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The Canadian Engineer

WEEKLY

ESTABLISHED 1893.

VOL. 19. TORONTO, CANADA, NOVEMBER 10, 1910. No. 19.

The Canadian Engineer

ESTABLISHED 1893.

Issued Weekly in the interests of the

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

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Present Terms of Subscription, payable in advance:

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

Copies Antedating This Issue by Two Months or More, 25 Cents.

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

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THE ENGINEER AS AN EXPERT WITNESS.

An engineer frequently finds himself called upon to give expert evidence in the courts. His position as expert witness should prevent him from becoming an advocate of either the plaintiff or the defendant. No matter who retains him, he should consider himself, in the witness-box, a servant of the judge and jury; he should do all he can to combat the impression that he has allowed a desire for his side to win, to warp his conscience. The first duty of the expert witness should be to place himself in a correct position with the court. His knowledge of technical matters, his ability to fence in cross-examination, his clear explanations will have little weight if his testimony makes it apparent that he is really an advocate of his own side. In the most sensational and bitterly contested cases in Canadian courts, where the dispute turned almost entirely on expert evidence, it has frequently occurred that the three experts for the plaintiff contradict and are flatly contradicted by the three experts for the defendant. This kind of expert evidence has made our judges disgusted with the expert.

It is the duty of the counsellor to handle the case. It is not the duty of the expert witness to act as advocate. The expert witness should give prompt and clear answers, even if they appear to damage his client's case. It is the duty of the attorney to explain it in a way or get around it if he considers the answer weakens his case.

The first duty of the expert witness should be to clearly understand the main facts of the case, and, having formulated his opinions, to communicate to his client. If he is unable to support a particular view, he should say so.

In giving his evidence he should not presume that the solicitor is without some scientific and technical knowledge. The legal gentlemen employed on such cases have usually a good store of such information, and if they are ignorant on any point are not shy about confessing it. In giving evidence, models and drawings frequently make it easier for both judge and jury to grasp the main points of the case. Long, rambling answers do more harm than good, and, if admissions are necessary, let them be candid, without any attempt to fence.

As a general rule, witnesses are not expected to read their documents, but when the array of facts and figures is large it is absolutely impossible for him to carry them in his head. He should commit them to

writing, and when on the stand will be permitted to refresh his memory if he is prepared to swear that the notes are the result of actual observation noted when he was making his examination.

One of the difficulties expert engineers have to face is text-books or writings, where the opinions of the authors, living or dead, appear to strengthen his opponent's case. By watching carefully while the case proceeds he may be able to discover the names of the works with which he is likely to be confronted, and, upon examination, he may find that it is antiquated, or even an old edition, and in a more recent issue the same author may have expressed an entirely different opinion.

Expert witnesses should keep their books of reference from public gaze.

An expert witness should not be too thin-skinned. A violent attack from the opponent's counsel should be considered as a compliment. It is quite apparent that the examiner considers his evidence has made an impression, else he would not attack it.

In the matter of fees he should arrange the amount beforehand, and be careful to stipulate that so much be paid down and so much per day as the trial progresses. There are, unfortunately, some members of the legal profession who, when they have lost a case, are, to say the least, careless in the matter of fees. When the case has been won, generous fees are allowed the successful client, and the expert witness should see to it that he receives his share.

But above all, he must adopt a high standard in reference to whatsoever things are true.

TOWN AND COUNTRY.

This is not a discussion of the relative advantages of country life compared with city life, but its purpose is to consider some of the figures obtainable from the census returns of Canada and the bearing the matter of congested population is sure to have upon problems which the engineer must face.

In Canada, as in other countries, the tendency of the population is to leave the country and heap up in the cities. This is one of the great worries of those who are over-anxious for the future. When the census of 1871 was taken there were some 457,000 people in the towns and 3,252,000 in the country sections of Canada, or the country dwellers were eight times as many as those living in the towns and cities, but when the census of 1891 was taken there were 1,589,000 people living in the towns and 4,052,000 in the country, or three times as many people in the country as in the cities. Looking at this in another way, it means that while the rural population was increasing twenty-five per cent. the urban population increased three hundred per cent.

In the decade preceding 1901 Toronto increased 27,000; it grows that much every year now, and what is true of Toronto is true of such growing cities of Canada as Montreal, Winnipeg, Edmonton, Vancouver and a dozen others.

The census of 1911 will undoubtedly show immense increases in our urban population compared with the increase in the rural districts, and all this in spite of the fact that we are spending annually $1,000,000 to encourage emigrants to settle upon our agricultural lands.

All this goes to show that, while in the past we have been developing rural highways and pioneer transportation routes, the engineering of the future will have to do with the problems that arise from the congestion of population and the crowding together of our population in cities.

SHEET PILING AND SHORING.

In most classes of work it is not difficult to decide upon a unit basis for payment, but in sheet piling work and shoring, which is of a temporary nature, it is sometimes difficult to prepare specifications that are fair alike to the owner and the contractor. In all classes of excavation works in towns and cities shoring has to be more or less resorted to. Structures are so close together that one cannot take the risk of the bank caving in. If the shoring or the piling have to be left in place, the basis of payment is not difficult to arrange, but where the material may be taken out and used again and again the situation is different. If the contractor is to give a lump sum covering all this work he will doubtless allow for all the work to be shored, and on those sections where he could avoid shoring he makes an extra profit. This is not fair to the owner, as he is paying for work which is not done.

Altogether, the fairest way to pay for this class of work is to arrange two prices, one price covering the material furnished, and the other the material in place. According to this plan the owner will then pay for all the material used and some that can be reused two or three times. It will be a saving. The contractor receives payment for work done, and he is not tempted to use lighter material than the work requires.

WATER POWER CONTROL IN QUEBEC.

Before the Caledonian Society at Montreal last week Mr. F. D. Monk, M.P. for Jacques Cartier, spoke on the enormous water power possibilities in Canada. After dealing in an interesting manner with the amount of power available in Ontario and Quebec, and the St. Lawrence valley more particularly, Mr. Monk emphasized the need of conserving the natural resources of Canada, and intimated that next January there would be submitted to Parliament seven recommendations from the committee on water powers. These recommendations are as follows:—

1. Water powers to be alienated for stated period only.
2. Reference before alienation is to be made of the application for water powers to the Conservation Commission.
3. Determination of the development to be made, and the right of entry and of the annual rental calculated on the horse-power used.
4. Time within which proposed development is to be made, and forfeiture in case of non-observance, and revision of rentals at expiry of each period.
5. Indemnification of lessee in case of failure to agree after each period,
6. Control of rates at which the public at large is to be supplied with electric power by the lessee.
7. Jurisdiction to determine differences between the government and lessees in case of failure to agree in some independent tribunal.

It is expected that legislation based on these recommendations would be introduced, and that laws aiming at the removal of existing abuses in the use of water power will shortly be enacted.

Canada has still large natural resources, and it is but proper that those which are still public domains should be under government control, the country at large having still a right to receive what benefits there may be in their developments.

EDITORIAL NOTE.

Returns from Interstate Commerce Commission of the United States show that for the three months, April, May and June, 1910, there were 137 killed and 2,741 injured in train accidents on United States roads. It shows the number of casualties for the year to be 3,804 killed and 82,374 injured. For the same period a year ago there were 2,971 killed and 63,920 injured, which shows an increase of 1,013 in the number killed and 18,454 in the number injured. There were 5,861 collisons during the year ending June 30th, 1910, causing the deaths of 433 persons and injuring 7,765 persons, with a damage to the property of the railroad companies of $4,629,279, being an increase of 1,140 in the number of collisions, with an increase of 91 in the number of persons killed, and an increase of 2,370 in the number of persons injured. There were 5,910 derailments during the year ending June 30th, 1910, an increase of 659. There were 340 persons killed in derailments and 4,814 injured, an increase of 79 in the number killed and 673 in the number injured.

FACTORS TO BE CONSIDERED IN VALUING A WATER POWER.

In making the total valuation of the property of a large manufacturing concern recently, Lockwood, Greene & Co of Boston, Mass., the architects and engineers for industrial plants, had occasion to determine the "Value" of the water power developments belonging to this company.

The method pursued in arriving at the final value contains matter of much interest and the factors considered are those which in a general way would enter into the valuation of any water power. Before entering into a discussion of the five principal factors considered it may be well to quote the general remarks at the beginning of the report. These are as follows:

"In the endeavor to affix the proper value to these properties, it is evident that more must be considered than the actual cost of the land and improvements. Some sites can be more economically developed than others, some rivers are more regular in their flow of water, are less subject to ice or silt, or are in a locality where coal is dear and transportation expensive. The value of a water power depends largely upon these factors and they have been considered in arriving at the prices named."

After these opening remarks, Lockwood, Greene & Co. proceed to enumerate the five principal factors to be considered in the valuing of a water power. These are as follows:

(1) "Regularity of flow of the river and average quantity of power delivered.

(2) "Cost of steam power in the vicinity, based on costs of bituminous coal of fair steaming quality.

(3) "Advantage to the company in possessing a supply of power only slightly affected by actions of other corporations or human agencies.

(4) "Liability to stoppage from

(a) Low water.

(b) Ice.

(c) Electrical or storm disturbances.

(5) "Future advantages owing to probable increase in price of coal and enhancement of water power generally, including increased efficiency or electrical application of energy."

Regarding Factor No. 1, there are three conditions under each one of which the effect of the regularity of the flow will be different. These conditions are: First, when the minimum flow is sufficient to supply all the power required; second, when the minimum flow is not sufficient to furnish all the power required, but the average flow is sufficient for this purpose; and third, when the average flow is insufficient to furnish all the power required.

Under conditions 2 and 3 it is necessary to have some auxiliary power, the installation of which has an effect on the total valuation of the water power in proportion to the amount of water power utilized from the development. For example, in the particular case being investigated, the power requirement of the company was greater than the average power of the water power development, and there was a steam plant with power sufficient to meet the deficiency in the water power output. Hence all the water power up to the capacity of the plants can be used, and the computations of the value were based on the average output without considering the primary and secondary power output.

Regarding factor No. 2, two items enter into this consideration. First, the cost of the steam plant complete, and second, the cost of its operation. In determining the cost of a steam plant complete, this should be taken for a plant most advantageously located and designed to operate at a minimum cost. The power developed in a steam plant should be taken as the brake horse power from the engine wheel shaft, and the size of the engine should be fixed after making due allowance for engine losses and mechanical efficiency. Another consideration in connection with a steam plant, is the possibility of operating it under a big overload, should necessity require, an attribute not held by a water power.

Factor No. 3 is a most important consideration, as a manufacturer can be greatly inconvenienced, or his business even be jeopardized, by having his power plant disabled on account of transportation troubles, strikes in coal mines, or other human or physical agencies.

In regard to factor No. 4, the so-called physical or natural agencies are considered. A careful study of the three items enumerated should be made for each local condition.

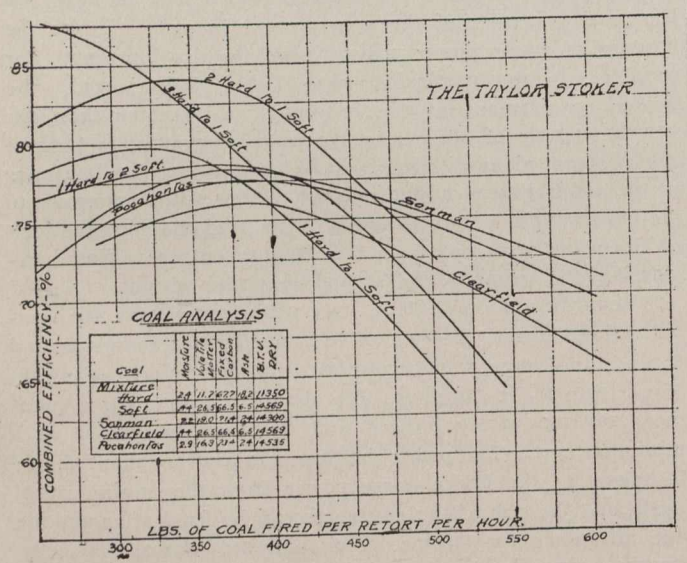
In factor No. 5 the future is considered, and it is undoubtedly true that the value of water power will be enhanced as the supply of coal decreases, this enhancement increasing up to the point where a value is determined through the law of supply and demand. The consideration of increasing the efficiency of electrical application and transmission of energy is of more immediate interest. This is especially true in regard to transmission, as great strides have been made within the past few years in the economical distribution of electrical energy over wide areas. The natural result is, of course, the increasing of the market for the output of any particular hydro-electric development and the consequent enhancement of its value.

Summarizing, it will be seen that Lockwood, Greene & Co. have in reality considered the fundamental factors in the value of a water power to be amount and condition of the water supply; the cost of producing an equivalent amount of power by other agencies; the effect of human and physical agencies, and last, the future possibilities.

FIRING MIXED FUEL.

In a recent address before the International Association for the Prevention of Smoke, Mr. R. S. Riley, President of the American Ship Windlass Company took occasion to point out the economy to be derived from efficient burning of mixtures of anthracite slack and bituminous coal. "The burning," said Mr. Riley, "of mixed fuels, is becoming an important factor in steam boiler economy in the East.

"The price and freight rates of anthracite screenings usually allow it to be bought at a much lower cost per B.T.U. than bituminous. Hence, the desirability of utilizing it in as large a proportion as possible. It has been proven by several large concerns, that steam can be produced most economically by burning these mixtures in Taylor Stokers." Mr. Riley illustrated his remarks with a slide which is reproduced below.



The curves of efficiency and load for three kinds of straight bituminous coals are shown, and the remarkable results obtained with mixed fuels of the compositions indicated are graphically demonstrated. The quantities of coal are for a seven retort Stoker, and represent a range of from 100 to 200 per cent. of the boiler rating. The automatic control of coal and air peculiar to the Taylor stoker and the underfeed feature account for the high efficiencies obtained.

CONSUMERS GAS CO., TORONTO, ONT.

That there had been during the past year an unprecedented increase in the gas sales in Toronto was the announcement made at the annual meeting of the Consumers Gas Company.

The output amounted to 2,621,247,000 cubic feet, or 395,084,000 cubic feet more than the output of 1909, the rate of increase being 17.74 per cent.

New services to the number of 6,268 have been put in during the year—an increase of nearly 500 over the largest number of services introduced in any previous year.

The erection of the new gas-holder of 5,000,000 cubic feet capacity, referred to in the last annual report, is proceeding satisfactorily, and it is expected that the holder will be ready for service about June 1st next.

Mr. John L. Blaikie, the president, pointed out that the balance carried forward, after meeting all demands on the company, was $77,411.79.

"The remarkable increase in the number of consumers," explained Mr. Blaikie, "is accounted for very largely by the appreciation by the public of the advantages of cheap gas when supplied through proper burners. There are still some belated consumers who use flat-flame burners. We are striving to secure the general introduction of the modern burners, the results from which are so much more satisfactory than from the flat-flame ones."

The company's mains, he continued, covered an area nine by seven miles, and their total length was over 423 miles.

"With increases at the rate of thirty miles or more per annum, a great deal of skill and careful thought is required in laying out the plans for the ultimate conditions when the city will have upwards of a million population.

"With reference to the output of gas, it is an astonishing fact that the volume of gas put out by this company during the past year is very nearly equal to the total quantity of manufactured gas sold during 1909 by all of the other gas companies in the Dominion of Canada combined."

Further on in his address Mr. Blaikie added:—

"I am glad to be able to say that, if nothing unforeseen arises, the directors hope to be able to make a further reduction in the price of gas at an early date. When we are able to take off another five cents per thousand, making the net price of gas 70 cents per thousand feet, it cannot fail to afford great satisfaction to the consumers of gas, whether for illuminating, manufacturing, cooking or other purposes. This will be the cheapest price for gas of any company on the continent, notwithstanding that coal and oil have to be brought hundreds of miles to the works, and that the company must pay customs duty of 53 cents upon every ton of gas coal used.

Undersell Electricity.

"The prospect of Hydro-Electric or Toronto Electric Light pushing their method of lighting the city does not cause your directors the smallest concern or anxiety, feeling perfectly confident that this company can, under any and all circumstances, undersell electric lighting."

General Manager Hewitt said that two years ago the company had no commercial department. Prior to that, miles of territory had been lost to other systems of lighting. In the last two years much of that lost ground had been regained.

(Continued on page 612).

Table Showing Growth of Company's Business for Six Decades, from 1855.

Year.	Pop.	Increase per cent.	Output of Gas M. ft.	Increase per cent.	No. of Meters.	Inc. %	Consumption per meter.	Per capita of pop.	Miles of main.	Inc. %
1855	42,500	....	22,000	.....	1,119	.....	11,500	302	23	....
1865	47,500	11.7	30,014	36.4	1,188	6.1	16,000	402	41¼	79.8
1875	68,678	44.6	100,122	233.9	2,508	111.1	26,500	969	66	60.0
1885	105,211	53.2	273,484	173.1	6,778	170.2	29,000	1,873	126	90.9
1895	190,000	80.6	614,553	124.7	20,626	204.3	25,000	2,883	227⅓	80.4
1905	250,000	31.5	1,374,114	123.6	39,711	92.5	31,334	5,496	302.06	32.9
1910*	375,000	10.7	2,621,247	17.7	64,781	10.7	40,463	6,990	423	13.3

* The increases shown are as compared with 1909.

PUBLIC TREATMENT OF MANUFACTURING WASTES.

A question of great importance to municipalities is likely to arise in the near future with reference to the treatment or purification of manufacturing wastes if admitted to connection with public sewers, and so into the sewage disposal system.

In Great Britain a sharp distinction has always been made between domestic sewage and the polluted waste waters, which are the result of any manufacturing process. It has been held that municipalities are not called upon to lay down a sewerge system or install sewage works which may be for the benefit of any particular trade or trades.

A communal sewerage system is primarily a joint health utility, providing that certain unavoidable products of communal existence be removed and satisfactorily dealt with for the common good. Domestic sewage is a necessary product, and it is a necessity to the health of the community that it be dealt with.

Trades wastes, however, are more or less accidental, occasioned not by the necessity to live as a community, but occasioned by the wish of certain individuals or corporations to carry on profit-making concerns. Hence a trade waste is part and parcel of the necessary manufacturing equipment, and as such, any cost entailed in dealing with it should be looked upon as part of the manufacturing process, and be a charge set off against the profits.

For instance, no manufacturer could ask that the community be at the expense of removing, dealing with, and purifying the smoke from a furnace, no matter how great a nuisance the smoke may be to the community. Further, no manufacturer could ask that the removal of waste or scrap material, rendered useless in the process of manufacture, be a charge upon the public assessment. Now, the water which is used in the process of manufacture is just so much water mixed with waste or scrap material, forming a necessary by-product of something which creates money for the producer. The money created by the finished product should be liable for the cost of dealing with the by-products, so that it may not become a nuisance to others who have no direct interest in the production.

In spite, however, of this logical conclusion, the point arises, and will arise acutely in Canada when the installation of sewage disposal works become more general, viz.: a manufacturing concern pays rates; it may, in fact, be the mainstay of the community. Then why should it be denied the use of, and entrance to, a sewerage system maintained principally by the rates which it contributes? The answer is simply as stated above: a sewerage system is provided for sewage, and not for trade by-products. The factory has the right to use it to the full extent for its legitimate purposes, but not otherwise.

Modern methods of treating sewage make it impossible to treat certain trade wastes along with the sewage. If the right were granted by law to every manufacturer or prospective manufacturer to connect with a public sewer, then we might have the following condition arise: A community possesses a sewerage system and disposal works, with bacterial filter beds, which provide efficient results in purifying domestic sewage. A factory commences operations, pays taxes and demands the use of the sewerage system for its waste water. The particular trade waste may contain strong acid as a by-product, which will render the work of the bacteria filters absolutely ineffectual; and so, in order that a private individual or corporation may gain profit, a valuable public asset may become scrap. Or, in other words, the public may be called upon to spend a large sum to alter or increase their sewage works in order to provide a finishing touch to a manufacturing process.

On the other hand, there are many manufacturing wastes which have no deleterious effect either upon the sewerage system or the method of sewage purification, but which, if not dealt with, would cause a public nuisance. In the event of there being no sewerage system, the manufacturer could not ask the public to pay the cost of dealing with the trade waste. He would have to do so himself, and debit the cost as operating expenses. In the event of there being a sewerage system, then, if the manufacturer is allowed to enjoy the use of it for his trade liquid by-products, he should pay to the municipality some sum equivalent to the burden relieved from the operating expenses.

In permitting a manufacturer to use a public sewerage system for the discharge of liquid by-products, it appears necessary that two principles should be recognized, viz.:—

(a) That any manufacturer shall only be allowed to discharge trade wastes into a public sewerage system after such have received preliminary treatment (where necessary) in order to remove or neutralize any contents which may deleteriously affect either the sewerage system or the method of sewage purification.

(b) That any manufacturer discharging trade wastes into a public sewerage system, and receiving the benefit of any method of purification treatment, shall pay to the municipality an annual sum at the rate of..... per 1,000 gallons treated.

The above principles have been only recently incorporated in a special sewerage Act for the village of New Toronto, in the Township of Etobicoke, and they form the principal features of a by-law adopted this week by the Township Council.

The preliminary treatment insisted upon at the factories will probably take the form of a demand that the trade effluents will not exceed ordinary domestic sewage in organic strength or content of suspended matter, and that they contain no acids or other chemicals which would have a germicidal action upon the bacterial method of sewage purification now adopted at New Toronto.

We understand that this is the first case in Canada where special legislation has been obtained for dealing with this important problem. New Toronto is unique, inasmuch as it is principally a manufacturing centre, and where the trade effluents exceed the domestic sewage in volume.

The Etobicoke Council in framing their by-law have accepted precedents from the older manufacturing districts in Great Britain, as exemplified in the Yorkshire and Mersey and Irwell Rivers' Boards Acts.

THE SEPARATE OR THE COMBINED SYSTEM OF SEWERAGE.

The recognition of the necessity in Canada for methods of sewage purification has a direct bearing upon the question of the adoption of the separate or the combined system of sewerage.

Where modern sewage disposal works are installed, efficient working depends upon the delivery of a constant volume and strength of sewage.

The separate system alone will provide the nearest approach to the above conditions unless storm overflows are provided, allowing only a given quantity of sewage to enter the works. The combined system, taking not only domestic sewage, but also all road water, is subject to fluctuating volumes of flow.

In choosing between the separate and combined systems the following points should be considered:—

(1) If streets and roads are unpaved, the combined system will be useless until such time as they are paved, which in small communities may be years.

(2) The combined system requires diameters of pipes which only allow complete flushing during rainstorms, otherwise the sewers are too large for the ordinary domestic sewage, and remain unflushed, producing evil smells and unhealthy conditions.

(3) The combined system is about 30 per cent. more expensive than the separate system in the first instance, and should be provided with automatic flush-tanks at the head of each sewer.

(4) The combined system is apt to choke up with filth during periods of dry weather, consequently, in the case of sudden rains, cellars connected with sewers are flooded.

(5) The separate system of sewerage allows of a sewage disposal works being built to take care of a given amount of sewage, about equal to the water supply.

(6) The combined system requires a system of sewage disposal of a capacity beyond what is required for domestic sewage in order to meet rainfall.

(7) Storm overflows are necessary to the combined system. Such overflows carry all the filth collected in the sewers in dry weather into the streams or other points receiving them.

(8) In Great Britain it is the universal custom when installing sewage works where the combined system exists to retain the old system for road water and put in a new system for domestic sewage only. Regina, in Saskatchewan, is at present spending an enormous sum in order to convert from the combined to the separate system.

(9) The only towns in Canada which have the combined system of sewerage are the older cities, such as Montreal, Toronto and Winnipeg. They have this system, because those who framed the systems knew no better, and never conceived of any method of sewage disposal being called for.

(10) All the newer towns and cities of Canada have the separate system, and in certain provinces such a system is now compulsory, as in Saskatchewan.

(11) In order to obtain efficiency, either in the sewer system or in the disposal system, it is absolutely necessary to adopt the separate system.

SEWAGE TREATMENT—WITHIN REASON.*

By Arthur Bowes, Assoc.M.Inst.C.E.

By those who have followed for the last twenty or thirty years the melancholy history of sewage treatment, the conclusions and recommendations embodied in the Fifth Report of the Royal Commission on Sewage will be welcomed as a hopeful sign. They seem to indicate that the duties and possibilities of local authorities are being viewed in a more reasonable manner than has previously been the case. It will be remembered that only ten years ago no scheme of sewage treatment would secure the approval of the Local Government Board unless it provided for turning the effluent over a specified area of land, while at the same time county councils and river boards had their standards of perfection which must be attained by the luckless authorities concerned, quite irrespective of the quality of the sewage which had to be dealt with, the nature of the stream into which the effluent had to be discharged, or the quality of the land in the neighborhood of the sewage works. No guidance was offered as to the methods which would satisfy the powers in authority. The position assumed was: "Here is the standard we require; you must attain it as best you can." In the legal conflicts which ensued from non-compliance with these requirements it was always the smaller authorities which suffered, for what effect could be made on a large and wealthy corporation by an injunction or the infliction of a small fine? Consequently, we were presented with the incongruity of two or three harassed communities saddling themselves with the burden of expensive works and doing their best to purify their sewage, while higher up the stream into which their effluent was discharged some immense town continued to discharge its pestilential filth in such quantities as to nullify the good effects of their little efforts.

Even the knowledge of purification methods was so little advanced that an authority which ten years ago sought the approval of the Local Government Board to a scheme based on the then comparatively new bacterial treatment would probably be told that it could only be installed "as an experiment" on the responsibility of the local authority.

The Fifth Report contains not only a large amount of definite and useful information as to what has been done at the various sewage works of the country, but also gives plain expression to the opinions of the Commission on various details in such a manner as to be really helpful to those who are anxious to meet the requirements of modern sanitation. And, above all, there is displayed a tendency to recognize the difficulties of the task and to take a more reasonable view of the requirements which should be asked for. The rigid ruling as to land treatment was abandoned in the First Report, so long ago as 1901. The Fifth Report goes much further in its reasonableness when it says that the main question to be considered is "what degree of purification is required under the circumstances of the town and of the river or stream into which its liquid refuse is to be discharged?" In the matter of the treatment of storm water, too, the views expressed are less stringent than formerly.

It is gratifying to find that local conditions are at last to receive the consideration they deserve. Under the existing state of things a town may turn its effluent into a stream so notorious for its filthy condition as to be declared by a county analyst to be a stream which it is impossible to pollute. The situation of the town may be such that while it receives a stream already highly polluted there are no other towns or villages on the lower reaches of the stream. To ask such a town to purify its sewage to a high degree is to ask for something which is a sheer waste of money. The average town councillor of a town so situated will very properly ask why an expensive system of purification should be required when not a single human being will be benefited by it. Morally, of course, there is a pleasure in well-doing, and it may be said that virtue is its own reward, but—is there any virtue in spending money to no useful purpose?

The recommendation of the Royal Commission that the

*Paper read before the Institution of Municipal Engineers at Eastbourne.

circumstances of the town and river should be taken into account is a wise and just one, and will no doubt lead to a more considerate treatment of authorities placed in the unfortunate position described. The national work of improving the condition of our streams and rivers must still, however, be carried on, though the methods of procedure may be modified by the suggestion of the Commission. Seeing that the principle is now recognized of taking into account the condition of the stream, might it not be desirable to make such condition the starting point from which to determine the amount of purification to be asked for? Supposing that it were made compulsory for every effluent to be a little better than the stream—say, that it should contain 10 per cent. or 20 per cent. less pollution—it is obvious that without any very great burden being imposed a decided change might soon be brought about in the condition of many of the smaller rivers and streams. In the few cases where effluents are turned into the upper reaches of a pure stream such a requirement would perhaps be too stringent. It would then suffice to follow the present system of defining an amount of pollution which must not be exceeded, but as matters now stand most towns receive their streams already polluted with the sewage of other towns further up the watershed. Nay, sometimes the effluent of the lower town, though technically a pollution, is actually helping to purify the stream, and if it were possible to keep out the effluent the condition of the stream would be worse than before.

Under such a system as is suggested above it would be necessary for the effluents to be a definite degree better than the stream. Then, when the authorities higher up had been brought into line and also turned out effluents of greater purity than the stream, the standard of purity would automatically raise itself by gradual steps. As the stream became less and less polluted it would be incumbent on every authority gradually to improve the quality of its effluent until at length a uniform degree of excellence was obtained over the whole watershed, instead of the present sporadic system of half a dozen towns turning out fair effluents only to be overwhelmed by the noisome discharge of some neighboring city.

GARBAGE DISPOSAL.

Methods Adopted in Some of the Large European Cities.

Reports by United States Consuls.

Acting on the request of American firms, special enquiries were directed to the engineers of several of the boroughs of metropolitan London for securing information regarding the collection and disposal of garbage. The substance of these replies is as follows:—

Saint Pancras.

In the Borough of Saint Pancras the collection of all garbage is supervised by officers in the employ of the borough council. The collection of house refuse is carried on by a staff in the direct employ of the local authority. The collection of street refuse is also made by the council's own staff, but its removal from the streets is effected by contractors. In the letting of contracts no distinction is made between individuals and corporations.

The collection generally proceeds all day, from 7 a.m. to 5 p.m., but in certain main streets police regulations forbid dust vans to carry on their work after 10 a.m., and in these streets daily collection is made between 7 a.m. and 10 a.m., the residents being required to bring their dust receptacles to the footway.

In the case of hospitals, large hotels, and large restaurants daily collection is made, and in some of the more densely occupied localities the collection is made three times or twice a week, but generally throughout the borough the collection of house refuse is made once a week. No machinery is used in the disposal of the refuse. The larger part is burned, while the remaining part is sent away by canal barges. The street refuse becomes the property of the contractors, who remove it, and it is disposed of as they can best arrange. It is nearly all sent away by barge on canal or river.

In the Borough of Saint Marylebone it has been the custom of the council to have house refuse collected and disposed of by contract.

Horse-drawn carts and vans are used for the collection of garbage and the receptacles for carrying the refuse from the premises to the vans, have to be approved by the medical officer of health. Strong wicker baskets or metal receptacles are used for this purpose. The contractors collect the refuse during the whole of the day, except in special streets, where the occupiers are required to place the refuse on the curb in proper receptacles before 9 a.m., and the contractors are bound to remove it by 10 a.m.

The refuse is taken away by barge on the canal, and while the paper and garbage is burnt the siftings of the refuse are used for brick-making.

In the Borough of Islington the collection and disposal of garbage is undertaken by a department of the council's staff under the control of the borough engineer. For this purpose the borough is divided into districts, each district containing about 2,400 houses, being served by a gang consisting of four dust loaders (one of whom acts as ganger), three car men and three vans. The several districts are divided into sections, so that the houses of the several sections may be collected from on given days during the week, and the occupants are thus aware of the day of the week when the cart or van may be expected.

The refuse, both house and trade, is carried to the council's depots adjoining certain railways passing through the borough and is tipped into railway trucks and conveyed to farmers and others along the line. The council pays a small sum toward the cost of the railway rates. The council has no dust destructors.

In the Borough of Paddington the garbage of about nine-tenths of the area is collected by the borough council and the remaining one-tenth by contractors. The contracts are let to individuals for a period of three years for a lump sum per annum. The garbage is collected by horse-power covered tipping, vans, usually between the hours of 6 a.m. and 6 p.m. The garbage is removed by barge along the canal by the contractors.

Hamburg.

In the northern and north-western sections of the city of Hamburg garbage and house refuse are collected and carted to districts beyond the city boundaries to be spread over fields and eventually plowed under as fertilizing material. In the central, eastern and southern boroughs, including the harbor, such material after being collected, is incinerated in a municipal establishment commonly regarded as a model of its kind, and one which has given perfect satisfaction during the entire fourteen years of its particular use. I am convinced that American municipalities can study profitably the experience of Hamburg in this very important matter.

The refuse reduced to ashes in the municipal plant is conveyed thereto in four-wheeled water-tight iron carts, each of which has a capacity of about four cubic meters. The cart bodies can be lifted from the wheels by means of electrical travelling cranes and the contents discharged directly into the furnace. There are 36 of these furnaces, built according to the method of a firm in Leeds, England, all of which burn

continuously, except when they require cleaning. When the fires are once started no commercial fuel is required, and, therefore, the consumption of coal in the plant is insignificant.

The slag is removed from the furnaces in small iron carts and conveyed therein to a cooling apparatus where the contents are sprinkled with cold water, and thence to the slag breakers, which are capable of producing broken slag in three sizes.

The scrap iron recovered is sold at public auction and the slag itself is disposed of at a fixed price of 23.8 cents per ton of 1,000 kilos (2,200 pounds). There is always a great demand for this slag, for which there are numerous applications. The fine cinders are used as a top dressing for promenades, the coarser grade for establishing the drainage foundation of roads and the middle size for the top dressing of roads. Used in this way, garbage slag is cheaper than any substitute material, and it serves its purpose perfectly. It is used advantageously in mixing concrete.

The very fine garbage slag may be utilized wherever coarse sand can be used, for example, to form a bed for street paving blocks, for the manufacture of slag bricks, as anti-slipping material on city streets in winter, and as filling material in buildings under floors and over ceilings. Many other uses could be named.

As a filling material between floors and ceilings, this slag is used very extensively in the docks and warehouses of Hamburg, for the particular reason that it is absolutely sterile, and, unlike other kinds of slag, contains no sulphur by which merchandise in storage is sometimes damaged.

The garbage incinerating furnaces furnish sufficient power to drive all the electrical machinery in the establishment to operate the cranes, slag breakers, and light plant furnishing also electricity for the accumulators of an electric motor launch and an electric motor cart used in the transportation of garbage.

Edinburgh.

All refuse in Edinburgh is collected and disposed of by the municipal cleaning department. There is a daily removal system, the work of collecting beginning every week-day at 7 a.m. A city ordinance provides that "any straw, chaff, ashes, shop or house sweepings, or any offensive matter or thing," shall be placed on a street or court only "in pails, baskets or other suitable vessels;" that waste paper "shall be placed on a street or court only tied in a bundle, or after it has been reduced to pulp, and in the latter case the pulp must be contained in pails, baskets or other suitable vessels;" that the time during which any of the above specified material may be so placed on any street or court "shall be between 6.30 a.m., on any lawful day, and the time at which the collecting cart may, on the same day, pass on its round;" that vessels placed on a street or court "must be removed therefrom within half an hour after their contents are emptied into the dust carts." The penalty for each contravention of this ordinance is a fine not exceeding £5 ($24.33), or in default of payment, imprisonment.

All kinds of garbage, ashes, etc., may be out together in the same pail or box. Street sweepings are collected separately from other refuse, as is also stable manure.

The number of workers in the cleaning department is 581 men and 54 boys, who average about $6.10 and $3 per week, 52½ hours, respectively. A week's vacation in the year with full pay is allowed.

The destructor, which takes the refuse from a small district, is simply a furnace, reducing everything to ashes or into the form of clinker, this latter residium being sold to builders and others in small quantities, or, when no demand exists, dumped with the ashes into places in process of levelling up. Into such places are also dumped all the mud, sand, etc., from macadamized roads, amounting annually to about 60,000 tons.

There are some exhausted limestone quarries in the city's possession, bought for the purpose of depositing garbage and other refuse, on a tract of 115 acres called Burnhouse farm, 10½ miles from the municipal boundary. I am informed by the chairman of the cleaning and lighting committee of the town council "that in a short time the city will probably have these in use, and it is thought they will prove to be the best and cheapest method of disposal."

Glasgow.

The collection and disposal of garbage is under the direct supervision of the superintendent of the cleansing department of the corporation. The refuse is now conveyed direct to a covered cart from the bin, thus avoiding the pollution of the atmosphere and the nuisance of light material being scattered by the wind. Refuse dispatch works and destruction furnaces were gradually erected for the disposal of refuse and the unsightly and unsanitary gigantic heaps of accumulated filth in the open depots soon disappeared.

At the nine dispatch works the refuse is treated mechanically. The portions fit for sale are separated from the lighter and unsaleable parts, which are cremated in furnaces designed for the purpose. The corporation owns 700 railway cars which it uses for the conveyance of the city refuse over the various systems, and this process of separation is in operation at four stations.

The total quantity of material collected and disposed of by the department during the year ended on May 31st, 1909, amounted to 358,972 tons, 850 pounds. The revenue derived from waste materials taken from city refuse and scrap from workshops and stores during the year ended on May 31st, 1909, was: Clinker, $81,916; tins and galvanized buckets and light iron, $26,249; scrap iron, $38,675; waste paper, $32,694; bottles, $1,279; total, $189,813.

Old tins and galvanized and enamel articles which in previous years gave great trouble and annoyance to the cleansing department, now produce a substantial revenue annually. All old tin articles are now detinned and the remaining steel is pressed into solid billets by hydraulic power.

At each station there is an inexpensive brick-built furnace for removing the tin and solder. The material is then conveyed in a motor vehicle to a hydraulic press and pumps at one of the stations, where it is pressed into billets. In the process of cremating the refuse more than sufficient power is generated to drive the clinker-crushing machinery and to furnish electricity for lighting the destructor stations, stables and offices.

In 1900 the system of collecting waste paper by means of old bags issued to business premises and better class dwelling houses was inaugurated. By this method the paper procured is clean and consequently more valuable than that taken from dust bins and to a great extent obviates the nuisance connected with its removal. The revenue from this source has grown in ten years from $580 to $3,200. This is a remarkable increase in view of the fact that private concerns, paper-stock merchants, are competitors of the corporation.

In fifteen years the total revenue from the utilization of waste products has increased from $1,000 to $22,500.

Liverpool.

The work of collection and disposal of refuse in Liverpool, is done entirely by the corporation of the city, with direct employment of workmen and not by contract.

The total quantity of refuse collected per day in Liverpool is approximately 1,000 tons. Combustible refuse is collected and destroyed at the corporation's destructors, in the process of which steam is generated for various purposes. The clinker residue from this operation is utilized for the manufacture of concrete slabs and making concrete for foundations, brick, mortar, etc. The refuse collected from the streets of a manurial nature is graded and sold for agricultural purposes according to quality. Fish garbage is collected and disposed of for the manufacture of a patent fish manure. Old tins are separated and disposed of by being pressed by hydraulic machinery into billets and sold.

A separate class is made of waste paper, which is made up into bales and sold to paper manufacturers for repulp. Oyster shells are collected and after grinding utilized as poultry gravel. Incombustible material and garbage of no value is conveyed to sea by steam hopper barge and tipped in deep water.—From Consul Horace Lee Washington.

A CANADIAN DEEP SEWER TRENCH EXCAVATION.

The automatic ditching machine utilizing a wheel for excavation is not suitable for sewer trenches from fifteen feet to thirty feet in depth and from five feet to twenty feet in width, a steam shovel with a long dipper handle being utilized to greater advantage for this work. A new concrete sewer system is under construction by the city of Hamilton, Ont., having inside dimensions of 8 feet by 4 feet and the

Shovel Working Over Trench.

accompanying illustration shows the method used for the excavation of the sewer trench with a Vulcan steam shovel, which is about a mile long and measuring nineteen feet in depth and five feet wide.

A steam shovel is utilized weighing 64,000 pounds provided with a dipper handle thirty-feet in length enabling the shovel to dig fully twenty feet below the surface without difficulty. It carries a dipper having a capacity of three quarters of a cubic yard which will dump 28 feet out either way from the centre and 15 feet high, the cranes measuring 21 feet in length from centre to centre.

It will be noted that the car body is mounted on a timber frame work which operates over rollers on each side of the trench. It is maintained that this construction makes the machine more stable and enables the shovel to dig several feet deeper, although it could be operated on its two wheels for a trench of the width by throwing timbers across.

In moving the shovel a drum is mounted on the forward end which pulls it ahead by means of a cable fastened to a "dead man," this pull ahead rig not being necessary however when operated on its own wheels. Only about a score of men are required for this work, fifteen of whom place the concrete, the others looking after the water supply concrete forms and sheeting and braces to keep the trench from caving in. For operating the shovel, a fireman, crane-man and engineer only are necessary so that the manual labor required with an equipment of this kind is reduced to a minimum. This steam shovel required about 1,500 gallons of water per day, and somewhat over a ton of coal, the cost of operation being very light as compared with hand labor for this trench excavation.

At Hamilton the material handled is hard clay which is dumped at one side of the trench, as indicated in the illustration at the left. The machine works about two hundred feet ahead of the concrete gang and digs ten lineal feet to each "move up," a total of 90 lineal feet being excavated per day of ten hours. The excavation could be carried on at double this rate per day it is maintained, but it is held not to be wise to excavate too far in advance of the concrete gang, which cannot work to advantage to exceed one hundred lineal feet per day. The same shovel is utilized for back filling as the sewer is completed, being mounted on traction wheels for this service and equipped with a dipper handle and dipper adapted for this work.

ADDRESS ON A FORM OF TECHNICAL EDUCATION BEFORE THE CANADIAN INSTITUTE.

At the opening meeting of the Canadian Institute, held on Wednesday, November 2nd, in the lecture hall of the Physics Building, University of Toronto, a very instructive and entertaining address was given. Mr. Wm. Frecheville, of London, England, prominently connected with the management of the Royal School of Mines, and at the present time a member of the Royal Commission on Technical Education for the University of London, gave a paper on the "Technical Education of a Mining Engineer." Mr. Frecheville said: When asked by your president to speak to you, I rather wished to avoid doing so, as I did not think that, in my present hurried trip, I would be able to do justice to any subject. However, he wished me to speak to you, and, since he kindly let me choose my own theme, I have selected the rather broad one, "The Technical Education of a Mining Engineer," which, however, I shall treat from a rather narrow aspect. I will speak fom the point of view of what I should like my boy to be taught if he should elect to follow the profession of a mining engineer. In the first place, up to the age of eighteen I should favor a broad training, no specialization, but a good, all-round education, including mathematics and science, and also the classics and languages. A good education in one's own language and a capability to use it thoroughly should be sought after. Next to the English language I should consider the French

of highest importance, for, no matter where one goes, we find French used quite extensively by officials, and in connection with mining its use is quite important. The language occupying third place in the consideration of the mining engineer is undoubtedly the Spanish. Great mining sections are in countries where it is supreme, and it will probably be still more so in future. Having completed this preliminary education, a student should be entered into one of the large schools of mines. I should advise a four-year course. Some years ago the Royal School of Mines had but a three-year course, but at present it has a four. Four years is short enough time into which to crowd the foundation work for this profession. The first two years the various underlying sciences should constitute the course, as, for instance chemistry, geology, mineralogy, physics. The last two years would be well spent upon mechanical engineering, metallurgy and kindred subjects perhaps a little more relative to the practical after life. I should advise that not too many subjects be studied at the same time. The best arrangement would be, possibly, to take two allied subjects along together, as chemistry and physics. I thoroughly believe, from my own experience, that this is the best procedure. I should further emphasize the teaching of mechanical engineering for the training of a mining engineer. This brings up another question, which was discussed in England by some of the most eminent scientists and authorities on scientific training, namely, the question of how far machinery should be used in the training of students as object lessons and for demonstration purposes. Many expressed the opinion that it is a mistake to have the machinery itself to show, but I disagree with this view. I believe the best way to teach the parts and workings of a machine is to show not only its plans on paper, but to show and work the machine. The knowledge of a steam engine would be fuller if the engine could be seen and handled and worked. I would favor even the introduction of other mining machinery, as, for instance, a stamp mill. Furthermore, a man who has worked these machines in practice should be obtained, and should give the gist of his experience of years to the class. I could give a knowledge of a stamp mill, for example, which it took years of experience and some mistakes to obtain to a class in a few hours, comparatively. Many warnings and much valuable information, which could only be gathered in years of experience, could thus be imparted to the student. With regard to the teachers, the best ought to be sought for our schools of mining. While buildings and equipment are, indeed, necessary, nevertheless they are only secondary to teaching staff. That should be of the best, and sufficient salaries should be paid to such teachers to be worth their while. In London the salaries are far too small, as some teachers are getting one-tenth of what a practice of their profession might bring them.

Having spent four years in actual training, a good start is all-important for the young mining engineer. In England, at least, there has been difficulty in this direction. Mining companies sometimes do not want the man just graduated, but prefer to get him a little later. A post-graduate course partially to tide over this period of uncertainty has been formed in England. In this, about twenty or thirty students are sent each year to South Africa, Australia, United States, and now to Canada. Large companies take them on a living wage, and in a sort of an apprenticeship of one or two years. In return they are expected to be employees of the company, put in the time of working hours, and they are given opportunity to learn all procedures at the mine. I should like to see this idea grow in favor, as it has proven very satisfactory to all concerned, oftentimes those sent out remaining on the permanent staff, or else returning with very favorable impressions. When the engineer is once launched upon his career finally, he should consider the first ten or fifteen years as period of the continuation of his learning. Of a choice of two positions, one of which extends one's experience and the other does not, I should certainly favor the latter, even though the immediate pay may be much less; it will be far better in the long run. A student should go to some large centre of operation preferably to going as manager of some small unimportant mine.

This is an age of scientifically trained men, and it will be still more so in future. Thirty or forty years ago scientific training was often scoffed at as impractical, but not so to-day, although, of course, practical experience, linked with scientific training, constitute the success of the best men.

I do not wish to lay down the law in his matter, but only to give these remarks as expressing my conception of the necessary and best training. I shall be glad if these remarks will lead to discussion and criticism.

Mr. Falconer, President of Toronto University, when asked for a few remarks, said that he did not expect to add anything, but that what he was impressed with in the address was the deep note of experience running through it. He considered that there was largely a contest between the theoretical and the practical in all lines. What is really practical is often said to be abstractly scientific. He appreciated the paper for what was back of it in experience, and he considered that the main function of the education was to give the man a knowledge and scientific foundation as a base on which to build ever-increasing knowledge.

Dean Galbraith offered a few remarks. He said that, although apparently engineers were made in all ways, yet he considered the scientific training the best and coming means of producing engineers. He believed that the advantage accrued from studying so many subjects was not that the engineer would remember them all in later life, but that he would know where to place himself by a familiarity with these allied subjects. He expressed his appreciation of the paper and the help afforded the university by Mr. Frecheville.

Professor H. E. T. Haultain, Professor of Mining, said that there was an important sign of the times indicated by the presence here of prominent engineers as Mr. Frecheville. Ontario is attracting the best types of men from all over the world. He further urged a need upon the part of engineers of taking a greater part in the advancement of public interests, as in technical education, and hoped a still larger number of engineers would find time for such work, a little outside of their own immediate business. He was impressed with the training in mechanical engineering spoken of in the paper, and said that he was convinced that the mining engineer was really more of a mechanical than a civil engineer. The chief purpose after all was to teach students to think engineering. He said it had been held up constantly to the students at Toronto that a graduate was not an engineer, but only the material for the making of an engineer. Prof. Haultain did not think that the scholarship or post-graduate apprenticeship was quite as necessary for Canadian students, as they are required to do six months of an ordinary miner's labor before they can take a degree. He highly endorsed such labor.

THE CANADIAN SOCIETY OF CIVIL ENGINEERS WILL MEET AT WINNIPEG, MAN., JANUARY 24th, 25th, 26th and 27th, 1911.

THE HEATING SYSTEM OF THE BOSTON SAFE DEPOSIT AND TRUST COMPANY BUILDING.

The new banking and office building of the Boston Safe Deposit and Trust Company is equipped with a heating and ventilating system, combining Webster Modulation direct and "direct-indirect" heating with an indirect fan heating system in an unusual manner. The entire heating and ventilating equipment was designed and installed by Buerkel and Co., heating contractors of Boston. The fans, motors, and indirect heaters are from the works of the B. F. Sturtevant Co., Hyde Park, Mass., and the air washer and Modulation direct heating system from Warren Webster and Co., Camden, N.J.

The building, which stands on Franklin Street, extending from Devonshire to Arch, is ten storeys high, exclusive of the basement and sub-basement. The latter contains the power plant, including the heating and ventilating units, a laboratory and storage rooms. The safe deposit department is located in the basement and includes vaults, coupon room, etc. On the ground floor are the main banking rooms, offices and main corridor. Above this is a mezzanine floor surrounding the main bank room. This also is devoted to the needs of the bank. From the third to the tenth or top storey, the building is given over to rented offices, these floors being practially identical in plan and arrangements.

For the ventilation and heating of the basements and the banking floors, an indirect fan system has been installed while the offices on the floors above, as well as the main floor corridor, are provided with the Modulation system of steam heating. The arrangement in the latter case is such as to provide for either.

The fresh air intake for the main indirect system is in one corner of the building. Through a brick down-take the air is led to the main supply duct which is of concrete and located under the sub-basement floor. This duct extends approximately one half of the length of the building and opens upward through a floor grating into a duct leading to the Webster Air Washer. Just at the entrance to the latter is the Sturtevant tempering coil or heater, which consists of 2,868 linear feet of one inch pipe, set in two banks. A steam supply line of 2½-in. pipe provides steam for this heater and the condensation is returned to the feed water heater through a 1½-in. drip line.

The function of this primary heater is to raise the temperature of the incoming air to a point where the operation of the air washer is most efficient and to preclude the possibility of freezing up the spray system in very cold weather. The Webster Air Washer proper consists of a housing of 18 oz. copper, braced with 1½-in. x 1½-in. angles containing the spray head and its attendant piping and two rows of V shaped eliminator plates. It forms in reality an enlargement of the air duct being 10-ft. 1½-in. high by 11-ft. 2-ins. wide. A concrete tank below the washer acts as a receiver for the spray water and a source of supply for the 2½-in. centrifugal circulating pump. The latter is belt-driven from a 7½ h.p. motor and runs at 1,500 r.p.m. When in operation the entire cross section of the washer is filled with two parallel sheets of finely divided water particles discharged from the spray head at the top of the air washer. Through this double curtain the ventilating air is drawn by the fan, and so thorough is the scrubbing action of the combination "rain and spray" effect, peculiar to the Webster apparatus, that 98 per cent. of all solid matter is removed from the air. The eliminator baffles next remove all mechanically entrained water and the air passes through the Sturtevant reheater, and is warmed to the temperature desired for distribution through the bank. Forty thousand cubic feet per minute is the capacity of the washer. The main heater is made up of 4,780 linear feet of one inch pipe, supplied with steam by a 2½-in. pipe and dripped to the feed water heater through a one-inch pipe connection.

Just beyond the heater is located the main ventilating fan. This unit is a Sturtevant steel plate fan 108-in. in diameter by 54-in. wide. It is direct driven by a 25 h.p. Sturtevant motor and is specified as capable of handling 45,200 cubic feet per minute at full speed. From the fan two outlets are provided. Galvanized iron ducts carried on the sub-basement ceiling lead to vertical risers from which branches are taken to different parts of the basement vaults, laboratory, main banking rooms and the mezzanine floor. All these ducts end in galvanized iron register boxes, the greater part of which are placed in the side walls and well above the heads of the occupants.

On the roof of the building is a Sturtevant steel plate exhaust fan, 84-in. diameter, capable of handling 32,000 cubic feet of air per minute. This serves to abstract the vitiated air from the banking floors through a series of galvanized iron ducts converging to a vertical brick riser to the roof. A 13 h.p. Sturtevant motor drives this fan. Remote control apparatus enables the motor to be started and stopped from the engine room.

For the ventilation of the boiler, engine and pump rooms in the sub-basement, there is provided a 54-in. Sturtevant steel plate fan, with a capacity of 12,700 cubic feet per minute. A fresh air down-take similar to that of the main fan system supplies this unit, which is direct driven by a 6 h.p. motor running at 315 r.p.m.

In addition to the ventilating systems mentioned, there is a separate exhaust system for the toilets, closets, and lockers. These are in general ventilated through the fixtures to ducts leading to a vertical riser. On the roof a 36-in. diameter Sturtevant fan completes this auxiliary system. This fan is also of the steel plate type and is specified to exhaust 5,220 cubic feet of air per minute at 477 revolutions. A direct connected 2½ h.p. motor supplies the power.

The entire indirect system has been most successful in operation, providing an agreeable feeling of freshness as well as even temperature in the bank. During the past summer, it has been possible by means of the air washer, to keep the temperature in the bank 10 deg. lower than that in the street. All windows are kept closed and the entrance doors, being of the revolving type, exclude most of the air that would ordinarily enter from the street. At the approach of hot weather it was a matter of great interest to the bank officials to personally determine the efficiency of the washer as a cooling device, as well as an air purifier and humidifier, and the results attained are reported to have been most gratifying to all concerned.

In connection with the operation of the Webster Washer, the engineer of the building said recently that the unit required practically no attention. Once a week the tank is flushed out, and about one inch of mud, which has been taken from the air in that time, removed. No trouble has been experienced from clogging of the spray heads. The generous proportions of the openings provided in the Webster Washer account for the absence of difficulty in this direction. The washer is operated from midnight to 6 p.m., and requires no supervision except the weekly flush-out already mentioned.

To supply heating and ventilation for the parts of the building not connected with the indirect system, consisting

of the eight floors of offices and corridors, as well as the main floor corridor, the Modulation Steam Heating System, manufactured by and installed under the direction of Warren Webster and Company, of Camden, N.J., was installed. Wherever possible the radiators were arranged for direct-indirect heating. Because of the large amount of wall space, it was possible to use this system is practically all of the offices, the corridors being in the main on the ordinary direct system.

The arrangement for fresh air admission to the rooms planned for the direct-indirect system is as follows: The radiator is set beneath a window, and a narrow slot 2-in. x 20-ins. extends through the wall just below the window. This slot connects with a similar vertical passage under the plaster on the inside of the building wall. The latter leads downward to an opening close to the floor at the radiator base. Deflecting dampers at this point cause the incoming air to flow upward over the radiator coils. In addition to the deflecting dampers referred to, a shut-off damper is provided in the horizontal duct, which may be operated by a knob just above the radiator. The deflecting dampers may be set in several positions according to the results desired and may also be used as shut-off dampers. Accordingly, if either damper is closed, the air is shut off and the radiator acts as a direct-heating unit.

Each radiator is equipped with a standard Webster Modulation Valve on the inlet and a Webster Water Seal Motor on the discharge end. The latter automatically traps the water and air to the returns while preventing the passage of steam. The Modulation Valve is hand-operated, and governs the amount of steam admitted, and consequently the surface heated. This system enables the occupant of each room to modulate the temperature as desired by a simple movement of the Modulation Valve handle. As the return end of the radiator is sealed, there is no possibility of backing up from the returns and accordingly a positive flow is always obtained regardless of the amount of opening of the Modulation Valve, and furthermore, but very slight pressure is necessary on the entire system. In this connection the statement of the engineer of the building is of interest. He reports that in spite of the size of the building and consequent length of risers, and the fact that the system is atmospherically vented, it was never necessary to carry more than ½-lb. pressure for heating last winter, and that most of the time "you couldn't find the pressure on the gauge." No trouble of any kind was reported and the temperature regulation was at all times flexible and exact.

Steam for all purposes is generated by three Heine 153 h.p. boilers at 120 lbs. pressure. The heating main consists of a run of 10-in. pipe supplied from the main engine exhausts and various pump and other auxiliary exhausts. An 8-in. low pressure main supplies the steam required by the tempering coil and main heater of the indirect system. Both low pressure mains are cross connected to the high pressure steam main through reducing valves, in order that either or both may be supplied from the boilers direct if necessary, at any time. The main 10-in. exhaust pipe leads into the feedwater heater, and the two heating branches mentioned are taken off from this. In addition to the connections referred to, there is a 10-in. free exhaust pipe leading through a back pressure valve to the roof and surmounted by a Swartwout centrifugal exhaust head. A 4-in. vapor line from the boiler blow-off tank is likewise carried to the roof and provided with a Swartwout head.

There are in all 11,960 sq. feet of radiating surface divided among 320 cast-iron radiators of various sizes.

From the 10-in. heater main, branches run on the sub-basement ceiling to the risers, of which there are twenty-one varying in size from 2-in. to 3-in. The returns and drips are collected in a 4-in. main return in the boiler room. This pipe carries the condensation to the automatic return tank, which is situated just above the two Warren steam-driven boiler feed pumps and supplies the latter. A three-inch return line from the indirect heaters likewise terminates in the automatic return tank. All risers and returns for the indirect and direct-indirect radiation system are provided with expansion joints at a point about seven feet above the third floor and are anchored to the steel framing of the building at the 7th and mezzanine floors, except in the case of Nos. 15 to 21 inclusive, which do not feed any radiators below the 2nd floor. They are anchored at the 2nd floor level and again at the first floor level in the case of Nos. 17, 20, and 21.

Whenever the return mains are carried on the walls above the water line, they are sealed with an inverted loop. All steam lines of the system are dripped through traps back to the return tank. Wherever the piping was to be concealed a consecutive twenty-four hours' test for tightness, under 50 pounds hydraulic pressure, was made before closing it in. All concealed radiators are of the Aeral type, manufactured by H. B. Smith Co., the exposed radiators being furnished by the American Radiator Co. The radiators were tested to 100 pounds pressure before being installed.

In every respect the heating and ventilating system of this building has proven an entire success, and might well serve as a model for future structures of a similar nature everywhere. The architects were Shepley, Rutan and Coolidge, of Boston.

CONSUMERS GAS CO., TORONTO, ONT.

(Continued from page 604).

The price of gas has been gradually reduced since 1850 as shown below:—

1850	$5 00
1875	2 50
1880	1 75
1885	1 50
1886	1 25
January, 1890	1 12
January, 1893	1 05
July 1st, 1896	90
January 1st, 1903	80
October 24th, 1906	75

And now they expect to make it 70 cents.

The classes continued for many years in Montreal by the Council of Arts and Manufacturers of the Province of Quebec, assembled last month, several hundred pupils being enrolled. A very creditable variety of instruction is represented there, as the following memorandum will show:

The classes are held on the following evenings:

Monday and Wednesday—Modelling, freehand drawing, lithography, boot and shoe pattern making, architectural drawing, dress cutting and sewing.

Tuesday and Friday—Plumbing, freehand drawing, sign painting and lettering, carpentry and stair-building, mechanical drawing.

ROADS AND PAVEMENTS

ANNUAL CONVENTION OF THE AMERICAN ROAD BUILDERS' ASSOCIATION.

The seventh annual convention of the American Road Builders' Association will be held at German House, East Michigan and New Jersey Streets, Indianapolis, Ind., on December 6th, 7th, 8th and 9th. In connection therewith will be held a congress of road builders and a "good roads show."

The sessions of the convention and congress will be devoted to the presentation of a large number of technical papers on the subjects of road and pavement construction and maintenance by leading highway officials, discussions of the papers and of matters pertaining to the work of highway improvement, and to addresses by prominent men interested in, and identified with, the various phases of the work. The programme is now being prepared, and will be announced later. It will comprise papers and addresses covering every phase of road and street improvement, and treating the subject from the viewpoint of each of the many classes to which it is of moment.

The membership of the American Road Builders' Association includes the foremost road making and street paving authorities of the United States and Canada, men occupying the chief administrative and engineering positions in the highway departments of states, counties, cities and towns. The experience of these men embraces work with all the materials and methods used in the construction of country roads and city streets and the building of highways under all the varying conditions encountered throughout the country. The opportunities afforded by the conventions of the Association to learn from these men, both through the papers prepared and presented by them and by personal meeting with them, renders the annual convention of the American Road Builders' Association the chief event of the year in road building circles.

Following the custom inaugurated last year at the sixth annual convention at Columbus, O., the exhibition of materials and machinery will form an important feature of the convention. Ample exhibition space has been obtained in German House and the grounds connected with it, thus bringing the meetings and the exhibits together and facilitating attendance upon both without the loss of time. The exhibits will include the various materials and the most improved machinery and appliances for road making and street paving. The greater number of exhibits will be shown in the German House, while the larger and heavier machinery will be displayed in the adjacent grounds.

The meetings and exhibits will be open to the public, and a general invitation is extended to everyone interested in any branch of highway work. The headquarters of the association are at 150 Nassau Street, New York City.

AN IRISH TRUNK ROADS SCHEME.

(The Surveyor.)

The Irish County Councils' General Council have been inquiring into the question of road improvement in Ireland, particularly in view of such assistance as may be expected to be obtained from the Road Board for the purpose, and the outcome of their deliberations has been a memorandum which is now engaging the attention of the local authorities, and was recently approved by the Queen's County Council. This incorporated the proposal that with the consent of the various councils participating, 50 per cent. of the total grants from the Board to Ireland during the coming five years should be allocated to the purposes of reconstructing, strengthening and steam rolling the leading roads in the various counties, selected with a view to their forming part of a complete scheme intended to benefit districts remote from railway facilities. The object is to provide highways which would be capable of carrying agricultural produce, live stock and passengers, somewhat on the lines of the Iveagh-Pirrie transit scheme, and which would also aid Irish millers and other manufacturers to distribute their goods at a low cost over wide areas, and provide the country generally with serviceable trade routes. It is too early as yet, to say how this proposal will be received by the Irish councils, but there seems to be a disposition to view it with favor, not without good reason, seeing that it points to a practical solution of an Irish problem of great economic importance. A great deal will, of course, depend upon the amount derived from the new taxation in Ireland; but, apart from this, the idea of setting aside and ear-marking, so to speak, a moiety of the sum for a specific purpose would appear to commend itself as quite a business-like proceeding.

OIL FOR ROADS.

The use of oil for laying dust on macadam, clay and sand roads is a question that has received very much attention. In this section of the Canadian Engineer last week, we published the results of experiments carried on by Mr. Clark, city engineer of Saskatoon, Sask. Recently Dr. Chas. Sheard, Street Commissioner for the city of Toronto, was requested by the municipality of Barrie, Ont., to let them know something of his experiments in the city of Toronto. Dr. Sheard replied as follows:

TORONTO'S EXPERIMENTS WITH CRUDE OIL.

Dr. Chas. Sheard.

I have personally been conducting the experiment of laying the dust on the city streets by the use of crude oil, and on the whole this experiment has proved eminently satisfactory. The method we employ is to use crude petroleum residue, and as there are many kinds of petroleum oil, we endeavor to secure one that has the least odor, and is the least expensive. I may say in this connection that varying localities will have different opportunities for securing an oil more or less free from smell; thus, for instance, if Texas crude be employed, it has many advantages which the simple petroleum residue has not. It is comparatively odorless, and is to some extent mixable with water. This, however, we could not use here because of our difficulty in securing a plentiful supply, and also on the ground of expense. In Pennsylvania they have some varieties of petroleum residue which are practically odorless; that I believe from the neighborhood of Oleon is of this character. Nevertheless, the oil we are using has little to be complained about regarding the odor, which soon dies away after its application. Generally after five or six hours the odor is entirely gone. The method of application is to apply oil in several relays, with a few days between. The number of applications required will vary somewhat according to the road to be treated. If

the road is a reasonably good one, free from ruts, and not subject to very heavy traffic, three applications of oil should last three months. If, however, the road is a bad one, full of ruts and subject to being traversed by heavy drays and wagons, it will probably not last longer than one month. The better the road bed, the lighter the dose required. If it be simply a sandy, mud road, with a thick covering of several inches of flour-like dust, then a heavy first dose of oil is preferable, the idea being that the admixture of oil and dust will form a coating upon the surface of the road to which the dust particles adhere. If the road has considerable grade, and is much exposed to the sun's rays, the oil will dry out sooner than it would if the road happened to be more or less shaded by the trees. The method of application consists in lightly sprinkling the streets with oil from a watering cart, driven at a pretty rapid gait over the surface of the road, endeavoring to so deposit the oil that the spots of oil will be more or less separate, care being taken not to leave puddles of oil in the depressions or channels. Should such occur, it is advisable to have them swept away with a broom, so that they will not be splashed by traffic, or stain the clothing of pedestrians. The road is then watched for three or four days, when the second dose is given, and again allowed to rest for awhile, and after another week or so the third application is made. The road is better for being prepared, channels being cleaned out, depressions levelled and ruts more or less filled up. This, however, is not always practical, and the road may be treated without such preparation. The rain does not affect disadvantageously a road that has been treated with oil; such a road will dry more rapidly after a rain storm. The surface water will more speedily run to the channels of the road, and generally such a road is rather improved than otherwise after a rain. The sun coming out, brings the oil again to the surface, and the dust adheres.

We have found that upon ordinary roads 1,500 gallons per mile will complete the three applications specified above, and ought to maintain the road for at least from one to two months. This, at four cents a gallon would be $60, and the cost of application from $10 to $15. This is probably less than the cost of sprinkling. A mile road sprinkled twice a day would cost for labor alone $1 a day, which would leave the road more or less muddy. It would not be dustless for more than two or three hours, and in some cases, if very dusty and sandy, a mile of road or little more would require the constant attention of a man and horse and watering cart. Should the road be in good condition, and in close proximity to other roads, a man would probably do a mile of road in an hour, and $1 a day would provide for two sprinklings a day.

When the cost of a large area of macadam roads is considered, I think the oil would not be more expensive than the cost of sprinkling. On roads that are not much frequented by heavy traffic, I consider the oil application will be found exceedingly serviceable and comparatively inexpensive as a dust reducer.

In setting forth the above facts as I have found them in connection with the work in the City of Toronto, I am free to admit that there is yet considerable investigation required as to the cheapest and best application to be employed. Preparations of tar have been used in the City of Boston; a mixture of oil, soap and tar in some places, and in other localities various oleaginous residue capable of a more or less admixture with water. However, they are, I think, apt to dry out more rapidly than pure oil.

STREAM MEASUREMENTS FOR THE DOMINION GOVERNMENT IN ALBERTA, SASK.

(Concluded from last week).

Reconnaissance Trip.

The object aimed at on this part of the work was to make a careful study of the Milk River and pick out sections which were suitable for making immediate stream measurements, and which were also suitable for establishing permanent stations. Cross-sections of the river throughout its whole length in Canada, all have the same controlling elements. They all have one high bank and one low; they are all liable to overflow at flood and the soil is sandy loam or gravel. There are very few settlers along the river who live close to it so that great difficulty was experienced in finding gauge readers, and in picking out the locations for the several stations the main point which had to be considered was to find a place where a permanent gauge reader could be relied upon. Another difficulty encountered was to erect gauge rods which would not be liable to destruction by the ice, the spring floods, or by the river cutting away the bank against which they were placed. The type of gauge rod support adopted was as follows: A strong upright varying from 6 to 12 feet in length was sunk in the bed of the stream to a solid footing. This upright was secured in pla e by two strong braces nailed to it near the top, and triangling off and nailed to two solid posts sunk four feet deep in the bank. Across these supports a platform was laid and the whole well weighted down with large stones or with bags of sand where stones were not procurable. To one face of the upright the gauge rod was securely nailed with 6-inch spikes. The standard form of gauge rod used was a wood staff graduated to one-hundredths of a foot and showing 10 feet.

After the location of the station had been decided on the procedure was as follows: Two posts were sunk, one on each side of the river, and between these a "low water" measuring wire was stretched for use in metering by the wading method. This wire was graduated to 5 feet and every 10 feet marked by a tin hanger. The zero distance of the section was usually taken on the left hand side of the stream and was always marked by a cedar post solidly sunk in the ground and marked accordingly. At some convenient place—usually on the line of the section—a large cedar post was sunk to such a depth that it would not be disturbed by frost. This was cut off leaving only about 10 inches above the ground so as not to be disturbed by cattle, and on it a bench mark was made. The gauge rod was then erected and its zero referred to the B.M. by very careful levelling.

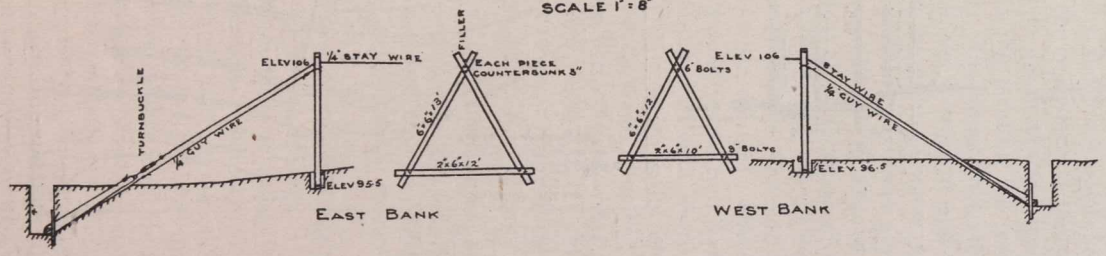
The cross-section at the station was then carefully developed with the level for use in designing the structures for a permanent station. In this connection evidences of extreme high water were always carefully searched for and their elevations noted.

Construction Trip.

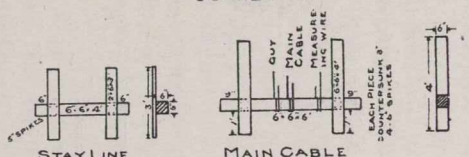
The Milk River in Canada has no dams across it, and the only point where it is spanned by a bridge is at Milk River station, so it was early decided to adopt the "cable car" type of station for establishing the permanent gauging stations.

In the first instance it was decided to erect these stations so that they would span the whole width which might be covered by the stream at its highest flood. However, after an examination of the river it was found that the banks were subject to such a wide overflow that this would be impossible. The stations as finally erected span the stream from bank to bank, and allow the measurement of the main bulk of the discharge at all stages of flood. During periods of extreme

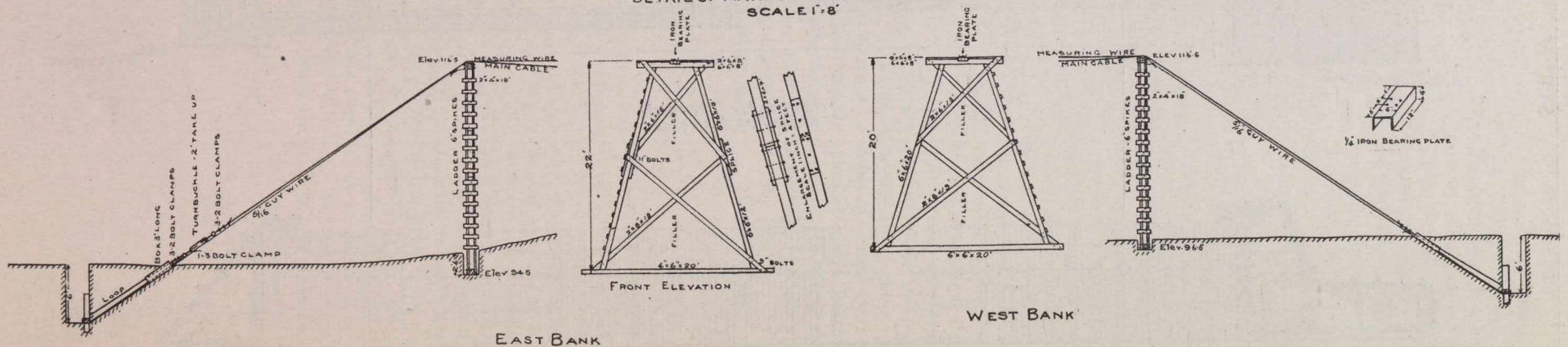
DETAIL OF STAY LINE WIRE
SCALE 1" = 8'



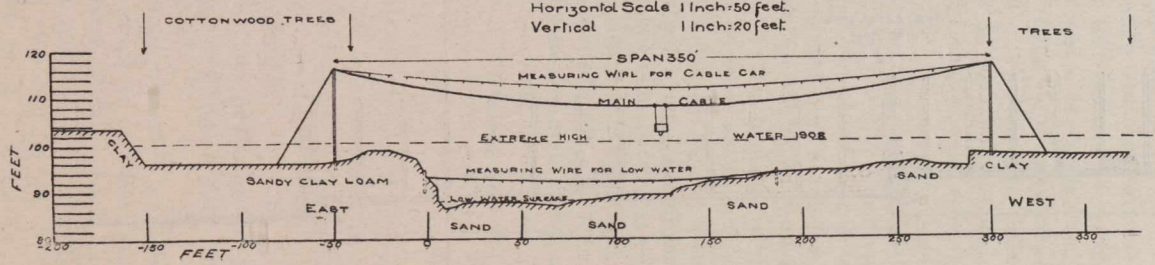
ENLARGEMENT OF DEADMEN
SCALE 1" = 4'

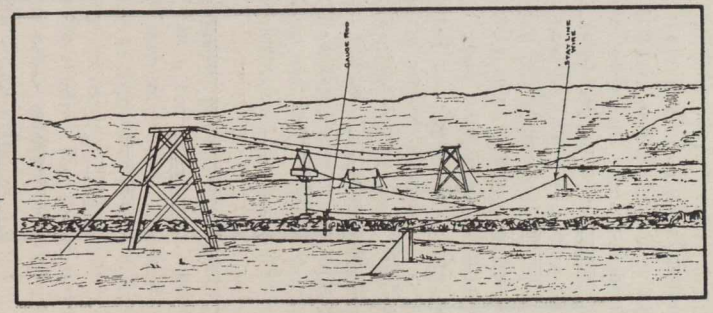


DETAIL OF MAIN CABLE EQUIPMENT
SCALE 1" = 8'



SECTION ON ℄ OF GAUGING STATION
Horizontal Scale 1 Inch = 50 feet.
Vertical 1 Inch = 20 feet.





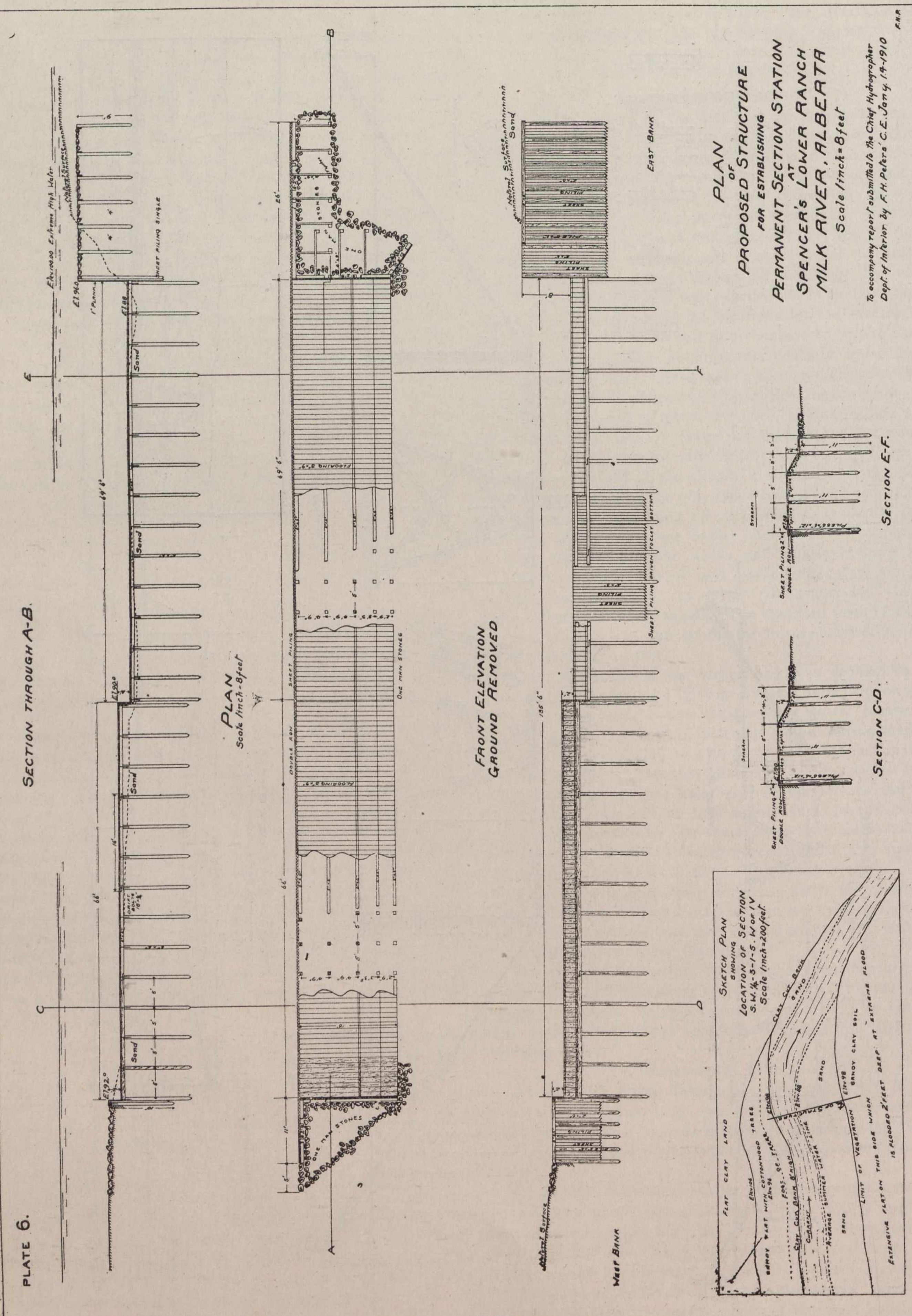


PLATE 6.
SECTION THROUGH A-B.
PLAN
Scale 1 inch = 8 feet
FRONT ELEVATION
GROUND REMOVED
EAST BANK
WEST BANK
PLAN OF PROPOSED STRUCTURE FOR ESTABLISHING PERMANENT SECTION STATION AT SPENCER'S LOWER RANCH
MILK RIVER, ALBERTA
Scale 1 inch = 8 feet
To accompany report submitted to the Chief Hydrographer Dept. of Interior by F. H. Peters C.E. Jany. 14-1910
SECTION E-F.
SECTION C-D.
SKETCH PLAN SHOWING LOCATION OF SECTION S.W. 1/4-3-1-5. W of IV
Scale 1 inch = 200 feet

flood the cable supports are liable to be submerged, but as the duration of these floods is short the actual amount of water passing around the stations will be small and in many cases is impossible of accurate measurement by any means owing to scrub, brush and other obstructions.

In some cases one support was liable to such deep submersion that it was liable to destruction by flood. In such cases the support was placed where it would have some natural protection (such as in a clump of trees) or when it was necessary to place it where the current would have a clear sweep, the base of the support was well protected by a riprap of large stones. At every station a meter stay-line wire was stretched 30 feet upstream for use in flood measurements.

The main timbers used at all stations were of dimensions 6 x 6 inches. It was realized that for supports of a height of 20 feet or more these were rather light, but, owing to the difficulty of obtaining any material of larger dimensions, and also to the great distances and bad roads over which the materials had to be hauled, they were adopted as the most suitable under existing conditions.

The conditions existing at Spencer's lower ranche (near the eastern crossing), are typical of those existing on the river.

Method of Stream Measurements.

All the discharge measurements made during the season were made by the "one point method." That is, at each distance of the cross-section the velocity was measured at a depth equal to 0.6 of the measured depth, and this velocity was taken as representing the mean velocity of the water in that vertical. The large Price electric meter was considered the most reliable instrument and was used for all measurements where the depth of water was sufficient to allow of its immersion. For the shallower cross sections the small Price electric meter was used. At some of the wading stations which were chosen at the beginning of the season, the velocity of the current later in the season became too slow to allow of accurate measurement. The rule followed in such cases was as follows:—When the mean velocity at the section fell below 0.5 feet per second the section was abandoned and a new one located at the nearest place where the current had a suitable velocity. The great majority of the stream measurements were made by the wading method, and in a few cases where the depth of water was too great they were made by the use of a collapsible canvas boat. The usual procedure was to immerse the meter at both edges of the stream and at intervals of 5 feet across the stream.

Compilation of Data.

The accuracy of the data computed from the field measurements is affected by the following conditions:—

(i) The gaugings at each station were not frequent enough.

(ii) The gauge rods in some cases were not read closely enough by the gauge readers.

(iii) The inability to check the meter ratings.

(i) It has been noted in the first part of this report the conditions which made it impossible for the party to devote all their time to stream measurements. The gaugings at each station were made frequently enough to cover all considerable changes in gauge height and therefore theoretically they should have been sufficient to develop a good station rating curve for the range of gauge heights which they covered, but it was found that all the sections, particularly from Milk River eastwards, had shifting bottoms, and even during periods when the gauge height was stationary or changing very slowly the river was found to have a continually shifting bottom. This condition necessitates the shifting of the station rating curve to meet the varying conditions of the river bottom, and owing to the considerable changes which took place in the river bottom between gaugings it was sometimes difficult to know how to manipulate the curve correctly. The manipulation of the station rating curves, made necessary on this account, was performed by the "Bolster method," and although much thought and care was bestowed on this part of the work the gaugings were not frequent enough to ensure great accuracy.

Fig. 6 shows the changes which took place in the river bottom at the sections used at Milk River from May 18th to October 5th, 1909, and also the necessary manipulation of the station rating curve to cover the same period. The conditions at this station are typical of those existing on the whole course of the river.

(ii) The standard type of gauge rod installed was graduated to one-hundredths of a foot. In some cases the gauge readers employed were men of little or no education, and it was found very difficult to instruct these men to read the gauge rod to hundredths correctly. These men would gradually drift into the habit of reading the gauge rod to the nearest tenth or perhaps half-tenth, which made the gauge heights recorded by them liable to an error up to the 5-100ths of a foot. The hydrographer, when visiting stations frequently noticed these discrepancies on reading the gauge to hundredths. At these stations where the gauge rod was read only to tenths the station rating curve was constructed by plotting gauge heights only to the nearest tenth because this method minimizes the error in discharges taken from the curve corresponding to gauge heights read only to the nearest tenth.

(iii) The meters used during the seasons were new (supplied by W. & L. E. Gurley, of Troy, N.Y.) and had the usual rating tables attached to them, which were used for computing discharges. These rating tables are not the ratings of the actual meters themselves, but are the mean of many ratings of the same type of meter. It has been found in practice that these rating tables can be relied upon so that their use in the first instance was justifiable. It is also found in practice that a new meter, provided it has careful handling and is well supplied with new points, usually does not change its rating until it has had considerable use. However, the action of a current meter cannot be relied upon, and it is highly desirable and the usual practice to rate every meter periodically in order to make sure that its rating is correct. During the past season there was no opportunity to rate the meters so that the rating tables mentioned above were used for computing discharges all through the season without any check on their accuracy.

All the information collected during the season regarding stream measurements has been compiled in the following form: All the discharge measurements made at the several stations have been tabulated on sheets headed, "discharge measurements at regular stations."

The daily gauge heights and discharges at the several stations have been tabulated on sheets headed "daily mean gauge heights and discharges."

For the purpose of comparison between stations this same information has been again tabulated on sheets headed "Milk River, Alberta, daily discharge sheet." Each one of these sheets cover a period of one month and on it the daily gauge heights and discharges are tabulated for all of the stations on the river taken in order going down stream.

It will be seen on consulting tabular information that the relative run-off per square mile for that part of the water

shed of the north branch above Peter's ranche is extremely high. This is accounted for by the fact that this part of the river is fed by many springs, most of which have a continuous flow all summer. This condition exists in a lesser degree along the river as far down as Knight's ranche. It will also be noticed on consulting the data, and also the sheets headed "Milk River, Alberta, daily discharge sheet," that the discharge at certain stations is greater than that at the station next below it on the stream. This may be accounted for to some small extent by inaccuracies in the stream measurements, but the large differences shown on these tables are certainly not to be accounted for in this manner. The explanation of these differences (which the writer thinks is the correct one) is that the stream has a large sub-surface flow at some stations while at other stations this flow is brought up into the bed of the stream by underlying impervious strata. Some observations made at Writing on Stone constitute a certain evidence that this condition does exist along the river.

At this station the width of the river channel between banks is about 126 feet, and during the summer the actual width of the channel through which the water ran was only about 60 feet. This left a stretch of bare sand on one side of the stream about 60 feet wide, and the average elevation of its surface above the water was about 1 foot. Several holes were dug in this stretch of sand, and in each one the water was seen to have a quite perceptible motion in the same direction as the stream, proving that there was a considerable flow of water through this stretch of sand which could not be measured at this station.

Proposed Permanent Section Structure.

It has already been stated in this report that the sections used were all found to have shifting bottoms and that this condition is accentuated as one follows the river down stream from the western crossing of the north branch to the eastern crossing, and it was pointed out that this condition makes it necessary that gaugings be made at very close intervals in order to be able to plot an accurate discharge curve to cover a season's work. It is also probable that, owing to this same condition, the sections on the river will vary so much from season to season that a station rating curve developed from one season's work will be of little value for estimating discharges from gauge heights recorded during any succeeding season, which means that during all the years that information is required of the discharge of the river, gaugings at close intervals must be kept up continually.

There are also certain evidences, as already noted, to show that the Milk River has a considerable sub-surface flow and that this flow at certain stations is brought up to the bed of the stream where it is measurable, while at other stations it flows below the bed of the stream and is not measurable. It is thought that this flow is never far below the bed of the stream and it would be desirable to be able to measure this sub-surface flow at all stations.

It is thought that perhaps the best way to overcome these difficulties, and to prepare the river so that reliable information regarding discharges can be easily obtained in future years, would be to establish permanent sections along the river by artificial means.

Fig. 7 shows a plan of proposed structure for establishing a permanent section station at Spencer's lower ranche.

The section at Spencer's lower ranche was used because it is typical of the conditions existing along the river and also because, having the greatest width of any section used and being the most difficult point at which to obtain materials, the estimate of the cost of this structure shows the maximum cost of establishing a structure of this kind at any point on the river. This plan is not intended to be a final plan nor have the minor details of construction been closely looked into, but it merely shows the type of structure which the writer thinks would be practicable. The idea kept in mind in designing this structure was to create a permanent section where all the sub-surface flow would be brought to the surface and to have the floor of sufficient width and with a sufficient depth of water flowing over it to admit of the use of a current meter. It would be necessary to establish these structures at points on the stream where the slope of the stream below the structure would be sufficient to ensure against its being buried by silting up.

A structure of this type would not back up the water in the stream to any appreciable extent, and at flood periods it would be liable to complete immersion.

The artificial section created by the structure would be designed to carry the whole volume of the stream at all ordinary stages and after the station rating curve had been once developed to cover all the range of gauge heights, accurate discharges could be estimated at any future time simply by reading the gauge height at the section.

The total cost of this structure is estimated at $3,343.15.

Tables D, E, and F, attached to this report show the several items which constitute this total in detail.

The writer has not been able to find any record of this type of structure having been used before, but he feels confident that the information gained by its use would be very satisfactory and reliable. The writer's main object in including the discussion of this proposed structure in this report, is to have it on record so that the idea may be kept in mind and its merits looked into more carefully in the future than it has been possible to do at the present time.

RECOVERING CEMENT FROM "EMPTY" CEMENT SACKS.

An interesting investigation has recently been conducted by the Aberthaw Construction Co., of Boston, Mass., relative to the economy of treating empty cement sacks to recover cement adhering to them before bundling for return shipment. Instructions were sent to a number of jobs to have the man who was bundling the bags stretch each one over two sticks, mouth down, and then beat well. The cement was collected in a box. A careful account was kept of the number of bags shaken, the amount of cement saved, and the amount of the man's wages. Strength tests were made on the recovered strength, as it was probable that dirt or other foreign substances might be mixed with same. The total number of bags reported was 7,598; the amount of cement saved 4,130 pounds. The cost of shaking, bundling and tagging the above bags was $22.44, or about one-third more than the average cost of bundling and tagging without shaking. Hence the net cost of the cement saved was $7.48.

Comparative tests were made of the tensile strength of the shakings and of fresh cement from the same lots. An average of these tests showed a loss of 59 per cent. in strength after a 24-hour set, but a loss of only 35½ per cent. after a 7-day set. On the basis of this last figure, the 4,130 pounds of shaken cement is equivalent to 2,664 pounds of fresh cement. At 380 pounds to the barrel, there was an equivalent of seven barrels of fresh cement recovered. The average price paid for cement on these jobs was $1.41, so the value of the recovered cement was $9.87.

There is a further consideration, however, and that is the saving in freight on the cement shaken from the bags. The average freight paid for returning the bags from these jobs was 24 cents per hundred pounds, which would amount to $10.91 on 4,130 pounds.

The total amount saved is consequently $20.78, which was accomplished with an extra expenditure of $7.48, the net saving being $13.30, or 17½ cents per 100 bags.

COST OF ELECTRICAL PRODUCTION IN A PLANT WITH RAILWAY LOAD.*

The power plant of the Hyde Park Electric Light Company, in one of the suburbs of Boston, has the distinction of supplying more electrical energy for street railway service than any other central station in Massachusetts. The return of the company for the year ended June 30, 1910, was recently filed with the Board of Gas and Electric Light Commissioners, and it shows that of a total energy sale and distribution of 4,103,384 kw-hours, 88.5 per cent., or 3,636,390 kw-hours, were supplied to electric railway feeders. The total output of the plant at the busbar for the year was 4,357,648 kw-hours. The plant is under the management of the Old Colony Street Railway Company.

The return shows that the maximum load upon the station occurred on Jan. 14, 1910, the peak output being about 3,439 amp. The maximum load on the day of least output during the year was 1,300 amp., the date being Aug. 8, 1909. The station equipment consisted of nine boilers of an aggregate rating of 1,350 h.p., operating at 115 lb. steam pressure, and five reciprocating engines driving five d.c. 500-volt generators and two alternaters. The total generator capacity was 1,775 kw. The two largest generators in the station were rated at 850 kw. and 525 kw., and were each driven by a direct-connected cross-compound engine. The station payroll includes three engineers, three firemen and two coal passers. The cost of manufacture at the busbar was as follows for the year:

Cost of Production (net at switchboard), Hyde Park, 1910.

Fuel	$34,228.04	or 0.78 cents per kw-hour
Oil and waste	746.45	
Water	707.63	
Wages at station	9,609.76	or 0.22 cents per kw-hour
Station building repairs	607.44	
Steam equipment repairs	2,966.14	
Electric equipment repairs	652.71	
Minor station tools	776.19	
	$50,294.36	or 1.15 cents per kw-hour

The coal burned was bituminous at $3.94 per ton and No. 3 buckwheat at $3.17 per ton.

*The Electric Railway Journal.

ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

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

12067—October 22—Authorizing the C.N.R. Company to cross the C.P.R. Langdon Branch at Section 35, Township 24, Range 27, west of 4th Meridian.

12068—October 22—Relieving the C.P.R. Company from providing further protection at the crossing of Brock Road, at North Claremont, Township of Pickering, Ontario.

12069—October 21—Authorizing the C.P.R. Company to open for the carriage of traffic that portion of its line of railway from a point on its London Section, mile 9.56, Lot 6, Concession 4, Township of Etobicoke, County of York, to a point of connection with the G.T.R. in Lot 7, Concession 1, said Township, and "Y" connections with the Applicant Company.

12070—October 12—Authorizing the T. H. & B. Railway Company to construct branch lines or interchange tracks in the city of Hamilton from a point west of Grant Avenue to a point on the east side of Wentworth Street; also to a point a short distance west of Sherman Avenue, Hamilton, Ont.

12071—October 21—Authorizing the C.P.R. Company to cross with the line and tracks of its Estevan to Forward Branch, the line and tracks of the Maryfield Branch of the C.N.R. Company in the north-east quarter of Section 30, Township 5, Range 16, west 2nd Meridian, Saskatchewan.

12072—October 22—Directing the Canadian Northern Railway Company, on or before December 1st, 1910, to erect fences according to the provisions of the Railway Act, along both sides of its right-of-way where the same is unfenced between Maidstone and Paynton, Sask., and to install all proper cattle guards, as provided by the Railway Act.

12073—October 22—Authorizing the Ottawa Electric Company to erect wires across the C.P.R. at a point where the Metcalfe Road crosses the railway, one mile south of Billings Bridge.

12074—October 24—Approving the revised location of part of the C.N.R. Company's Vegreville-Calgary Branch through Townships 25-24, Ranges 25-27, west of 4th Meridian, mileage 224.49 to mileage 238.82.

12075—October 10—Authorizing the corporation of the city of Fort William to cross the industrial spur of the C.P.R. Company of the Fort William Terminal Railway and Bridge Company, which leads from the main line of the C.P.R. Company, into the industrial spur sites within Mary, Christina, Sprague, and Syndicate Streets, with its street railway on Syndicate Avenue, Fort William.

12076—October 22—Amending Order No. 11750, dated September 9th, 1910, which authorizes the Vancouver, Fraser Valley & Southern Railway Company to carry its tracks across certain highways in Vacouver, B.C., by adding thereto the following word: "And subject to the terms of the consent dated September 8th, 1910, a copy of which is attached to the file."

12077—September 22—Directing the C.N.R. Company to provide and construct a siding connecting its line of railway with the property of the Tuxedo Park Company, and the Canada Cement Company, Limited, on Lots 60, 61, 62, and 63, Parish of St. Boniface, and 1 to 11, Parish of St. Charles, Man.

12078—October 24—Directing the C.N.R. Company to provide and maintain a suitable highway crossing at or near the place where the easterly limit of Lot 8, Concession 1, Township of Paipoonge, Ont., intersects the line of the Railway Company.

12079—October 24—Dismissing application of the Alf. Denis Company, Limited, of Edmonton, Alberta, for an Order that, owing to the scarcity of hay in the Western Provinces, the C.P.R. Company be required to carry hay from Eastern Canada at the rates charged on grain from the west to the east.

12080—October 24—Approving location of the Burrard Inlet Tunnel & Bridge Company's line of railway from Station 122:57.5, at the west side of Kootenay Street, to Station 154:86.9, at the north side of Burrard Inlet, near Seymour Creek.

12081—October 24—Authorizing the corporation of the city of Edmonton to cross at rail level, with the lines of its Electric Street Railway, the lines of the Edmonton, Yukon and Pacific Railway Company, at the intersection of said lines with Edward Street, between Stony Plain Road and MacKenzie Avenue, within the limits of said city; and granting leave to the corporation of the city of Edmonton to erect transmission wires across the tracks of the E. Y. & P. Railway Company at the said crossing.

12082—October 24—Authorizing the corporation of the city of Edmonton, to cross, at rail level, with the lines of its Electric Street Railway, the line of the Edmonton, Yukon & Pacific Railway Company at the intersection of the company's said lines with Edward Street at the junction thereof with Stephen Avenue, within limits of said city; and granting leave to erect transmission wires across the tracks of the E. Y. & P. Railway Company at the said crossing.

12083—October 24—Authorizing the corporation of the city of Port Arthur to construct a highway across the C.P.R. at Nelson and Clavet Streets, in said city.

12084—October 25—Authorizing the Canadian Light and Power Company to erect transmission wires across the wires of the Beauharnois Light, Heat and Power Company at the St. Louis Road, Beauharnois, P.Q.

12085—October 24—Authorizing the Twin City Oil Company, Limited, to construct tramway across the tracks of the C.N.R. Company at Strathcona, by means of an overhead bridge.

12086—October 25—Authorizing the municipal corporation of city of Brantford to cross at grade, the track of the Brantford & Hamilton Electric Railway Company at Alfred Street, Brantford.

12087—October 25—Approving the location of the C.P.R. Company's new station at Thessalon, on Soo Branch of its railway, in the Province of Ontario.

12088—October 25—Authorizing the C.P.R. Company to remove the station building at Sault Ste. Marie from its present position to the new location as shown on plan on file with the Board.

12089—October 24—Authorizing the municipal council of Township of Sandwich East, to construct a drain along right-of-way of G.T.R. from the Parent Outlet between Lots 143 and 144, Concession 1, westerly to the Little River.

12090—October 25—Rescinding Order No. 11202, dated July 21st, 1910, which authorized the crossing of transmission wires of the Seymour Power & Electric Company, Limited, on Lots 8 and 9, Concession 2, Township of Thurlow, County Hastings, Ontario.

12091—October 15—Relieving the O. & N. Y. Railway Company from providing further protection at the crossing of the third highway south of the Rideau River, 2nd Concession, Russell Road, Township of Gloucester, County Carleton, Ontario.

12092—October 25—Authorizing the G.T.R. Company to construct new station at Amigari, near Fort Erie, on 20th District of its railway.

12093—October 25—Approving the highway crossing road diversion in north-east quarter of Section 35, Township 28, Range 21, west 2nd Meridian, District of Saskatoon, Sask.

12094—October 26—Approving location of a portion of the C.P.R. Company's Regina, Saskatchewan Branch from mile 199.2, to the crossing of the C.N.R. Company's spur to East Prince Albert, at mile 232.4.

12095—October 26—Authorizing the Shawinigan Cotton Company, Limited, to lay a sewer under the C.N.Q.R. between Shawinigan Falls Junction, and Shawinigan Falls, Quebec.

12096—October 25—Authorizing the Peterboro' Radial Railway Company to erect power wires across the G.T.R. at George Street, Peterboro, Ont.

12097—October 25—Authorizing the Ontario Distributing Company, Limited, to erect power wires across the G.T.R. (Air Line Division), at the 3rd Concession Road, Township of Stamford, Ont.

12098 to 12102 Inc.—October 25—Authorizing the Hydro-Electric Power Commission of Ontario to erect transmission wires across the track and wires of the Galt, Preston and Hespeler Electric Railway Company at Queen Street, Hespeler, Ont.; across the wires of the Bell Telephone Company at Queen Street, Hamilton, Ont.; across the wires and tracks of the Hamilton-Brantford Electric Railway Company at Queen Street, Hamilton, Ont.; across the wires of the Bell Telephone Company at Lots 18 and 19, Concessions 2 and 1, Township of East Oxford, Ontario; and across the wires of the C.P.R. Company's Telegraph at Asylum Road, Hybury Avenue, London, Ontario.

12103—October 25—Granting leave to the Canadian Northern Railway Company and the Grand Trunk Pacific Company to operate their trains over the crossing of the lines and tracks of the C.N.R. with the lines and tracks of the G.T.P.R., at or near Riley, Alta., without their being brought to a stop.

12104—October 25—Approving the plans and specifications submitted by the municipal corporation of Township of Lochiel, of proposed culvert under the tracks of the G.T.R. Company on the west half of Lot No. 4, Concession 2, of Township of Lochiel.

12105—October 25—Approving the plans and specifications submitted by municipal corporation of Township Lochiel, of proposed culverts under the track of the G.T.R. Company on south half of Lot 15, Concession 2, Lot 16, Concession 3, Township Lochiel.

12106—October 25—Approving plans and specifications submitted by the municipal corporation of Township of Lochiel, of proposed culvert to be constructed under the track of the G.T.R. on north half of Lot No. 6, Concession 4, Township Lochiel.

(Continued from page 621).

ENGINEERING SOCIETIES.

CANADIAN SOCIETY OF CIVIL ENGINEERS.—413 Dorchester Street West, Montreal. President, Col. H. N. Ruttan; Secretary, Professor C. H. McLeod.
Chairman, A. E. Doucet; Secretary, P. E. Parent. 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, A. A. Dion, Ottawa; Secretary, H. Victor Brayley, N. T. Ry., Cory Bldg.

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.

THE UNION OF CANADIAN MUNICIPALITIES.—President, W. Sanford Evans, Mayor of Winnipeg; Hon. Secretary-Treasurer, W. D. Lighthall, K.C., ex-Mayor of Westmount.

THE UNION OF NEW BRUNSWICK MUNICIPALITIES.—President, Mayor Reilly, Moncton; Hon. Secretary-Treasurer, J. W. McCready, City Clerk, Fredericton.

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 GAS ASSOCIATION.—President, Arthur Hewitt, General Manager Consumers' Gas Company, Toronto; J. Keillor, Secretary-Treasurer, Hamilton, Ont.

CANADIAN GAS EXHIBITORS' ASSOCIATION.—Secretary-Treasurer, A. W. Smith, 52 Adelaide Street East, Toronto.

CANADIAN INDEPENDENT TELEPHONE ASSOCIATION.—President, W. Doan, M.D., Harrietsville, Ont.; Secretary-Treasurer, Francis Dagger, 11 Richmond Street West, 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. McDonald, Manager, Montreal Street Railway; Secretary, Acton Burrows, 157 Bay Street, Toronto.

CANADIAN SOCIETY OF FOREST ENGINEERS.—President, Dr. Fernow, Toronto; Secretary, T. 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, Victoria Embankment, London, W.C.; 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.

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

ROYAL ARCHITECTURAL INSTITUTE OF CANADA.—President, F. S. Baker, F.R.I.B.A., Toronto, Ont.; Hon. Secretary, Alcide Chausse, No. 5 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 IRRIGATION ASSOCIATION.—President, Wm. Pierce, Calgary; Secretary-Treasurer, John T. Hall, Brandon, Man.

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.

COMING MEETINGS.

CANADIAN SOCIETY OF CIVIL ENGINEERS.—Ottawa Branch, 177 Sparks Street, November 16th, 1910, Programme, Douglas H. Nelles, A.M., Can. Soc. C.E., D.L.S. Subject: International Boundary Survey. Secretary, H. Victor Brayley, N. T. Ry., Cory Bldg.

NEW YORK CEMENT SHOW.—December 14-20, 1910. First annual convention in Madison Square Garden, New York. Under the management of the Cement Products Exhibition Company, 115 Adams St., Chicago.

CHICAGO CEMENT SHOW.—February 15-23, 1911. Fourth annual exhibition, at the Coliseum, Chicago, Ill. Under the management of the Cement Products Exhibition Company, 115 Adams St., Chicago.

RAILWAY EARNINGS; STOCK QUOTATIONS.

The following table gives the latest traffic earnings it is possible to obtain at the time of going to press:

Road	Wk ended	1910	Previous week	1909
C. P. R.	Oct. 31	$3,177,000	$2,302,000	$3,130,000
G. T. R.	Oct. 31	1,392,943	963,374	1,321,050
C. N. R.	Oct. 31	556,200	403,900	457,300
T. & N. O.	Oct. 31	38,014	23,772	54,588
Hal. Elec.	Oct. 31	5,403	3,643	5,003

Figures showing the earnings of Canadian roads since July 1st, this year and last, are appended:

Road.	Mileage.	July 1st to	1910.	1909.
C. P. R.	10,326	Oct. 31	$36,757,000	$24,890,000
G. T. R.	3,536	Oct. 31	15,333.492	14,334,057
C. N. R.	3,180	Oct. 31	5,225,800	4,111,600
T. & N. O.	264	Oct. 31	822,338	598,793
Hal. Elec.	13.3	Oct. 31	78,987	74,913

Stock quotations on Toronto, Montreal and London exchanges, and other information relative to the companies listed in the above tables, are appended. The par value of all shares is $100.

Co.	Capital. 000's Omitted.	Price Nov. 4 1909.	Price Oct. 27 1910.	Price Nov. 3 1910.	Sales last week.
C. P. R.	$150,000	-184½	199-198	-199	2,050
Mont. St.	18,000	209-208½	230-229	229¼-229	1,539
Hal. Elec.	1,400	119¾-119	130-129	130-129⅜	10
Toronto St.	8,000	-123⅜	123½-	-120½	196
G. T. R.	226,000	1st pfd. 107½; 2nd pfd. 53⅜; com. 25⅛			

MONTREAL STREET RAILWAY.

The annual report of the Montreal Street Railway shows an excellent financial condition, while the story of the organization tells an interesting tale of progress from the humble horse-drawn car to the steel-clad pay-as-you-enter monster.

The report of the present contains the following financial statement:

Your directors beg to submit their 50th annual report accompanied by the financial statements, which show the following results:

Gross earnings		$4,352,551.18
Operating expenses		2,455,301.06
Net earnings		$1,897,250.12
Interest from M.P. & I. Ry. Co.		85,878.04
Total income		$1,983,128.16
From which deduct:		
City p.c. on earnings	$278,084.93	
Interest	175,421.07	
Rental of leased lines	6,472.05	
Taxes	48,000.00	
		507,978.05
Net income		$1,475,150.11
Dividend 10 per cent.		1,000,000.00
Surplus		$ 475,150.11
From which has been appropriated for:		
Contingent account	$250,000.00	
Fire insurance fund	25,000.00	
		275,000.00

The gross earnings increased during the year $477,712.67, or 12.33 per cent., the operating expenses $200,281.86, or 8.88 per cent., the net earnings $277,430.81, or 17.13 per cent.

The gross earnings continue to show very satisfactory increases. The per cent. of expenses to gross earnings is 56.41 per cent., against 58.20 per cent. for the previous year.

The Underground Service.

During the past year the company secured an amendment to its charter authorizing the construction and operation of underground railways. Preliminary plans for the construction of the same have been prepared by the well-known firm of Jacobs and Davies, of New York, and the question will be taken up with the city during the coming year.

The company has paid to the city of Montreal, taxes and percentages on earnings amounting to $387,264.25, on account of snow removal $50,919.30, a total of $438,183.55, being an increase over the previous year of $51,998.39.

The following abstract of a statistical statement gives a synopsis of bonuses during the past three years:

	1910.	1909.	1908.
Gross earnings	$ 4,352,551	$ 3,874,838	$ 3,677,432
Oper. expenses	2,455,301	2,255,019	2,158,394
Exp. p.c. of earn.	56.41	58.20	58.69
Net earnings	1,897,250	1,619,819	1,519,038
Passengers carried	107,241,406	95,376,373	90,746,032
Car earnings per passenger	3.95c	3.96c	3.96c
Transfers	36,437,123	32,285,208	30,343,113
Total pass. carried	143.678,529	127,661,581	121,089,145
Car earnings per pas. total carried	2.95c	2.96c	2.97c

The assets of the company total $18,641,769, leaving a surplus of $2,988,712 over liabilities.

Their first attempt at modernizing Montreal resulted in the construction of six and a half miles of single passenger track with eight passenger cars, a stable and car house, which cost altogether some $80,000, and the company closed its stock books when 2,500 shares at $50 each had been sold for $125,000.

To-day the company is capitalized at $10,000,000 stock and $4,420,000 bonds, operates over 144 miles of track and controls and operates subsidiary companies with some 86 miles of track, a total of 230 miles.

ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

(Continued from page 620).

12107—September 22—Directing that the C.N.R. Company haul pine and spruce logs upon its line for any distance up to 150 miles from Winnipeg, from the point, if any, where the railway touches Rainy River to Winnipeg, at a rate not to exceed $2.50 per thousand feet, board measure; also file with the Board joint tariffs with the Minnesota & Manitoba Railway Company, showing through rates from Minnesota points to Winnipeg; and disallowing the $2.00 switching toll charged by the C.N.R. Company for switching services.

(Continued on page on 49).

TORONTO, CANADA, NOV. 10, 1910.

CONTENTS OF THIS ISSUE.

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.

Further information may be had from the issues of The Canadian Engineer referred to.

Place of Work.	Tenders Close.	Issue of.	Page.
Burke's Head, N.S., breakwater	Nov. 22.	Nov. 3.	600
Calgary, Alta., timber trestle	Nov. 10.	Nov. 3.	600
Lorneville, N.B., breakwater	Nov. 23.	Nov. 3.	600
Maple Creek, Alta., light and power plant	Nov. 10.	Nov. 3.	600
Ottawa, Ont., ice houses	Nov. 15.	Nov. 3.	600
Oak Lake, Man., truss bridge	Nov. 10.	Nov. 3.	600
Point Grey, B.C., reservoir		Nov. 3.	600
Paris, Ont., armoury	Nov. 10.	Oct. 27.	569
St. Louis du Mile End., Que., post-office	Nov. 24.	Oct. 20.	537
Temiskaming, Ont., excavation	Nov. 15.	Oct. 27.	569
Walhachin, B.C., steel bridge	Nov. 28.	Oct. 27.	569
Winnipeg, Man., pole and line supplies	Dec. 1.	Nov. 3.	56
Winnipeg, Man., cast iron pipe	Nov. 14.	Nov. 3.	60
Winnipeg, Man., public baths		Nov. 3.	600
Walhachin, B.C., bridge	Nov. 28.	Nov. 3.	600

TENDERS.

Chapel Cove, N.S.—Tenders will be received until Dec. 5th for the construction of a breakwater. R. C. Desrochers, Secretary Dept. of Public Works, Ottawa.

Maccan, N.S.—Tenders will be received by the Maritime Coal, Railway & Power Company's office for the supply of the following timber delivered at Joggins' Mines, during the coming year: 2,000 spruce booms, 13 ft. long, 8 in. at top end. 10,000 spruce booms, 10 ft. long, 7 in. at top end. 25,000 6-ft. spruce props, 6 in. at top end. 200,000 pieces 4-ft. butt timber 5 in. at small end. Butt timber can be made from spruce, pine, fir or hemlock. 2,000 hemlock or jack pine railway sleepers 8 ft. long, and if sawn on four sides to be made 6 x 8, if flatted to be 6 in. thick and not less than 6 in. face. The lowest or any tender not necessarily accepted. David Mitchell.

Montreal, Que.—Tenders will be received until November 15th for the construction of sewers on Tenth Avenue, Rosemont, from Masson Street, to Cote Visitation Road. L. N. Senecal, secretary, Board of Commissioners, City Hall.

Stratford, P.Q.—Tenders will be received until December 5th for the construction of a landing pier. R. C. Desrochers, secretary, Department of Public Works, Ottawa.

Toronto, Ont.—Tenders will be received until November 15th for the construction of the following sewers: Bloomfield Avenue, from Greenwoods Avenue to 250 ft. west. Antler Avenue, from Symington Avenue to 125 ft. east. Campbell Avenue, from Royce Avenue to C.P.R. Cheltenham Avenue, from Greenwoods Avenue to 400 ft. west. Drumsnab Road from Castle Frank Avenue to North Branch, and on North Branch from north limit lot No. 4 to south limit lot 11. Follis Avenue, from Christie Street to Clinton Street. Ivy Avenue, from Greenwoods Avenue to 200 ft. west. Prust Avenue, from 1st lane north Gerrard Street to Ivy Avenue. Drumsnab Road, from Castle Frank Avenue to the northern branch and on the northern branch from the north limit of lot 4 to the south limit of lot 11. G. R. Geary (Mayor), chairman Board of Control.

Toronto, Ont.—Tenders will be received until November 15th for Tungsten Lamps. G. R. Geary (Mayor), chairman Board of Control.

Toronto, Ont.—The time for receiving tenders for Cast Iron Lanterns and Pillars is extended from noon of Tuesday, November 8th, until noon of Tuesday, November 15th. G. R. Geary (Mayor), Chairman of Board of Control. Toronto, November 5th, 1910.

Toronto, Ont.—The city council will shortly call for tenders for the work on the low level trunk sewer, to run along Front street, from Bathurst to sewage tanks east of the Don. This will require the construction of another siphon under the river.

Calgary, Alta.—Tenders will be received by the secretary of the Calgary Public school board up to November 15th, for the various trades required in the erection and completion of two eight-room schools. Hodgson, Bates and Butler, architects.

Calgary, Alta.—Tenders will be received by the secretary of the Calgary Public school board up to November 15th, for the various trades required in the erection and completion of a twelve-roomed school in block 6, Hillhurst. Lang & Dowler, architects.

East Calgary, Alta.—Tenders will be received for laying fifty thousand brick or more. C. C. Snowden, wholesale oil merchant, Box 1384.

Edmonton, Alta.—Tenders will be received until November 15th for the sinking of a shaft for the Black Diamond Collieries, Limited, situated on the main line of the G.T.P. Railway. James Hargreaves, mining engineer. Room 34, 124 McDougal Avenue.

Nanaimo, B.C.—Tenders will be received until November 28th for additions and alterations to the public building. R. C. Desrochers, secretary, Department of Public Works. Ottawa.

Nelson, B.C.—Tenders will be received until November 28th for additions and alterations to public building. R. C. Desrochers, secretary, Department of Public Works, Ottawa.

Victoria, B.C.—Tenders will be received until November 14th for the erection and completion of a large one-roomed school building at Westholme. F. C. Gamble, Public Works Engineer, Department of Lands.

CONTRACTS AWARDED.

Acton, Ont.—H. E. Croft, of Guelph, has secured a contract to build cement walks and crossings here at the rate of 10 cents per foot.

St. Catharines, Ont.—The Warren Paving Company, Toronto, received the contract for the construction of pavements on King and Queenston Streets respectively, at $30,000—$29,000, being the lowest. Other bidders were: Thomas Riley, $30,906—$30,937; Newman Bros., $31,060—$30 624; City Engineer, $31,854—$31,011.

Kingston, Ont.—In addition to previous orders on hand, the locomotive works has received an order for eight more engines to build for the C.P.R.

Lindsay, Ont.—The Toronto Construction Company has sub-let contracts for C.P.R. grain route for section commencing near Cambray and extending west of Lorneville, to Johnston Bros. The contract for the section between Cambray and Lindsay has been awarded to the firm of Perry & Stewart.

Moose Jaw, Sask.—H. Giles received the contract for the excavation of Saskatchewan College, at this place. Contracts for superstructure may not be let for many months yet.

The Bishop Construction Company, Limited, Montreal and Toronto, has been awarded the contract for the construction of waterpower development and pulp mill for the Eastern Pulp and Paper Company, Limited, Murray Bay, Que. Contract price, $296,000.00. Engineer, Geo. F. Hardy New York.

Toronto, Ont.—Tenders have been received for the supply of approximately six thousand feet of two-and-one-half-inch fire hose required to be purchased for the Fire Department, as follows:—

Hose Tenders.

Tender No.	Brand.	Ply.	Weight.	Pressure Guarantee.	Time Guarantee.	Price per foot.
1.	Dunlop D'ble Jacket....		59 lbs.	400 lbs.	3 yrs.	$1 05
	Niagara D'ble Jacket....		55½ "	400 "	3 "	95
	Cataract D'ble Jacket....		52 "	400 "	3 "	90
2.	Keystone D'ble Jacket..		58 "	400 "	3 "	1 05
	Patrol Double Jacket....		55 "	400 "	3 "	95
	Squelcher	3	47 "	400 "	3 "	1 00
3.	Magnet Multiple Wov'n..		58 "	400 "	3 "	95
4.	Special High Pressure Multiple Woven	4	60 "	400 "	3 "	1 10
	Trojan Jacket	3	50 "	400 "	3 "	90
	Paragon	3	49 "	400 "	3 "	1 05
	Multiple Woven	2	47 "	400 "	3 "	1 00

The Board awarded contracts as follows:—

Tender No. 1.—Dunlop double jacket, 1,000 feet, price $1.05 per foot—To the Dunlop Tire and Rubber Goods Co.

Tender No. 2.—Keystone double jacket, 1,000 feet, price $1.05 per foot—To the Canadian Rubber Co.

Tender No. 3.—Magnet multiple woven, 1,000 feet, price 95c. per foot—To the Durham Rubber Co.

Tender No. 4—Special high pressure multiple woven, 3,000 feet, price $1.10 per foot—To the Gutta Percha and Rubber Manufacturing Co., Ltd.

Victoria, B.C.—Contract for supply of brass goods, pipes and fittings was awarded to the Miller Co., Limited, of London, Ont., at $12,636.00.

Vancouver, B.C.—The British Columbia Telephone Company has awarded contracts for $500,000 of material as follows: To the Wire & Cable Company, Montreal, for about 250,000 feet of cable, average size of 200 pairs of wires per cable, and for 25 tons of supporting wire; to the Northern Electric Company, Montreal, for 52 switchboard sections, and 3,000 telephone instruments.

Vancouver, B.C.—Tender of Messrs. John W. Moore and George H. Pethick was accepted for the clearing of 1,000 acres of the townsite of Port Mann, the Canadian Northern Railway terminal on the Fraser River opposite New Westminster.

RAILWAYS—STEAM AND ELECTRIC.

Fredericton, N.B.—Mr. Harry F. McLean, superintendent of the Toronto Construction Co., who has been here, states that within ten days the company will have completed work on their contract of over 100 miles of the G.T.P. construction.

Fredericton, N.B.—The C.P.R. management plan extensive additions and improvements to their Fredericton facilities. Recently, Supt. Downie announced that the yard facilities were insufficient to handle the growing freight business and now plans for the new C.P.R. yard have been completed. Early next spring the actual work of making the improvements will commence. If the necessary land was available the C.P.R. would increase their facilities even more than is at present intended.

Saint John, N.B.—The new Grand Isle-Fort Kent extension of the Bangor & Aroostook Railroad system, or the St. John River extension as it is more popularly known, is rapidly nearing completion, and it is expected that it will be formally opened for travel some time between November 14th and 21st.

Montreal, Que.—Control of the Montreal Street Railway has passed into new hands. It is now in the control of what is known as the Robert syndicate, an amalgamation with the Canadian Power Company, who elected a new directorate consisting of Messrs. E. A. Robert, president; J. W. McConnell, vice-president; D. Lorne McGibbon, F. Howard Wilson, J. M. Wilson, W. C. Finlty and George G. Foster, K.C., the election taking place without a contest and almost without a protest. After the meeting concluded, Mr. K. W. Blackwell, the ex-vice-president, stated that after the old directors had looked over their proxies they came to the conclusion that the Robert group had 49,500 shares and expected to have a couple of thousand more at the meeting, and as the men then in power only had from thirty to thirty-five thousand there was only one thing to do, viz., to hand over the direction of the Montreal Street Railway Company to the men who had secured control.

Montreal, Que.—The plans which are now being completed by the Grand Trunk engineers for elevating the company's tracks into Montreal will take at least two years to carry out, under the most favorable conditions, according to one of the officials. Previous to work being started these plans have to be passed upon by the Railway Commission, and the city council will then be asked to exercise the authority conferred upon it by the Provincial Legislature to contribute up to two million dollars to the project. The total cost is estimated to be about $5,000,000. This is quite irrespective of the cost of the new station terminals and buildings, with which the company proposes to replace the Bonaventure Station. The company's plans for this station are stated to be modelled on one of the largest and most up-to-date of the railway stations in the United States, with, of course, important modifications to suit local conditions.

Brantford, Ont.—It is announced that in a week or two the Great Western branch will be opened from Harrisburg to Brantford.

Guelph, Ont.—The People's Railway Company have deposited at the Registry Office in this city their plan, profile and book of reference of right of way through Guelph township. It is not yet known just what the route chosen is. It is learned that the People's Railway are progressing with the work of construction, and a lot more will be done before the snow flies.

Ottawa, Ont.—The commissioners have been considering the question of signals for level crossings and other safety appliances. The railway commission ordered that all passenger, mail, baggage and express cars on trains be equipped with proper tools for use in case of emergency. The tools, the order stated, must be put in a conspicuous place and be easily accessible. Several representatives of signal manufacturers were heard. Each spoke in favor of the advantages of his particular signal for use at level crossings. The board will consider this matter and specify later, the kind of signal that must be placed at all level crossings.

Ottawa, Ont.—The Grand Trunk Pacific Branch Lines Company has given notice of application to Parliament for authority to construct a number of additional branch lines in Alberta and Saskatchewan including the following: From Moose Jaw westerly to Calgary; from a point on the western division between ranges 21 and 28 west of the second meridian, westerly to a junction with the authorized line between townships 29 and 37; from a point on the authorized branch line between ranges 12 and 16, west of the second meridian, southerly to the international boundary.

Ottawa, Ont.—To permit of the Canadian Northern Railway explaining to the city council what it proposes in the matter of crossing Hurdman Road, the railway commission to-day put over, after argument, the application of the Canadian Northern to cross the road and connect with the Ottawa and New York Railway. It was explained that the connection was only for freight purposes and would be used in certain hours. The application for a connection with the C.P.R. was withdrawn.

Ottawa, Ont.—So strongly is the C.P.R. project for closing the canal and tunnelling under the city gaining in public opinion that there now seems little doubt that the city will appoint an expert engineer to act with the city engineer in the matter. One man suggested is W. F. Tye, formerly chief engineer for the C.P.R. but now in independent practice. He was Toronto's expert in its big viaduct fight and had much to do with winning the case for the city. The name of Mr. Walter Shanley, a railway engineer of Montreal, is also suggested.

Ottawa, Ont.—Mr. William Mackenzie, president of the Canadian Northern Railway, who was here yesterday on business connected with the company's lines in the West, stated that the hint of the chairman of the railway commission will be followed and the company will at once write to the city explaining what are its plans for crossing the Hurdman Road. It pointed out that the crossing sought is a temporary one to be used for freight on a track connecting

with the Ottawa and New York Railway. This privilege is sought pending the adjustment of the general question of entrance.

Toronto, Ont.—At a meeting of the Etobicoke Township Council, a resolution was adopted authorizing negotiations with the city of Toronto, with respect to the taking over of the Mimico Electric Railway System by the city, when the company's franchise expires fifteen months hence.

Toronto, Ont.—That the C.P.R.'s present construction activity along its line from Smith's Falls to Toronto is a strong indication of its intention to shortly proceed with the double tracking between these two points, is the general opinion of railroad authorities. So far the company has not made any statement regarding its plans, but in view of this activity, it is considered probable in railroad circles, that the C.P.R. will abandon temporarily its avowed intention of constructing a branch line between Kingston and Toronto via Belleville.

Toronto, Ont.—City Engineer Rust's plan for the construction of a retaining wall from Dufferin Street East and the arrangement of service tracks on the grounds were approved.

Toronto, Ont.—North Bay is acting for a furtherance of the scheme of constructing a line from Parry Sound. Mayor Rankin of North Bay, and Mr. John Ferguson of the board of trade of the same town, had a long conference with Wm. Mackenzie, president of the Canadian Northern Railway, regarding the further extension of various branches of the C.N.R. through Northern Ontario.

Moose Jaw, Sask.—The work of constructing the tracks for the street railway, on the route which will comprise the first three miles of a system, is going on as rapidly as conditions will permit. High Street west and Main Street are the two thoroughfares on which the progress made is most prominent. Double tracks are laid on High Street from the corner of Main up to Fourth Avenue, that is on the paved portion of the street, and for four blocks westward as far as the Saskatchewan Mills. These will be continued for a half block further to the site of the power house and barns. Half a mile of double trackage is completed on this street.

Regina, Sask.—Mr. J. J. Hill, the United States railway magnate, who controls the Great Northern System, proposes a further extension of his lines into Saskatchewan, Manitoba and Alberta. Mr. Hill, who was associated with some of Canada's railway kings in the early days, has immense faith in Canada's future, and desires to link his system in the States with all the main Canadian lines.

Edmonton, Alta.—Grading has been started on the Morinville east branch line of the C.N.R. The line will run east from Morinville, but as yet it has not been decided just where it will connect with the main line. In all probability a town on the line in the North Battleford district will be made the junction.

Edmonton, Alta.—The approach of winter, as signified by recent storms, will stop all railway construction work in the province. Grading outfits will all cease work this week and seek winter quarters. This brings to a close a very active year in railway building in the province. A total of 400 miles has been built, as follows: C.N.R. main line, 40 miles; G.T.P. main line, 80 miles; C.N.R. Calgary branch, 110 miles; Brazeau branch, 35 miles; Goose Lake branch, 25 miles; Landing branch, 39 miles; G.T.P., Calgary branch 125 miles. Of the 400 miles, 265 were constructed under Provincial Government guarantees.

Vancouver, B.C.—General Manager Sperling of the British Columbia Electric Railway Company announced that the management had outlined its car building programme for the ensuing year, and that the total value of the rolling stock which was deemed necessary to accommodate the growing demands of the company's business would be in the neighborhood of $500,000. The programme as decided upon covers 122 cars of various types for the various branches. More than half of these are to be built for city service.

Vancouver, B.C.—The Canadian Northern Railway Company is now pushing construction of its wharf at Bon Accord, a large number of men being employed on the work, as it is desired to have the wharf finished at as early a date as possible, as considerable railway construction material will be handled there.

LIGHT, HEAT AND POWER.

Moncton, N.B.—Another two million cubic feet gas flow per day has been struck by the Maritime Oilfields Company, at McLatchey's. The latest well is No. 16 which looks promising at a depth of 1,410 feet. Mr. Shaw, the superintendent at the wells, without making a test estimates the new well to be good for between two and three million feet a day, but it is the intention to go a little deeper before capping it.

Cobalt, Ont.—Work has been started on the development of a hydro-electric plant on the Mattagami River at Sandy Falls in the Porcupine district, six miles from the Timmins Mine. Three thousand (3,000) horsepower in generators has been ordered from the Canadian Westinghouse Company, Limited, and turbines of like capacity from the S. Morgan-Smith Company of New York, Pa. This plant will be in operation by June 1st, 1911. Current will be generated at a pressure of twelve thousand volts and a frequency of twenty-five cycles per second. Forms of contract for power can be had from Mr. John B. Holden, Manning Arcade, Toronto Ontario, solicitor for the company, or from H. D. Symmes, Niagara Falls, Ontario.

Niagara Falls, Ont.—The Hydro-Electric lines are to be exempt from taxation. A court of revision of taxes was held in city hall. The appeal of the Hydro-Electric Commission was brought before the court. It was decided in their favor, and the assessments made on their lines and conduits which are on the boundaries between this city and the township of Stamford were repealed.

Niagara Falls, Ont.—The city's street lighting system is declared obsolete and in no condition for the coming winter. Manager Folger recommends the wiping out of the present 100 open arcs and providing for additions and extensions of either arcs or tungstens on the new equipment and having both circuits constantly, so as to be interchangeable at any point and at any circuit. The cost of this would be $9,300. Even if the city got cheap water power, the above expenditure would still be necessary for the power would have to be transformed. The manager said that the plant was doing the best it could with the present arcs.

Toronto, Ont.—Seventy cent. gas was promised to the people of Toronto by President Blaikie of the Consumers Gas Company at the annual meeting. The present price is seventy-five cents per thousand feet, said to be the lowest anywhere in America. The Company pays ten per cent. The output has amounted to 2,621,247,000 cubic feet or 395,084,000 cubic feet more than the output for 1909, showing a rate of increase of 17.74 per cent.

Toronto, Ont.—The Canadian National Exhibition Board has adopted a report recommending the expenditure of $10,000 for wiring the Exhibition grounds. The cost has been estimated by Mr. Percy Mackid, the Exhibition electrical engineer, and Mr. W. R. Sweaney, business manager of the city's hydro-electric department at $30,000 for the buildings and $50,000 for the grounds. The directors decided to ask the city to proceed with the work immediately.

Toronto, Ont.—The city architect has issued to J. C. Eaton a permit for a power house to be erected on Davenport Road, near Spadina Road at a cost of $5,800. The object of the building is to supply heat and power for Mr. Eaton's new residence, which is being erected on the same lot. This will be completed early next year.

Toronto, Ont.—The Board of Control have been considering making an offer to the Toronto Electric Light Company. The company, it seems, is fighting strongly any competition on the part of the city in the matter of lighting.

Welland, Ont.—Dunnville is desirous of getting Hydro-Electric power. At a largely-attended public meeting, the matter of electric power was discussed. A committee of ten was appointed to meet the Hydro-Electric Power Commission and private companies with a view to finding the most advantageous arrangements that can be made.

Calgary, Alta.—Calgary is seeking electric power. The power committee of the city council will endeavor to get Henry Holgate and William Kennedy, Jr., of Montreal, to report on power sites for the city on the Bow and Elbow rivers.

Calgary, Alta.—The new $100,000 power plant for the city will be completed in a month's time. It will be up-to-date in every particular and it is said will be unsurpassed by anything of its kind in the West. It will be capable of generating 4,500 horse power and will be an auxiliary to the Horse Shoe Falls supply.