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MISSING

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The Canadian Engineer

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RAILWAYS IN ALBERTA.

Western Canada is still suffering from growing pains, and increased transportation facilities is the crying need of many sections. To assist in this work Premier Rutherford announces that a provincial department of railways will be organized, but whether the Alberta Government will construct the new roads or simply plan for systematic assistance is not yet known. In any case Alberta is likely to see several years of active railroad construction.

It is to be hoped Albertans will not allow their Province to be blanketed with railway charters, nor offer subsidies as a reward to each new promoter. Eventually any new line will find itself either absorbed by or dependent upon one of the three Canadian railway systems, and this new department should be able to eliminate the promoter's profit, and see that all the money voted goes to building railways and not to laying the foundations of large private fortunes.

A new department in a new Province, with the experience of other Provinces to assist, should be able to prevent many of the abuses in railway building which discredit the engineer. Pinched to the very last cent, he has frequently to plan make-shifts, diversions, and adopt unsatisfactory gradients, the engineering bending too much to the financial.

If these new roads are Government-built, they will be well built, and if they are subsidized, then the limiting curvature and gradients should be specified, and the Government inspection should be thorough enough to ensure building to specifications.

STEEL-MAKING IN AMERICA.

Two recent utterances on the iron and steel trade of the United States, by men who should be fully informed on the subject, are worthy of attention, especially so, as the cost of producing pig iron and steel on this continent, and the effect of protective duties upon the market price of these articles, are touched upon. The speakers are Andrew Carnegie, whose enormous fortune has been made out of steel, and Charles M. Schwab, a modern leader in American steel production. What will seem to protectionists an audacious statement is made by Mr. Carnegie. This is that the steel industry needs no protection. He declares that steel is produced at less cost in the United States than anywhere else, and that, notwithstanding the higher wages paid per man, not a ton of steel is produced in the world at so small an outlay for labor. Coal, coke and iron ores are cheaper, because more easily obtained and transported in the United States than anywhere else. The output per man is also greater, owing chiefly to the enormous standard orders obtainable. It would seem, therefore, that the industry has no cause to be alarmed at the prospect of foreign nations dumping steel on their market. But the apprehension that some thing of the sort might happen is very likely to cause the Americans to keep to their protective duties. And the effect of these must be to prevent the lowering of prices of finished iron and steel for home consumption to a point which might be reached without them.

Dealing with the statement that the United States possesses three great strategic centres of iron manufac-

ture, the Great Lakes region, the South, and the Atlantic Coast, Mr. Schwab declares that the East will rise in its position in the making of steel, as compared with the West. "The material from which to make a ton of pig iron can be assembled in Wilmington, Delaware, on the Atlantic Coast, cheaper than it can be assembled in Pittsburg, Pennsylvania." He basis this statement on the alleged fact that from the great ore fields of Cuba rich iron ore can be laid down for \$1 per ton; less than two tons of which will make a ton of pig iron, instead of more than two tons of American ore being required at Pittsburg. The cost of a ton of pig iron at Pittsburg, he says, is about \$5, while at Wilmington it is only \$1.80. Freights, of course, would equalize this otherwise irreconcilable difference in value. The whole subject is of interest to Canada, whose resources in coal and ore are so great, and to whom the means of getting at them readily and utilizing them economically are so vital.

EDITORIAL NOTES.

How often we demand immediate results, and fret and chafe if we do not get them! This week we had an enquiry from a purchaser in reference to certain articles advertised in The Canadian Engineer fourteen years ago. What familiar saying such an incident recalls and what a tribute to the silent salesman—the well-written advertisement!

* * * *

The Canadian Railway Commission appear ready to co-operate with those municipalities in an endeavor to prevent the smoke nuisance. They have passed a regulation providing that steam railways operating in municipalities that enforce the smoke by-law must equip their locomotives so as to prevent the emission of dense or opaque smoke. Provision is made for the emission of smoke at intervals under unusual conditions. These regulations are all very proper and necessary, but better results will be secured by the railway superintendents offering encouragement to firemen, for they are the masters of the situation, after they are provided with proper equipment.

* * * *

At a meeting of the Oshawa, Ont., town council this week a motion which may be far-reaching in its effect was unanimously passed. It reads: "Moved by Messrs. Crysdale and Samells, that the council of Oshawa desires to draw the attention of the Local Legislature to the necessity and desirability of granting material assistance to the towns and villages of Ontario in their struggle to construct new sewers, extend a system already established, or build sewerage disposal works as individual cases may require. To this end we would submit for the consideration of the Government that a sewerage system has become as necessary to the very life and existence of our urban municipalities as good roads have become needed in the townships and counties of Ontario, and should receive Government encouragement, supervision and financial assistance, at least in a like proportion to the good roads movement."

* * * *

Despite the trade and financial depression which touched Japan as it did the rest of the world, the foreign trade of Yokohama shows a satisfactory increase. In 1907 the figures were \$193,128,500 against \$178,603,840. The increase was maintained in both imports and exports. In the former case gains were shown by Canada, the United Kingdom and Australia. Almost all departments of machinery exhibited increases, especially steam and gas engines, turbines and electrical machinery. The acting vice-consul of Britain at Yokohama draws attention to the fact that until a few years ago British and other foreign firms established in Yokohama were nearly all merchant firms representing numerous

manufacturing and other companies in their home countries, and doing general import and export business. While the number and importance of such firms remain undiminished, there is an increasing tendency for large manufacturing concerns in the United Kingdom to have their own branches or representatives in Japan. This increase of direct interest in the trade with this country leads to a growing number of members of firms, agents and travellers visiting Japan. Sometimes this is a mere tour of inspection, but often the intention is to open and register a branch office, appoint an agent, register a trade-mark, or do some similar work. It may, therefore, not be amiss to point out that such visitors often come to Japan very inadequately equipped with necessary papers. Any kind of official work in Japan nearly always necessitates the filing of documents and certificates. It is, therefore, advisable that a person intending to transact any official business in Japan should be provided with all documents necessary. It is always advisable to have a passport or other documentary evidence of status as a British subject. Again, he should be provided with documentary evidence of his position and powers in his own firm.

ELECTRIC POWER DEVELOPMENT IN NORTHERN CANADA.

In 1906 the city of Winnipeg called upon the Board of Engineers for a report as to the available hydraulic power sites upon the Winnipeg River. On the advice received from those gentlemen, Messrs. Wm. Kennedy, jr., of Montreal, Que.; Col. H. N. Ruttan, of Winnipeg, Man., and C. B. Smith, of Toronto, Ont., who reported on April 25th of that year, the city determined to proceed with the development of what was then known as the 30-foot falls, a distance of seventy-five miles away.

Complete designs for the power plant, transmission lines and terminal station were prepared under the superintendence of Mr. Cecil B. Smith, and throughout the past two seasons the construction of twenty-five miles of tramway has been proceeded with, and is now completed. The Power Construction Department of the city under contract is now engaged in the excavation of earth upon the site of the works, and tenders are now being called, returnable on December 28th next, for the rock excavation, for the construction of concrete and other dams and for the power house building, all at Point du Bois, Manitoba. Tenders are also being received for the supply of steel towers and transmission cable, and for the erection of the transmission line between Point du Bois and Winnipeg. It is anticipated that these works will be rapidly proceeded with, and that the city will, at an early date, be supplied with its own electric power. The ultimate capacity of the works will be 60,000 horsepower under a head of 45 feet of water, and the installation at present to be made will have a capacity of 20,000 horse-power.

The Consulting Board of Engineers consists of Messrs. Col. H. N. Ruttan, chairman, and Wm. Kennedy, jr., and Prof. L. A. Herdt. The construction will be carried on under Messrs. Smith, Kerry & Chace, of Toronto, Ont., as engineers-in-charge.

Since January 1908 there have been 242 killed and 259 injured on Canadian steam railways. The least number of fatalities occurred in August, and the most in April. They were due to the following circumstances: Run over by cars, 72; explosions, 57; collisions, 23; derailments, 19; caught between cars, 13; falls, 12; struck by trains, 10; falling materials, 10; rock slides, 4; struck by passing obstacles, 4; machinery, 4; suffocated, 2; fires, 21; fumes of gas-line, 1.

THE FIFTH REPORT OF THE ROYAL COMMISSION ON SEWAGE DISPOSAL, 1908.

A Review By T. Aird Murray.

(Continued.)

Percolating Filters.

As might be expected a large amount of space is given to the various points arising in connection with percolating filters. Seventeen pages are occupied with observations and conclusions on the most suitable depths of filtering media, while 50 pages in all are devoted to the subject.

With reference to the depth of the filtering media par. 153 states:

(1) "That the deeper the filters the better the effluent. This holds both for fine and coarse material, assuming good distribution and aeration."

(2) "For practical purposes and assuming good distribution, the same purification will be obtained from a given quantity of coarse material, whether it is arranged in the form of a deep or of a shallow percolating filter, if the volume of sewage liquid treated per cube yard be the same in each case."

Thus a filter, 3 feet deep, worked at the rate of x gallons per square yard per day would give similar results to a filter 6 feet deep, worked at the rate of 2 x gallons per square yard.

In the absence of clogging, the balance would be slightly in favor of the deep filter, because the greater the depth the more the errors of distribution would be neutralized."

A limit to shallowness is fixed at 3 feet. The Commissioners do not recommend the use of fine material for percolating filters." But when a liquor may be so free from suspended matter, that fine material may be used, they recommended shallow filters rather than deep ones.

No mention is made by the Commissioners of the maximum efficient depth, but there is probably an economical limit which may be found between 6 and 9 feet.

Par. 133.—Comparative tests made on 3 percolating filters respectively 8 feet, 6 feet and 3 feet deep of the same super area medium sized clinker receiving liquor at the same rate per square yard.

Grains Per Gallon.

	Shallow filter 3 feet deep.	Medium filter 6 ft. deep.	Deep filter. 8 feet deep.
Free ammonia.	2.6	2.4	2.2
Alb. ammonia.20	.18	.14
Oxygen absorbed by permanganate in 4 hours.....	1.1	.8	.50
Nitrogen as nitrates.....	.84	1.10	1.30
Total solids.....	65.0	66.0	65.0
Koch's gelatine and incubation test.	Fairly satisfactory.	Satisfactory.	Very satisfactory.

The Commissioners prove by further experiments that if in the case of the deep filter the same cubic quantity of material was arranged to cover a large surface so that there was only a depth of 3.0 instead of 8 feet, similar satisfactory results would be obtained.

The importance of this point is obvious to engineers. So often is it impossible to obtain sufficient fall without resource to pumping, that shallow filters are often a necessity. The point to be observed is that the shallow filter shall contain cubic contents equal to the deeper. In fact the size of the filters in proportion to the amount of sewage to be treated is a question of gallons to the cubic yard of filtering material within certain limits of depth, from 3 feet 0 inches to 9 feet 0 inches.

Filtering Material.

Par. 139, with reference to the nature of the filtering material and purification effected, experiments were carried out at York with different materials. These are of considerable interest. A percolating filter 100 feet diameter was used with a revolving distributor feeding the sewage liquor. The filter was divided into four segments each, independent of each other. Each segment was respectively filled with clinker, broken

bricks, blast furnace slag, gas coke, all of 1 1-2 to 3 1-2 inches diameter.

Result of analysis of the average of 24 samples from each segment.

Parts in 100,000.	Clinker.	Coke.	Slag.	Broken brick.
Ammoniacal nitrogen ...	0.01	0.06	0.05	0.21
Albuminoid nitrogen	0.10	0.10	0.12	0.15
Oxidized nitrogen	2.90	2.47	2.32	2.48
Total nitrogen	3.18	2.95	2.72	2.88
Oxygen absorbed at 27° C. at once.	0.38	0.49	0.63	0.63
Oxygen absorbed at 27°C. in 4 hours.	1.46	1.27	1.48	2.23
Dissolved oxygen taken up in 24 hours at 18°C.	0.09	0.19	0.24	0.37
Dissolved oxygen in C.C. per litre	0.65	1.32	1.72	2.57
Solids in suspension.	2.15	1.22	1.73	2.00
Solids by centrifuge (vols.).	33.5	24.4	20.5	37.00
Ratio of solids in suspension to centrifuge solids.	1:15.6	1:20.4	1:17.3	1:15.0
	all	all	all	all
Incubator test (scudder)	passed	passed	passed	passed
	all	all	all	all
Incubator test (by smell)	passed	passed	passed	passed
Smell when analyzed.	all good	all good	all good	all good

It will be seen if we differentiate between the above, the following order of merits is the case.

- (1) Clinker.
- (2) Coke.
- (3) Slag.
- (4) Broken brick.

These results go to prove that as in the case of contact beds good hard burnt furnace clinker cannot be beaten as filtering material for sewage.

The Commissioners further point out that better results are obtained by filtration through clinker than through pebbles. The rate of filtration in the latter being too rapid.

Par. 141.—Defines filtering materials thus:—

- Coarse, 2 1-2 inch to 3 inch diameter.
- Medium, 1-2 inch to 1 inch diameter.
- Very fine, under 1-4-1-2 inch diameter.

The Commissioners, however, do not lay down any hard and fast rules as to size of filtering media, but only give general suggestions such as "the size of the filtering material should depend very largely, upon the amount and character of the suspended matter in the liquid to be filtered." This is all that could be expected and the decision as to the most suitable size of material must be left to the judgment of those entrusted with the works. The Commissioners are, however, in favor of medium sized material as producing the best effluents, with ordinary sewage.

Pars. 156-157.—Deal with the various methods of feeding percolating filters. The main point of any distributor being that "it distributes the liquid uniformly over the whole filtering area." Many of the various types are discussed, but no recommendations are made as to the best form of distributor to adopt. We are treated to an elaborate list of defects of each system, and may conclude to avoid all the systems in use and yet be in the position to have to chose one or the other.

However, there are many improvements which have been made in distributors, especially on the revolving type, since the Commissioners obtained their evidence, and engineers will have little difficulty on this score in making a choice after careful study and examination of the types in use. For example, the improved open trough arm sprinkler is not referred to, which entirely gets over the difficulty in the older type in which the perforations in the pipe arm were liable to choke. With reference to the Stoddart dripping trays and tipping troughs, the Commissioners have to say that "the distribution is seldom perfect and that they are more suitable for small plants than for large installations."

Par. 95.—With reference to the amount of sewage which may be safely passed through percolating filters, there is a

large amount of evidence, and the conclusions, are, for the purposes of this review condensed into the following table.

Strength of Sewage in parts per 100,000 of suspended matter.	Grade of Material.	Gallons per cubic yard per day.	Material to be cleaned once in years.
30	3 in. diameter and upwards	50	2 years
10-20	"	100	10-15 years
4-7	"	100 to 150	
1-4	"	150 to 200	
30	1-2 in to 1 in. diameter	25	2 to 3 years
10-15	"	50	3 to 4 years
4-7	"	75-100	3 to 5 years
1-4	"	150-200	1 to 2 years
4-7	1-4 inch diameter	75-100	4 to 5 years
1-4	"	150-200	4 to 5 years

The above may be taken as within safe limits, there are cases within the author's knowledge where larger rates of flow have been continued with satisfactory results. In designing plants, the above data allow ample factor of efficiency, unless of course, there are exceptional characteristics appertaining to the sewage to be dealt with requiring exceptional treatment.

Par. 159 contains the following statement:—"It is not necessary for purposes of aeration to expose the sides of a percolating filter to the atmosphere, in order to obtain good results." In fact, it has been amply shown that sufficient air is always drawn into the filter from the top surface, provided that drainage and sub-ventilation are good. The Commissioners, therefore, lay great stress upon ample base drainage and the necessity of providing a layer of coarse material around and over such drains.

Pars. 162-164.—With reference to fungoid growths there is practically nothing new, and the general custom of giving the filters 2 to 3 days rest will prove an efficient remedy. These growths generally appear during the first 6 or 7 weeks of working, and after rest the growths do not as a rule reappear.

Relative Cost of Contact Beds and Percolating Filters.

Par. 166.—The Commissioners in considering the relative cost of contact beds and percolating filters, as in the case of contact beds assume:

"That ample fall is available." "An average domestic sewage which would require 100 parts of oxygen by weight, for the oxidation of the organic matter contained in 100,000 parts of sewage." A flow of 1,000,000 gallons per day dry weather. In time of storm, twice the dry weather flow is passed through the filters.

Para. 167.

Comparison Between Contact Beds and Percolating Filters.

Preliminary Process	Strength of Tank liquor in parts weight of oxygen per 100,000 required for the oxidation of the organic matter	Amount of Suspended matter in Tank liquor (parts per 100,000)	Contact Beds		Percolating Filters	
			Rate of Filtration per cubic yard per day	Cubic contents of filtering material required to treat 1,000,000 gals. per day	Rate of Filtration per cubic yard per day	Cubic contents of filtering material required to treat 1,000,000 gals. per day
			Gals.	cu. yds.	Gals.	cu. yds.
Quiescent Settlement with chemicals	50	1 to 4	140	7,143	175	5,714
Continuous flow settlement with chemicals	60	3-6	85	11,765	150	6,666
Quiescent Settlement without chemicals	70	5-8	55	18,182	100-125	8,928
Continuous flow settlement without chemicals	80	10-15	40	25,000	75-100	11,494
Septic Tank	80	10-15	40	25,000	75-100	11,494

From the above it will be at once apparent that in the case of percolating filters there is a great saving in filtering media as against contact beds.

Par. 168.—Initial cost of contact beds and percolating filters:—

	Contact beds.	Percolating filters
Quiescent settlement with chemicals	\$42,635	\$36,880
Continuous flow settlement with chemicals	74,590	44,180
Quiescent settlement without chemicals	110,400	52,980
Continuous flow settlement without chemicals	114,230	69,120
Septic tanks	114,230	69,120

From the above the initial cost of percolating filters is in each case less than that of contact beds. In connection with the above 15 per cent. has been allowed for engineering and contingencies, and \$1.50 per cubic yard for filtering material. All tank work of both base and walls is of concrete, and all of the best workmanship. It will be observed that as far as the initial cost is concerned, that with chemical treatment such systems work out at the least cost. When, however, the cost of up keep is considered the systems without chemicals work out at cheaper rates.

Par. 176 gives us the estimated cost per annum, taking into account the cost of land required at \$500 per acre, labor and supervision, loan charges at 3 1-2 per cent. per annum repayable in equal instalments over a period of 30 years, chemicals and all other charges.

Total cost of complete treatment per annum.

PRELIMINARY PROCESS	CONTACT BEDS.			PERCOLATING FILTERS.		
	Total Cost of Preliminary Treatment.	Total Cost of Filtration Process.	Total Cost of Complete Treatment.	Total Cost of Preliminary Treatment.	Total Cost of Filtration Process.	Total Cost of Complete Treatment.
Quiescent Settlement with Chemicals	\$6,290	\$ 4,000	\$10,290	\$6,290	\$2,660	\$9, 55
Continuous Flow Settlement with Chemicals	5,670	5,895	11,570	5,670	3,305	8 980
Quiescent Settlement without Chemicals	3,620	8,365	11,990	3,620	3,830	7-450
Continuous Flow Settlement with Chemicals	2,820	10,160	12,980	2 820	4 800	7,625
Septic Tanks	3,145	10,160	13,305	3,185	4,800	7,945

It now becomes apparent in accordance with the Commissioners estimate that the cheapest method in the above systems when up keep is concerned is that of continuous flow settlement without chemicals followed by percolating filter treatment. The difference between percolating filters and contact beds preceded by continuous flow settlement amounts to an annual sum of \$5,355 in favor of the former per each 1,000,000 gallons of sewage treated per day. Taking it that 1,000,000 gallons of sewage represents a population of 10,000 people, viz., allowing 100 gallons per head per day, the annual cost of continuous flow settlement with percolating filters would amount to 75 cents per head per annum.

It must be noted that these estimates are only of comparative value as far as Canada is concerned, as they are figured out on the basis of the price of labor and material in Great Britain. They are, however, slightly higher than the estimates in the Report as £1 has been taken at a value of \$5 and not at \$4.83 for the purposes of this review.

Relative Efficiency of Contact Beds and Percolating Filters.

Par. 178.—The Commissioners adopt a unit standard of purification by which effluents from various filters may be compared as to their degree of purity, thus: "to express the number of units of purification effected by a filter, we have deducted the number of parts by weight of oxygen taken up by 100,000 parts of the effluent from the filter, from the number of parts by weight of oxygen taken up by 100,000 parts of the liquor going onto the filter. The figure so obtained has been multiplied by the number of gallons of liquor, per cube yard, passing through the filter in 24 hours. The Commissioners then proceed to give the results of a large number of experiments testing the relative efficiency of the two systems of filtration. The results are tabulated in par. 189, thus:—

	Units of Purification per cube yard.
Crude or partially settled sewage treated on double contact beds	3,000-4,000
Crude or partially settled sewage treated on percolating beds	2,500-3,500
Well settled sewage treated on percolating filters	7,000-11,000
Septic tank liquor treated on single contact beds	3,000-4,500
Septic tank liquor treated on double contact beds	3,500-4,500
Septic tank liquor treated on percolating filters	7,000-11,000

Precipitation liquor treated on single contact beds	up to 11,000
Precipitation liquor treated on double contact beds	6,000—7,000
Precipitation liquor treated on percolating filters:—	
(a) Filters of coarse material	up to 8,000
(b) Filters of fine material	up to 18,000

Par. 190.—Taking into account the gradual loss of capacity of contact beds, a cube yard of material in the form of a percolating filter will generally treat satisfactorily nearly twice as much tank liquor as a cube yard of material in a contact bed.

Percolating filters are better adapted to variations of flow than contact beds.

Par. 191 contains numerous results of experiments showing the strengths of various sewages, and effluents from settlement tanks and septic tanks. The results are condensed further on in paragraph 283. It will be interesting here to compare the effluent liquors from continuous flow settlement and septic tanks, as these will in the majority of cases be the form of liquor usually dealt with.

Parts in 100,000:

Strong Sewage.

Ammoniacal nitrogen	Oxygen absorbed in 4 hours	Suspended solids
7.5	20	40

Continuous flow settlement for 15 hours	Septic Tanks. 24 hours continuous flow.
---	---

Settled Sewage Liquor	Septic Tank Liquor
Ammoniacal nitrogen 7.0—7.5	Ammoniacal nitrogen 8.0 to 8.5
Oxygen absorbed in 4 hrs. 12.0	Oxygen absorbed 4 hours 13.0
Suspended solids 15—20	Suspended solids 15.0 to 20.0

Average Sewage.

Ammoniacal nitrogen	Oxygen absorbed in 4 hours	Suspended solids
4.0	10—12	28-30

Continuous flow settlement for 15 hours	Septic Tanks. 24 hours continuous flow.
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Settled Sewage Liquor	Septic Tank Liquor.
Ammoniacal nitrogen 3.8	Ammoniacal nitrogen 4.5—5.0
Oxygen absorbed in 4 hrs. 7.5	Oxygen absorbed in 4 hrs. 7.5
Suspended solids 10—15	Suspended solids 10—15

Weak Sewage.

Ammoniacal nitrogen	Oxygen absorbed in 4 hours	Suspended solids
2	7—8	20

Continuous flow settlement for 15 hours	Septic Tanks 24 hours continuous flow
---	---------------------------------------

Settled Sewage Liquor	Septic Tank Liquor.
Ammoniacal nitrogen 2.3	Ammoniacal nitrogen 2.5
Oxygen absorbed in 4 hrs. 4.0	Oxygen absorbed in 4 hrs. 4.0
Suspended solids 7-8	Suspended solids 7-8

It will be noted that there is very little to choose between the two liquors as far as sewage strength is concerned, if anything the liquor from the ordinary settlement tanks is the weaker.

The reduction of oxygen consumed in every case in the liquors is not the result of any oxidation of the sewage in the tanks nor does it point to any degree of purity attained with regard to the total bulk of sewage. The retention of a portion of the solids in the sewage naturally produces a liquor of less organic strength than would be the case with the whole

mixture. This point is worthy considerable notice, as the reduction of oxygen consumed in tank liquors such as above has led inexperienced persons to the belief that absolute purification or oxidation of sewage takes place in such tanks. This fallacy is often put forward in behalf of septic tank liquors and the apparent degree of purity shown in amount of oxygen consumed, claimed as some peculiar property or characteristic appertaining to septic action. It will be seen, however, that if this claim were good, it equally and even to a greater extent applies to ordinary sedimentation tanks.

It should be noted that in connection with septic liquor the above data of strength only apply to such liquor when the tanks are regularly and frequently cleaned out, say every 4 months. After that period there is a decided rise in the strength of the sewage liquor, for instance:

	Character of sewage	Sludged	Solids in liquor parts in 100,000
Accrington.	Strong domestic	6 months frequently	19.0
Exeter main works	Trade and domestic	but only partially	12.5
Leeds	Trade and domestic	2 years	25.7

In the case of ordinary sedimentation tanks the strength of the liquor continues constant. So also in the case of septic tanks when regularly sludged.

From the above it is apparent that the effluent liquors vary considerably, the septic tank liquor becoming stronger than that from the continuous flow tank while the amount of suspended matter has a tendency to increase. This is the penalty which has to be paid, however, for the benefit of a 25 per cent. reduction of sludge.

In the case of the above the crude sewage showed the presence of 100,000 b. coli per c.c. In the case of the septic liquor no reduction takes place, whereas, in the continuous flow settlement liquor, b. colic is reduced to 1,000 to 10,000 per c.c.

Purification of Sewage by Treatment on Land.

Under this head the Commissioners have very little to add to what is already known on the subject. The net results simply confirm the conclusion that suitable soil is capable of giving good results, and unsuitable soil, such as clay and peaty land is useless for the purpose.

Par. 210 lays great stress upon the management of sewage farms. The Commissioners say "we think it would be useful that farm managers should be taught some simple test or tests to enable them to follow the operations of the land; that their instructions should include a definite order to consider the farming results as quite secondary to the production of an effluent of the required standard."

Par. 194 contains the important statement: "Our investigations have not shown that there is any essential bacteriological distinction between effluents from land and effluents from artificial filters, though effluents from land usually contain fewer micro-organisms than effluents from artificial filters." "The bacteria in the filter effluents can, however, be largely reduced, if this is necessary, by some additional process, such as sand filtration or sterilization."

With reference to cost the Commissioners conclude par. 222, "Assuming that really suitable land can be purchased at \$500 per acre, land treatment of sewage is probably cheaper than artificial treatment, but when the soil is unsuitable, the cost of land treatment would probably be greater than most of the artificial processes.

Sludge.

Twenty-nine pages of the Report are devoted to the subject of sludge disposal. This is admittedly one of the great difficulties in dealing with sewage. It is pointed out that the processes of converting sludge into marketable manure are rapidly diminishing year by year. Kingston-on-Thames is quoted, where the corporation on termination with their contract with the "Native Guano Co." "have now arranged to pay the company so much per ton to take the sludge." The

knowledge, however, that the market value of sludge is below par is common property.

The average cost to authorities for pressing sludge amounts to from 93 cents to \$1.50 per ton. Out of the twenty-one cases quoted by the Commissioners, it is noted that in ten cases it is given away free of charge and in the remainder the prices obtained range from 12—25 cents per ton. There is certainly not much encouragement here for installing expensive sludge pressing machinery.

Pars. 241 and 243 deal with the question of burial of sludge in land. The cost being from 8 cents to 14 cents per ton of wet sludge. This process, however, is practically only available on sewage farms, or where farmers contingent to the works are willing to take the sludge.

Par. 244.—Lagooning or air drying is described. This process is applied at many sewage works. It can be carried out either in beds made in the land for the purpose drained with clinker, or in special tanks constructed to receive the sludge, when lime is added to the sludge it is usually spadeable in two or three days.

Other methods of disposal are also mentioned, but no recommendations or conclusions on the subject are provided, and engineers and authorities are left pretty much as they were to be guided by the local circumstances of each place.

Effect of Trades Effluents on Sewage Purification.

Par. 270.—Here we have the important statement, "All the trade effluents of which we have had experience interfere with or retard processes of purification to some extent, but we are not aware of any case where the admixture of trade refuse makes it impracticable to purify the sewage either upon land or by means of artificial processes, although in certain extreme cases special processes of preliminary treatment may be necessary." Details are given of cases where some modifications have had to be adopted in consequence of the presence of trade wastes, such as those from breweries, wool-scouring, galvanizing works, dye works, tanneries and other industries. There are really no points, however, made evident which are not already familiar to sewage engineers.

Nuisance from Smell at Sewage Waters.

Par. 273.—"All sewage works are liable, at times, to give off unpleasant smells, and they should, therefore, be situated away from dwelling houses." "The extent of the risk of nuisance depends, however, not only on the character of the sewage, but also on the method of treatment."

Par. 274.—"Septic tank treatment is more offensive than simple sedimentation. During sludging operations, sulphuretted hydrogen is given off."

In this connection the practice in the United States of America may be noted, where it is considered advisable to reduce the risk of smell by using septic tanks of a capacity of eight hour flow, providing coarse grain filters which allow a large amount of suspended matter in the liquid to pass through into the filtrate, arresting it in the final effluent.

Par. 278.—It is an acknowledged fact that percolating filters are generally attended with smell. Especially is this the case when the foul liquor from septic tanks is treated. The Commissioners deal very fully with various suggestions for overcoming the difficulties by adding chemicals as deodorants to the septic liquor. Engineers will probably prefer to avoid the use of chemicals as the difficulty has been overcome elsewhere by other means.

Choice of a Method of Sewage Treatment.

Par. 282.—"The selection of a method of sewage disposal, and the settlement of details in connection with any method which it is proposed to adopt, should depend primarily on local conditions." The Commissioners then proceed to make several observations based upon the conclusions they have already come to, and attach an elaborate "genealogical tree," showing the various degrees of purification effected by the various processes already named, on sewages of different strengths. The final settlement of any one scheme, however, within the lines of the Report is left to the discretion of those responsible for any particular work.

Storm Water.

Par. 295.—"That special stand-by tanks (two or more) should be provided at the works and kept empty for the purpose of receiving the excess of storm water which cannot properly be passed through the ordinary tanks," as regards the amount, "the rate of flow through the ordinary tank may usually be increased up to about three times the dry weather flow, without serious disadvantage." Engineers will at once see the value of the first part of this paragraph. It is usually with the first rush of storm water that the strongest sewage is discharged owing to the extra flush after dry weather.

Standard for Sewage Effluents.

Par. 322.—"For the guidance of local authorities we may provisionally state that an effluent would generally be satisfactory if it complied with the following conditions:—

(1) That it should not contain more than three parts per 100,000 of suspended matter.

(2) That, after being filtered through filter paper, it should not absorb more than:—

(a) 0.5 part by weight per 100,000 of dissolved or atmospheric oxygen in twenty-four hours.

(b) 1.0 part by weight in four hours

(c) 1.5 part by weight in five days.

"At many sewage works which we have under observation effluents of this class are uniformly produced."

Pollution of Estuaries and Tidal Waters.

This question is dealt with very shortly in pars. 330—331 as it was treated with fully in the fourth Report. There is one point, however, which the Commissioners do not deal with, and that is the practicability of the sterilisation of effluents. This is much to be regretted as important conclusions have been arrived at by the United States Department of Agriculture dated 1907. In the case of discharging sewage into tidal basins when there may be shell fish beds, some method of sterilisation apart from mere purification as understood appears essential.

The remaining portion of the report is taken up with legislative suggestions with which it is unnecessary to deal with here. We will, therefore, conclude with the general conclusion of the Commissioners:—

"We are satisfied that it is practicable to purify the sewage of towns to any degree required, either by land treatment or by artificial filters, and that there is no essential difference between the two processes, for in each case the purification, so far as it is not mechanical, is chiefly effected by means of micro-organisms. The two main questions, therefore, to be considered in the case of a town proposing to adopt a system of sewage purification are, first, what degree of purification is required in the circumstances of that town and of the river or stream into which its liquid refuse is to be discharged; and, second, how the degree of purification required can, in the particular case, be most economically obtained.

The question of the removal of snow from the streets of Montreal in the winter has been discussed before the Road Committee times without number. The refusal of the Street Railway to pay its proportion of the cost of removal, last winter, for the reason that the service had cost too much and almost twice what the company would have performed the work for, resulted in the opening up of the whole subject once more. It is possible that the work will now be divided between the company and the city, thus furnishing a means for comparing costs. A few days ago, however, the suggestion that the snow be melted was again made. The proposal came from Alderman Ward, who offered further details of the scheme. It was his idea that wells should be sunk at intervals. These wells should be connected with the sewers. The snow would be dumped into the wells and melted with steam. This, he claimed, could be done at a lower cost, everything considered, than that of the present service. The suggestion received attention.

A PAGE OF COSTS

ACTUAL, ESTIMATED and CONTRACTED

THE COST OF EXCAVATING GRAVEL IN A CANAL WITH A 65 TON SHOVEL.

Mr. J. B. Brophy, of Trenton, Ontario, Canada, division engineer of the Trent Canal, Department of Railways and Canals, furnished the following data as to the working of a steam shovel under him for the month of June, 1908.

The work was done at the canal near Trenton, Ontario. The material was a gravel. The cutting was 10 1-2 feet deep and was side cutting, the material being loaded into cars as high as the machine would reach. From June 1 to 13 the shovel excavated 16,000 cubic yards, the average haul being 1,200 feet. From June 15 to 30, 20,000 cubic yards were excavated, the average haul being 1,400 feet. This makes a total of 36,000 cubic yards with an average haul of a little more than 1,300 feet.

The outfit used on the work consisted of the following: A 65-ton steam shovel with a 2 1-2 cubic yard dipper, made by the Bucyrus team Shovel Co., of South Milwaukee, Wis. Two 12-ton Porter dinkeys. About 1-8-mile of track was used and 22 dump cars of 4 cubic yards capacity. The cost of this outfit was approximately as follows:—

65-ton shovel	\$9,000
2 12-ton dinkeys	5,000
22 4-yd. dump cars at \$230	5,060
16 tons 20-lb. rails at \$32	512
1,000 ties at 10 cents	100

Total \$19,672

Estimating 2 per cent. for monthly interest, depreciation and repairs, gives a charge per month of about \$390.

The shovel worked 12 hours per day, but the track gang and water wagon only worked 10 hours per day. We assume the standard wages on this class of work, which are:—

70-Ton Shovel Working in Clay.

Shovel runner	\$125.00 per mo.
Craneman	90.00 per mo.
Fireman	60.00 per mo.
Watchman	40.00 per mo.
Dinke runners	3.00 per day
Brakemen	2.00 per day
Foreman	3.00 per day
Oiler	1.75 per day
Laborers	1.50 per day
Water boy	1.00 per day
Teams	5.00 per day

During the month 26 days were worked. The total cost of the work and the organization of the forces were:—

Loading:

1 Shovel runner	\$125.00
1 Craneman	90.00
*Adapted from Engineering-Contracting.	
1 Fireman	60.00
4 Pitmen	156.00
1 Team hauling water	180.00
50 Tons coal at \$5.00	250.00
Oil, waste, etc.	10.00

Total \$871.00

Hauling:

2 Dinkey runners	\$156.00
2 Brakemen	104.00
1 Oiler	45.50
1 Trackman	39.00
60 Tons coal at \$5.00	300.00
Oil, waste, etc.	16.00

Total \$660.50

Dumping:

1 Foreman	\$ 78.00
16 Laborers	624.00
1 Water boy	26.00

Total \$728.00

Miscellaneous:

1 Superintendent	\$150.00
1 Timekeeper	65.00
1 Watchman	40.00

Track gang:

1 Foreman	78.00
5 Laborers	195.00
Interest, depreciation and repairs (estimated)	390.00

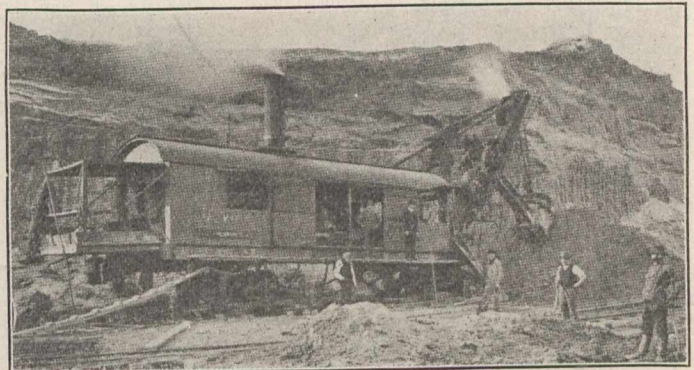
Total \$908.00

Grand total \$3,177.50

The cost per cubic yard of material excavated was:

Superintendence	\$0.007
Loading	0.024
Hauling	0.018
Dumping	0.020
Track work	0.008
Interest, depreciation and repairs (estimated)	0.010

Total \$0.087



The yardage moved in one shift is very large for this size shovel. For another output of a 65-ton Bucyrus shovel see Engineering-Contracting, August 5, 1908, page 82. On the Trent Canal 1,385 cubic yards were moved in a 12-hour shift, which would be at the rate of 1,155 cubic yards in 10 hours, of 115 cubic yards per hour. When it is remembered that only 4-yard cars were being loaded and the bank was only 10 1-2 feet high, this record is a very good one. It means that the shovel was actually digging earth about one-half of its time. These are the reasons for the very low costs.

The contractors on this work are Larkin and Sangster, of St. Catharines, Ontario. Mr. J. H. Wallace is superintendent in charge of the work.

EXCAVATING CEMENTED GRAVEL.

In a clay cut on railway work in Ontario County, Ontario cemented gravel was encountered. The bed of gravel lay along the bottom of the cut, and required a cutting of from eight-tenths to four feet. The gravel bed was so hard that a pick would only enter it about one and a half inches, but the extent of work was so small that the contractor did not feel justified in purchasing a pick plough.

The work required 5 pickers for 4 shovellers with, in addition, one man on the dump. The material had to be hauled up to one thousand feet and four, and towards the end six carts were required, on the work.

In all 500 cubic yards were moved at a total cost of \$387 or 77 2-5 cents per cubic yard.

The cost was distributed very much as follows:

Shovellers:	
1,016 hours at 15 cents per hour	\$152.40
Pick men:	
817 hours at 15 cents per hour	122.55
Dumpman:	
101 hours at 15 cents per hour.....	15.15
Carts:	
543 hours at 18 cents per hour	97.74
	\$387.84

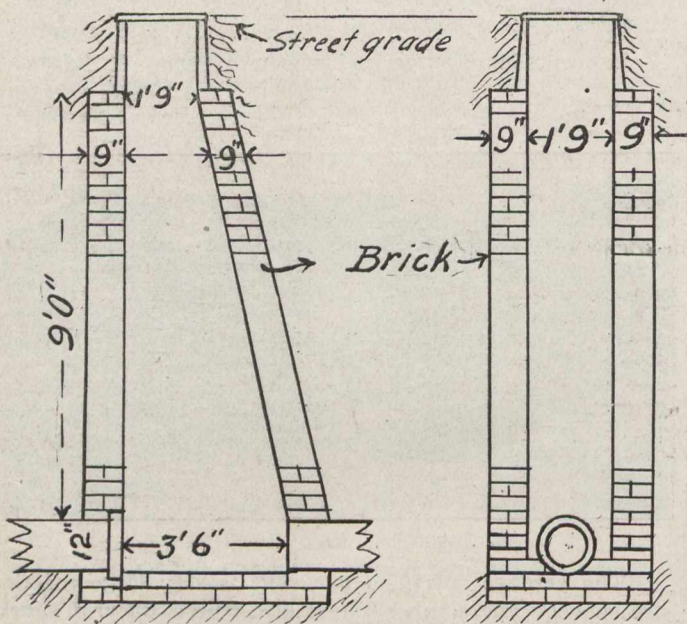
From this it will be seen that the cost of picking or loosening of the material comprised about one-third of the total cost.

BRICK MANHOLE.

Brick is almost universally used for manholes. The one illustrated in the diagram does not show steps. Steps, however, were placed and the cost of the manhole includes placing of steps, covers and 12-inch sewer pipe, but does not cover the cost of material in these three items.

The Cost of Material Was:

1,400 brick at \$10 per M.....	\$14 00
12 bags of cement at \$2 per barrel.....	6 00
1 cubic yard sand.	1 00
	\$21 00



Brick Manhole.

Cost of Labor.

Bricklayers, 12 hours at 50 cents per hour..	\$6 00
Bricklayer's helper, 16 hours at 25 cents per hour.	4 00
	\$10 00

Total cost. \$31 00

Or 1,000 brick in place cost \$22.15.

The brick were laid in cement mortar.

Considerable discussion has been going on in Montreal regarding the proposal of Mr. George E. Drummond to place four street car tracks on Craig Street—which should be widened for that purpose—in order to remove the tracks altogether from the central section of St. James Street, that street being now too crowded with pedestrians to permit of the operation of cars at certain times of the day. Following this, has been a number of other suggestions from many public men, among these being elevated railways and underground tubes. The consensus of public opinion is that something will have to be done ere long to relieve the congestion and that the scheme, whatever it may be, should be a comprehensive one which will also include rapid transit from the central to the outer districts of the city.

GROUNDING TRANSMISSION MEDIUMS—I.

By J. Stanley Richmond, Consulting Engineer, Toronto, Ont.

Historical.

The history of the use of the earth or of grounded metallic substances as portions of the mediums whereby engineers have carried out practical electrical transmission would almost read like a romance.

First among the engineers to so use the earth were the telegraphists, prominently represented by Mr. W. H. Preece (now Sir William H. Preece), who, up to or about 1899, was for many years engineer-in-chief and electrician to the British post office. It can be easily understood that in such a position and controlling the telegraphs of that country (which are operated by the government) the British authorities were more inclined to make regulations to suit the electrical requirements of Mr. Preece's department than to suit the electrical requirements of the general public; so that, in the eighties, they formulated rather strict regulations to govern the use of grounded returns. Thus it was that electric traction was much delayed in the British Isles; the public of which country, when they finally awoke to the fact that their traction facilities were much behind those of some other countries (such as the United States of America), brought pressure to bear on their parliamentary bodies to again take up this question with the view to make the regulations less restrictive. A joint committee of the House of Lords and Commons was, therefore, appointed in 1893, with the result that a considerable amount of evidence was taken before it and published in one of the blue-books under the title "Electric Powers (Protective Clauses)." A short abstract of such evidence, from an electrolytic corrosive point of view, is as follows:—

Sir Courtney Boyle—The government should, in drawing up regulations, consider the telegraphs first. Referred the committee to Major Cardew.

Mr. W. H. Preece—Had been on the lookout for electrolytic corrosion but, up to the time of his evidence, had been unable to find such. Referred the committee to Major Cardew, who decided that the judicious connection of pipes to rails would prevent detrimental action.

N.B.—Sir William and Major Cardew have, during the past few years, acted jointly as consulting engineers in connection with the installation of single trolley systems in England.

Dr. John Hopkinson—Was pretty common observation, both in England and the United States of America, that pipes became oxidized and had holes eaten in them.

N.B.—Dr. John, for some time previously to his deplorable loss with other members of his family during one of his Alpine excursions, acted as consulting engineer (engineer) to the Liverpool tramways committee during the construction of the first portion of their electrical traction system. Sir Arthur Forward, who, up to the time of his death (about the same time as Dr. John's) was the chairman of this tramways committee, was one of the members of the joint committee.

Lord Kelvin—Grounded returns were a serious menace to pipe systems. It was useless for any one to come in to protect the Glasgow corporation's pipes from their own street railway system.

N.B.—Glasgow uses the single trolley.

Mr. G. E. Fletcher (L. & N. W. Railway)—Grounded returns resulted in detrimental action. Such could be avoided by connecting the pipes to the rails. Trouble would, anyway, result at bad pipe joints.

Mr. C. H. Morse (Boston, Mass.)—A report by him on conditions in Boston submitted—track returns in Boston were in a bad state; and that a considerable loss of power to the company and damage to the pipe resulted, but that such was preventable.

Mr. C. E. Spagnoletti (G. W. Railway)—Non-committal; and his evidence, in the main, of a chemical nature.

Mr. James Swinburne—Electrolytic action, as a result of grounded returns, by no means necessary. Favored connec-

tions between pipes and rails. Electrolysis more serious to companies operating traction systems than to companies operating pipe systems.

Mr. R. E. B. Crompton—Considered electrolytic corrosion, as a result of thorough investigations made in London,

a negligible factor. That the action of certain soils in London was much greater than the action due to electrolysis.

N.B.—London soil is mostly marl.

Major Cardew (Board of Trade)—Electrolytic damage could be avoided by ordinary care. Proper precautions taken

Investigator.	Locality	Date.	Publication	Remarks.
Adams		January, 1900	Municipal Engineer	Cause and Remedy
Barrett	Brooklyn, N.Y.	Jan. 18, 1895	Railroad Gazette	Report to commissioners of electrical subway
"	"	Jan. 26, 1895	Street Railway Gazette	Report to commissioners of electrical subway
"	"	Feb. 23, 1895	Engineering Record	Report to commissioners of electrical subway
Bridgden	Battle Creek	April 15, 1900	Engineering Record	Injury—Map
"	"	vol. 8, No. 6, 613	Cassier's	Protecting pipes
"	"	vol. 5, No. 12, 739	Street Railway Review	Potential readings
Brown	Newark, N.J.	Dec. 15, 1895	Street Railway Review	Prevention
"	"	October 14, 1897	Electrical Engineer	American and European practice
"	"	March, 1899	Domestic Engineer	Testing and protection
Brownell		June, 1900	N. E. W. Works Association.	Illustrated discussions
"		April, 1895	Cassier's	Legal aspect
"		April 6, 1895	Street Railway Gazette	Legal aspect
City Engineers	Boston	April, 1893	Report	Showing injury
Chamen	Glasgow, Scotland	June 7, 1898	Journal Gas Light	Report
Committee		Sept. 1, 1894	Am. W. Works Association.	Preventive measures
Davis	American Cities	Dec. 1899	Municipal Engineer	Conditions in cen. state
Dayton	Dayton			Trial—Evidence
Expert Engineer	St. John, N.B.	Jan. 4, 1894	Engineering News	Pipe breakage
"	"	March 29, 1894	"	Broken returns
"	"	Jan. 26, 1899	"	Abstracts of report
"	Jersey City	Feb. 2, 1899	"	Abstract Knudson's report
"	Cambridge, Mass.	Oct. 14, 1893	Engineering Record	Increased bonding
"	Milwaukee, Wis.	Oct. 14, 1893	"	Pipe-rail connections
"	Jersey City	Feb. 11, 1899	"	Illustrated report
Farnham		April, 1894	Transactions A. I. E. E.	Paper
"		April 7, 1894	Engineering Record	Abstracts of paper
"		April 21, 1894	Street Railway Gazette	"
"		April 25, 1894	Electrical Engineer	"
"		May 3, 1894, etc.	Engineering News	Corrosion of pipes conclusively shown
"		May 11, 1894	Railroad Gazette	Corrosion of pipes conclusively shown
"		May 25, 26, 1894	Engineering Record	Corrosion of pipes conclusively shown
Gray		Jan. 3, 1896	Electrical Review, London.	Re work of Smith, Jenkins, Brown and Wilkinson
Herrick		June, 1898	Engineering Magazine	General treatment
"		May 5, 1900	Street Railway Journal	Paper N. E. Society
Hewitt		July, 1896	Journal Franklin Institute.	General treatment
Hoopes		May 25, 1895	Electrical World	Prevention
Irving	Bristol, England	June 5, 1900	Journal Gas Light	Paper—Prevention
Jackson		Aug. 9, 1894	Engineering News	Criticisms of experiments
"		Aug. 11, 1894	Street Railway Gazette	"
"		Aug. 17, 1894	Railroad Gazette	"
"		September, 1894	Soc. of Assoc'd. Engineers.	"
"		Dec. 5, 1896	Electrical World	Details of experiments
Jenkins		May 15, 1900	Street Railway Review	Paper—Prevention
Keithley		September, 1894	Street Railway Review	Rail returns
Kelsey	Salt Lake City	Oct. 16, 1894	Engineering Record	Paper—Amer. W. Works Assn...
"	New York City	October, 1898	Transactions A. I. E. E.	Paper
"	"	Nov. 1898	Transactions A. I. E. E.	Discussion
"		March, 1900	American Electrician	Joint resistance
Knudson	Providence	August 4, 1900	Engineering Record	Corrosion pipe interiors
Low		February, 1895	Transactions A. I. E. E.	Prevention, bonding
Morse		March, 1893	N. E. W. Works Association.	Cause and remedy
"		July 19, 1900	Am. W. Works Association.	Paper abstract
"		May 19, 1900	Engineering Record	Railway companies responsible
Maury	Richmond, Va.,	July, 1903	Report	Report
Newbaker		February, 1900	American Electrician	General treatment
Perry		Sept. 15, 1894	Street Railway Gazette	Series method
Peoria	Peoria			Trial—Evidence
Quincke		April 27, 1895	Ztsch. Ver. Ing.	Paper—Society of Engineers
Richmond Tn. Council	Richmond, Va.,	Feb. 27, 1896	Engineering News	Ordinance—1, 23, 9
"		August, 1904	Minutes	W. Works Committee
Richmond	New York City	February, 1903	Reports	Manhattan Railway Company..
"	Richmond, Va.,	February, 1903	Reports	Investments, improvements
"	New York City	July, 1904	Report, Subway	Action unlikely
"		Oct. 8, 15, 1904	Electrical Review	Earth voltages
"		Nov., etc., 1904	Electrical Review	General tests, etc.
Rowland		May, 1897	American Electrician	Planning returns
Schoen	Richmond, Va.,		Report	Corrosion Evidence
Sever	Long Island			
Sheldon	Brooklyn, N.Y.,	May, 1900	Transactions A. I. E. E.	Cast-iron immune
Stewart	St. Joseph, M.,	July 7, 1894	Street Railway Gazette	Corrosive action
Stone and Forbes	Boston	September, 1894	N. E. W. Works Association	General treatment
"	"	June 23, 1894	Engineering Record	General treatment
"	"		Brit. I. Gas. Eng.	General
Storrs		vol. 10, No. 1, 33	N. E. W. Works Association	Paper—General
Swinburne		August 30, 1902	Electrical Review	Abstract of above
Whynkop	Brooklyn, N.Y.,	January, 1900	Popular Science Monthly	Cause—Prevention
"	"	April 29, 1900	Electrical World	Paper—Engineers' Club, Brooklyn

at the outset and proper tests made afterward would prevent appreciable damage to pipes. Regulations could be drawn up which would make the use of grounded returns safe.

Sir Frederick Bramwell (recalled)—Only way to prevent damage was by insulating both conductors.

N.B.—In 1897, his partner, when before the Liverpool tramways committee, stated that their firm had a knowledge of electrical traction work—had advised, from England, a New Zealand concern in connection with the construction of one mile of road. Their traction work, since such evidence, has been in connection with conduit systems, somewhat similar to the one in use by the surface roads of New York, N.Y.

Professor Dewar—Having no knowledge of applied electricity, was inclined to take the same views as Sir Frederick Bramwell and Dr. John Hopkinson. His evidence, in so far as the question at large was concerned, was of a chemical nature—that corrosion of pipes depended, largely, on the chemical composition and the chemical constituents of the contiguous soil.

To those who have perused the voluminous amount of matter contained in the before-mentioned blue-book, the foregoing will appear very short. Such is, however, the result of much work; being an abstract of a longer abstract of a still longer abstract of the abstracted complete portions of all the evidence bearing on electrolytic corrosion which was taken.

The second body of engineers to so use the earth were the telephonists; the bitter fight between whom and the opposing traction interests (based, principally, on the fact of inductive disturbances) is too well remembered to require much comment. It is sufficient to say, therefore, that the Supreme Court of Ohio reversed the decision (unfavorable to the traction interests) of the superior court of Cincinnati; the final portion of the finding of which Supreme Court was: "We are of the opinion that there has been no invasion of the rights of the telegraph association by the plaintiff in error, and that the telegraph association is not entitled to the relief prayed for in its petition. The judgment, therefore, of the superior court at general and special term must be reversed and the original petition dismissed. Judgment accordingly." It is assumed that the decision so reached was not based so much on the fact that each and every person has an equal right to use the earth as on two other facts: first, that a really efficient system of telephone communication can only be obtained by the use of metallic circuits; while, second and "pro bono publico" (the lowest capitalization per mile and, thereby, the greatest distance which a passenger can be hauled for a given sum), the single-trolley system is the most suitable one for general electrical traction purposes. For which reason, it can be taken for granted that no amount of evidence taken in respect to the much debated question of electrolytic corrosion would lead, finally, to "lex scripta" which would prohibit street railways from using the single-trolley system. At the same time, it ought to be remembered that a favorable verdict on account of traction interests will only, on account of "lex non-scripta" permit such interests to operate with grounded returns which are installed and maintained on the most modern and approved engineering basis. This because no one corporation has the right by neglecting to maintain its plant in the proper condition to incidentally make abnormal use of the plant of other corporations and, thereby, accidentally cause a questionable amount of damage to such other plant.

The phrase "questionable amount of damage" is used because no really independent investigator would (because he could not) ever undertake to definitely state, even approximately, what the damage caused by earthed track returns to other earthed conductors (pipes, etc.) really amounts to: while those experts who rely on the remuneration received from either one or the other side generally feel that they must work in unison with the other sailors on the ship which is carrying them. For the sailor who is independent enough to question a captain's orders will soon find that the command is given that he must be placed in durance vile or marooned on a desert island.

While much incidental literature has been written on the question of electrolytic corrosion, it does appear as if no one has had the courage to publish in some convenient shape any work dealing, in an approximately complete way, with this subject; for which reason it may not be out of place to give a short abstract of some of the literature already published, arranged in tabulated form herewith.

[Note to Article I.—Since the first publication of these articles in 1904, a book has been published by Professor Sever. Mr. Waterman, who handled the office end in New York of the work undertaken by Mr. Richmond in the famous Richmond investigations, collaborated with Professor Sever when writing this book. In the courts, the street railway of Richmond won the case and the City of Richmond, which retained Mr. Maury, lost.]

ENGINEERING SOCIETIES.

ARCHITECTURAL INSTITUTE OF CANADA.—President, A. F. Dunlop, R.C.A., Montreal, Que.; Secretary, Alcide Chaussé, P.O. Box 259, Montreal, Que.

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

CANADIAN STREET RAILWAY ASSOCIATION.—President, J. E. Hutcheson, Ottawa; Secretary, Acton Burrows, 157 Bay Street, Toronto.

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

CANADIAN SOCIETY OF CIVIL ENGINEERS.—413 Dorchester Street West, Montreal. President, J. Galbraith; Secretary, Prof. C. H. McLeod. Meetings will be held at Society Rooms each Thursday until May 1st, 1908. Annual meeting at Toronto Jan. 28, 29 and 30, 1909.

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

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

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

ENGINEERS' CLUB OF TORONTO.—96 King Street West. President, J. G. Sing; Secretary, R. B. Wolsey. Meeting every Thursday evening during the fall and winter months.

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

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

CANADIAN CEMENT AND CONCRETE ASSOCIATION.—President, Peter Gillespie, Toronto, Ont.; Vice-President, C. T. Pulfer, London, Ont.; Secretary-Treasurer, Alfred E. Uren, 62 Church Street, Toronto.

NOVA SCOTIA SOCIETY OF ENGINEERS, HALIFAX.—President, J. H. Winfield; Secretary, S. Fenn, Bedford Row, Halifax, N.S.

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

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

It is reported in Montreal that John Preston, mechanical engineer of the Nova Scotia Steel and Coal Co., who has just returned from a tour of the Eastern States, has reported in favor of the installation of a turbine generator at Sydney Mines. The Dominion Iron and Steel Company, it is thought, will also add a turbo-generator to its plant next spring.

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.

Quebec.

MONTREAL.—Tenders will be received until Dec. 23rd, 1908, for the completion of the new jail for the District of Montreal. A cheque of \$60,000 must accompany each tender, Messrs. Marchand and Brassaid, 164 St. James St., Architects. Alphonse Gagnon, Secretary Dept. of Public Works.

British Columbia.

FERNIE, B.C.—This place is advertising for tenders for the installation of a 260 horse-power gas producer plant. Tenders will be received to 12 noon, December 15th. A. A. Sharpley, acting city clerk.

VICTORIA.—The Council will call for new tenders for the two pumps for salt water high pressure. The present tender does not comply with specifications. The price will be about \$20,000.

LIGHT, HEAT, AND POWER.

Quebec.

FARNHAM.—The property and water power of the defunct Canada Wood Company has reverted to the town of Farnham by mutual arrangement with the insolvent estate, the town surrendering the machinery to the liquidator.

MONTREAL.—The Montreal Light, Heat & Power Company have declined to extend until 1910 the lighting contract with the city at present prices, i.e., \$60 per arc lamp, but offer to extend the time two months upon a rate to be decided upon during that period.

Ontario.

OTTAWA.—The concrete work in the piers of Chaudiere dam are almost completed. The low water this fall has made the work easier than was anticipated, and very rapid progress has been made since the the work was commenced in August. It is expected the piers will be completed before the cold becomes intense, so that the cofferdams will not need to be maintained during the high water next spring. The work is being carried forward under the direction of Wm. Kennedy, consulting engineer, Montreal and J. B. McRae, consulting engineer, Ottawa, and when completed will increase very materially the power possibilities of the power companies on both sides of the Ottawa River.

Alberta.

MACLEOD, ALTA.—The ratepayers of this place have voted in favor of spending \$55,000 for additions to the electric light and power plant.

British Columbia.

LADYSMITH, B.C.—This municipality is calling for tenders for \$25,000 electric light debentures. J. Stewart, city clerk.

SEWERAGE AND WATERWORKS.

Quebec.

DELORIMIER.—Town Engineer F. C. Laberge has submitted his report for sewer extension north of C. P. R. tracks and the plans have been accepted by the council. The letting of contracts was referred to the Road Committee.

MONTREAL WEST.—The Montreal Water and Power Company have taken over the contract for supplying water to the town from the Le Credit Municipale Canadien. Ample pressure will now be secured and filtered water is promised as soon as the M. W. & P. Co. install a filter.

MONTREAL.—The Worthington pump at the water-works has received its final test, and the results show that its efficiency above requirements has earned for its manufacturers a bonus of \$5,000, according to the agreement with the city. The purchase was made from the John McDougall Company, the contract providing for a capacity of 12,000,000 gallons per twenty-four hours and a duty or efficiency guarantee of 160,000,000 foot pounds per 1,000 pounds of steam consumed. For every million duty the pump fell short of the 160,000,000 the company was to forfeit \$1,000, and for every million above the city was to pay the company \$1,000, the bonus, however, not to exceed \$5,000. The test showed 175,000,000, and during the last hour of the test the pump was run at the rate of 14,500,000 gallons capacity every twenty-four hours, so that the pump in every way exceeded the requirements laid down by the city in its contract with John McDougall & Co. The cost of the pump was \$60,000.

MONTREAL.—Mr. J. R. Binning, who represented the Board of Trade on the recent official trip of inspection of the harbor and river, reported to that body at a recent meeting that the trip lasted two days and a half, and extended from Montreal to St. Thomas Flats, below Quebec, and that great progress had been made. The marine signal service has been established at eleven points along the river, and it is suggested that a Marconi wireless service be established at Three Rivers. The tender, 225 feet long and 34 feet beam, being constructed at Sorel for lighthouse service, was a credit. The building of another dredge would also soon be undertaken. Dredges were at work in Lake St. Peter. Curves were being widened to 800 feet and straight sections to 450 feet, while advances were being made towards 35-foot depths, 30 having been attained. A channel was being dredged to 1,000 feet wide and thirty feet deep at Crane Island, 600 feet of this having been completed in July last. Steps were also being taken towards the construction of a dry dock at Montreal.

NOTRE DAME DE GRACE.—The Council has accepted the arrangement by which the Montreal Water & Power Company acquired the contract from the Credit Municipale Co. to supply the town with water. The contract has seventeen years to run.

SOREL.—About two hundred feet of the Government wharf situated on the east side of the mouth of the Richelieu River, built five years ago, tumbled into the river. Those two hundred feet are the continuation of the five hundred feet that gave way some time ago, which means the whole wharf is not safe.

New Brunswick.

MONCTON.—City Engineer Edington has just presented a very complete report of the Water and Light Committee as to the advisability of increasing the city's water supply. The plans submitted would entail an approximate expenditure of \$217,000.00, made up as follows:

Embankment, including gate house, wasteway etc.	\$87,000
20-inch leading main	87,400
Cleaning bed of reservoir	5,500
Diversion of Alexander Road	1,200
Land and damages	5,000
Contingencies	6,000
	<hr/>
	\$192,100
Pumping Station	25,000
	<hr/>
	\$217,100

If nothing is done in the meantime with the larger scheme, then the only alternative is to install an additional pumping engine at a cost of about \$25,000.

Ontario.

MARKDALE, ONT.—This place is going ahead with its waterworks scheme this winter.

OTTAWA.—City Engineer Ker has reported to the City Council in favor of a booster system to cost \$40,000 in connection with the city water supply. Recent additions have increased the city area by 54 per cent. and to increase the water pressure in case of fire it is proposed to install auxiliary pumping stations and equip them with electric driven turbines. The present mains will be fitted up with check valves and gates so that in any area and more particularly in the business district a pressure of 120 pounds can be secured at the fire hydrants. Such a scheme will give the necessary fire protection and will not require extra mains &c., the installing of which would be very expensive in a city built on rock like sections of Ottawa.

OTTAWA.—City Engineer Ker has written the Ontario Board of Health regarding Aylmer's sewage disposal scheme. He pointed out that while the sewer construction is going ahead the Quebec Board of Health have not taken action, nor are they endeavoring to co-operate with the Ontario Board of Health in attempting to safeguard the water supply of Hull and Ottawa. Tests show that sewage deposits find their way down to the source of the city's water supply. If the Boards of Health do not act the City of Ottawa may be forced to take out an injunction.

PEMBROKE.—Pembroke Council are planning to extend their water works intake. The new pipe will cost \$50,000. Sand filtration is also talked of. A sand filtration plant with the new intake would cost \$90,000. Town Engineer Bryson made such a recommendation some time ago.

ST. THOMAS.—A petition has been presented by the residents of Yarmouth Heights asking for an extension of the water service along Wellington street to Fairview avenue.—City Engineer, J. J. Bell.

TORONTO.—City Engineer Rust reports that owing to the extremely dry summer a number of sewers are badly in need of cleaning. He estimates that 800 feet of hose will have to be purchased to do the work.

TORONTO.—The City Engineer has reported that approximately the following quantity of water pipe will be required during 1909: Three miles of 12-inch pipe and four or five miles of 6-inch pipe.

Alberta.

MACLEOD.—The ratepayers of this place have voted in favor of spending \$35,000 for the installation of a sewerage system.

CONTRACTS AWARDED.

Ontario.

ST. CATHARINES.—The Fire and Light Committee have recommended the purchase of 500 feet of hose, "Red Cross Brand" from Gutta Percha & Rubber Co., at 85 cents per foot, and the purchase from the Ontario Rubber Company of rubber coats at \$4.50 each, 4 sizes; \$4.75 each, 4 sizes.

Manitoba.

MANITOBA.—The Manitoba Government has awarded the contract for 25,000 telephone poles to J. L. Nelson, Winnipeg, who will during the winter months cut and distribute them to points throughout the province where they may be required for next year's construction by the Government-owned telephone system. The larger portion of this big contract for poles will be secured from the territory tributary to the Grand Trunk Pacific Railway east of Winnipeg.

British Columbia.

NEW WESTMINSTER.—Tenders were opened for the new New Westminster Lulu Island bridge as follows: For the substructure: The International Contract Co., Seattle, \$29,642; Armstrong, Morrison & Co., Vancouver, and the

Burrell Bridge and Construction Co., Seattle. For the metal, 562,500 pounds of steel, for the superstructure, there were five tenderers, the U. S. Steel Products Export Co., Canada Foundry Co., Canadian Bridge Co., Minneapolis Steel and Machinery Co., Kansas City. The first was the lowest tender, but only about \$120 less than that of the Canada Foundry Co., \$26,831.25. The contract was awarded to the International Contract Co. for the sub-structure and the Canada Foundry Co. for the superstructure. The contract price is about \$20,000 higher than the estimate price.

VICTORIA.—Tenders were opened for the supply of twenty special type hydrants for the high pressure service. These were three in number: Hutchison Bros. & Co., Victoria, \$90 or \$98 each, two forms of hydrant being tendered on; Ramsay's Machine Works, Victoria, \$140 each; Canadian General Electric Co., Vancouver, \$125 each.

RAILWAYS—STEAM AND ELECTRIC.

Ontario.

OTTAWA.—Hon. George P. Graham has fixed Dec. 17th for hearing of the application of the Canadian Northern Railway for approval of its plan of entrance to Ottawa.

British Columbia.

VANCOUVER.—The Albert Central Railway Company is applying for legislation granting it an extension of time, an increase of capital from one to two million dollars, an increase of debentures from \$20,000 to 35,000 per mile and authorizing the extensions of its line from its western terminus near Rocky Mountain House to G. T. P. at Yellow Head pass from its present terminus near Elbow of Battle River, easterly to Saskatoon or Warman, and from Red Deer southeasterly to Moose Jaw.

VICTORIA.—The Victoria and Barclay Sound Railway Company will ask for an act of incorporation. The proposed charter authorizes a line from Victoria by Otter Point and San Juan to Barclay Sound near Sarta River.

FINANCING PUBLIC WORKS.

Nova Scotia.

WESTVILLE.—A. W. McBean, Town Clerk and Treasurer, invites tenders until December 14th for \$7,000 20-year 4¼ per cent. waterworks debentures.

Ontario.

LONDON.—The Water Commissioners have decided to take in the Kilworth supply at a cost of \$125,000. This will turn at least 500,000 gallons into the city mains by June of next year. The cost of the scheme is estimated at \$441,000.

NIAGARA FALLS.—By-laws will be submitted to the ratepayers at Niagara Falls, Ont., next month to raise \$19,000 for an armory site, sewer extension and improvements to city fire halls.

Manitoba.

BRANDON.—The City Council have received an offer from an Eastern bond house for all the city's debentures in sight. These include the following to be voted on this month: Western Agricultural and Arts by-law, \$55,000; bridge by-law, \$25,000; cemetery by-law, \$10,000; hospital by-law, \$35,000.

ST. ANDREWS.—On December 15th the electors will vote on a by-law authorizing the issue of \$30,000 debentures for roads and bridge purposes. J. Macdougall, secretary-treasurer.

Alberta.

LETHBRIDGE.—As previously noted, \$75,000 city of Lethbridge, Alta., debentures for the purchase of the electric light plant have been awarded to the Dominion Securities Corporation, Toronto. The Electric Light Company sold their own bonds, which were handed to them in payment of the plant. The city is now asking for tenders on

the balance of the issue of \$121,500 authorized under the same by-law. The assessed valuation of the city is \$4,914,608, and the total debenture debt, \$447,560. The population is 6,500.

Saskatchewan.

MOOSE JAW.—The ratepayers have carried the three money by-laws passed by the council and submitted for their approval. These provided for, among other things, \$40,000 for extending the present sewer system. J. Darlington Whitmore, City Engineer.

British Columbia.

LADYSMITH B.C.—This municipality is calling for tenders for \$50,000 sewage debentures. J. Stewart, city clerk.

ROSSLAND.—This place is offering \$22,000 5 per cent. waterworks debentures for sale. Tenders to be in by Dec. 15. J. F. Collins, City Treasurer.

MISCELLANEOUS

Ontario.

PETERBORO'.—The old Wm. Hamilton Manufacturing Co., Limited, are again in operation. A new company, known as the Wm. Hamilton Co., Limited, has been organized and have acquired the business, and are carrying on the manufacture of all kinds of sawmill machinery. Mr. Andrew McFarlane is president, and L. A. Potvin secretary-treasurer of the new company. C. R. Cameron, former sales manager, will continue with the company. The A. R. Williams Machinery Company, of Vancouver, have been appointed sales agents for British Columbia and Alberta.

ST. CATHARINES.—The Colonial Wood Products Company, of Niagara Falls, N.Y., have purchased twenty acres of land in Thorold for a factory site, and will begin the erection of a pulp mill. The council will submit to the ratepayers in January a by-law to grant the concern a fixed assessment of \$2,500 for ten years and certain water and light privileges.

THOROLD.—The Coniagas Reduction Company is preparing to add another building to its extensive plant here. The company finds it necessary to extend in order to meet the demands upon its smelter from its own and other very productive mines at Cobalt.

THOROLD.—Thorold has secured a new industry. The Colonial Wood Products Company, the president of which is H. B. Eschelman, of Niagara Falls, N.Y., has purchased the Fraser property, better known as the old fair grounds, and the Neil property, and has two other lots adjoining, eighteen acres in all, as a site, and intend breaking ground soon for the erection of a pulp mill. The town council will submit a by-law to the ratepayers at the municipal elections in January to grant the company a fixed assessment of \$2,500 for ten years and a business assessment of \$1,500. The water main will also be extended to give the company fire protection, and electric lights from the municipal plant will be provided.

TORONTO.—A drainage scheme involving the reclamation of 20,000 acres was laid before Hon. Dr. Reaume by a deputation from Amaranth township. The proposal includes widening of the Grand River and other measures, and aid from the Government was requested. Consideration was promised by the Minister of Public Works.

WELLAND.—Welland has secured a tinplate factory, and the gentleman who will establish it is R. Jenkins, of Wales. It will be capitalized at \$250,000, and will be located in Crowland township, immediately adjoining the town and east of the G.T.R. Railway. The buildings are to be of steel, and 250 workmen will be employed.

Alberta.

EDMONTON.—The Provincial Government, in response to a request from a delegation representing the cities of Edmonton and Strathcona, have promised to proceed at

once with the preliminary work for the new Central bridge, which is to be located near the power houses of the two cities. The Government promised that the survey would be made at once.

PERSONAL NOTES.

Angus Smith, city engineer, Regina, Sask., has handed in his resignation to the City Council, to take effect in March next.

MR. J. C. DUFRESNE has resigned his position as city engineer to the City of Nelson in order to take up a private practice.

MR. ARTHUR KNIGHT, formerly superintendent of the foundry of the Manitoba Iron Works, Winnipeg, Manitoba, Can., has taken charge of the foundry of the Canadian Northern Railway Co. of that place.

GEORGE McCONNELL STEWART, formerly of Toronto, has returned after a protracted stay in Brazil. Mr. Stewart has been engaged on electrical construction work in that country two years for the Rio de Janeiro Light, & Power Company.

MR. CHARLES MOSELY, chief engineer of the Toronto Electric Light Company and Mr. William Corrigan, Chief Engineer of the Physics building, Toronto University, have been appointed to the Board of Examiners for Stationary Engineers of Ontario.

MR. W. O. BARNES, M. E., Engineer in chief of the Ross Rifle Company, Quebec, has tendered his resignation to that company, and proposes to devote his time and energies to the formation of a company for the manufacture of gas engines of his invention for which he has recently obtained Canadian patent rights. Mr. Barnes has had an extended experience in the design and construction of gas engines and his high technical standing gives assurance of success to the undertaking.

OBITUARY.

News has been received of the death by drowning at Campbellford, Ont., of Augustus Sawers, civil engineer. Mr. Sawers was for a number of years connected with the construction of the Trent Valley Canal.

SOCIETY NOTES.

Canadian Railway Club, Montreal.

At the last meeting of the club Mr. F. P. Gutelius, C.E., Superintendent of the Lake Superior Division of the C.P.R., read an interesting paper upon "Steel Rails in Canada." This is a subject to which Mr. Gutelius has given much attention during the years he was assistant chief engineer for the C.P.R.

Engineers' Club, Toronto.

About one hundred members and friends were in attendance at the regular meeting of the club last Thursday evening, to listen to Mr. T. Aird Murray present a most interesting and complete digest of the Fifth Annual Report of the British Royal Commission on Sewage Disposal. Mr. Dillon-Mills occupied the chair. The following applications for membership were read and approved:—E. W. Hyde, jr., J. J. Salmond, P. J. Simmen, E. T. J. Brandon, G. W. Dickson, S. L. Gibson, F. B. Ward, J. F. Alexander, A. B. Mitchell, W. M. Treadgold, G. B. Allan, J. R. Cockburn, F. A. Fifield.

The second annual banquet of the Manitoba Association of Architects was held in the Royal Alexandra Hotel, Winnipeg, on the evening of December 8.

PRECIPITATION FOR NOVEMBER, 1908.

The precipitation was unusually heavy over the Lower Mainland of British Columbia. It was generally a little above the average in the more northern portions of Ontario as well as very locally in Eastern Nova Scotia, but over the large remaining portion of the Dominion it was everywhere below the usual quantity and with few exceptions to a considerable amount. In the Maritime Provinces the negative departure was usually from two to nearly three inches. In Quebec and the southern portions of Ontario the deficiency was also very marked, while in the Western Provinces the precipitation varied from nil in parts of Southern Alberta to a half or less of the usual quantity over the larger portions of Saskatchewan and Manitoba. In the Upper Mainland of British Columbia the precipitation was locally deficient.

Depth of Snow.

At the close of the month snow lay on the ground in the northern portions of Alberta and Saskatchewan to a depth of from 6 to 8 inches, diminishing to little or none in the southern portions. In Manitoba there was a light covering in most localities, also in eastern Quebec and northern New Brunswick, elsewhere except very locally there was no snow.

The table shows for fifteen stations included in the report of the Meteorological Office, Toronto, the total precipitation of these stations for the month.

Ten inches of snow is calculated as being the equivalent of one inch of rain.

Station	Depth in Inches	
Calgary, Alta.	0.0	— 0.8
Edmonton, Alta.	0.9	+ 0.3
Swift Current, Sask.	0.4	— 0.2
Winnipeg, Man.	1.4	+ 0.4
Port Stanley, Ont.	1.5	— 1.7
Toronto, Ont.	1.6	— 1.1
Parry Sound, Ont.	4.7	+ 0.6
Ottawa, Ont.	2.6	+ 0.2
Kingston, Ont.	2.5	— 0.6
Montreal, Que.	2.8	— 0.7
Quebec, Que.	2.1	— 1.5
Chatham, N.B.	1.9	— 1.8
Halifax, N.S.	3.3	— 2.3
Victoria, B.C.	4.0	— 2.3
Kamloops, B.C.	0.1	— 1.1

BLASTING.

As the cold weather comes on more accidents are happening daily for premature or delayed dynamite explosions. The chief mining inspector in Victoria, N.S.W. makes the following recommendations for the handling of explosives:—

1. Use an efficient cap. Select for the particular kind of explosive, the cap (detonator) with the proper charge of fulminate—i.e., the explosive compound contained in the cap. The grade of cap to be on the strong rather than on the weak side. The longest charge requires the strongest cap; a weak cap will leave hole unbottomed. The cap to be freed from sawdust by gentle tapping. Used under water, the upper end of cap where it joins the fuse to be made water-tight (grease, pitch, clay, etc.). The cap deteriorates by exposure to damp air.

2. Select the right fuse for the kind of work. The fuse to be cut clean across, and not slanting. The powder not to be shaken out of end of fuse. Fuse to be inserted in cap until it reaches the fulminate. The upper part of cap to be crimped with a broad-faced tool, and not grooved so as to choke the fire in the fuse. With fuse too ragged or too large to enter cap, the end to be swaged to proper size by broad crimper. The fuse should not be kept in a damp place.

3. Do not bury cap in primer, so as to cause the burning of latter. The cap to be pushed into primer, the fuse not touching the explosive, and securely tied in that position. The primer to be pushed home with a wooden rammer into contact with charge.

4. Allow no break in the contact of plugs, due to presence of borings, or to careless charging. The plugs to be

rammed home firmly with wooden rammer to fill up spaces round charge, and so completely fill the hole to proper depth.

5. Tamp the charge sufficiently with clay, dry sand, or borings. Tamping not to contain any sharp particles that would damage the fuse.

6. Do not charge the hole with plugs damaged by storage in a damp atmosphere. The explosive to be stored in a dry and cool place.

7. Do not charge the hole with frozen or partially frozen plugs. The plugs to be soft and plastic. A stronger cap to be used under cold conditions.

8. Do not overcharge the hole.

MARKET CONDITIONS.

Toronto, Dec. 10th, 1908.

Building materials are not active. This is to be accounted for by the colder weather and moderate snow falls reducing construction. But in Toronto, at all events, a good deal of building is still going on, especially of dwellings. Cement makers are gloomy over the accumulating stocks and the dulness of business, but hopeful that 1909 will see improved conditions. The brickmakers have had a good season, and some of them are still busy delivering. Prices of lumber are in the main well kept up, although the stocks of pine in the Ottawa Valley are very considerable. Consumption is steady but not to say brisk.

The condition of the metals market is not satisfactory, in fact it is distinctly disappointing, for it was supposed that the feverishness and fluctuation of the various metals, owing largely to speculative dealings abroad, would by this time have steadied. The alleged great activity in production of late by the United States Steel Co. of structural steel caused by so-stated railway demand is negated by the statistics of idle cars on United States roads. But with patience and economy, conditions in that country will improve steadily.

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

Antimony.—Price unchanged at 8¼c., with less enquiry.

Axes.—Standard makes, double bitted, \$8 to \$10; single bitted, per dozen, \$7 to \$9.

Bar Iron.—\$1.95 base, from stock to the wholesale dealer.

Boiler Plates.—1-4 inch and heavier, \$2.40. Boiler heads 25c. per 100 pounds advance on plate.

Boiler Tubes.—Orders are small. Lap-welded, steel, 1 1-4 inch, 10c.; 1 1-2 inch, 9c. per foot; 2-inch, \$8.50; 2 1-4 inch, \$10; 2 1-2 inch, \$10.60; 3-inch, \$12.10; 3 1-2 inch, \$15.30; 4-inch, \$19.45 per 100 feet.

Building Paper.—Plain, 30c per roll; tarred, 40c. per roll. Business no longer brisk.

Bricks.—Common structural, \$9 per thousand, wholesale, and the demand moderately active. Red and buff pressed are worth, delivered, \$18; at works, \$17.

Cement.—Market still weak; cement can be had in 1,000 barrel lots at \$1.70 per bbl, including the bags, which is equal to \$1.30 without bags. At this time of year building operations are closing down, demand is therefore naturally limited. The smaller dealers, however, are busy selling small quantities.

Coal Tar.—Season about over, price still \$3.50 per barrel.

Copper Ingot.—There is more activity in the States, rather quiet demand here. Prices are higher, at 15 to 15½c. with a prospect of their maintenance for a while.

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

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