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The Canadian Engineer

ESTABLISHED 1893.

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TORONTO, CANADA, APRIL 22, 1910.

CONTENTS OF THIS ISSUE.

ESTIMATING.

The Standard Dictionary defines the word "estimate," "to form an opinion about the value, size, quantity, worth, etc., from the best information at hand."

"Estimation," "the act of estimating, or the conclusion arrived at; a valuation or computation based on opinion or data."

When one considers the great variation in the tender price on work being let in Canada to-day, it is, indeed, perplexing to attempt to fathom from what source the estimators have received their data. In some cases the data must have been very inexact. We have recently seen tenders opened that varied as much as one hundred per cent. The cost estimates system of contractors must work in very different ways.

The basis for estimating should be in addition to a well-tested cost system and thorough knowledge of the materials and quantities required.

It is not the general custom for the engineer to place before the contractor the result of his careful calculation as to the cost of the work. If this were done the contractor would be better informed as to what he had to do, and the engineer would receive more uniform prices on the work to be done.

It is just as necessary for the contractor to have a basis upon which to build his estimate as it is to have material with which to construct. The engineer should furnish this basis, and we consider it unfortunate that the lump sum tender has become so common. We are willing to admit that there are many conditions in which this form of tender is most suited, but we feel that in large works this has been forced to an absurdity, and as a result most of the estimating is mere guesswork. It is asking too much of the firms tendering to spend large amounts of money in securing information upon which to bid, having in mind the fact that their chance of securing the contracts is, perhaps, but one in twenty.

We think the contractor and engineers' client would both be more fairly treated if it were the custom among engineers to prepare in detail an estimate of the quantities of material, so that whether the work is let by unit prices or lump sum, the contractor would not require to spend much time in preparing his bid. In this way he could figure more closely and with much greater assurance.

It will place greater responsibility upon the engineer, requiring him to be more exact in his work, but it will make it possible for him to secure better returns for his work. The matter of estimating has to be paid for by somebody, and the engineer in charge of the work is as much entitled to it as anyone else.

There is nothing that will cause the public to lose confidence so quickly in the engineers' figures and the contractors' bids as an array of figures spread over a wide range.

THE UPPER AND LOWER BERTH.

The United States Inter-State Commerce Commission have issued an order that the Pullman Car Company must not charge as much for the upper berth as for the lower berth, in their sleepers. They consider the lower berth worth forty cents more per night than the upper berth.

The agitation in connection with the lower berth rate will likely be revived in Canada, and it will not be long before the Dominion Railway Commission will have an opportunity of dealing with the problem. There is a difference in service rendered, and the charges should be different. If people are willing to pay more for lower berths, then it should be made possible for the railways to furnish additional cars without loss. If the travelling public are willing to take an upper berth, providing they get it at a less rate, there is no doubt that the present car service will be sufficient.

In this connection it might be interesting to note that the first Pullman in the United States was built in 1863 at a cost of $18,000, to-day a Pullman may be built for $17,000, but there is no comparison between the comforts and luxuries of the cars to-day and those of fifty years ago.

RAILWAY CHARTERS.

The most spectacular scenes in the Canadian Parliament to-day are in connection with the granting of water-power and railway charters. Of the two, perhaps the question of railway charters has been the more bitterly contested. Between 1900 and 1908 the Canadian Parliament has authorized sixty-five companies (outside of the Canadian Pacific, Grand Trunk, G.T.P. and Canadian Northern) to build over thirty-seven thousand miles of railway. Of the thirty-seven thousand miles authorized, not five hundred have been built, and of the sixty-five companies granted privileges to build, only thirteen have taken advantage of their privilege.

These figures would suggest that some people make it a business to blanket territory with railway charters, thus preventing those who would build from entering the same territory, or making it possible for them to hold up the larger roads until they paid handsomely for the charter.

Senator Davis brings forward again his bill to provide for the granting of railway charters by the Railway Commission instead of by Parliament. Parliament would lay down certain general conditions, and under these general conditions, following the instruction and inspection by the Railway Board, any body of men could secure a charter, and the Railway Board would make it possible for lines willing to build to proceed without being hampered by the methods of procedure which are now required to successfully carry a bill through a railway committee and Parliament.

The Railway Commission would be in a much better position to require a certain amount of preliminary expenditure; to check over the feasibility of the scheme; to regulate the issuing of bonds, and to secure the building of the road to requirements than it now is under the divided authority of the Railway Committee of the House and its present position as inspector for the Government.

EDITORIAL NOTES.

The American Waterworks Association will meet in New Orleans, La. from April 26th to 30th. The programme has been arranged and distributed, and the outlines suggest a series of very interesting addresses. In addition to the addresses on various technical matters which will engage the attention of the membership, there will be some very interesting excursions in and around this pretty southern city. Mr. J. M. Diven, 14 George Street, Charleston, S.C., is secretary of the association.

* * * *

The Canadian Institute, of Toronto, is arranging for two very interesting lectures on April 23rd. Mr. R. E. Young, D.L.S., of Ottawa, will give an address on "The New North-West." Mr. Young is familiar with the great north country of Canada, and his address will be both informing and interesting. On April 27th, at Massey Hall, Sir Edmund Shackleton will appear under the auspices of the Canadian Institute, and it is expected that the citizens of Toronto will join with the members of the Canadian Institute in listening to one of the most instructive and entertaining lectures that has been given in Toronto this winter. The Canadian Institute is doing a great work in having discussed by its membership and guests, some of the most interesting questions that concern Canada.

GREAT BRITAIN HAS LOANED CANADA MORE THAN SIX HUNDRED MILLIONS OF DOLLARS IN THE PAST FIVE YEARS.

Abridged from an article by Fred W. Field in The Monetary Times, April 23rd, 1910.

Canadian bank shares purchased	$ 1,125,000
Investments with loan and mortgage companies.	5,719,774
British insurance companies' investments	9,731,742
Municipal bonds sold privately	10,000,000
Industrial investments	22,500,000
Land and timber investments	19,000,000
Mining investments	56,315,500
Canadian public flotations in London	481,061,836
	$605,453,852

In five years Great Britain has loaned Canada more than half a billion dollars, or to be exact, $605,453,852. This sum is obtained after five months careful investigation by The Monetary Times, and special inquiry from practically every known reliable source of information. It is the first authoritative and approximately accurate compilation regarding the export of British capital as it specially relates to the Dominion. While open to some revision the claim may safely be made that no pains have been spared to make it of commanding value and accuracy to bankers, financiers, investors, industrial and commercial interests.

The figures are the best possible reply to the complaint sometimes heard that Great Britain is not taking sufficient financial interest in this country. Our railroad development has practically been financed from first to last by the British investor. Mr. George Paish, an eminent London financial statistician states that British capital has been invested in Canada to the extent of £300,000,000. It is practically impossible to check this sum, but it is safe to accept the estimate of Mr. Paish, who not long since lectured on the advantage to borrowing countries of importing capital. The young country he says, requires to do all those things which in older countries have been gradually performed through the cen-

turies, and it desires to do those things quickly. The rapidity with which things now move in a young country is so astonishing to those accustomed to the slower progress of the older countries that it is difficult for the two kinds of countries to understand each other. Persons living in the older countries cannot and do not believe that the growth in the young countries is as rapid as it is said to be.

Heavy Borrowing in London

That Canada has been a heavy borrower in the London market in the past half decade is seen in the carefully compiled statistics of The Monetary Times. The amount is no less than £98,983,917, an average of nearly nineteen and a half millions sterling per annum. One of the most interesting features of this record is that last year's figures as stated above represented more than half the total for the previous four years, as will be seen in the following table:—

1905	£13,530,287
1906	6,327,500
1907	11,203,711
1908	28,950,621
1909	38,971,798
Total	£90,983,917

Besides this amount a sum of £5,936,008 was raised for enterprises controlled or partly so by Canadian interests but whose properties were in other countries. These included the Mexican Consolidated Electric, Rio de Janerio Tramway, Light and Power, Monterey Railway, Light and Power Company, and the Mexico Tramways Company.

The following table shows the division of the large amount publicly loaned in London for Canadian development:—

Railroads	£47,853,484
Government	30,756,900
Municipal	6,536,863
Light and Power	4,046,522
Industrial	3,143,148
Mining	2,349,554
Miscellaneous	2,103,806
Land and Timber	1,651,140
Paper and Pulp	542,500
Total	£98,983,917

Fifty Millions Sterling For Railroads

That Canada owes a large debt for its growth in railroad facilities is seen in the fact that in five years it has obtained almost fifty millions sterling for that purpose. Government loans have been nearly as heavy, while municipal flotations come third. Industrial, mining, land and timber, paper and pulp, light and power, and miscellaneous classes, together aggregate less than half the sum represented by federal and provincial Government loans and only a little more than one third of the railroad total. The greater part of the Dominion's railroad financing is done in Great Britain. In one case late in 1909 where Kansas City financiers were backing a new railroad for Alberta the flotation was made in London, which is recognized as the best possible market for Canadian railroad stock and bond issues.

The following is a summarized statement of the Canadian public borrowings for the five years in certain departments.

Railroads

Atlantic, Quebec & Western	£ 925,000
British Columbia Electric	1,285,000
Canada Atlantic	1,025,000
Canada Northern	9,840,687
Canadian Northern Ontario	1,593,569
Canadian Pacific	11,027,981
Central Ontario	200,000
Dawson, Grand Forks & Stewart River	125,000
Grand Trunk	2,598,400
Grand Trunk Pacific	14,204,000
Montreal Street	460,000
Nova Scotia Eastern	940,000
Temiscouata	50,000
Winnipeg Electric Railway Co.	300,000
Minneapolis, St. Paul & S. S. M.	1,244,444
Wisconsin Central Railway Co.	514,403
Alberta Great Waterways Railway Co.	1,520,000
Total	£47,853,484

Municipal

Calgary	£ 257,800
Edmonton	514,100
Montreal	1,400,000
Quebec	192,821
Regina	224,700
St. John	115,000
Saskatoon	100,000
Sherbrooke	102,700
Vancouver	531,300
Victoria	159,800
Winnipeg	2,327,642
Ottawa	156,900
Toronto	394,100
Fort William	60,000
Total	£ 6,536,863

Light and Power

Canadian General Electric	£ 620,000
Electrical Development of Canada	500,000
Kaministiquia Power	265,000
Montreal Light Heat and Power	710,000
Shawinigan Water and Power	700,000
Toronto Power	500,000
West Kootenay Power and Light	240,000
Montreal Water and Power Co.	100,000
Northern Light, Power and Coal Co.	411,522
Total	£ 4,046,522

Paper and Pulp

Canadian Pacific Sulphate Pulp	£ 82,500
Imperial Paper Mills	60,000
Northern Sulphate Mills	100,000
Western Canada Pulp and Paper	300,000
Total	£ 542,500
Grand Total (Sterling)	£98,983 917
Or (American currency)	$481,061,836

Grand Trunk Pacific Had Much

In railroad borrowing, Canada's new transcontinental, the Grand Trunk Pacific, is the heaviest debtor, with fourteen millions sterling. The Canadian Pacific comes next with eleven millions and adding thereto its subsidiary companies' borrowings its total does not fall short of the Grand Trunk Pacific's figures. The parent Grand Trunk was a small borrower, with two and a half millions sterling. The Canadian Northern is the third largest railroad capital seeker, with a total of almost ten millions sterling. Electric railways in five years obtained £2,045,000 from the London market.

ELEMENTARY ELECTRICAL ENGINEERING.

L. W. Gill, M.Sc.

This series of articles will be continued for some months. They will be of particular interest to the student of electrical work and the civil engineer anxious to secure some knowledge of the simpler electrical problems.

Ohm's Law.—Let the two bodies shown in Fig. 4 be replaced by two long conductors or wires connected together at the ends by a smaller conductor, as shown in Fig. 7. When the generator is running, its e.m.f. will tend to maintain a certain difference of potential between these conductors. Because of this difference of potential

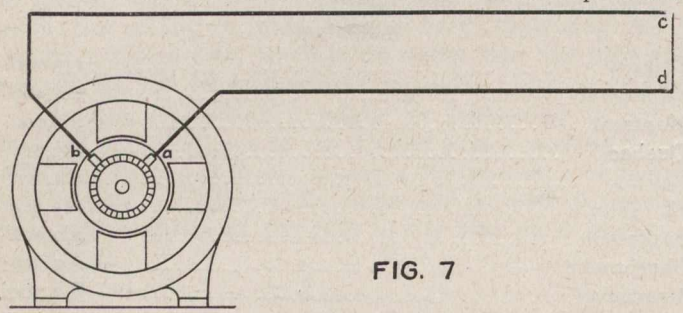


FIG. 7

there will be a flow of electricity from one conductor to the other through the end connection, and this will tend to equalize the potential. If the e.m.f. of the generator is steady, as much electricity will pass per second from one conductor to the other through the generator as will flow back through the end connection. There will thus be a continuous flow of electricity around the closed circuit formed by the generator and conductors. Experiment has shown that when the current is steady its magnitude varies directly as the e.m.f. of the generator and inversely as the resistance of the circuit. If E represents the e.m.f. of the generator in volts, I the current in amperes, and R the resistance in ohms (see definition previously given), then

$$I = \frac{E}{R} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (4)$$

This simple equation, known as "Ohm's Law" (being named after the distinguished physicist who first established it), forms one of the corner-stones of electrical engineering. It is necessary, however, to exercise care in applying this law to any particular case. When applying it to a given circuit it must be remembered that the symbol E represents the **total e.m.f. acting in one direction around the circuit.** If, for example, the e.m.f. of the generator in Fig. 7 is 50 volts, tending to force electricity from **a** to **b**, and the resistance of the whole circuit is 5 ohms, the current will be 50/5 = 10 amperes. Suppose, now, that a second generator with an e.m.f. of 40 volts is placed in the circuit between **c** and **d**, and that this e.m.f. tends to drive electricity from **d** to **c**. The total e.m.f. acting around the circuit is now 50-40 = 10 volts, and the current will be 10/10 = 1 ampere. If, on the other hand, the e.m.f. of the second generator acts in the opposite direction, the total e.m.f. will be 50 + 40 = 90 volts, and the current will be 90/10 = 9 amperes. It must also be remembered when applying equation (4) to any circuit that the symbol R represents the **total resistance, including the resistance of the generators.**

It has been noted that electric pressure or potential is created by an e.m.f., and that the latter is measured by the former. The unit is thus the same for each, and when an e.m.f. of one volt is balanced by a potential (or difference of potential) of one volt, it is obvious that the tendency of the e.m.f. to drive electricity in one direction is exactly equal to the tendency of the latter to flow in the opposite direction because of its potential. The flow of electricity on account of potential will, therefore, be the same as the flow due to e.m.f., just as the flow of water through a pipe connected to the bottom of a tank will be the same as when the pipe is connected to a pump giving the same pressure as that due to the head of water in the tank. It thus follows that if U represents the potential between any two points of a circuit, the current flowing between these points will be

$$I = \frac{U}{R} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (5)$$

A little consideration will show that this equation cannot be applied to a circuit as a whole, for the total difference of potential found by adding from point to point around the whole circuit must always be zero. This follows from the axiom that if the whole circuit is included between two points, these two points must coincide, and consequently there cannot be any difference of potential between them. For purposes of illustration the circuit shown in Fig. 7 is stretched out into a straight line in Fig. 8, the corresponding points in the two figures being indicated by corresponding letters. To make the problem as simple as possible it may be assumed that the seat of the e.m.f. is at a single point **o**, and that the point **a** is connected to earth so that its potential is zero. The direction of the e.m.f. of the generator is assumed to be from **a** to **b**, and the direction of the flow of the current, as indicated by the arrows, is taken as positive. In this case the difference of potential between the point **a** and any other point on the circuit is represented by the vertical distance between the base line **aa** and the broken line **aevxa.** From the point **a** there is a gradual decrease of potential up to the point **o**, and at this point it is increased by the e.m.f. of the generator, represented by **ev.** From **o** to **b** there is a gradual decrease, which brings the potential at **b** to the value **bw.** From **b** to **c** there is a decrease from **bw** to **cx**, and from **c** to **d** a further decrease to **dy**, and from **d** to **a** there is a final fall to zero. Starting with the potential **ov** at the point **o**, and passing from point to point around the circuit in the positive direction, the total decrease or fall of potential from **o** to **a** is **ov**, and

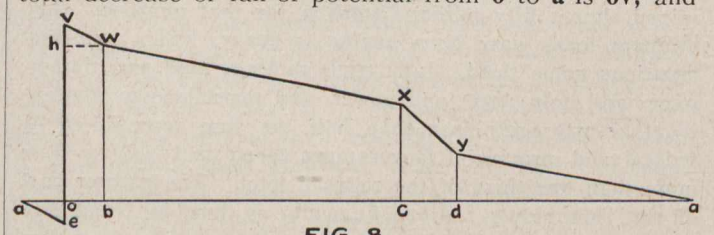


FIG. 8

the decrease from **a** to **o** is **oe.** But (**ov** + **oe**) = **ev**, and the latter represents the total increase of potential. The total change of potential around the circuit is, therefore, nil. Since, however, e.m.f. and potential have the same dimensions and are measured by the same unit—the volt—equation (5) may be combined with (4), provided the symbol E is taken to represent the resultant volts, including electromotive forces and changes of potential due to resistance. The term "voltage" may be appropriately used to express this resultant. Interpreted in this way, equation (4) may be applied to the whole or any part of a circuit. For example, in Fig. 7 the

Continued on page 381.

THE

Sanitary Review

SEWERAGE, SEWAGE DISPOSAL, WATER SUPPLY AND WATER PURIFICATION

VALUABLE PROCESSES FOR THE PURIFICATION OF SEWAGE.

We have just received from Dr. Elzear Pelletier, secretary of the Board of Health of the Province of Quebec, a copy of the address he delivered at Sherbrooke last August on the above subject. Dr. Pelletier has taken the matter up in a very thorough manner, and has outlined the various methods of purification. Commencing with methods suitable for small quantities, he gives the various methods employed both for preliminary treatment and final treatment. He mentions broad irrigation, intermittent filtration, precipitation, biological purification and the treatment of storm waters.

Dr. Pelletier has issued his address in pamphlet form, and it will be found very interesting to those having to deal with these problems.

STANDARDS OF SEWAGE EFFLUENT.

Mr. John C. Thresh, County Medical Health Officer for Essex, England, in an address delivered before the Association of Managers of Sewage Disposal Works, outlines the standards agreed upon in connection with the pouring of sewage effluent into the Thames River. They are as follows:—

It was found that a single contact bed produced an effluent up to this standard:—

(1) The effluent shall be free from putrid odor, and have no tendency to become putrid. (This tendency to be determined by the three-minute oxygen absorbed test, applied to an average sample, first, immediately after collection; and secondly, after keeping excluded from air for five days at 98 deg. Fahr.) Should the effluent at the end of five days have developed an offensive odor, and the oxygen absorbed by the incubated effluent exceed that absorbed by the fresh effluent, it shall be held to be unsatisfactory, and not to conform to this requirement.

(2) The effluent upon analysis shall conform to not less than three of the following requirements: (a) The suspended matter shall not exceed 3 grains per gallon; (b) the albuminoid ammonia shall not exceed .15 grain per gallon; (c) the oxygen absorbed in three hours shall not exceed 1.5 grains per gallon; (d) the nitrogen in nitrites and nitrates shall be at least .25 grain per gallon.

In another English town the following standard was required by the Government Board:—

(a) Each gallon shall not contain more than 4 grains of solid matter in suspension.

(b) The effluent shall have no offensive odor, and when kept for three days at a temperature of 98 deg. Fahr. in a full-stoppered bottle shall not develop a putrefactive odor.

(c) The impurity figure, as ascertained by the method described in these regulations, shall not exceed 16.

THE DIGBY-SHENTON METHOD OF PRODUCING ELECTROLYTIC CHLORINE.

In this issue we publish a contribution from Mr. C. H. Shenton of Westminster, England, re "Disinfection of Sewage."

Mr. Shenton takes objection to certain statements and conclusions made in Phelps' recent valuable report on the experiments recently made in chlorine disinfection, reviewed at some length in The Canadian Engineer.

Phelps claims that hypochlorites electrically obtained are inferior to chemical hypochlorites.

In view of the point raised by Shenton we quote the portion of Phelps' report dealing with the question as follows:—

Numerous processes of the first kind have been developed, of which the Hermite and Woolf processes have already been mentioned. The commercial preparation, called "Chloros," is made in this way. The most recent, and probably the most improved, cell of this type has recently been described by Digby and Shenton. The reaction by which the hypochlorite is produced from chlorine and caustic soda in cold dilute solution is:

(1) $2NaOH + 2Cl = NaOCl + NaCl + H_2O$.

In the paper just cited Digby proposes the reaction,

(2) $NaOH + Cl = NaOCl + H$.

He bases his view on the observation that the electrochemical efficiency of the cell is over 50 per cent. Aside from the obvious impossibility that a reaction can produce at one and at the same time nascent hydrogen and a strong oxidizing agent, it is apparent that reaction (1) if it were carried out completely, would yield a product containing not 50, but 100 per cent. of the available chlorine initially present. The conception that this reaction represents a loss of half the available chlorine is due apparently to a mistaken idea of the term available chlorine, which, as has been explained on page 18, is really a misnomer. The fact is that the oxidizing power, or the available chlorine as ordinarily determined, of the products of reaction (1) is equivalent to twice the chlorine of the hypochlorite, or to the total chlorine present. There is, therefore, no apparent basis for the reaction proposed by Shenton and Digby, which would yield twice as much available chlorine as the amount allowed by the law of electro-chemical equivalents. The reactions of equation (1) are complete only in cold dilute solutions. If the solution is hot, or if it is concentrated, chlorates and perchlorates are produced simultaneously. It is for this reason that the disinfectant value of these two sets of compounds was determined in an earlier part of the present investigation. It was found that they possess practically no disinfecting power, and that their production in the cell represents a loss of energy. Economy in electric current demands strong salt solutions and high current densities with consequent heating of the electrolyte. Electrical efficiency is, therefore, opposed to chemical efficiency, and the problem in designing cells of this type is to balance the two efficien-

cies in the most economical manner. The electro-chemical equivalent of a current of one ampere is 1.32 grams an hour of chlorine, and the equivalent is not modified by the voltage. However, as the total energy employed in a process determines its cost, it is necessary to consider voltage as well as current in discussing electrolysis. In any electrolytic reaction there is a definite minimum voltage required for carrying out the reaction, and this can be computed from thermal considerations as follows: The complete reaction in the cell before the recombination of the hydroxide and the chlorine may be written,

$$NaCl + H_2O = NaOH + H + Cl.$$

Substituting the heats of formation of these compounds gives,

$$964 + 684 = 1118 + x, \text{ whence}$$
$$x = 530 \text{ calories (K)}.$$

Here x is the heat required by the reaction, expressed in calories (K) per gram-equivalent of the reacting substances, and its value is 530 calories. One gram-equivalent of substance is transformed with the passage of 96,540 coulombs of electricity, and one coulumb transferred under a difference of potential of one volt has an energy equivalent to 0.00241 calories. Therefore, one electro-chemical heat value of 96.540 multiplied by 0.00241, or 232.7 calories. Consequently the voltage required to effect the desired reaction, which calls for a heat absorption of 530 calories per equivalent, is 530 divided by 232.7 or 2.28 volts. This is the minimum voltage with which the reaction can take place, and efficiency calculations to an energy basis must be referred to this voltage. At a difference of potential of 2.28 volts, one kilowatt gives 439 amperes, so that an output of 579 grams of chlorine per kilowatt-hour represents a process of 100 per cent. efficiency on both a current and an energy basis. In practice a current at a tenion of at least 4.5 volts is usually found necessary, even with strong solutions of salt and with electrodes placed as near together as possible. This factor alone reduces the energy efficiency to 55 per cent. with perfect current efficiency. The current efficiency depends especially on the design of the cell. If there are no complicating secondary reactions during the recombination of the products it approaches 100 per cent. very closely, and this is also the case in the most improved design of chlorine cell in which recombination does not take place. It is clear that the production of hypochlorite in one operation within the cell is not economical, and a review of the available information and a laboratory study of various hypochlorite cells have led to the conclusion that cells of that type can not be expected to yield much more than one-half the available chlorine that can be obtained from the same electric current by means of direct chlorine cells.

"THE DISINFECTION OF SEWAGE AND SEWAGE FILTER EFFLUENTS."

By Mr. H. C. H. Shenton.

Mr. Earle Bernard Phelps, in an admirable report to the Department of the Interior, United States Geological Survey, published in volume five of "Contributions to the Massachusetts Institute of Technology," has dealt more fully with the subject of sterilization than has been done by any author up to the present time, and the records of his work and the work of others are, without doubt, not only the most valuable, but are absolutely impartial and correct, but on pages 66 and 70 of the Report he makes certain comments upon opinions expressed and statements made by the author, together with Mr. Pollard Digby, upon the application of electrolytic hypochlorites to sewage sterilization, and, moreover, raises objections to these statements which demand an answer.

Mr. Phelps makes a statement giving the comparative germicidal efficiencies of chlorine and some of its compounds, from which he concludes that hypochlorites are the most efficient germicides, but he also is of opinion that hypochlorites prepared electrically are inferior to chemical hypochlorites.

It is necessary for the author to take exception to this statement. It is not at all clear from Mr. Phelps' paper how electrolytic hypochlorite solution, upon which his conclusions are based, was prepared. In this respect the author can do no better than quote from a Review published in the "Surveyor," and "Municipal and County Engineer," London, in which he dealt with Mr. Phelps' interesting paper.

"Chemical hypochlorite solutions can be prepared by passing gaseous chlorine through caustic soda solutions. In the preparation of such solutions temperatures require careful watching to prevent production of unstable solutions. Electrolytic hypochlorites made in the Woolf, Hermite and Atkins electrolysers are the result of the union of the anode and cathode products in the main body of the electrolyte.

Mr. Pollard Digby's statements made in the Digby-Shenton paper, read before the Society of Engineers, are criticized. And in this respect it should be noted that Mr. Digby contends that electrolytic hypo-chlorite solutions made in the Digby cell are the result of the union of the anode and cathode products within the cell, separate from the main body of the electrolyte—that is to say, in the electrode compartment, where one of the products of decomposition is liberated in a nascent condition.

Now, on page 35, Mr. Phelps says that "an electrolytic chlorine cell, having a capacity of 22 lb. a day of chlorine gas was placed at the disposal of the writer." Are we to understand that the electrolytic hypochlorites used in Series II. of the experiments of comparative germicidal efficiencies was prepared by mixing the solution of gaseous chlorine and the sodium hydroxide? Color is lent to this interpretation by the words on page 61, which read: "Hypochlorite, electrolytically prepared by the recombination of the products of the electrolytic cell." Further, on the same page, in describing the third series of experiments: "The hypochlorite was made in the sewage by adding separately the chlorine water and the hydroxide." It is submitted that if the recombination of the products of electrolysis take place outside the cell itself, the hypochlorite solution must be classed as chemically produced. The term "electrolytic hypochlorite" must be reserved for the liquid yielded by such cells as the Woolf, Hermite and Atkins, in which the products of decomposition reunite in a nascent condition in the electrolyte, or as in the Digby cell, where the products of decomposition reunite in the compartment closely surrounding one electrode where one of the products is liberated and is in a nascent condition.

Otherwise one might as well buy caustic soda produced in one country by an electrolytic process using a mercury cathode, and chloride of lime (the gas for which was produced in another country by a rival process) and, having purchased these and prepared a hypochlorite solution, label the same "electrolytic hypochlorite," because it is prepared by the recombination of the products of the electrolytic cell."

With regard to Mr. Phelps' contention that there is no apparent basis for the reaction proposed by Mr. Digby, it must be remarked that this equation simply expresses the actual facts in the simplest possible way. Hydrogen is copiously evolved during the production of hypochlorite, and the whole of the surface of the liquid frequently becomes

covered with large bubbles which explode on the application of a lighted match.

The equation (1) quoted by Mr. Phelps, may be perfectly true for certain laboratory experiments, but it does not represent what takes place in the production of electrolytic hypochlorite in the apparatus described by Messrs. Digby and Shenton.

On page 67, Mr. Phelps speaks of "the obvious impossibility that a reaction can produce at one and the same time nascent hydrogen and a strong oxidizing agent"; yet, on the next page, gives the equation showing simultaneously the liberation of nascent hydrogen and nascent chlorine to express the "complete reaction in the cell before the recombination of the hydroxides and the chlorine."

Exception must be taken to the statement that "the oxidizing power from the available chlorine as ordinarily determined of the products of reaction (1) is equivalent to twice the chlorine of the hypochlorite, or to the total chlorine present," which is incorrect and misleading, inasmuch as it might induce non-chemical readers to suppose even that the chlorine existing as chloride were capable of exerting an oxidizing influence.

The oxidizing power of sodium hypochlorite is dependent on the liberation of its oxygen atom in a nascent condition, and there is not any confusion or misconception as to the meaning of the term "available chlorine" beyond that which Mr. Phelps has introduced. It is, and has long been, a matter of common knowledge that for each univalent atom of chlorine existing as hypochlorite, one bivalent atom of oxygen is set at liberty under suitable conditions, but this does not warrant Mr. Phelps' statement.

Again, Mr. Phelps' equation (1)—

$$2NaOH + 2o1 = NaOCl + Na\ Cl + H_2O.$$

is said to make manifest the fact that if it were carried out completely a product would be yielded containing 100 per cent. of the available chlorine initially present. Now, that is manifestly impossible, because the equation shows that half the chlorine liberated as a result of the electrolysis reverts to the state of chloride, and Mr. Digby's equation (2)—

$$NaOH + Cl = NaOCl + H.$$

does not indicate that the yield of available chlorine would be twice the amount allowed by the law of electro-chemical equivalents. It would be interesting to have Mr. Phelps' explanation of this matter.

Elementary Electricity—Continued from page 378

voltage acting from **a** to **b** through the generator is **ev** positive, and **bw** negative. The resultant is, therefore, **(ev-bw)** = **(oe + hv)** = E_1. The voltage between **b** and **c** is **(bw-cx)** = E_2; between **c** and **d** it is **(cx-dy)** = E_3, and between **d** and **a** it is **(dy-o)** = E_4. If R_1, R_2, R_3 and R_4 represent respectively the resistance of the conductors between these points, then

$$I = \frac{E_1}{R_1} = \frac{E_2}{R_2} = \frac{E_3}{R_3} = \frac{E_4}{R_4}$$

Since the net change of potential around the whole circuit is zero, the total voltage is equal to the e.m.f. of the generator, which is represented by **ev**. But **ev** = $E_1 + E_2 + E_3 + E_4$; therefore,

$$I = \frac{E_1 + E_2 + E_3 + E_4}{R_1 + R_2 + R_3 + R_4}.$$

This equation may be used either to determine the current which will flow through a conductor of given resistance to determine the resistance of a given conductor by measuring the current and the voltage between its terminals.

ROAD SUPERVISION.*

W. A. McLean, Provincial Engineer of Highways.

"Supervision" is the foundation stone on which road-building reform in Ontario must be placed. Lack of management has been the cause of an enormous amount of waste in road expenditure. The outlay on township roads in Ontario, in statute labor and money, exceeds two millions annually. This is steadily increasing. Statute labor in pioneer days was the right thing in the right place. To-day it is more than undoing the good done in former years. Not only is statute labor of to-day inefficient in itself, but cash expenditure is largely made in conjunction with statute labor, by pathmasters, on the statute labor basis, so that it places a two-fold handicap on road improvement. If this large outlay were handled in such a way as to give good roads, the misfortune would not be so great; but with statute labor squandered, and a considerable cash expenditure in its train, we still have the evil of bad roads. County road systems with Provincial aid are undeniably beneficial, but while increased outlay is needed the greatest good can come from such an awakening on the part of the ratepayers as will lead to the skilful direction of all expenditure now being made in the rural districts.

The remedy is not simply the abolition of statute labor. That is a minor part. The important feature is—the system adopted in place of statute labor. Not only must that system be thoroughly efficient and practical, but it must be carried out with energy and good judgment. No system, however thorough, can be of use if left to itself—it will not be automatic. What is required is an active working out of an efficient system by the men upon whom its administration falls, backed up by a clean-cut and healthy public opinion.

Road-building, as with any other constructive work, has two parts—the theoretical and the practical. The one pertains to the engineer; the other to the contractor or foreman. The one includes the knowledge of what the completed road should be as regards materials, form, drainage, and the application of scientific principles to the design of a road; the other involves the direction of labor so as to produce maximum results at minimum cost.

How do pathmasters trying to build roads with statute labor serve these conditions? Without over-estimating the scientific ability necessary to build roads, it is safe to say that in no township can one or two hundred men be found who, as pathmasters, can qualify as road engineers; while to expect them as foremen to efficiently manage statute labor as well, is a travesty on the art of roadmaking.

No two pathmasters can agree as to what a road should be as to width, crown, grade, drainage, quality of material,—yet it is only by the skilful treatment of such details that a good road can be cheaply and durably designed. A defect in one particular may readily mean the undoing of the entire work. In teaming material, which is one of the great factors of cost, the size and number of loads per day often does not amount to one-third or one-quarter what a contractor or good foreman would exact. This means in effect that, for a given quantity of material, the cost of teaming is three or four times what is should have been. In many townships a rate of $3 or $4 per day for man and team is nominally paid, yet it really amounts to $12 or $16 for a full day's work. This is the rigid economy being practised on the township roads of Ontario—as their condition fully testifies.

*Read before the Ontario Good Roads' Association.

The organization which should exist is very simple—that of a joint-stock company. The ratepayers are the stockholders; the council, the board of directors; and there should be one permanent manager (or road superintendent) carrying out the wishes of the directors. This centralizes responsibility, while the growing experience of the superintendent will be of increasing value. So long as municipal councillors rotate in office from year to year, their services in actual supervision of roadwork can be only a series of experiments in which they gain their experience at the expense of the people. If there is need for a permanent clerk or treasurer, much more is there need for a permanent road superintendent.

Cities and large towns, as a rule, have such a system in the employment of a city engineer who can supervise, through foremen and inspectors, all work of either day labor or contract. County councils, in carrying on systems of county roads under the Highway Improvement Act are required to have a road superintendent or engineer; while their steel truss bridges must be constructed under a qualified engineer who can see that the plans and specifications are properly carried out.

The duties of a road superintendent will vary in detail according to local circumstances, and the municipality in which he is engaged, whether township or county. In general, he should attend all regular meetings of the council to receive instructions from the council, or give information regarding work proposed or in progress. He should report to the council in the spring as to work he considers advisable, which report the council may adopt or amend. He should report at the end of the year showing a full statement of work carried out and the cost. It will be his duty to purchase all ordinary supplies; and make such recommendations to the council as may be desirable regarding machinery or other equipment needed.

All men, teams, foremen and inspectors should be employed or discharged by him, and should be subject to his direction only. A councillor should never give instructions as to work except through the road superintendent. A contractor never gives directions to laborers except through a foreman or superintendent, and the same principle should be rigidly followed in municipal road work. To do otherwise destroys the superintendent's prestige with the men, undermines his power to preserve discipline and to secure the best work. Every man should feel that he owes his employment to the superintendent only, and that no "pull" can save him if the superintendent wishes to dismiss him.

The superintendent should keep an accurate record of men employed and the work done, furnishing to the council at regular intervals, accounts and pay-sheets. The methods of payment and the keeping of accounts should be complete and above suspicion, requiring the certificates of foreman, the superintendent and chairman of the road committee, and should have the approval of the council. Wherever possible the certificate of two men should be on every account and pay-sheet presented to the treasurer.

Sufficient of the duties of the road superintendent have been suggested to show the object of having a road superintendent—to make it one man's business in every municipality to have direct charge of road-work. If he is thoroughly practical and a man of business, he can prepare plans and organize the work so as to get the greatest results for every dollar expended. The council and people will hold him responsible for so doing. He will study the best methods of road construction, of operating machinery, and of organizing the work. He should have, what few men possess, the ability to manage men so as to get full results from them. In the last analysis, upon the ability and energy of the man in charge, will depend the success or failure of the municipal road expenditure. Road improvement is a work not of one year, but of many years, it should be planned as such, and the first necessity is a man who will give it continuous attention for a term of years.

On works which he does not personally oversee, the superintendent should place a foreman. The foreman will receive his instructions as to how the work is to be done from the superintendent, and the foreman's essential qualification will be his ability to organize and control the labor to the best possible advantage. A first-class foreman is the most valuable part of any contractor's equipment. For a thoroughly efficient foreman, a contractor will pay the highest market price, for he knows that the cost of the work may easily be one-half under one foreman of what it is under another. As with the superintendent or engineer, these foremen should be retained as permanently as possible, so that their growing experience will make their services of increasing value to the county.

So long as work is carried on in short patches, the need for expert supervision is not felt throughout the country. To build roads profitably, they must be constructed in long sections, involving a very different degree of experience. A reeve recently pointed out to me, with pride, "the first continuous mile of road to be built in the township." This is not an isolated case. Many townships in the Province have yet to build their first continuous mile of road.

What part the engineers of the country will take in the road work of the future, must remain for the profession to determine. That every municipality would be benefited by having an engineer as road superintendent is undoubtedly the case. They have the knowledge as to how a road should be built and can procure foremen to carry out their directions and manage the labor. I would urge that engineers take a more active part in the movement for better roads, and that they go more frequently before the public with practical advice in this matter. Engineers have been too apt to stand aloof, take no part in the good roads agitation, and when a superintendent is sought, may wonder why they have been overlooked, and a layman chosen instead. Had they "cast their bread upon the waters," would it not have been more apt to return to them? My own view of the case is that there is too great a tendency for engineers to "hide their light under a bushel." When an up-to-date merchant has goods to sell, he displays them to the best advantage. If the engineers "have the goods," they should show them. Engineers will be employed in this work in county and township just as soon as the public are convinced that their services will be profitable. But the people of Ontario are not yet accustomed to the services of engineers in road work.

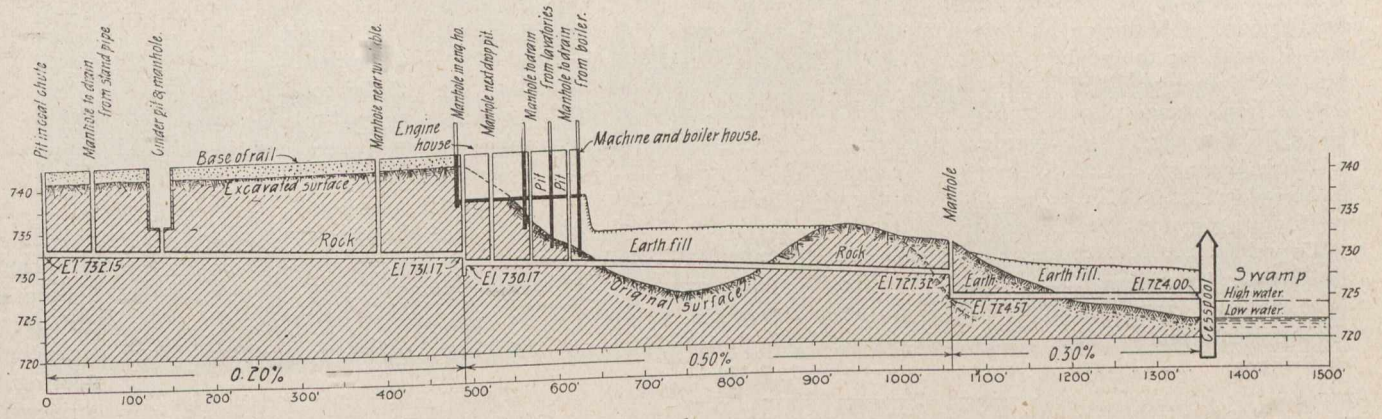
That the supervision of road work on each system,—township, county, city, or Province—should be centralized is a principle that has been found valid wherever the best roads are being built. In France, Germany, England, and the American States advanced in road building, the centralizing of responsibility is recognized as a vital necessity. In this way expert knowledge is directed to the design of roads; and the forces available are directed by businesslike methods adapted to any other form of construction. The country roads, looked at as a purely local quantity, do not impress with their importance; but as a part of the great transportation system spreading as a vast network throughout the Province, the aggregate forms a work of magnitude, and the results of neglect will seriously retard the material development of the country.

A PAGE OF COSTS

ACTUAL, ESTIMATED and CONTRACTED

COST OF SEWER, MUSKOKA, ONT.

In September, 1908, the Canadian Pacific Railway opened their Toronto-Sudbury line. This line, two hundred and sixty miles long, runs from Toronto in a northly direction, leaving the Owen Sound branch at Bolton Junction, it passes to the west side of Lake Simcoe and crosses the G.T.R. Collingwood branch on the level at Utopia; the Penetang branch on the level near Coldwell Junction and the Midland branch on the level east of Coldwater. The line continues north, west of Muskoka Lakes, crossing over-head the G.T.R. (Canada Atlantic Division) near Parry Sound, and joining the main line of the C.P.R. at Romford Junction, a station seven miles west of Sudbury.



At Muskoka, one hundred and thirty-one miles north of Toronto, is situated the only division point on this line. At present it consists of a railway division yard, a small village of a dozen houses, railway station, round-house, machine shop, coal chute, etc., and a railway-owned-and-operated electric light plant and waterworks system.

In 1907 this district was uninhabited forest, and when the new townsite was laid out under Mr. F. S. Darling, M. Can. Soc. C.E. Division Engineer, in charge of construction, the first work to follow the grading was the construction of a sewer.

Surveys showed that the most suitable sewer to build would average ten feet deep through some seven hundred feet of Laurentian granite.

The work of digging the sewer was ordered to go ahead in the middle of July, 1907, and as the erection of necessary buildings for the yards could not be proceeded with until the sewer was completed, because of the blasting, the work was opened up in four places at once and four gangs kept busy until the work was nearly completed.

Continued dry weather made it possible to work to grade at the upper end of the sewer before the lower end was open so that work was commenced simultaneously at stations 0, 6, 8 + 50 and 11 + 50 at the same time.

The material from station 8 + 50 to 11 + 50 was wasted between stations 11 + 50 and 15 + 50, and from station 8 + 50 to 7, thus making this haul very short but the material from station 0 to station 6 had to be hauled about 1,500 feet i.e., to the south end of the yards.

This material was broken by dynamite in the trench, mucked into skips and hoisted by horse-derricks upon horse-cars which ran on 30-pound rails.

The profile will show fairly well that there was about 550 feet of sewer 9 feet deep in granite rock and 350 feet about averaging 4 feet deep with a stripping of 2 feet of earth.

A close measurement of the work gave the following quantities:

Common excavation	950 cu. yds.
Loose rock	30 cu. yds.
Solid rock	1,850 cu. yds.

From the following calculations the common excavation and loose rock are eliminated as the cost of that work was kept separate.

The complete cost for 1,850 cubic yards of solid rock was as follows:

			Per cu. yd.
Superintending—			
Walking boss, at 60c. per hour	$222.45	or	12.0c
Clerk and timekeeper, at 37½c per hour	158.60	or	8.5c
Foreman, at 45c per hour	608.15	or	32.8c
Total for superintending per cu. yd			53.3c
Labor—Mucking, loading, hauling and dumping—			
Laborers, at 20c per hour	$2,877.00	or	$1.555
Teamsters, at 21c per hour	499.70	or	.270
Teams, at 40c per hour	1,010.60	or	.545
Cars, at 5c per hour	117.00	or	.063
Carts, at 5c per hour	65.50	or	.035
Derricks and power, at 15c per hour	175.50	or	.095
Handy men, at 27½c per hour	125.15	or	.067
Total for labor per cu. yd			$2.630
Drilling rock—			
Foot drilling, at 30c per ft	$1,245.00	or	0.673
Sharpening drills, at 27½c per hour	250.80	or	.135
Nippers, at 17½c per hour	382.20	or	.206
Coal, at $10 per ton	29.00	or	.157
For drilling per cu. yd			$1.171
Explosives—			
Electric fuses			$ 95.95
Caps and fuses			23.20

Batteries, rent	38.00
60% dynamite, at $10 per box	1,020.00
Or 0.636 per cubic yard.	$1,117.15

Making a total of **$4.97 per cubic yard.**

To this must be added an amount for the depreciation of plant, in this case $930. This included broken and wasted material and drill steel sharpened away.

This was equivalent to 50 cents per cubic yard and made a grand total of $5.47 per cubic yard. When it is remembered that it was rock work where the wear and tear upon plant was great this amount is not unreasonable.

This price, i.e., $5.47 per cubic yard for solid rock, is high, but the trench was for 18-inch pipe; it was not wise to use large shots and the amount of drilling, i.e., one foot for 4½ cubic yards, was excessive. The price is not high for trench work in rock.

COST OF HIGHWAY WORK IN MAINE

The following figures are given by the state highway commissioner of Maine in his last annual report as a summary of work for the year:

No. of Towns.	Nature of Improvement.	Square yards.	Length in feet.	Cost.
1	Block paving	1,356	714	$ 2,197.00
34	Macadam	107,480	41,411	62,515.28
5	Bituminous macadam	20,110	†5,065	†23,044.70
335	Gravel		290,385	150,970.82
84	Earth and drainage		71,220	34,223.97
4	Earth and gravel		4,907	1,685.53
8	Abutments and culverts		.....	1,519.44
6	Bridges		.....	2,344.41
477	Total		413,702	$278,501.15

†Including 224 lineal feet of granite block on Hassam base.

Reports show 10,671 feet additional not classified as to surfacing material, making a total length of state road of all classes of 424,373 feet or 80.37 miles.

From above table we learn that the average cost per mile (including the cost of the bridge and culvert jobs) is $3,465.24.

Average cost, block paving, per square yard	$1.62
Average cost, macadam, per square yard	0.5818
Average cost, bituminous macadam, per square yard	1.145
Average cost, gravel road, per mile (55 miles of gravel road built; surface from 12 to 21 feet in width.)	2,744.90
Average cost, earth and drainage, per mile (13.49 miles.)	2,536.00

COST OF LABOR ON RAILROADS

From the railroads of the United States have been gathered figures showing the total amount paid to their employees in the year ended June 30th, 1908.

The figures now gathered show the increase in the proportion of labor cost to gross operating revenue and to operating expenses, as follows:

	1902	1907	1908
Percentage of labor cost to operating revenue	38.2	40.4	42.1
Percentage of labor cost to operating expenses	60.5	61.3	62

A most interesting feature of the statistics is the fact that the aggregate amount of wages paid to enginemen exceeds by $29,000,000, the total paid to conductors, and that firemen received within $5,000,000 of as much as the total paid to the conductors.

COST OF HIGHWAY BRIDGES.

During 1909 the Nova Scotia erected a number of steel highway bridges. Erected under the specifications of the Department of Public Works, Nova Scotia, the cost per foot was as follows:—

Material.	Span in ft.	Width in ft.	Total cost.	Cost per foot.	Remarks.
Steel	25	14	$ 875.00	$35.00	Swing.
Steel	87	12	2,240.00	25.74	Swing.
Steel	45	15	489.00	10.86	Does not include flooring or stringers.
Steel, deck	50	14	698.00	13.96	
Steel	50	15	533.00	10.66	
Steel	50	15	538.00	10.76	
Steel	50	16	548.00	10.96	
Steel	60	15	648.00	10.80	
Steel	65	15	749.00	11.52	
Steel	70	15	829.00	11.84	
Steel	75	15	1,050.00	14.00	
Steel	80	15	975.00	12.18	
Steel	80	15	1,186.00	14.82	
Steel	100	14	1,550.00	15.50	Does not include flooring or stringers
Steel	125	15	2,015.00	16.12	Does not include flooring or stringers.

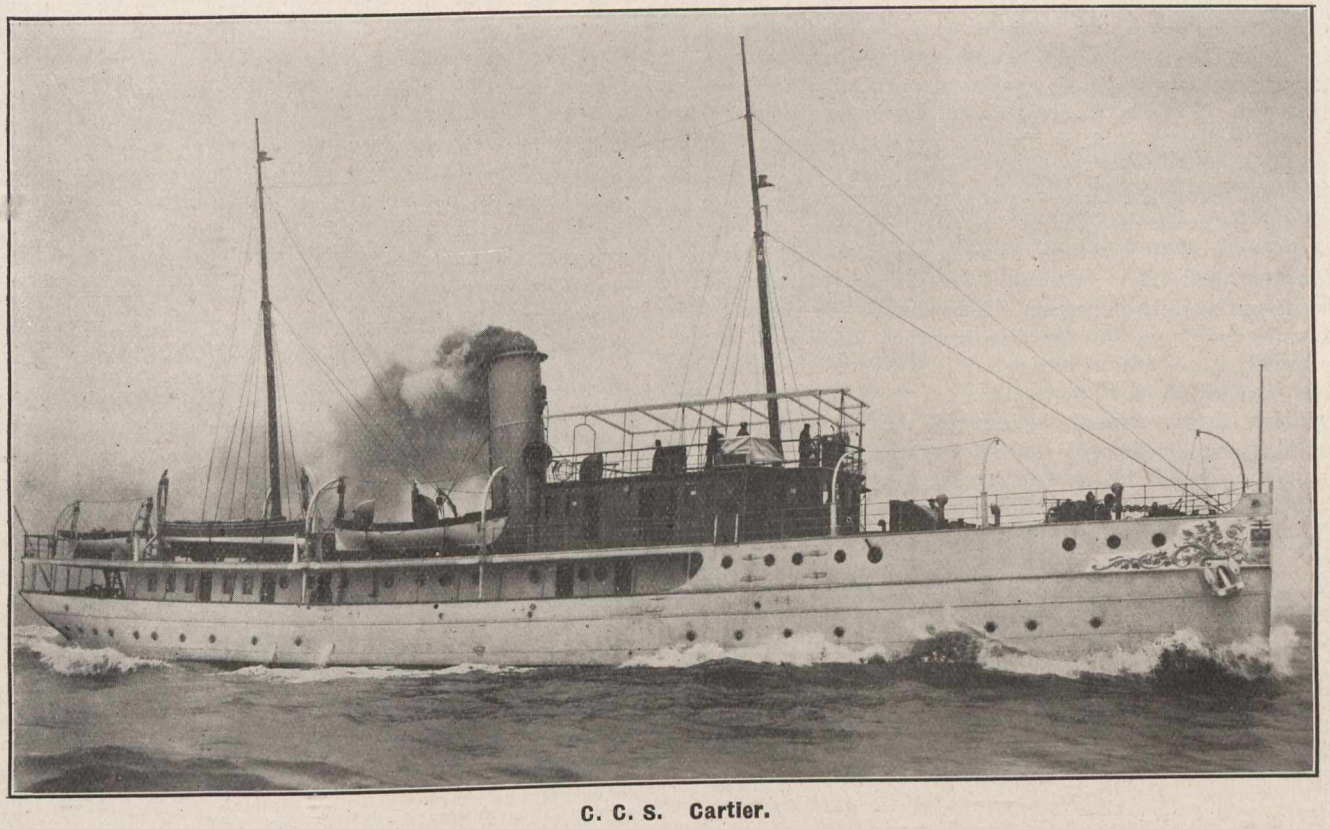
COST OF PUMPING WATER.

The Water Commissioners of London, Ont., found that they could pump 274 gallons per lb. of coal. The average static and dynamic was 240 ft., and cost $8.35 per million gallons pumped, or 3½ cents per million gallons raised one foot.

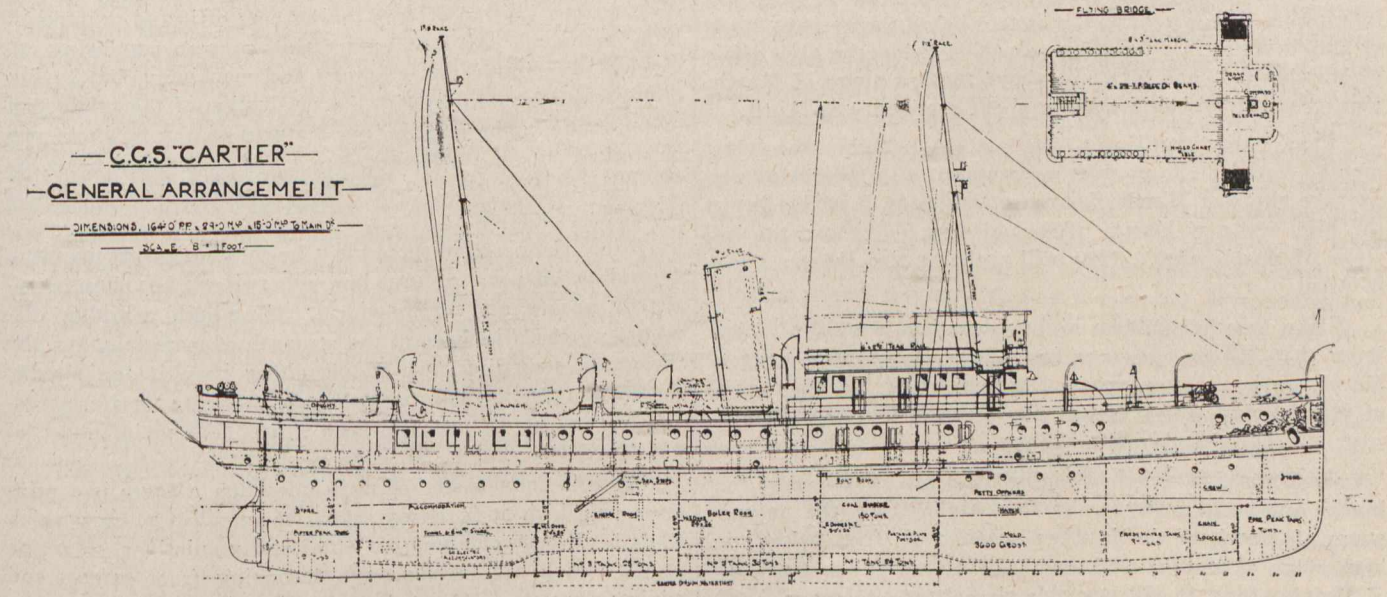
HYDROGRAPHIC SERVICE STEAMER FOR THE CANADIAN GOVERNMENT

Messrs. Swan, Hunter & Wigham Richardson, Limited, the builders of the Mauretania, have quite recently constructed at their Neptune yard, Walker-on-Tyne, (England) the twin-screw steamship Cartier, which was designed by Mr. R. L. Newman, of Victoria, B.C., for the hydrographic service of the Canadian Government. Fig. 1 gives an elevation and deck plan of this steamship, and, as supplementing the details given in the drawings, it may be recited that the Cartier has the following overall dimensions:—Length, 173 ft. 6 in., and breadth, 29 ft. 1½ in.; while the depth, moulded, to upper deck, is 15 ft. The gross tonnage is 555.7 tons, and the net tonnage 234 tons. The d.w. capacity of the vessel is 230 tons on lift, and the displacement is 1035 tons on Lloyds draft of 12 ft. 8 in. The service speed is 11½ knots, The Cartier is fitted with twin screw triple expansion engines, with cylinders 11½ in., 18 in., and 31 in. x 24 in. stroke, supplied with steam by two cylindrical multitubular boilers, 10 ft. 6 in. diameter x 11 ft. 6 in. long, having a pressure of 185 lbs., and working under Howden's system of forced draft. As will be seen from the drawing, there are a large number

of watertight compartments, ensuring the safety of the vessel when in uncharted waters. 79 tons of water ballast is in the double bottom, and 17 tons in the peaks, whilst there is a deep tank forward for fresh water. The coal bunker has a capacity of 150 tons. On the lower deck aft is accommodation for the hydrographic staff, consisting of saloon, bathrooms, living room, and four state rooms; and, forward, on the same deck is accommodation for the petty officers, seamen and firemen. On the main deck, aft, is a deck saloon and messroom for the hydrographic staff, with pantry and stewards stores generally, and, forward, is the messroom for the navigating and engine staff, with pantry and steward's stores, and two state rooms for the second and third engineers and mate. In the forecastle side houses are wash room and bath room accommodation for the crew and petty officers on the port side, and carpenter's shop and coal storage on the starboard side, whilst immediately under the forecastle is storage room for gasoline in tanks. On the shade deck is a Lucas sounding machine arranged on the bulwark rail on the port side, and towards the centre, abaft the main mast, is a sounding poney constructed by Messrs. Clarke, Chapman & Company, Limited, of Gateshead-on-Tyne. This poney has a winch of from 7 to 8 horse power, and exerts a pull of about 5 cwt. on the sounding wire. Amidships on this deck is the chartroom, and pilot house, with bedroom and day room for the sailing master. The chartroom, 15 ft. x 7 ft., is fitted with a special table, 5 ft. x 10 ft., built in three thicknesses of lin. pine, whilst the front and frame is of oak. There is accommodation for a total crew of forty-three, including officers and enginemen.



C. C. S. Cartier.



The auxiliary machinery consists of a steam windlass (Clarke, Chapman & Company); steam and hand steering gear by John Hastie & Company, and a refrigerating engine of the No. 3 single vertical marine type by J. & E. Hall, Limited, of Dartford, Kent. There is steam heating throughout the vessel, and in all rooms and toilets, with the exception of those under the forecastle, are steam radiators, each having 25 sq. ft. heating surface for each thousand feet. As the vessel will be required to work in extremes of temperature, an elaborate system of ventilation has been introduced. The electric lighting equipment, which was fitted by the Wallsend staff of Messrs. Swan, Hunter & Wigham Richardson, Limited, includes a searchlight on the bridge, and the accumulators are arranged in the tunnel space between the propelling shafts. In shallow water, the staff of the Cartier will leave the steamer and conduct survey in launches and boats, afterwards returning to the vessel to work up their observations. Accordingly the outfit of the Cartier comprises two gasoline launches, each 27 ft. x 6 ft. 7 in. x 3 ft., as also two gigs, 27 ft. x 6 ft. x 2 ft. 5 in., and one dinghy, 18 ft. x 5 ft. 4 in. x 2 ft. 2 in. The steam winches, provided for the hoisting of the boats, are arranged with special leading blocks, so that they may be used for hoisting any one of the four boats. Included in the special outfit of the Cartier is a standard compass of the Lord Kelvin Navy pattern, whilst the steering compasses include a Ritchie standard compass, and a Wilson & Gillie compass. It is understood that the vessel is required for survey work on the Eastern side of Canada, and in its design consideration was paid to the fact that the vessel would be absent for long periods on surveying work.

MARCH LAKE LEVELS

The United States Lake Survey reports the stages of the Great Lakes for the month of March, 1910, as follows:—

Lakes.	Ft. above tide-water, New York.
Superior	601.54
Michigan-Huron	580.00
Erie	571.68
Ontario	245.75

Lake Superior is 0.19 foot lower than last month, 0.19 foot higher than a year ago, 0.45 foot below the average stage of March of the last ten years, 0.74 foot below the high stage of March, 1901, and 0.53 foot above the low stage of March, 1892. It will probably remain about stationary in April.

Lakes Michigan-Huron are 0.04 foot higher than last month, 0.06 foot lower than a year ago, 0.15 foot below the average stage of March of the last ten years, 2.95 feet below the high stage of March, 1886, and 0.89 foot above the low stage of March, 1896. They will probably rise about 0.4 foot in April.

Lake Erie is 0.49 foot higher than last month, 0.10 foot lower than a year ago, 0.11 foot above the average stage of March of the last ten years, 2.17 feet below the high stage of March, 1887, and 0.85 foot above the low stage of March, 1896. It will probably rise about 0.8 foot in April.

Lake Ontario is 0.72 foot higher than last month, 0.05 foot higher than a year ago, 0.32 foot higher than the average stage of March of the last ten years, 2.06 feet below the high stage of March, 1886, and 1.45 feet above the low stage of March, 1897. It will probably rise about 0.9 foot in April.

RAILWAY SIGNALLING.

V. I. Smart, B.A., Professor of Railway Engineering, McGill.

The most important department of railroading is that which deals with the movement of trains. This must be done with a maximum of safety and expedition to be economical. The important thing to be determined is what is the method to be used that will give the greatest safety, utilizing the track to its fullest capacity, and at a minimum of cost.

There are two general methods of controlling train movement. First by means of a time table, in which all the regular movements are scheduled, irregular movements being made under the direction of a dispatcher, who issues train orders to the conductor and engineman of the train about to make this irregular movement, not provided for in the time table. The necessity for these irregular movements occurs when a train is run that is not scheduled, or when a scheduled train is late or has to meet a late train.

Second, by means of signals, in which the line is divided into sections, the number and length of which is determined by the density of the traffic, the entrance to each section is controlled by a signal, the trains being advanced from section to section by means of the signals. Only one train being admitted to the section at any one time. Meeting points being made when the necessity arises, by refusing admittance of one train to a section and advancing the other up to the same point, where one of the trains is passed round the other.

We might perhaps add a third method, which is a combination of the first two. As for instance, where automatic block signals are used, the introduction of the automatic does not permit of the discontinuance of the train order system.

The first and third methods are employed in America, the second is employed to a small extent in America, but is the method used in Great Gritain, Europe generally, South Africa, India, and Australia.

I believe that in America we are suffering from the fact, that we have not recognized that every department of a railroad, with the possible exception of that department engaged in the collection, and care of passengers and freight, involves principles of engineering. The whole machine from its inception, its construction, its operation, and its maintenance is as truly a question of engineering, as is the permanent, way, or the power and equipment. Unfortunately we have relegated the engineer to position of simply taking care of the machine, instead of both taking care of it and running it. It is very much like a manufacturing concern employing engineers to maintain the buildings and machinery, but having nothing whatever to do with the production of the product of manufacture. The engineering features of any business will be worked out on a more consistent and economical basis, by the trained man, than they will by one who has not had a scientific education.

In every operation there must be some principle involved, depending on some natural law, otherwise it becomes inconsistent, unsafe, and uneconomical. If we build a bridge, disregarding the principles of the strength of materials, and the theory of structures, we would either have it too strong, therefore uneconomical, or too weak, therefore unsafe, necessitating the use of props to keep it up. The maintenance of which would again be uneconomical.

This is equally true of train operation. There is a principle on which it is based. It is the neglect of this which leads to the use of numerous rules and regulations, to act as props, which are inconsistent, detracting from safety, and adding expense. If we do not recognize, and follow the

fundamental basis, we have the natural result; a lack of co-relationship between the different functions of train operation, which necessitates the framing of rules to meet conditions, which in themselves are a natural consequence of this neglect of principle.

The history of the development of our present system of operation is instructive. In the beginning trains were operated on American railways, by time table. Each train was scheduled, and meeting points with other trains were specified. If a train became late, the opposing train had to wait at the specified point; every train that became late caused every other train interested in its movement to lose time also. This was unimportant when there were but few trains, but as the number of trains increased it meant serious loss. To overcome this, messages were sent to the train crews changing the meeting points. These orders were simply messages, not in any prescribed form, and not requiring any acknowledgement from the men to whom they were sent. There was no guarantee that the messages had been received. This naturally lead to serious accidents, and it became necessary to provide some means whereby the dispatcher would know that the message had been received by the trainmen of the train, the right of which was being restricted, before issuing instructions conferring right on some other train. This led to the requirement that the order should be signed by the man in charge of the train and repeated back to the dispatcher and O.K'ed by him before the order could be acted upon. The wording of the orders was not prescribed, each dispatcher composing orders in his own words, and addressing each train interested separately. The consequence was that the orders were misunderstood by the different train men.

The American Railway Association finally took this matter up, and formulated the standard code. This prescribes the form of the order, and makes it necessary that each train interested receives the order in the same wording. This is delivered simultaneously to all points where the trains are to receive them.

This did not furnish the safety expected. Train men would mistake the meeting point. The middle order was then introduced which requires that a "meet" order should be sent to the two trains, and in addition to the operator at the station, at which the meet was to be made.

As traffic increased, and was irregular, scheduled trains were not sufficient to move the business. It became necessary to send out additional trains, known as extras. These trains were moved by orders, and had to keep out of the way of scheduled trains. They were therefore slow. In order to overcome this delay, trains were sent out as sections of regular trains. These ran on the rights of the scheduled trains. Preceding sections display signals on the engine, indicating that there are sections following, these signals are simply a green flag carried by the sections in advance, the final section having no distinctive mark. Any number of sections of a regular train can be run. This has not added anything to the safety of operation. Take a concrete example.

No. 56 is a regular train due at A at 12.35.

No. 55 is a regular train due at A at 12.35.

A is the scheduled meeting point for these two trains.

No. 56 is running in two sections.

No. 176 is a regular train running in three sections.

The even numbered trains are north-bound, the odd numbered trains are south-bound.

The following order is issued to 1st No. 176, 2nd No. 176, and No. 55.

"First and second No. 176 will wait at A until 12.35 p.m. for No. 55. No. 55 has right over 3rd 176 D to E."

No. 55 makes A on the order and is in on the siding.

First No. 176 goes at 12.45 displaying green flags.

First No. 56 goes at 12.50 displaying green flags.

Second No. 56 goes at 12.55 displaying no signals.

The crew of No. 55 checks them as follows.

First 176 checked all right, first 56 checked as second 176, second 56 checked as No. 56, No. 55 pulls out and meets 2nd 176 on main track.

No rule has been violated in this case, and the mistake on the part of the train crew of 55 is one due to the system and not to the carelessness of the men.

The above is a rough outline of the development of the present system of train operation by Standard Code. There does not seem to have been any investigation of the principles underlying the question. It appears simply to be a sporadic growth. When a particular condition arose, means were adopted to meet this condition. The engineer has had little or nothing to do with the development. Whether these means have been adequate or not can be seen from the table below. This is a compilation of the accidents due to collisions for a period of a year and one-half, taken from the United States Accident Bulletin. During the period covered by these, there were a total of 6,412 collisions. Can there be any doubt, with this weight of evidence, that the method of operation under the Standard Code, is unsafe and uneconomical.

In contrast to the above, the history of the development of train operation in Europe is striking. It was at once recognized that from the nature of a railway, (that is that all trains much of necessity occupy the same path), some means had to be provided to prevent two of these trains attempting to occupy the same space at the same time. The method adopted was to divide the line into sections, each of which was put under the control of a signal man. This man supervised the operation of his section alone, and could have but one train in the section at any one time. Trains had no time table rights, they simply had the right to run through one section, the right to proceed being given or withheld, depending on whether the succeeding section was occupied or not, or depending on whether a meeting was to be made with some other train or not.

At first trains were admitted to the section provided the preceding train had departed at least ten minutes previously. This refers to double track and to following trains only, this method was found wanting, in as much as it was impossible to tell positively that the section was clear, through to the next signal man, as a train might have stopped in the section and out of view of the signal man. To overcome this apparatus was installed, between the succeeding signal men, making it necessary for the men at both ends of any one section to communicate with each other before a train was admitted. One train not being allowed to enter a section until the previous train had passed out of the section. A train would continue to run until entrance to the next section was refused. There was no stopping for orders. If one train had to meet another, they would both continue to run until held by the non-receipt of a signal to proceed, and the meet made at this point. The principle involved being that of the impenetrability of matter. Collisions are impossible where it is impossible to get two trains on the same section of track at the same time. This method was developed by engineers.

Bearing in mind that there are three elements in the problem to be considered, namely safety, expedition in the movement, and the lowest possible cost consistent with these, the question is what method of operation will produce a maximum of the first two, and a minimum of the last.

	Killed.	Injured.	Damages to engines, cars and roadway.	Cause.
No. 1	0	0	$ 1,467.00	False clear manual block, operator unconsciously cleared signal. Not controlled.
No. 2	1	3	3,075.00	Failed to deliver meet order.
No. 3	2	13	4,500.00	Mistake in order. Time on order 12.50, should have been 12.15.
No. 5	1	1	5,000.00	Fouled end of double track, failed to read bulletin.
No. 6	2	23	6,400.00	Extra pass, ran by home and distant automatic signal, dense fog.
No. 8	0	7	9,220.00	C. and E. misread name of meeting station on meet order.
No. 9	0	0	10,250.00	E. of light engine overlooked meeting order.
No. 10	1	20	11,852.00	C. and E. of N.B. pass. overlooked meeting order, also ran automatic.
No. 11	0	4	14,914.00	Misunderstanding between conductors of east-bound and west-bound trains as to station for meeting the second part of separated train.
No. 12	5	2	18,600.00	Mistake in order, omitted the word "East" from name of station.
No. 13	1	13	21,000.00	Mistake in order, the order read, "Run from A to C, meet 7 at B," it was delivered "Run from A to C, meet 7 at C."
Bulletin 28.				
No. 1	1	6	1,085.00	Passenger train ran 9,044 ft. past an automatic signal at stop.
No. 3	1	9	3,350.00	Telegraph line out of order, trainmaster attempted to modify dispatcher's order.
No. 4	0	2	2,500.00	Engineer misread watch, making a mistake of one hour.
No. 5	0	0	4,000.00	Extra train was run without orders.
No. 6	0	32	6,380.00	E. forgot order, modified block system in service, signalman gave train a clear signal, thinking that the train was to run to the far end of the siding, there to wait for the opposing train.
No. 7	0	25	12,874.00	C. and E. forgot one of three orders, met one train failed to wait for another.
No. 8	1	31	13,184.00	Operator failed to deliver order to east-bound train. Had three orders.
No. 9	2	54	20,845.00	C. and E. of north-bound freight encroached on time of passenger, mistake in figuring the time from the time table.
No. 10	10	21	25,000.00	Disregard of a despatchers order.
Accidents, due to collisions, derailments, mis, train accidents, June 30th, 1908, 807 killed, 14,248 injured.				
Bulletin 29.				
No. 2	4	40	3,000.00	Confusion of orders, neglect to notice the sequence in the numbers of the orders, and neglect of dispatcher to use the phrase "instead of."
No. 6	3	37	6,000.00	Operator failed to deliver order.
No. 7	20	14	11,000.00	West-bound freight encroached on time of pass.
No. 8	5	49	12,000.00	Mistake in writing order.
No. 9	4	2	13,300.00	Operator accepted order after the train had passed.
No. 10	8	59	22,297.00	Operator accepted order after train had passed.
Bulletin 30.				
No. 4	4	14	2,200.00	Pass. standing at station run into by freight, at high speed
No. 6	1	1	2,835.00	Standing train not protected by flag.
No. 7	0	3	3,152.00	Operator accepted order after train had left.
No. 8	0	7	3,739.00	Operator having two orders, delivered only one.
No. 10	7	11	4,616.00	C. and E. of freight had order to run late one hour and thirty minutes, forgot order and ran one hour and fifteen minutes late.
No. 11	2	11	6,075.00	Misread dispatcher's order.
No. 12	0	25	7,314.00	Failure to observe wait order.
No. 13	2	4	8,000.00	Failure to observe wait order, and failure of inferior train to clear five minutes.
No. 14	2	5	8,300.00	C. accepted orders from operator, receipted for same, but failed to take them with him.
No. 15	0	9	9,000.00	C. and E. having an order that second section of train would be one hour late, assumed that the first section was also late.
No. 17	1	4	11,000.00	C. and E. misread name of station on order.

	Killed.	Injured.	Damages to engines, cars and roadway.	Cause.
No. 19	1	7	11,100.00	C. and E. saw engine 605 on side track, mistook it for engine 602, which they had orders to meet.
No. 20	4	3	12,148.00	Entire crew of north-bound train forgot schedule of south-bound train.
No. 21	1	47	12,550.00	Freight encroached on time of passenger train.
No. 22	2	5	14,700.00	Operator reported extra train by when it had not passed, despatcher acted on this information.
No. 23	1	4	11,000.00	E. forgot order.
No. 24	8	27	20,000.00	Engineman disregarded time interval.
No. 25	1	7	21,145.00	Freight encroached on time of passenger.
Bulletin 31.				
No. 1	0	0	1,394.00	Order delivered by despatcher at his own office gave the wrong station.
No. 2	0	1	2,925.00	Light engine ran by new train order signal, account of failure to read bulletin.
No. 3	0	1	3,500.00	Despatcher gave rights to an inferior train, before he restricted the right of the superior train.
No. 4	2	1	4,106.00	Operator gave clear train order signal when he had an order for the train.
No. 5	1	3	4,565.00	Engineer ran by meeting point.
No. 6	0	46	5,200.00	Freight train encroached on time of passenger train, passenger train passed station at 9.28, it had order to wait until 9.30.
No. 7	2	6	7,500.00	Operator made mistake in name of station, despatcher did not check the error.
No. 8	0	8	5,600.00	Engineer forgot part of order telling him to take siding at the meeting point, met east-bound train on main track.
No. 9	0	27	7,995.00	Engineer of pass. train in reading the schedule of the opposing train took the time opposite the wrong station, Conductor trusted to memory, a change of ten minutes had been made in the schedule.
No. 10	4	2	8,200.00	C. and E. of the north-bound train neglected to check register.
No. 12	0	4	12,200.00	Operator received order giving right over train 64, the order he delivered read train 84, he made a new copy, and made the error in copying.
No. 13	20	28	17,910.00	West-bound pass. train ordered to wait at D until 9.55 passed about 9.45. Engineer thought he had until 9.55 to reach next station E.
No. 14	1	14	21,250.00	Manual block system was in effect, the operator was at fault in giving the signals, while at the same time meeting orders had been issued by the despatcher, which orders were disregarded by the train men. The operator at S after having authorized train number 24 to leave M gave a clear signal for a train to leave S for M, the error of the trainmen was in reading No. 33 when the order actually read No. 32.
No. 15	3	30	27,888.00	Engineman of second section of train ran by home and distant automatic.
Bulletin 32.				
No. 3	1	2	2,001.00	Misread order, order was 4 k. a.m., was read 4.15 a.m.
No. 4	0	1	2,100.00	Signalman neglected to deliver order. This signalman at b on receiving word from A that engine 5 was approaching, called C and having received proper authority from him, displayed his signal in the position to permit Engine 5 to proceed to C. Immediately after doing this, he received from the despatcher, an order to deliver to Engine No. 5. In receiving this order he gave to the despatcher the regulation symbol, indicating that he had displayed his signal to stop Engine No. 5; but in point of fact, he had not displayed it, and did not. Under the code he should have also displayed a red flag in addition to the fixed signal, but this also was neglected. The collision was due to the non-delivery of the order.
No. 5	0	3	2,365.00	C. and E. misread order.
No. 6	1	1	2,450.00	Failure of automatic signal in the clear position.

	Killed.	Injured.	Damages to engines, cars and roadway.	Cause.
No. 7	0	6	3,250.00	Operator failed to deliver meet order.
No. 8	1	22	3,635.00	Schedule of superior train overlooked.
No. 9	0	3	4,968.00	Mistake in despatcher's order. Extra had right from A to B, despatcher issued an order to a train at B making a meet with the extra at A, order only delivered to the train at B, despatcher had 5 years' experience on this road.
No. 10	1	57	5,800.00	Operator made mistake in name of meeting place in writing despatcher's order.
No. 11	1	2	7,000.00	Failure to flag, train at rest.
No. 12	1	13	7,000.00	Error of despatcher, directed both trains to hold main track at meeting point.

No. 27	Bulletin	shows	a	total	of	13	collisions,	of	which	11 were due to Standard Code method of operation.
No. 28	"	"	"	10	"	"	9	"	"	" " "
No. 29	"	"	"	11	"	"	6	"	"	" " "
No. 30	"	"	"	26	"	"	18	"	"	" " "
No. 31	"	"	"	15	"	"	14	"	"	" " "
No. 32	"	"	"	14	"	"	10	"	"	" " "
				86			68			

Of the collisions reported in the quarterly bulletins of the Interstate Commerce Commission, 79 per cent. of them were due to mistakes in train orders, misreading of time-table, confusion between train orders and a so-called block system, all sanctioned under the Standard Code.

Considering the first of these. It is quite impossible to prevent all accidents. Material will fail despite the very best care and inspection man can give. The elements will produce conditions productive of accidents beyond the power of man to forsee. The more highly developed and intricate a thing becomes the greater the danger of failure in some of its parts, we have to pay a toll for our increased development. By careful inspection and the study of conditions we are able to reduce the above failures to a minimum, but there are accidents in train operation which are of daily occurance which are preventable, the collision is one of these. If we can prevent two trains from occupying the same section of track we can have no accident of this kind. There is but one way to do this and that is by absolute blocking.

In the construction of signal apparatus there is one princip'e to be kept constantly in view, i.e., the failure in any part of the apparatus must produce a danger signal, it must prevent all movement, better delay all traffic than have it possible to authorize a movement which can be done only on account of the failure of some of the mechanism of the signalling. This principle is absolutely necessary to produce safety.

(To be Continued).

This is the first of a series of articles contributed by Prof. Smart.—Ed.

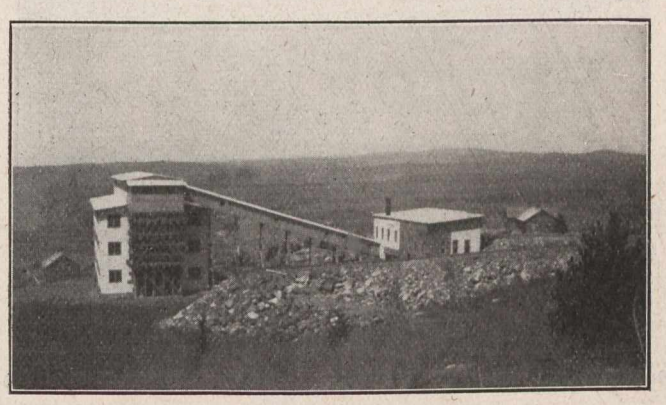
PLANT OF THE DOMINION ASBESTOS FIBRE CO.

The new factory of the Dominion Asbestos Fibre Company is one of the most up-to-date asbestos extracting plants in the asbestos bearing district of Canada. Situated in the Black Lake district of the Province of Quebec upon the side of a partly developed asbestos range it is a considerable distance above the level of the main line of the Quebec Central Railroad, and consequently lacking in transportation and building facilities. In spite of the difficulties encountered in assembling the construction materials, the details involved in mining the ore to the final operation of grading the fibre was most successfully worked out by Mr. F. W. Dean and his associate, Mr. William W. Crosby, mill engineers and architects, Boston, Mass. The elevation shown herewith is that of the No. 1 mill, which is the beginning of an extensive development on the part of the company.

As will be noted, the structure is of slow-burning mill construction inside, but boarded with matched sheathing covered with asbestos protected metal on the outside, thus securing a risk upon practically the same basis as that taken on regular mill construction with brick walls. The building, which is 180 feet x 60 feet, with monitor, has three stories, each being 16 feet high. The floors are 4 inches thick supported by 12 inch by 14 inch spruce beams in the case of the two lower floors, and by 12 inch by 12 inch beams under the third floor. Spruce columns, 12 inch by 12 inch sections, at intervals of 15 feet, furnish support for the beams. The foundations of the building consist of 1-2-5 concrete piers upon which rest the supporting columns of the first floor provided with cast iron pier caps between.

In view of the particularly efficient production of asbestos fibre, it is of interest to describe the method of handling the material from the mining pit to the grading screens, constituting the final process in separating the fibre from the ore rock. The entire plant has been designed by Mr. Crosby for a capacity for handling 25 tons of asbestos bearing ore per hour, the work being carried on in two shifts of ten hours each, making a total of 500 tons handled per day. The so-called open pit method of mining is employed in getting out the ore rock, and by means of cables and derricks the material is raised to the surface and deposited in tram cars. The longest fibre, which is very valuable, is picked out by hand in the mining pit. Facilities at the mining pit allow of taking out 1,000 tons per day, 40 to 60 per cent. of which is rejected as carrying too little fibre to pay for its extraction. The remainder is carried by the tram cars to the crusher house where in two operations the ore

is reduced to a size that would pass through a 1-inch screen, and delivered by bucket elevators to revolving driers of the shell type. These are inclined in the direction of delivery so as to place the dried material on a 16-inch belt conveyor which carries the crushed ore to the ore bin adjoining the mill. This bin has sufficient capacity to furnish material enough for a day's work, thus insuring running of the mill machinery and allowing for break-downs and repairs in the crushing and drying plants. The final mill process is made up of four successive reductions of the ore in the crushing rolls, each reduction being followed by screening to sift out sand and pulverized stone. The asbestos fibre remains on the screens and is conveyed away by vacuum pipes; the screenings are taken to the waste pile by conveyor. The grading screens are of the revolving type.



Dominion Asbestos Plant

Electric power generated several miles away by water power, furnishes alternating current of 16,000 volts, 3 phase, 60 cycle, which is stepped down to 2,200 volts at the sub-station close by. This voltage is used on motors without further reduction. The crushers of the Bacon type manufactured by the Jenckes Machine Company, are driven by Allis-Chalmers motors aggregating 250 H.P.

The matter of ventilation and lighting has been given ample consideration. In addition to sufficient window area, a monitor roof firmly braced to resist the wind pressure, which is particularly severe in this part of the province, has been provided with the idea of furnishing ventilation as well as additional light. Though inexpensive, this type of building has proved particularly satisfactory. The danger from fire is practically non-existent, as the power used is electrical.

MISCELLANEOUS

Montreal, Que.—Council are considering plans submitted by Building Inspector Chausse for the enlarging of the City Hall by the erection of an annex to the rear of the present building at a cost of about $175,000.

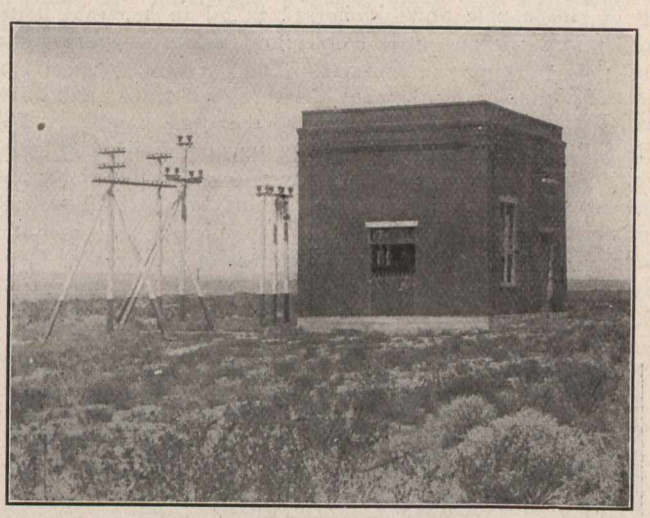
Quebec, Que.—It is estimated that over thirty-six millions will be spent on public works in Quebec during the next five years. An estimate follows:—

Quebec bridge and approaches, $10,000,000.
Dry dock and ship-building yards, $5,000,000.
Grand Trunk Pacific terminals, $3,000,000.
Quebec and Saguenay Ry., $2,000,000.
Q. R. L. and P. Co.'s improvements, $1,500,000.
Customs house and other Government public buildings $1,000,000.
Harbor improvements, including extension Louise Dock, etc., $2,000,000.
Canadian Pacific Hotel and station extension, $1,500,000.
Four thousand new houses at an average cost of $2,000 each, $8,000,000.
Civic improvements in Limoilou, etc., including two bridges over the St. Charles River, $500,000.
Battlefields Commission, $1,000,000.
Total, $36,500,000.

THE TRANSMISSION SYSTEM OF THE IDAHO-OREGON POWER COMPANY.

The present transmission system of the Idaho-Oregon Light & Power Company, in the region surrounding Boise, Idaho, comprises two water-power generating stations; one of 1,500 kilowatts capacity at the Horseshoe Bend of the Fayette River, and one of 900 kilowatts capacity at Barber Dam on the Boise River, six miles from the City of Boise, together with about 112 miles of high tension transmission line, approximately one-half of which operates at the transmission potential of 66,000 volts and one-half at 23,000 volts.

The two generating stations, above referred to, at the present time supply the principal load of the system, the lighting and traction service of the City of Boise, through 23,000 volt lines. To supply the region north and west of Boise where, besides the local service, power is used for mining, a transformer sub-station has been installed at Emmett, 42 miles from the city and 16 miles beyond the power plant on the Horseshoe Bend line, stepping up from 23,000 to 66,000 volts through three 1,000 kilowatt delta connected Westinghouse transformers. From this station the 66,000 volt lines continue through the Plymouth and Ontario sub-stations to the Weiser sub-station. Sixty-five miles northwest of this point, the Idaho-Oregon Company is building the great Oxbow hydraulic water-power plant on the Snake



Ontario Sub-station, Idaho-Oregon Power Co., showing entrance of 66 000 volt lines.

River, which will make available approximately 30,000 horsepower, and will ultimately be used to supply the principal load of the system at Boise, at a transmission distance of 125 miles.

When the Oxbow station is completed and put into operation, the Horseshoe Bend and the Barber Dam plants will be operated as auxiliary generating stations.

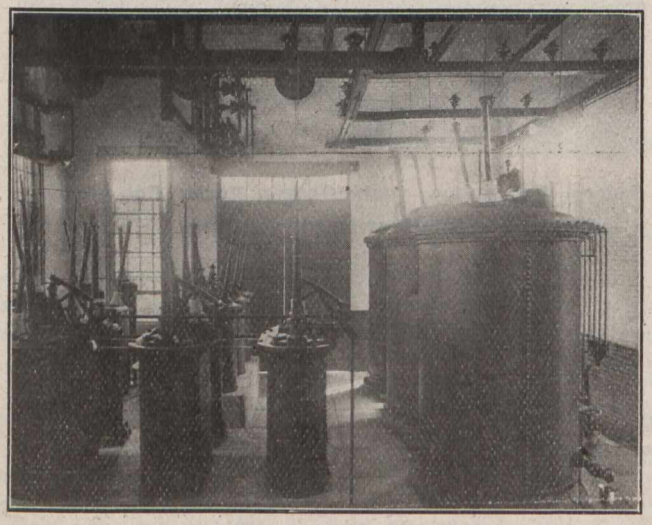
The principal sub-station, both in the present plant operation and in the transmission scheme including the new Oxbow stations, is that at Emmett. This station equipment includes three delta connected 1,000 kilowatt transformers, stepping from 23,000 to 66,000 volts, for transforming the principal through load; and three 100 kilowatt 66,000 to 2,300 volts, transformers, star connected, for supplying the local distribution lines in the territory adjacent to the station.

The incoming 66,000 volt lines from Ontario and Weiser, of stranded aluminum cable of a carrying capacity equivalent to No. 1 copper, are brought into the Emmett sub-station past aluminum cell, electrolytic lightning arresters, and carried through disconnecting switches to impedance coils, and thence to the 66,000 volt station busbars. Feeding from

these, the main power load of the system is led through three Westinghouse type "G A" oil circuit breakers to the group of 1,000 kilowatt transformers stepping down to 23,000 volts. The low tension terminals of these units are connected through Westinghouse type "E" oil circuit breakers to the line, after passing lightning protective apparatus, in general, similar to that on the incoming 66,000 volt lines. The second circuit taken from the 66,000 volt station busbars is led, through a similar set of type "G A" oil circuit breakers, to the 100 kilowatt transformers of suitable ratio, lowering to the 2,300 volt distribution voltage. From these 2,300 volt busbars, the feeder circuits are controlled by Westinghouse type "B" circuit breakers. The equipment of the other sub-stations is quite similar in the arrangement of the distributing and feeder circuits and the apparatus involved, although the Emmett station is the only one where the main power load must be controlled at the full transmission voltage.

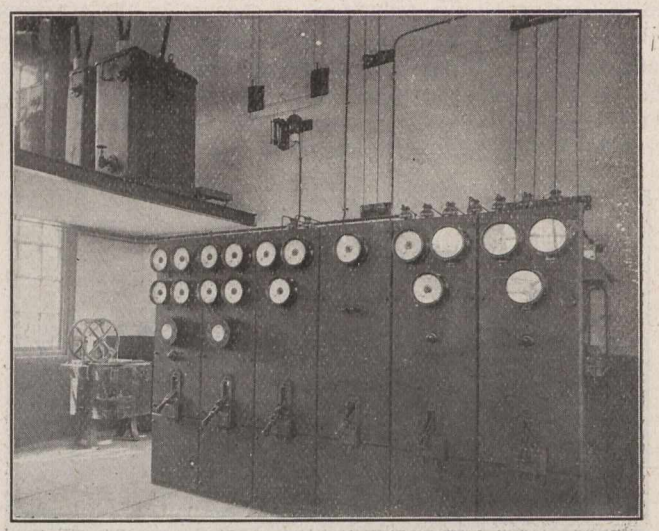
One of the interesting developments of the Idaho-Oregon installation has been the performance, as recorded in service, of the Westinghouse type "G A" oil circuit breakers. On this transmission system there are now four of these three-pole units operating. Two of these are in the Emmett sub-station, and one in each of the Weiser and Ontario sub-stations.

The Westinghouse type "G A" circuit breaker is made up of single pole units immersed in oil in separate boiler steel tanks, without other connections than the operating or pull rods working the contacts. The operating system consists of a simple arrangement of levers, bell cranks and links, actuated by a toggle from the switchboard handle. The trip coils are actuated from the low tension winding of series transformers connected in the line wires. In the newer and present standard type of these circuit breakers above 100 amperes capacity, these series transformers are mounted directly over the high tension bushings of the breaker forming a part of the breaker. An accompanying illustration shows the assembly of a group of "G A" circuit breakers



Interior Emmett Sub-station, Idaho-Oregon Power Company.

with this self-contained arrangement of the series transformers and also pictures very clearly the system of operating links and the tripping mechanism. The controlling force in the opening of these circuit breakers is that of gravity, the moving parts being so positioned and proportioned that the contacts automatically drop open to produce a wide and ample break in the clean oil of the centre of the tank when the mechanism is released by the handle or tripping coils. The spring socketed seats of the butt contacts also assist in producing a rapid positive break, besides assuring a self-aligning and firm closure of the contacts. The leads or bushings of the "G A" circuit breakers are of the well-known condenser terminal type brought out by the Westinghouse Company. A simple tell-tale device indicating the position of the contacts is provided by a small double pole, double throw switch operated by the controlling system which is arranged to light a red lamp on the switchboard while the circuit is closed, and a green lamp when the breaker is open.



Switchboard, Emmett Sub-station, Idaho-Oregon Power Co.

The 66,000 volt "G A" circuit breakers for the Idaho-Oregon system have a total break of about 17½ inches per contact, or 35 inches per pole. Each breaker has a rated capacity of 300 amperes being especially designed to open the circuit under severe conditions. The small space and head room required by this apparatus especially recommends it for installations where space is limited, and the thorough insulation afforded by its oil immersed contacts in lined tanks, the internal insulating barriers and condenser terminals insure the reliability and safety of its operation in handling the heaviest overloads and short circuits. The ease with which these circuit breakers are installed and adjusted, and the accessibility of all operating parts for examination, are also important items in gaining the favor of operating men where "G A" breakers have already been put into service.

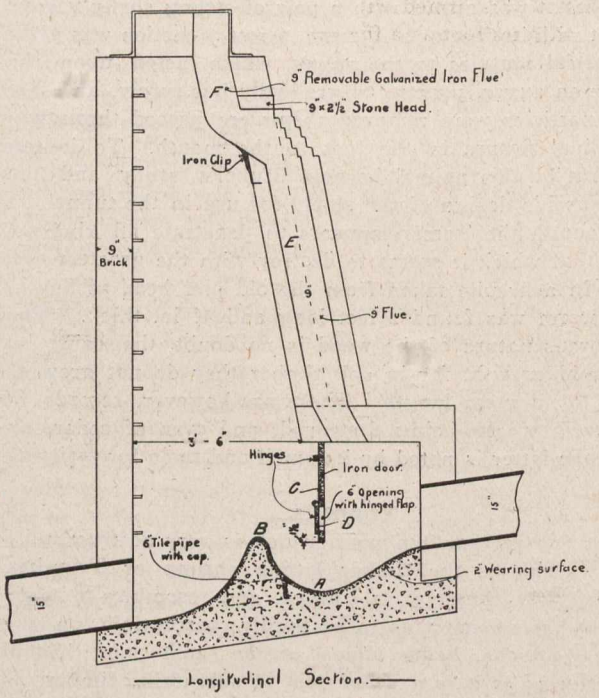
The "G A" circuit breakers on the lines of the Idaho-Oregon Light & Power Company have already been operated more than six months, and during this time have handled some extreme overloads and surges in a manner gratifying to the company's engineers. Several surges have occurred in which the voltage rose beyond the scale of the meters, 90,000 volts. These phenomena have been observed during heavy wind storms and when the Boise sub-station trips out. The Boise load is inductive and tends to neutralize the heavy capacity of the lightly loaded transmission line. No static appears on these terminals although at times the wiring and porcelain insulators have displayed considerable corona. The performance of these circuit breakers has been a source of much satisfaction to the operating officials, as their operation has been uneventful and dependable under all conditions so far met during the most severe season of the year.

Mr. O. G. F. Markus is general manager of the Idaho-Oregon Light & Power Company, and Mr. W. H. Trenner is superintendent. The alternators, sub-station apparatus, transformers, switchboards and circuit breakers, in fact the complete electrical equipment of the power generating and transmission system, was furnished by the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa.

MANHOLE FOR DEEP SEWER.

W. R. Worthington, B.A.Sc.

There is one branch of Sanitary Engineering which has not up to the present time received sufficient attention. Wherever sewage systems have been installed there is a general complaint regarding sewer gas. These complaints come particularly from the residential districts which are, as a rule, situated on the highest elevations. The gas accumulates in the sewers serving these districts. Some



Sanitary Engineers have agreed that an important step towards the elimination of sewer gas nuisance would be made if a cheap, simple, and effective device could be designed to prevent its accumulation in the lateral sewers. If every lateral were trapped at its connection, then the amount of gas generated in each sewer would be small and easily ventilated without a very noticeable odor by the ordinary opened top manhole. With this object in view, I have designed a trapped manhole. The accompanying drawing although not complete in detail will give a general idea of the construction.

The manhole is of the general type used in Toronto. The invert instead of being on the grade of the sewer takes the form as shown on plan with a weir across. Depression A. and Crest B. varies according to the grade and size of the sewer. In case of flat grades where B. is the same height as the invert, A. has to be deep enough when trapped not to diminish the amount of discharge. For steep grades A. can be made shallow and Crest B. fairly high.

The ¼inch steel trap door "C" is hung on the side of the M.H. and is the same width. It is placed about the centre of the pocket, and is sufficiently deep to allow 1½ in. seal. With this door sealed the gases will escape through the manhole instead of rising from the lower to the upper sewer. In order to produce a current of air through the upper section of the sewer there is a flue E. built into the wall of the manhole. This extends from the trap chamber to near the top and is continued by a removable galvanized iron flue "F" to the underside of the opening. In case of any sediment lodging in "A" the auxiliary flap gate "D" will provide relief for the overflow.

To allow for inspection of the sewer or manhole, the galvanized iron flue may be removed and the door "C" swung back thus making everything convenient.

This scheme will also be found workable for the prevention of erosion in cases where a lateral enters the main sewer at a steep grade. The sewage would first fall into a pocket of water and quietly flow over weir "B."

FAILURE OF WOODEN PILING DUE TO PRIVATE AGENCIES AND METHODS OF PREVENTION*

W. Putman

The destruction of timber by various worms and insects may be spoken of as "Animal Rot." These destructive insects which prey upon timber tress may be divided into three classes according to their method of attack, viz. :—

(1) Those which feed upon the leaves and tender shoots.
(2) Those which feed upon the bark and the albumen.
(3) Those which feed upon the heart wood.

Now many of these insects which feed upon the heart of the wood do not cease their ravages upon the removal of the tree—but continue to devour the wood long after it has has been placed in buildings. There seems to be very few means of defense against this class of insects, and very few reliable indications of their existence or the extent of the damages they have committed and it thus frequently happens that a sound, hearty-looking stick of timber may be so seriously bored by these insects as to be of comparatively little value for building purposes of any description, now, it is those woods which are soft and tender, and whose juices are not bitter which are assailed by these worms. Hence thorough seasoning of the wood to get rid of these juices is one of the best methods of fighting this pest. Further safety may be insured by the infusion into the wood of some bitter decoction which will be a very effectual preventitive.

And if cut when full of sap is very much subject to the attack of the worms. Beech, alder, birch, oak, silver fir, under similar conditions are also liable to this attack. On the other hand, cedar, walnut, cypress and mahogany are fairly free from these attacks.

The White Ant is the most destructive insect to timber on land, while the Teredo is by far the most dangerous of Sea worms. The destructive effects of these marine worms have been known for hundreds of years. It is generally supposed that the worm is a native of India, and that it was introduced to Holland 200 years ago, from whence it spread over the coast waters of Europe and to the shores of the American Continent.

*Read before the Nova Scotia Society of Civil Engineers.

The Teredo is very destructive to harbor works and Piling. The bottoms of ships and timbers exposed to the action of thet sea are often destroyed by this worm. It has been said that the gun boats used in the Crimean War suffered more from dry rot and Teredo than from the shot and shell of the Russians.

It is almost impossible to estimate the damage done each year in European waters by these insects. In the short space of 12 years these worms made such havoc of the Fir Piles of a bridge in Seignmouth that the whole bridge fell suddenly and had to be entirely reconstructed.

The reason why Balaclava, in Russia is not a place of mercantile importance is due largely to the ravages of the worms with which its waters are infested and by which the hulls of ships remaining there for any length of time become perforated.

The destruction of the pier head of the old Southend Pier, England, in a few years is another instance of the serious damages these worms cause.

This pier head was built in 1833, and in three years the majority of the wooden piles had been almost destroyed, and at the end of ten years, in addition to the piles being all eaten through by worms, the whole structure had sunk 9 in. at the Western end, so that in a short time it would have fallen.

The materials used were of first quality Baltic fir and English Oak. It was all perfectly sound in places where the Teredo had not attacked it, and indeed portions of it were afterwards used in the extension of the piers.

The whole of the timber work was well coated with Pitch and tar previously to being fixed, but notwithstanding these precautions and the use of copper sheating, the Teredo made its appearance, and committed such ravages that the entire destruction of the pier head seemed inevitable. The Teredo first showed itself six months after the completion of the work and was reported within 12 months to have seriously injured the piles above the copper while at the low water mark of neap tides nearly all the piles showed signs of destruction and in less than four years from the completion of the pier head they had progressed in their work to such an extent that some of the piles were eaten through, both above and below the Copper sheating.

The first appearances of the Teredo are somewhat singular—no indications of their presence being vsiible to the casual observer—no sign of destruction on the surface—nor are the animals themselves visible, until the outer part of the wood has been broken away—showing the honeycomb which they have formed. Upon a closer examination of the wood however a number of small holes are discovered on the surface, covered with slimy matter, and on opening one wood at one of these, and tracing it the tail of the animal is immediately found and after various windings the head which is often three feet from the point of entrance. They enter at the surface, bore in every direction both with and against the grain of the wood, growing in size as they proceed.

A portion of a pile broken from a pier at Yarmouth, England, was so honeycombed that it could be crushed in the hand like paper. This piece 7 in. long and 11 in. in circumference weighed under 4 oz. a considerable portion even of this being due to the shelly tubes of the Teredo.

The eggs of the Teredo affix themselves to the wood they are washed against, are then hatched, and the worm commences boring. Any timber, constantly under water, but not exposed to the action of the air at the fall of the tide, is extremely likely to be destroyed by them. The body of the Teredo is enveloped by a shell and the neck is provided with powerful muscles. The manner in which it appears to perforate the wood is by a rotary motion of the foot, carrying around the shells which act as an auger. It lines the passage in the wood with a hard shell which surrounds but does not adhere to the body of the Teredo. It is both curious and wonderful to watch the mysterious instinct which seems to regulate the mechanical skill of the Teredo. It is said that when Brunel was considering how to construct the Thames Tunnel he was one day passing through the dockyard at Chatham, when his attention was attracted to an old piece of ship timber which had been perforated by the Teredo. He examined the perforations and subsequently the animal and found that it was armed with a pair of strong shelly valves, and that with its foot as a fulcrum, a rotary motion was given by powerful muscles to the valves which acted upon the wood as an auger, penetrated gradually but surely, and that as the particles were removed they were passed through a longitudinal fissure in the foot to the mouth. To imitate the action of this animal became Brunel's study and the result was his design of the shield for use in the tunnel.

Although the Teredo appears to penetrate all kinds of timber, that which it seems to destroy with the greatest ease is fir. In a fir pile taken from the old pier head at Southend, a worm was found 2 feet long and ¾ in. thick. The soft, porous nature of the wood is no doubt the cause of their rapid growth, for in oak timber they do not grow as fast or to no great length. There are however, records of ships keels of oak being destroyed, and even of cedar, although the latter is noted by its smell and resin for resisting worms.

Trinnoria.

There is yet another worm which is very destructive to timber. This is the timber boring shrimp or Trinniria. It is also very abundant in Europe, and resembles a wood louse, and is so small as to be hardly perceptible on the timber it attacks, being almost of the same color. Small as this insect is it is a great pest in submarine timber, as it makes up in energy and numbers what it lacks in size, as many as 20,coo will appear on the surface of a pile 12 inches square. The surface of the timber is first attacked, it proceeds into the wood to the depth of 1½ inches and this layer becomes rotten and is washed away by the sea. The Trinnoria differs from the Teredo in that it works by means of solvent juices which it secretes.

It also prefers tender wood, but the hardest do not escape. The rate of boring in pure salt water is about one inch per year, but may be much worse. At Greenock, a pile 12 inches square was eaten through in 7 years. It is stated that a 3 inch oak plank 12 feet long would be entirely destroyed in about 8 years. The Trinnoria always works just under neap tides and cannot live in fresh water, and while the Teredo is destroying the heart the Trinnoria is eating at the surface.

There are three methods of preventing the ravages of these worms, viz., the natural, chemical and mechanical.

(1) By using woods which are able to resist the attacks of these worms.

(2) By subjecting the piles to a chemical process.

(3) By adopting a mechanical process.

First, there are practically very few woods which unaided resist the action of worms.

The following is a list of timber woods which resist for a considerable time their action: North American "Locust," "African Oak" of Sierra Leona, Tasmania "Blue Gum," "Ligium Vitas" of West Indies, "Greenheart" Jamaica, and a few other foreign woods.

Second: It has been found that the Kyan or corrosive sublimate process, pitching and tarring, the zinc chloride process, and practically all chemical processes except the

creosoting one are failures. This may be due to either of two causes; either the sea water decomposes the poisonous ingredients in the wood, or these have no effect upon the worms. Both these, no doubt are to blame, but principally the latter.

In America white ozide of zinc is used as a marine paint for ships and piles. In the United States navy yard it is well spoken of and very frequently used. It is said to be much superior to white lead—Red lead or coal tar, and that timber covered with two coats of white zinc is quite free from the attacks of the worm.

Third: The mechanical processes are few in number, and rather expensive. In spain the piles of a wooden bridge standing in the sea have been guarded against the attacks of sea worms in the following manner:

Each pile is surrounded by a wooden box and the space between filled with cement. After six years it was proved that the piles were in perfect condition, while the outer boxes were riddled by the worms.

In 1835 Brunel suggested an easy way of defending piles, which was to give them first a coat of tar, then powder them with brick dust which would render the wood sufficiently hard to receive a coat or two of cement.

In some cases sheet lead nailed on to the piles, ropped with well tarred rope has been used. Copper sheeting has been used as at Southend, England, with poor success, for although nearly all the piles were covered with it for about 9 or 10 feet, the Trinnoria not only penetrated between copper and timber, but the copper had decayed to such an extent as to be in some cases no thicker than paper; it was soft and peeled off the wood very easily, and in two or three years would probably have been entirely destroyed.

Captain Brown of Royal Navy, states that from experiments he is satisfied that there is no specific remedy against the attack of sea worms upon timber, except iron nails. He proposes to encase the piles with broad headed iron nails and he says that in a few months corrosion takes place and spreads into the cracks, the rust hardens upon the pile and becomes a solid mass which the worm will not touch. Experiments at New-haven and Brighton pier have proved the effectiveness of his method.

In conclusion: Of all the various schemes which have been proposed for the protection against sea worms, the chemical process of creosoting is probably the best. This method when properly carried out, thoroughly protects wood against Teredo and other marine worms.

A most searching examination was made in 1849 upon every pile in Lowestoft Harbor with the following results:

The whole of the 900 creosoted piles in the North pier were sound and quite free from Teredo and Trinnoria. There was **no instance** of an **uncreosoted** pile being sound but were all attacked both by the Trinnoria and Teredo to a very great extent and the piles in some instances are eaten through

There was only one case of a treated pile being attacked which had been cut by the workmen exposing the heart of the pile where the creosote had not penetrated. At this spot a worm entered and bored to the right where it found creosote. It then turned to the left and finding creosote all around its progress was stopped and it then appeared to have left the timber entirely.

These practical observations seem to show pretty conclusively the value of the creosoting process as a method of preventing the ravages of marine worms.

SOCIETY NOTES.

Quebec Land Surveyors: The annual meeting of the Provincial Land Surveyors of the Province of Quebec was held last week. Four of the retiring directors were re-elected without opposition, namely, Messrs. A. Leoford. A. Smith, G. Michaud and M. Sirois. 8

McGill University Notes: A fund has been established at McGill University, Montreal, by the Applied Science class of 1899, to be known as the "Class of 1899 Fund," for the purpose of aiding, each year, one or more students who upon the completion of their second year work, require assistance to enable them to finish their course of study. The loans from this fund made to students will be repayable after graduation. Applications are to be made through the Dean.

Canadian Branch, International Electro-Technical Commission: A Canadian branch of the International Electro-Technical Commission has been formed, Professor L. A. Herdt, head of the Electrical Engineering Department, McGill University, Montreal, being elected chairman. The other members are Dr. H. T. Barnes, McGill University; Prof. T. T. Rosebrugh, Toronto University; Professor L. W. Gill, Queen's University; Mr. O. Higman, chief electrical engineer, Electrical Standards Laboratory, Ottawa; John Murphy, electrical engineer, Railway Commission, Ottawa; W. A. Duff and A. B. Lambe, Winnipeg. This commission, which has local committeees in practically all countries, has for its purpose the standardization of nomenclature and ratings of electrical apparatus and machinery. Meetings of delegates of the various national committees meet once a year in London, England. The present committee, named by the Canadian Society of Civil Engineers, is the first move that has been made in Canada in this direction, although in 1906, at the inaugural meeting in London, Professor Herdt was the Canadian representative and last year Mr. O. Higman attended the meeting.

ENGINEERING SOCIETIES.

CANADIAN SOCIETY OF CIVIL ENGINEERS.—413 Dorchester Street West, Montreal. President, Col. H. N. Ruttan; Secretary, Professor C. H. McLeod.

Chairman, L. A. Vallee; Secretary, Hugh O'Donnell, P.O. Box 113, Quebec. Meetings held twice a month at Room 40, City Hall.

TORONTO BRANCH—

96 King Street West, Toronto. Chairman, A. W. Campbell; Secretary, P. Gillespie, Engineering Building, Toronto University, Toronto. Meets last Thursday of the month.

MANITOBA BRANCH—

Chairman, J. E. Schwitzer; Secretary, E. Brydone Jack. Meets first and third Fridays of each month, October to April, in University of Manitoba, Winnipeg.

VANCOUVER BRANCH—

Chairman, Geo. H. Webster; Secretary, H. K. Dutcher, 40-41 Flack Block, Vancouver. Meets in Engineering Department, University

OTTAWA BRANCH—

Chairman, W. J. Stewart, Ottawa; S. J. Chapleau, Resident Engineer's Office, Department of Public Works.

MUNICIPAL ASSOCIATIONS.

ONTARIO MUNICIPAL ASSOCIATION.—President, Mr. George Geddes, Mayor, St. Thomas, Ont; Secretary-Treasurer, Mr. K. W. McKay, County Clerk, St. Thomas, Ontario.

UNION OF ALBERTA MUNICIPALITIES.—President, H. H. Gaetz, Red Deer, Alta.; Secretary-Treasurer, John T. Hall, Medicine Hat, Alta.

UNION OF NOVA SCOTIA MUNICIPALITIES.—President, Mr. A. E. McMahon, Warden, Kings Co., Kentville, N.S.; Secretary, A. Roberts, Bridgewater, N.S.

UNION OF SASKATCHEWAN MUNICIPALITIES.—President, Mayor Hopkins, Saskatoon. Secretary, Mr. J. Kelso Hunter, City Clerk, Regina, Sask.

CANADIAN TECHNICAL SOCIETIES.

ALBERTA ASSOCIATION OF ARCHITECTS.—President, E. C. Hopkins, Edmonton; Secretary, H. M. Widdington, Strathcona, Alberta.

ASSOCIATION OF SASKATCHEWAN LAND SURVEYORS.—President, J. L. R. Parsons, Regina; Secretary-Treasurer, M. B. Weeks, Regina

ASTRONOMICAL SOCIETY OF SASKATCHEWAN.—President, N. McMurchy; Secretary, Mr. McClung, Regina.

BRITISH COLUMBIA LAND SURVEYORS' ASSOCIATION.—President, W. S. Drewry, Nelson, B.C.; Secretary-Treasurer, S. A. Roberts, Victoria, B.C.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.—President, Charles Kelly, Chatham, Ont.; Secretary, W. A. Crockett, Mount Hamilton, Ont.

CANADIAN CEMENT AND CONCRETE ASSOCIATION.—President, Peter Gillespie, Toronto, Ont.; Vice-President, Gustave Kahn, Toronto; Secretary-Treasurer, R. E. W. Hagarty, 662 Euclid Ave., Toronto.

CANADIAN CLAY PRODUCTS' MANUFACTURERS' ASSOCIATION.—President, W. McCredie; Secretary-Treasurer, D. O. McKinnon, Toronto.

CANADIAN ELECTRICAL ASSOCIATION.—President, N. W. Ryerson, Niagara Falls; Secretary, T. S. Young, Canadian Electrical News, Toronto.

CANADIAN FORESTRY ASSOCIATION.—President, Thomas Southworth, Toronto; Secretary, James Lawler, 11 Queen's Park, Toronto.

CANADIAN MINING INSTITUTE.—Windsor Hotel, Montreal. President, Dr. Frank D. Adams, McGill University, Montreal; Secretary, H. Mortimer-Lamb, Montreal.

CANADIAN RAILWAY CLUB.—President, H. H. Vaughan; Secretary, James Powell, P.O. Box 7, St. Lambert, near Montreal, P.Q.

CANADIAN STREET RAILWAY ASSOCIATION.—President, D. Mc Donald, Manager, Montreal Street Railway; Secretary, Acton Burrows, 157 Bay Street, Toronto.

CANADIAN SOCIETY OF FOREST ENGINEERS.—President, Dr. Fernow, Toronto; Secretary, F. W. H. Jacombe, Ottawa.

CENTRAL RAILWAY AND ENGINEERING CLUB.—Toronto, President, J. Duguid; Secretary, C. L. Worth, 409 Union Station. Meets third Tuesday each month except June, July, August.

DOMINION LAND SURVEYORS.—President, Thos. Fawcett, Niagara Falls; Secretary-Treasurer, A. W. Ashton, Ottawa.

EDMONTON ENGINEERING SOCIETY.—President, Dr. Martin Murphy; Secretary, B. F. Mitchell, City Engineer's Office, Edmonton Alberta.

ENGINEERING SOCIETY, TORONTO UNIVERSITY.—President, A. D. Campbell; Corresponding Secretary, A. H. Munroe.

ENGINEER'S CLUB OF TORONTO.—96 King Street West. President, C. M. Canniff; Secretary, R. B. Wolsey. Meeting every Thursday evening during the fall and winter months.

INSTITUTION OF ELECTRICAL ENGINEERS.—President, Dr. G. Kapp; Secretary, P. F. Rowell, 92 Victoria Street, London, S.W.; Hon. Secretary-Treasurer for Canada, Lawford Grant, Power Building, Montreal, Que.

INSTITUTION OF MINING AND METALLURGY.—President, Edgar Taylor; Secretary, C. McDermid, London, England. Canadian Members of Council:—Prof. F. D. Adams, J. B. Porter, H. E. T. Haultain, and W. H. Miller, and Messrs. W. H. Trewartha-James and J. B. Tyrrell.

MANITOBA LAND SURVEYORS.—President, George McPhillips; Secretary-Treasurer, C. G. Chataway, Winnipeg, Man.

NOVA SCOTIA MINING SOCIETY.—President, T. J. Brown, Sydney Mines, C.B.; Secretary, A. A. Hayward.

NOVA SCOTIA SOCIETY OF ENGINEERS, HALIFAX.—President, S. Fenn; Secretary, J. Lorne Allan, 15 Victoria Road, Halifax, N.S.

ONTARIO PROVINCIAL GOOD ROADS ASSOCIATION.—President, W. H. Pugsley, Richmond Hill, Ont.; Secretary, J. E. Farewell, Whitby, Ont.

ONTARIO LAND SURVEYORS' ASSOCIATION.—President, H. W. Selby; Secretary, Killaly Gamble, 703 Temple Building, Toronto.

ROYAL ARCHITECTURAL INSTITUTE OF CANADA.—President, A. F. Dunlop, R.C.A., Montreal, Que.; Hon. Secretary, Alcide Chausse, Beaver Hall Square, Montreal, Que.

ROYAL ASTRONOMICAL SOCIETY.—President, Prof. Alfred T. de Lury; Toronto; Secretary, J. R. Collins, Toronto.

UNDERGRADUATE SOCIETY OF APPLIED SCIENCE, McGILL UNIVERSITY.—President, H. P. Ray; Secretary, J. P. McRae.

WESTERN CANADA RAILWAY CLUB.—President, Grant Hall; Secretary, W. H. Rosevear, 199 Chestnut Street, Winnipeg, Man. Second Monday, except June, July and August, at Winnipeg.

AMERICAN TECHNICAL SOCIETIES.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS (TORONTO BRANCH).—W. H. Eisenbeis, Secretary, 1207 Traders' Bank Building.

AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION.—President, John P. Canty, Fitchburg, Mass.; Secretary, T. F. Patterson, Boston & Maine Railway, Concord, N.H.

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION.—President, L. C. Fritch, Chief Engineer, Chicago G. W. Railway; Secretary, E. H. Fritch, 962-3 Monadnock Block, Chicago, Ill.

AMERICAN SOCIETY OF CIVIL ENGINEERS.—Secretary, C. W. Hunt, 220 West 57th Street, New York, N.Y. First and third Wednesday, except July and August, at New York.

AMERICAN SOCIETY OF ENGINEERING-CONTRACTORS.—President, George W. Jackson, contractor, Chicago; Secretary, Daniel J. Hauer, Park Row Building, New York.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—29 West 39th Street, New York. President, Jesse M. Smith; Secretary, Calvin W. Rice.

WESTERN SOCIETY OF ENGINEERS.—1735 Monadnock Block, Chicago, Ill. J. W. Alvord, President; J. H. Warder, Secretary.

ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

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

10042—April 2—Authorizing the C.P.R. to construct a branch line in Block 165m in the City of Saskatoon, Sask.

10043—March 29—Amending sub-clause (N-a) in Clause "N" in the Standard Conditions and Specifications for Wire Crossings, by inserting the words "or copper-clad steel wire" after the words "copper wire" at the end of the third line in the said sub-clause.

10044—April 2—Authorizing the City of Toronto to carry electrical power cables on Pacific Avenue under the tracks of the G.T.R.

10045—March 22—Refusing application of the G.T.R. for approval of the location of its semaphore, wire fences and works on the Northern Division of its railway between Old Yonge Street and Yonge Street near Holland Landing, in the County of York, Ontario, with leave to any of the parties interested to renew the application upon the usual notice being given.

10046—March 22—Rescinding Order No 7706, dated August 3rd, 1909, as amended by Order No. 8079, dated the 14th of September, 1909, authorizing the G.T.R. to construct a branch line of railway in Oakville, Ontario, to the premises of Messrs. Davis & Doty.

10047—March 22—Ordering the Railway Company concerned in the crossing at the following point be relieved for the present from providing further protection at the crossing named, it appearing from an inspection made by the Board's Engineer and Operating Department, and from plans furnished, that the view at the crossing is excellent from both directions; that the crossing sign-board is properly placed, and that there are whistling posts on the railway:—C.P.R. crossing at Dundas Street, Lambton, Ont.

10045—March 22—Rescinding Order No. 8055, dated September 13th, 1909, authorizing the G.T.R. to construct a branch line of railway in Oakville to the premises of Messrs. Shields & Hilmer.

10049-50—April 1 and 2—Ordering the Railway Company concerned in the crossings at the following points be relieved for the present from providing further protection at the crossings named, it appearing from an inspection made by the Board's Engineer and Operating Department and from plans furnished, that the view at the crossings is excellent from both directions; that the crossing sign-board is properly placed, and that there are whistling posts on the railway:—1. G.T.R. crossing second highway east of station at Upton Road, Quebec; 2. G.T.R. crossing 1¼ miles south of Moorefield station, in the County of Wellington, Ontario.

10051—April 2—Authorizing the C.P.R. to construct a branch line of railway at mileage 27.62, Woodstock Section, for the Hon. J. K. Fleming, Woodstock, N.B.

10052—April 2—Approving road diversion of the G.T.R. in S. W. Section 1, Tp. 44, R. 4, W. 4th M., Dist. of North Alberta, Province of Alberta.

10053—April 2—Directing that the G.T.R. install, within sixty days from the date of this Order, an electric bell at the crossing of the G.T.R. just east of station at Maxville, Ontario.

10054—April 1—Ordering the Railway Company concerned in the crossing at the following point be relieved for the present from providing further protection at the crossing named, it appearing from an inspection made by the Board's Engineer and Operating Department, and from plans furnished, that the view at the crossing is excellent from both directions; that the crossing sign-board is properly placed and that there are whistling posts on the railway: C.P.R. crossing at mileage 27.5, Teeswater Branch between Lots 16 and 17, Tp. Arthur, Ontario.

10055—March 22—Directing that the Michigan Central Railway provide protection at the crossing by said railway company at Tillson Avenue, Tillsonburg, Ontario.

10056-57—April 2—Authorizing the Bell Telephone Company to erect its aerial wires and cables across the tracks of the G.T.R. at public crossing, Daniel Street, Arnprior, Ont., and at public highway crossing, John Street, Arnprior, Ont.

10058—April 2—Authorizing Mr. J. Sidey, of Garden Hill, Ontario, to erect aerial wires across the track of the G.T.R. at public crossing just north of Garden Hill, Ont.

10059-60—April 2—Authorizing the Ontario Power Company, of Niagara Falls, to erect its line of wires for the transmission of electrical energy over the Grand Trunk Y connecting Welland and Buffalo and Lake Huron Divisions on Welland Street, in village of Port Colborne, Ontario, and on King Street, in the village of Port Colborne, Ontario.

10061—April 1—Ordering the Railway Company concerned in the crossing at the following point be relieved for the present from providing further protection at the crossing named, it appearing from an inspection made by the Board's Engineer and Operating Department and from plans furnished that the view at the crossing is excellent from both directions, that the crossing signboard is properly placed, and that there are whistling posts on the railway:—G.T.R. crossing of second highway east of Stanfold station, Par. of Stanfold, Quebec.

10062—April 5—Authorizing the G.T.R. to construct certain branch lines of railway and sidings from a point on the Northern Division of the Applicant Company's railway south of Bloor Street, Toronto, thence extending north-westerly to and into the premises of the Fairbanks Morse Canadian Mfg. Co., Ltd.

10063—April 5—Directing that the G.T.R. within sixty days from the date of this Order, install an electric bell at the crossing of the G.T.R., of Laggan Road, in the village of Alexandria, Ontario.

10064—April 5—Extending, until July 31st, 1910, the time within which the C.P.R. should construct an industrial spur for the city of Winnipeg in the Par. of St. Paul, near Birdshill Station.

10065-66—April 4 and 5—Authorizing the C.N.O.R. to cross the highway between Lots 8 and 9, Con. 3, and between Lots 14 and 15, Con. 4, Township of Hope, Ontario.

10067—April 5—Authorizing Dr. A. C. Beatty, of Garden Hill, Ont., to erect telephone wires across the track of the C.N.O.R., between Lots 23 and 24, Con. 5, Tp. of Hope, Ontario.

10068 to 10072 Inc.—April 5—Authorizing the Bell Telephone Company to erect its aerial cables across the track of the C.P.R. at five different points in Ontario and Quebec.

10073—March 25—Refusing application of E. N. Richards, for an Order directing the G.T.R. to provide and construct a suitable farm crossing where its railway intersects farm Lot 102, in the 1st Concession of Township of Sandwich East, Ont.

10074—April 5—Amending Order No. 8627, dated October 21st, 1909, by substituting the word "Railway" for the word "Applicant" where it appears in the 7th and 11th lines of the preamble in the first and second paragraphs of the operative part, and in conditions 2 and 10 of the Order; and by adding the word "Railway" before the word "Company" where the latter word appears in conditions 3, 4, sub-section (3) of condition 4, 5, 7, 8, and 9, of said Order.

10075—April 6—Directing that the G.T.R., within sixty days from the date of this Order, install an electric bell at G.T.R. crossing of highway just east of Breslau Station, in the Province of Ontario.

10076—March 15—Refusing application of Messrs. P. C. Larkin Company, of Toronto, Ontario, for a lower rating in the Canadian Classification for "packet" tea, boxed, than for "bulk" tea, boxed.

10077—March 22—Directing that the G.T.R. within sixty days from the date of this Order put the approaches at crossing allowance for road known as "The Seventh Line" between the 7th and 8th Concessions, Tp. of Esquesing, on both sides of the railway in condition to comply in all respects with the General Regulations of the Board Affecting Highway Crossings, dated January 26th, 1909.

10078—April 6—Authorizing the Metcalfe Rural Telephone Association to erect its wires across the track of the O. & N. Y. Railway Company, at Edwards Station, on the boundary road between Townships of Osgoode and Gloucester.

10079-80-81—April 6 and 7—Authorizing the Canadian Niagara Power Company to erect its wires across the wires of the Bell Telephone Company at three different points in Ontario.

10082—April 6—Directing that the G.T.R. within sixty days from the date of this Order install an electric bell at the 1st crossing east of Mallorytown, Ontario.

Continued on next page, 2nd column.

RAILWAY EARNINGS AND STOCK QUOTATIONS

NAME OF COMPANY	Mileage Operated	Capital in Thousands	Par Value	RAILWAY EARNINGS. Date from	Date to	1910	1909	STOCK QUOTATIONS TORONTO Price April 15 '09	Price April 7 '10	Price April 14 '10	Sales Week Ended Apr. 7
Canadian Pacific Railway...	10,048	$150.000	$100	Jan. 1	April 14	$23,309.000	$20 017 000	175½ 175¼	182½ 182⅝	181½ 183⅝	2058
Canadian Northern Rail'y.	3,180	.....	.....	"	Ap il 14	2,852 20)	2,226 800	.....	.....	.....	.....
*Grand Trunk Railway	3,536	226,000	100	"	April 14	11.932 630	9,804 214	*1st, 1 ref. 110, 3rd pref 64¾, ord'y 78.			
T. & N. O.....	264.74	(Gov. Road	.....	"	April 14	3 2 117	229,608	.....	.....	.....	.....
†Montreal Street Railway..	141.79	18,000	100	"	April 16	1,193,20[illegible]	1 016,535	209½ 209	247⅞ 2 7	246⅜ 246¼	2255
Toronto Street Railway,...	114	8.000	100	"	March 31	975 806	804 631	.....	123¾ 122	124⅜	66
Halifax Electric	13.3	1.400	100	"	April 14	52 798	46.560	110½ 10[illegible]	124 123	124 123	14

* G.T.R Stock is not listed on Canadian Exchanges. These prices are quoted on the London Stock Exchange.
† Quoted on Montreal Exchange

WEEKLY EARNINGS

NAME OF COMPANY	TRAFFIC RETURNS Week Ending	1910	Previous Week	1909
Canadian Pacific Railway.	April 14	$1,8[illegible]7.000	$1,959 000	$1,490.000
Canadian Northern Rail'y.	April 14	255,000	24[illegible],600	177,800
Grand Trunk Railway	April 14	824.890	815,843	74[illegible],283
T. & N. O.....	April 14	[illegible] 563	39,689	[illegible],573
Montreal Street Railway	April 10	77,732	70,94[illegible]	69,801
Toronto Street Railway....	.....	.....	.....	.....
Halifax Electric.....	April 14	3 802	3,501	3,051
London Street Railway	March 1	[illegible]8,083	.....	17 454

†For month of January—31 days.

GRAND TRUNK HALF-YEARLY REPORT

The report of the Grand Trunk Railway of Canada for the half-year ending December 31st, 1909.

The report shows an increase over the corresponding six months of last year in gross receipts as the following table shows:—

Description of Receipts.	1909.	1908.	Increase.
Passengers	£1,091,426	£1,041,423	£ 50,003
Mails and Express	182,855	169,302	13,553
Freight and Live Stock....	2,252,106	2,014,205	237,901
Other Receipts	106,516	101,228	5,288
	3,632,903	3,326,158	306,745

The Chief Engineer, Mr. Howard G. Kelley, in his report gives some interesting figures as to cost of operation.

The expenditure, mileage, &c., was:—

Half-year ended	Total Expenditure. Dollars.	Train Mileage.	Rate of Expense per Mile. Train. Cts.	Eng. Cts.	Car. Cts.
Dec., 1909...	4,849,724	9,951,487	48.73	38.33	2.96
" 1908...	4,361,930	9,793,220	44.54	34.84	2.76

An increase in expenditure of $487,788 or 11.18 per cent. compared with an increase in train miles of 158,261 or 1.62 per cent.

	Passenger Trains.	Freight Trains.	Mixed Trains.
The average number of cars moved per train was	5.0	26.5	7.1
And for the corresponding period...	4.8	26.4	6.9

The comparative cost of repairs per train, engine and car mile was:—

Cost per Mile.	Repairs and Renewals of Locomotives. 1909. Cents.	1908. Cents.	All Repairing Charges, including Shop, Machinery, Tools, and Marine Equipment, etc. 1909. Cents.	1908. Cents.
Train	15.47	10.05	17.17	13.37
Engine	12.17	7.85	13.53	10.46
Car	0.94	0.62	1.04	0.82

The expenditure, mileage, etc., for cars was as follows:

Half-year ended.	Total cost of Repairs and Renewals. Dollars.	Cost per Mile. Car. Cents.	Train. Cents.
December, 1909	1,605,676	0.979	16.14
" 1908.	707,211	0.447	7.22

TORONTO STREET RAILWAY

Following are figures which show the earnings of the Toronto Street Railway during the month of March for the past six years:—

	Receipts.	City's Percentage.
March, 1910	$343,541.86	$51,531.28
March, 1909	301,005.95	40,244.70
March, 1908	277,293.12	33,838.80
March, 1907	267,721.05	32,126.53
March, 1906	234,448.20	26,851.70
March, 1905	207,618.23	20,761.82

CALGARY MUNICIPAL STREET RAILWAY.

Earnings and Expenses for March

		Car Mile.
Revenue	$13,257.65	25.424
Operating Expenses		
Maintenance of Way and Structures.....	$ 388.31	
Maintenance of Equipment	903.98	
Transportation Expenses	6,097.06	
General Expense	473.27	
Gross total Operating Expenses.....	$7,862.62	15.878
Net Profit	5,395.03	
Net Profit per Car Mile.....		9,546

RAILWAY ORDERS—Continued from page 397.

10083—April 5—Order the Railway Company concerned in the crossing at the following point be relieved for the present from providing further protection at the crossing named, it appearing from an inspection made by the Board's Engineer and Operating Department, and from plans furnished, that the view at the crossing is excellent from both directions, that the crossing signboard is properly placed, and that there are whistling posts on the railway:—G.T.R. crossing highway 1½ miles east of St. Basile le Grand Station, known as "Rang des Trente," Quebec.

10084—April 6—Approving by-law of the Alberta Railway and Irrigation Company, respecting expectoration in railway cars, stations, etc.

10085—April 5—Authorizing the Hydro-Electric Power Commission of Ontario, to erect its transmission lines across the track of the Niagara, St. Catharines and Toronto Railway Company at part of Lots 124 and 125, Township of Thorold, Ontario.

10086—April 7—Directing that the C.N.Q. Railway provide and construct a suitable farm crossing where its right-of-way crosses the property of Moise Francoeur, of the Parish of St. Jerome, County Terrebonne, Que.

10087—April 7—Directing that the G.T.R. install within sixty days from the date of this Order, an electric bell at the crossing of the first highway west of Norval Station, Ontario.

10088—April 5—Authorizing the C.N.O.R. to construct its railway across the public road between Lot 25, Con. 2, and Lot 25, Con. 3, Township of Pickering, Ontario.

CONSTRUCTION NEWS SECTION

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

TENDERS PENDING.

In addition to those in this issue.

Place of Work.	Tenders Close.	Issue of.	Page.
Weyburn, Sask., sewerage and waterworks	Apr. 27.	Mar. 25.	281
Calgary, Alta., canal system	May 1	Apr. 1.	46
Prince Rupert, B.C., electrical and water works equipment	May 3.	Apr. 1.	307
Sault Ste. Marie, Ont., Railway.	Apr. 30.	Apr. 8,	56
Yorkton, Sask., concrete sidewalk	Apr. 25.	Apr. 8.	50
Brantford, Ont., reinforced concrete bridge	Apr. 22.	Apr. 8.	50
Winnipeg, Man., Electrical Supplies	Apr. 30.	Apr. 15.	50
Ottawa, Ont., canal construction.	Apr. 26.	Apr. 15.	374
Ottawa, Ont., canal construction.	May 5.	Apr. 15.	374
Ottawa, Ont., removing beacon.	Apr. 28.	Apr. 15.	374
Victoria, B.C., Cluster St. lights.	Apr. 25.	Apr. 15.	368
Windsor, Ont., Post Office, interior fittings	Apr. 25.	Apr. 15	367
Toronto, Ont., new seminary	Apr. 27.	Apr. 15.	367
Ottawa, Ont., steel steamer	May 31.	Apr. 15	367
Chatham, Ont., drainage outlet construction	Apr. 27.	Apr. 15.	367
Port Arthur., Ont., asphalt pavements	Apr. 30.	Apr. 15.	367

TENDERS.

St. John, N.B.—Tenders will be received until April 26, for 1,000 bbls. Gas Works Coal Tar, 95 tons Trinidad Lake Asphalt, about 600 loads Bank Sand, 40 cords of Hard Wood, 6,000 sq. yds. Spruce Paving Blocks. Wm Murdoch, City Engineer.

Beith, Que.—Tenders will be received until May 10th, for building of about eight miles of macadamized road. Stone easily obtained. Work must be done with modern crushing machinery, sprinkled and rolled. Andrew Coffey, Mayor, Municipality of Elgin.

Montreal, Que.—Tenders will be received until April 26th, for timber supply for 1910. David Seath, Secretary-Treasurer, Harbour Commissioners, 57 Common Street.

Quebec, Que.—Tenders will be received up to April 28th, for the demolition of the old Jacques Cartier Market. Rene P. Lemay, Architect, 21 d'Aiguillon Street.

Brantford, Ont.—Tenders will be received until April 27th, for extension to public school. M. E. B. Cutcliffe, Chairman, Buildings and Grounds Committee, Public School Board.

Fort William, Ont.—Tenders will be received until April 28th, for 460 cubic yards sand, 7,460 cubic yards crushed trap rock, 2,740 cubic yards screenings. A. L. Farquharson, Street Railway Construction Superintendent.

Grimsby, Ont—Tenders will be received until May 30th, for the erection of a high school. Plans may be seen at the offices of architects, Munro & Mead, Hamilton, and W. W. Kidd, Grimsby.

London, Ont.—Council of Hay Township, Huron Co., invited tenders for concrete abutments for a steel bridge over the Sauble River, near Exeter, also for reinforced concrete arch, 35 ft. span, over Black Creek, near Hensall. F. W. Farncomb, C.E., 64 Bank of Toronto Chambers, London.

Orillia, Ont.—Tenders will be received until April 25th, for the erection of a Sunday school building for the Methodist Church, Peter Street. J. H. Robertson, Architect.

Ottawa, Ont.—Tenders will be received until April 27th, for construction of a stop butt for the new Niagara rifle range. Plans may be seen at the offices of the general officer commanding Western Ontario Command, Toronto, the officer commanding the 44th Regiment, Niagara Falls, Ont., and the Director of Engineer Services, Headquarters, Ottawa. Eugene Fiset, (Colonel), Deputy-Minister of Militia and Defence.

Ottawa, Ont.—Tenders will be received until April 21st, for alterations to the City Hall. John Henderson, City Clerk.

Ottawa, Ont.—Tenders will be received until May 2nd, for the construction of a station at Lake Superior Junction, Ont. P. E. Ryan, Secretary, The Commissioners of the Transcontinental Railway.

Ottawa, Ont.—Tenders will be received until May 2nd, for the construction of a station at Lake Superior Junction, Ont. P. E. Ryan, Sec. Commissioners, Transcontinental Railway.

Ottawa, Ont.—Tenders will be received until April 26th, for the erection of two new schools. Crawford Ross, Sec.-Treas., Public School Board.

Brandon, Man.—Tenders will be received until April 25th, for a steam or gasoline road roller, weighing 12 tons. R. E. Speakman, City Engineer.

Winnipeg, Man.—Tenders will be received up to April 30th, for the erection of the Rostrevor Apartment building. Wm. Wallace Blair, Architect, 400 Nanton Building.

Winnipeg, Man.—Tenders will be received up to April 30th, for the erection of an office building on Main Street. Tenders using cut stone, marble or terra cotta required for entire front of building. Wm. Wallace Blair, 400 Nanton Building.

Winnipeg, Man.—Tenders will be received until May 7th, for the construction of bridge over Assiniboine. Plans may be seen at the office of Henry Tillman, Secretary-Treasurer, Ellice Municipality, and at the Department of Public Works.

Winnipeg, Man.—Tenders will be received until April 25th, for the erection of 1.200 lineal feet wire fencing. C. W. Sharp, Chairman, Public Parks Board.

Winnipeg, Man.—Tenders will be received until April 30th, for excavating 8,000 yards of trenching. 705 Builders' Exchange.

Winnipeg, Man.—Tenders will be received until April 26th, for the erection of a brick and stone school. Alexander Britton, Chairman of Britannia School District No. 1517.

Moose Jaw, Sask.—Tenders will be received until April 30th, for the construction of a telephone line. T. C. Greer, Box 321, Moose Jaw.

Winnipeg, Man.—Asphalt pavements for which tenders are being called for are:

Market Avenue from Main to Bertha, cost $16,793. Salter Street from Redwood to College, cost, $6,736. Boyd Avenue from Salter to Powers, cost $5,976. Inkster Avenue from Main to Scotia, cost $28,432. Aberdeen Avenue from Main to Salter, cost $17,700. Florence Avenue, from Pembina to Fisher, cost $14,685. M. Peterson, secretary, Board of Control.

Regina, Sask.—Tenders will be received until April 29th, for laying 2,160 square yards of asphalt block paving and creosoted plank subfloor on the traffic bridge at Saskatoon. F. J. Robinson, Deputy Minister of Public Works.

Regina, Sask.—Tenders will be received until April 29th, for building reinforced concrete bridge abutments over the Qu'Appelle River. F. J. Robinson, Deputy-Minister, Department of Public Works.

Saskatoon, Sask.—Tenders will be received until April 25th, for concrete sidewalks. Geo. T. Clark, city engineer.

Edmonton, Alta.—Tenders will be received until April 23rd, for electric conduit wiring, supplying wood-fibre plaster and maple flooring, for Insane Asylum at Ponoka. John Stocks, Deputy-Minister of Public Works.

Cumberland, B.C.—Tenders will be received until May 4th, for the construction of sewerage works. A. M'Kinnon, City Clerk.

Vancouver, B.C.—Tenders will be received until May 3rd, for the construction of wood block pavement. Wm. McQueen, City Clerk.

Victoria, B.C.—Tenders will be received until April 30th, for clearing of the right-of-way, Comox Extension, Esquimalt & Nanaimo Railway, between Union Bay and Oyster River. H. E. Beasley, Superintendent.

CONTRACTS AWARDED

Campbellton, N.B.—The Council let contracts for the ensuing year as follows: Bar lead, lead pipe, wrought iron, pipe and fittings, and brass goods. Jas. Robertson Co., Ltd., St. John, N.B.; excavations for water service, Wm. J. Christie, Campbellton, N.B.

Levis, Que. — Joseph Couture of this town has been awarded the contract for the construction of a new stone church at Causapscal. The price of the contract is $39,000.

Montreal, Que.—N. T. Railway commissioners have awarded contracts for steel rails, fish-plates and fastenings to the Dominion Iron & Steel Company and the N. S. Steel & Coal Company.

East Zorra, Ont.—Township Council have awarded to Hamilton Bridge Works Co. a contract for the erection of a steel bridge and concrete abutments, bridge to be 70 feet long over all and 14 feet clear width, with concrete reinforced floor, and guaranteed to carry a moving load of 15 tons. The contract price for the complete structure is $2,029.

Guelph Ont.—The Fielder Paving Company of Chatham, were awarded a contract for laying cement macadam foundations for pavements here.

Hamilton, Ont.—Barton Township have awarded to Chas. Brayley, Hamilton, at 13 cents a sq. foot, a contract for concrete sidewalk construction. This price includes crossings. Cut and fill over one foot, 35 cents a cubic yard. Other tenders were:—Other bidders and prices, D. W. Mitchell, Niagara Falls, 11 9/10 cents for walks, 14¾ cents for crossings, 45 cents cu. yard for cut and fill. The Maple Leaf Company Simcoe, 13½ cents sq. ft. walks and crossings, filling $1.25 cu. yard, excavation, 25 cents, rock excavation, first cost plus 10 per cent.

Lindsay, Ont.—County council of Victoria considered the following bids for the construction of the Little Bob bridge of two steel spans, including metallic re-enforcement for concrete ffoors:

Western Bridge and Equipment Co., Chatham	$2,075
The Jenks-Dresser Co., Sarnia	2,150
The Hunter Bridge and Boiler Co., Kincardine	2,700
R. Macmanus Co., Hamilton	2,375
The Dickson Bridge Works Co., Campbellford	2,048
The Hamilton Bridge Works Co., Hamilton	1,840

The tender of the Hamilton Bridge Works Co. was accepted with additions, as follows:

Two spans, $1,736; channel curbs, $90; steel aprons, $60; concrete floors, $504; approach railings, 40 running feet, $40; railings on each side of centre fill, 200 running feet, $200; total, $2,630.

London, Ont.—F. W. Farncomb, consulting engineer, has let to D. Witherspoon, Ailsa Craig, on behalf of the Council of Lobo, a contract for concrete abutments, at $4.70 a cubic yard, and reinforced concrete floors for two steel bridges, at 20 cents a square foot.

Mimico Ont.—The Forcott Construction Company, as mentioned last week, were given the contract at $2,495, for the construction of a pipe sewer connecting the Victoria Industrial School with the new sewerage system of New Toronto.

Other tenders were:

Page & Britnell	$2,544
Excelsior Construction and Paving Co.	2,785
John Campbell	6,428
J. H. McKnight Construction Co.	2,845
Thomas Cruttenden	6,550

Port Stanley, Ont.—John McGugan will construct a dock here for the O. & O. Navigation Company, at a cost of several thousand dollars.

Toronto, Ont. — Wells & Grey were awarded a $26,900 contract for the concrete piers for the Wilton Avenue bridge by the Board of Control. The National Iron Works got the contract for 3-inch iron pipe at $4.35 per length; 4-inch at $4.88; 6-inch at $6.97. The Canada Foundry got an order for 8-inch iron pipe at $10.50; 10-inch pipe at $14.80; 12-inch pipe at $19.85.

The Canada Foundry Company was also awarded the contract for special castings to be supplied the City Engineers' Department at $598. The other tenders were $710 and $791. The Drummond-McCaul Company gets the contract for a ten-inch water meter at $785. The other tender was $975.

Toronto, Ont.—Contracts for the balance of the construction of the high level intercepter in connection with the trunk sewer, from the west bank of the Don to the sewage disposal tanks were awarded by the Board of Control on Wednesday afternoon. The high-level section of the main drainage sytsem is that section north of Adelaide street which will work by gravitation. The low-level section is south of Adelaide street to the bay, where pumps will be employed. The tenders accepted yesterday did not include those for siphons, these being referred to the City Engineer to be reported upon to-day. Following were the contracts awarded: Section No. 1, Logan Avenue to Leslie Street, 3,409 feet in length, sewers 9 feet and 9 feet, 3 inches, John Wagner, Cleveland, Ohio, $31.52 per foot. Section No. 2, from the Don to Logan avenue, 2,993 feet in length, sewer 8 feet, 9 inches, J. H. McKnight Construction Company, this city, $30.85 per foot, Section No. 7, Leslie street to Morley avenue, 3,246 feet in length, sewer 9 feet, 6 inches, W. J. Gawne, Cleveland, $23.70 per foot. Section No. 8, Morley avenue to the disposal tanks, 1,216 feet in length, sewer 7 feet, 10 inches, Wm. Layman, Nicholson & John Cleveland, $19.35 per foot.

Toronto, Ont.—Temiskaming and Northern Ontario Ry. have awarded to Pete Nicholson, of North Bay, a contract for the construction of bridge abutments at mile post 48.91, and construction of substructure for steel trestle over Wabis River at mile post 119.13.

Winnipeg, Man.—The tender of the Canadian Fairbanks Company, Winnipeg, was acepted for the hydrants to be installed this year at $37 each. T. McAvity of St. John, N.B., secured the tenders for the valves.

Moosejaw, Sask.—The Ontario Concrete Paving Co'y., of Toronto, will probably be awarded the contract for furnishing material and constructing 13,500 lin. feet of curb and gutter, and 116,500 square feet of concrete sidewalk. Bids were as follows:

Concrete Sidewalks.

Ontario Concrete Paving Co., Toronto	$17,490
R. L. Frost, Moose Jaw	18,656
Forest City Paving Co., Regina	19,472
Western Pavers, Ltd., Winnipeg	20,210
Navin Bros., Moose Jaw	20,988
Clark & Jones, Owen Sound	23,028

Curb and Cutter.

Ontario Concrete Paving Co., Toronto	$6,480
Navin Bros., Moose Jaw	8,100
R. L. Frost, Moose Jaw	8,100
Clark & Jones, Owen Sound	8,100
Western Pavers, Ltd., Winnipeg	8,505
Forest City Paving Co., Regina	8,775
National Paving Co., Winnipeg	13,500

Moose Jaw, Sask.—Contract for laying 7,000 lineal feet of 10 in .x 12 in. sewer pipe, including manholes, catch basins, etc., was awarded to H. G. McVean, of Moose Jaw, at $6,878. Other bids, $9,522, from P. KilKenny, Moose Jaw.

Moose Jaw, Sask.—Tenders were recently invited for furnishing material and constructing 33,300 square yards of pavement. Following is a list of the bids received:

Bitulithic and Contracting, Ltd., Winnipeg.

Bitulithic pavement. Wearing surface, 2 in. to 2¾ in. thick	$103,152
3 in. creosote wood block pavement. Wearing surface, 1½ in.	$94,931
3 in. creosote wood block pavement	116,472

Rudolph S. Blome Co., Chicago.

Granatoid pavement 1½ in. wearing surface	$105,184

National Paving and Contracting Co., Winnipeg.

Natural asphalt sheet pavement. Wearing surface, 1½ in.	$94,931

Forest City Paving Co., Regina.

Creosote wood block pavement. Wearing surface 3 in.	$103,230

Navin Bros., Moose Jaw.

3 in. asphalt block pavement	$120,750
2½ in. block	107,763

The Kettle River Co., Minneapolis.

Creosoted wood block pavement. Thickness of wearing surface, 3 in., 3½in., and 4 in.

3 in. block, 14 x treatment	$103,400
3 in. blocks, 16 x treatment	106,064
3½ in. blocks, 14 x treatment	111,725
3½ in. blocks, 16 x treatment	114,389
4 in. blocks, 16 x treatment	124,379

Fielding & Shepley, St. Paul.

Creosoted wood block pavement, 3½ in. wearing surface	$117,070

McKay Construction Co., Regina.

Westrumite pavement, 2 in. wearing surface	$89,244

Regina, Sask.—The contract for the pile work and construction of the reinforced concrete abutments for the Albert Street subway has been awarded to the Parsons Construction Company of this city, at about $75,000.

Regina, Sask.—The excavation work for the Albert Street subway will be done by the Canadian Pacific Railway, whose tender was accepted.

Saskatoon, Sask.—Following is a list of tenders received for labor required in connection with the new sewage disposal and water works:

Contractor.	Section 1.	2.	3.	4.	Bulk.
William Cooke.	$14,874	$29,875	$27,330	$22,639	$94,700
Saskatoon Construction Co...	14,052	28,825	29,823	21,608	91,437
John Craig	20,889	36,391	35,825	24,712	112,385
William Newman Co., Ltd.	23,300	43,800	39,400	33,300	135,600
James Priel.....	15,340				

The tender of the Saskatoon Construction Co. was accepted for Sections 1, 2 and 4, while for the 3rd Section the contract went to Wm. Cooke.

Some other tenders were opened: For the coal and oil warehouse, V. Simmons, $3,335; G. N. Hughes, $2,168; Jas. Allan, $2,247; deferred. Standpipe base, Saskatoon Construction and Engineering Co., $2,677, accepted.

Lethbridge, Alta.—McDiarmid & Company of Winnipeg, will build the new C.P.R. station here.

Wetaskiwin, Alta.—John Hawke was given the contract for back-filling on sewer work here at 4¾ a foot.

Vancouver, B.C. — Contractor Ledingham was given a contract to construct 15 miles of concrete sidewalk at 13 cts. per foot. Other tenders were: Palmer Bros. & Henning, 13⅓ cents; McEachern & Richardson, 13½ cents.

Vancouver, B.C.—J. J. Thornycraft Co., Ltd., were awarded the contract for two motor wagons, at $11,000, and a detachable sprinkler for garbage collection, at $500. Other tenders were: Pacific Garbage and Auto Co., $10.500, for wagons and sprinkler; Halley Industrial Motors, Ltd., $10,400, for wagons, $525 extra for sprinkler; Yorkshire Patent Steam Wagon Co., £880, for wagons, and £70 for sprinkler; Jno. L. Richardson & Co., $11,000 for wagons complete; Leland Motors, Limited, $13,700 for wagons, $300 for sprinkler.

RAILWAYS—STEAM AND ELECTRIC.

Quebec, Que.—Considerable double-track extensions will be made this summer by the Quebec Railway Light & Power Company, while two new pay-as-you-enter cars have been ordered from Ottawa Car Company. A $200,000 building will also be erected.

Quebec, Que.—Plans of the Montreal Street Railway Co., providing for three distinct underground lines and one junction subway route in Montreal, have been submitted to the Railway Committee of the Legislature. The details are as follows:—

(1) Subway under St. Catherine Street from Harbor Street to Atwater Avenue.

(2) Subway under St. Denis Street, from Mount Royal Avenue to Craig Street, across Champ de Mars diagonally to Notre Dame Street, and west to Victoria Square.

(3) Junction subway system from St. Catherine Street down Windsor, under Chaboillez Square, and joining Notre Dame Street subway.

(4) Tunnel under St. James Street from Victoria Square to St. Lawrence Street.

The Street Railway officials now in Quebec state that the St. James St. tunnel, the most important, will be started at once. After that the St. Denis Street subway is regarded as most needed, and following that, St. Catherine Street The Underground and Elevated Company's plans have also been completed, but have not yet been submitted to the committee. They provide for a line from Verdun to Bout de l'Isle, which will be elevated outside the city limits, and underground inside. Its north and south subway is located under St. Lawrence Street.

Montreal, Que.—Grand Trunk Railway will shortly invite tenders for freight equipment and rolling stock to cost over $5,000,000.

Montreal, Que.—E. H. Fitzhugh in a recent interview stated that the Grand Trunk would commence survey and construction work on the new line to Providence immediately.

Montreal, Que.—The Grand Trunk Pacific Branch Lines Company announce in London an issue of £1,270,500 four per cent. first mortgage sterling bonds, due 1939, principal and interest unconditionally guaranteed by the Government of the province of Saskatchewan. The issue price is £98 per £100 bond. The proceeds under the law are to be devoted to the following projected lines:—

	Miles.
Regina, in a southwesterly direction, to the U. S. boundary	155
Regina to Moose Jaw, etc.	110
Biggar, in a southwesterly direction	50
Prince Albert Branch	110
Cut Knife Branch	50
	475

These branch lines will be worked under agreement, by the Grand Trunk Pacific Railway Company, and will form feeders to the main line of that company.

Kingston, Ont.—Kingston & Pembroke railway will carry out a number of improvements on the line this summer, the total cost of which will amount to over $32,000.

Toronto, Ont.—In a recent interview here, Vice-president D. McNicoll of the C.P.R. states that construction work would shortly commence on the branch line from Islington to Mimico, five miles.

Toronto, Ont.—Board of Control have adopted City Engineer Rust's suggestions in respect to new street car lines, and the city will endeavor to reach an agreement with the company.

Trenton, Ont.—At the junction of the Central Ontario and Canadian Northern Railways, in the vicinity of Trenton, the laying of steel for the Canadian Northern Toronto-Ottawa line was begun last week. Clarence G. Young drove the first spike and the laying of steel was proceeded with. This short stretch of line will be brought into use at once to bring down ties from along the Central Ontario. The first sod was turned last November. It is stated that Louis D. Barchfield, purchaser for the company, has secured options on proporety in Sidney for the extension of the line to Belleville.

Windsor, Ont.—A meeting of the shareholders of the Windsor, Essex & Lake Shore Rapid Railway Company will be held April 25th at Windsor, to authorize the issue of bonds at the rate of $25000 for each mile of road constructed.

Saskatoon, Sask.—Council and the Canac Railway have reached an agreement in respect to subway construction. Subways will be built at 10th and 23rd Streets,

Calgary, Alta.—Ten new street car routes have been recommended by City Engineer Child and it is expected that the ratepayers will approve of their construction.

Nelson, B.C.—The report that the C.P.R. will electrify the Crow's Nest Pass line is revived by the incorporation of a company capitalized at $1,000,000 to develop power from the Pend D'Oreille River at its junction with Salmon River. It is the largest water power in the upper country and has a head of 53 feet, with unlimited power.

Nelson, B.C.—The contract for its new track including road-bed, switches, pole system and trolley wires, all ready for operation, has been awarded to L. G. Brandt of Nelson, by the directors of the Nelson Street Railway Company. When the extension is completed there will be four and a half to five miles ready for operation. The contract calls for the new line being turned over in forty days from date. Construction will be carried on under the supervision of the city engineer. The motor generator has been installed and the car barns completed. The new cars are nearly completed at Ottawa and Nelson will have a fully equipped street car service next month.

Vancouver, B.C.—J. W. Stewart & Company who were recently awarded a contract for building the Victoria, Vancouver & Eastern Railway between Princeton and Abbots-

ford, have just awarded to Martin, Welch & Company, a subcontract for the twenty-mile section between Abbotsford and Chilliwack. Not more than a year and a half will be occupied in completing the line now under contract. Subcontracts for the sections between Chilliwack and Hope will be awarded shortly and the work will be rushed with energy. East of the Hope mountains an eighteen-mile section between Princeton and Otter Flat is now under construction.

BY-LAWS AND FINANCE.

Montreal, Que.—Debentures amounting to $90,000 are offered for sale by W. Desjardins, secretary of the Hochelaga School Commission until April 26th.

Berlin, Ont.—Council recently passed the following by-laws, $19,745 for roadways; $917 for gutters; $6,531 for sewerage; $6,009 for sidewalks; $72,000 for school purposes and $60,000 for Peoples Railway stock.

Dundas, Ont.—On May 16th the ratepayers will be asked to approve of a by-law to guarantee to the extent of $30,000 the bonds of the proposed engine works.

Dunnville, Ont.—Three by-laws were carried as follows: To loan $30,000 to the promoters of an industry for the manufacture of auto parts, furnaces, shovels and other articles; to grant a fixed assessment of $25,000 and free water for ten years to the Dominion Hammock Manufacturing Co., and a by-law to spend $30,000 for a new high school.

Peterboro', Ont. — Peterboro' County council have published notice of the submission of a $17,000 bridge by-law.

Peterboro', Ont.—The $70,000 by-law which should have been submitted on April 19th was withdrawn in view of the agreement with the Canadian General Electric Company.

Stratford, Ont.—A by-law to raise $85,000 for a distribution plant for Hydro-electric power was carried.

Dauphin Man.—The ratepayers voted $175,000 for waterworks and sewerage.

Grandview, Man.—Tenders will be received up to the 4th May for debentures amounting to $5,000. Wm. Dickie, Secretary-treasurer.

Winnipeg, Man. — The hospital by-laws, which involve the expenditure of $500,000, were given their second reading in council and will be voted on by the ratepayers on June 2.

Winnipeg, Man.—Until May 14th, H. F. Tench, secretary-treasurer of S. D. Britannia, No. 1517, offers for sale $40,000 debentures.

Regina, Sask.—On May 6th the ratepayers will vote on the following by-laws:—Trunk sewer, $280,000; general hospital grant, $25,000; Children's Shelter, $10,000.

Saskatoon, Sask. — By-laws for waterworks extensions, sewers and granolithic walks will shortly be considered.

Saskatoon, Sask.—The council are asking for plans of a new hospital, the cost of which will be covered by a by-law to be submitted to the ratepayers. A similar by-law for $110,000 was recently defeated.

Calgary, Alta.—The council will be asked to submit a $20,000 horse show building by-law to the ratepayers.

Ladner, B.C.—Tenders will be received up to May 13th by the Delta municipal council for $135,000 waterworks debentures. N. A. M'Diarmid, C.M.C

Revelstoke, B.C.—Ratepayers have passed a $30,000 school by-law.

Victoria, B.C.—The ratepayers will vote at an early date on a $65,000 road improvement by-law.

PERSONAL.

Mr. Archie Gillies, B.A.Sc., who recently completed the construction of a 4,000 h.p. electric plant for Beech Bros. at Cobalt, has been appointed resident engineer on the construction of a power plant at Minnedosa, Man., for which Mr. C. H. Mitchell is the consulting engineer.

Mr. E. Whitby has been appointed second assistant city engineer at Hamilton, Ontario.

Mr. A. E. Jupp has resigned his position in the City Engineer's department, Toronto, to accept an appointment at Haileybury.

Mr. W. C. St. John of Toronto has been appointed by the Ontario Government to the staff of the Surveys branch in the Department of Lands, Forests and Mines. Mr. St. John has been assisting in the Surveys Department for some months past and his appointment to the permanent staff takes effect at once.

Mr. W. A. Bowden, who has been acting as chief engineer in the Department of Railways and Canals, Ottawa, since the retirement of Mr. Butler, will probably succeed that gentleman. Mr. Bowden is an associate member of the Canadian Society of Civil Engineers, and has been connected with the department in question for five years.

OBITUARY.

Mr. S. Gagné, B.A.Sc., of the firm of O'Brien, Gagné & Jennings, was killed at Chicoutimi, Que., on April 14th, by a land slide, caused by an explosion of blasting powder in one of the cuts on the line of the Ha Ha Bay Railway which this company are building. Mr. Gagné graduated from the Faculty of Applied Science of Toronto University in 1901, with the degree of B.A.Sc. Since graduation his most important work has been in connection with the Toronto and Niagara Power Company's right-of-way, a line from Toronto to Niagara, the Niagara and Western Railway Company and the Niagara and St. Catharines Railway Company.

For many years Mr. Gagné was associated with the late Mr. W. T. Jennings and more recently in partnership in engineering work in Toronto with Mr. Gordon Jennings. About a year ago Mr. O'Brien joined Mr. Gagné and Mr. Jennings, and they undertook the engineering and the construction of a section of the Ha Ha Bay Railway.

Mr. Gagné was an associated member of the Canadian Society of Civil Engineers, and had acted as secretary of the Toronto Branch. In addition to close application to his own personal work he took a very great interest in the engineering profession generally and spent much time in assisting in the work of the Canadian Society of Civil Engineers and the Engineers' Club of Toronto, of which he had been for many years a member. He served on the Executive in various capacities.

MARKET CONDITIONS.

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

Montreal, April 19th, 1910.

During the week a fuel manufacturing plant of the United States Steel Corporation put 1,100 ovens on the idle list, thus indicating a very considerable falling-off in the requirements for fuel. Many records were broken during last month in the matter of production in ore, coke, pig-iron and certain classes of steel. There is still a large production in certain districts, but there is unquestionably a tendency to reduce output at the present moment. The railway business has been keeping up right along, but it also is showing a tendency to fall off again, and it begins to look as though there would be a much smaller demand from that source during the coming few months than there has been for some time past. Purchases of pig-iron by manufacturers of cast-iron pipe have recently been due to the fact that grey forge and No. 4 foundry iron are quite scarce. Recent negotiations for some large quantities have been barren of results. Although there is talk of the curtailment of the production of pig-iron, and several furnaces have been blown out, it would seem that there has not yet been any signs of a general blowing out movement. The furnaces which have been blown out have been generally in need of re-lining. The buying movement among large foundry interests for the second half of the year has fallen off and the general tone of prices is downwards. It is not thought, however, that the decline in the price of pig will affect the values of the finished materials to any very great extent, owing to the fact that the price of the latter never advanced to a basis of the high cost of the former.

Advices from Great Britain indicate that the market there is rather less buoyant than previously reported, this being, possibly, in sympathy with conditions in the United States. Middleboro warrants have declined from 51s. 4½d. to 50s. 10½d. during the week. London reported the closing of the spelter market at £22 7s. 6d., this being a reduction of 2s. 6d. One cable, however, stated that demand from consumers showed an improvement, mostly for prompt delivery.

Figures on the production of pig-iron in Germany, which have just been issued, show that 115 works produced 12,149,834 tons in 1909, as against 11,186,379 in 1908.

Some advices refer to a rupture in the arrangements between a large Glasgow and a large Barrow firm, but no particular importance is attached thereto.

It will be but a short time now before shipments begin to arrive at Montreal by water, and this will doubtless result in increased activity in the market here, although prices are not likely to be greatly affected thereby. Compared with other countries, the outlook in Canada is unusually promising. No unfavorable reports are being heard of in any quarter and iron and steel manufacturers and importers are looking forward to an excellnet demand during the coming season, at higher prices than prevailed a year ago.

Prices are as follows:—

Antimony.—The market is steady at 8¼ to 8½c. (111).

Bar Iron and Steel.—The market promises to advance shortly. Bar iron $1.90 per 100 pounds; best refined horseshoe, $2.15; forged iron, $2.05; mild steel, $1.90; sleigh shoe steel, $1.90 for 1 x ⅜-base; tire steel, $2.00 for 1 x ⅜-base; toe calk steel, $2.40; machine steel, iron finish, $1.95; imported, $2.20 (111, 119).

Building Paper.—Tar paper, 7, 10, or 16 ounces, $1.80 per 100 pounds, felt paper, $2.75 per 100 pounds; tar sheathing, 40c. per roll of 400 square feet; dry sheathing, No. 1, 30 to 40c. per roll of 400 square feet; tarred year will be the largest in the history of the country. Prices on foreign fibre, 55c. per roll; dry fibre, 45c. (See Roofing; also Tar and Pitch). (164).

Cement.—Canadian cement is quotable, as follows, in car lots, f.o.b., Montreal:—$1.30 to $1.40 per 350 lb. bbl., in 4 cotton bags, adding 10c. for each bag. Good bags re-purchased at 10c. each. Paper bags cost 2¼ cents extra, or 10c. per bbl. weight. (26, 164).

Chain.—Prices have advanced considerably of late, being now as follows per 100 lbs.:—¼-inch, $5.10; 5-16-inch, $4.50; ⅜-inch, $3.70; 7-10-inch $3.45; ½-inch, $3.35; 9-16-inch, $3.25; ⅝-inch, $3.20; ¾, ⅞, and 1-inch, $3.15.

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

Copper.—Prices are strong at 14¼ to 14½c.

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

Galvanized Iron.—The market is steady. Prices, basis, 28-gauge, are:—Queen's Head, $4.10; Colborne Crown, $3.85; Apollo, 10¾ oz., $4.05. Add 25c. to above figures for less than case lots; 26-gauge is 25c. less than 28-gauge, American 28-gauge and English 26 are equivalents as are American 10¾ oz., and English 28-gauge. (111).

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

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

Laths.—See Lumber, etc.

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

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

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

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

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

Pipe.Cast Iron.—The market shows a steady tone although demand is on the dull side. Prices are firm, and approximately as follows:—$32 for 6 and 8-inch pipe and larger; $33 for 3-inch and 4-inch at the foundry. Pipe, specials, $3 per 100 pounds. Gas pipe is quoted at about $1 more than the above. (74, 188).

Pipe.—Wrought and Galvanized.—Demand is about the same, and the tone is firm, though prices are steady, moderate-sized lots being: ¼-inch, $5.50 with 63 per cent. off for black, and 48 per cent off for galvanized; ⅜-inch, $5.50, with 59 per cent. off for black and 44 per cent. off for galvanized; ½-inch, $8.50, with 60 per cent. off for black, and 59 per cent. off for galvanized. The discount on the following is 71¼ per cent. off for black, and 61¼ per cent. off for galvanized; ¾-inch, $11.50; 1-inch, $16.50; 1¼-inch, $22.50; 1½ inch, $27; 2-inch, $36; 2½-inch, $57.50 3-inch, $75.50; 3½-inch $95; 4-inch, $108.

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

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

Railway Ties.—See lumber, etc.

Roofing.—Ready roofing, two-ply, 70c. per roll; three-ply, 05c. per roll of 100 square feet. Roofing tin caps, 6c. lb.; wire roofing nails, 5c. lb (See Building Paper; Tar and Pitch; Nails, Roofing). (164).

Rope.—Prices are steady, at 9c. per lb. for sisal, and 10¼c. for Manila. Wire rope, crucible steel, six-strands, nineteen wires; ¼-in., $2.75; 5-16 $3.75; ⅜, $4.75; ½, $5.25; ⅝, $6.25; ¾, $8; ⅞, $10; 1-in., $12 per 100 feet. (132).

Spikes.—Railway spikes are firmer at $2.45 per 100 pounds, base of 5¼ x 9-16. Ship spikes are steady at $2.85 per 100 pounds, base of ⅝ x 10-inch, and ⅝ x 12-inch. (132).

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

Telegraph Poles.—See lumber, etc.

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

Tin.—Prices are firm, at $34.50 to $35.

Zinc.—The tone is easy, at 5¾ to 6c.

CAMP SUPPLIES.

Beans.—Prime pea beans, $2 to $2.25 per bushel. (74).

Butter.—September and October creamery, 28 to 32c.; dairy, 23 to 24c.

Canned Goods.—Per Dozen.—Corn, 80 to 85; peas, $1.05 to $1.15; beans, 85c.; tomatoes, 85 to 90c.; peaches, 2s, $1.65, and 3s, $2.65; pears, 2s, $1.60, and 3s, $2.30; salmon, best brands, 1-lb. talls, $1.87½, and flats, $2.02½; cheaper grades, 95c. to $1.65. (74).

Cheese.—Finest, colored, 12¾c.; white, 13 to 13¼c. (74).

Coffee.—Mocha, 20 to 25c.; Santos, 15 to 18c.; Rio, 10 to 12c. (74).

Dried Fruits.—Currants, Filiatras, 5¾ to 6½c.; choice, 8 to 9c., dates, 4 to 5c.; raisins, Valentias, 5 to 6¼c.; California, seeded, 7½ to 9c.; Evaporated apples, prime, 8 to 8½c. (74).

Eggs.—New laid, 21 to 23c. (74).

Flour.—Manitoba, 1st patents, $5.80 per barrel; 2nd patents, $5.30; strong bakers, $5.10. (74).

Molasses and Syrup.—Molasses, New Orleans, 27 to 28c.; Barbadoes, 40 to 45c.; Porto Rico, 40 to 43c.; syrup, barrels, 3½c.; 2-lb. tins, 2 dozen to case, $2.50 per case. (74).

Potatoes.—Per 90 lbs., good quality, 45 to 60c. (74).

Rice and Tapioca.—Rice, grade B., in 100-lb. bags, $2.75 to $2.80; C.C., $2.65. Tapioca, medium pearl, 5½ to 6c. (74).

Rolled Oats.—Oatmeal, $2.20 per bag; rolled oats, $2, bags. (74).

Sugar.—Granulated, bags, $5.05; yellow, $4.65 to $5. Barrels 5c. above bag prices.

Tea.—Japans, 20 to 38c.; Ceylons, 20 to 40c.; Ceylon, greens, 19 to 25c., China, green, 20 to 50c.; low-grades, down to 15c. (74).

Fish.—Salted.—Medium cod, $7 per bbl.; herring, $5.25 per bbl.; salmon, $15.50 per bbl., for red, and $14 for pink. Smoked fish.—Bloaters, $1.10 per large box; haddies, 7½c. per lb.; kippered herring, per box, $1.20 to 81.25. (74).

13½c. per lb. for compound. (74).

Provisions.—Salt Pork.—$30 to $34 per bbl.; beef, $18 per bbl.; smoked hams, 16 to 20c. per lb.; lard, 17 to 18c. for pure, and 11¾ to 13½c. per lb. for compound. (74).

* * * *

Toronto, 21st April, 1910.

The soft coal situation is but little relieved from that existing a week ago. A little mine run and lump is coming forward through independent operators who are not affected by the strike conditions; but slack is exceedingly firm and prices asked almost prohibitive, being in many cases greater than that asked for lump coal under normal conditions of the market, and at that the coal is of inferior grade. Large consumers are uncomfortable over the condition of things.

A fair demand exists for cement, not greater than usual at this time of year. Movement by water is just beginning, and large quantities will presently be in course of delivery. Brick are firm and active; roofing materials moving briskly at unchanged prices. The market for iron and steel goods maintains itself, advices from both the States and Great Britain showing a firm front among producers.

Among camp supplies some changes are to be noted; butter is higher, up to 28 to 30tc. for dairy, and 33 to 34c. for creamery, but not much moving, recent rains being expected to help production. New cheese has begun to come in. Lard is easier, say 16½c. for tierces, 17¼c. for pails. No quotable change for smoked and dry salt meats.

The following are wholesale prices for Toronto, where not otherwise explained, although for broken quantities higher prices are quoted:

Antimony.—Demand quiet at 9c. per 100 lbs. (332).

Axes.—Standard makes, double bitted, $8 to $10; single bitted, per dozen, $7 to $9. (217, 377).

Bar Iron.—$2.00 to $2.10, base, per 100 lbs., from stock to wholesale dealer. Market supply limited. (332).

Bar Mild Steel.—Per 100 lbs., $2.10 to $2.20. (372).

Boiler Plates.—¼-inch and heavier, $2.20. Boiler heads 25c. per 100 pounds advance on plate. Tank plate, 3-16-inch, $2.40 per 100 pounds. (241, 362, 456).

Boiler Tubes.—Orders continue active. Lap-welded, steel, 1¼-inch, 10c.; 1½-inch, 9c. per 10 foot; 2-inch, $8.50; 2¼-inch, $10; 2½-inch, $10.60; 3-inch, $11 to $11.50; 3½-inch, $18 to $18.50 per 100 feet. (514).

Building Paper.—Plain, 27c. per roll; tarred, 35c. per roll. Demand is moderate. (518).

Bricks.—In active movement, with very firm tone. Price at some yards $0 to $0.50, at others, $0.50 to $10 for common. Don Valley pressed brick are in request. Red and buff pressed are worth $18 delivered and $17 at works per 1,000. (518).

Broken Stone—Lime stone, good hard, for roadways or concrete, f.o.b., Schaw station, C.P.R., 75c. until further notice, per ton of 2,000 lbs., 1-inch, 2-inch, or larger, price all the same. Rubble stone, 55c. per ton, Schaw station, and a good deal moving. Broken granite is selling at $3 per ton for good Oshawa. (518).

Cement.—Car lots, $1.75 per barrel, without bags. In 1,000 barrel lots $1.60. In smaller parcels $1.90 is asked by city dealers. Bags, 40c. extra. Demand good; in another week or two the movement by water will be active. (61, 518).

Coal.—Anthracite, $7.25 net at retail for grate, egg, stove, chestnut; pea coal, $6. We suspend quotations for bituminous, owing to the strike in the Virginia and Pittsburg coal mines. Very little mine-run or lump is coming in, and prices asked for inferior are very high.

Copper Ingot.—The market may be described as "very sick," and the price is 13¾ to 14c.

Detonator Caps.—75c. to $1 per 100; case lots, 75c. per 100; broken quantities, $1. (212).

Dynamite, per pound, 21 to 25c., as to quantity. (212).

Felt Roofing.—The spring trade has opened very well at an unchanged price, which is $1.80 per 100 lbs. (518).

Fire Bricks.—English and Scotch, $30 to $35; American, $25 to $35 per 1,000. Fire clay, $8 to $12 per ton. (518).

Fuses.—Electric Blasting.—Double strength 4 feet, $4.50; 6 feet, $5. 8 feet, $5.50; 10 feet, $6. Single strength, 4 feet, $3.50; 6 feet, $4; 8 feet, $4.50; 10 feet, $5, per 100 count. Bennett's double tape fuse, $6 per 1,000 feet. (212, 217, 377).

Iron Chain.—¼-inch, $5.75; 5-16-inch, $5.15; ⅜-inch, $4.15; 7-16-inch, $3.95; ½-inch, $3.75; 9-16-inch, $3.70; ⅝-inch, $3.55; ¾-inch, $3.45; ⅞-inch, $3.40; 1-inch, $3.40, per 100 lbs. (217, 377).

Iron Pipe.—A steady request at former prices:—Black, ¼ inch, $2.03; ⅜-inch, $2.25; ½-inch, $2.63; ¾-inch, $3.28; 1-inch, $4.70; 1¼ inch, $6.41; 1½-inch, $7.70; 2-inch, $10.26; 2½-inch, $16.39; 3-inch, $21.52. 3½-inch, 27.08; 4-inch, $30.78; 4½-inch, $35.75; 5-inch, $39.85; 6-inch, $51.70. Galvanized, ¼-inch, $2.86; ⅜-inch, $3.08; ½-inch, $3.48; ¾-inch, $4.43; 1-inch, $6.35; 1¼-inch, $8.66; 1½-inch, $10.40; 2-inch, $13.86, per 100 feet. (185).

Pig Iron.—There is great activity and prices are maintained. Clarence quotes at $21 for No. 3; Cleveland, $20.50 to $21, Summerlee, for winter delivery. $22.50 in Canadian pig, Hamilton quotes $19.50 to $20 per ton. Producing plants are everywhere busy, and there is considerable business in prospect for 1910. (332, 372).

Lead.—The market is slightly easier, we quote $3.75 to $3.85.

Lime.—Retail price in city 35c. per 100 lbs. f.o.b., car; in large lots at kilns outside city 22c. per 100 lbs. f.o.b. car without freight. Demand is moderate. (518).

Lumber.—Dimension stuff is in brisk demand, for present or later delivery. Prices are generally firm, especially in pine. We quote dressing pine $32.00 to $35.00 per M; common stock boards, $26 to $30; cull stocks, $20; cull sidings, $17.50; Southern pine dimension timber from $30 to $45, according to size and grade; finished Southern pine according to thickness and width, $30 to $40. Hemlock in car lots, $17 to $17.50; spruce flooring, car lots, $22 to $24; shingles, British Columbia, are steady, we quote $3.10, lath growing scarce and stiffening, No. 1, $4.40, white pine, 48-inch; No. 2, $3.75; for 32-inch, $1.70. (333).

Nails.—Wire, $2.35 base; cut, $2.60; spikes, $2.85 per keg of 100 lbs. (217, 377).

Pitch and Tar.—Pitch, unchanged at 70c. per 100 lbs. Coal tar dull at $3.50 per barrel. (518).

Plaster of Paris.—Calcined, New Brunswick, hammer brand, car lots $1.95; retail, $2.15 per barrel of 300 lbs. (518).

Putty.—In bladders, strictly pure, per 100 lbs., $2.25; in barrel lots, $2.10. Plasterer's, $2.15 per barrel of three bushels. (518).

Ready Roofing.—An active demand; prices are as per catalogue. (453).

Roofing Slate.—Most of the slate used in Canada comes now from Pennsylvania or Maine, the Canadian supply being slender and mostly from the Rockland quarries of the Eastern Townships in Quebec. There is a great variety of sizes and qualities, so that it is difficult to indicate prices But No. 1 Bangor slate 10 x 16 may be quoted at $7 per square of 100 square feet, f.o.b., cars, Toronto; seconds, 50c. less. Mottled, $7.25; green, $7, with a prospect of advance. Dealers are beginning to be busy. (518).

Rope.—Sisal, 9½c. per lb.; pure Manila, 10½c. per lb., Base. (217, 377).

Sand.—Sharp, for cement or brick work, 90c. per ton f.o.b., cars, Toronto siding. (518).

Sewer Pipe.—

	4-in.	6-in.	9-in.	10-in.	12-in.	24-in.
Straight pipe per foot	$0.20	$0.30	$0.65	$0.75	$1.00	$3.25
Single junction, 1 or 2 ft. long	.90	1.35	2.70	3.40	4.50	14.65
Double junctions	1.50	2.50	5.00	....	8.50	.....
Increasers and reducers		1.50	2.50	....	4.00	.....
P. traps	2.00	3.50	7.50	....	15.00	.....
H. H. traps	2.50	4.00	8.00	....	15.00	.....

Business moderate; price, 73 per cent. off list at factory for car-load lots; 65 per cent. off list retail. (96, 211, 421).

Steel Beams and Channels.—Quiet.—We quote:—$2.50 to $2.75 per 100 lbs., according to size and quantity; if cut, $2.75 to $3 per 100 lbs.; angles, 1¼ by 3-16 and larger, $2.50; tees, $2.80 to $3 per 100 pounds. Extra for smaller sizes of angles and tees. (65, 77, 94, 241, 362, 363, 372, 454, 551).

Steel Rails.—80-lb., $35 to $36 per ton. The following are prices per gross ton, for 500 tons or over; Montreal, 12-lb. $45, 16-lb. $44, 25 and 30-lb. $43. (217, 377,422).

Sheet Steel.—The market continues steady; American Bessemer, 10-gauge, $2.50; 12-gauge, $2.55; 14-gauge, $2.35; 17, 18, and 20-gauge, $2.45; 22 and 24-gauge, $2.50; 26-gauge, $2.65; 28-gauge $2.85. As the dumping clause has been put in operation, an advance in price may be looked for. (65, 77, 94, 241, 362, 363, 372, 454, 551).

Sheets Galvanized.—Apollo Brand.—Sheets 6 or 8 feet long, 30 or 36 inches wide; 10-gauge, $2.90; 12-14-gauge, $3.00; 16, 18, 20, $3.10; 22-24, $3.25; 26, $3.40; 28, $3.85; 29, $4.15; 10¾, $4.15 per 100 lbs. Fleur de Lis—28-gauge, $4; 26, $3.80 per 100 lbs. A very large tonnage of all sorts has been booked. The feeling is toward an advance. (332).

Tank Plate.—3-16-inch, $2.40 per 100 lbs. (241, 362).

Tool Steel.—Jowett's special pink label, 10½c. Cammel-Laird, 16c. "H.R.D." high speed tool steel, 65c. (3, 372).

Tin.—Irregular outside, but firmly held locally. At present we quote slightly higher, at 34½ to 35c.

Wheelbarrows.—Navvy, steel wheel, Jewel pattern, knocked down, $21.60 per dozen; set up, $22.60. Pan Canadian, navvy, steel tray, steel wheel, $3.30 each; Pan American, steel tray, steel wheel, $4.25 each. (217, 377).

Zinc Spelter.—A very active movement continues, and a large business is being done. Price as before, $5.75 to $6 per 100 lbs.

CAMP SUPPLIES.

Butter.—Dairy prints, 25 to 26c.; creamery prints, 30 to 32c., the supply is very limited and the demand brisk. (74).

Canned Goods.—Peas, $1.10 to $1.50; tomatoes, 3s, 85c. to 95c.; pumpkins, 3s, 80 to 85c.; corn, 80 to 85c.; peaches, 2s, white, $1.50 to $1.60; yellow, $1.90 to $1.95; strawberries, 2s, heavy syrup, $1.50 to $1.85; raspberries, 2s, $1.50 to $1.95 (74).

Cheese.—Moderately firm; large, 13c.; twins, 13¼c. (74).

Coffee.—Rio, green, 11 to 12½c.; Mocha, 21 to 23c.; Java, 20 to 31c.; Santos, 11 to 15c. (74).

Dried Fruits.—Raisins, Valencia, 5¾ to 6¼c.; seeded, 1-lb. packets, fancy, 7½ to 8c.; 16-oz. packets, choice, 7 to 7½c.; 12-oz. packets, choice, 7c.; Sultanas, good, 5 to 6c.; fine, 6 to 7c.; choice, 7 to 8c.; fancy, 8 to 9c., Filiatras currants, 6½ to 7c.; Vostizzas, 8½ to 9c.; uncleaned currants, ¼c. lower than cleaned. California Dried Fruits,—Evaporated apricots, 15 to 16c. per lb.; prunes, 60s to 70s, 7½ to 8c.; 90s to 100s, 6c.; evaporated apples, 8c. (74).

Eggs.—New laid, free receipts, good demand, 20 to 21c. per dozen, in case lots. (74).

Flour.—Manitoba Flour.—Quotations at Toronto are:—First patents, $4.60, second patents, $5.10; strong bakers', $4.90; 90 per cents., Glasgow freights, 28s. 6d. Ontario Flour.—Winter wheat patents, for export, $4.20 to $4.25, in bupers' sacks outside. (74).

Lard.—In small supply, and again advanced. Tierces, 16¾c.; tubs 17c.; pails, 17¼ to 17¾c. (74).

Molasses.—Barbadoes, barrels, 37 to 45c.; West Indian, 27 to 30c.; New Orleans, 30 to 33c. for medium. (74).

Pork.—Market very firm. Short cut, $29 to $30 per barrel; mess, $27 to $28. Light stocks and not much doing. (74).

Rice.—B grade, 3½c. per lb.; Patna, 5 to 5¾c.; Japan, 5 to 6c. (74).

Salmon.—Fraser River, talls, $2; flats, $2; River Inlet, $1.55 to $1.75. (74).

Smoked and Dry Salt Meats.—Long clear bacon, 15 to 15½c. per lb., tons and cases; hams, large, 17 to 17½c.; small, 17½ to 18c.; rolls, 15 to 15¼c.; breakfast bacon, 19 to 20c.; backs (plain), 20 to 21c., backs (peameal), 21 to 22c.; shoulder hams, 13½c.; green meats out of pickle, 1c. less than smoked. Market very firm. (74).

Spices.—Allspice, 13 to 19c.; nutmegs, 30 to 75c.; cream tartar, 22 to 25c., compound, 15 to 20c.; pepper, black, pure Singapore, 14 to 17c.; pepper, white, 20 to 30c. (74).

Sugar.—Granulated, $5.20 per 100 lbs., in barrels; Acadia, $5.10; yellow, $4.80; bags, 5c. lower. (74).

Syrup.—Corn syrup, special bright, 3½c. per lb. (74).

Teas.—Japans, 20 to 35c. per lb.; Young Hysons, 10 to 35c.; Ceylons, medium, 16 to 45c. (74).

Vegetables.—Beans, hand-picked, $2.35; prime, $2.25; stocks light, market firm; beets, 85c. a bag; carrots, 60 and 65c. a bag; onions, $1.25 a bag; potatoes, best, 65 and 70c. a bag; turnips, 45c. a bag. (38).

* * * *

Winnipeg, April 19th, 1910.

All supplies continue to be in good demand on this market, and prices are well kept up. Building permits are away ahead of last year, and all work is said to be easily a month farther advanced. Brick is still scarce and manufacturers state that they have no stocks on hand, and in some cases the whole season's output is contracted for. Navigation is now practically open and it is likely that large stocks of all supplies will be rushed into the West. Cement stocks are very low, and orders are coming in rapidly so that fresh supplies are needed.

The Iron and Steel business is brisk in the West, and the numbers of contracts already closed this year by local firms is very gratifying. Railway supply houses also report an active business. Prices in all lines quoted below are steady and strong, and are as follows:—

Anvils.—Per pound, [illegible] to 12½c.; Buckworth anvils, 80 lbs., and up, 10¼c.; anvil and vice combined, each, $5.50 (111, 132).

Axes.—Chopping axes, per dozen, $6 to $9; double bits $12.10 per dozen.

Barbed Wire.—4 point and 2 point, common, $3.15 per cwt.; Baker, $3.20; Waukegan, $3.30.

Bar Iron.—$2.50 to $2.60.

Bars.—Crow, $4 per 100 pounds. (119.)

Beams and Channels.—$3 to $3.10 per 100 up to 15-inch. (4, 30, 41, 50, 118, 119, 127, 132, 145, 176.)

Boards.—No. 1 Common Pine, 8 in. to 12 in., $38 to $45; siding, No. 1 White Pine, 6 in., $55; cull red or white pine or spruce, $24.50; No. 1 Clear Cedar, 6 in., 8 to 16 ft., $60; Nos. 1 and 2 British Columbia spruce, 4 to 6 in., $55; No. 3, $45.

Bricks.—$10, $11, $12 per M, three grades.

Building Paper.—4½ to 7c. per pound. No. 1 tarred, 84c. per roll; plain, 60c.; No. 2 tarred, 62½c.; plain, 56c.

Coal and Coke.—Anthracite, egg, stove or chestnut coal, $9.75 larger lots to $10.50 ton lots, net; Alleghany soft coal; carload lots, basis, Winnipeg, f.o.b., cars, $6 per ton; cannel coal, $10.50 per ton; Galt coal, $2 f.o.b., carload lots, $9 single ton; coke, single ton, $7 at yard; large lots, special rates. American coke, $11 to $11.50 a ton; Crow's Nest, $12 a ton.

Copper Wire.—Coopered market wire, No. 7, $4 per 100 lbs.; No. 6, $4; No. 10, $4.06; No. 12 $4.20, No. 14, $4.40; No. 16, $4.70.

Cement.—$2.25 to $2.50 per barrel in cotton bags.

Chain.—Coil, proof, ¼-inch, $7; 5-16-inch, $5.50; ⅜-inch, $4.00; 7-16-inch, $4.75; ½-inch, $4.40; ⅝-inch $4.20; ¾-inch, $4.05; logging chain, 5-16-inch, $6.50; ⅜-inch, $6; ½-inch, $8 50; jack iron, single, per dozen yards, 15c. to 75c.; double, 25c. to $1; trace-chains, per dozen, $5.25 to $6.

Copper.—Tinned, boiler, 26½c.; planished, 29½c.; boiler and T. K. pits, plain, tinned, 45 per cent. discount.

Dynamite.—$11 to $13 per case.

Hair.—Plasterers', 80 to 90c. per bale.

Hinges.—Heavy T and strap, per 100 lbs., $6 to $7.50; light, do., 65 per cent.; screw hook and hinge, 6 to 10 inches, 5¼c. per lb.; 12 inches up, per lb., 4½c

Galvanized Iron.—Apollo, 10¾, $4.90; 28, $4.70; 26, $4.30; 22, $4.10; 24, $4.10; 20, $4; 18, $3.05; 16, $3.90; Queen's Head, 28, $4.90; 26, $4.70; 24, $4.30; 22, $4.20; 20, $4.10 per cwt.

Iron.—Swedish iron, 100 lbs., $4.75 base; sheet, black, 14 to 22 gauge, $3.75; 24-gauge, $3.90; 26-gauge, $4; 28-gauge, $4.10. Galvanized—American, 18 to 20-gauge, $4.40; 22 to 24-gauge, $4.65; 26-gauge, $4.65; 28-gauge, $4.90; 30-gauge, $5.15 per 100 lbs. Queen's Head, 22 to 24-gauge, $4.65; 26-gauge English, or 30-gauge American, $4.90; 30-gauge American, $5.15; Fleur de Lis, 22 to 24-gauge, $4.50; 28-gauge American, $4.75; 30-gauge American, $5. (110).

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

Lumber.—No. 1 pine, spruce, tamarac, British Columbia fir and cedar—2 x 4, 2 x 6, 2 x 8, 8 to 16 feet, except 10 feet, $27; 2 x 20 to 2 x 40, up to 32 feet, $40.

(Continued on page 50).

TENDERS CALLED FOR

Department of Railways and Canals, Canada.

SAULT STE. MARIE CANAL.

NOTICE TO CONTRACTORS.

SEALED TENDERS addressed to the undersigned, and endorsed "Tender for Removing Range Beacon, and widening the Channel at the Upper Entrance," will be received at this office until 16 o'clock on **Thursday, the 28th April, 1910.**

Plans, specifications and the form of the contract to be entered into can be seen on and after the 8th April, 1910, at the office of the Chief Engineer of the Department of Railways and Canals, Ottawa, and at the office of the Engineer in charge, Sault Ste. Marie, Ont., at which places forms of tender may be obtained.

Parties tendering will be required to accept the fair wages Schedule prepared, or to be prepared, by the Department of Labor, which schedule will form part of the Contract.

Contractors are requested to bear in mind that tenders will not be considered unless made strictly in accordance with the printed forms, and in the case of firms, unless there are attached the actual signatures, the nature of the occupation and the place of residence of each member of the firm.

An accepted bank cheque for the sum of $500.00, made payable to the order of the Minister of Railways and Canals, must accompany each tender, which sum will be forfeited if the party tendering declines entering into contract for the work at the rates stated in the offer submitted.

The cheque thus sent in will be returned to the respective contractors whose tenders are not accepted.

The cheque of the successful tenderer will be held as security or part security for the due fulfillment of the contract to be entered into.

The lowest or any tender not necessarily accepted.

By order.

L. K. JONES,
Secretary.

Department of Railways and Canals,
Ottawa, 8th April, 1910.

Newspapers inserting this advertisement without authority from the Department will not be paid for it.

TRENT CANAL

Ontario-Rice Lake Division

SECTION No. 4.

NOTICE TO CONTRACTORS.

SEALED TENDERS addressed to the undersigned, and endorsed "Tender for Trent Canal," will be received until 16 o'clock on **Thursday, the 5th May, 1910,** for the works connected with the construction of Section No. 4, Ontario-Rice Lake Division of the Canal.

Plans, specifications and the form of the contract to be entered into can be seen on and after this date at the office of the Chief Engineer of the Department of Railways and Canals, Ottawa, and at the office of the Superintending Engineer, Trent Canal, Peterboro', Ont., at which places forms of tender may be obtained.

Parties tendering will be required to accept the fair wages Schedule prepared, or to be prepared, by the Department of Labor, which schedule will form part of the Contract.

Contractors are requested to bear in mind that tenders will not be considered unless made strictly in accordance with the printed forms, and in the case of firms, unless there are attached the actual signatures, the nature of the occupation and the place of residence of each member of the firm.

An accepted bank cheque for the sum of $20,000.00, made payable to the order of the Honorable the Minister of Railways and Canals, must accompany each tender, which sum will be forfeited if the party tendering declines entering into contract for the work at the rates stated in the offer submitted.

The cheque thus sent will be returned to the respective contractors whose tenders are not accepted.

The cheque of the successful tenderer will be held as security or part security for the due fulfillment of the contract to be entered into.

The lowest or any tender not necessarily accepted.

By order.

L. K. JONES,
Secretary.

Department of Railways and Canals,
Ottawa, 7th April, 1910.

Newspapers inserting this advertisement without authority from the Department will not be paid for it.

TRENT CANAL

Ontario-Rice Lake Division

SECTION No. 6.

NOTICE TO CONTRACTORS.

SEALED TENDERS addressed to the undersigned, and endorsed "Tender for Trent Canal," will be received until 16 o'clock on **Tuesday, the 26th April, 1910,** for the works connected with the construction on Section No. 6, Ontario-Rice Lake Division of the Canal.

Plans, specifications and the form of contract to be entered into can be seen on and after this date at the office of the Chief Engineer of the Department of Railways and Canals, Ottawa, and at the office of the Superintending Engineer, Trent Canal, Peterboro', Ont., at which places forms of tender may be obtained.

Parties tendering will be required to accept the fair wages Schedule prepared, or to be prepared, by the Department of Labor, which schedule will form part of the Contract.

Contractors are requested to bear in mind that tenders will not be considered unless made strictly in accordance with the printed forms, and in the case of firms, unless there are attached the actual signatures, the nature of the occupation and the place of residence of each member of the firm.

An accepted bank cheque for the sum of $10,000.00, made payable to the order of the Honorable the Minister of Railways and Canals, must accompany each tender, which sum will be forfeited if the party tendering declines entering into contract for the work at the rates stated in the offer submitted.

The cheque thus sent will be returned to the respective parties whose tenders are not accepted.

The cheque of th esuccessful tenderer will be held as security or part security for the due fulfillment of the contract to be entered into.

The lowest or any tender not necessarily accepted.

By order.

L. K. JONES,
Secretary

Department of Railways and Canals,
Ottawa, 5th April, 1910.

Newspapers inserting this advertisement without authority from the Department will not be paid for it.

TENDERS—Continued on page 50.