTITUTE.

The annual meeting of the Canadian Mining Institute held last week in Ottawa was a most successful one. The attendance was large, debates and elections decidedly entertaining, and some thirty papers were presented for consideration.

Dr. W. G. Miller was elected president by acclamation, and the following officers were elected by ballot:—Vice-presidents, G. E. Drummond, Montreal; Dr. Barlow, Ottawa, and W. Flett Robertson, Victoria, B.C.; secretary, H. Mortimer-Lamb, Montreal; treasurer, J. Stevenson Brown, Montreal; council, W. M. Brewer, Victoria, B.C.; Arthur Cole, Cobalt; R. H. Drury, Montreal; Charles Fergie, Glace Bay, N.S.; J. E. Hardman, Montreal; R. T. Hopper, Montreal; J. McNab, Trail, B.C.; W. F. C. Parsons, Londonderry, N.S.; R. W. Robb, Amherst, N.S.; O. B. Smith, Phoenix, B.C.; R. H. Stewart, Rossland, B.C.; J. B. Tyrell, Toronto.

The retiring president, Mr. F. Keffer, in his annual address, referred to the visit to Canada of the London Institute of Mining and Metallurgy, next autumn on the invitation of the Canadian Institute. The London institute delegates, if possible, will visit all the mining centres, including British

Columbia. Mr. Keffer expressed gratification at the increase in membership from five hundred to seven hundred during the year, but deprecated the dissension which seemed developing between the members in Ontario and Quebec. Such dissension, he said, endangered the life of the Institute and some of the members in British Columbia favored forming an independent institute of western mining men. Personally he strongly favored the preservation of the national character and scope of the Institute, as independent provincial institutes would be suicidal. He also referred in appreciative terms to the move of the Institute to have branch libraries in various mining centres.

The treasurer's report, presented by Mr. J. Stevenson Brown, of Montreal, showed the gross receipts for the year, including a balance of \$1,354 from 1906, of \$11,396. The disbursements amounted to \$7,923, leaving a balance on hand of \$3,472. The receipts included a Dominion Government grant of \$3,000, a provincial grant of \$1,500, and membership fees, \$4,362.

The report of the secretary, Mr. H. Mortimer-Lamb, referred to the establishment of three branches of the Institute; Western men at Nelson, with A. B. W. Hodges, Grand Forks, as president, and E. Jacobs, Victoria, secretary; Cobalt Institute, A. A. Cole, president; and G. R. Harty, secretary, and the Eastern branch, at Montreal, with Geo. E. Drummond as president, and J. W. Bell as secretary. Appreciation was expressed at the formation of the federal department of mines and in the increase of the Federal Government grant to the Institute from \$3,000 to \$5,000. Mr. Lamb reported that Mr. Frank E. Lathe, of McGill University, had been awarded the president's gold medal for the best paper by a student member.

A resolution was adopted to memorialize the Dominion and Provincial Governments in favor of securing some more uniform system of mining legislation throughout the Dominion. Much fault was found with the present mining laws, many criticisms being levelled at the Ontario Government's policy of continuous change in laws through the passing of Orders-in-Council. Mining engineers present complained that the changeable policy of the Provincial Government prevented the development of mining property and drove away capital. It was also urged that the prospector was not adequately protected.

### DOMINION LAND SURVEYORS.

The results of the final examination for Dominion Land surveyors have been announced. Eighteen presented themselves for examination, and twelve were successful.

The successful men were:—H. G. Barber, Ottawa, Ont.; W. B. Bucknill, Winnipeg, Man.; A. Findlay, Winnipeg, Man.; F. H. Kitto, Edmonton, Alta.; B. F. Mitchell, Toronto, Ont.; T. H. Plunkett, Toronto, Ont.; C. Rinfret, St. Stanislas, P.Q.; E. W. Robinson, Victoria, B.C.; H. T. Routley, Haileybury, Ont.; H. M. R. Soars, Edmonton, Alta.; F. J. Steele, Ottawa, Ont.; A. S. Stewart, Edmonton, Alta.

### FINANCIAL HISTORY OF THE QUEBEC BRIDGE AND RAILWAY COMPANY.

In 1887 the company was given its charter, and at that time was capitalized at \$1,000,000, a very low capitalization for company undertaking a task, the probable cost of which was placed at \$12,000,000.

The stock payments of the company on the authority of the certificate of the secretary of the company shows, thus:—

968 shares, 25 per cent. paid up .....	\$48,200
125 shares, 4 per cent. paid up .....	500
150 shares, 100 per cent. paid up .....	15,000
1,243 shares, paid up .....	\$63,700

Of this it has been said, \$15,000 was paid in notes, not in cash, thus leaving the real capital at \$48,700.



**Parliamentary Aid.**

In August, 1899, Parliament was asked to vote aid to the extent of a million dollars. At that time estimates were presented to the House of the cost of the work thus:—Masonry, \$1,200,000; superstructure, \$2,400,000; approaches, \$400,000; total, \$4,000,000.

**Bonds Guaranteed.**

Cost kept going up. In 1903 when the question of guaranteeing the company's bonds came up, Mr. Collingwood Schreiber reported that \$1,416,394 had been spent; while the Quebec Bridge Company estimated the further cost at \$6,900,000, which was a total of \$8,316,394, or more than twice the estimates of 1899.

At this time the receipts of the company as shown by the records were:—

Province of Quebec .....	\$250,000
City of Quebec .....	300,000
Dominion aid .....	374,353
Paid up capital .....	65,585
Debentures .....	283,279
<b>Total .....</b>	<b>\$1,273,217</b>

of our investigations we have secured a large amount of general information on these and other matters not directly pertinent to the object of the inquiry, some of which has been introduced into the report so that the history of the undertaking might be more readily followed. We have not considered the scope of our inquiry limited concerning any matters which, in our judgment related to the collapse of the bridge.

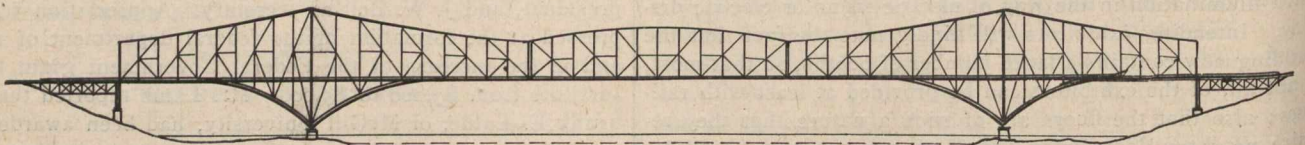
Some of our various inquiries have yielded negative results, but these are dealt with at some length in the report to make it clear that the subjects of these inquiries have not been overlooked.

**Subjects Investigated.**

In carrying out our instructions we have made the following investigations:—

(a) A study of the history of the Quebec Bridge and Railway Company, the evidence of our disposal being copies of the various public acts concerning it, the minutes of the directors' meetings, the reports of its officials, its annual reports, its correspondence and copies of the agreements and contracts that it has made.

(b) A perusal of the entire correspondence on file in the offices of the Quebec Bridge Company, the Phoenix Bridge Company, and of Mr. Theodore Cooper.



**The Quebec Bridge.**

The admitted receipts of the company at this time were \$1,198,141, leaving a balance of \$75,076.

At the same time the floating debt was:—

Debentures due .....	\$472,000
Interest due .....	34,298
Technical work .....	25,000
Superstructure .....	30,000
<b>Total .....</b>	<b>\$779,551</b>

**Present Liability.**

These are at present, the floating debt of \$779,551; and the monies borrowed from the Bank of Montreal on the guaranteed bonds, up to June 30th last, \$5,561,507 borrowed at five per cent.. That much, \$6,341,058, is definite. In addition the Government had given the company powers of expropriation which he understood had been exercised and would increase liability on the part of the Government. And finally there is no insurance on the bridge so that the loss is absolute.

**THE REPORT OF THE QUEBEC BRIDGE COMMISSION.**

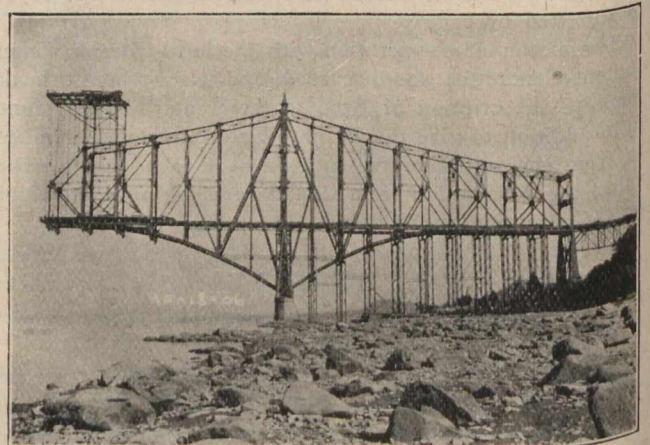
The Quebec Bridge fell on August 29th, 1907. On August 30th the Commission was appointed, and on September the 9th, they commenced taking evidence, and on March 9th, 1908, the report was presented to the House of Commons.

The Commission was composed of Henry Holgate, C.E., of Montreal, Chairman; John G. G. Kerry, C.E., of Toronto; and Prof. John Galbraith, also of Toronto. Sittings were held in Quebec, Montreal, New York, Phoenixville, and Ottawa, and after detailing these sittings the report says:—

We understand that the Commission instructs us to determine to the best of our ability the cause of the collapse of the Quebec Bridge, and to thoroughly investigate any matters appertaining thereto which might enable us to explain that cause. We do not think that either the general design of the Quebec Bridge, the methods of financing the enterprise, the payments of the money that have been made to or by the company or in its interests, or the obligations that the company has undertaken under various agreements have direct connection with the fall of the bridge. In the course

(c) A study of the working organizations of the Quebec Bridge and Railway Company, the Phoenix Bridge Company, and the Phoenix Iron Company. This involved the hearing of a number of witnesses under oath and the examination of the various documents produced by these witnesses on directions of the Commission and filed as exhibits.

(d) A personal inspection of the furnaces and rolling mills by which most of the metal that was used in the bridge was produced. The testing equipment at each of the works was examined and the file of the record of tests made by the inspectors during production was gone over.



**South Cantilever Arm Before Collapse.**

(e) A study of the methods used in the fabrication, transportation and erection of the bridge. This consisted of inspection of the shops of the Phoenix Iron Company, in which all the metal was fabricated and an examination of the plans, records, correspondence and photographs on file in the office of the Phoenix Bridge Company. The fabricated material for the north half of the bridge was also inspected and check measurements were taken to determine certain questions of workmanship.

(f) A study of the errors in workmanship detected by the several inspectors during the progress of the work, the evidence available being the record books kept by the shop inspectors for the Phoenix Bridge Company, and for the Quebec Bridge and Railway Company, the "field corrections"



sent by the Phoenix Bridge Company's resident engineer to the erection department of that company, and the weekly reports made by the inspector of erection for the Quebec Bridge Company to the consulting engineer.

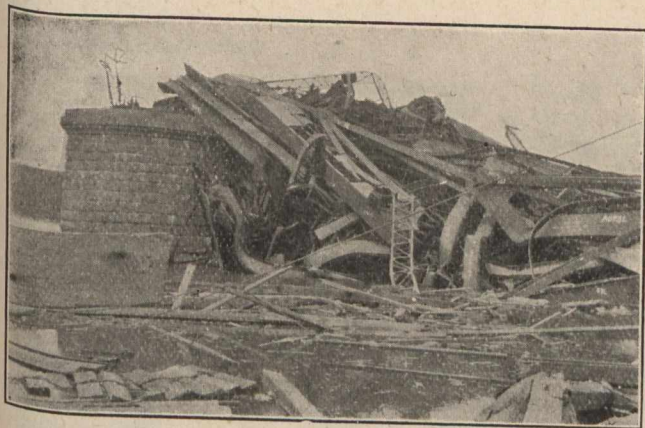
(g) An enquiry into the history of the erection of the bridge. This enquiry was made by obtaining direct evidence from witnesses under oath and by tracing out through records and correspondence the details of all the major difficulties that had occurred in the course of construction.

(h) An endeavor to obtain from eye-witnesses of the disaster all the details concerning it. Some twenty-five witnesses were examined for this purpose.

(i) An examination of the meteorological records of the day of the accident and for some time previous. The records of the observatory at Quebec and those kept by the Phoenix Bridge Company's staff were available for this purpose.

(j) A personal examination of the fallen structure made at different times and occupying several days, together with such surveys, check measurements and photographs which were considered necessary.

(k) A study of the methods adopted in the design of the bridge. This study required an inspection of the drafting office of the Phoenix Bridge Company, and an examination of the mass of preliminary and final designs on file there. The sworn statements of all the senior engineers formed an important part of the inquiry.



Main Pier and Steel Work After the Collapse.

ments may be attributed to the nervous tension under which the witnesses were laboring at the time.

"Owing to the necessity of having the evidence taken in the United States, sworn to by a British consul, written questions were submitted to each witness examined in the United States, and written answers were returned after an interval of some days."

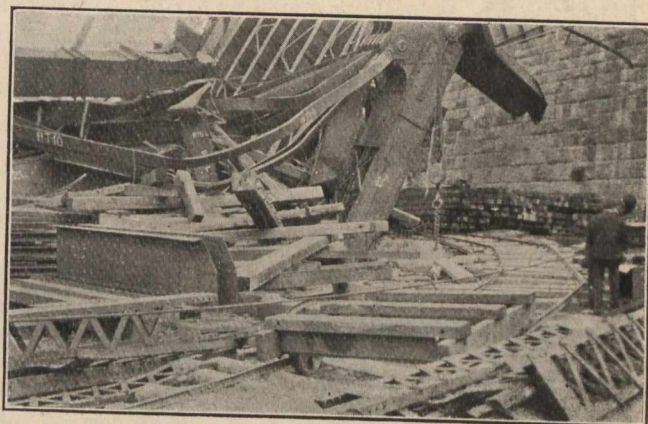
**Technical Investigations.**

The technical investigations have been by far the most arduous and difficult part of our inquiry, and it is questionable whether they could have been brought to any conclusion without the assistance that men of expert training and experience have so freely given.

In discussing the effect of financial limitations upon the design the Commissioners say: "The fact that the carrying out of the bridge project was for years delayed for lack of funds, being a matter of common knowledge, it was desirable to investigate the effect of the condition upon the design and execution of the work.

"Mr Cooper has stated: 'That during the early progress of the work it was an open secret that the Quebec Bridge Company had but a small amount of money in sight.' In proof of this statement reference may be made to the following facts. Between 1887 and 1898 the Quebec Bridge Company accomplished practically nothing.

"In 1900 it let the contract for the sub-structure, payment to be made partly out of subsidies and partly in bonds of the



Anchor Arm After the Collapse.

(l) A checking of the stress sheets prepared in the offices of the Phoenix Bridge Company by comparison with results obtained by Mr. C. C. Schneider, consulting engineer, who was employed subsequent to the disaster, by the Department of Railways and Canals, to report to it on the design of the bridge.

(m) A comparison of the organization and specifications used for the Quebec Bridge with those used for existing great cantilever bridges on this continent.

(n) A replotting of the records of tests made on full-sized compression members and a comparison of the design for the principal compression chords of the Quebec Bridge, with similar designs for other great cantilevers. In this connection special tests were made both by the Phoenix Bridge Company and by the Commission, the details of which are given.

(o) A study of the theory of compression members, standard books, transactions of technical societies and professional journals being consulted. The purpose of this part of the inquiry was to determine how thoroughly the designers of the bridge availed themselves of the professional knowledge at their disposal.

The Commissioners desire to acknowledge the hearty cooperation throughout the inquiry of all the officials of the companies directly concerned. Messrs. Cooper, Szlapka, Deans and Hoare, especially have in our judgment made every effort in their power to assist us to establish the facts and have not attempted to spare themselves.

Some clearly contradictory statements are to be found in the evidence given in the early days of the inquiry by witnesses on whom the burden of the disaster fell. These state-

company to be accepted at 60 per cent. of the face value, and offered its superstructure contract on similar terms.

**Bankers Decline Securities.**

"In 1900 its securities were thoroughly investigated by the leading firms of American bankers, who declined to invest in them. The Phoenix Bridge Company was paid for the construction of the approach spans, not by the Quebec Bridge Company, which ordered them, but by Mr. M. P. Davis.

"It must have been clear to the engineers from the first that the financial conditions were such that nothing but absolutely necessary work could be undertaken.

"The effect of the lack of funds is noticeable in the methods of calling for tenders, and of letting contracts, and in the delays that occurred in the execution of the work.

"In September, 1898, the bridge contracting firms were asked to submit tenders upon their own designs to be drawn in accordance with certain specifications. Practically this meant that each bridge company was asked to spend several thousand dollars on the preparation of plans and that in return it was given an opportunity to bid for a contract to be let by a company of weak financial standing. The result was that although the magnitude of the work placed it outside the limits of established practice, most of the tenders submitted were made from immature studies based upon insufficient data. The evidence shows that the Phoenix Bridge Company gave more time and attention to the competition than any other tenderer. But the error afterward made by it in assuming the weight of the structure for final designs shows how faulty the estimate accompanying its original tender was.

"We consider that the procedure adopted in calling for tenders was not satisfactory in view of the magnitude of the



work, and was not calculated to produce the most efficient results. In his evidence, Mr. Hoare ascribes the failure of the Quebec Bridge Company to take advantage of the lump-sum tender of the Phoenix Bridge Company to lack of funds. We are satisfied from the knowledge gained during the designing of the 1,800 foot span that the 1,600 foot span could not have been built with the weight of metal stated in the tender of March 1st, 1899. Mr. Deans' letter to Mr. Hoare, April 14th, 1899, shows that the Phoenix Bridge Company expected that its tender would be modified before the work was built."

#### A Matter of Finance.

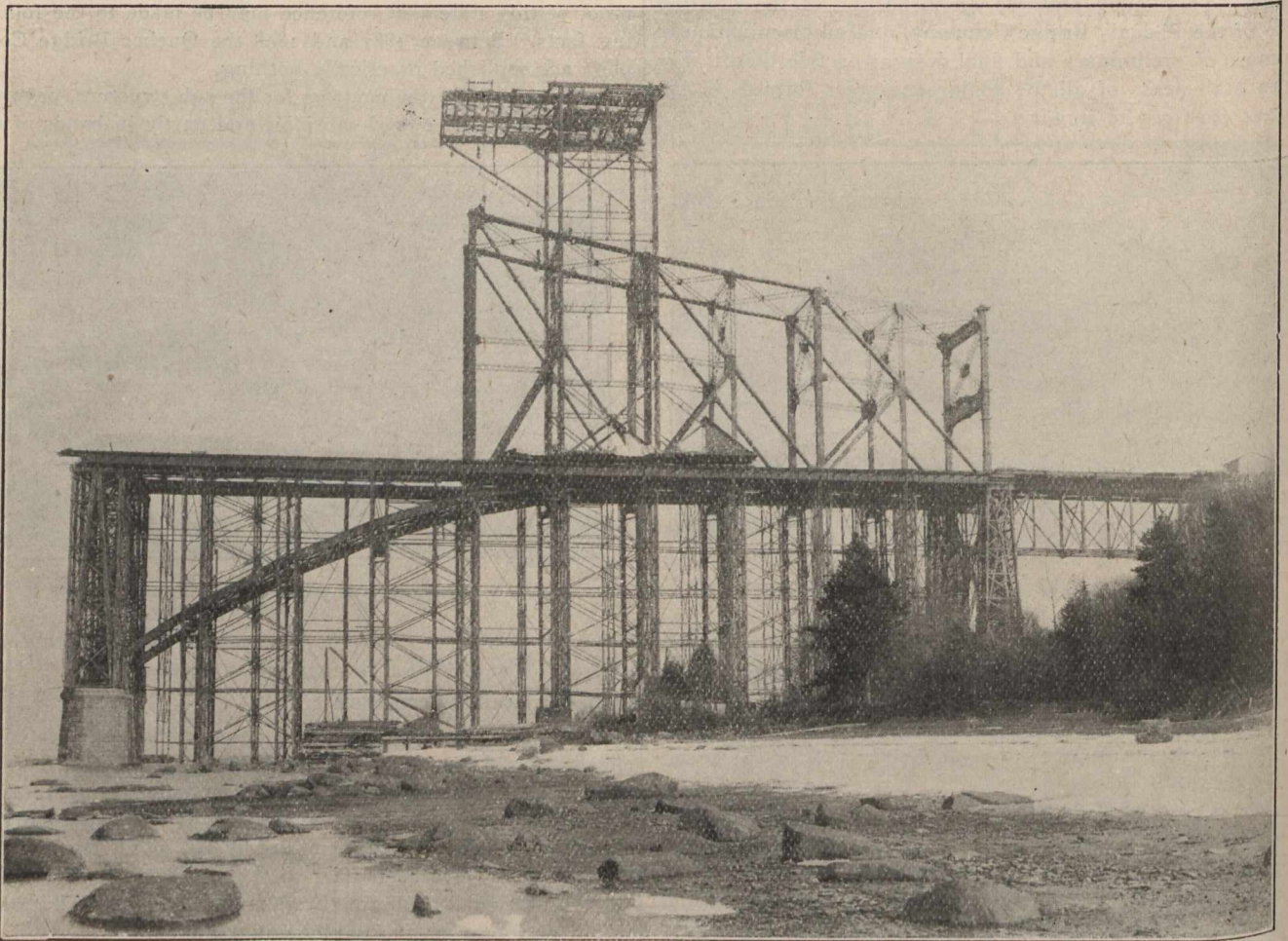
After detailing the history of the Quebec Bridge Company the report notes the effect of the financial limitations upon the design of the bridge. "The effect of lack of funds is noticeable," says the Commissioners, "in the method of calling for tenders and of letting the contracts, and in the delays that occurred in the execution of the work. We consider that the procedure adopted in calling for tenders was not satisfactory, in view of the magnitude of the work, and was not calculated to produce the most efficient results. While there is no evi-

#### Deans and Hoare Responsibility.

"We consider that Mr. Deans was lacking in judgment and in sense of responsibility when he approved the action of Mr. Yenser in continuing the erection and when he told Mr. Birks and Mr. Hoare that the condition of the chords had not changed since they left Phoenixville." They also state that the whole incident points out the need of a competent engineer in responsible charge at the site."

Continuing the report says:

"Mr. Hoare was the only senior engineer who was able to reach the structure between August 27th and August 29th. He was fully advised of the facts but yet did not order Mr. Yenser to discontinue erection, which he had power to do. We consider that he was in a much better position than any other responsible official to fully realize the events that had occurred and his failure to take action must be attributed to indecision and to a habit of relying upon Mr. Cooper for instructions. We are satisfied that no one connected with the work was expecting immediate disaster and we believe that in the case of Mr. Cooper his opinion was justified. He understood that erection was not proceeding and without



South Arm Under Construction.

ence of any cheap and insufficient work being purposely done by either Mr. Cooper or the Phoenix Bridge Company, there is evidence to prove that the financial weakness of the Quebec Bridge Company seriously interfered with the carrying out of the undertaking."

Dealing further with the financial weakness of the Quebec Bridge Company before its bonds were guaranteed by the Dominion Government, the report states: "When the Dominion Government finally came to be more closely identified with the Quebec Bridge Company in 1903 it intimated unofficially to the Phoenix Bridge Company its desire that the bridge should be ready for the Quebec tercentenary in 1908. For this and for ordinary business reasons the Phoenix Bridge Company hurried the work of designing and manufacture as much as possible, this hurry resulting in errors, but not in those errors which were immediately the cause of the accident, these having previously been made."

additional load the bridge might have held out for days."

#### Incompetent Supervision.

After summarizing the evidence bearing upon the discovery of a bond in one principal member of the bridge, in regard to which Engineer McLure had been hastily despatched to New York for consultation with Mr. Cooper, the report goes on to say: "It was clear that on that day the greatest bridge in the world was being built without there being a single man within reach who by experience, knowledge and ability was competent to deal with the crisis. Mr. Yenser was an able superintendent, but he was in no way qualified to deal with the question which had arisen. Mr. Birks, well-trained and clear-headed, lacked the experience that teaches a man to properly value facts and conditions, and Mr. Hoare, conscious that he was not qualified to exercise judgment, simply assented to the courses of action that had been determined on by Messrs. Yenser and Kinloch, and made no en-



deavor to make a personal examination of the suspected chords.

"Shortly after 11 a.m. on August 29th, Mr. Cooper reached his office (in New York) and found Mr. McLure there. After a brief discussion Mr. Cooper wired to Phoenixville as follows: 'Add no more load to bridge till after due condition of facts. McLure will be out at 5 o'clock.' This message was received at Phoenixville at 1.15 p.m. Mr. Cooper was then under the impression that work had been stopped on the bridge.

"Mr. McLure had promised to wire Mr. Cooper's decision to Mr. Kinloch immediately, but did not do so. Mr. Deans received Mr. Cooper's telegram at 3 o'clock p.m., and after Mr. McLure arrived from New York there was a consultation between them with Mr. Szlapka. It was decided to postpone action until the morning, and to await the arrival of Mr. Birks' letter on August 28th. This decision was made almost at the moment the bridge fell.

"We are satisfied that no one connected with the work was expecting immediate disaster, and we believe that in the case of Mr. Cooper his opinion was justified. He understood that the erection was not proceeding and without additional load the bridge might have held out for days.

"Our tests have satisfied us that no temporary bracing, such as was proposed by Mr. Cooper, could have long arrested the disaster; struts might have kept the chords from bending, but failure from buckling and rivet shear would soon have occurred."

#### Government Exonerated.

Taking up the question of the relations of the Dominion Government with the work of construction, the Commissioners say: "The connection of the Government with the enterprise provided means for building the bridge, and final approval of plans rested with it, but in no way did the Government exercise any check on the work itself, or any authority over the contractors. The administration of the contract and disposition of the funds supplied by the Government were left entirely in control of the Quebec Bridge Company, subject to approval of the estimates by the Government inspector, and except that the quantities of material were checked at Phoenixville by a clerk appointed by the Department of Railways and Canals, and an officer of that Department visited the bridge in connection with the checking of estimates, there was no supervision on the part of the Government. By no act did the Government assume or exercise authority over the Phoenix Bridge Company, nor did it intervene under the contract for the bridge. The checking and inspection done by the Government, and above referred to, were with reference to the Quebec Bridge Company, as the agreement for financing was between the Government and the Quebec Bridge Company. The only party, therefore, who was competent to deal with the Phoenix Bridge Company, and who only did deal with it, was the Quebec Bridge Company.

"On the part of the Government its confidence in the Quebec Bridge Company was complete, in so far as the integrity of the structure itself was concerned. This was because of the presence of Mr. Cooper as the consulting engineer for the Quebec Bridge Company."

#### Summary.

In summing up the Commissioners say: "As a conclusion reached from the evidence, and from our own studies and tests, we are satisfied that the bridge fell because the latticing of the lower floors near the main pier was too weak to carry the stresses to which it was subjected. We also believe that the amount of these lattice stresses is determined by the deviation of the lines of centres of pressure from the axis of the chords and this deviation is largely affected by the conditions at the ends of the chords. We must, therefore, conclude that although the lower chords 9-L and 9-R anchor arm which in our judgment were the first to fail failed from weakness of latticing, the stresses that caused the failure were to some extent due to the weak end details of the chords and to the looseness, or absence of the splice plates arising partly from the necessities of the method of erection adopted and partly

from a failure to appreciate the delicacy of the joints and the care with which they should be handled and watched during erection. We conclude from the tests that owing to the weakness of the latticing the chords were dangerously weak in the body for the duty they would be called upon to do. We have no evidence to show that they would have actually failed under working conditions had they been axially loaded and not subject to transfer stresses arising from weak ends details and loose connections. We recognize that axial loading is an ideal condition that cannot be practically attained but we do not consider that sufficient effort was in this case made to secure to a reasonable approach to this condition."

#### Findings.

The Commissioners find that:—

(a) The collapse of the Quebec Bridge resulted from the failure of the lower chords in the anchor arm near the main pier. The failure of these chords was due to their defective design.

(b) The stresses that caused the failure were not due to abnormal weather conditions or accident, but were such as might be expected in the regular course of erection.

(c) The design of the chords that failed was made by Mr. P. L. Szlapka, the Designing Engineer of the Phoenix Bridge Company.

(d) This design was examined and officially approved by Mr. Theodore Cooper, Consulting Engineer of the Quebec Bridge and Railway Company.

(e) The failure cannot be attributed directly to any cause other than errors in judgment on the part of these two engineers.

(f) These errors of judgment cannot be attributed either to lack of common professional knowledge, to neglect of duty, or to a desire to economize. The ability of the two engineers was tried in one of the most difficult professional problems of the day, and proved to be insufficient for the task.

#### Specifications Unsatisfactory.

(g) We do not consider that the specifications for the work were satisfactory or sufficient, the unit stresses in particular being higher than any established by past practice. The specifications were accepted without protest by all interested.

#### Erroneous Assumption.

(h) A grave error was made in assuming the dead load for the calculation at too low a value, and not afterwards revising this assumption. This error was of sufficient magnitude to have required the condemnation of the Bridge even if the details of the lower chords had been of sufficient strength because, if the bridge had been completed as designed, the actual stresses would have been considerably greater than those permitted by the specifications. This erroneous assumption was made by Mr. Szlapka and accepted by Mr. Cooper, and tended to hasten the disaster.

(i) We do not believe that the fall of the bridge could have been prevented by any action that might have been taken after August 27th, 1907. Any effort to brace or take down the structure would have been impracticable owing to the manifest risk of human life involved.

(j) The loss of life on August 29th, 1907, might have been prevented by the exercise of better judgment on the part of those in responsible charge of the work for the Quebec Bridge and Railway Company, and for the Phoenix Bridge Company.

#### Supervision Lax.

(k) The failure on the part of the Quebec Bridge and Railway Company to appoint an experienced Bridge Engineer to the position of Chief Engineer was a mistake. This resulted in a loose and inefficient supervision of all parts of the work on the part of the Quebec Bridge and Railway Company.

(l) The work done by the Phoenix Bridge Company in making the detail drawings and in planning and carrying out



# 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.

## LIGHT, HEAT, AND POWER.

### Ontario.

TORONTO.—Application is being made to the Legislature for a charter incorporating the Lorne Power Company, who desires to establish their base of operations at Wabagshik Falls. The petitioners ask to be given the right to generate and distribute electricity, to operate mines and construct an ore-reducing plant. In addition it is asked that they should be given powers to construct a railway, to be operated either by steam or electricity, from a point near the Falls to the Township of Denison.

WELLAND.—The British Canadian Smelters, Limited, are to locate a large plant on the Niagara River, in the Township of Willoughby, just above Chippewa. A site of twenty acres has been taken by the company in the Slater farm. The company will ultimately employ 500 hands in the treatment of metaliferous wastes, ores, and bullion. Negotiations are now under way with the Hydro-Electric Power Commission for a quotation on power.

### Manitoba.

WINNIPEG.—The city has decided to go ahead with the power development at Pointe du Bois Falls as soon as possible, and the Board of Control has taken action dealing with the tramway from Lac du Bonnet to Pointe du Bois. The Board has decided to call for tenders for 500 tons of 56-pound rails, and the necessary fastenings. The Board requires that the rails should be delivered f.o.b. Lac du Bonnet on or before April 30th. The tenders for the rails will close at the office of the Board of Control, March 14th, 1908. A recommendation will probably be sent to the City Council that tenders be called for two spans required for a bridge over the Lee Channel. It will be necessary to build the bridge if the tramway is to be completed to Pointe du Bois. The question of calling for tenders for the construction of the main works may also be considered, but it is doubtful if any definite action will be taken for the present.

### Saskatchewan.

PRINCE ALBERT.—Mr. Chas. Mitchell, who is the hydro-electric expert engaged to report upon electric energy available for Prince Albert, states that at least 10,000 horse-power can be developed there at a cost approximately of \$350,000. For \$1,000,000 a concrete dam can be built to develop over 100,000 horse-power.

SASKATOON.—Particulars of a bill are now before the Senate of Canada for the incorporation of a company with a scheme of development of power of the Saskatchewan River here. The capital stock is one million dollars, and is called "The Saskatchewan Power Company, Limited." The stockholders are Messrs. Fred. Engen, J. F. Cairns, W. G. Sutherland, James Clinskill, James Straton, and A. P. McNab.

### British Columbia.

FERNIE.—At the last meeting of the City Council the first steps were taken towards acquiring a water system to be owned and controlled by the municipality. The council are unanimous in desiring to get the water supply from Fairy Creek, which is situated a few miles east of the town and instructed the city engineer to stake rights and draw up an estimate of the cost of construction. There is also a fall at the creek which can be utilized to generate power in the event of the town deciding to install their own electric light plant.

## TENDERS.

### Quebec.

MONTREAL.—Tenders will be received until March 16th, for the supplying of general supplies, materials for permanent walks and pavements, and for the supply and laying of permanent sidewalks and pavements, and for the laying of Curbstone and Flagstone Sidewalks, etc., required by the Roads Committee. L. O. David, City Clerk, Montreal.

### Ontario.

TORONTO.—Tenders will be received until March 18th for the building of an addition to the west wing of Osgoode Hall, Toronto. H. F. McNaughten, Secretary, Public Works Department.

CHUTE A BLONDEAU (County of Prescott).—Tenders will be received for the construction of landing pier here until March 18th. Fred. Gelinas, Secretary, Department Public Works, Ottawa.

### Nova Scotia.

GLACE BAY.—Tenders, endorsed "Tender for Glace Bay Road Protection Work," will be received until Tuesday, March 24th, 1908, for the construction of a Road Protection Work at Glace Bay, Cape Breton County. E. G. Millidge, Resident Engineer, Antigonish, N.S.

### New Brunswick.

FREDERICTON.—"Tenders for Apohaqui Bridge" Substructure, will be received at the Department of Public Works, Fredericton, until the 23rd day of March, 1908, for building the concrete substructure and approaches of Apohaqui Bridge over Kennebecasis River, King's County, N.B. C. H. LaBillois, Department Public Works, Fredericton.

FREDERICTON.—"Tenders for St. Jacques Bridge" Substructure, will be received at the Department of Public Works, Fredericton, until Monday, 23rd March, 1908, for building the concrete substructure and approaches of St. Jacques Bridge, Madawaska County, N.B.

FREDERICTON.—Tenders will be received until March 23rd, for building Mill Creek Mouth Bridge, Albert County. C. H. LaBillois, Department Public Works, Fredericton.

FREDERICTON.—Tenders will be received at the Department of Public Works, Fredericton, until Monday, 23rd day of March, for building the concrete substructure and approaches of Apohaqui Bridge over Kennebecasis River, King's County. C. H. LaBillois, Department Public Works, Fredericton.

HILLSBORO.—Tenders will be received until March 23rd for building Mill Creek Mouth Bridge, Albert County. C. H. LaBillois, Department of Public Works, Fredericton.

### Manitoba.

WINNIPEG.—Tenders addressed to the Chairman of the Board of Control here for supply of turbine pump of 2,500,000 imperial gallon capacity, with electric motor for City Water Works, will be received until Tuesday, March 24th, 1908. M. Peterson, Secretary, Board of Control, Winnipeg.

WINNIPEG.—Tenders will be received at the Department of Public Works, Ottawa, until Friday, March 20th, 1908, inclusively, for the erection of an Examining Warehouse at Winnipeg, Man.

WINNIPEG.—Tenders are being asked until March 14th for 500 tons of 56-pound rails and the necessary fastenings, to be delivered f.o.b., Lac du Bonnet, before April 30th. H. N. Ruttan, City Engineer.

### British Columbia.

VICTORIA.—Tenders will be received until March 16th for supplying the following cast-iron water pipe:—33,000 feet 12-inch, 18,000 feet 8-inch, 36,500 feet 6-inch, 25,000 feet 4-inch. W. W. Northcote, Purchasing Agent, Victoria.



## RAILWAYS—STEAM AND ELECTRIC.

**Ontario.**

**KINGSTON.**—The T. & N. O. Railway expect to add six powerful ten-wheelers to their locomotive stock next month. The engines are being turned out by the Kingston Locomotive Works.

**BROCKVILLE.**—The G.T.R. shops here will be moved to Manitoba yards. This change will not take place for another year at least.

**British Columbia.**

**NEW WESTMINSTER.**—The B. C. Electric Company has issued orders that the work on the construction of the Eburne-Westminster tram line is to be resumed. It is expected by the company that the grading will be completed by April 1st, and also that track laying will be commenced within the next month.

**GREENWOOD.**—C. S. Moss, resident engineer of the C.P.R., in company with J. A. Macdonald and C. S. Gzowski, contractors of Vancouver, have gone over the proposed grading on the Mother Lode branch of the C.P.R. where a new grade will be made about three-quarters of a mile in length, so as to eliminate the two lower trestles. Mr. Moss stated that he expected work would be started on the grade within two or three weeks. About forty men will be required on the work, which will mean an expenditure of from \$25,000 to \$30,000.

**China.**

**CANTON.**—Four more Canadian engineers have just reached Canton, China, for the construction of the Canton and Hankow Railway. The construction is carried on by coolies, with baskets, no horses are employed. Each engineering party has an armed native escort of 20 men.

## SEWERAGE AND WATERWORKS.

**Ontario.**

**GANANOQUE.**—It is proposed by the council to install a new pump in the pump house here.

**Quebec.**

**MONTREAL.**—At the meeting of the Water Committee held recently, Mr. George Janin, superintendent, pointed out the great need of laying a large water main from Atwater Avenue as far as Delorimier Avenue. The total cost would be \$180,000.

## MISCELLANEOUS.

**Ontario.**

**TORONTO.**—A by-law for the construction of a bridge across the Don at Wilton Avenue, voted down several years ago, will be again submitted to the people. The cost is placed at \$185,000. It was also decided to have the Polson in-tead of the Glasgow boilers for the high-pressure system.

**TORONTO.**—Alterations and additions to Customs Department of the Post-Office in Toronto are being proceeded with. Structural steel, cast-iron and brick are the main materials. The steel is fire-proofed by cement, the floors of wood. Building, two stories in height, 56 feet by 90, to replace the building west of the Post-Office, and facing on Lombard Street, thus far occupied for postal purposes. George Henry & Son, of Rusholme Road, Toronto, are the general contractors; Reid & Brown, of the Esplanade foundry, do the steel and iron work.

**BRANTFORD.**—City Engineer Jones, of this city, has presented a report calling for the laying of a number of concrete walks during the coming summer.

**Alberta.**

**RED DEER.**—Alberta Government will build a telephone line to Pine Lake almost at once as all requirements with regard to numbers have been compiled with for the construction of such a line.

**British Columbia.**

**VANCOUVER.**—The Provincial Government in response to the request of the Hastings Townsite Property Owners' Association will expend about \$15,000 in road improvements in that townsite this year. The announcement was made at a recent meeting of the Association.

**GRAND FORKS.**—It is stated that a great deal of new machinery is being installed just now at the Granby smelter, and this spring will witness modern appliances on the works which will revolutionize the work in several departments at the big reduction works. It is also announced that a portion of the new machinery will be for handling the slag, and that the familiar "donkey engines" will be entirely done away with.

**Saskatchewan.**

**REGINA.**—Competition for the construction of the new Albert Street bridge and dam was very keen, no less than ten bids being received. The lowest tenderer, and consequently the successful one, was the Parsons Construction Company, of this city.

## PERSONAL.

**MR. McARTHUR** has been appointed city engineer of Guelph.

**CITY ENGINEER LINDSAY**, of Guelph, Ont., is going to Belleville to take up a similar position in that city. Many applications for the post were received from all parts of Canada and Mr. Lindsay is to be congratulated.

## THE REPORT OF THE QUEBEC BRIDGE COMMISSION.

(Continued from Page 191.)

the erection, and by the Phoenix Iron Company in fabricating the material was good and the steel used was of good quality. The serious defects were fundamental errors in design.

(m) No one connected with the general designing fully appreciated the magnitude of the work nor the insufficiency of the data upon which they were depending. The special experimental studies and investigations that were required to confirm the judgment of the designers were not made.

**Design Too Advanced.**

(n) The professional knowledge of the present day concerning the action of steel columns under load is not sufficient to enable engineers to economically design such structures as the Quebec Bridge. A bridge of the adopted span that will unquestionably be safe can be built, but in the present state of professional knowledge a considerably larger amount of metal would have to be used than might be required if our knowledge were more exact.

(o) The professional record of Mr. Cooper was such that this selection for the authoritative position that he occupied was warranted, and the complete confidence that was placed in his judgment by the officials of the Dominion Government, the Quebec Bridge and Railway Company, and the Phoenix Bridge Company was deserved.

## FINANCIAL POSITION OF THE C.P.R.

The Canadian Pacific Railway has \$38,000,000 in its treasury or in sight to spend upon betterments and extensions, a sum greater than any other railway in the world has on hand. Of the total, \$24,000,000 is being secured from the issue of new common stock, \$10,000,000 from the sale of debenture stock, and there remains from the last issue of common stock \$4,000,000.



## ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

Copies of these orders may be secured from the Canadian Engineer for a small fee

4386—Feb. 25.—Approving by-law of the Schomberg & Aurora Railway Company authorizing W. H. Moore, general manager, to prepare and issue tariffs of tolls to be charged by the Schomberg & Aurora Railway Company for traffic carried upon its lines.

4387—Feb. 26.—Authorizing North American Telegraph Company to carry its aerial wires across the track of the G.T.R. at Campbellford, Ontario.

4388—Feb. 26.—Extending until June 1st, 1908, the time within which the North American Telegraph Company shall file and receive approval of its tariffs of tolls.

4389—Feb. 26.—Extending until June 1st, 1908, the time within which the Bell Telephone Company of Canada shall file and receive approval of its tariffs of tolls.

4390—Feb. 26.—Extending until the 1st of June, 1908, the time within which the Express Companies in Canada shall file and receive approval of the Board of their tariffs of tolls.

4391—Feb. 25.—Authorizing the Lindsay, Bobcaygeon and Pontypool Railway Company to cross the spur line of the G.T.R. at the Town of Lindsay, Ontario.

4392—Feb. 21.—Authorizing the Windsor, Essex & Lake Shore Rapid Railway to operate its cars across the tracks of the Pere Marquette Railway Company at Lansdowne Avenue, Kingsville, Ontario.

4393—Feb. 25.—Authorizing the Georgian Bay & Seaboard Railway Company to divert the public highway from mile 8.14 to mile 8.38 of its line of railway through Lots 7 and 8, in the 11th Concession of the Township of Tay, County of Simcoe, Ontario.

4394—Feb. 25.—Authorizing the Georgian Bay & Seaboard Railway Company to divert public highway at mileage 9.88 to mile 10.005 and from mileage 10.22 to mile 10.58, through Lots 1 and 2 in the 11th Concession of Township of Tay, County of Simcoe, Ontario.

4395—Feb. 27.—Extending until March 15th, 1906, the time within which Order of the Board No. 3346, dated July 5th, 1907, shall come into effect, with respect to disposition of appeal from the G.T.R. Company of Canada for leave to prosecute before the Judicial Committee of the Privy Council from the Judgment of the Supreme Court of Canada as regards the application of W. N. Robertson, of Toronto, Ontario.

4396—Feb. 28.—Approving revised location of the G.T.R. from the Richelieu River to a point near the public road crossing between Range 1 and Range 2, Parish of St. Hilaire, County of Rouville, P.Q.

4397—Feb. 4.—Authorizing the Canadian Northern Ontario Railway to take part of the east half of Lot 33 in the Township of Clarence, County of Russell, Province of Ontario.

4398 to 4400, inclusive—Feb. 28.—Bell Telephone crossings over C.P.R.

4401—Feb. 28.—Authorizing G.T.R. to construct bridge over Otterburn Park Road, at mile 21.50, near St. Hilaire, P. Q.

4402—Feb. 28.—Approving revised location of G.T.P. Company's Lake Superior branch from 0 to mile 50 in the Province of Ontario.

4403—Feb. 28.—Approving revised location of G.T.P. Railway Company's from mile 50 to mile 100, near White Fish Lake, Ontario.

4404—Feb. 28.—Approving revised location of Le Chemin de Fer de Colonization du Nord, between Nominique and a point ten miles north-westerly in the Province of Quebec.

4405—Feb. 28.—Authorizing the G.T.R. Company to construct bridge over public roads at mile post 21¼, Second District, Beloeil, P.Q.

4406—Feb. 27.—Approving amended location of Hamilton, Waterloo & Guelph Railway Company through the city of Hamilton.

4407—March 6.—Approving location of the Montreal and Southern Counties Railway Company from a point marked "A," near Victoria Street, St. Lambert, to the east side of Common Street, in the city of Montreal, a distance of 2.83 miles.

4408—March 3.—Authorizing the Clarenceville and St. Thomas Local Telephone Company to carry its telephone wires across the tracks of the Rutland & Noyan Railway Company at Voxburgh Crossing, in the Parish of St. Thomas, Missisquoi, in the Province of Quebec.

4409—March 6.—Approving revised location of the G.T.P. Railway Company Lake Superior branch, mile 134 to mile 150, English River to Surprise Lake, Rainy River District, Province of Ontario.

4410—March 6.—Approving revised location of G.T.P. Railway Company's Lake Superior branch from Whitefish Lake to English River, mile 100 to mile 134, District of Thunder Bay, Ontario.

4411—March 6.—Authorizing the C.P.R. to construct spur in the city of Calgary, Alta., from a point on the centre line of the spur already constructed on the lane running parallel to and between Eighth and Ninth Avenues, distant about sixty-five feet easterly from the said centre line, from the easterly side of Sixth Street West, and then south-easterly to the premises of the city of Calgary.

4412—March 6.—Authorizing the C.P.R. to construct, maintain and operate a branch line across Huron Street, and then to the premises of P. Burns and Company, Toronto, Ont.

4413—March 6.—Authorizing C.P.R. to construct branch line of railway or spur across Huron Street, Toronto, Ont., on the southerly side of the three tracks across the said street already existing.

4414—March 5.—Authorizing the Bell Telephone Company to erect its wires across the track of the G.T.R. at Grasshill station, Ontario.

4415—March 6.—Authorizing C.P.R. to construct certain branch lines of railway or spurs in the city of Vancouver, B.C., and to carry the same across Victoria Drive and Cambridge Street, Vancouver, B.C.

4416—March 6.—Certifying to corrections made in the location of the Quebec, Montreal and Southern Railway Company in the parishes of Gentilly and St. Pierre les Becquets, County of Nicolet, P.Q.

4417—March 6.—Authorizing the Koshee-Sparrow Lake Private Telephone Line, to erect its wires over the tracks of the G.T.R. at Koshee Siding, Ontario.

### NEW FOREIGN AGENCIES FOR ALLEN RIVETERS.

Some recent notable connections have been arranged by John F. Allen, 370-372 Gerard Avenue, New York City to push the sale of the "Allen" riveting machines abroad.

An agency has been established at Vienna to build up the Austrian trade.

Mr. Robert Lindenthal has opened an office in Berlin, intending to cover Germany thoroughly.

Mr. Samuel Ranko has taken over the sale of the "Allen" tools in Russia, establishing an office at Cherson, the capital of Odessa, the expectation being that within a very short time he will secure a good sized order from the Government which has outlined big expenditures for bridge and other steel structural work.

Mr. Edwardo Carrasco, Santiago, Chile, has taken the agency for that country.

Previously established agencies are Fenwick, Freres & Company, Paris; John Turnbull, Jr., Glasgow, and V. Lowiner Company, Copenhagen.

Regarding foreign business generally, the John F. Allen Company say:—"Our actual foreign business has increased wonderfully while inquiries at the present time are really surprising us being so numerous."



The Western Iron Works, Limited, of Winnipeg, would be pleased to represent firms manufacturing Engineering Specialties, Builders' and Ornamental Ironwork, and Contractors' and Mining Supplies, desiring to increase their Western trade. They have a very large Western connection and could place good lines without delay.

MARKET CONDITIONS.

Montreal, March 12th, 1908.

The market situation in the United States is practically unchanged, although there have been somewhat heavier sales during the past week or ten days. This applies particularly to metals of the lower grades, for pipe-makers, etc., who have, no doubt, been securing some concessions from published quotations. Generally speaking, the market is quiet and unsatisfactory.

The English and Scotch markets are firmer in tone and the tendency of prices seems to be upwards. Stocks continue to show a slight decrease, owing partly to continued heavy exports to Germany and the Continent. A few more furnaces have gone out of blast, and stocks appear to be narrowing into the hands of a few people. Many look for further advances in price, and latest market advices express the view that the bottom has been reached in both English and Scotch metals, including steel-making grades, which have heretofore been on the weak side. The strength of the market for Middlesboro' iron is apparently largely based on prospects of a continuance of business with Germany, but it would seem that German users are now well stocked, and that producers in that country are making at a sufficiently rapid rate to take care of the ordinary requirements of the country. Consequently, there is a bare possibility of demand for English grades not being maintained, and this would, no doubt, exercise a weakening influence on the English market. German makers have recently reduced prices on pig iron about 3s. per ton, bringing them to a basis of English prices.

Locally, the demand for car lots for prompt shipment is somewhat brisker and stocks in Montreal are being rapidly depleted. Inquiries for delivery on opening of navigation are good, and would indicate a fair business for the first half of the year. Several good orders have recently been placed and a number of others are now under consideration. Owing to the quietness of the past few months, consumers generally have larger stocks on hand than are usual at this time of year.

**Antimony.**—Prices continue steady, at 10½ to 11c. per pound.

**Bar Iron and Steel.**—The market on mild steel, sleigh shoe, tire and machine steel has declined 5c., that on toe calk having declined 10c. Bar iron, \$2 per 100 lbs.; best refined horseshoe iron, \$2.25, and forged iron, \$2.15; mild steel, \$2.05; sleigh shoe steel, \$2.05 for 1 x ¾-base; tire steel, \$2.05 for 1 x ¾-base; toe calk steel, \$2.50; machine steel, iron finish, \$2.15.

**Boiler Tubes.**—The market holds steady, demand being fair. Prices are as follows: Two-inch tubes, 8 to 8¼c., 2½-inch, 11c.; 3-inch, 12 to 12¼c.; 3½-inch, 15 to 15¼c.; 4-inch, 19¼ to 19½c.

**Building Paper.**—Tar paper, 7, 10, or 16 ounce, \$2 per 100 pounds; felt paper, \$2.75 per 100 pounds; tar sheathing, No. 1, 60c. per roll of 400 square feet No. 2, 40c.; dry sheathing, No. 1, 50c. per roll of 400 square feet, No. 2, 32c.

**Cement—Canadian and American.**—Canadian cement is generally quoted at \$1.70 to \$1.75 per barrel, in cotton bags, and \$1.95 and \$2.05 in wood, weights in both cases 350 pounds. There are four bags of 87½ pounds each, net, to a barrel, and 10 cents must be added to the above prices for each bag. Bags in good condition are purchased at 10 cents each. Where paper bags are wanted instead of cotton, the charge is 2½ cents for each, or 10 cents per barrel weight. American cement is steady at \$1.10 per 350 pounds, basis Glens Falls or Lehigh mills, cotton or paper bags. When the cotton bags are returned in good condition, only

7½ cents is allowed for them. American cement sold at \$2 on track.

**Cement—English and European.**—English cement is unchanged at \$1.75 to \$1.85 per barrel in jute sacks of 82½ pounds each (including price of sacks) and \$1.95 to \$2.05 in wood, per 350 pounds, gross. Belgian cement is quoted at \$1.70 to \$1.80 per barrel in bags, and \$2.05 to \$2.10 per barrel, in wood.

**Copper.**—The market for copper is unchanged. Prices are 15½ to 16c. per pound.

**Iron.**—Prices for delivery after the opening of St. Lawrence navigation are approximately as follows: No. 1 Summerlee, on cars, Montreal, \$21 to \$21.50 per ton; No. 2 selected Summerlee, \$20.50 to \$21; No. 3, \$20 to \$21; No. 1 Cleveland, \$18.50, and No. 3 Clarence, \$18.

**Lead.**—Quotations are still \$4 to \$4.10 per 100 pounds.

**Nails.**—Demand for nails is steady, prices being \$2.30 per keg for cut, and \$2.25 for wire, base prices.

**Pipe—Cast Iron.**—The market is next thing to dead, as nothing is used during the winter. Prices are steady at \$36 for 8-inch pipe and larger; \$37 for 6-inch pipe, \$38 for 5-inch, and \$39 for 4-inch at the foundry. Gas pipe is quoted at about \$1 more than the above.

**Pipe, Wrought.**—The market is firm but duller. Quotations and discounts for small lots, screwed and coupled, are as follows: ¼-inch to ¾-inch, \$5.50, with 54 per cent. off for black and 38 per cent. off for galvanized. The discount on the following is 66 per cent. off for black and 56 per cent. off for galvanized: ½-inch, \$8.50; 1-inch, \$16.50; 1¼-inch, \$22.50; 1½-inch, \$27; 2-inch, \$36; and 3-inch, \$75.50; 3½-inch, \$95; 4-inch, \$108.

**Spikes.**—Railway spikes are not in very good demand, \$2.60 per 100 pounds, base of 5½ x 9-16. Ship spikes are steady at \$3.15 per 100 pounds, base of 5½ x 10 inch and 5½ x 12 inch.

**Steel Shafting.**—At the present time prices are steady at the list, less 25 per cent. Demand is very dull and lower figures would hardly be refused.

**Steel Plates.**—Demand is quite dull and a firm bid at lower figures than quotations would be considered. Quotations are: \$2.75 for 3-16, and \$2.50 for ¼ and thicker, in small lots.

**Tar and Pitch.**—Coal tar, \$4 per barrel of 40 gallons, weighing 575 to 600 pounds; coal tar pitch, No. 1, 75c. per 100 pounds, No. 2, 65c. per 100 pounds; pine tar, \$4.35 to \$4.50 per barrel of about 280 pounds; pine pitch, \$4.25 per barrel of 180 to 200 pounds.

**Tin.**—The market shows a slight advance, being now quoted at 33 to 33½c. per pound.

**Tool Steel.**—Demand is light, but the market is firm. Base prices are as follows: Jessop's best unannealed, 14½c. per pound, annealed being 15½c.; second grade, 8½c., and high-speed, "Ark," 60c., and "Novo," 65c.; "Conqueror," 55 to 60c.; Sanderson Bros. and Newbould's "Sabon," high-speed, 60c.; extra cast tool steel, 14c., and "Colorado" cast tool steel, 8c., base prices. Sanderson's "Rex A" is quoted at 75c. and upward; Self-Hardening, 45c.; Extra, 15c.; Superior, 12c.; and Crucible, 8c.; "Edgar Allan's Air-Hardening," 55 to 65c. per pound.

**Zinc.**—The market is unchanged, at 5¼ to 5½c. per pound.

\* \* \* \*

Toronto, March 13th, 1908.

The labor market, in the direction of builders' employees in different classes, is much more satisfactory to employers. Plumbers and steamfitters have all the hands they want, on terms independent of the Union; structural ironworkers can get what hands they need; stonemasons and bricklayers are under agreement from 1st March, 1908, to 11th May, 1911, at 50c. per hour; carpenters and painters are working on same terms as 1907; builders' laborers are also content with same arrangement as last year. Men are abundant for all the building going on now. No worker, however, need look for an increase.

Lumber dealers are firm in their prices and confident of advancing in spring. Cement-makers maintain their attitude



# The Latest Book on the Electric Furnace

Electric Smelting is a subject of increasing importance to Canadian Engineers and this work contains a clear and connected account of the principle on which electric furnaces are constructed, the uses to which they can be put and the more important details of their construction. The articles upon which the book is based appeared in the Canadian Engineer during 1906.

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Professor of Metallurgy, McGill University

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and expect an active May, if not April. Brick-makers find matters dull; the extremely bad weather of last month permitted no building, in marked contrast with the open February of 1907. The volume of metals moving is increasing a little over previous weeks, in shelf goods and house-interior goods mainly; but no real activity is expected till the snow goes. Tin is advancing; copper, though fluctuating abroad, is fairly steady here. Pig iron quiet and unchanged. Structural steel slack just now, but with activity expected in May.

The following are wholesale prices for Toronto, where not otherwise explained. Higher prices are quoted for broken quantities:—

**American Bessemer.**—Fourteen-gauge, \$2.45; 17, 18, and 20-gauge, \$2.60; 22 and 24-gauge, \$2.65; 26-gauge, \$2.80; 28-gauge, \$3.

**Antimony.**—Quiet, but inquiries are coming in more freely; we quote 11½ to 13c.

**Bar Iron.**—\$2.10 base, from stock to the wholesale dealer.

**Beams and Channels,** \$2.75 to \$3, according to size and quantity; angles, 1¼ by 3-16 and larger, \$2.65; tees, \$2.90 to \$3 per 100 pounds. Extras for smaller sizes.

**Boiler Heads.**—25c. per 100 pounds advance on boiler plate.

**Boiler Plates.**—¼-inch and heavier, \$2.50. Supply probably adequate and quotations still firm.

**Boiler Tubes.**—Lap-welded steel, 1¼-in., 10c.; 1½-in., 9c. per foot; 2-in., \$9.10; 2¼-in., \$10.85; 2½-in., \$12; 3-in., \$13.50; 3½-in., \$16.75; 4-in., \$21 per 100 ft.

**Building Paper.**—Plain, 32c. per roll; tarred, 40c. per roll.

**Bricks.**—Common structural \$10 per thousand, wholesale; small lots \$12 to \$13, and the demand improving. Red and buff pressed are worth \$18 at works.

**Cement.**—The price of Canadian manufactures of cement to the dealer in thousand barrel lots and up is \$2.15, in cotton bags, including cost of packages, on car, Toronto. The dealers' price to the contractor up to car-load lots without package price, are general at \$1.95 per barrel in cotton bags and \$2.10 in wood, weight in each case 350 pounds.

**Detonator Caps,** 75c. to \$1 per 100; case lots, 75c. per 100; broken quantities, \$1.

**Dynamite,** per pound, 21 to 25c., as to quantity.

**Felt Paper—Roofing Tarred.**—Market steady at \$2 per 100 pounds. The spring prospects good.

### SECOND-HAND FOR SALE

Hoisting Engines, double cylinders & drums, 6½x8" & 7x10" with boilers  
Robinson Steam Shovel, 2½ yards capacity.  
Saddletank Locos, 36" and standard gauge.  
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Crushers, gyratory and jaw, various sizes, some portable.  
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