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MISSING

The Canadian Engineer

WEEKLY

ESTABLISHED 1893

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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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NOTICE TO ADVERTISERS

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

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TORONTO, CANADA, JULY 9, 1909.

CONTENTS OF THIS ISSUE.

Copy and cuts for changes of advertisements must be in our hands by the Monday preceding date of issue. If proofs are to be submitted, changes should be in our hands at least ten days before date of issue. When advertisers fail to comply with these conditions, the publishers cannot guarantee that the changes will be made.

CANADA'S WATER POWER.

The water power of Canada is one of the most valuable assets, and when one considers that the probable available water power of Canada exceeds 25,000,000 horse-ower one must be impressed with the possibilities of hydro-electric development in this country.

In a recent report on this question Mr. J. B. Challies, B.A.Sc., of the Department of the Interior, Ottawa, estimated the minimum flow development of all the water powers of Canada at 25,682,907 horse-power, and of this enormous amount only about a fiftieth has been developed, or some 516,885 horse-power It has been estimated that the maintenance of one horse-power per annum from steam power requires 21.9 tons of coal. On this basis the Canadian water powers would develop annually as much energy as 562,455,633 tons of coal will give out in steam power.

The following table gives the distribution by Provinces of the power possibilities and of the present developments:—

Location.	Minimum Flow Development.	Present Development.
Yukon	470,000	....
British Columbia	2,065,500	73,100
Alberta	1,144,000	1,330
Saskatchewan	500,000	....
Manitoba	505,000	18,000
North-West Territories	600,000	....
Ontario	3,129,168	331,157
Quebec	17,075,939	50,000
New Brunswick	150,000	....
Nova Scotia	54,300	13,300
Total	25,682,907	516,887

The largest single water power is said to be on the Hamilton River, Labrador, where there are some nine million horse-power available.

With the solution of the problem of long distance transmission of electricity there will come a period of great activity in power plant erection.

Canadian water powers will in time be utilized for long distance haulage of freight and passengers. Electricity will be used for heat as well as for lighting, and the Department of the Interior did well in pointing out the location, distribution, and possibilities of Canada's water power.

MR. LUMSDEN'S RESIGNATION.

The resignation of Hugh Lumsden, Chief Engineer of the National Transcontinental Railway Commission, again places this great public work, its management, and its staff of engineers in the limelight.

Mr. Lumsden has been chief engineer since the organization of the Transcontinental Commission five years ago. This great enterprise has grown under his direction, and he must be familiar with routine and details to such a degree that his resignation will be serious, indeed.

It is but natural that in work of such magnitude, covering such a stretch of country, there should arise circumstances in which criticism would find room for expression. Add to the difficulties—engineering, financial, strategic, and politics—and you have a combination that will quickly breed scandal talk.

The reason for Mr. Lumsden's resignation has not been given. It is not a matter of holidays nor incapacity for hard work. Men of Mr. Lumsden's type do not quit work in the midst of difficulties. The motive for his resignation must be sought elsewhere.

Last winter Major Hodgins' charges were not fully considered. The Government and the contractors were pleased to see them dropped. Greater candor on the part of the Government at that time and a more thorough investigation at that time would have made unnecessary much of the work of the Arbitration Board.

The public have decided that Mr. Lumsden resigned because, from first to last, the politicians appointed and promoted more engineers than did the chief, and any fairy tales that may be invented will not satisfy.

The public are about right, and, Mr. Graham, if you are going to save the situation, you will require more resignations, and those from men around the top.

The C.P.R. furnished scandal talk for twenty years. The G.T.P. will do likewise unless some courage is shown in handling the present situation.

THE ENGINEER AND HIS JOB.

The engineer who is most sought after is the one who asks as few questions as possible. Whether as an engineer taking charge of work for a client or as an engineer reporting to his chief, he will never favorably impress by fussing and volleys of questions.

Results are what are required, and no amount of talk or show will take its place. Your client or your chief does not want to be worried with unnecessary questions, nor does he want you to take undue responsibility.

The successful engineer is the man whose courage and good judgment will allow him to take the initiative, and who can be trusted to work out successfully the scheme and its details.

THE ENGINEERS' CLUB, TORONTO, ANNUAL EXCURSION.

The Engineers' Club, Toronto, have arranged to hold their annual excursion this year on July 16th and 17th. The trip will be by C.P.R. train to Bobcaygeon, and from there on the following day the party will sail through the Kawartha Lakes and Canal to Lake Simcoe, returning by the York Radial Railway to Toronto.

Those who took the trip with the Club last year had a most enjoyable and profitable time, and it is expected this year the attendance will be even larger than on previous occasions. There is much to see, the trip is planned away from the usual path of sightseers, and those wishing to go should at once communicate with the treasurer, J. L. Street, 37 Melinda Street (M. 3280), so that travelling arrangements may be completed, and so the comfort of all provided for.

EDITORIAL NOTES

The Dominion Iron and Steel Company made a new record in nearly all of its departments during the month of June. The products were as follows:—

	Tons.
Pig iron	24,260
Steel	28,142
Rails	18,419
Wire rods	7,404
Total shipments	27,000

The Canadian Pacific Railway Company's fiscal year closed June 30th. Gross earnings for the year were the greatest on record, being at least $76,117,167, compared with $71,384,173 last year. In June the gross earnings amounted to $6,354,000, but this figure will be considerably augmented by the miscellaneous receipts when the final reports are made up.

* * * *

The Interstate Commerce Commission have issued the railway accident returns for the first three months of 1909. The returns show that in the United States there were 663 people killed and 15,122 injured. This shows an increase in casualties of 344, but a decrease of 65 in deaths over the first three months of 1908. The damage to cars, engines and roadways by these accidents amounted to $1,847,202.

* * * *

The ratio of working expenses to traffic receipts on the French railways is increasing. On the Orleans system in 1905 the ratio was 46.70 per cent., in 1906 it was 48.29 per cent., and in 1908, 53.88 per cent. The increased price of material had something to do with this, but so also had the decision to grant each employee fifty-two holidays in the year. This alone cost this system $600,000.

PRECIPITATION FOR JUNE, 1909.

The rainfall was very deficient in nearly all portions of the Dominion, except in a few isolated localities, noticeably in the Gaspe Peninsula, and in the extreme southwestern portion of Saskatchewan, where for the most part the usual quantity appears to have been well exceeded. Ottawa City recorded an amount in excess of the average, also a few places in the extreme southwestern counties of Ontario, in each instance owing to the prevalence of thunderstorms in the localities affected. In British Columbia the negative departure varied from six-tenths of an inch to three inches. In the Western Provinces, the deficit was very generally from 33 to over 100 per cent., in Ontario, from one and a quarter to two inches and a half, in Quebec, from three-fourths of an inch to over two inches, and in the Maritime Provinces from one-half to nearly three inches.

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

Station.	Depth in inches.	Departure from the average of twenty years.
Calgary, Alta.	2.1	—1.0
Edmonton, Alta.	1.8	—1.3
Swift Current, Sask.	5.0	+2.0
Winnipeg, Man.	1.5	—2.0
Port Stanley, Ont.	2.8	+0.0
Toronto, Ont.	1.2	—1.5
Parry Sound, Ont.	1.1	—1.6
Ottawa, Ont.	2.4	+0.8
Kingston, Ont.	1.1	—1.7
Montreal, Que.	1.6	—2.1
Quebec, Que.	3.2	—0.7
Chatham, N.B.	3.0	—0.5
Halifax, N.S.	1.1	—2.7
Victoria, B.C.	0.5	—0.6
Kamloops, B.C.	0.8	—0.6

CANADIAN SOCIETY OF CIVIL ENGINEERS' ANNUAL EXCURSION.

This year the Canadian Society of Civil Engineers held their annual excursion on June 24th and 25th, to Windsor, Ont., and visited the Detroit tunnel and the Canadian Bridge Works, Walkerville.

Three coaches were required for the party, one coach from Montreal, one from Ottawa, and one from Toronto. A quick and pleasant trip was made by C.P.R., T.H. & B., and M.C.R.

At Windsor, Ont., the party were the guests of the Butler Bros.' Company, who have the contract for building the new tunnel under the Detroit River. A thorough inspection was made of the shield work at the approaches and the subaqueous section where the work is being carried on under air pressure. A trip was made to the concreting barge in midstream, from which the concrete is poured around the iron pipe.

On the second day the Canadian Bridge Works at Walkerville was inspected.

Among the party from Montreal was:—A. Belanger, J. T Bertrand, W. I. Bishop, W. E. Boucher, J. L. Busfield, P. Davis, J. A. DeCew, J. A. Jamieson, T. Lanctot, J. G. Legrand, T. W. Lesage, H. M. MacKay, A. McCulloch, C. M. McKergow, C. H. McLeod, M. Morssen, S. F. Rutherford, T. G. Randolph, F. P. Shearwood, J. H. Sullivan, W. V. Taylor, W. F. Tye.

From Toronto:—A. C. D. Blanchard, L. O. Clarke, S. J. Fisher, J. Galbraith, E. A. James, E. B. Jost, E. H. Keating, K. A. MacKenzie, N. M. McLeod, F. F. Miller, W. Miller, C. W. Noble, W. F. Scott, C. R. Young.

From Ottawa:—A. Amos, N. Cauchon, C. R. Coutlee, A. S. Cram, F. Davis, H. M. Davy, R. F. Davy, G. A. Mountain, J. J. Murphy, A. Roger, A. Surveyer, G. Volckman, E. T. Wilkie.

From St. Thomas:—J. A. Bell, F. A. Bell, G. A. McCubb'n.

AIR COMPRESSION.

On the evening of July 5th, at the Engineers' Club, Toronto, Mr. William Reavell, M. Inst., M.E., of Ipswich, Eng., gave an address on the Principals Governing the Compression of Air.

Mr. E. Wragge, Consulting Engineer, Toronto, acted as chairman, and the audience listened with great interest to Mr. Reavell's address.

Mr. Reavell described the design and workings of one, two, or three stage compressors, as well as unjacketed compressors, he also outlined the various methods of testing the efficiency of compressors. He also took up the question of the relative efficiency of turbo and reciprocating machines, and said in part:—"The difficulty of making exact tests, and the difference of opinion which exists as to the proper way in which efficiency should be measured, account for much of the confusion by which the subject is surrounded. If the heat generated during compression could be continuously extracted, so that compression was isothermal, the work done would be a minimum, and the efficiency, consequently, the highest possible. Isothermal compression is quite impossible of realization, though the ideal forms a convenient basis for comparison. On the other hand, one may assume no heat abstracted, and compute efficiency, therefore, on the basis of an adiabatic compression. This is in a sense fairer to the machine, but not so good a guide to the purchaser, particularly if he wants to use his air cold. A third method is that used by Professor Rateau, by which, in the absence of water-cooling, the efficiency is deduced from the temperature rise of the air in passing through the machine."

PERSONAL.

MR. LAWFORD GRANT has been appointed manager for Canada of the Canadian British Insulated Company, Ltd., Montreal, Canada, who have bought out the Canadian interests of the British Insulated and Helsby Cables, Ltd.

MR. FRANK W. MORSE, former General Manager of the Grand Trunk Pacific Railway, is in Montreal. Mr. Morse came from New York on the G.T.R. private car by which Mr. C. M. Hays went to New York en route to England.

WATER STORAGE IN ELEVATED TANKS AND STANDPIPES.*

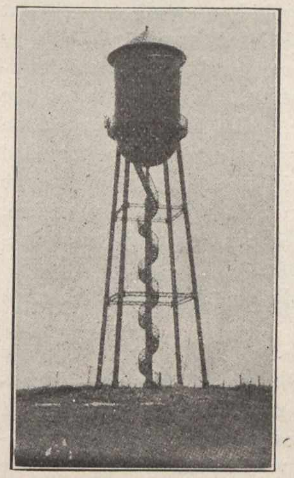
H. E. Horton, M.W.S.E.

The advantage of water stored at an elevation is recognized by all as desirable; to fit to the varying local conditions many expedients are resorted to. We have under discussion the use and advantage of the elevated tank and standpipe.

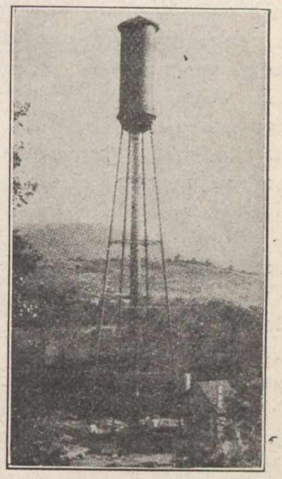
It may be interesting to notice the evolution from the wood tank on a low trestle, as so universally used for water supply to the railway locomotives, placed upon a higher trestle for a small town's water supply, this trestle as time went on being substituted by metal, and following this the tank being made of steel; all in the same line of evolution and about the same time that bridges and cars changed from wood to steel.

Occasionally there is suggestion of building elevated water storage in reinforced concrete. However, as it takes the same amount of steel to reinforce the concrete that it does to hold the water without the concrete, it has only been used where there is an apparent intensity of desire for the truly unique, and for the purpose of this discussion we will ignore it.

A standpipe, open at the top, of small diameter, was an attachment to large pumping works at a very early date



70,000 Gals.—100 ft. High.
Highland Park, Dallas, Tex.



70,000 Gals.—220 ft. High.
Rutland, Vt.

to relieve the water hammer on the pumps. We have in Chicago the water tower at "Chicago Avenue" and "Ashland Avenue" Pumping Stations as examples.

Mr. Cook, of Toledo, Ohio, some forty years ago was, I believe, the originator of a system of waterworks for small towns wherein, with a moderate sized pumping engine, the standpipe was materially enlarged, thereby providing storage under pressure (the advantage being the relief from continuous pumping), and the standpipe came into very general use for such locations as fitted for—a level town or small city.

The term, standpipe, as here used, defines a class of structure, say, 10 ft. to 30 ft. in diameter, with heights equal to 3 to 12 diameters. Such a structure has its limitations as to economy of construction.

The largest examples of metal tanks (not known as standpipes), to hold water that have come under my notice are those for making the water seal of gas holders, where tanks of some 200 ft. in diameter and 50 ft. high have been used and as stresses in the shell = radius × water pressure —it follows that in all tanks or standpipes the stress in the unit of the material is as the height multiplied by the diameter; hence, a tank 40 ft. in diameter and 250 ft. high would have the same stress in the material as for the one indicated above, and would be something over 25,000 pounds per inch vertical near the bottom of such tank, and material

* Read before the Western Society of Engineers.

must be provided for normal unit stresses of over 2 in. in thickness.

Now, as it happens that water stored for purposes like fire protection in its various demands, such as sprinkler system for fire extinguishment for regular town waterworks, water is frequently required at considerable elevation and with the least range of varying pressure; in fact, an absolute uniform pressure would be ideal. This is impracticable; hence, we must allow at least 10 per cent. of the extreme height for a varying pressure.

From estimates covering a large number of examples, with limitations as above, it may be asserted that with a low elevation like a mere flat tank, a tower is at a disadvantage, but when the average elevation of water required is 100 ft. it will cost twice as much to store it in a standpipe as in an elevated tank. Again, it may be wanted at an average elevation of 150 ft.; if so, it will cost three times as much to store it in a standpipe as in an elevated tank. When wanted at 200 ft. average elevation it will cost four times as much to use a standpipe as the tower and tank. At 250 ft. average elevation it will cost five times as much in a standpipe as in a tower and tank. At 300 ft. average elevation it will cost six times as much to use the standpipe design as a tank. From all the above, it is apparent why towers and tanks have come into use for storage of water where potential energy of the water is a matter of consideration.

The tower to support a tank may be readily designed with three or more supporting legs. The foundations for such tower and the stresses from wind are well worked out in connection with the elevated skeleton structures so frequently seen on our railroads. Local conditions must determine the character of the foundations. The batter of the legs will usually be such that the uplift from the wind on the windward side (and tank empty) is abundantly provided for by convenient anchorage. It will be found an advantage to place the legs of such a tower radially from the centre, so all the legs will be alike for convenience in manufacturing.

The tank itself may be a cylinder with a flat bottom placed upon a platform built of beams. This class of design will invariably be over costly, the relation varying somewhat as the diameter to height of tank varies. Preferably the bottom may be conical or hemispherical, made of plates only; in fact, combinations of the spherical combined with the conical have been worked out to relieve the excessive stresses developed at the intersection of the cone and cylinder. It is somewhat the personal equation of the designer that determines how this part of the design shall be carried out.

At the point of attaching the tower to a tank it is quite the usual practice to use a horizontal girder strong enough to take up any tendency to deform the cylinder by the horizontal components of the supporting posts; hence, it will be observed that this girder is of much greater importance on a tank supported with three posts than if the same tank was supported by six.

From conditions as herein indicated there has been much discussion and variation in design in placing a tank with a conical or spherical bottom on a tower. Many designers believing it is a necessity to extend the cylindrical part some distance below the water level, and look at, and think of, this extension as a circular girder, while others have treated the entire depth of the cylinder of the tank as the web of a circular girder. Sufficient to say that there is no difficulty in making an efficient design either way.

Some engineers feel a greater satisfaction in designs so developed as to present a multiple number of supports from the tower to the tank, which to all of this there is no objection other than the one of increased cost. The best results with least cost will always be found with a standard design.

The tank must hold water. Tight work has to be developed. It will ordinarily be found to great advantage in construction if a close study is made of the joints and their disposition to the end that rivets will not necessarily go through a large number of plates, and that caulking edges be so arranged that the same may be gotten at to caulk and make the work watertight.

The tank on such towers is usually supplied with water by a riser pipe up the centre of the tower. This riser pipe is enclosed in a frost casing, some three or more thicknesses of lumber, about which "building felt" is freely used.

For sprinkler tanks, where water merely stands in the tank, in this climate they will have to be supplied with artificial heat. This may be accomplished by a moderate-sized water heater directly connected with the riser pipe, or with live steam, if the tower is so situated that live steam is available.

If the tank is in general service, like a town's waterworks, and the service is such as to require, say, one hour's pumping in the morning and one hour in the evening, a very moderate-sized works will require no further attention as to freezing.

I do not wish to be understood as advocating the use of an elevated tower and tank in connection, say, with a hill, to put an ordinary earth reservoir in, or to place a flat metal tank on, provided said hill is within convenient reach from both the pumping station and the point of consumption. Each location presents a problem

50,000 and 75,000 Gals.—71 ft. and 130 ft. High. Factory Power Co., Cincinnati, O.

112,000 Gals.—162 ft. High. Lackawana Steel Co. Buffalo, N.Y.

When not favored with a convenient natural elevation, the elevated tank offers to average communities, water storage, so that the pumping plant requires to be in actual operation only some small portion of each twenty-four hours, and one force of operators can maintain the works, thus making it possible for many small towns to maintain and operate waterworks that otherwise could not because of the operating costs.

Examples without number have come under my observation of the reduced expenses where a tower and tank has been installed, where work has previously been done by direct pressure from the pumps. In the city of Chicago, at the Washington Heights Pumping Station, while the full force of men have been maintained, the quantity of coal was reduced approximately one-third upon the installation of the elevated tank.

At Paris, Ill., the city had operated a direct pressure pumping plant for twenty years, and with a double set of operators, when in 1895 an elevated tank was attached to the system with the result that at once one set of operators was sufficient to continue the work; in fact, the entire cost of operation was reduced 40 per cent.

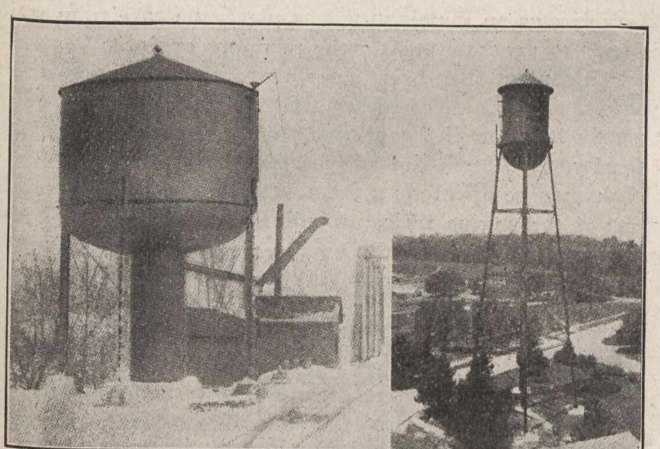
At Galion, Ohio, a franchise company, after running the pumps for direct pressure for twenty-five years, introduced an elevated tank, and the cost of their operations was reduced one-third, with a much more satisfactory and uniform pressure for the town. The list of instances of advantage as here indicated could be extended almost without limit.

Of the standpipes built in other years a number of somewhat startling failures have occurred. Reviews have been made of the structures that failed, and it seems to be noticeable that there were fairly high unit stresses involved in all cases.

In years past little attention seemingly has been given by designers of standpipes to the efficiency of the rivet connections. In analyzing this question of efficiency of connections we assume that rivet shear is equal to two-thirds the tension value of the material, and it is not unusual to find standpipes with rivet efficiency of no more than 30 per cent. of the value of the plates.

The question of rivet efficiency in anything like boiler or tank work is of paramount importance. While it is possible by double butt strap joints to make a rivet joint of more than 90 per cent. efficiency, yet due to the added weight of material as well as cost of labor, it may be doubted if there is any advantage in attempting to develop efficiency to exceed 80 per cent. In fact, in moderate-sized tanks something like 70 per cent. efficiency will quite likely work out the most satisfactory. Experience seems to justify the use of lap joints on material up to, say, ½-inch thickness.

There never has been a failure where the stresses on the efficiency of the joints in the standpipe were as low as 15,000 pounds per square inch, and larger numbers of pipes are standing and have stood for a long period of years where the stress on the efficiency of the joints is over 30,000 pounds per square inch.



60,000 Gals.—35 ft. High. C.P. & St. Louis Ry., Lock Haven, Ill.

100,000 Gals.—150 ft. High. Hospital for Insane, Columbus, O.

The group of standpipes referred to above were designed on a basis of gravity stress of about 15,000 pounds per square inch of the gross section of the plates. That the mortality has not been more serious is surely a kind interposition of an over-ruling Providence. While there may have been bad material and bad workmanship, there has also been most unfortunate designing. To such designs the failures must be charged.

Towers and tanks have a better record as to their mortality. In fact, very little in the way of failure or criticism has presented itself. There have been examples of conical bottoms attached to the cylindrical part with a moment on the joint. Great difficulty has been experienced in keeping such joints tight, and the one only very considerable failure of a tower and tank has occurred from this fault in design.

It is my pleasure to present to you some illustrations of sundry examples of elevated towers as constructed. These have been selected as showing a variety of use, as also a variety of structures.

We have the tower and tank, with sundry expressions of architectural effort and atmosphere, all of which reminds us that the personal must have consideration, and the further very interesting fact that there is no gauge in the matter of taste.

We have a tank with elaborate protection against the cold in the extreme north. We have them with no protection in the south.

The towers and tanks shown are in use for:—

City Water Works.
Public Institutions.
Private Estates.
Industries.
Railroads.
Hydraulic Works.

With examples of:—

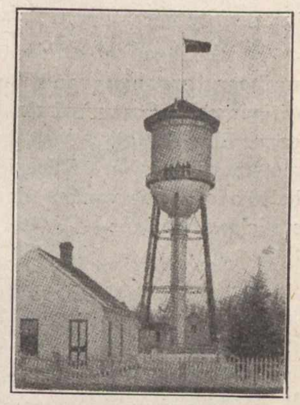
Three supports to tank.
Four supports to tank.
Six supports to tank.
Eight supports to tank.
Twelve supports to tank.

Also the:—

Flat bottom tank.
Conical bottom tank.
Hemispherical bottom tank.
Semi-elliptical bottom tank.

We also have a lantern slide showing a 50-foot diameter tank bottom, fully assembled in the yard for reaming 15,000 radial holes through approximately 1⅞-in. from 11-16-inch to 1 1-16-inch.

125,000 Gals.—135 ft. High. C.P.R., Winnipeg, Man.



75,000 Gals.—91 ft. High. Edmonton, Alta., N.W.T.

In the matter of spherical work, the surface cannot be developed, while the cylinder or cone may be. The difficulties of mechanical execution are such as to generally preclude the use of the sphere or sections thereof in plate metal construction.

The amount of water pumped for Erie, Pa., during 1908 was 4,483,392,032 gallons, an increase of 157,295,184 gallons over 1907. The average daily pumpage was 12,249,705 gallons, or a per capita of 175 gallons on a basis of 70,000 population. The amount of water furnished by meter measurement to manufacturers and other large consumers was 1,169,536,621 gallons, a decrease of 27,590,994 gallons from the previous year. Deducting the amount of water furnished by meter measurement from the total amount of water pumped, gives the approximate amount of water furnished for domestic use, churches, schools, charitable purposes, fire protection and other city uses, 3,313,855,441 gallons, a daily average of 9,054,249 gallons, and an average daily consumption for the several uses mentioned of 129.35 gallons, being an increase in the daily per capita of 2.35 gallons.

The Canadian Pacific Railway Company's fiscal year closed last Thursday, and the new year started on Friday morning. Gross earnings for the year ending June 30th, 1909, were the greatest on record, being at least $76,117,167, compared with $71,384,173 last year. In June the gross earnings amounted to $6,354,000, but this figure will be considerably augmented by the miscellaneous receipts when the final reports are made up. Steamship earnings will be added to the above figures in the final report.

ENGINEERING ORGANIZATION.

R. E. W. Hagarty, B.A.Sc.

As a conclusion to "Hydraulic Engineering in the Yukon," an article which appeared in The Canadian Engineer, February 19th, 1909, a few words regarding the organization features of the Yukon Gold Company are probably in order.

The importance of organization in a large engineering work is evident; but, nevertheless, we are sometimes surprised to find clever engineers either naturally or affectedly deficient in regard to this feature. There are others who will frankly admit the importance of thorough organization, but who trust such matters to a walking boss, or a foreman. For instance, the management of the Panama Canal under the old regime was an example of this condition.

However, after examining the working conditions which existed in the Yukon construction one realizes not only the importance of organization, but that the effective application of the same is a science which must play a large part in any successful engineering undertaking.

The fact that the Yukon is widely remote from the outside world, and also the shortness of the working season rendered complete organization designed for rapid construction doubly necessary.

At the head of affairs was a man who ranked as chief engineer, organizer and business manager combined. He was virtually "czar" of the entire concern and was personally responsible for all details in every department. His position was known as that of "resident manager" Under him were the heads of the various departments, of which the following is a classification:—

- I. Construction Department:
  - (a) Main ditch (excavation),
  - (b) Pipe line,
  - (c) Flume.
- II. Hydraulic Department.
- III. Dredging Department.
- IV. Surveying Department.
- V. Electric Department.
- VI. Business and Legal Department:
  - (a) Legal,
  - (b) Accountants',
  - (c) General book-keeping,
  - (d) Time-keeping and employment,
  - (e) Commissariat,
  - (f) Warehouse, ordering and shipping,
  - (g) Cost department (distribution, book-keeping).

The heads of each department reported directly to the Resident Manager, who was thus kept in constant possession of the details of the entire system to an extent impossible under other conditions.

Under these circumstances, however, the heads of departments have practically independent control over their respective sections of the work; and this frequently caused trouble to the resident engineers, or the foremen who had work within the jurisdiction of more than one of the department superintendents each of whom was apt to expect his own portion given precedence.

Considering the enormous difficulties of construction and the extent of the work the organization proved a practical success and reflects considerable credit upon Mr. O. B. Perry, Mr. C. A. Thomas, and others in charge of the work.

SOME PRODUCER GAS PLANTS IN AND AROUND THE CITY OF BERLIN, GERMANY.*

B. F. Haanel, B.Sc.

Five gas producer plants were visited; four of which were situated in Berlin and vicinity. Of the four inspected in Berlin, and vicinity, two were equipped with anthracite producers; one with a coke producer; and one with a lignite (brown coal) briquet producer. The fifth was installed at the plant of the Körting Brothers at Hanover, and was equipped with a producer for gasifying badly caking bituminous coal.

Coke Producer Gas Plant.

This plant is situated at Wilmersdorf, a suburb of Berlin, and is used for pumping water for city purposes.

The equipment consists of four 400 horse-power two-cycle, Körting gas engines—using either producer or illuminating gas—and two large coke gas producers. Under ordinary circumstances coke would never be used whenever cheaper fuel is available, inasmuch as its cost is prohibitive. In this case, however, the municipality operating this pump station also operates an illuminating gas plant, the coke from which is used to generate gas for the pumping engines.

This plant has been operated continuously for several years, and the cost of repairs and up-keep is said to be extremely low; much below that for a steam plant of like capacity, used for a similar purpose.

It may be of interest to note that, the number of revolutions of the engine varies according to the work done; from 30-90—the efficiency of the engine remaining constant.

The consumption of coke per effective horse-power hour is 1.5 kg. (3.3 lbs.), which seems excessive, and as it costs at Wilmersdorf from 30 to 40 marks ($7.20 to $9.60 per ton), coke—especially at this place—cannot be called an economical fuel.

Anthracite Producer.

A plant, consisting of three gas engines of 110 effective horse-power each, and three anthracite gas producers, was installed in the basement of the warehouse of A. Yandorf and Company, Berlin. The power developed was used for generating electricity for light and power purposes.

This plant has been in operation for four years, and employs a chief engineer, one assistant engineer and one stoker. The cost of repairs during the four years it has been running is said to be very low.

The consumption of fuel per effective horse-power hour is 0.38 kg. (0.836 lbs.), which is very satisfactory, the builders in this case guaranteeing one lb. per horse-power hour.

No trouble at all is experienced from any source with these producers, and the labor of stoking and cleaning of ashes is almost negligible.

*Extraction from a report to Hon. W. Templeman, Minister of Mines for Canada.

RAILWAY EARNINGS AND STOCK QUOTATIONS

NAME OF COMPANY	Mileage Operated	Capital in Thousands	Par Value	Earnings Week of June 28: 1909	Earnings Week of June 28: 1908	Toronto: Price July 2 '08	Toronto: Price June 24 '09	Toronto: Price July 1 '09	Toronto: Sales Week End'd July 1	Montreal: Price July 2 '08	Montreal: Price June 24' 09	Montreal: Price July 1 '09	Montreal: Sales Week End'd July 1
Canadian Pacific Railway	8,920.6	$150,000	$100	1,971.000	1,777,000	158½	181¾	183	110	160 159	182⅜ 182½	182½ 182	470
Canadian Northern Railway	2,986.9	....	....	260,600	218,700	....	....	....	....	....	....	....	....
*Grand Trunk Railway	3,536	226,000	100	1,195,366	1,184,808	....	*1st. pref. 105½, 3rd pref. 56⅛, ordinary 23¾					....	....
T. & N. O.	334	(Gov. Road)	....	34,957	21,873	....	....	....	....	....	....	....	....
Montreal Street Railway	138 3	18,000	100	78,113	74,128	....	....	....	....	173 172	218 217¾	218¼ 218	232
Toronto Street Railway	114	8,000	100	79,868	71,584	....	123¾	123¾	2	98¼ 98	124 123½	124 123⅞	215
Winnipeg Electric	70	6,000	100	....	....	157	185	187½ 186	96	159 158	....	....	20

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

An interesting feature of this installation is the arrangement of the charging hoppers of the producers. As described above, the producers are situated in the basement of the building, and the roof of that part containing the producers is level with the ground above, and constitutes the driveway for trucks, etc. The charging hoppers of the battery of producers project through this roof into this open court or driveway, and the fuel is simply hauled beside the charging hoppers and dumped into the coal boxes contiguous to them.

By this method, the cost of stoking—in addition to being accomplished in the open air—is reduced to a minimum.

The waste gases of the engine exhaust—which are a nuisance in most gas engine plants, owing to the odor and noise—are in this plant discharged at the top of the building, which is four stories high.

The cost of fuel delivered is 19 marks ($4.56) per metric ton. A metric ton corresponds to the English long ton, from which it will readily be seen that the plant is very economical.

The second anthracite gas producer plant visited was that of the Spindlershof Geschaftshaus, Berlin.

This installation is composed of two engines of 110 horse-power, running at 160 revolutions per minute—used for lighting; and one engine 180 horse-power, 140 revolutions per minute, used for power purposes. The anthracite gas producers in this plant are identical with those employed in that described above. The engines and producers have been in constant use for six years, during which time no troubles of any kind have been experienced, and during this period the cost of repairs was remarkably low.

The average consumption of fuel per effective horsepower is 0.4 kg., about 0.88 lbs. The price of coal delivered at this plant is about 19 marks ($4.56).

Caking Bituminous Coal Producer.

The only producer gasifying caking bituminous coal inspected was at the workshops of the Körting Brothers, Hanover, and was utilized as part of the permanent power installation, for generating electricity. This producer is of 150 horse-power capacity, and has been run for a period of six weeks—twelve hours per day—without closing down. The only reason for terminating the run at the end of that period was, an accident to the electric generator. During the entire length of the run, no trouble of any sort was encountered, scarcely any poking of the fuel bed was resorted to, and the gas delivered to the engines was of a uniform quality. While no trouble was experienced in the running of the gas engines on account of tarry matter, an inspection after closing down disclosed the fact that, about 3 mm. of tar and soot were deposited on the walls of the cylinder, and in the entry and exhaust pipes.

The fuel consumption during the run was about one lb. per effective horse-power hour.

The smallest producer which the Körting Brothers guarantee to operate successfully on caking bituminous coal, is of 150 horse-power capacity; any smaller generator will not operate for any length of time, owing to the fusing of the

A UNIQUE GASOLINE ENGINE TESTING PLANT.

By Frank C. Perkins.

The accompanying illustration shows a most complete and thoroughly up-to-date testing room as utilized at Detroit, Michigan, for testing Gray gasoline engines which are run under conditions as near like those in service as possible.

The engines are run in such a way that every possible thing that might be a defect or cause of difficulty at a later date in the hands of a customer, is observed and corrected.

The illustration shows in this testing room eight blocks, or large testing stands, each of which holds two motors. In the centre of the testing stand is a water-cooled brake wheel, and between this wheel and the motor on each end is a friction clutch.

It is stated that this arrangement is to enable each engine under its own power to work out an engine which has just been brought from the testing room, and after an engine has been run under its own power for several hours or long enough to satisfy the inspector and chief tester that it is entirely satisfactory—a final brake test is taken from the water-cooled brake wheel.

It is interesting to note the method of testing employed. The engines are placed on a stand and the first engine is started under its own power and the friction clutch, driving the brake, is thrown in after which the second friction clutch is thrown in, which causes the first engine to drive a second engine.

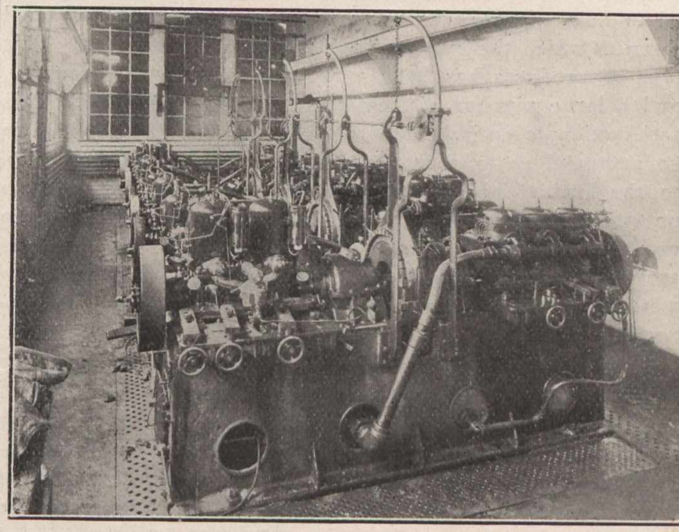
Sufficient load above the drag of the second engine is then added by tightening up the brake to absorb the full power of the engine at its normal speed.

The two engines, one driving and the other driven, are run in this manner for several hours, or until every detail of the outfit has been thoroughly tested and adjusted. A careful brake test on the first engine is then made, full data of which are recorded on a test card.

This engine is then removed and sent to finishing department to be prepared for shipment, and in its place is put the third engine and the second engine is then started up under its own power, driving the third engine, and this method is followed out continuously.

It is claimed that all moving parts are worked to a perfect contact before working strains are applied, and then when the motor is run under its two-power it is always given a load.

It is maintained that the fault with the testing out of



many motors is that they are run without a load and the brake test is taken from the fly-wheel; the fly-wheel soon heats and expands and requires frequent adjustment of the brake band, and practically makes it impossible to take a long test, but by using a water-cooled brake wheel the test can be given for as long as desired.

It will be noted that the beam of the brake is connected to a dynamometer and all engine power records are carefully taken at a certain speed, registered by a tachometer.

The careful testing of all up-to-date apparatus in engineering practice is now acknowledged to be invaluable, as in the end the added cost and trouble of this work is repaid to the manufacturer as well as the consumer many times over.

STATEMENT OF ACCIDENTS DURING MAY, 1909.

Trade or Industry.	Killed.	Injured.	Total.
Lumbering	27	19	46
Mining	10	3	13
Building Trades	2	32	34
Metal trades	3	27	30
Railway service	23	19	42
Navigation	6	13	19
General transport	3	18	21
Civic employees	1	4	5
Miscellaneous	..	7	7
Unskilled labor	1	6	7

SEPTIC TANK CONFERENCE.

On July 7th representatives of several Ontario municipalities, including London, Guelph, Waterloo, Berlin, Woodstock, St. Thomas, Peterborough, Preston and Barrie, met at the Engineers' Club, Toronto. After discussing the present situation and the probability of legal action being taken a deputation headed by Mayor Steveley and Mr. T. G. Meredith, K.C., of London, and Dr. Mearns, of Woodstock, waited upon Sir James Whitney.

They pointed out that in accordance with the directions of the Provincial Board of Health, they were installing systems calculated to purify sewage, and had been threatened with action for infringement of patent by the Cameron Septic Tank Company. They asked the Government to secure a competent opinion from Dr. Amyot and a patent attorney as to their rights.

"The request is a reasonable one," was the Premier's encouraging comment. "The Government will probably be able to give you an answer after its meeting on Thursday."

THE SUCTION GAS PRODUCER FOR SMALL POWER PLANTS.

(Continued from Page 43.)

through which air and the water to form the steam was allowed to flow. These chambers are encased in a steel shell through which the exhaust from the engine circulates. This type of producer has been very successful in this country, and a large number of them are still being installed. This satisfaction is entirely due to the water regulator, which is so arranged as to vary the amount of water in proportion to the load. This water regulator is situated immediately on top of the vaporizer, and is controlled by the suction of the engine. An objection to this arrangement in my mind is that no steam is generated until after the engine has been working sufficient time to heat up the vaporizer and its connecting pipes.

One of the first producers that I built in this country and one that gave exceptionally good results is shown on the screen. A feature of this producer was that surrounding the generator proper there is a jacket in which the air to support combustion is pre-heated before it passes through the vaporizer, which is situated upon the pipe conducting the hot gases away from the producer. By this means I secured nearly enough heat to vaporize all the water fed. This identical producer was tested by Prof. MacFarland, of the Armour Institute, and although it was of only 16 horse-power he secured a fuel consumption of 1.02 of a pound of coal per B.H.P., which result I do not think is being bettered even at the present day on such a small size plant as 16 horse-power. I abandoned this design for the reason that steam was not generated sufficient to give a maximum value of the gas.

I next put on the market a producer in which I pre-heated the ingoing air by means of a jacket surrounding the pipe conducting the gas away from the generator, which hot air passes into the ash pit, the necessary steam being generated in an annular ring surrounding the boss. This plant gives a rich gas immediately upon the start, but requires more or less continual attention, due to the ashes accumulating at the base of the fuel column, so preventing enough heat from reaching the vaporizing ring. Another objection that developed was that if the plant was worked on a light load for any length of time the water fed to the vaporizer was immediately flashed into steam and passed up through the fuel column unequally, that is to say, that in the same vertical plane as the water admission pipe there would be plenty of steam, while on the side farther from the water pipe there was nearly an absence of steam. This caused clinkers to form at this side. Lately I have developed a plant in which I have combined the good features of my previous plants and at the same time overcome their objections. In this producer I use a double shell, the space between which I utilize to vaporize and superheat the air and resulting steam to 500 degrees F., the mixture becoming thoroughly mixed before it reaches the bottom of the annular chamber and it is admitted equally all over the base of the fuel column, thus preventing clinker formation. The vaporizer in this producer consists of an iron spiral surrounding the inner shell and is supplied with a measured quantity of water at or near the same place where the air to support combustion is admitted. The method of regulating this water is extremely simple.

This apparatus consists of two tanks of equal capacity, mounted upon a rocking table, which is balanced by means of a spring or pendulum. These tanks are partially filled with a liquid and are connected at the bottom by means of a pipe. One of these tanks is connected by means of flexible connection to the gas pipe supplying gas to the engine. As the demand for gas varies the liquid with which these tanks are filled flows from the one to the other, so upsetting the balance of the table and causing it to assume a new position, which position governs the effective opening supplying water to the vaporizer. It is necessary that suction producers be fitted with a charging device for the admission of fresh fuel while the plant is in operation; we use the regular bell type of hopper, which has given satisfaction for a number of years, but we have gone a step farther in so arranging it that it is impossible to open the top cover while the valve at the bottom is open, or open the valve at the bottom while the cover is open. These plants occupy a very small floor space and are so arranged that all parts can be gotten at for purposes of inspection or cleaning.

In an installation of a 100 horse-power plant which is operating 24 hours per day there is a fuel consumption of ¾-pound of coal per B.H.P. per hour.

ASSOCIATION FOR THE DEFENCE OF SEPTIC PROCESS SUITS.

In his address before the Canadian engineers interested in the Septic Process of Sewage Purification, Mr. Wyllie, of Chicago, mentioned the Association for the Defence of Septic Process Suits in the United States. This association has for its objects:—

To aid the village of Saratoga Springs in determining the measure of damages due the company for the use of the septic process (the courts having already affirmed infringement); to defend any suits for royalties brought against any members of the association; to resist efforts to secure an extension of the life of the Cameron patent (which expires this year); to collect data as a basis for giving advice to members which will enable them to so operate tanks as to avoid infringement. Finally, to assist members in the adjustment of damages where infringement is affirmed by the courts.

The members are divided into three classes: municipalities, private companies or individuals owning or operating septic tanks, and individuals not owning or operating septic tanks. The last class is not subject to assessment, but the first two are to be assessed when necessary, according to a schedule. These assessments are intended to cover the cost of defending suits from time to time as such suits are brought, and for resisting the extension of the patent.

The officers of the association are: President, F. Herbert Snow, Chief Engineer, State Health Department of Pennsylvania; the secretary and treasurer, Geo. A. Johnson, of New York City; Executive Committee, Messrs. Johnson and Snow and seven other engineers, including H. M. Herbert, Chief Engineer of the New Jersey State Board of Health, and R. Winthrop Pratt, Chief Engineer of the Ohio State Board of Health; Patent Committee, George W. Fuller, of the firm of Hering & Fuller, who is also the consulting engineer of the association. The Executive Counsel is George W. Rightmire, of Columbus, O., and Charles L. Sturtevant, of Washington, D.C., is the consulting counsel.

THE

Sanitary Review

SEWERAGE, SEWAGE DISPOSAL, WATER SUPPLY AND WATER PURIFICATION

SEPTIC PROCESS PATENTS.

Septic process suits have been carried on in the United States for years and from court to court. The Cameron Septic Tank Company secured a decision in their favor, and since then many American municipalities and individuals have paid them royalties.

Many engineers throughout the United States do not approve of paying royalties on this process, and have organized an association for the defence of septic process suits. Particulars of the organization are given elsewhere.

In Canada the question of patentability has not yet been tested, but the present agitation may end in a test case being submitted. If such is done, it is to be hoped the question will receive careful consideration, so that when a decision is arrived at all parties to the dispute will be content with the finding, and then no attempt at evasions or impositions will be made.

MONTREAL WATER SUPPLY.

The city of Montreal has had considerable trouble with their water supply, but through it all there has been so much secrecy that the uncertainty is just as trying as the actual conditions. Certain of the citizens have decided it is in the public interest that more information be given out in connection with the water supply. With this object in view they have presented the following petition to the city council:—

> Whereas, none of these reports have been published, nor the general public been made acquainted with the contents of these various reports; and
>
> Whereas, the city is about to expend a large sum of money (said to be $5,000,000) to acquire the Montreal Water and Power Company.
>
> Resolved, that it is, in our opinion, most important to determine, by expert analysis, before purchase, if such water is a safe and wholesome supply.
>
> Resolved, that we, the undersigned, citizens of Montreal, request that the various reports on the water supply be published, so that the public may be made aware of the findings of these experts and the recommendations made in their reports.

It is to be hoped that the city council will grant the request, and that other municipalities will see the wisdom of placing such information within easy access of those interested.

SEPTIC ACTION AND WATERBURY SEWAGE.

That the ways of septic action are at times somewhat peculiar is amply demonstrated by a comprehensive study of the characterists of the Waterbury (U.S.) sewage in this connection.

For a period of eighteen months beginning July, 1905, a study has been made of this sewage in relation to its behaviour under septic conditions and other forms of preliminary treatment for removal of solids.

The deductive studies have been carried out under the Board of Public Works, Mr. R. A. Cairns, M. Am. Soc. C.E., city engineer; Mr. Wm. Gavin Taylor, M. Am. Soc. C.E., resident engineer, and Mr. Harry B. Hommon as chemist. Although two years have elapsed since the completion of the experiments, they have just found publication by Mr. Taylor in the Engineering News.

The crude sewage was of medium strength, substantially free from refractory trade wastes, and was alkaline in character. It was delivered at the screen chambers practically fresh, the organic matters being in large pieces. The composition of the sewage is shown by averaging the chemical analyses of 314 daily composite samples, consisting of 15,072 half-hourly portions, as per following table.

Average chemical composition of Waterbury sewage November 1905 to November 1906:—

Parts Per One Million.

Temperature degees F.	58.0
Oxygen consumed, total	46.0
Oxygen consumed, dissolved	26.0
Oxygen consumed, suspended	20.0
Organic nitrogen, total	14.8
Organic nitrogen, dissolved	10.3
Organic nitrogen, suspended	4.5
Free ammonia	7.8
Nitrites	.14
Nitrates	1.52
Chlorine	48.0
Suspended matter, total	165.0
Suspended matter, volatile	115.0
Suspended matter, fixed	50.0
Dissolved oxygen	3.8
Free CO_2	18.0
Alkalinity as CA CO_3	26.0
Fats (other soluble matter)	26.0

Septic action of the crude sewage was studied for the purpose of determining the value of such treatment in preparing the sewage for filtration through sand and sprinkling filters and for its purification by means of contact beds.

Two tanks were used in the tests for septicization, each being 14 ft. long by 6 ft. 3 ins. wide by 6 ft. deep and containing about 4,000 gallons. A third and similar tank was operated as a plain sedimentation tank for a comparison. Flow periods through these tanks ranged from 8 to 33 hours.

Tests were made upon the tanks to prove the uniformity of flow, by noting the passage of colored sewage and by a close comparison of analyses just before and after the interposition of an extensive baffling system in tank 2, with the result that no marked irregularity or non-uniformity of the flow could be detected. The actual flow rate within each tank was in substantial accord with the calculated flow period.

From September 3rd, 1905, to November, 1906, screened crude sewage was continuously pumped into septic tanks 2 and 3, the calibrations of the flow periods being as follows: Tank 2, 16 hrs., November, 1905, to Jan. 20, 1906, and March 23 to November, 1906; 24 hrs., January 20, 1906, to March 1, 1906; 33 hrs., March 1 to March 23rd, 1906; Tank 3, 8 hrs., June 6 to November, 1906; 16 hrs., November, 1905, to March 23, 1906; 32 hrs., March 23 to June 6, 1906. The tanks were not drained, neither was any of the sludge removed until the conclusion of the tests. A brief summary of results of operations under the schedule outline is shown in Table II.

Table II.—Average Composition of Septic Tank Effluents, Waterbury, Conn.

(Parts per million.)

	Flow period hours						
	Tank 3			Tank 2			
	8	16	32	16*	16†	24	32
Oxygen consumed	38	36	31	36	35	35	32
Organic nitrogen	8.5	10.3	8.2	6.9	9.8	12.6	10.5
Free ammonia	11.1	9.0	11.8	11.0	11.5	9.5	8.9
Nitrites	.00	.52	.19	.41	.14	.25	.19
Nitrates	.00	.84	.23	.67	.54	1.18	1.24
Dissolved oxygen	.00	1.9	0.7	2.7	1.2	2.5	2.4

Observations upon the action of these tanks showed that they behaved in an unusual manner, most notably, perhaps, in the abnormally long time required to effect anaerobic conditions. At Columbus, Ohio (Report on Sewage Purification, 1905), it was found that the septic action was matured, if we consider such maturity as being shown by the first pronounced and continued ebullition of the gases of fermentation in the tank liquid taken in conjunction with the analyses of the effluent samples, in from 8 to 17 days, depending upon some function of the temperature, as may be shown by plotting a curve representing the time required for maturity. In evidence collected in England by the Royal Commission on Sewage Disposal, Mr. T. W. Harding stated that several weeks passed before evidences of fermentation appeared in the tanks at Leeds, England. Mr. E. G. Mawbey, Leicester, England, stated that septic conditions "began in about three weeks; about from a fortnight to three weeks; if it was hot weather they began sooner than in the cold weather;" Mr. Gilbert J. Fowler, Manchester, England, stated that "in the course of a few days (the tank liquid) will begin to give off gas, but it will be by no means thoroughly septic before some months."

In the case of the test tanks receiving Waterbury sewage no evidence of fermentative actions, as marked by the ebullition of gas, occurred until about the middle of May, 1906, or until more than eight months after the starting of the tanks. At this time small bubbles began to appear, but the gas formation was not sufficiently pronounced nor the bubbles of such size as to admit of their being "flashed" by a lighted match until the middle of June. From June to September the intensity and violence of the putrefactive action rapidly increased and the ebullition of gas during this period was exceptionally active.

A surface scum did not appear upon the tanks between September, 1905, and May, 1906; during this latter month a growth of green algae spread over the surface. Beginning in June, with the increased activity of the gas formation, small masses of sludge were thrown up from the bottom, forming a series of thin, temporary surface scums, each of which was dissipated by the first wind or rain. Gradually the turbulence in the tank became more pronounced and the sludge masses dislodged from the bottom increased in size, until in July they were frequently as large as a waterpail. These large masses soon formed a deep, dense and tenacious surface mat which was persistent. A handful of timothy seed was scattered over the surface of one of the tanks in July, and the grass growing therefrom attained, before frost, a height of about 8 ins. The grass roots grew throughout the surface mat and bound it together into a tough mass which tenaciously held together.

Besides the apparent inactivity of fermentative actions within the tanks between September and June, as shown by the absence of gas formation during that period, further proof may be shown by a study of the chemical data. The daily analyses of the crude sewage during the September-to-May period invariably showed the presence of nitrites, nitrates and dissolved oxygen in considerable quantities. In fact, during the entire period covered by the tests, even in midsummer, these three constituents were almost invariably present in the half-hourly and daily composite samples of crude sewage.

Throughout the colder months the parts per million of each have been higher than during the warmer months. The effluents of both septic tanks 2 and 3 upon analysis showed that previous to June all three of the constituents under discussion were present, although reduced in amount from that found in the crude sewage. The presence of available oxygen in the form of nitres, nitrates and dissolved oxygen (Table III.) in the effluents of the septic tanks obviously proves beyond a doubt that anaerobic conditions had not been established throughout the tanks and that the putrefactive and hydrolysing actions were feeble.

Table III.—Dissolved Oxygen, Nitrites and Nitrates in Waterbury Sewage and Septic Tank Effluents.

	Crude sewage.			Septic effluents.		
	Dissolved Oxygen.	Nitrites.	Nitrates.	Dissolved Oxygen.	Nitrites.	Nitrates.
Yearly average (Nov., 1905, to Nov., 1906)	3.8	0.14	1.52			
Seven months (Nov., 1905, to May., 1906)	4.5	0.18	2.18	*3.9	0.14	1.71
				†3.6	0.14	2.10

That tanks could receive sewage constantly from September 3 to May 1 of the next year, as these tanks did, without the establishment of active putrefactive conditions is a most interesting and remarkable occurrence.

In searching for an explanation of the unusual amount of available oxygen present in the crude sewage and the effluents of the septic tanks, in the form of oxygenated nitrogen compounds and in the gaseous state, the mode of sample collection and preservation, and the technique of the analyses were subjected to elaborate checks until definite and absolute proof of the correctness of the results was established. The flows through the tanks were studied until it was shown that the actual flow period did not materially differ from that calculated by the flow passing the gauging device, and an efficient system of baffles and scum boards was constructed in tank 2 which absolutely prohibited the sewage from passing through in any other than the rated period of time. The interposition of this baffling system did not effect, in the least, a change in the character of the effluent, nor did it assist in the promotion of putrefactive actions. A study of the average monthly analyses of tanks 2 and 3 shows that the anaerobic conditions were less complete in tank 2 than in tank 3 even in the face of the fact that the latter tank did not have a baffling system and that it was operated during the summer at twice the rate of the former.

As an explanation of the non-activity of putrefaction of fermentation in the sewage and the extreme slowness with which its available oxygen was exhausted, Table IV. has been prepared from data contained in the daily analyses of the crude sewage. The table shows, by months, the amount of nitrites, nitrates and dissolved oxygen in the sewage and also the oxygen consumed value as measured by a three-minute contact with an acidified solution of permanganate at room temperature, or its equivalent value, 20 per cent. of the 5-minute boil, the oxygen available in the oxygenated nitrogen compounds and in the dissolved gaseous state. Two ratios are shown: first, that existing between the available oxygen in the nitrites and nitrates and the oxygen consumed value, and second, that existing between the oxygen available in the

*Nov., 1905, to Jan. 20, 1906; †March 23 to Nov., 1906.

*Tank 2; †Tank 3.

form of nitrites, nitrates and dissolved oxygen and the oxygen consumed value. The highness of these ratios during the colder months amply explains, it is believed, the feebleness of the putrefactive action.

Table IV.—Average Amount of Available Oxygen in Waterbury Crude Sewage as Dissolved Oxygen and Oxygenated Nitrogen Compounds.

TABLE IV.—AVERAGE AMOUNT OF AVAILABLE OXYGEN IN WATERBURY CRUDE SEWAGE AS DISSOLVED OXYGEN AND OXYGENATED NITROGEN COMPOUNDS.

(Parts per 1 000,000)

Month 1901	Available oxy. as nitrites and nitrates	Oxy. consumed	Ratio Col. 1÷ Col. 2	Available oxy. as nitrates nitrates and dis. oxy.	Ratio Col. 4÷ Col. 2
January	6.1	9.2	66	10.8	117
February	4.47	8.0	56	8.11	101
March	7.00	8.8	79	11.7	133
April	8.01	8.4	95	12.11	144
May	5.35	8.8	61	8.45	96
June	2.43	8.4	29	6.03	72
July	1.69	8.6	20	4.69	55
August	1.27	9.0	14	3.87	43
September	2.54	10.4	25	4.74	45
October	5.18	11.8	44	8.58	73

As further evidence bearing upon the time required for the exhaustion of the available oxygen and the establishment of putrescent conditions it may be said that 4-oz. samples of crude sewage collected during the winter of 1906 and incubated for 24 hours at 98 deg. F. still contained a small amount of available oxygen and were free from the characteristic putrescent odors or discolorations. The samples would, however, break down at the end of 30 or 33 hours incubation and show at that time a blackening, a depletion of the available oxygen and the presence of hydrogen-sulphide.

Observations upon the Naugatuck River substantiate the results of the above tests. The stream is grossly polluted and during periods of dry weather about one-third of the flow reaches it through the city sewers. Except during the months of July, August and September the nuisance caused by the polluting wastes is not apparent by odors or gases arising from the putrefaction of the organic matters.

A test was made March 14-17 upon tank 2 to show exhaustion of the dissolved oxygen. The tank influent was stopped at 8 a.m. March 14 and started again at 8 a.m. March 17, the retained liquid being held in a state of quiescence. Table V. shows that the available oxygen was exhausted at the end of 22 hours. The free ammonia increased slightly, with a corresponding dcrease in the organic nitrogen. Upon the resumption of the influent flow the anaerobic conditions rapidly disappeared and the effluent returned to its normal quality.

Table V.—Test for Oxygen Exhaustion, Septic Tank 2.

Date.	Nitrites.	Nitrates.	Dissolved Oxygen.
March 13, 8 a.m.	0.22	.91	3.0
*March 14, 8 a.m.	0.04	.26	3.6
March 14, 6 p.m.	.02	.22	2.5
March 14, 12 mid.	.01	.23	.30
March 15, 6 a.m.	.00	.00	.00
†March 17, 8 a.m.	.00	.00	.00
March 17, 12 mid.	.00	.00	0.8
March 18, 8 a.m.	.14	.79	2.0
March 19, 8 a.m.	.20	1.29	4.1

An exhaustion of the dissolved and other available oxygen from the septic tanks did not occur until June. Following this exhaustion the ebullition of gas became violent, causing great turbulence within the tank. The incessant upheavals of gas, during this period of accentuated putrefactive action, put into suspension much finely divided organic matter, the complete exclusion of which from the effluent was practically impossible. This abnormal action of the septic tanks under the Waterbury conditions makes their control much more difficult than is generally the case, for throughout the colder months they operate practically as plain sedimentation tanks, the action of which is succeeded by a most violent fermentation during the summer months.

*Influent shut off; †influent flow resumed

The sludge accumulating within these tanks during the first eight months of their operation had a coarse, fibrous texture, and a dark, grayish color and showed the result of but a small amount of bacterial action. In November, however, after the period of intensified bacterial action occurring throughout the summer, the sludge was well digested, finely divided and jet black.

The average flow periods of tanks 2 and 3 was 15.5 and 11 hours, respectively, the horizontal velocities being .08 and .11 mm. per sec. At the conclusion of the tests tank 2 held 1.07 and tank 3, 0.55 cu. yds. wet sludge per 1,000,000 gals. of sewage passed through. In each tank there had been deposited 0.25-ton of dry solids per 1,000,000 gals. of sewage treated, and of this 56 per cent. was retained in tank 2 and 36 per cent. in tank 3 at the conclusion of the tests.

Under the same conditions that governed the septic tanks, tests were made with a plain sedimentation tank. The sludge was removed so frequently from the sedimentation tank that septic action never became established. The adaptability of the effluent from the sedimentation tank so far as its subsequent purification by filtration is concerned, has been substantially upon a parity with the more or less completely hydrolized effluents from the septic tanks. The principal advantage in the use of septic tanks under the local conditions appeared mainly in the economic disposal of the accumulating sludge.

The practicability of successfully treating the effluent from plain subsidence basins upon sand or sprinkling filters at high rates has much value in the present instance, as it admits of the efficient purification of the sewage almost from the time of filling the basins, the only lost time being that required in the development of the biological construction in the filters. Since Waterbury is under obligation to purify its sewage wastes only during the months between May and November, it is evident that through this parity of effluents the annual cost of pumping is greatly reduced, and further it is practicable to operate tanks at flow periods of 16 hours or less, whereas if a much more perfectly hydrolized effluent was required the flow period would necessarily exceed 32 hours.

Note.—The above experiments should be of great interest to those interested in septic action. They practically substantiate the conclusions of the British Royal Commission's Fifth Report. We note that no figures are given showing the actual digestion of sludge taking place in the tanks, as no allowance is made for the increased amount of solids passing off in the effluents during septic action. It is stated above: "The incessant upheaval of gas, during this period of accentuated putrefactive action, put into suspension much finely divided organic matter, the complete exclusion of which from the effluent was practically impossible."

In giving the percentage of sludge retained in tanks No. 2 and 3 as 56 per cent. and 36 per cent., respectively, it would appear to have been useful to have known how the balance was accounted for, as between hydrolysis and gasification on the one hand and direct passage as fine particles with the tank liquor on the other. In comparing septic liquor with sedimentation liquor for secondary treatment in either contact beds or percolating filters, this is a most important consideration, the life of the filter and its fineness of material depending to a great extent upon the maximum removal of matters in suspension.

Ed. San. Review.

SPECIFICATIONS FOR PILE AND PILING.

The city council of New York City decided to have their building code revised, and for this purpose they appointed a Building Code Revision Commission. This Commission consisted of engineers and architects of prominence, and many of their findings are of interest to engineers.

Two reports were submitted, a majority and minority report.

Both reports are quoted here and it will be seen the main difference is in connection with concrete piles, but even here there is great similarity.

MINORITY REPORT.

Wood and Concrete Piles.

Wood Piles.

Wood piles may be of spruce, oak, longleaf yellow pine, Norway pine, or fir, but shall not be of hemlock or scrub pine. Piles shall be sound and straight. The diameter at the butt shall not be less than ten inches, and the diameter at the point shall not be less than six inches. The length shall not exceed twenty-five times the diameter at the butt.

They shall be driven to refusal if possible, and the method of driving shall be such as not to impair their strength. The centre to centre distance between piles shall not be more than thirty-six inches nor less than three times the average butt diameter.

If driven to refusal a maximum load per pile of fifteen tons may be used unless the load be otherwise determined by test. If not driven to refusal the maximum load per pile shall not exceed ten tons.

The Superintendent of Buildings shall be notified before any test is made of the sustaining power of piles so that he may be present or represented thereat. When doubt arises in regard to the safe sustaining power of piles in the soil upon which a building is to be erected, the Superintendent of Buildings shall order test piles to be driven by or at the expense of the owner of the proposed building. The record of such test shall be filed in the office of the Superintendent of Buildings.

The safe sustaining power, of a pile not driven to refusal, which shall in no case exceed ten tons, shall be determined by calculation based upon the following formula:—

$$L = \frac{2WH}{P + 1}$$

in which L = the allowable load in tons (maximum is 10 tons).
W = the weight of the hammer in tons,
H = the fall of the hammer in feet,
P = the penetration in inches under the last blow after the pile has sunk to a point where successive blows produce equal penetrations.

Piles shall be cut off so that the top is always below the level of mean low water. When required concrete shall be rammed down in the interspaces between the heads of the piles to a depth of not less than twelve inches and laterally for a distance of not less than twelve inches on each side of the rows of piles.

If piles are capped with timbers the timber shall be of sound, hard wood, not less than six inches thick and properly joined together. The tops of all such timbers shall be below the level of mean low water, except in the case of frame buildings built over water or on soft meadow, or similar land, in which case piles may project above the water a sufficient distance to raise the building above high tide and then the building may be placed directly thereon.

Concrete Piles.

The mixture used for concrete piles shall be one part of Portland cement; two parts of sand; three parts of broken stone which will pass through a ring three-fourths of an inch in diameter.

Concrete piles when not reaching rock or hardpan, and depending for their supporting power on friction between the surface of the pile and the surrounding material, shall not be loaded in excess of four hundred pounds per square foot of surface in contact with the soil, and shall not be driven closer centre to centre than three times their average diameter.

Concrete piles, when driven to a solid bearing, such as rock or hardpan, may be loaded to three hundred pounds per square inch of cross-section of pile, the cross-section being taken at the smallest point of the pile, provided sufficient steel reinforcement is embedded in the pile to provide against failure by shear or by bending when the pile is figured as a long column.

All steel reinforcement shall be embedded in the concrete forming the pile and shall be protected by at least two inches of concrete.

The loading per pile shall not be increased by reason of the steel reinforcement.

If the concrete piles are built in position and not driven, the forms are not to be removed until the concrete has obtained its final set.

MAJORITY REPORT.

Wood and Concrete Piles.

Wood Piles.

(1) Wood piles shall be only of spruce, oak, longleaf or yellow pine, Norway pine or fir. They shall be sound and straight. The diameter at the butt shall not be less than ten inches, and the diameter at the point shall not be less than six inches. The length shall not exceed twenty-five times the diameter at the butt.

(2) They shall be driven to refusal if possible, and the method of driving shall be such as not to impair their strength. The centre to centre distance between piles shall be not more than thirty-six inches, nor less than three times the average butt diameter. If driven to refusal, a maximum load per pile of fifteen tons may be used unless the load be otherwise determined by test. If not driven to refusal the maximum load per pile shall not exceed ten tons.

(3) The Superintendent of Buildings shall be notified before any test is made of the sustaining power of piles, so that he may be present or represented thereat. When doubt arises in regard to the safe sustaining power of piles in the soil upon which a building is to be erected, the Superintendent of Buildings shall order test piles to be driven by or at the expense of the owner of the proposed building. The record of such test shall be filed in the office of the Superintendent of Buildings.

(4) The safe sustaining power, of a pile not driven to refusal, which shall in no case exceed ten tons, shall be determined by calculation based upon the following formula:—

$$L = \frac{2WH}{P + 1}$$

in which L = the allowable load in tons (maximum is 10 tons).
W = the weight of the hammer in tons,
H = the fall of the hammer in feet,
P = the penetration in inches under the last blow after the pile has sunk to a point where successive blows produce equal penetrations.

(5) Piles shall be cut off so that the tops are always below the level of mean low water. Concrete shall be rammed down in the interspaces between the heads of the piles to a depth of not less than twelve inches, and laterally for a distance of not less than twelve inches on each side of the rows of piles.

(6) Under frame buildings piles may be capped with timbers; the timbers shall be of sound, hard wood, not less than six inches thick and properly joined together. The tops of all such timbers shall be below the level of mean low water, except in the case of frame buildings built over water or on soft meadow, or similar land, in which case piles may project above the water a sufficient distance to raise the building above high tide, and then the building may be placed directly thereon.

Concrete Piles.

(7) The mixture used for concrete piles shall be one part of Portland cement, two parts of sand, and three parts of broken stone, which will pass through a ring three-quarters of an inch in diameter. The concrete shall be machine mixed.

(8) Steel reinforcement, which shall meet the approval of the Superintendent of Buildings, shall be provided to pre-

vent failure by shear or bending. The steel reinforcement, when imbedded in concrete, shall be protected by at least two inches of concrete. No allowance shall be made for steel reinforcement.

(9) The allowable bearing capacity of concrete piles shall be as determined by the Superintendent of Buildings.

GRADE SEPARATION.

F. L. Somerville.*

(Continued from last week.)

New York, N.Y.

Park Avenue Viaduct Improvement. Eng. Rec., Vol. 34, page. 309.

The Grand Central Station at 42nd Street is the terminal of three railroads, viz.:—

The M. Y. C. & H. R. R. R., the N. Y. & H., and the N. Y. N. H. & H. About 500 trains a day run to and from it and pass through nearly five miles of the densely built portion of the city to the crossing of the Harlem River. There are four tracks which enter a tunnel soon after leaving the Grand Central Station and emerge from it at 96th Street beyond which there were formerly embankments and cuts nearly to the river which was crossed by a low level draw bridge.

In connection with the completion of the Harlem Ship Canal the United States Government required the bridge to be raised 14 feet, which necessitated the raising of the approaches which has been done by building a four-track steel plate girder viaduct from 110th Street to 134th Street, (a distance of 1¼ miles) on the south side of Harlem River and embankments and plate girder viaduct on the north side.

Harlem River Branch of the N. Y. H. & H. R. R. Engineering Record, Vol. 56, page 506, November 9th, 1907.

This track runs through a point near the junction of Harlem and East Rivers in the Borough of Bronx northward to New Rochelle where it joins the main line.

The traffic is largely freight, much of which originates on the line while there is a rapidly increasing suburban passenger traffic.

The main work done was to bring the road up to a six track line coincident with which and other improvements is a change of grade to eliminate grade crossings which was done by eliminating the track with subways for the streets or depressing it with overhead bridges for the streets as the levels of the land made advisable.

Newark, N.J. Population, 1900, 246,070.

Engineering Record, Vol. 48, page 806.

Delaware, Lackawana and Western Improvement.

In Harrison, which is separated from Newark by the Passaic River there were 13 crossings all at grade except four, which were subway. The track has been elevated and now all the crossings are subways.

In Newark there were 27 street crossings, all but one at grade. In order to reduce a heavy 3 per cent. grade the track was partly elevated and partly depressed, and all grade crossings abolished and four of the streets now cross the tracks by subways, the remainder by overhead bridges.

The maximum old grade was 3 per cent. The maximum new grade is 1.15 per cent.

In Newark the city pays part of the cost of the work, but in Harrison the railway bears the whole cost.

Philadelphia, P.A. Population, 1900, 1,293,697.

Philadelphia and Reading Track Elevation. Railroad Age Gazette, Vol. 65, page 612, July 31st, 1908.

In October, 1906, an ordinance was approved authorizing the Mayor of Philadelphia to make a contract with the railroad to elevate certain section of track on the line operated within the city.

This work was done on three sections.

*Consulting Engineer, Toronto, Ont.

The Philadelphia Germantown and Morristown from Green to Broad Street will be elevated, all streets will pass under the tracks of which the surfaces of four will be more or less depressed. For about 4,500 the track will be carried on steel viaduct having four tracks and the remainder will be on solid fill between retaining walls and steel bridges with solid waterproof floors. At Broad Street the grade is unchanged, that street and Lemon Avenue which intersects at the crossing being carried over the tracks by a bridge.

The P. G. & N. from a point north of Broad Street to the crossing of the Richmond Branch just south of the Wayne Junction will be elevated and carried over all the streets. The four tracks are carried on solid fill with masonry walls and steel bridges with solid waterproof floors, all streets appear to be more or less depressed.

On the Richmond Branch from the northeasterly part of the city the tracks are to be elevated from the bridge at Summerset to Richmond Street. This section includes a large yard which will also be elevated.

The extent of the work and the number of grade crossings which will be done away with are shown on the following table:—

Sections.	Length, miles.	Grade crossings abolished.
P. G. & N., Green to Broad	2.2	21
P. G. & N., Broad to Richmond..	1.5	8
Richmond Branch	1.3	3
	5.0	32

The depression of some of the streets has made necessary a large amount of reversion of sewers.

Under the terms of the ordinance the cost of the work, including damages for change of grades of streets, etc., is to be evenly divided between the city and the railway, except that the latter pay the entire cost of additional cost.

South Norwalk, Conn. Population, 1900, 6,591.

Railroad Gazette, Vol. 28, page 613, September 4th, 1896.

The work in South Norwalk is part of the plan of elimination of grade crossings on the New York Division of the New York New Hampshire and Hartford Railroad, and at the same time provided increased traffic facilities by making a four track road.

The work described in the article is the raising of the grade about 15 feet, through the city of South Norwalk and across the Norwalk River a distance of about three fifths of a mile. This improvement connects with former work at the east end by descending grade of 30 feet per mile and on a level at the west end. It also entailed new connections with the Danbury Division and the Wilson Point Branch, single track lines, requiring a distance of half a mile on each to reach the old grade with a maximum of 40 feet per mile.

On the main line two grade crossings were abolished and three on the branches. All the material (sandy loam) for main line fill, about 200,000 cubic yards was brought 22 miles in 25 car trains, each car holding about 25 cubic yards.

Seattle, Wash. Population, 1900, 80,671.

Terminal Improvements. Railroad Gazette, Vol. 37, page 510, November 4th, 1904.

The article gives the population as about 120,000, which shows a large growth since 1900. The city is one of the principal seaports on the Pacific Coast, and owing to the large amount of shipping the water front has become greatly congested and a large amount of additional land has been acquired east of the old railway terminals, on which to build new freight and passenger stations with the necessary yards and tracks.

Because of the peculiar conformation of the land on which the city is built the only way to approach the terminals from the north other than over the present line along the water front was to build a tunnel under the high ground of the business district. This was decided upon as it was imperative to do away with the congestion along the line of docks

DISCUSSION OF VARIOUS PILES AND METHODS OF DRIVING THEM.*

By Frederic W. Swain.

Until recent years, the wooden pile has been used in nearly every case where the soil was too soft to carry the weight of the building to be imposed upon it. But now, since concrete has come into such general use as a construction material, the superiority of concrete piles has successfully been demonstrated. When concrete piles were first invented, wooden piles had been used for so many years that many engineers and architects considered them standard, and at first hesitated to use piles made of concrete; however, the use of concrete piling has increased rapidly each year, as its advantages have become more generally recognized.

The different types of piles may be divided into the following main heads:—

1. Wooden piles.
2. Concrete piles.
   - Method.
     - a. Molded.
     - b. Made in place.
   - Shape.
     - c. Tapered.
     - d. Uniform diameter.

Wooden Piles.—Owing to the fact that, unless wood is constantly kept saturated with water it will decay in a short period, the building laws of all cities require that wooden piles should be cut off at, or below, the level of the water

Fig. 1.—"Broomed" Wooden Piles, Supposed to be in Good Condition, Until Excavated for Inspection.

table. Whenever this level is a considerable distance below the surface of the ground, deep and costly excavation, sheathing and pumping are necessary in order to carry the foundation down to the tops of the piles. Such a foundation, with its deep excavation, and the excessive amount of stone or concrete required for its construction, is necessarily very expensive. There is a danger in cutting off wooden piles at the exact level of the ground water, due to the fact that frequently sewers or street drains are subsequently installed, or dams removed near the building, which may appreciably lower the level of the water table. Many buildings in Boston have been caught in this way, and before many years have passed it will be necessary to reinforce their present foundations.

Sometimes, under very heavy buildings, the whole area is filled with piles driven as closely together as conditions will permit. This is usually about two and one-half feet on centres. After the piles are cut off, a solid bed of concrete, into which the tops of the piles extend for perhaps six or eight inches, is laid over the whole area of the basement. To be sure, this practice ensures a rigid binding of the piles, but it gives an excellent opportunity for dry rot to take place in the wood which is embedded in the concrete. The bond between the concrete and the surface of the wood is very close and will permit little, if any, water to soak up into the top of the pile. Air, also, is largely excluded in the same way, and where these conditions exist dry rot is sure to take place before many years have passed.

In many localities the upper strata of the soil are fairly soft and are underlaid by a bed of stiff clay or hardpan. If wooden piles are driven in such soil no difficulty is encountered in driving through the soft material, but they are not sufficiently rigid to penetrate hard soil to any depth. Under these conditions the bearing power of the pile is limited nearly to its end support. The reasons for this are that the coefficient of friction between smooth wood and soft ground is low, that the frictional area of the pile is small, and that the compression of the soil, due to driving, is correspondingly small. Attempts to drive wooden piles into hardpan are attended with considerable danger of "brooming" the pile, and of course a "broomed" pile is worse than no pile. Many people claim that they know just what is taking place in the ground when a wooden pile is being driven, but such piles have frequently been exposed and found to be badly "broomed." When a pile is splintering in this way it apparently is in good condition because it is forced down under

Fig. 2.—Section of Wooden Pile, Showing the Destructive Work of the Teredo and Limnoria.

each blow, but instead of the point of the pile going deeper into the ground the fibres are merely buckling.

Specifications usually call for wooden piles not less than eight inches in diameter at the butt, and six inches at the point. Such a pile, having a small end area, small friction surface, and low coefficient of friction, necessarily has only a low carrying capacity. The customary loads for wooden piles range from about six to twelve tons, according to the length of pile and the condition of the soil. Even a four-story manufacturing building may be as heavy as fifteen tons per linear foot of foundation, from which it may be seen that a great number of piles would be necessary safely to carry the building.

No pile is safe unless it is drawn vertically, and since it is seldom that wooden piles over twenty feet long are any-

*Abbreviated from the Harvard Engineering Journal.

where near straight, it is very difficult to drive them perpendicularly. If a pile is inclined to the perpendicular, its load is eccentric, which gives rise to serious stresses in the wood.

Wharf piles are subjected to alternate wetting and drying which, after a period of twenty years, will seriously decompose the wood. Other enemies of wooden piles in the water are the teredo and the limnoria, which honeycomb the pile and destroy it in a very few years. In the tropics this destruction takes place in about nine or ten months.

Wooden piles are driven usually either with a drop hammer or a steam hammer, the first being by far the more popular, because the energy of its blow is a definite quantity, whereas that of steam hammer is somewhat uncertain.

Concrete Piles.—All types of concrete piles have the advantage of their point of "cut-off" being independent of the level of the water table; that is, they can be carried to any height desired. Most concrete piles have a much larger carrying capacity than wooden piles.

Concrete piles are considered by some to be a luxury. As a matter of fact, under many conditions, they are an economy, because, although the cost per linear foot of pile for concrete is considerably greater than that for wood, the saving in number of piles, excavation, sheathing, pumping, foundation materials, and time of doing the work, far more than balances the greater cost of the piling itself.

Molded Concrete Piles.—Owing to the fact that there is so much handling necessary in the manufacture and installation of molded piles, the cost is comparatively high, but there are conditions where the molded pile is superior to other types, and is well worth the additional expense. One source of expense is the reinforcement, which is always necessary in molded piles, as protection against breaking in handling and driving.

Such piles are driven in three ways: With a drop hammer, a water jet, and a third method to be mentioned later.

Obviously it is unwise to use a drop hammer on a molded pile, because of the great danger of rupturing it.

The water jet is a safer method, but there is great danger of a larger hole being washed out than can be filled by the pile, hence the soil gives little or no lateral support to the pile. Not only is there lack of support in such a case, but there is also a lack of side friction. To be sure the coefficient of friction between smooth concrete and soft soil is not very great, but frequently it is surprising how much friction adds to the carrying power of the pile. When a pile is jetted down it is customary to tap it lightly with a hammer after jetting, to make sure that the end bearing is good.

The third method, and undoubtedly the most successful one of installing molded piles, is to drive by means of a drop hammer a heavy steel tube, fitted with an "alligator" point. This point, which is shown in the accompanying photograph, is similar to the "clam shell" dredge bucket, and is fastened to the bottom of the driving form by means of hinges, which allow the two sections to fall apart when the form is withdrawn. After the tube has penetrated to good bearing, a few cubic feet of concrete are deposited in the bottom of the form. Then a molded pile, slightly smaller in diameter than the inside of the driving form, is lowered into the form and forced into the plastic concrete. Then the heavy driving form is withdrawn, leaving the pile with a perfect end bearing and the necessary vertical support. The main advantage of this method lies in the fact that this driving form may be forced into stiff clay or hardpan, whereas it is impossible to penetrate such material with a jet. This being the case, the pile merely rests on the surface of the hard stratum, and has but little support from the soft overlying stratum against lateral forces.

Concrete Piles made in place.—For the sake of clearness we will call the two principal systems installing this kind of pile No. 1 and No. 2. Briefly No. 1 is as follows:—A fairly rigid, collapsible, tapered core, about which is placed a thin sheet-iron shell, is driven to the proper penetration and then the core is collapsed and withdrawn, leaving the shell in the ground. In system No. 2 a heavy steel tube of uniform diameter, having a detachable cast-iron point, is driven, then filled completely with concrete by means of bottom dump buckets, after which the driving form is pulled, leaving the cast-iron point in the ground.

In system No. 1 the alleged object of leaving the shell in the ground is that concrete requires a form to keep out the water and protect it until it is set. It may be easily seen, however, that this shell is usually superfluous, because the compression of the soil about the pile itself constitutes a fairly rigid mold. As far as being sufficiently rigid to withstand the back pressure of the earth until the concrete has been placed is concerned; this shell is altogether inadequate. Besides, the use of a smooth shell appreciably reduces the friction force on the side of the pile.

When no shell is left in the ground, the surface of the concrete being very rough, a tremendous frictional value is obtained, which is capable of carrying a very large percentage of the load imposed upon the pile.

Piles made in place, if properly installed, have many advantages over other types in most soils. They are cheaper ordinarily than molded piles, because there is much less handling and less time required in installing them. Another advantage is that there is no possibility of injury to the pile in driving, as no concrete is placed until the form has been driven to the proper penetration.

In system No. 1 the concrete is shoveled into the form, which is bad practice, because the stone is very likely to separate from the sand and cement during the fall, thus giving an imperfect mixture.

Some people make the claim concerning system No. 2 that, since no shell is left in the ground to protect the concrete, the back pressure of the soil might squeeze the concrete, but the filling of the tube completely before the tube is drawn maintains a sufficient head of concrete in the tube to resist any possible earth pressure. In order to squeeze a pile in this way the back pressure of the earth must be great enough to lift the concrete bodily, and of course, this condition is an impossible one.

Tapered Concrete Piles.—The following discussion applies to tapered piles, whether molded or made in place.

Most tapered piles have the following dimensions:—For a twenty foot pile, a six inch point and twenty inch butt, and for a thirty to forty foot pile, an eight inch point and an eighteen inch butt. Since the volume per linear foot of the pile is greatest at the butt, the compression due to driving is correspondingly greater at the surface of the ground that at the point. The friction area, also, is proportional to the volume, and the result of these two facts is that a greater proportion of the load per linear foot of pile is carried at the top. But since piling is necessary, it follows that the top soil is not capable of carrying a heavy load, and yet a very large part of the load on the pile is carried by the top five or six feet. This obviously is wrong, because the poorest soil is made to carry the heaviest load, and the firmest soil at the lower end of the pile carries a comparatively light load, and is not fully developed, inasmuch as the volume per linear foot of the lower end of the pile and the frictional area there are much smaller than at the top.

An example, showing how incorrect is the use of piles with small points, is the method of building plain foundation walls. Such a wall always rests on a broad footing, and is wide at the bottom and narrow at the top. The reason for this is that it is necessary to distribute the load over the ground, and not concentrate it on a small area. No man would ever put in a foundation wall narrow at the bottom and wide at the top, and is it any more reasonable to put in piles in that manner?

The so-called "wedge action" in a tapered pile is a myth. To be sure, there is a slight upward component to the force exerted by the soil upon the pile, but this is small, and is negligible, because it is much less than the loss in frictional force due to the small volume of the end of the pile.

The shortest driving form for this type of pile is about twenty feet. It is easy to see that if only a ten foot pile is driven its cross section is very small, the top being thirteen inches in diameter, while the point remains six inches. Hence the volume and frictional area are very much reduced, and if the usual load of thirty tons is imposed upon the pile, the concrete will certainly be overloaded. Allowing the customary four hundred and fifty pounds compressive stress to the concrete, a pile must be at least one hundred and thirty-four square inches in cross section in order safely to carry a load of thirty tons. To be sure the area of a thirteen inch circle is one hundred and thirty-three square inches, but the section of the pile at the point where the load is carried is probably several feet below the top of the pile, and hence at a point where the cross-section is very much less. This overloading of the concrete may be clearly shown if we take a definite example of conditions frequently encountered: if a tapered pile is driven through sixteen feet of soft top soil and then four feet into stiff clay or hardpan, practically the entire load is transmitted, without reduction, to the top of the hard stratum, hence the whole load must be carried on a cross section of concrete at most not greater than the area of a nine-inch circle, or sixty-three and six-tenths square inches. Now if this pile is carrying the usual load of thirty tons, on not more than sixty-three and six-tenths square inches of concrete, the load per square inch would be nine hundred and forty-four pounds, which is far in excess of that allowed by the building laws of any city in this country. This overloading of the concrete is a very serious matter, and is a condition which should be strictly avoided.

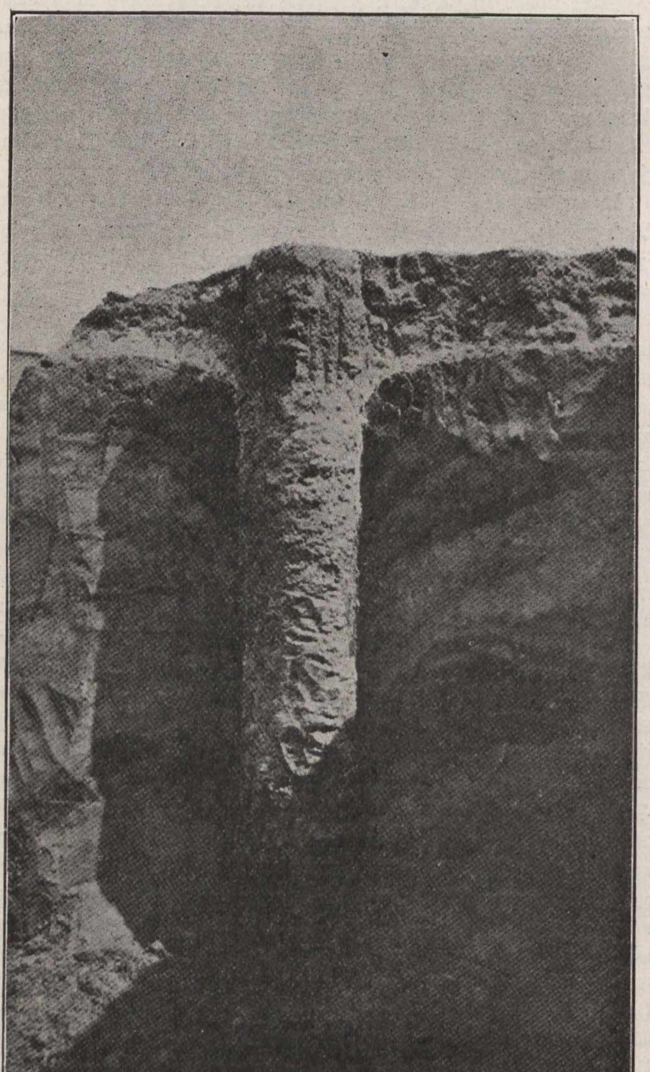


Fig. 3.—Concrete Pile, Made in Place, Showing Lines of Compression.

Concrete Piles of uniform diameter.—This type of pile has a great many advantages over a tapered one, among which are: that the cross section of a short pile is as great as that of a long one, and hence there is no danger of overloading the concrete; also that piles of this type very seldom have sheet iron casings, so that the concrete comes in intimate contact with the soil about it, and actually becomes cemented to it; and since the surface of the concrete is naturally very rough, a tremendous friction value is present; also that the frictional area per linear foot of pile, and the intensity of compression due to driving, are constant throughout the length of the pile. The resistance of friction on such a pile increases steadily from nothing at the very surface of the ground to a maximum value at the point. This is the ideal condition, because the top soil, since piling is necessary in the locality, is not capable of carrying a heavy load, and the firmer soil, which is able to sustain a heavy load, is fully developed. If we disregard friction and consider only end bearing, the uniform diameter pile has a much larger point than a tapered one, because the diameter throughout the length of a straight pile is very nearly that at the butt of a tapering one. The diameter of the type of "uniform" pile, which has been used far more than any other system, is sixteen inches. Now compare the area of a sixteen-inch pile, 201 square inches, with those of six and eight-inch points of tapered piles. The area of an eight-inch circle is one-quarter of that area, or fifty and three-tenths square inches; and the area of a six-inch circle is twenty-eight and three-tenths square inches, or less than one-seventh that of a sixteen-inch pile.

A steam hammer is sometimes used for pile driving, but the ordinary drop hammer is by far the more popular. The reason for this being that there is absolutely no uncertainty as to the energy of a blow struck by a drop hammer, if the weight of the hammer and the distance through which it falls is known, whereas a steam hammer may apparently be making very heavy blows when actually the blow is comparatively light.

"Alligator" Point—Open.

This article has considered conditions as they actually occur in practice, and no theoretical assumptions have been made. Recently the subject of uniform diameter versus tapered piles has been widely discussed, but many of these articles have been based on theoretical conditions such as are never encountered in practice. Mathematical calculations and niceties cannot rigidly be applied to piles of any kind, because conditions of the soil vary very greatly, and no reliable coefficients for friction value are possible except for individual cases.

YEARLY COST OF BRIDGE.

The operating cost of the Brooklyn Bridge is found to be as high as $360,000 a year according to an investigation made by the controller of New York City. This figure is the average of ten years' maintenance and operating costs, beginning with 1898.

CANADIAN ICE-BREAKING AND PASSENGER STEAMER.

The success of the Canadian ice-breaking and surveying steamer, "Lady Grey," completed three years ago at the Vickers Works at Barrow-in-Furness, has encouraged further development in the same direction. This earlier vessel, "Lady Grey," has done efficient work in breaking up the ice in the St. Lawrence River, and when not thus engaged has performed various duties associated with the Marine and Fisheries Board. The Canadian Government, in consequence, decided to order another and larger vessel from the Vickers Company, and this steamer, which was launched last month, marks developments, especially in size and speed. The Government authorities decided, in the interests of economy, carefully to consider the uses to which such a

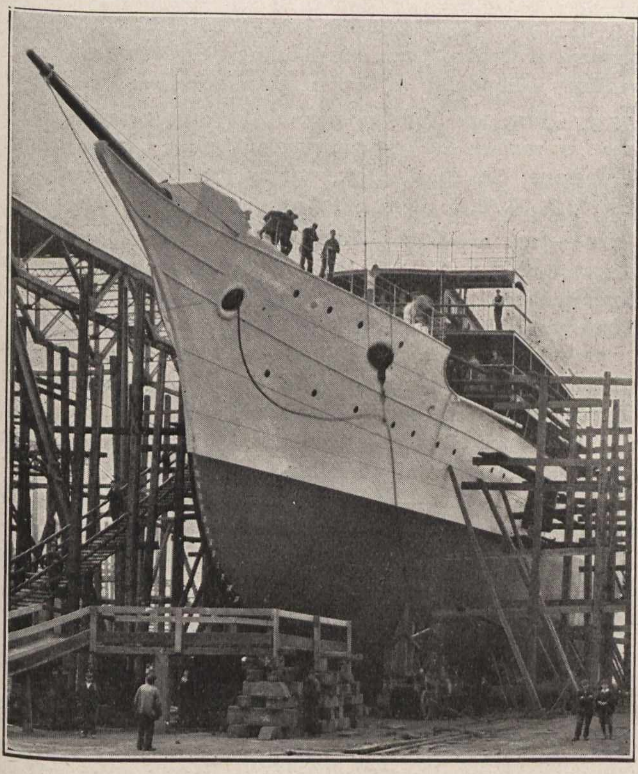


Fig. 1.

vessel could be put when there was no ice. The problem was a difficult one, in respect that the great strength necessary for ice-breaking involved a special form of hull; but the experience of the Vickers Company has enabled them to guarantee 17 knots, while forfeiting nothing of the essential qualities required for maintaining a free passage through the winter's ice. With the promise of this high speed, it was decided to fit the new vessel for passenger service, not only in winter, but throughout the summer season, across the Northumberland Straits, which separate Prince Edward Island from the mainland. At the same time the vessel has special quarters, so that she may be used as a yacht by the Governor-General, and is, therefore, appropriately named "Earl Grey." In view of this, the designers have achieved a remarkable success, so far as the appearance of the vessel is concerned. While the strength of the hull is obvious at a glance, grace has been lent to the appearance not only by fine shear, but by the adoption of a cut-water stem and a short bowsprit, an elliptical stern, and two steel pole-masts, which have a considerable rake, and are schooner-rigged.

A closer examination, however, shows that a consideration of strength has dominated the design of the hull, in order that effective work may be done amongst the heavy ice-fields of the Northumberland Straits and the Gulf of St. Lawrence. The frames are very closely spaced, in order to take up the thrust of the pack-ice, which will, at times, be piled around the vessel. The shell plating is thicker than usual, and the outer skin is doubled along the water line right fore and aft and to the bottom of the keel in the forebody, where the friction of the ice tends, in the case of ice-breaking steamers, to wear away the material faster than in ordinary marine practice. As is well known, the procedure is to drive the ship forward until the forebody glides on to the floe sufficiently far to cause the ship's weight to crush the ice. In order that the weight may be increased at will, large tanks are built into the structure, and the pumps for filling and emptying these tanks deal with 250 tons of water per hour. The vessel is also equipped for breaking ice when going astern, and the counter has been suitably strengthened to resist the shocks. The rudder takes the form of the vessel, so that the movements of the ship are not in any way impeded by the ice floes.

The dimensions of the vessel are tabulated alongside those of the earlier steamer, which was named the "Lady Grey."

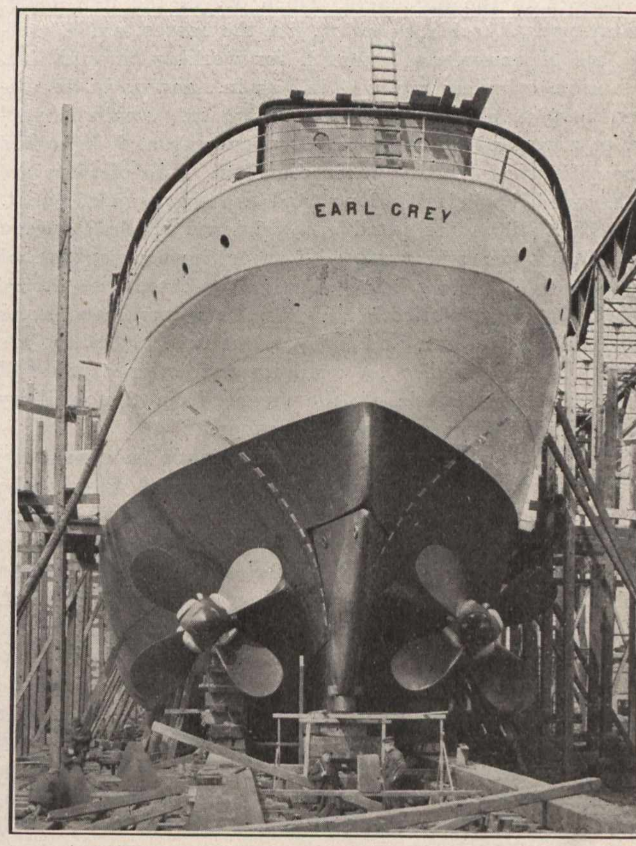


Fig. 2.

	"Lady Grey"	"Earl Grey"	
	Ft.	Ft.	In.
Length between perpendiculars	172	250	0
Breadth, moulded	32	47	6
Depth, moulded	18	26	6
Draught, normal	12	17	7
Displacement	1,055 tons	3,400 tons	
Speed	14 knots	17 knots	

The arrangement for the accommodation of passengers is on the promenade, upper, and main decks, while above this is the bridge-deck, which contains the quarters for the captain and navigating officers in the deck-house, the roof of which serves also for the navigating bridge. The apartments for the Governor-General, together with the smoking-room, are placed in the deck-house on the promenade deck, in which also there is arranged the entrance-hall and lounge for first class passengers. A broad companionway leads down to the upper deck, where there are arranged staterooms for fifty first class passengers, as well as the first class dining saloon, pantry, galley, etc., while the chief engineer has his quarters close to the engine-room; on this deck also the petty officers of the ship are accommodated. The mail-rooms are aft on this deck, and the seamen are accommodated forward. The second class accommodation, which affords room for twenty passengers, is on the main deck, where also the remainder of the engineers and others of the crew of the ship have their accommodation. On this level, too, there is a hold for light cargo.

The vessel is subdivided into numerous watertight compartments, and the doors of the principal compartments are ... the Stone-Lloyd system, so that they can be closed simultaneously from the navigating bridge. A watertight bunker bulkhead extends on each side of the vessel throughout the length of the boiler-rooms, and a double bottom is fitted for almost the entire length of the vessel.

The vessel is lighted throughout with a complete system of electric light, and is heated by steam. Arrangements are provided for rapidly handling the cargo and for coaling expeditiously.

The machinery is of the triple-expansion, three-crank type, and in the design the heavy stresses to which the vessel will be subjected in ice-breaking have had special consideration. Consequently, the shafting and the working parts are of considerably greater strength than usual. This also applies to the propellers, which are of the four-blade, built-up type. The blades which, like the bosses, are of cast-steel, are of exceptional strength for working through ice. The engine cylinders are 27½ in., 43 in., and 70 in. in diameter, respectively, with a stroke of 39 in. Steam is supplied at a working pressure of 180 pounds from four boilers of the cylindrical type, 15 ft. in diameter. Two of these are double-ended, being 21 ft. long, and two single-ended, 11 ft. long. The boilers are fitted with furnaces of the Morison suspension type, and work with the Howden system of forced draught, the air being supplied by three fans driven by enclosed forced lubrication engines. The main condensers are cylindrical in form, and independent twin air-pumps are provided. There is also an auxiliary condenser capable of dealing with the whole of the steam from the auxiliary engines, and having separate air-pumps.

Special arrangements have been made in connection with the pumping plant, owing to the special duty of the ship in the ice-floes. In the event of the ordinary suction or discharge valves being choked with ice, the circulating water may be drawn from or discharged into a part of the double bottom, two frame-spaces being specially divided off for this purpose. In the way of these the outer skin of the ship is perforated in such a manner as to give a large area for the passage of the circulating water. Steam jets are arranged on the branches of all sea inlet valves, to enable them to be cleared of ice as occasion arises. A ballast-pump of the centrifugal type, capable, as already stated, of dealing with 250 tons of water per hour, is fitted in the engine-room, with connections for transferring water between the forward and aft tanks when trimming the vessel for making its way through the ice.

In addition to the usual feed, bilge, and sanitary pumps, the machinery department is fitted with evaporating plant, grease-extractor, feed-heater, and Stone's ash-expellers, the equipment generally embodying the latest up-to-date practice for this class of vessel.

A workshop for repairing purposes is installed on the vessel, the lathes and other machines being driven by electric motor.

The machinery, like the ship, has been built to the requirements of the Board of Trade, Lloyd's Registry of Shipping, and the Canadian Steamboat Inspection Act.

ORDER OF THE RAILWAY COMMISSIONERS OF CANADA.

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

7318—June 19—Dismissing application of the village of Coteau Station for Order directing the G.T.R. to cease wilfully permitting its engines, and cars, and trains to stand at the highway at the level crossing at Coteau Station for a longer period than five minutes at one time; and in shunting to obstruct public traffic on highway for a longer period than five minutes at one time.

7319—June 17—Directing the Grand Trunk Railway System to install an automatic electric bell with a cut-out opposite the station, at the village of Morrisburg, Ont.

7320—June 19—Approving plans of the location of the C.N.R. through the city of Saskatoon, Sask., also proposed subway to be constructed at 22nd, in the said city.

7321—June 21—Granting leave to Elric Archambault, of Primeauville, County of Chateauguay, P.Q., to erect, place, and maintain electric light wires across the track of the G.T.R. on the main street in the town of Ste. Martine, P.Q.

7322—June 19—Directing the C.N.R. to install an interlocking plant where its lines cross the line of the C.P.R. at Gladstone, Man.

7323—June 22—Approving revised location of a portion of the C.P.R. Company's New Westminster branch in the city of New Westminster, B.C.

7324—June 22—Authorizing the G.T.R. to reconstruct 14 bridges on the Eastern Division of its line.

7325—June 22—Amending Order No. 3258, of July 6th, 1907, by striking out clause "h" of the said Order.

7326—June 19—Dismissing complaint of G. B. Janes & Company, of Orillia, Ont., complaining that the rates charged by railway companies on cheese box veneers are excessive.

7327—June 22—Approving plan of the proposed new iron bridge, to replace the present wooden bridge carrying Avondale Avenue, Stratford, Ont., across the right of way and track of the G.T.R. at mile 116.75 on the 20th Dist.

7328—June 22—Directing the C.P.R. to install and maintain gates at the crossing of the C.P.R. where it crosses Columbia Avenue, leading to Evans, Coleman & Evans Wharf, Vancouver, B.C.

7329—June 23—Authorizing the C.P.R. to open for the carriage of traffic that portion of its second track of its double track, Ignace Section, from mileage 115.0 to mileage 119.8; a distance of 4.8 miles, and from mileage 120.0 to mileage 127.8; a distance of 7.8 miles.

7330—June 23—Approving Standard Passenger Tariff of the Grand Valley Electric Railway, C.R.C., No. 3.

7331—June 8—Directing the C.P.R. to construct a subway in the city of Montreal, P.Q., under its tracks, where same crosses Iberville Street, Montreal, P.Q.

7332—June 22—Authorizing the G.T.R. to construct, maintain, and operate branch line to and into the premises of the Frost Wire Fence Company, Hamilton, Ont.

7333—June 22—Authorizing the C.P.R. to reconstruct two bridges; one on its Lake Superior Division, No. 42.55; and one on its Eastern Division, No. 0.3.

7334—June 22—Granting leave to the Western Counties Electric Company, to erect, place, and maintain its wires across the track of the T. H. & B. Railway, on Oak Street, Brantford, Ont.

7335—June 23—Authorizing the C.P.R. to construct, maintain, and operate spur for the Asquith Milling Company in the town of Asquith, Sask.

7336—June 23—Rescinding Order No. 7299, dated June 16th, 1909, directing the Western Counties Electric Company to maintain its electric wires across the track of the G.T.R. at Elgin Street Subway, Brantford, Ontario.

7337—June 22—Amending Order No. 7023, dated May 10th, 1909, by striking out clause 2 of the said Order; Order No. 7023 approves Supplement No. 1 to Canadian Classification No. 14.

7338—June 21—Dismissing application of the Canadian Pacific Railway for Order rescinding or varying an Order of the Privy Council, dated May 13th, 1908; whereby the C.P.R. were ordered to leave an opening in a trestle bridge carrying a branch line of its railway to Dixon's Mills, Peterboro, Ont., across the channel of the Otonabee River, by permitting the C.P.R. to fill said opening and substitute for the trestle a solid embankment.

7339—May 4—Ordering the G.T.R. and C.P.R. to protect, by folding gates, to be installed within four months from date of Order, crossing at Collage Street, Lennoxville, P.Q.

7340—June 23—Granting leave to the C.P.R. to construct its railway across the highways in the Township of Medonte, at mileage 12.96, 0.07, and 0.13, on "Y" of the Georgian Bay & Seaboard Railway.

7341—June 24—Authorizing the C.P.R. to construct additional track across public crossing from Sudbury to Azilda, at a point near Murray Station Grounds, Township of McKim, Ont.

7342—June 24—Authorizing the C.P.R. to construct additional track across Orr Street, Calgary, Alta.

7343—June 23—Dismissing and refusing four complaints of the Produce Merchants' Association of Montreal, P.Q.; also ordering that on cheese shipped from points west Montreal to Montreal on separate rail bills of lading, the railway companies absorb the wharfage and port warden's fee when such cheese is subsequently exported from the port of Montreal; said absorption to continue so long as it is applied in the case of cheese shipped on joint rail and ocean bills of lading to Europe, the tariffs of the railway companies to provide for such absorption to be filed and published and to become effective within thirty days from the date of this Order.

7344—June 25—Authorizing the C.P.R. to reconstruct two bridges on its line, No. 20.2, Blagdon Brook, St. John Section, Atlantic Division, and No. 3.4, near St. Sabine, Stanbridge Branch, Eastern Division.

7345—June 24—Granting leave to the rural municipality of Miniota to erect, place, and maintain its wires across the track of the C.P.R. at Arrow River, Man.

7346—June 24—Granting leave to the Riverside Telephone Co., Limited, to erect, place, and maintain its wires across the track of the C.P.R., between Sections 23 and 26, Township 14, Range 22, west second meridian, Sask.

7347—June 23—Granting leave to the village of Warman, Sask., to erect, place, and maintain its wires across the track of the C.N.R. at Warman, Sask.

7348—June 24—Granting leave to the Bell Telephone Co. to erect, place, and maintain its wires across the track of the M.C.R.R. at public crossing two and a half miles north-east Welland, Ont.

7349—June 25—Reporting to the Governor-in-Council for sanction By-law No. 94, adopted by the directors of the C.P.R. re spitting in cars and on railway premises.

7350—June 23—Amending Order No. 5102, dated July 29th, 1908, authorizing the G.T.R. to install interlocking plant at the crossing of the C.P.R. east of Weston Road, Toronto Junction, by providing that the work of installing said interlocker be performed by the C.P.R.

7361—June 25—Approving plans showing drawbridge of the O. and N.Y.R. over the Cornwall Canal.

7352—June 25—Amending Order No. 7076, dated May 26th, 1909, granting leave to the G.T.P.R. to construct its railway at grade across the highway between Section 7, Township 48, Range 13, and Section 12, Township 48, Range 14, west fourth meridian, District of North Alberta, by striking out the last clause of the Order.

7353—June 25—Authorizing the C.P.R. to construct, maintain, and operate industrial spur for the Consolidated Mining and Smelting Co., Kootenay District, B.C.

7354—June 25—Authorizing the C.P.R. to construct, maintain, and operate an industrial spur for Messrs. George & Robinson, Macleod, Alta.

7355—June 25—Granting leave to George Coultis & Son to erect, place, and maintain wires across the track of the G.T.R. at King Street, Thedford, Ont.

7366—June 25—Authorizing the Toronto, Hamilton and Buffalo Railway to construct, maintain, and operate spur to and into the premises of George Ritchie, Hamilton, Ont.

7357—June 25—Authorizing the C.P.R. to construct, maintain, and operate spur in the town of Lethbridge, Alta.

7358—June 25—Authorizing the C.N.O.R. to take, for the purpose of avoiding a sink-hole, part of Lot 12, Concession F, Township of Medora, District of Muskoka, Ont.

7359—June 3—Approving plan showing crossings of Dufferin, Dunn, Jamieson, Dowling, Sunnyside, and Howard Avenues and Indian Road, in western end of Toronto, by the G.T.R. and C.P.R., and several streets in the Township of Etobicoke, Ont.

7360—June 26—Extending for a period of sixty days from July 1st, 1909, the time within which the work directed to be constructed in connection with the Richmond Road Crossing, Ottawa, Ont., be done.

7361—June 3—Ordering the G.T.R. to provide better protection at the level crossing, known as Sunnyside Crossing, Toronto, Ont.

7371 to 7373—June 29—Granting leave to the Alberta Government to erect, place, and maintain its wires across the C.P.R. at Erskine, between Sections 9 and 15, Township 44, Range 16, west fourth meridian, and near Medicine Hat, Alta.

7374—June 29—Granting leave to the Creston Power, Light and Telephone Co. to cross the track of the C.P.R. at Creston, B.C.

7375 and 7376—June 29—Granting leave to the Malahide and Bayham Telephone Association, Limited, to erect, place, and maintain its wires across the track of the C.P.R. at Griffins, Ont., and east of the town of Tillsonburg, Ont.

7377 to 7386—June 29—Granting leave to the Government of the Province of Alberta to erect, place, and maintain its wires across the track of the Canadian Pacific Railway at ten places in the Province of Alberta.

7387—June 21—Granting leave to the Bell Telephone Co. to erect, place, and maintain its wires across the track of the T.H. and B.R. at public crossing one and a quarter miles east of Cainsville Station, Ont.

7388—June 30—Rescinding Order No. 7338, dated June 28th, dismissing application of the C.P.R. for Order rescinding or varying an Order of the Railway Commission of the Privy Council, dated May 13th, 1898, under which the C.P.R. was ordered to leave an opening in a trestle bridge carrying a branch to Dixon's Mills, Peterboro', Ont., as Order No. 7338, dismissing application, was issued by mistake.

7389—June 29—Authorizing the G.T.P.R. to construct five bridges in the Province of British Columbia.

7390—June 29—Authorizing the C.P.R. to construct, maintain, and operate industrial spur for the Lethbridge Brewing and Malting Co., Lethbridge, Alta.

7391—June 29—Authorizing the C.P.R. to reconstruct one bridge on its Atlantic Division No. 23.53, and No. 101.5 on its Pacific Division.

7362—June 29—Recommending to the Governor-in-Council for approval the rules and regulations of the Niagara, St. Catharines and Toronto Railway Co.

7363—June 29—Approving location of the C.P.R. Co.'s Manitou Lake Branch from mileage 0 to mileage 51.33.

7364—June 29—Approving location of the C.P.R. Co.'s Langdon-North Branch from mileage 45 to mileage 60.

7365—June 29—Authorizing the Georgian Bay and Seaboard Railway Co. to open for traffic that portion of its line between Coldwater Junction, on its Toronto-Sudbury Branch, to Maple Island, on Hog Bay, in the vicinity of Victoria Harbor, a distance of thirteen miles.

7366—June 29—Approving location of the C.P.R. Co.'s Langdon Branch from Langdon, a short distance east of Calgary in a north-east direction, mileage 0 to mileage 45.

7367—June 25—Dismissing application of the Transportation Bureau of the Montreal Board of Trade for an Order directing a reduction from the second class rate on ingot tin, in the Canadian Classification, to third class, as in the Official Classification.

7368—June 28—Amending Order No. 7284, dated June 8th, 1909, authorizing the construction of a spur at Mile End, town of St. Louis, District of Montreal, across Sanguinet Street, by adding the word "indemnified" in the first line of the second clause of the said Order.

7369—June 29—Granting leave to the E. and N. Railway to construct its railway across the highways at mileages 96.9, 91.2, and 95.93 of its Wellington and Alberni Branch, British Columbia.

7370—June 29—Authorizing the C.P.R. to open for traffic portion of second track of the double track of its line of railway, Kenora Section, from mileage 13.8 to mileage 16.0, a distance of 2.2 miles.

THE SUCTION GAS PRODUCER FOR SMALL POWER PLANTS.*

C. J. Atkinson.

Of late years the producer has been gradually gaining in favor as a means for supplying gas to operate gas engines, and having been asked to contribute a paper, I do not think I can do better than explain the principles by which these machines work. It is a subject of importance to all internal combustion engine builders or the users of internal combustion engines, and being one with which I am perfectly familiar, having devoted in the past a large amount of time to this subject, and at present all of my time.

When we speak of gas producers we mean that class of machine that makes a gas by what might be termed a partial combustion method, although any machine that makes gas, whether it is by distillation or evaporation, might equally be termed a gas producer, but the term gas producer, although not a descriptive one in the strictest sense of the word, has come to mean and is generally understood to mean a machine for manufacturing a cheap, low grade of gas suitable for power and fuel purposes.

Gas producers can be divided into two classes, namely, pressure and suction. The difference between them being that those of the pressure type work above atmospheric pressure, while those of the suction type work slightly below atmospheric pressure. In other words, in the pressure producer, the gas is under a slight pressure caused by forcing of air and steam into the generator. In the suction type of producer the pressure is reduced below atmospheric pressure by drawing the gas away from the producer either by means of an exhauster, or allowing the engine, which is being supplied with gas, to suck it. Theoretically, the process of gas making is the same in both cases. The suction producer has been more developed of late than the pressure, and as now manufactured is complete in itself.

Gas producers use as fuel, coal, coke, charcoal and wood, all substances rich in carbon. We, for the purpose of describing, will imagine at first that we are using carbon as fuel.

If we have a cylindrical casing lined with a refractory material having at its lower extremity a fuel supporting grate enclosed by an ash pit having a passage for the admission of air, etc., while at the top of the cylindrical shell we have a gas outlet and a means for admitting fresh fuel without allowing either gas or air to pass.

With such a machine we can make a number of experiments.

As is well-known, the atmosphere consists of about four-fifths nitrogen and one-fifth oxygen. But we, for the purposes of explaining the action of air upon incandescent carbon, will assume at first that there is no nitrogen, as in practice it only acts as a dilutent. If we have a shallow fire in our producer and an abundant supply of air, the carbon will be completely consumed. The products of combustion being CO_2 and a large quantity of heat will be developed; for instance, one pound of carbon completely consumed would give us

$$C+2O=CO_2 \times 14640 \text{ B.T.U.},$$

but if there was a considerable depth of fire in the producer, as there should be in practice, the resulting gas would be CO instead of CO_2, for when there is an excess of highly heated carbon the CO_2 formed in the lower part of the fire is reduced to CO with an absorbtion of heat

$$CO_2+C=2CO - 5820 \text{ B.T.U.}$$

Therefore we see that it is absolutely necessary that there should be a deep fire so that these two reactions can take place. It is not absolutely decided that these two reactions are what goes on inside the gas producer. It may be that the carbon is changed direct into CO, as illustrated by the third equation,

$$CO_2+C=2CO+8820 \text{ B.T.U.},$$

or it may be that all of these reactions take place, but the result is the same. We get carbon monoxide formed plus a certain amount of heat liberated and the gas would have the following composition, taking into consideration the nitrogen of the air, carbon monoxide 34.7, nitrogen 65.3. Now, if the producer was so constructed that no heat could leave the fuel column, the temperature would increase to such an extent as to be impracticable but some heat will escape through the brick lining or will be carried away as sensible heat in the gas formed. This is, therefore, a loss, and to avoid this loss as far as possible is it best to keep the temperature of the fire within due bounds. This we are able to do by mixing a certain proportion of steam with the in-going air, which steam will be decomposed and so absorb some of the heat which would otherwise be carried away. The reaction of steam upon heated carbon may be as follows, providing the fire is of sufficient temperature:

$$H_2O=C=H_2+CO - 8740+4420 \text{ B.T.U.}$$
$$=H_2+CO - 4320 \text{ B.T.U.}$$

If the temperature of the fire is too low, another reaction will take place,

$$2H_2O+C=2H_2+CO_2 - 2820 \text{ B.T.U.}$$

It will be observed that in both cases there is a large absorption of heat, and it is at once apparent why a very small quantity of steam reduces the working temperature. The effect of the presence of steam in the air blast is that a smaller proportion of the total heat of combustion is liberated in the form of sensible heat in the producer, but a correspondingly larger proportion is available when the producer gas is used.

It should be understood that from the point of view of heat quantities the use of steam in the gas producer is simply a means of absorbing the sensible heat developed by the partial combustion of carbon and storing it for future use. There can be no actual increase in the total quantity of heat which can be obtained from a given weight of fuel. Besides avoiding excessive heat in the producer, the steam has a further practical advantage, in that a gas of greater calorific power per unit volume can be obtained than when air is used alone. It has been shown that for every volume of carbon monoxide in the gas made with air alone, there must of necessity be 3¾ volume of nitrogen, but where steam is used the gas which is formed by its decomposition is free from nitrogen, therefore the larger the quantity of steam used the richer the gas per unit volume, but as we see from the figures, there is a limit to the quantity of steam that can be used, due to its cooling action on the fire. This quantity is not the same in all producers, as some producers are so constructed that less heat escapes through the lining or is carried away with the gas.

In designing a producer it is necessary that the velocity of the steam and air through the fuel column should not be excessive, otherwise there is no time for the reaction to be completed, and the fine ashes of the fuel will be carried upwards, so choking the fuel column. It is also necessary that where the load on the engine or the demand for gas is variable the amount of steam should be varied and varied in greater proportion than the variation of the load. Also we have seen that by insulating the fuel column, extracting the sensible heat from the gas and returning it to the fuel column by some means or other, we can make a richer gas, as the fire will then stand a larger proportion of steam, there being less loss of heat.

Theoretically, the maximum amount of steam that an ideal producer would stand is 64 pound for every pound of carbon consumed. But it is impossible to use this quantity in practice and still have the whole of it converted into hydrogen and carbon monoxide. If a larger quantity is used it will still be decomposed, but will give a certain amount of carbon dioxide. This carbon dioxide is formed because of the

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*Read before National Gas and Gasoline Engine Trades Association, June 22, 1909.

lower temperature of the fibre. In practice we aim to keep our fire at the maximum temperature permissible, which temperature is limited by the ash contained in the fuel used and depends upon the temperature at which this ash fuses. With most of the American coals we can make a producer in which the amount of carbon dioxide runs about 4 per cent., but to do so we have to keep as much heat in the fire as possible.

In the theoretical gasification of anthracite coal, 80 pounds of carbon converted into carbon monoxide gives us 186.66 pounds of this gas, or a percentage volume of 33.4. Five pounds of carbon completely burnt to carbon dioxide, gives us 18.33 pounds, or a percentage volume of 2. Five pounds of volatiles, hydro-carbons distilled, gives us 5 pounds of hydro-carbon gas, which equals 1.6 per cent. volume. One hundred and twenty pounds of oxygen are required, of which 30 pounds are supplied by the decomposition of the water. Ninety pounds of oxygen are furnished by the air, and the associated nitrogen with it gives us of this gas 301.05 pounds or 35 per cent. In calculating the energy in the above gases obtained from 100 pounds of anthracite, the carbon monoxide gives us 807,304 heat units; the hydro-carbon or marsh gas gives us 117,500 heat units, while the hydrogen gives us 232,500, making a total of 1,157,304, or a heat value of 152.7 B.T.U. per cu. ft. The efficiency of the conversion is 86 per cent. This theoretical gasification is practically what should be obtained in the modern suction gas producers.

One of the first to apply producer gas to internal combustion engines was Dowson. In 1881 he showed a 3-h.p. gas engine operating with this gas, before the British Association for the Advancement of Science. His producer was of the pressure type, and was a complicated piece of apparatus, consisting as it did of a steam boiler, the steam from which was utilized for putting the plant under pressure and supplying the moisture to the ingoing air. The generator worked intermittently, due to the large amount of steam being used; in addition, there were various gas coolers, a scrubber and gas holder to supply the engine with gas when the fire in the generator had to be blown up. The next historic producer was built by Lencanshez, where the same principle was used, but the steam boiler was combined with the gas producer, the necessary steam being raised by utilizing the heat from the outgoing gas. This producer worked fairly well, when coal with a very small amount of ash was used, otherwise there were clinkers formed, due to there not being enough steam generated.

Bollincks introduced a producer of the suction type, which works in a very similar manner to the one just described; the principal difference being that instead of putting a steam boiler on top of the producer it is fixed at the side, the gas passing out and through it, this arrangement giving a very much larger heating surface. This producer was the first to work on the suction principle. They gave fair satisfaction over in Europe, principally due to the good quality of the fuel used.

Pintsch invented a producer of the suction type. In this producer the gas and steam was generated in the pan of the upper part of the fuel column and derived its heat from the outgoing gas. This plant required a lot of attention, as it is necessary to charge it with fuel often, otherwise the green coal being introduced cools down the vaporizer, and so affects the quality of the gas.

In this country there is a producer built on practically the same lines as the Pintsch, but slightly improved, in that the vaporizer is placed lower down the fuel column, therefore it is not affected to the same extent upon the introduction of fresh fuel, and more steam can be generated, which is necessary when American fuels are to be used. We now come to another type of producer. In this producer the generator has no vaporizer attached to it. It consists of just as simple a piece of apparatus as it is practical to build. In order to secure the necessary steam with which to enrich the gas and to prevent clinkers, a separate vaporizer is used, which secures its heat from the exhaust of the gas engine. This vaporizer consists of a number of cast iron circular chambers

(Continued on Page 30.)

ENGINEER'S LIBRARY

WORKS OF REFERENCE.

The engineer must ever be a student. The progress in engineering science is as great as the progress in any other study. To keep pace with this progress the engineer must not only design and build and experiment, but he must read and study and index the methods and processes described by others.

It is impossible for a man to read all the books written on his particular subject, and yet he wishes to know what has been written, and from these select his works for study and reference.

The purpose of our book review department is to give an outline of what each book contains, so that the reader may know at a glance its value to him. Usually, the reviews are prepared by engineers actively engaged on work akin to subject matter in the book reviewed.

The index to Volume XVII. will contain a list of books reviewed, so that our readers may have an index to a reference library index.

It is not only books that are of value, but frequently catalogues and reports contain information useful to the engineer and contractor, and for this reason we give monthly a list of the more useful catalogues. These, too, are very useful for reference purposes.

Altogether, we consider our Engineers' Library one of the most valuable sections of The Engineer, and we hope to improve it by additions and new features.

BOOK REVIEWS.

Books reviewed in these columns may be secured from the Book Department Canadian Engineer, 62 Church Street, Toronto.

Laboratory Experiments in Metallurgy. — By Albert Sauveur and H. M. Boyleston; published by the authors, Cambridge, Mass. Size, 8 x 10; pages, 150; cloth. Price, $1.25.

These short notes, describing some experiments in metallurgy, are written primarily for the use of students at Harvard University who take the courses in General Metallurgy and in the Metallurgy of Iron and Steel. The authors hope that these notes may prove suggestive, at least, to other teachers and students in metallurgy, and even to practitioners of the art.

Mr. Albert Sauveur is professor of Metallurgy and Metallography at Harvard, while Mr. H. M. Boyleston is instructor in Mining and Metallurgy at the same university.

The work is divided into two parts. Part I. deals with General Metallurgy, and Part II., the Metallurgy of Iron and Steel. The apparatus and experiments are described, and at the end of each experiment there is a form for recording the results. The book is conveniently arranged, useful, and will be much used in science colleges.

Thermal Properties of Steam.—By L. S. Marks and H. N. Davis. Published by Longmans, Green & Co., 91 Fifth Avenue, New York. Size, 6 x 9; pages, 110. Price, $2.

This work, which has been prepared by Lionel S. Marks, M.M.E., assistant professor of Mechanical Engineering at Harvard, and Harvey N. Davis, Ph.D., instructor in Physics at the same college, places before the reader the results of recent investigations along these lines.

The properties of superheated steam are tabulated for every pound pressure and for every ten degrees of superheat within a range which exceeds present practice. Supplementary tables extend the superheated steam tables to very high temperatures. Besides the tables there are two large diagrams showing the properties of saturated and superheated steam.

Machine Drawing and Design for Beginners.—By Henry J. Spooner, C.E. Longmans, Green & Co., 39 Paternoster Row, London, Eng.; 91 and 93 Fifth Avenue, New York. Pages, 266. Price, $1.25.

The book is edited as an introduction to the subject of Machine Design, and leads up to the study of the author's more advanced work, Machine Design, Construction and Drawing, and is intended to supply a long-felt need among evening students, during the first year or two of their work, who require a book easily carried about, and which is not too expensive.

The first six chapters are devoted to drawing, where such items as drawing instruments, printing, shading, straight-line drawing and working drawings are given consideration. Then follow several chapters on machine parts, such as stuffing boxes, journals, keys, riveted joints, machine and lever handles, principal joints, roller and ball bearings, engine parts, and many complete examples of working drawings.

A great number of examination papers are given with which the instructor should make himself familiar. There are a score of useful tables given and over one hundred set exercises.

One is a little surprised to note the small amount of attention given to printing, which is all important, but it is intended that the student get that elsewhere. The book goes very much ino detail, and gives very many illustrations. All lines are clear and legible, and suited for work with artificial light. This work would be of great assistance to the zealous but overloaded instructor and to the student who "wants to know." A. E. D.

Automatic Block Signals and Signal Circuits, apropos of American practice in the installation and maintenance of signals electrically controlled and operated by electric and other power, with descriptions of the accessories now regarded as standard. Author, Ralph Scott. Publishers, McGraw Publishing Co., New York City. Size, 6 x 9; pages, 243. Price, $2.50 net.

In character, the work is original. With commendable consideration for those who are not familiar with railway terms, the author has adopted a style which will be appreciated by all. Comparatively speaking, little has been written upon the art of railway signalling.

"Automatic Block Signals" is replete with information of inestimable value alike to the signal engineer, the railway engineer, the electrical engineer, and the railway man generally. Over two hundred illustrations and diagrams are given in the volume, which is devoted almost exclusively to railway signalling mechanism. Its scope does not permit of any reference to the history of signalling, and, although the author pretends to deal with American practice only, some comment upon the systems of other countries might have been included to advantage.

Chapter I. opens with definition of blocks and block signals, and gives a description of the various standard signals, the positions they occupy, the functions they perform, and their methods of operation. Simple circuits are illustrated and discussed in a practical manner in Chapter II., while the third chapter is devoted to normal danger circuits. The movements of trains are followed, and the different positions the signals assume are clearly shown. Chapter IV., entitled "Normal Clear Circuits," is somewhat similar in scope to Chapter III.

Fifteen pages constitute the fifth chapter, which contains a good description of semi-automatic circuits and signals and the parts they play in the operation of trains.

The batteries generally used in connection with electrically operated signals are dealt with in Chapter VI. The component parts of the Gravitz, Gordon and Edison primary cells are touched upon, and their merits or demerits pointed out. Ten pages are devoted to a description of the track circuit, which includes that part of the control feature affected by the presence of a train. Both simple and comprehensive arrangements are referred to. This chapter also embraces an account of rail joints and rail bonds, while mention is made of a circuit-breaking device used in conjunction with a swing bridge.

Chapter VIII., comprising fifteen pages, is descriptive of controlled manual systems, which are still used extensively by many railways. The parts forming the system are treated separately.

The ninth chapter relates to motors, relays, etc.

Chapter X. tells of the apparatus, known as the disk signal, used on the Lehigh Valley and other American roads, and includes an interesting discourse upon the advantages and disadvantages this type of mechanism possesses. A description of Union apparatus and instruments comprises Chapter XI. Electro-pneumatic and electro-gas systems, used on many busy lines, are discussed in Chapter XII., while Chapters XIII. and XIV., upon the subjects of electric locking and all-electric interlocking are particularly interesting. Chapter XV. is devoted entirely to three-position signals.

Chapter XVI., on electric railway systems, is timely, in view of the developments constantly taking place. A section devoted to maintenance concludes a desirable addition to the literature on American railway signalling apparatus and practice.—W. M.

Modern Methods of Sewage Disposal.—By W. H. Trentham, M.I.M.E., and James Saunders, A.M.I.C.E. Published by the Sanitary Publishing Co., Limited, 5 Fester Lane, Fleet Street, London, E.C.

This publication is a condensed account of the leading features appertaining to sewage disposal works on the biological system. Instead of being termed "Modern Methods," a better term would have been "A Modern Method." The publication does not pretend to be technical, but, as the preface states: "The members of local authorities and their officials, who are, as a rule, active business men, usually have no time to study elaborate treatises when it is necessary for their boards to undertake the construction of such works, and we believe that the information given, based entirely on practical acquaintance with the subject, will prove of value in assisting them to decide which system of sewerage and sewage disposal should be adopted to meet the requirements of their particular town or district."

The authors here evidently assume that it is part of the duties of these gentlemen engaged in municipal business, along with their officials, to decide on the particular method of sewage disposal applicable to their district. We have always understood that this is particularly the business of the expert engineer only. We, however, certainly consider that the business men referred to will require a wider knowledge before being capable of making any determination on this subject than is supplied in the modest booklet before us. One-half page is devoted to the question of sedimentation, and two and a half pages to "Aërobic Treatment in State Beds" (W. I. Dibdin's system). We do not exactly know to which class of our readers to recommend this book, but if there are any who do not require any real or sufficient knowledge upon the sewage disposal problem, but think that a slight smattering and quick dip into the shallows of the subject would do them no harm, then to such we have pleasure in bringing this publication to notice.

Generally speaking, we feel a certain amount of diffidence in reviewing a publication which, on the face of it, is neither technical nor scientific, but, generally speaking, is simply an advertisement of the authors as consulting engineers. There is little doubt that the intention is not that the business men referred to shall be educated to the extent of being able to choose a system, but rather that with the assistance of the authors, whose practical experience receives notice, they may be able to arrive at a satisfactory choice. —T. A. M.

Concrete Bridges and Structures.—This book is handbook size, 4¼ by 6½ inches, and contains 128 pages and 51 illustrations. It is printed on a fine quality of heavy glazed paper, with gilt edges, and bound in flexible black leather. Price, $2.50.

Part I. treats of concrete bridges for both highways and railroads. It gives in a concise form the most approved methods of design and construction, and puts the information in such a practical way that the busy engineer can easily apply the methods of design without spending valuable time in the perusal and study of obstruse mathematical treatises.

In this part there are about forty chapter headings, describing quite fully the methods of design, and an actual example of a 60-foot arch span is given, and the various steps in the design described in detail.

There is also a table giving the principal concrete arch bridges now in existence and building. Nine of these are described in detail, and are illustrated with half-tones and line drawings. Views are shown also of some old Roman bridges that are still existing, and dating back about two thousand years.

Part II. contains methods of design and construction for minor bridges and structures, including concrete trestles and culverts. It contains original tables giving upwards of nine hundred separate estimates for structures of various sizes, together with charts showing the relative costs of various forms. There are also about thirty full-page illustrations, showing structures of various designs, and these are accompanied with tables of sizes and estimated costs

Reinforced concrete beam and slab tables are given, showing the economic span length for each of the various combinations of slab and beam for use in bridge design.

The book may be purchased at all book stores, or from any of the engineering journals. For sale also by the author, H. G. Tyrrell, Evanston, Ill.

PUBLICATIONS RECEIVED.

Georgian Bay Ship Canal Report.—The report for 1908 in two volumes accompanied by sixty plates and numerous photographs and maps. Pages, 600. Price, $4. Hon. Wm. Pugsley, Minister of Public Works; Eugene D. Lafleur, Chief Engineer, Ottawa, Ont.

Sewage Disposal.—A Report to the Council of North Toronto, Ont., dealing with the possibilities of connecting with the Toronto system and the cost of independent works. By T. Aird Murray, 612 Continental Life Building, Toronto. Size, 6 x 9. Page, 20. Price, 50 cents.

Annual Report of the Minister of Mines of British Columbia for the year ending 31st December, 1908, being an account of mining operations for gold, coal, etc., in the Province. William Fleet Robertson, Provincial Mineralogist. (British Columbia Bureau of Mines.) 271 p., plates, maps, 1908. Victoria, Government Printing Office, 1909.

Report of the Mines Branch for 1908.—Pages, 100. Size, 6 x 9. A summary report for last nine months of 1908. Hon. W. Templeman, Minister; A. P. Low, LL.D., Deputy Minister; Eugene Haanel, Ph.D., Director.

Tables and Diagrams of the Thermal Properties of Saturated and Superheated Steam, by Lionel S. Marks, M.M.E., and Harvey N. Davis, Ph. D., both of Harvard University. New York: Longmans, Green & Company, 91-93 Fifth Avenue.

CATALOGUES.

Belt Dressings.—Belt dressings are dealt with at some length in a booklet just issued by the Joseph Dixon Crucible Co., of Jersey City, N.J. The first section is devoted to belts, and tells why they slip, while the next refers to dressings, good and bad, and gives directions for applying. In another portion, headed, "Hints, Kinks, Tables," much information of interest is given.

Sewage Filters.—Pacific Flush Tank Company, 184 La Salle Street, Chicago, Ill. The object of this book is to show the application of automatic apparatus to various types of bacterial sewage filters. Illustrations of the automatic apparatus with detailed dimensions are given. Also diagrams of sand filters, contact beds, and percolating filters. It is a very useful catalogue and engineers interested in sanitary matters should have a copy.

Flush Tanks.—A catalogue issued by the Pacific Flush Tank Company, 184 La Salle Street, Chicago, Ill., will be found of great interest to all engaged in sanitary engineering. It contains diagrams, dimensions, and information in connection with the various flush tanks handled by this firm. It will be valuable for reference.

Electric Smelting.—Large transformers for electric smelting, the details of construction, etc., are described in a booklet published by the Packard Electric Company, of St. Catharines, Ont. Numerous illustrations are given as well as a description of installations at Welland and Niagara Falls.

Water Main Cleaners.—The Whitney Pipe Cleaning Co., 220 Broadway, New York, are distributing a booklet which tells of their success in cleaning water mains. Their machines work in mains in sizes from 4 inches to 4 feet. The cost of operation is very small and the increase in efficiency very great.

Automatic Sewage Appliances.—Messrs. Drummond, McCall & Company, Montreal, Canada, Canadian representatives of Mather and Platt, are distributing a booklet on the above subject. The booklet contains information as to arrangement of sewage plant and many diagrams and photos of completed works.

Tungsten Lamps.—In concise form, the Engineering Department of the National Electric Lamp Association present much information of interest to central station men, jobbers, dealers and consumers, upon the Carbon, Gem, Tantalum, and Tungsten incondescent lamps of many sizes. Address, 4411 Hough Avenue, Cleveland, Ohio.

Steam Road Rollers.—The Monarch Road Roller Co., 114 Liberty Street, New York, have issued a booklet descriptive of their road rollers. Diagrams illustrate the main dimensions and unusual features, while the illustrations show the various uses these machines may be put to, for besides road rolling they are traction engines, for graders, etc., and power engines for crushing plants. Wm. Eddie, corner Princess and James Street, Winnipeg, is their Canadian representative.

Municipal Filtration.—A booklet of unusual interest to municipal officials, sanitary engineers and medical health officers, as it is devoted almost exclusively to methods of water purification and filtration. Many illustrations are given of plants installed by the publishers, The Pittsburgh Filter Manufacturing Company, of Pittsburgh, Pa.

Gas and Oil Engines.—Dudbridge Gas, Oil and Spirit Engines and Gas Producing Plants of various types are illustrated and described in a booklet which is being distributed by A. H. Wright, 32 Church Street, Toronto, the Canadian representative of The Dudbridge Iron Works, of Stroud, Glos., England, a long-established and reputable firm. The engines described have many distinctive features.

Engineers Supplies.—E. R. Watts & Sons, 408 Portage Avenue, Winnipeg, and 200 Wellington Street, Ottawa, send out a catalogue of engineers', surveyors', architects' and draughtsmans' instruments and supplies. Besides giving a full list of goods with prices it has also chapters on the care and adjustment of instruments. Their shop at Winnipeg is prepared to repair any British or American instrument.

Forge Blowers.—Two catalogues have recently been published by the Buffalo Forge Company, Buffalo, N.Y. One will be of usual interest to blacksmiths, carriage and wagon manufactures. The increasing demand for electric forge blowers has prompted them to design a line of high efficiency blowers for serving forge fire. Bulletin No. 78C is entirely devoted to this line. The other catalogue No. DW Electric covers a new design exhaust fan of the disk type, this contains, in addition to cuts of the pulley and direct connected types, tables giving speeds, capacities and prices. This should be of interest to those needing ventilation in overheated quarters.

ENGINEERING SOCIETIES.

CANADIAN SOCIETY OF CIVIL ENGINEERS.—413 Dorchester Street West, Montreal. President, Geo. A. Mountain; Secretary, Prof. C. H. McLeod.

QUEBEC BRANCH—

Chairman, L. A. Vallee; Secretary, Hugh O'Donnell, P.O. Box 115, Quebec. Meetings held twice a month at Room 40, City Hall.

TORONTO BRANCH—

96 King Street West, Toronto. Chairman, J. G. G. Kerry; Secretary, E. A. James, 62 Church Street, Toronto.

MANITOBA BRANCH—

Chairman, H. N. Ruttan; 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 College.

OTTAWA BRANCH—

Chairman, C. R. Coutlee, Box 560, Ottawa; S. J. Chapleau, Box 203.

ALBERTA ASSOCIATION OF ARCHITECTS.—President, R. Percy Barnes, Edmonton; Secretary, H. M. Widdington, Strathcona, Alberta.

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

AMERICAN MINING CONGRESS.—President, J. H. Richards; Secretary, James F. Callbreath, Jr., Denver, Colorado.

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

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION.—President, Wm. McNab, Principal Assistant Engineer, G.T.R., Montreal, Que.; 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 MECHANICAL ENGINEERS.—29 West 39th Street, New York. President, Jesse M. Smith; Secretary, Calvin W. Rice.

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

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.—President, E. Grandbois, 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, Alfred E. Uren, 62 Church Street, Toronto.

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

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

CANADIAN MINING INSTITUTE.—Windsor Hotel, Montreal. President, W. G. Miller, Toronto; 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, F. W. H. Jacombe, Ottawa.

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

DOMINION FORESTRY ASSOCIATION.—President, Thomas Southworth, Toronto; Secretary, R. H. Campbell, Ottawa.

DOMINION LAND SURVEYORS.—Ottawa, Ont. Secretary, T. Nash.

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

ENGINEERS' CLUB OF TORONTO.—96 King Street West. Prtsident, A. B. Barry; Secretary, R. B. Wolsey. Meeting every Thursday evening during the fall and winter months.

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

INTERNAL COMBUSTION ENGINEERS' ASSOCIATION.—Homer R. Linn, President; Walter A. Sittig, Secretary, 61 Ward Street, Chicago, Ill.

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

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

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

ONTARIO LAND SURVEYORS' ASSOCIATION.—President, Louis Bolton; Secretary, Killaly Gamble, 703 Temple Building, Toronto.

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.

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

COMING MEETINGS.

Nova Scotia Society of Engineers: September 9 and 10. Third annual meeting at New Glasgow, N.S. S. Fenn, Halifax, N.S., secretary.

American Railway Bridge and Building Association.—October 19-21. Nineteenth annual convention at Jacksonville, Florida. Secretary, S. F. Patterson, Boston & Maine Railway, Concord, N.H.

National Irrigation Congress.—Seventeenth meeting, August 9-14, at Spokane, Washington; Arthur Hooker, Secretary, Board of Control, Spokane, Wash.

League of American Municipalities.—August 25-27. Thirteenth annual convention at Montreal, Que. John MacVicar, Secretary, Des Moines, Iowa.

American Society of Municipal Improvements.—November 9-11. Annual convention at Little Rock, Ark., U.S.A. A. Prescott Folwell, Secretary, 241 W. 39th St., New York City.

Royal Architectural Institute of Canada.—October 5-7, at Toronto, general annual assembly. Secretary, Alcide Chaussé, R.S.A.; P.O. Box 259, Montreal, Que.

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.

Prince Edward Island.

CHARLOTTETOWN.—Tenders will be received up to Monday, July 12th, for the construction of a 20 stall, brick and concrete engine house, foundation for turntable, foreman's office and lavatories. Plans may be seen at the Resident Engineer's Office, Charlottetown, at the office of the Chief Engineer, Moncton, N.B.. M. J. Butler, Chairman, Ottawa, Ont.

Quebec.

MONTREAL. — Tenders for macadamizing several streets and also the building of sewers will be received to the 9th instant at 6 p.m Plans and specifications to be seen at the Town Engineer's Office, 5 Beaver Hall Square Montreal. R. D. Dunn, secretary-treasurer town of St. Paul.

WESTMOUNT.—Tenders are invited for the construction of cement or granolithic sidewalks, to be filed not later than Friday, 9th July, at 5 p.m. A. D. Shibley, city clerk.

Ontario.

ALEXANDRIA.—Tenders for the erection of a new French Catholic Church will be received up to Thursday, 15th July. Tenders to be for rubble stone or cement blocks. Rev. J. W. Dulin.

BRAMPTON.—Tenders will be received until Saturday, 10th July, for the construction of 6,500 square yards of concrete walks, a concrete reinforced floor over a girder bridge, a 32-foot girder span across the Etobicoke River, and two concrete abutments for the above bridge. W. M. Treadgold, town engineer.

BRANTFORD.—Tenders will be received until noon, 10th July, for two horizontal multi-tubular boilers, required for the Institution for the Blind, and two horizontal multi-tubular boilers, required for the Normal School, Toronto. H. F. McNaughten, secretary Public Works Department, Toronto.

CALLENDER.—Tenders wanted for the erection of a cement block, two-storey school, having cement foundations; also for moving of present school. B. Shannon, secretary school board.

HICKSON.—Tenders will be received until Monday, July 12th, for the erection and completion of a Steel Bridge and Concrete abutments in the township of East Zorra, Oxford County. Length, 30 feet; width, 14 feet; height of abutments, probably 12 feet. Tenders to be for either beam or truss span and capable of carrying a cement floor and 20,000 lbs. load. Work to be completed on or before October 1st. James Anderson, clerk, East Zorra.

MOOSE CREEK.—Tenders will be received until July 12th for excavations for a drain. Estimated cost, $5,000. F. D. Brunet, Township Clerk.

NORTH BAY.—Tenders for Customs and Inland Revenue fittings will be received until Monday, July 12th, 1909. Napoleon Tessier, Secretary, Department of Public Works, Ottawa.

OTTAWA.—Tenders will be received up to August 15 for the furnishing of iron posts for use on the survey of Dominion lands. P. G. Keyes, secretary, Department of the Interior.

OTTAWA.—Tenders will be received until Friday, July 23, for the construction of a building for refinery, Royal Mint. Napoleon Tessier, secretary, Department of Public Works.

OTTAWA.—Tenders will be received until July 15th for the supply of coal for the Public Buildings throughout the Dominion. Napoleon Tessier, Secretary, Department of Public Works.

PETERBOROUGH.—Tenders will be received up to Saturday, the 17th July, for the construction of abutments for the steel bridge over the Indian River. Plans and specification may be seen at the office of the County Engineer, J. E. Belcher. Ed. M. Elliott, County Clerk, Peterborough.

PETERBOROUGH.—Tenders will be received up to the 17th July for the steel work of a bridge over the Indian River, 75 feet span from abutments' faces at water level. County Engineer, J. E. Belcher. Ed. M. Elliott, county clerk.

PETERBOROUGH.—Tenders for the erection of Knox Church will be received up to Monday, July 19th. Secretary Building Committee, 283 Park Street.

TORONTO.—Tenders will be received until July 12th, for the construction of concrete storage and regulating dams near Port Arthur. H. F. McNaughten, Secretary, Department of Public Works. (Advertized in the Canadian Engineer.)

TORONTO.—Tenders will be received until Tuesday, July 13th, for the several works required for the enlargement of Harbord Street Collegiate. W. C. Wilkinson, secretary-treasurer, Board of Education.

WATERLOO.—Tenders will be received up to Monday, July 12th, for covering bridges with concrete. Ford S. Kumpf, town clerk.

Manitoba.

BRANDON.—Tenders will be received up to July 17th for a supply of creosote wood paving blocks for bridge paving. Price to be per yard f.o.b. Brandon, duty paid. Harry Brown, city clerk.

WINNIPEG.—Tenders will be received until August 2nd and August 16th for hydraulic, electric, and auxiliary equipment for the generating station at Point du Bois. For plans, etc., apply Smith, Kerry & Chace, engineers, Winnipeg; William Kennedy, jr., Y. M. C. A. Building, Montreal, and M. Peterson, secretary, Board of Control, Winnipeg.

WINNIPEG.—Tenders will be received up till July 12 for all of the works required in connection with the erection of a brick and concrete warehouse building at Calgary. J. H. G. Russell, architect.

Saskatchewan.

MOOSE JAW.—Tenders will be received up to Monday, 18th July:—1-50 light, constant current transformer or regulator, with 35 arc lamps and suitable switchboard, with necessary instruments for controlling same; one year's supply of Watt meters; one' year's supply of transformers. John D. Simpson, City Clerk.

REGINA.—Tenders will be received until July 19th, for a supply of sewer pipe. Angus Smith, City Engineer. (Advertized in the Canadian Engineer.)

REGINA.—Tenders will be received until July 19th, for concrete pavements, curbs, and sidewalks. Angus Smith, City Engineer. (Advertized in the Canadian Engineer.)

REGINA.—Tenders will be received until July 19th, for a supply of pipes and valves for waterworks system. Angus Smith, City Engineer. (Advertized in the Canadian Engineer.)

REGINA.—Tenders will be received up to Monday, July 19th, for the erection of a hospital. J. Kelso Hunter, city clerk.

REGINA.—Tenders will be received up to Thursday, July 15, for the supply and delivery of coal, 1909-10, for the

Royal North-West Mounted Police. R. S. Knight, inspector, supply officer.

YORKTON.—Tenders will be received up till July 12 for the erection of a concrete and brick business block for the Enterprise Publishing Company. T. A. Patrick, M.D., secretary.

YORKTON.—Tenders will be received until Monday, July 19, for a heating system. Napoleon Tessier, secretary, Department of Public Works, Ottawa.

British Columbia.

VANCOUVER.—Tenders will be received up till noon, July 12th, for the whole or part of the construction of Sections 3 and 4 of the Fraser Valley branch of the British Columbia Electric Railway Company, Ltd. Charles Garden, Engineering Department, British Columbia Electric Railway Company, Ltd.

VICTORIA.—Tenders will be received up to Monday, 16 August, for the supplying of cast iron water pipe, pig lead, gate valves, for waterworks. W. W. Northcott, Purchasing Agent.

CONTRACTS AWARDED.

Nova Scotia.

HALIFAX.—S. Cunard & Company were the lowest tenderers for all the city coal contracts for 1909 excepting that for 400 tons of Pictou nut on which H. D. McKenzie & Company, figured lowest, and the committee recommend the contracts be awarded to Cunard & Company, and McKenzie & Company. The prices were all for the "long" ton of 2,240 pounds. The quantities and prices at which the contracts were awarded were as follows:—City Health Board—4 tons anthracite and 16 tons bituminous; Cunard & Company, anthracite at $7.15 and Old Sydney at $5.40. City Prison—90 tons Sydney at $5.40, and 15 tons anthracite at $7.10, Cunard & Company. City Home—400 tons Pictou nut at $4.20; McKenzie & Company, 25 tons egg anthracite at $6.95, Cunard & Company. Fire Department—25 tons Acadia lump at $5.45, 133 tons Sydney at $5.40, 6 tons Albion slack at $4.75, 105 tons anthracite at $7.20, S. Cunard & Company. Public Gardens—40 tons Acadia nut at $4.65, 8 tons Sydney at $5.20, 8 tons anthracite at $6.25, S. Cunard & Company. City Works Department—140 tons anthracite at $6.95 and 13 tons Sydney, for the City Hall, at $5.20; 15 tons Acadia lump for the steam roller, at $5.30; 40 tons Acadia nut, for the crusher, at $4.30; 23 tons lump, for the steam drill, at $5.20; 11 tons bituminous for stables and workshop; 12 tons Albion slack for the blacksmith shop, at $4.75, and 7 tons anthracite for the stockyard, at $7.25, Cunard & Company.

New Brunswick.

MONCTON.—For 3,800 lbs. of No. 4 W.P. wire for transmission lines in connection with the new electric plant. the city received the following tenders:—

* Wire & Cable Company, f.o.b. Moncton	$613.70
Canada General Electric Company	630.80
Sumner Company, f.o.b. Moncton	638.40

* Accepted

Tenders were also received for special castings for the new pumps, embracing 18 inch, 14 inch and 12 inch T's and bends, also a few lengths of 14 inch, and 18 inch pipes, and were as follows: Canada Iron Corporation Company, Londonderry, $399.51 f.o.b. cars, Moncton; Canada Foundry Company, Halifax, $554 f.o.b. cars, Moncton. The tender of the Canada Iron Corporation Company, Ltd., was accepted.

In connection with steam and electric plant, City Engineer Edington recommended the following tenders: Canada General Electric Company, generator, $6,470; Robb Engineering Company, engine, $5,448, and boiler, $1,040. These were accepted.

Quebec.

MONTREAL.—Westmount Council met recently regarding contracts for street paving. The Bitulithic & Paving Company's tender for asphalt and scoria combination paving on St. Catherine Street, from Atwater Avenue to Greene Avenue, and Greene Avenue, from Dorchester Street to Sherbrooke Street, at $36,658, and the Barber Asphalt Company's tender for paving Dorchester Street and Greene Avenue to St. Catherine Street, from Atwater Avenue to Hallowell Street, with asphalt, for $18,459.76, were accepted. The Bitulithic & Paving Company was also successful in its tender for paving Victoria Avenue from St. Catherine Street to Sherbrooke Street, with combination pavement, gutter and curb, for $28,627.

MONTREAL.—At the last meeting of the Council of Outremont tenders for the construction of the sewer on St. Catherines Road were opened and the contract was awarded to Messrs. Gilbert, Toussaint & Company, they being the lowest tenderer, at $7.90 per running yard, and $3.10 for rock excavation per cubic yard extra.

MONTREAL.—A contract for cement sidewalks has been given to the Modern Paving Company at $2.22 a yard. The E.D. Hofeller Company offered to do the work at $1.86 a yard.

Ontario.

BERLIN.—Aug. May has received the contract for cement curb and gutter. The following tenders were submitted:—

	Curb and Gutter	Driveways
Aug. May, Berlin	35c.	11c.
P. Bergmann, Waterloo	45c.	12½c.
John Conn, Windsor	66c.	14c.

BLENHEIM.—A contract for the tank and pumping station at the power house has been given to J. H. Collier and D. H. Grady at $500. Clunis & McIntyre will install a gas engine to pump two thousand gallons an hour for $173.

KINGSTON.—E. B. Merrill, civil engineer, of Toronto, has secured the contract for reconstructing the gas tank here at $4,300.

OTTAWA.—The contract for building the new G.T.R. Central Station has been awarded to Peter Lyall & Sons, of Montreal, and work will be started immediately. The station will cost $500,000.

Ontario.

ST. CATHARINES.—The Council received the following tenders for 2-inch pipe: A. Moore, f.o.b. Montreal, $13.50; Watts & Bate, f.o.b. St. Catharines, $14; S. P. Gourlay, f.o.b. St. Catharines, $13.25; Coy Bros., f.o.b. St. Catharines, $14.95. Mr. S. P Gourlay's tender was accepted.

ST. THOMAS.—Hamilton & Stott have been given a contract for a heating system, by the city council, at $2,668. The American Steel Company, of Lockport, N.Y., bid $1,960 and $1,485, which did not include freight or duty.

ST. THOMAS.—Tenders for work on the Grace Methodist church were let as follows:—Sanders & Bell, carpenter work, $8,484; A. E. Ponsford, masonry and brickwork, $9,836; Celeste Blonde, Chatham, plastering, $1,575; Sandham & Roberts, electric wiring, $119.

TORONTO.—The Board of Control recently opened tenders for laying between 350,000 and 450,000 duct feet of underground conduit. The bulk tenders of twelve contractors were as follows: $55,801; $60,466; $60,622; $62,631; $66,766; $71,205; $72,275; $77,403; $77,578; $77,890; $83,336; $99,368. The lowest tenderers, Golden & Lansing, of Troy, N.Y., will be given the contract if the city engineer approves.

TORONTO.—The contract for cedar culverts on section one of the Soo-Sudbury trunk wagon road was awarded by the Public Works Department to D. McNaughton, of Sudbury. This section runs from Copper Cliff to Naughton.

TORONTO.—The Connell Anthracite Coal Mining Company have been given an order by the Board of Education for 4,000 tons of semi-bituminous coal at $5.15 for grate and $5.30 for egg, stove and nut.

TORONTO.—George M. Hendry & Company have been awarded a contract for chemical apparatus ($264,341), and for physical apparatus ($4,053) for the high schools.

PETERBOROUGH.—For the erection of new library here the tenders were as follows:—

James Bogue	$22,680
Malcolm McIntyre	22,150
R. Sheehy	26,194
W. J. and G. H. Baptie	24,600
Rutherford Bros.	21,887
J. G. Hayes	22,450
H. Carveth	33,000
W. J. Johnston	23,500

Rutherford Bros. got the contract.

Saskatchewan.

MOOSE JAW.—Three tenders were received for the work of grading for the spur track to the power house and for putting new guy wires to the smoke stack. The contract was let to the lowest tenderer, Riddell & Cline, at the rate of 30 cents per cubic yard for the grading and $120 for placing the new guy wires.

British Columbia.

VANCOUVER.—The tender of Cameron & Company for the grading of Harris Street to Victoria Drive at $3,973 was accepted.

VANCOUVER.—The works department will lay a wood block pavement on Cambie Street, 41 feet wide, on a 6-inch concrete foundation with concrete curbs. Estimated cost, $42,130; contract price, $33,704. The Robson Street pavement will cost $6,570; contract price $5,256. It is 42 feet wide. Approximate cost per foot frontage: Cambie Street, $7.01; Robson Street, $7.27 1-5.

VICTORIA.—Some tenders for pavement work were: H. E. Canova, $16,000; Steven, Sabine & Steadham, $16,045.

Foreign.

PHILADELPHIA (PENN.).—The Raymond Concrete Pile Company, of New York, has been awarded the contract for placing Raymond concrete piles in the foundations of the cold storage building that will be erected for the Philadelphia Warehousing and Cold Storage Company at Front and Noble Streets, Philadelphia. Fifty thousand feet of Raymond concrete piling will be used in the work. Cramp & Company are the general contractors.

RAILWAYS—STEAM AND ELECTRIC.

Ontario.

BERLIN.—The surveyors for the People's Railway are at work. On Monday last Mr. Warfield, construction engineer, and party of surveyors started on the route of the proposed railway, between New Hamburg and Stratford via Tavistock. Mr. H. Stuart, of Mitchell, Ont., Provincial Land Surveyor, Mr. J. H. Wood, of Hereford, England, draughtsman, and Messrs. Kerr and Kropf are among the party.

OTTAWA.—The contract for the new Grand Trunk depot at Ottawa has been awarded to Messrs. Peter Lyall & Sons of Montreal. The new station will be on the site of the present Central Depot, by the side of the Rideau Canal, but will be of much greater dimensions. It is to be 140 feet in width and 228 feet in depth. It will be four storeys in height and will be connected with the hotel on Major's Hill Park by a well ventilated and well lighted subway. It is proposed to make this station one of the largest and most complete in Canada, and the contract price will run into the millions.

OTTAWA.—The C.N.R. has filed for approval a route map in connection with its line through the suburbs of this city.

OTTAWA.—Hon. George P. Graham, Minister of Railways, has now signed the route maps of railway extensions in Alberta, to which he gave his verbal approval a week ago, and the following details are now available. The routes approved are: Canadian Pacific, line from Langden to a point forty-five miles north, and then to a point on their own line between Penhole and Red Deer; and of Canadian Northern from Strathcona south-west, crossing the Calgary and Edmonton line just north of Red Deer, passing near the same and south to Calgary; and also of the G.T.P. from Riley on the main line southerly to near Pound Hill, through Camrose, passing near, but west of Content and close to Three Hills, and south to Calgary. The Canadian Northern route map through Camrose was withdrawn.

SARNIA.—It is believed here, from the surveying that has been going on lately, that the G.T.R. are contemplating another tunnel to connect with Port Huron. The present one is too small.

TORONTO.—The Grand Trunk will commence operations on their old belt line round the city about the first week in October. It will be used chiefly for handling freight to and from the north end.

TORONTO.—The C.P.R. is working a transformation at Victoria Harbor, having a line of railway in operation for the construction purposes only. They are carrying on construction of immense docks and an elevator. The new million dollar elevator is in the preliminary stages yet, the concrete foundations being under construction. The Government dredges are working at the harbor.

Manitoba.

WINNIPEG.—Relative to the McPhillips Street subway, which is to cost $360,000, the city to pay one-third, the contract between the city and the C.P.R. has been shaped.

WINNIPEG.—Within the next three weeks the C.N.R. will begin work 120 miles south of Camrose, and construction camps will be strung out all along the line. Two hundred miles of the Vegreville to Camrose to Calgary branch will also be constructed this summer.

Saskatchewan.

CARLYLE.—The gang which will do the grading work on the C.N.R. Maryfield-Lethbridge line arrived here some days ago.

ESTEVAN.—A party of Grand Trunk Pacific surveyors has been working east of this town on a proposed line from Regina to Portal.

SASKATOON.—By a ruling of the Railway Commission the plans of the city regarding the subway under the C.N.R. tracks from east to west have been approved. By this decision the railway company will have to pay some $20,000 towards the cost of the subway. This subway will be built at Twenty-Second Avenue, and as the company has declared its intention to construct thirteen additional tracks at this point it will be seen that the subway will be a mammoth affair, unless the railway company decide to carry the yards further north.

Alberta.

CALGARY.—A new era in this city dates from this week, when the first section of the street railway was opened. This runs from First Street to the Fair grounds. The City Council, with a party of prominent citizens, made the initial run. A five-minute service is given.

HIGH RIVER.—A construction gang of the C.P.R. is busily engaged laying two more tracks and extending the yards away south of the Little Bow River. Three cement bridges will be built across the Little Bow.

British Columbia.

VANCOUVER.—Plans submitted by the British Columbia Electric Railway for extensions in Vancouver have been approved.

VICTORIA.—The British Columbia Electric Railway Company is erecting a power house and installing new plant at Victoria. Malcolm & Dinsdale have the contract.

England.

LONDON.—The G.T.R. has opened new offices in Cockspur Street.

CEMENT—CONCRETE.

Nova Scotia.

SYDNEY.—The annual meeting of the Sydney Cement Company, Limited, will be held on Monday, July 12th, at 11 a.m., in the company's office here.

Quebec.

MONTREAL.—Cement sidewalks for this municipality will be laid by the Modern Paving Company at $2.22 a yard.

WESTMOUNT.—Tenders for sidewalks of cement will be opened by A. B. Shibley, city clerk, this week.

Ontario.

ALEXANDRIA.—Rev. J. W. Dulin invites tenders until July 15th for the construction of a church of cement blocks or rubble stone.

BELLWOOD.—On July 2nd Mr. T. Goodall opened tenders for concrete abutments for a bridge which will be erected by the West Garafraxa Council.

BERLIN.—A contract for cement curb and gutter work has been given to Aug. May, of Berlin, by this town.

BRAMPTON.—In our list of tenders, on another page, appears a memo. of the work to be done in Brampton, including concrete walks and bridges. The town engineer is W. M. Treadgold.

BURFORD.—Mr. Wm. Shaver has been awarded the contract for laying 7,000 feet of cement walk in the village.

CALLENDER.—A cement block school, two storeys high, will shortly be erected here by the school board. B. Shannon will receive tenders.

HICKSON P.O.—James Anderson, clerk of the township of East Zorra, Oxford County, asks for tenders for a bridge with concrete abutments until Monday, July 12th.

KINGSTON.—The Board of Works are purchasing two mixers from the London Concrete Machinery Company. Concrete will be used in the reconstruction of the gas tank, a contract for which has just been given to E. B. Merrill, of Toronto.

LONDON.—Much cement is being used on the streets of London in walks, curbs, gutters and other improvements.

PETERBOROUGH.—Until July 17th, plans for abutments for a steel bridge over the Indian River, may be seen at office of J. E. Belcher, county engineer.

PETERBOROUGH.—Plans for a concrete bridge, to cost $32,500, have been outlined by the city officials, and the ratepayers will decide on July 29th whether the work is to be carried out. It is expected that the by-law will carry.

WATERLOO.—For covering bridges with concrete, F. S. Kumpf asks for tenders until July 12th.

Saskatchewan.

YORKTON.—The Enterprise Publishing Company are asking for tenders for a concrete and brick business block.

Alberta.

CALGARY.—Hodgson & Bate, architects, are calling for tenders for a brick and concrete warehouse.

FINANCING PUBLIC WORKS.

Nova Scotia.

ANTIGONISH.—D. C. Chisholm, town treasurer, asks for tenders for $8,000 debentures.

Quebec.

VERDUN.—A meeting will be held on Friday, the 9th instant., for the purpose of discussing By-law No. 111, respecting the issue of debentures for $150,000. Geo. A. Ward, secretary-treasurer.

Ontario.

BELLEVILLE.—A by-law to raise $70,000 for three new schools was defeated.

BERLIN.—The Provincial Public Works Department have approved of the by-law to cover the cost of contemplated road improvements and will contribute one-third.

BERLIN.—The by-law covering an expenditure of $19,000 for double-tracking the street railway carried by 37.

BROCKVILLE.—At a special session of the Council of Leeds and Grenville, on July 6, it was decided to introduce a by-law at he Nov. session to raise $200,000 by debentures for the improvement of the roads of the counties. A Government grant under the Good Roads Act of $100,000 is expected to supplement the amount decided upon to-day.

LONDON.—On July 26th the ratepayers will vote on a by-law to provide $95,000 for waterworks.

OTTAWA.—An issue of debentures amounting to $419,000, for local improvements, has been authorized by the Board of Control.

PETERBOROUGH.—Peterborough ratepayers will on July 29th, vote on two by-laws, both of which were defeated at the municipal elections last January. The ratepayers did not have sufficient information regarding the measures at that time, but it is expected that they will have a better fate this time. The present Smith Street Bridge By-law is for $32,500, and the street extension proposition is for $21,500.

PETROLEA.—The by-law of $4,000 for a bridge carried.

SEAFORTH.—A by-law to raise $20,000 for steel and concrete bridges will be voted on by County of Huron ratepayers shortly.

WELLAND.—Welland citizens by 303 to 9 carried a by-law to permit the Provincial Natural Gas Company to pipe the town for natural gas.

Manitoba.

PORTAGE LA PRAIRIE.—Waterworks and sewerage debentures, amounting to $50,000, will be placed on the market by this city.

Saskatchewan.

ROSTHERN.—A by-law to provide $6,000 for the purchase of fire protection system, including a gasoline fire engine and underground cement tanks, was defeated.

SASKATOON.—Messrs. Wood Gundy & Company, of Toronto, have purchased $184,800 city of Saskatoon debentures, which were issued for the erection of a collegiate institute and municipal buildings, extension of power plant, parks and roads.

British Columbia.

EBURNE.—The corporation of Point Grey invites tenders for $280,000 road debentures and for $28,000 school debentures. Herbert Beeman, Clerk.

SEWERAGE AND WATERWORKS.

Ontario.

LONDON.—A million gallons of water from the artesian wells sunk by Hon. Adam Beck to prevent a shortage again this summer, was turned into the city main. The by-law to take in the whole scheme of the wells will be put before the ratepayers on July 26.

NEWMARKET.—J. Harvey, of Greensville, Ont., is boring a well here for the Davis Leather Company.

PETERBORO'.—Six carloads of machinery and tools of the Bishop Construction Company, of Montreal, have arrived in the city and will be used in the work done by this company at the new waterworks dam.

RICHMOND HILL.—Mr. Frank Barber, York County engineer, is preparing a report which will deal with the possibilities of a gravitation water system for this municipality.

Manitoba.

DAUPHIN.—A delegation from Dauphin recently paid a visit to the new compressed air waterworks system at Yorkton, Sask., with a view to installing a similar system here.

PORTAGE LA PRAIRIE.—Several extensions of the water and sewerage system have been ordered by the City Council here.

British Columbia.

VANCOUVER.—On the recommendation of City Engineer Clement, the Board of Works decided to proceed with the construction of city sewers to cost in the neighborhood of $75,000.

VICTORIA.—An option has been made to the Oak Bay Council by the Esquimalt Waterworks Company. The company offers to supply water at the same rate as that prevailing in this city at six cents a thousand gallons. The present supply is obtained through the city of Victoria at a flat rate of 18 cents per thousand gallons. The option was accepted.

CURRENT NEWS.

Ontario

DELHI.—The unexpected striking of natural gas here has been realized. After continuous drilling on the Strout farm, Mr. Strout and Henry Darby have reached gas and oil at a depth of 1,220 feet.

OTTAWA.—A question of general interest to come up before the Dominion Railway Board shortly, concerns the location of switch stands in railway yards. The complaint is that they are often too near the tracks, thus endangering the lives of employees.

OTTAWA.—The Department of Inland Revenue announces that it is prepared to receive electrical instruments for examination or testing at its electrical standardizing laboratory at Ottawa. A scale of fees is published in the Canada Gazette.

OTTAWA.—Another electric smelting plant has been established at Trollhatten Falls, Sweden, and is operated under conditions similar to those existing in Canada. Dr. Haanel is enthusiastic regarding the possibilities of the installation of a plant in Canada.

Manitoba.

WINNIPEG.—The plant of the Manitoba Gypsum Company was destroyed by fire on July 3rd, entailing a loss of $60,000, well covered by insurance.

Alberta.

LETHBRIDGE.—A special party is being placed in the field for the purpose of taking stream measurements on the St. Mary's and Milk Rivers and their tributaries in Canada with a view to determining more accurately the quantity of water for irrigation and other purposes in each stream. The work will be done under the direction of P. M. Sauder, of Calgary, and the engineer in charge of this part will be D. J. Peters, of London, Ont., who has had some previous experience in this kind of work in connection with the Georgian Bay Ship Canal. The outfitting of the party is being done here now, and they will start work from Lethbridge early in July.

TELEPHONY.

Ontario.

BROCKVILLE.—At a meeting of representatives of rural telephone companies operating in Leeds and Grenville, held at Athens, it was decided to establish an independent switchboard there that would unite all the various lines.

HENSALL.—A. G. Smilie, clerk of this municipality, invites tenders for a hundred miles of line and some two hundred instruments.

Saskatchewan.

CUPAR.—A meeting was held here recently to form a telephone company, and steps toward this end are already afoot.

MISCELLANEOUS.

Ontario.

OTTAWA.—Aqueduct, paving and drainage work to be done by this city will involve an expenditure of half a million.

PORT ARTHUR.—Hon. W. Pugsley, Minister of Public Works, performed the ceremony of turning the first sod for the big dry dock and shipbuilding plant to be established here by stockholders of the American Shipbuilding Company. It is practically promised than an extension of the breakwater will be made to cover the proposed plant which will be big enough to accommodate the largest ships on the lakes.

TORONTO.—The resident Government Engineer, J. G. Sing, has received instructions to proceed with the work of construction on the superstructure of the northerly 1,600 feet of the west pier of the eastern channel. The Government has reserved and strengthened a portion of the island breakwater, and the contractor has resumed work on the 1,500 feet westerly. When these improvements including the new western gap are completed the Government will have spent $614,000.

Manitoba.

ST. BONIFACE.—The Council have decided to recommend the spending of $75,000 on bitulithic pavement at once.

LIGHT, HEAT, AND POWER

Ontario.

SARNIA.—The town voted for the extension of the gas franchise to the Sarnia Gas and Electric Light Company for twenty years. The Sarnia Gas Company have a contract to pipe gas from the Tilbury field and sell it for 14 cents per thousand feet for manufacturing purposes and 30 cents for domestic use.

British Columbia.

FERNIE.—The City Council of Fernie is negotiating for a new site for the electric light and power station.

PERSONAL.

JAMES STOTT, Inspector of Electricity for Alberta and Saskatchewan, has been transferred to Vancouver as Inspector of Gas and Electricity for that district.

PROFESSORS F. D. ADAMS, J. B. Porter, H. E. T. Haultain and W. H. Miller and Messrs W. H. Trewartha-James and J. B. Tyrell, have been elected as Canadian Members of Council of the Institute of Mining and Metallurgy of Great Britain.

Mr. F. JOHN BELL, of Montreal, has been appointed General Manager of the Mines Power Limited, Cobalt, Ont. The company are building a 10,000 horse-power hydro-electric plant for supplying power to the various mines in the Cobalt camp.

MR. HUGH D. LUMSDEN, who has resigned as chief engineer of the National Transcontinental Railway, was elected a Member of the English Institute of Civil Engineers in 1885, and has had a long and varied experience in railway construction work, being engineer in charge of the location of the northerly portion of the Toronto and Nipissing Railway under Edmund Wragge in 1870. Since that year his services have been in constant demand. He had charge of surveys on the Northern Railway, on the Credit Valley Railway, on the Georgian Bay branch of the C.P.R., and on the C.P.R. main line, including surveys in the Crow's Nest Pass and the Rocky Mountains, and was chief engineer on the location and construction of the Ontario and Quebec Railway from Toronto to Perth (197 miles) on the C.P.R. between Smith's Falls and Vaudreuil (104 miles), on the railway between St. John's and Lennoxville, and from Hobel to Mattawamkey, in Maine (129 miles), and was supervising engineer on the Qu'Appelle, Long Lake and Saskatchewan, and Calgary and Edmonton Railways, a distance of 524 miles. Mr. Lumsden is one of the foremost of Canadian Civil Engineers, and his judgment in railway matters is usually sound and practical. It would be a difficult matter to tabulate all the different works on which Mr. H. D. Lumsden, C.E., the acting chief engineer for the construction of the N.T.R. lines since its inception has been engaged. For the last thirty-five years he has been actively at work on Canadian railways and has had part either as Government expert or as consulting engineer in the locating or construction of all the more important roads which have been built during that time. He is an Englishman by birth, and was educated at Belhelvie Academy and Wimbledon School. He came to Canada in 1861 and since that time has attained a leading position in his profession. On several occasions he has been chosen on the council of the Canadian Society of Civil Engineers, and in 1906 was elected president of the society.

MR. W. SCOTT BROOKE, C.E., has been appointed town engineer of North Toronto, Ont.

MR. ELMER JONES, formerly of the Toronto Construction Company, has entered the employ of the J. D. McArthur Company. He will be engaged on the construction of the main feeder of the Southern Alberta Irrigation Company at High River, Alta.

MR. R. T. MACKEEN, formerly connected with the Canadian General Electric Company in the sales and engineering departments, has become associated with the Canadian Fairbanks Company, Ltd., in connection with their electrical interests.

MR. H. A. BAYFIELD has been appointed superintendent of dredges in British Columbia, a new federal post. Mr. Bayfield graduated in mechanical engineering from McGill University in 1896, and began his carrer in railway work with the Intercolonial and Great Northern Railways. He was superintendent of shops on the Great Northern, and after that was for three years mechanical superintendent of the Montreal harbor works before going West. On his arrival in Vancouver he was for two years mechanical superintendent with the British Columbia General Contract Company, and for the last five years he has been in private practice as a member of the firm of Bayfield & Archibald.

MARKET CONDITIONS.

Toronto, July 8th, 1909.

Merchants in lumber, in metals, hardware, and other merchandise tell us that they are doing a steady moderate business, with no rush. But the way things are shaping in Ontario country districts, and with the favorable crop prospect here and in the West, they expect a big trade in September and October. Railway earnings continue good, increased over last year indeed, and bank clearings show increase; but the Sydney coal strike may prove a serious matter for the eastern end of the Dominion.

There is a curious quietude in metals, pig-iron has been in increasing supply—especially Cleveland—for some time, and the manufactured iron trade in Britain unsatisfactory. But there is a slight improvement there in structural steel. Taking the four metals, tin, copper, lead, and zinc, there is hardly a penny difference in the price of the first three on July 6th and May 6th; they are all low in price, and yet buyers seem afraid, from no definite reason, to "go in."

Revival of trade in the United States is but slow, in spite of continued efforts to make it appear that a boom exists. An able New York commentator puts the matter thus:—"Powerful interests have determined to ignore the slow revival in trade, and to re-establish and force advance of prices in excess of actual conditions and actual prospects. * * * * We have, indeed, two months holiday dullness before us, but the autumn prospect is excellent."

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

Antimony.—Demand inactive, market unchanged at $9 per 100 lbs.

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

Bar Iron.—$1.95 to $2, base, per 100 lbs., from stock to wholesale dealer. Market well supplied.

Boiler Plates.—¼-inch and heavier, $2.20. Boiler heads 25c. per 100 pounds advance on plate.

Boiler Tubes.—Orders continue active. Lap-welded, steel, 1¼-inch, 10c.; 1½-inch, 9c. per foot; 2-inch, $8.50; 2¼-inch, $10; 2½-inch, $10.60; 3-inch, $12.10; 3½-inch, $15; 4-inch, $18.50 to $19 per 100 feet.

Building Paper.—Plain, 30c. per roll; tarred, 40c. per roll. The spring rush is over and business steady.

Bricks.—Business is very active, price at some yards $9 to $9.50, at others, $9.50 to $10, for common. Don Valley pressed brick move also freely. Red and buff pressed are worth, delivered, $18; at works, $17 per 1,000.

Broken Stone.—Lime stone, good hard, for roadways or concrete, f.o.b., Schaw station, C.P.R., 70c. per ton of 2,000 lbs., 1-inch, 2-inch, or larger. price all the same. Broken granite is selling at $3 per ton for good Oshawa.

Cement.—The supply is far beyond the demand, and every maker seems to have his storage capacity occupied to the full. There is no reason, therefore, to look for any immediate change in the present quotation of $1.70 per barrel, including bags, or $1.30 without bags, car lots; for smaller quantities $1.40 to $1.50 per barrel in load lots delivered in town and bags extra. In paper packages, price would be, including paper bags, $1.40 to $1.50.

Coal.—Pennsylvania hard coal the retail price in Toronto is $6.50, with a strong likelihood of its continuing at this price for a month or two, the operators appearing to have agreed for a while. This price applies to grate, egg, stove, and chestnut; only pea coal is cheaper, namely, $5.50. These are all cash, and the quantity purchased does not affect the price. Soft coal is in good supply, American brokers have been covering the ground very fully. In the United States there is an open market for bituminous coal and a great number of qualities exist. We quote. Youghiogheny lump coal on cars here, $3.70 to $3.80; mine run, $3.60 to $3.75; slack, $2.65 to $2.85; lump coal from other districts, $3.40 to $3.70; mine run 10c. less; slack, $2.50 to $2.70; cannel coal plentiful at $7.50 per ton; coke, Solvey foundry, which is largely used here, quotes at from $5.25 to $5.50; Reynoldsville, $4.50 to $4.75; Connellsville, 72-hour coke, $5.25 to $5.50.

Copper Ingot.—Unchanged and quiet at $13.85 to $14.05 per 100 lbs. Demand abroad not commensurate with real values at present prices.

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

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

Roofing Felt.—Unseasonably quiet, price maintained at $1.80 per 100 lbs.

Fire Bricks.—English and Scotch, $30 to $35; American, $27.50 to $35 per 1,000. The demand is steady and stocks light.

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

Galvanized Sheets.—Apollo Brand.—Sheets 6 or 8 feet long, 30 or 36 inches wide; 10-gauge, $3.05; 12-14-gauge, $3.15; 16, 18, 20, $3.35; 22-24, $3.50; 26, $3.75; 28, $4.20; 29, $4.50; 10¾, $4.50 per 100 lbs. Fleur de Lis—28-gauge, $4.30; 26-gauge, $4.05; 22-24-gauge, $3.50. Queen's Head—28-gauge, $4.50; 26-gauge, $4.25, per 100 lbs. Sheets continue in active request.

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

Iron Pipe.—Black, ¼-inch, $2.03; ⅜-inch, $2.26; ½-inch, $2.63; ¾-inch, $3.16; 1-inch, $4.54; 1¼-inch, $6.19; 1½-inch, $7.43; 2-inch, $9.90; 2½-inch, $15.81; 3-inch, $20.76; 3½-inch, $26.13; 4-inch, $29.70; 4½-inch, $38; 5-inch, $43.50; 6-inch, $56. Galvanized, ¼-inch, $2.86; ⅜-inch, $3.08; ½-inch, $3.48; ¾-inch, $4.31; 1-inch, $6.19; 1¼-inch, $8.44; 1½-inch, $10.13; 2-inch, $13.50, per 100 feet. Some talk of an advance in price.

Lead.—Prices steady outside. This market is rather weaker, at $3.75 to $3.85 per 100 lbs.

Lime.—Retail price in city 35c. per 100 lbs. f.o.b., car; in large lots at kilns outside city 22c. per 100 lbs. f.o.b. car. In active demand.

Lumber.—Considerable demand for both Southern and Canadian dimension pine continues; hemlock dull. Prices are rather stiff all along the line. Dressing pine quotes $32 to $35 per M; common stock boards, $26 to $30; cull stocks, $20; cull sidings, $17.50; Southern pine dimension timber from $30 to $45, according to size and grade; finished Southern pine according to thickness and width, $30 to $40. Hemlock in car lots, $16.50 to $17; spruce flooring in car lots, $22; shingles, British Columbia, $3.20; lath, No. 1, $4.25; No. 2, $3.75; for white pine, 48-inch; for 32-inch, $1.60, and very few to be had.

Nails.—Wire, $2.25 base; cut, $2.70; spikes, $3, per keg of 100 lbs.

Pitch and Tar.—Pitch, demand moderate, price so far unchanged at 70c. per 100 lbs. Coal tar quotes $3.50 per barrel.

Pig Iron.—There is fair activity and prices are maintained. Clarence quotes at $20.50 for No. 3; Cleveland, $20.50 to $21; in Canadian pig, Hamilton quotes $19.50 to $20 per ton.

Plaster of Paris.—Calcined, New Brunswick, hammer brand, wholesale, $2; retail, $2.15 per barrel of 300 lbs.

Putty.—In bladders, strictly pure, per 100 lbs., $2.25; in barrel lots, $2.05.

Ready Roofing.—In moderate request at prices per catalogue. It is impracticable to quote figures, so great is the variety of this kind of goods, but prices are steady.

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

Rope.—Sisal, 9½c. per lb.; pure Manila, 12½c. per lb., Base.

Sewer Pipe.—

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

Not much moving; price, 73 per cent. off list at factory for car-load lots; 65 per cent. off list retail. Small lots subject to advance.

Steel Beams and Channels.—Quiet. We quote:—$2.50 to $2.75 per 100 lbs., according to size and quantity; if cut $2.75 to $3 per 100 lbs.; angles, 1¼ by 3-16 and larger, $2.50; tees, $2.80 to $3 per 100 pounds. Extra for smaller sizes of angles and tees.

Steel Rails.—80-lb., $35 to $38 per ton. The following are prices per gross ton, for 500 tons or over: Montreal, 12-lb. $45, 16-lb. $44, 25 and 30-lb. $43.

Sheet Steel.—Market steady, at the former prices; 10-gauge, $2.50; 12-gauge, $2.55; American Bessemer, 14-gauge, $2.35; 17, 18, and 20-gauge, $2.45; 22 and 24-gauge, $2.50; 26-gauge, $2.65; 28-gauge, $2.85. Quite a quantity of light sheets moving.

Tank Plate.—3-16-inch, $2.40 per 100 lbs.

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

Tin.—Prices steady and demand good. The price continues at 31c. to 31½c.

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

Zinc Spelter.—A very active movement continues, and the market is firm at $5.50 to $5.75.

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Montreal, July 7th, 1909.

The pig-iron markets of the United States continue to show firmness, although there is little, if any advance. As a matter of fact, several furnaces are asking 25c. more than a week ago, but it is very doubtful if