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The Canadian Engineer

A weekly paper for engineers and engineering-contractors

BREAKWATER AND FERRY LANDING CONSTRUCTION AT CARLETON POINT, P. E. I.

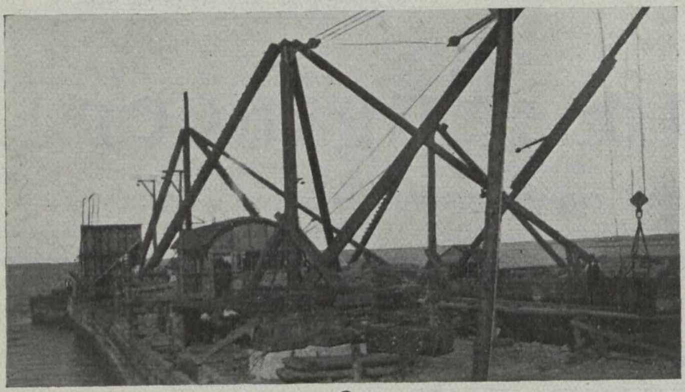
AN IMPORTANT GOVERNMENT RAILWAY DEVELOPMENT IN THE MARITIME PROVINCES—GENERAL FEATURES OF P.E.I. TERMINAL—NOTES ON ROCK QUARRYING, TRANSPORTATION, AND PLACING.

THE Department of Railways and Canals at Ottawa has under construction in the maritime provinces terminals for a car ferry to connect the Intercolonial Railway in New Brunswick with the Prince Edward Island Railway. A branch line extends from Sackville, N.B., to Cape Tormentine, on the main land, while another branch line, known as the Cape Traverse branch, will connect the other terminal, Carleton Point, P.E.I., with the main line of the Government railway in that province. The distance between the two terminals is about nine miles.

This project is largely the result of an elaborate study of conditions in that locality, made for the Department by the late Professor Kirkpatrick, of Queen's University, Kingston, Ont., who recommended the adoption of the above system.

The terminal at Carleton Point begins with a rockfill extending out from shore for a distance of about 1,500 ft. At its extremity a landing pier for the car ferry will be formed by the placing of ten large reinforced concrete cribs. Farther out, about 600 ft. beyond the end of the outer crib, a breakwater about 500 ft. in length is being built to protect the harbor thus formed between the breakwater and the landing pier from the southeast winds. This harbor is to be dredged to a depth of 20 ft. below low-water level. The natural depth of water in this proposed harbor ranges around 15 ft. while a gradual decrease in depth occurs from it to the shore.

General View of Quarry Yard, Showing Track Layout, Cableway and Rock Formation.



Rock Loading Plant at Point Du Chene.

The landing pier and breakwater are both of rock-bound type, faced with large stones.

The contract for the work at Carleton Point was awarded by the Department of Railways and Canals to Roger Miller & Company, Toronto, in August, 1913, and the season of 1914 witnessed a great deal of preparatory and under-water work. The former included the construction of a floating drydock, scows, cable-way towers and piers, railway sidings, quarry stripping and working, etc. Besides, both the 1,500-ft. rock-fill and the 500-ft. breakwater were constructed up to the level of low water, while a length of approximately 500 ft. of the former was built up to the level of high tide.

An abundant supply of excellent rock was located about 1½ miles from Shediac, N.B., which is about 2½ miles from Point Du Chene, where the stone is loaded. The rock for the core of the breakwater and fill was conveyed from the quarry to Point Du Chene by railway, the line being about 5 miles in length. A siding, connecting with the Intercolonial, ran about 1,000 ft. into the quarry. Transportation from the quarry was effected by 40 standard steel-frame cars, each capable of carrying four steel skips, each of which held about 6 cubic yards. The skips were loaded by steam shovel while in position on the cars, and taken to Point Du Chene where two stiff-leg derricks picked them up and dumped their contents into the scow pockets, the capacity of the scow being about 850 tons. The scows were then towed across to the site by the company's tug, "J. O. Gravel," a vessel 100 ft. in length, drawing 12½ ft. of water, built in England and brought across under its own steam. Night operations at the site of dumping were accomplished by the use of a searchlight, at first erected on the shore and later removed to the landing pier, when the cable tower had been constructed there.

After both landing pier and breakwater were brought up in this manner to low-water level the construction of the former was continued by the use of a cable. Two wooden cribs were sunk about 1,500 ft. from shore, each 100 ft. long by 30 ft. in width. They were built up to about 8 ft. above high tide. The side farthest from shore was protected by a bank of stone about 80 ft. in width, the outer side of which was faced up with large pieces of rock. This afforded ample protection from the sea and from the ice during winter. A 95-ft. wooden tower was then erected, partly on the cribs and partly on the rock-fill back of them.

These cribs were built at Point Du Chene, in a specially constructed floating dry dock. The first crib was not

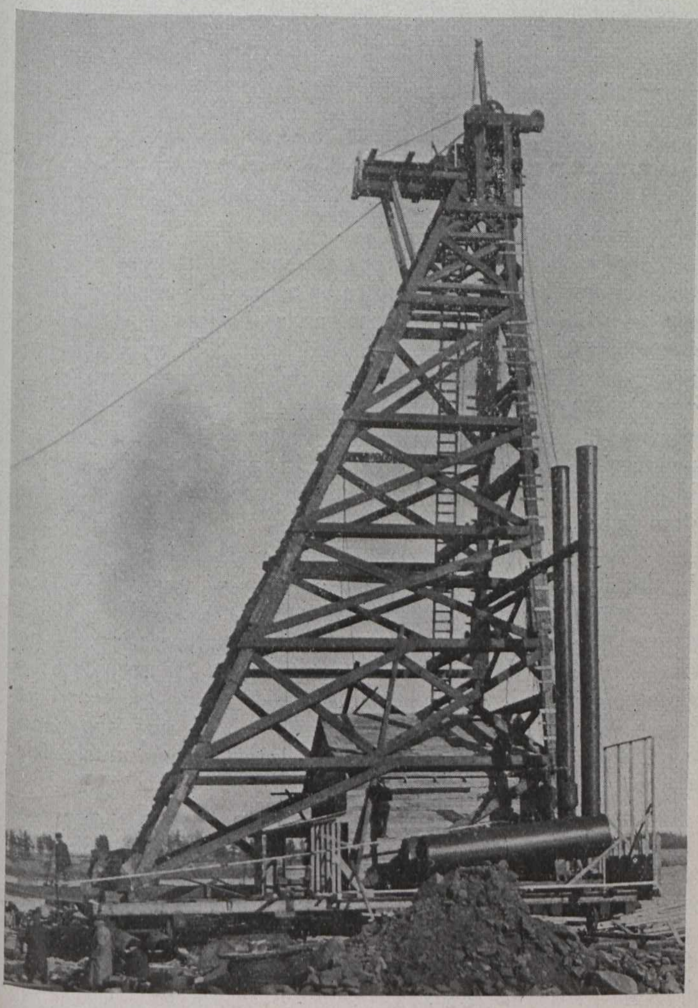
Rock Used in Facing Pier and Breakwater.

Dry Dock and Steel Deck Scow Under Construction at Point Du Chene.

removed from the dry dock at that point, but the whole was towed over to the site of the landing pier, a distance of 40 miles, where the dry dock was sunk, the crib floated into position and filled with stone. In the case of the second, the crib was removed from the dry dock at Point Du Chene and towed across.

Another tower, 105 ft. in height, was constructed on the shore, and a 2¼-inch Lidgerwood cable strung between them. The skips, filled with rock, were brought by scow to the landing pier where they were lifted and conveyed along the rock-fill by cable. A steel scow 125 ft. long, 35 ft. wide and 12 ft. deep, constructed by the company at Point Du Chene, was employed in this work.

The large facing stone is also produced by the quarry. It is loaded on cars by means of a cableway 600 ft. in length and of 15 tons capacity, and a 25-ton locomotive crane. Cyclone drills are used in blasting operations.



Outer 90-foot Tower of 1,505-foot Cableway at Carleton Point. Tower Resting on Wooden Cribs and Rock-fill.

For the construction of the large reinforced concrete cribs which will constitute the walls of the landing pier, a floating dry dock has been built at Point Du Chene. It is 125 ft. long, 47 ft. wide and 12 ft. in height, and is equipped with valves for flooding purposes, and with an opening end.

The cribs themselves will have reinforced concrete walls and solid wooden bottoms. They vary in length from 102 to 113 ft. They are to be 35 ft. wide and 32 ft. high. It is the intention to construct them in the dry dock to about half their height, whereupon they will be removed and finished. They will then be towed across to Carleton Point and sunk by means of valves operated from the top of the cribs. Their construction will be proceeded with during the coming summer, simultaneously with the completion of the rock-fill and facing of landing pier and breakwater.

Mr. F. B. Fripp is engineer in charge for Messrs. Roger Miller & Company, with Mr. Downing as resident engineer at Carleton Point.

WASTE OF NATURAL GAS.*

By Dr. F. D. Adams,
Chairman, Committee on Minerals, Commission of Conservation.

NATURAL gas is the most perfect fuel with which we are furnished by nature. It is clean, can be readily piped for long distances, and has a very high heating power. Consequently, when it is found in large quantities, it speedily supplants all other kinds of fuel. It is a material, however, which has been produced very slowly, and the great volumes of it which are found stored in certain favorable situations within the crust of the earth represent the result of a slow process of accumulation extending over an enormous lapse of time.

The gas, however, is often under great pressure in the earth's crust, and when tapped by bore holes frequently escapes in such enormous volumes that persons unacquainted with the conditions of its occurrence are led to believe that the supply is so great as to be practically inexhaustible, or that at any rate the exhaustion of the field is a contingency so far removed in the future that its discussion is a matter of purely academic interest.

The greatest supplies of natural gas hitherto discovered are those of the United States, and these gas fields are those which are nearest in position to the Canadian fields. The gas fields of the United States have now been operated for some thirty years, and the experience drawn from them is directly applicable to the problems presented by the gas fields of Canada, which are now in a relatively early stage of their development.

The Experience in the United States.—It is that within a few years after its discovery the output of gas in one field after another in which the supply was supposed to be inexhaustible is found to be gradually lessening, and in some of the fields where natural gas was at first so abundant that it was the fuel almost exclusively employed in the great factories of the district as well as for private use, the supply is now practically exhausted and it has been necessary to return to coal.

In fields where the supplies have not as yet been exhausted the decline in pressure, indicating approaching exhaustion, has been marked. One of the most rapid declines is that seen in the fields of northern Indiana, where the pressure dropped from 400 pound in 1886 to 50 pounds in 1902. Thus those fields were practically exhausted within 15 years. McDowell states that three times as much gas was wasted in those fields as was used.

Other instances of quick decline are found in Kansas and Oklahoma. In the latter state the rock pressure

* From a report on "Mineral Resources and the Problem of their Conservation," Annual Meeting, Commission of Conservation, January, 1915.

of the gas in the Hogshooter field in 1912 fell off at the rate of a pound a day, and only recently the volume of gas yielded by the Copan field, in the same estate, dropped in a single year from 300,000,000 feet per day to 100,000,000 feet per day. In Louisiana a similar decline is noted. In a well of the Midway field in California the 16-inch casing tapped a gas sand at a depth of 540 feet; the flow was 50,000,000 cubic feet per day for a few days and then practically ceased.

The experience, in short, has been that no gas field is inexhaustible, but that each has a life extending over a comparatively few years. Consequently, the supply of gas in any district which is fortunate enough to possess one should be carefully husbanded.

The decline in the yield of the gas fields of the United States has been greatly accelerated by the enormous waste which was allowed to take place in the earlier years when the gas appeared to be so abundant that it was difficult to persuade people that it would not last forever. Dr. Orton states that in the early days of the Ohio gas fields the operators tried to believe that the gas was being formed within the earth as fast as it was being allowed to escape, or comforted themselves with the aphorism that "Nature would not go back on us." The supplies, however, fell off there as elsewhere.

Dr. I. C. White in his address before the great Conference on Conservation, held in Washington in 1908, made the following statement with reference to the waste which was taking place in the United States at that time: "The blazing zone of destruction extends in a broad band from the lakes to the Gulf and westward to the Pacific, embracing in its flaming pathway the most precious fuel possessions of a continent. No one can even approximate the extent of this waste. From personal knowledge of the conditions which exist in every oil and gas field, I am sure the quantity will amount to not less than 1,000,000,000 cubic feet daily, and it may be much more. The heating value of a billion cubic feet of natural gas is roughly equivalent to that of 1,000,000 bushels of coal. What an appalling record to transmit to posterity!"

Mr. David T. Day, of the United States Geological Survey, estimates that at that time in the United States about one-half of all the natural gas which was produced by the gas wells was wasted.

Mr. McDowell states that the daily waste of gas in Oklahoma by escape into the air is at present equivalent to the destruction of at least 10,000 tons of coal daily, and that 80 per cent. of this loss is preventable.

Now in the United States when the horse (or a considerable part of him) has been stolen, the stable door is being shut. Legislation has been passed and so effectively enforced in Indiana, Ohio and Pennsylvania that the waste of natural gas in these states has practically ceased. The laws of Indiana, Ohio, Pennsylvania and West Virginia call for the proper capping of every well when not in use. In other states of the Union, however, where preventive legislation does not exist, the waste is still enormous. It is estimated by the Director of the United States Bureau of Mines that the aggregate waste in the United States at the present time exceeds a value of $50,000,000 per annum, of which 80 per cent. might be readily saved.

The Canadian Situation.—Natural gas first appears in the statistics of the mineral products of Canada in the year 1892, when the total output had a value of $150,000. In 1913 this had risen to $3,360,000. This comes from the provinces of Ontario, New Brunswick, Saskatchewan and Alberta.

The most highly productive area at the present time is the extreme southerly portion of Ontario, in a strip of territory along the shore of Lake Erie, the total product here having a value of rather over $2,000,000, of which about two-thirds comes from Kent County.

The discovery of natural gas in New Brunswick is of much more recent date and the output has risen rapidly in the last few years, having a value in 1913 of $174,006. The field is situated in Albert County and supplies gas to the cities of Moncton and Hillsborough.

In Saskatchewan and Alberta gas has been found in places over a wide stretch of country along the line of the Canadian Pacific Railway from Medicine Hat to Calgary and thence to the north as far as Pelican Portage, about half way between Edmonton and Lake Athabasca.

While the gas is known to have a wide distribution, the gas which has been used so far has been obtained from two fields known respectively as the Medicine Hat and the Bow Island gas fields. From the former gas is taken to Medicine Hat and from the latter the gas is piped to Lethbridge and Calgary, 160 miles distant, supplying also intermediate points along the route. The total product of Alberta in the year 1913 had a value of rather over one million dollars.

There is, however, every prospect that new productive gas fields will in the future be opened up in other parts of the provinces of Saskatchewan and Alberta as well as elsewhere in the Dominion. And having in mind the experience of the United States, definite steps should at once be taken to prevent all waste. It is to be noted that the gas field in Essex County, Ontario, formerly highly productive, has now ceased to yield, and that a falling off in the supply of gas is already seen in certain other Canadian fields.

The most striking case of the waste of natural gas in the Dominion is the great column of gas which has been escaping from the bore hole put down by the Government near Pelican Portage, Alberta, in 1897. The records show that in this well at 820 feet "a tremendous flow was struck, the roaring of which could be heard at a distance of three miles or more." This gas has been burning like an immense torch almost continuously for the past 17 years.

The district in which this gas is escaping is at present somewhat remote from settlement, but it is a district which is nearer to Edmonton than Calgary is to the great gas wells which supply it, and yet this gas, representing a great accumulation of the finest fuel, which might have formed the basis of important industries in Edmonton, has been for all these years running to waste.

In endeavoring to arrive at some estimate of the waste of gas which has taken place at this well, Mr. W. J. Dick, Mining Engineer of the Commission on Conservation, communicated with Mr. Louis G. Huntley, of Pittsburg, Pa., the engineer who examined the well for the city of Edmonton in 1913. Mr. Huntley writes as follows:

"When the writer visited this locality in 1912, he estimated the flow of the old government well at something less than a million cubic feet per day. In 1913 Mr. Williams, of the Pelican Oil and Gas Co., reported to his stockholders that the well pressure was 225 lbs. per square inch with a flow of about 840,000 cubic feet per day. The writer again visited the well in 1913 in connection with the report for the city of Edmonton, and while more gas was being used for fuel for drilling purposes, the flow seemed somewhat less than the previous year. Mr. Williams would not allow the well to be gauged, however, although it was still blowing into the air through a one-inch pipe.

"While Mr. Williams' statement may have been somewhat optimistic, yet it is reasonably certain that the well was not making more than his estimate, *viz.*, 840,000 cubic feet. Now, in line with Orton's hydrostatic theory of underground pressures, and knowing the difference in elevation of the Dakota Sand at Pelican and its nearest outcrop at Boiler Rapids to be very close to 500 feet, the pressure would theoretically be 260 lbs. per square inch in the Dakota Sand at a depth of 820 feet at Pelican. This coincides very well with Mr. Williams' report of 225 lbs., and it is believed that probably the pressure was not much higher in 1897 than it is at present. However, the flow of gas from this well has decreased very greatly, according to the reports of those who make yearly trips down the Athabasca River. There is no certain way of estimating the original flow of this well when drilled 17 years ago. However, in the writer's judgment, an eight-inch hole at a pressure of 260 lbs. would not produce more than a maximum of 5,000,000 cubic feet per day from a sand of the character of the Dakota. In other words, an average flow of 2,900,000 cubic feet per day for 17 years. This may be regarded in the nature of a maximum figure and is very approximate, due to our assumption of a fairly constant pressure at all times. However, in a sand as uniformly coarse as the Dakota, with a uniform dip to its outdrop at Boiler Rapids, it is difficult to imagine a much greater pressure to exist at Pelican than one equal to the hydrostatic head, due to the difference in elevation of the sand at the two points. In all fields far removed from the out-crop of the gas-bearing formation, where many wells are drawing from the same area, a drop in pressure of from 30 to 100 pounds per year is the rule. But with one well only draining the district, and other conditions such as at Pelican, I believe we are safe in the assumption that the pressure was never much above 260 lbs., the flow decreasing due to the greater distance through which the gas must now travel to reach the well."

Taking the amount of gas which escaped daily at 2,900,000 cubic feet, a simple calculation shows that this amounts to 17,994,500,000 cubic feet in 17 years. The average price for natural gas in Canada in 1913 was 15 cents per 1,000 cubic feet, which would give $2,700,000 as the value of the gas wasted. Even if this estimate be reduced by 50 per cent., the waste still remains enormous and inexcusable.

Furthermore, another point must be borne in mind in connection with these supplies of natural gas, and that is that the gas often travels for long distances underground and a waste at one point affects not merely the supply in its immediate vicinity, but often exhausts the supplies of gas in the entire field underlying a great tract of country, so that it is not merely the area about the point of escape which is affected but the whole surrounding region whose potential development is seriously impaired by the destruction of one of its great natural resources.

With the single exception of Ontario, no province in the Dominion at the present time requires gas wells which are not being used to be plugged, and this province has further reduced the waste in the area under its jurisdiction by levying a tax of two cents per thousand feet with a rebate of 90 per cent. for the gas that is actually used. The Dominion Government and all the provincial governments should at once pass enactments requiring all gas wells which have been abandoned or are not in use to be plugged. Legislation similar to that in force in Ontario should also be passed by the Dominion Government and the other provinces requiring the payment of a royalty on gas with a suitable rebate for the gas actually used. Natural gas, when discovered, enters into direct competition and supplants coal which pays a royalty to the government and the rebate, if properly adjusted, makes waste unprofitable and, therefore, tends to stop it.

The public should also be brought to realize that there are many forms of waste against which it is difficult to legislate but which are none the less disastrous. Among these may be mentioned the custom of selling natural gas at a flat rate of so much per burner per month instead of at so much per 1,000 cubic feet. The inevitable tendency of this, as seen in Medicine Hat at the present time, is to allow the gas to burn all day, seeing that it costs no more to do so, while at the same time it is easier to let it burn than to turn it out, and the spectacle of gas blazing throughout the day conveys a general suggestion of the abundance of a product which one can afford to waste so lavishly. No company manufacturing coal gas sells it in this manner since they clearly recognize that if they did so the gas would certainly be wasted and all profits would disappear. Natural gas should always be sold at a definite rate per thousand cubic feet. Furthermore, since natural gas has not, as a general rule, a very high illuminating power, the best and most economical results are obtained if, instead of burning a large number of jets as open flames, a relatively smaller number are used with incandescent mantles, which greatly increase the illuminating power of the gas.

Economy may also be practised when the gas is used for the development of power. Thus 80 to 130 cubic feet of natural gas are required to develop one horse-power per hour when the gas is burned under a boiler and the steam produced is used for driving a steam engine of the ordinary type. The same power can be developed with a consumption of 9 to 15 cubic feet per hour in a gas engine of equal reliability and the same cost of maintenance. Hence a great saving can be effected if the gas is employed directly in a gas engine.

It must always be remembered that the prevention of waste in the case of our mineral resources is the only true conservation.

FATALITIES IN COAL MINES.

The fatalities in coal mines in the United States in 1914 were 334 less than during the preceding year, the total fatalities being 2,451 as compared with 2,785 for 1913.

The principal causes of accidents that show a material decrease were: coal-dust explosions, 96 per cent.; haulage, 11 per cent.; and falls of roof and pillar coal, 10.6 per cent. The net decrease, in underground fatalities was 365, or 14 per cent. This is equivalent to saving one life every day during the year.

There were 331 fatalities due to gas explosions as compared with 91 in 1913, making a net increase of 240. Of the total gas-explosion fatalities, 261 were due to four serious explosions. There were slight increases in accidents due to explosions and electricity. There was also a net increase of 26 fatalities in shaft accidents, or 42 per cent., while on the surface, the net increase was five, or about 3 per cent. The net decrease for the year for both underground and surface accidents at coal mines as compared with 1913 was 12 per cent.

SURVEY OF PHILADELPHIA WATER DISTRIBUTION SYSTEM.

IN a paper which he read last December before a meeting of the Engineering Section of the Association for the Advancement of Science, Mr. Carl. E. Davis, chief of the Bureau of Water of Philadelphia, gives some information of a nature similar to the underground survey work in Ottawa, referred to in our issue of February 11th, but on a more extensive plan. According to Mr. Davis, the original waterworks of Philadelphia were constructed about 1801. The first cast-iron pipe was laid in 1817 and considerable pipe which was in the ground as early as 1820 or 1830 is still doing service in the distributing system. The city at present is an amalgamation of a number of distinct municipalities, some of which had a water supply at the time of incorporation with the larger community.

As the city has grown, various water-supply projects have been developed, used, outgrown, and abandoned in whole or in part. During the last fifteen years the introduction of a filtered supply has brought about a radical readjustment of the principal supply mains and a realignment of the distribution districts.

Certain general maps and plans, compiled by William Whitby, of the Bureau of Water, are now being developed and expanded. The scheme provides certain general features:

(1) Data used chiefly for controlling and regulating the amount and pressure of water throughout the system, or in other words, data used in operating the supply. Under this head are maps defining the limits of the several distinct distribution areas, accompanied by data showing the sources of supply for each area and a list of valves controlling the supply: likewise, general maps showing all large mains, reservoirs and pumping stations, together with detail maps of the piping system and operating valves at the pumping stations, filters and reservoirs.

(2) Data used chiefly for repairs and maintenance, including detail maps showing the complete gridiron of distribution pipes on which the location of all valves and hydrants are indicated. Each street intersection is mapped on a separate plan of a size convenient for use in the field.

(3) Data used chiefly for the business relations between the consumer and the Bureau of Water, such as location, depth, size, date of insertion, kind of pipe, etc., of service connections. These data are listed in a card index and filed by streets and numbers. The system likewise proposes under this head full plans of all pipes in important establishments which may have a special supply for sprinkler systems or other fire protection. These plans will indicate the relations between pipes carrying city water and private pipes which may carry a possible polluted water from a private source, introduced for the purpose of fire protection or manufacturing. The necessity for the complete severance of these dual supplies can be readily seen.

Assuming an available force of sufficient size and individual experience and capacity, the work of mapping pipes and valves proceeds normally along three lines:

(1) Compilation of existing data wherever and however those data may be listed.

(2) An investigation and determination of the present and possible function and use of the several parts of the system. Each foreman in charge of a repair or maintenance crew is furnished with a pad of paper showing the lines of typical street intersection with house lines, curb lines, etc., printed on it. Whenever and wherever such a crew is called for work, the foreman is required in his spare minutes, which always occur in such an operation, to list up on these blanks such data as an intelligent inspection of his immediate vicinity will discover.

(3) The proper recording of new work and the reduction to tangible shape of existing data.

The system depends upon centralized overhead control. All new work is directed from a central office, thereby insuring uniform practice and procedure, stimulating branch offices by the feeling that their returns are scrutinized and compared with similar returns from other branch offices. Uniform practice and procedure is essential as a man transferred from one section of the city to another feels at home among the familiar records, even though the geography of the district is strange.

Book records have been discarded as far as possible in favor of records capable of easy and rapid reproduction. A complete and satisfactory record, distributed as widely as desired, may not be obtained for some time to come, but enough has already been accomplished to prove the worth of the system.

FILING OF MILEAGE TARIFFS BY RAILWAYS.

AT a recent sitting in Ottawa of the Board of Railway Commissioners an amendment took place of the standard regulations of the Board as to the opening of new lines, so as to provide that, in addition to filing the standard mileage tariff applicable to traffic on the portion of the railway to be opened, the appropriate special tariffs also be filed.

The railways are now required, before opening for the carriage of traffic any extensions of their existing railway systems west of Lake Superior, to publish and file the appropriate supplementary special class or "town" tariffs, mileage commodity tariffs, and special tariffs on grain to the Lake Superior terminals, and on lumber from British Columbia, as these may be applicable to the territories to be served by the new lines, in addition to the standard mileage tariffs therefor.

This action is necessary by the Board owing to the fact that cases have occurred in the past where it has been shown that, although railway companies before opening new lines have either filed standard mileage tariffs applicable to the extensions opened, or already have sufficient mileage to cover the extensions expressed in their existing tariffs, the companies have delayed in filing commodity rates with the result that, in certain instances, shippers on the new lines suffer from a direct discrimination.

In the past, according to the Board, companies at the urgent request of shippers have, through their construction departments, carried freight at any rate they chose to charge. These rates, while excessive as compared with railway rates, were nevertheless always less than those of the previous methods of transportation, and were sought to be justified on the grounds of the necessity of settlers, and the fact that such a service was in any event never remunerative to the carrier and to some extent a nuisance as interfering with construction work.

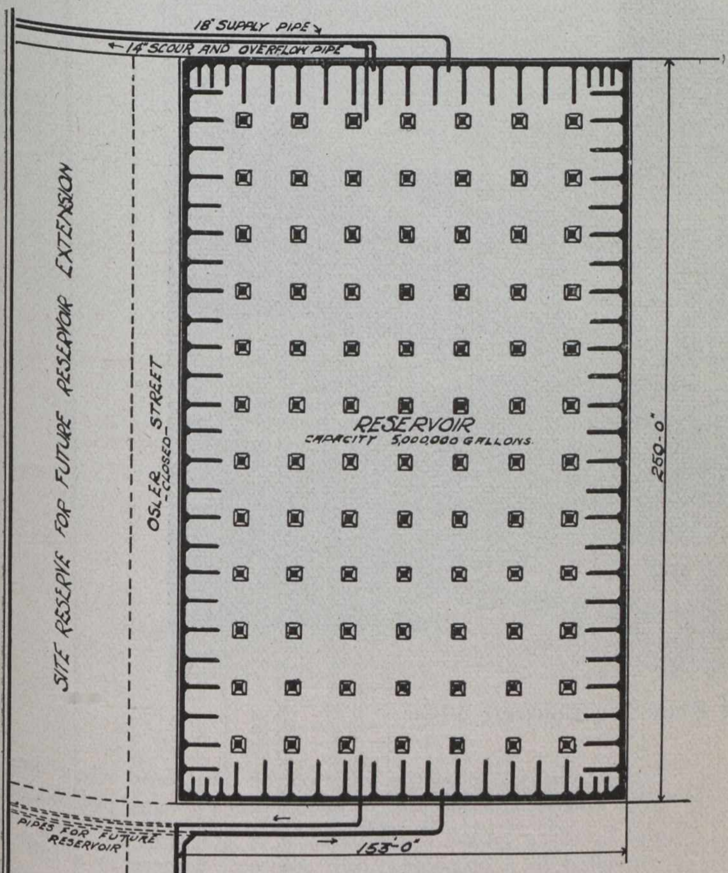
"In dealing with such applications in the future, while it is clear that the railways cannot be compelled to make the application, some action must be taken by the Board having regard to the necessities of the emergency justifying leave to operate which will limit the toll the railway company may collect."

NEW CITY RESERVOIR, REGINA, SASK.

NOTES ON WATER SUPPLY AND PROPOSED SCHEME OF ADDITIONS OF WHICH THIS 5,000,000-GALLON RESERVOIR IS A PART—NOTES ON ITS DESIGN AND CONSTRUCTION.

By R. O. WYNNE-ROBERTS, M. Inst. C.E., M. Can. Soc. C.E.
Consulting Engineer, Regina.

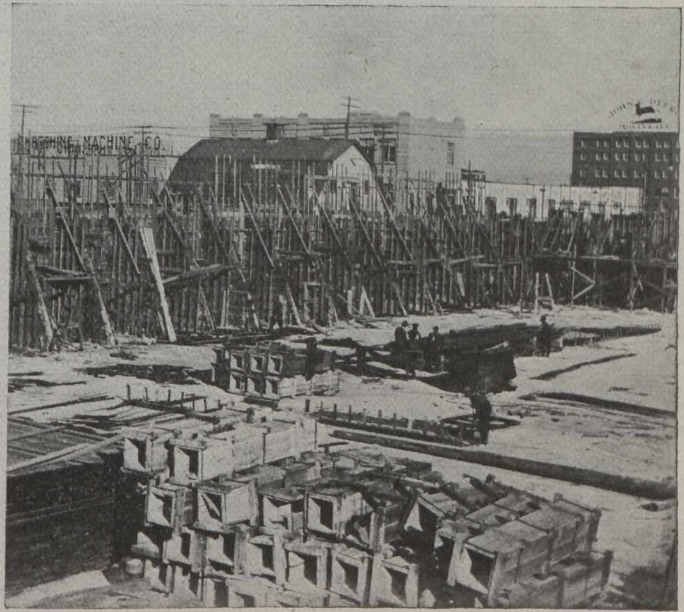
THE part of Boggy Creek watershed from which the City of Regina obtains its main supply of water, is about 72 sq. mi. in area, and the nearest point is about six miles distant by skyline, or eight miles by road. The watershed has a pear-shaped boundary, the narrowest and lowest point being at the southwest corner where the city owns land. On this land about 45 artesian wells have been sunk, under the writer's advice; the water in all cases overflows the surface and is collected and conveyed by underground pipes to Barton pump-well,



Plan of Reservoir and Connections.

which has a capacity of 270,000 gallons. In a pump-house adjacent to the well there are two 80-h.p. Crossley oil engines, and two 2,000,000-g.p.d. turbine pumps to raise the water to Tor Hill reservoir, which was described in these columns about a year ago. This reservoir has a capacity of 5,000,000 gallons, built of reinforced concrete, circular in plan, 202 feet in diameter, 25 feet deep, and stands about 90 feet above the pumps and about 120 feet above the city street level. The water is conveyed from this reservoir to the city by an 18-inch steel main, which has a maximum delivering capacity of about 3,500,000 gallons per diem.

In an adjoining section are located a number of springs, yielding from 400,000 gallons, upwards, according to the season. This constituted the only source of supply for the city until 1911, and was quite inadequate. This water is conveyed by 15-inch vitrified pipes to a basin half-way to Regina, and thence by a cast iron main partly 12, but principally 10 inches in diameter. The present total yield is from 2½ to 3 million gallons per day, but it is estimated that Boggy Creek area will yield up to 4 or 5 million gallons per day by extending the collecting lines and sinking additional wells.



Formwork for Counterforts and Columns.

The 10-inch supply is pumped into the city mains by an electrically driven turbine pump, but the 18-inch ordinarily affords a gravity pressure of 45 pounds per square inch. When the demand is great and the pressure is diminished, then the water is pumped by a 5,000,000-g.p.d. Escher Wyss turbine pump, driven by Belliss & Morcom high-speed steam engines.

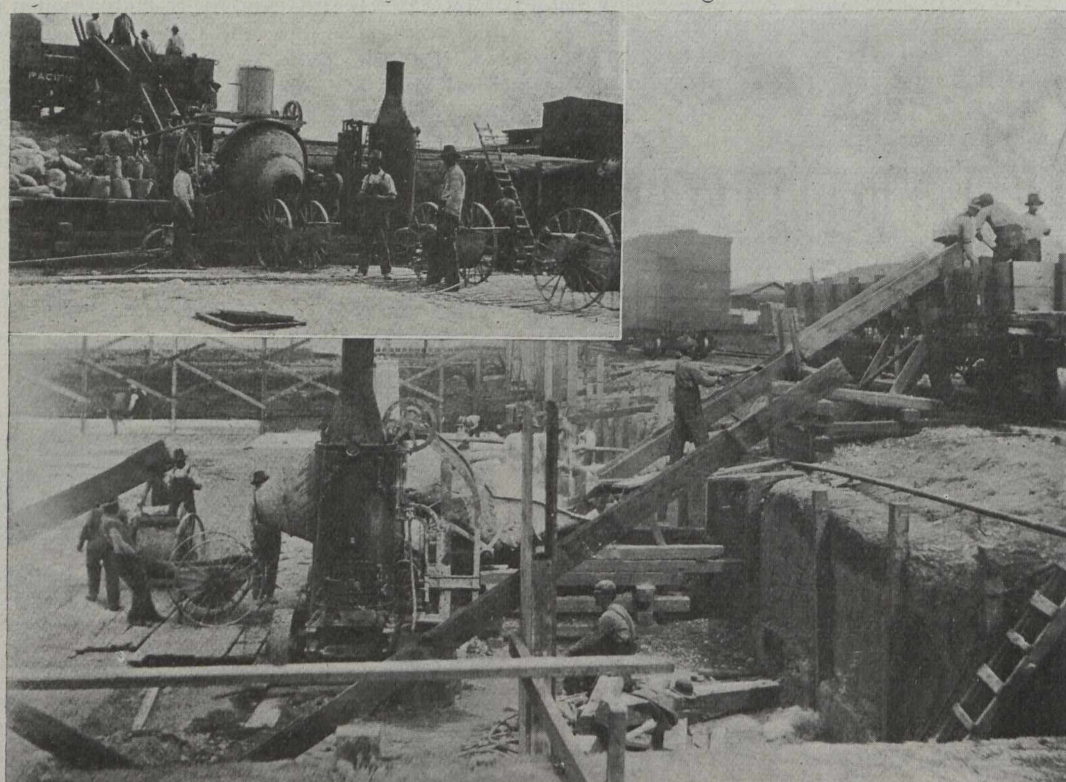
Additional Supply.—The writer some time ago reported to the city council on the question of additional water supply, and recommended the adoption of a scheme which involved the taking of water from five watersheds contiguous to Boggy Creek, making a total area of about 200 square miles and estimated to yield about 10,000,000 g.p.d. This scheme can be carried out piecemeal, provided the initial works are properly laid out. A part of the scheme was a 27-inch steel main to tap the Silver Stream area, with a branch to Tor Hill reservoir. As the existing mains from Boggy Creek were delivering the maximum quantity on gravitation pressure system, it was deemed desirable to lay the part of the 27-inch main from Tor Hill reservoir to the city so as to supplement the quantity and pressure. The cost of the pipe line was estimated at about $508,000, which was a large amount to incur under the prevailing financial conditions. As a city reservoir would be necessary even with such a main, City Works Commissioner Thornton considered that the reservoir would suffice for the time being. The supply to the reservoir is from the 10-inch line and the night surplus from the 18-inch main.

Having considered all points of the scheme, it was decided to build such a reservoir. There were two sites available, one near the cemetery on which a duplicate of the Tor Hill circular reservoir could be constructed, and the other a piece of land near the power house. Having regard to the convenience of a reservoir near to the power house and the obviation of the cost of laying a large main from the other site, the power house site was selected. This land, however, was limited, and did not permit of embankments, consequently the writer designed a rectangular basin covering the entire site and part of a closed street, the length being 250 feet, width 153 feet, water depth 22 feet, and a capacity of 5,000,000 gallons, which was estimated to cost about $125,000, exclusive of the land. (See Fig. 1.) Reservation was made for a duplicate reservoir to be built in the future.

General Design of Structure.—The site was practically level, and as it was advisable to assure a constant head on the turbine pumps, most of the reservoir had to be built above ground. The floor level is 6 feet below the ground surface, and the top water line about 16 feet above. The work will be described in the order of construction.

Excavation.—It was intended to excavate the ground by machine, but to afford more employment, it was done entirely by manual labor. The excavation extended about one foot beyond the wall lines, and to an average depth of 7 feet 4 inches. The actual cost of labor was 46 cents and team work 30 cents per cubic yard. The material was entirely gumbo clay.

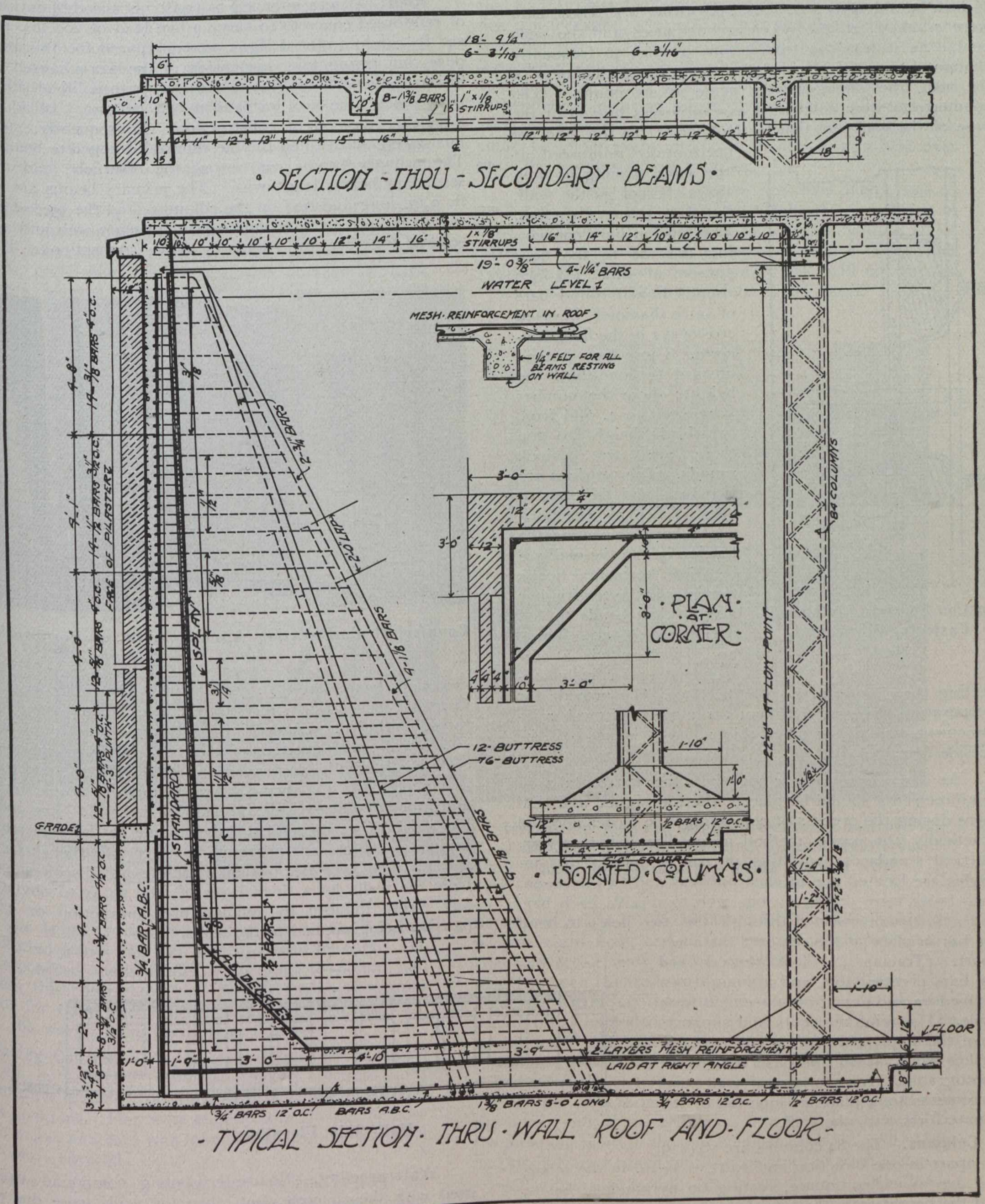
Floor.—The floor for a distance of 22 feet inwards from the walls is 20 inches thick; the central portion is 12 inches thick and under each column 20 inches thick. The reinforcements consist of ¾-inch rounds at 12-inch centres in the lower part of the thicker concrete near the walls, and these bars extend 8 feet up the walls to form the necessary tie. Half-inch round bars are also laid within 6 inches of the surface at 6-inch centres in two directions. These bars are tied with wire at every fifth intersection in one direction, and at every intersection in the other. The column bases have an extra layer of ½-inch bars at 12-inch centres in the lower portion. The concrete was laid to the level of the bars, and when these were placed the next portion of concrete was poured on, and finally a 2-inch finishing coat of fine concrete laid and trowelled to a close textured surface. There is a fall of one foot from one end to the other of the floor, and a small fall from the sides to the major axis.



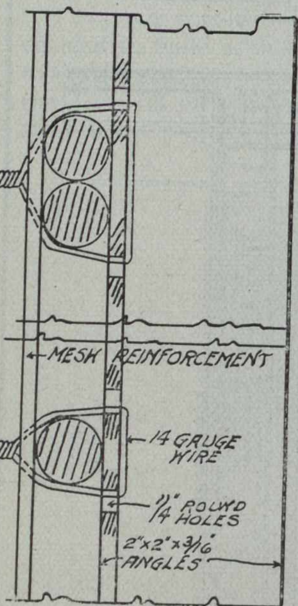
Arrangement of Mixing Plant for Concrete Floor

Walls and Counterforts.—The walls are 33 inches thick at the base, with an addition of a splay on the inside of 36 inches. There is a set back on the outside of the wall at the ground surface, and here the concrete is 14 inches thick, and at the top 10 inches thick. (See section 2.) The external faces are vertical, but on the inside there is a batter of 11 inches in a height of 23 feet. There is an overhanging coping on top with a sloping surface to shed the water. The set back and overhanging coping of 12 inches will be the base and finish, respectively, of a cellular tile wall which will be explained further. The counterforts are 14 inches thick, and are located on the line of beams and intermediately, and their bases extend into the reservoir for 11 ft. 6 in., and finish at 9 inches above top-water level, the projection there being 12 inches. The counterforts at the corners are smaller to splays are provided. Spaces were left in top of walls to receive beams, etc.

The reinforcements were calculated on the assump-



admit of circulation of the water. The extreme corners were filled in solid to avoid complicated form work, etc. At the connections of counterforts with the wall 6-inch tion that the walls between the counterforts were acting as simple beams, having depths equal to the thickness of the walls, and an uniform load equivalent to the varying depths of water. The horizontal reinforcements are round bars varying in diameters and spacing to correspond approximately to the area of steel required—at the base there are ¾-inch bars at 3½-inch centres, and at the top ⅜-inch bars at 4-inch centres. (Drawing 2.) These bars were cranked at the necessary distances and the ends bent. As it was too troublesome a work to frequently change the cranking, owing to the reduced thickness of the wall, the changes were made at six points. The counterforts were calculated as cantilevers hinged at the base of the wall and tied to the floor at the toe, and are horizontally reinforced at the same spacing or multiples thereof as the wall, but the diameters are less. The tension bars connecting the toe to the floor consist of nine 1⅛-inch rounds linked round bars of same diameter, inserted crossways in the floor concrete. These bars extend upward for one-third the height; there the number is reduced to 4, and from two-thirds height to top there are two ¾-inch rounds. The overlaps are two feet, and the ends of bars all bent. The horizontal bars connecting the tension bar to the wall are bent into horizontal hooks to slip over the tension bar and vertical bends to fall over the wall bars. There are ½-inch rounds at 12-inch centres vertically connecting the counterforts with the floor. To provide for temperature stresses, continuous triangle steel mesh reinforcements are inserted within about 3 inches of the outside face.

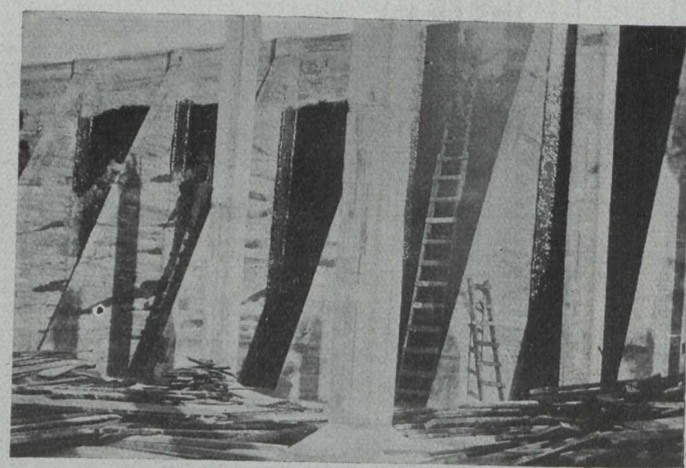


Section Showing Method of Fastening Horizontal Rods.

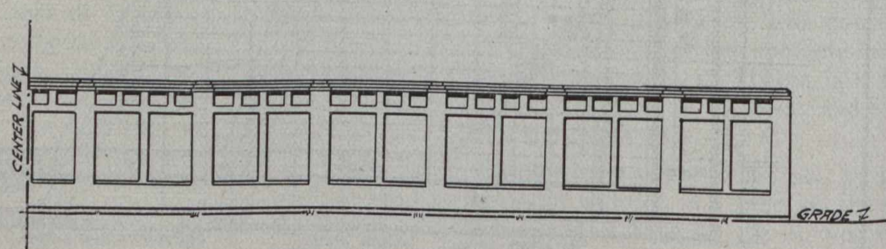
As it was most important that the horizontal wall reinforcements should be placed where designed and held there during the process of concreting, the writer adopted practically the same method as on Tor Hill reservoir. Vertical standards consisting of 2-in. x 2-in. x 3/16-in. angles are located one at each buttress and two between. Two holes were drilled on one web to receive each bar, and a soft wire inserted through the two holes to bend the bar in place at the required distances apart. (Tracing 3.) This method fixed the bars permanently, and although men climbed up and down, no movement took place. The reinforcements and supports gave the impression of a secure steel basket work, as will be observed by the photographs. All overlaps of wall reinforcements took place at junction of the counterforts with the wall.

Columns.—The 84 columns are 18 ft. 9 in. apart in one direction and 19 ft. 0-⅜ in. in the other, and are 16 inches square, resting on pyramidical bases, and the height from the top of the base to the under-side of the beams is 21 ft. 9 in., or slightly over 16 times the least dimension. It is somewhat difficult to assure true alignment and perpendicularity for a vertically cast column of this height, and to prevent any bending, the reinforcement consisted of 2-in. x 2-in. x 3/16-in. steel angles tied together by 1-in. x ⅛-in. flat iron riveted at 24-inch centres, which proved to be very satisfactory.

Roof.—It was intended to construct the roof entirely of reinforced concrete to carry a live load of 200 lbs. per sq. ft., and careful designs were prepared for this purpose, but owing to a suspension of the work caused by financial disturbances due to the European political situation, much time was lost and it was necessary to adopt a quicker method of construction. Consequently, steel joists were substituted for the reinforced concrete beams. The primary beams run across the reservoir, and the secondary beams lengthwise. The primary beams are 18 ft. 9 in. long and rest on the columns, and the secondary are 19 ft. 0-⅜ in. less thickness of primary web and are secured together by standard angle connections. The secondary beams are 6 ft. 4 in. apart. The roof concrete floor is 5 inches thick, rests on the steel beams and reinforced with No. 31A continuous triangle steel mesh 54 inches wide, with overlaps of 4 inches. The work of concrete has had to be suspended owing to the frost, and will be completed in the spring. Manhole covers at each end and four ventilators were inserted in the roof. The roof has a fall of 12 inches from the middle to the ends and rainwater outlets are provided to carry off the surface water. The roof beams and concrete are disconnected from the walls by a thick layer of felt, so as to obviate any stress induced by temperature contraction or expansion being applied to the walls.



Counterfort Construction After Removal of Formwork.



Half Side Elevation.

Waterproofing.—No waterproofing compound was used with the concrete, but when the walls were dry a thick layer of hot liquid bitumen was painted on, and this afterwards coated with neat cement cream. This process was found to be effectual in the Tor Hill reservoir and was again applied in this case. The roof will be coated in a similar manner.

Concrete Mixtures.—The cement was supplied by the Canada Cement Co. and the gravel was obtained from the city gravel pits, supplemented by some screened gravel from the neighborhood. The pit gravel was tested before the work was started and found to be fairly uniform. No screening was done. There are railway spur tracks at each end of the reservoir, which were found to be very convenient, for the gravel was shovelled into the hopper, cement added, and the whole mixed by Ransome mixers. Five bags of cement per cubic yard of gravel were used in the floor, 6 bags in the walls, 8½ bags in the columns, 8 bags in the roof, and 6.3 bags per cubic yard in the floor finish.

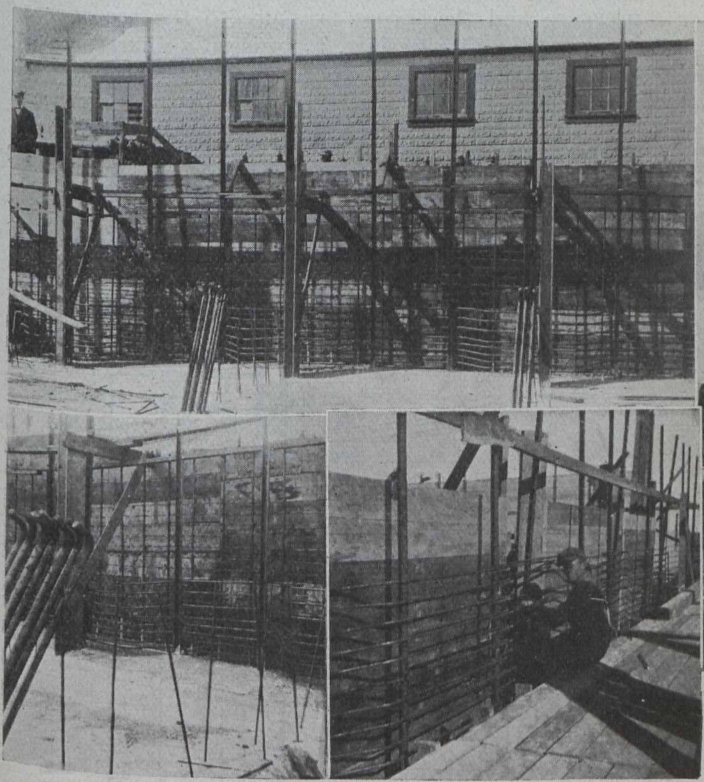
Drawings.—The drawings were so prepared that the nature of the reinforcements in every part of the work could be seen; that is, the position of the cranks, bends, overlaps, etc., were shown, and the number of bars, diameters, lengths, and weights were given. When the work was being carried out, the cranked bars fell into their allotted places and then were fastened by wire. The work proceeded methodically from start to finish, and doubtless this contributed considerably to the economies effected, for there was very little loss of labor and materials, the work having been prearranged.

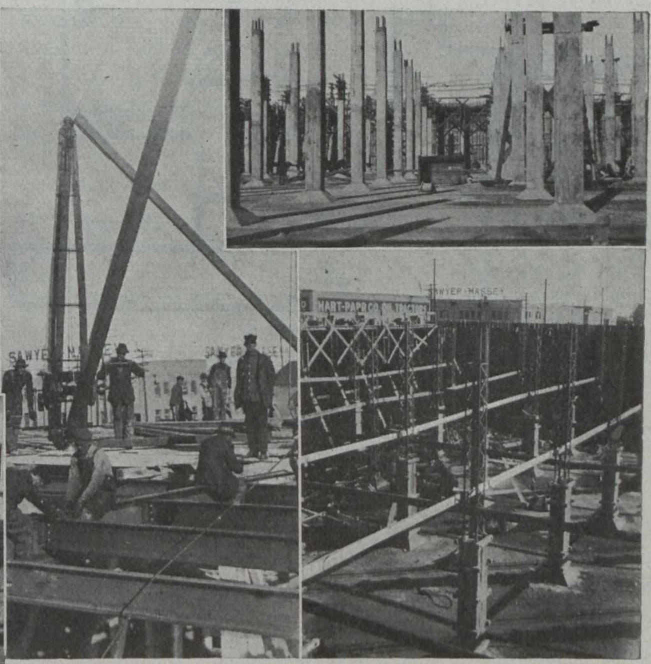
Placing Concrete.—As the concrete was mixed it was conveyed in ordinary two-wheel tipping concrete carts over runways erected from time to time in the most convenient positions. Men were employed in slicing the concrete in place, and care was taken to assure that the steel was properly covered.

Drains.—An 8-inch sewer pipe was laid outside the base of the walls to remove any water that may collect there, and also to conduct the rainwater to the sewer.

Tile Facing.—As the land occupied by the reservoir was limited and expensive, it was essential that the fullest possible use should be made of it. Consequently, embankments had to be eliminated and the walls supported internally, hence the reason for using counterforts. Owing to the absence of external protection such as would be obtained by embankments, steps were taken to insulate the wall against temperature in another manner. After due consideration, the method that was deemed expedient was the construction of an external cellular tile facing Ties have been left on the outside of the concrete walls to bind the tile facing to it. The facing has been designed to produce a pleasing effect, by providing pilasters and recessed panels. The winter arrived before this work could be undertaken, and consequently it was held over until the coming spring weather.

Iron Work.—*Inlets.* There are two inlets, one at each end, one 18-inch and one 10-inch; this is because of local conditions. Each inlet is provided with a sluice valve on the outside of the reservoir, and a Glenfield & Kennedy equilibrium ball valve which will control the height of water at any predetermined level. As previously mentioned, the 18-inch inlet will discharge the surplus night flow, and to assure the city a pressure, a Glenfield & Kennedy loaded equilibrium valve with by-pass has been inserted on this main, and so adjusted that no water will discharge into the reservoir until the main pressure has exceeded a fixed point. In other words, the equilibrium valve will act as a relief, and when the water level has reached a definite position, then the ball valve will shut off the supply.





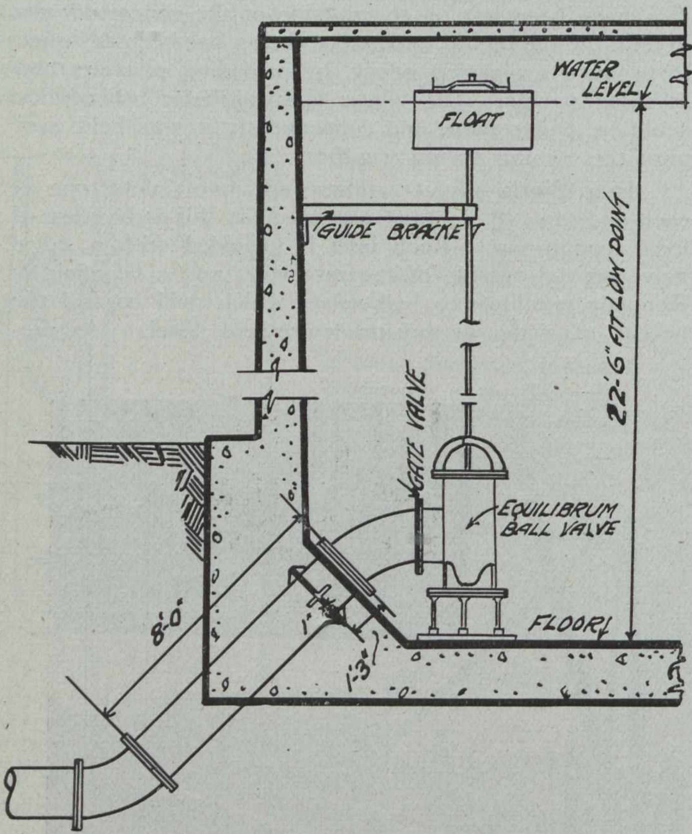
Interesting Views of Regina Reservoir Construction, Showing Type of Wall and Column Reinforcement and Method of Placing Steel in Roof.

Outlet. There is one 30-inch bell-mouthed outlet at the upper end of the reservoir, and this is connected to the pumping plant in the power house close by. All valves on this line are 24-inch, with taper pipes at each end.

Overflow and Scour. These are located at the lower end of the reservoir. The overflow pipe has a bell-mouth top, and is 22 ft. 6 in. above the floor at that point. It is secured to the wall by 4-in. x ½-in. steel stays. The scour pipe, also 14-inch diameter, is situated in a sump 3 ft. deep. The overflow and scour run into one pipe outside the reservoir where the valves are located.

All external valves are provided with chambers. Ladders are constructed of 4-in. x ½-in. steel stringers and ¾-in. rungs 15 inches apart, and 18 inches long.

Puddle Rings. All cast iron pipes, bends, etc., inserted in the concrete work were provided with 6-in. x 1-



Elevation of 18-inch Inlet.

in. puddle rings cast on with brackets, with the view to preventing water seeping along the pipework.

Power House Connections.—Inasmuch as it was important to provide adequately for fire extinction, the writer advised that the connections between this city reservoir and the pump should be made as large as possible, to suffice for some years, and in the interval the additional 27-inch main from Tor Hill reservoir, already referred to, would doubtless be constructed.

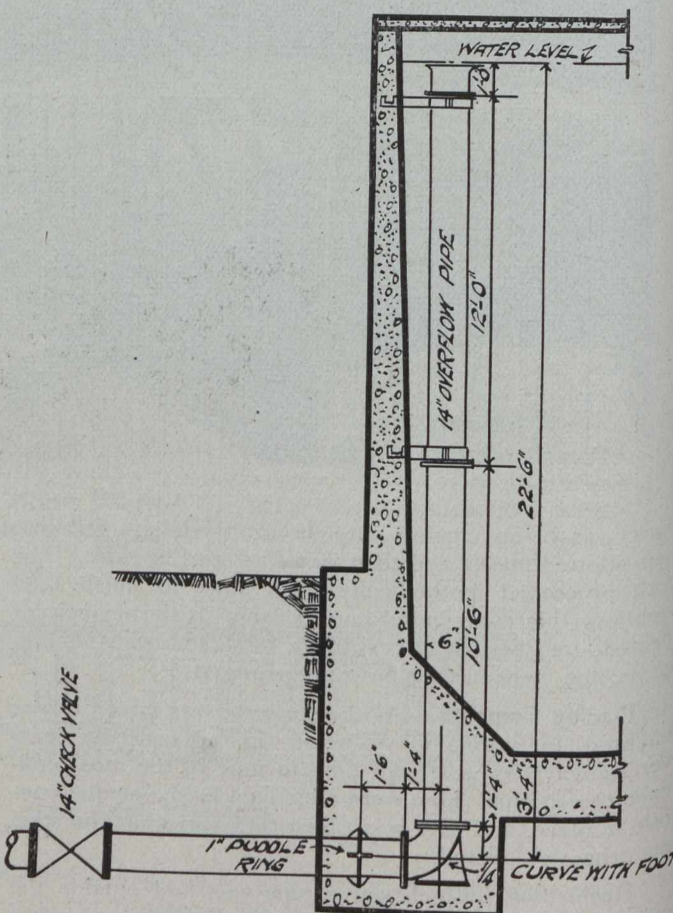
The basis of this calculation in connection with computing the quantity of water required for fire extinction purposes, was the formula suggested by the American National Board of Fire Underwriters, which is:— $Y = 850 \sqrt{x} (1 - 0.01 \sqrt{x})$ in which Y represents Imperial gallons per minute, and x represents the population in thousands.

The pipe arrangement at the power house consists of one 36-inch supply main fed by the 18-inch main from Tor Hill reservoir, and 30-inch pipe from the city reservoir, and one 36-inch delivery main; these are parallel and only a few feet apart. When the gravity supply and pressure from the 18-inch main is ample, (supplemented by the 10-inch supply which hitherto had to be pumped), then the water passes direct into the 36-inch delivery main; otherwise all water is conducted to the supply main and pumped at city pressure into the 36-inch delivery main. There is an outlet from the 36-inch delivery leading into a warmed underground chamber under the footway, and there it is divided into three distributing mains, 24-inch to southeast district, 24-inch to southwest district, and an 18-inch to the north district. Each of these distributing mains is so arranged that the connections in the chamber will allow one, two or three of the branches to be used simultaneously. On each branch there is a Glenfield & Kennedy pressure-regulating valve, which can be adjusted to any pressure, and each main has a Simplex Venturi meter. The pressure-regulating valves are normally out of commission, but when a fire occurs in any district, two of the pressure regulators are put into action by simply opening small taps near the pump, and thus the fire pressure produced by the pumps is thereby concentrated on the district from which the alarm is received. These regulators have lever arms carrying the weights which fix the outlet pressure, and the piston connected to the free end of the lever is operated by the outlet pressure, causing it to rise or fall, and in doing so an indicator in the power house is moved correspondingly, and thus the operating engineer can see at a glance what is taking place.

Each Venturi meter is connected to the power house by two wrought iron pipes, which conduct the main pressure and the throat pressure to the recorder which indicates the rate of flow, records on a chart the varying flows and also shows by a counter the total quantity discharged.

The credit for the neat and simple contrivance installed in connection with the regulator valves and Simplex Venturi meters is due to Mr. T. H. Smallwood.

Forms.—The wall forms consisted of 1-in. x 8-in. sheeting supported by 2-in. x 4-in. uprights at 24-inch centres, tied and strutted to forms on the opposite face



Elevation of 14-inch Overflow Pipe.

by soft wire. The counterforts were formed in a similar manner, except that the sloping face had 2-in. x 8-in. and splays 2 in. x 10 in.

The runways were built of 6-in. x 6-in. verticals, 4-in. x 6-in. horizontals, and 2-in. x 12-in. surface boards.

Cost.—As already stated, the estimated cost of the reservoir and connection was $125,000; the reservoir alone was estimated to cost $110,000, and the connection the balance. The total actual cost of the reservoir was $78,514.86, and the pipe connections $14,951.72, making a total of $93,466.58, or $94,657 inclusive of sundry expenses, so that a saving of at least $30,343, which is equal to 23.2 per cent. on the estimate, was effected by carrying out the work under the direct control of the Waterworks Department.

Itemized Cost.—It may be interesting to give a few of the itemized costs.

Labor—

Excavation	$ .46	cu. yd.
Concrete mixing, for floor	.47½	cu. yd.
Concrete placing, for floor	.21½	cu. yd.
Concrete mixing, for walls	.54	cu. yd.
Concrete placing, for walls	.50	cu. yd.
Concrete mixing, floor finish	.51½	cu. yd.
Concrete laying, floor finish	2.03	cu. yd.
Concrete mixing, columns	.46	cu. yd.
Concrete placing, columns	1.22½	cu. yd.
Concrete mixing, roof	.49½	cu. yd.
Concrete placing, roof	.44½	cu. yd.
Steel reinforcement in floor	.16	per 100 lbs.
Steel reinforcement in walls	.59½	per 100 lbs.
Steel angle standards	.77	per 100 lbs.
Steel bending for walls	.44½	per 100 lbs.
Steel mesh in roof	.20¾	per 100 lbs.
Formwork, wall	.5	per sq. ft.
Stripping formwork from walls	.¾	per sq. ft.
Formwork for columns	.5¼	per sq. ft.
Stripping formwork from cols.	.1½	per sq. ft.
Formwork for roof	.3	per sq. ft.
Waterproofing walls	.½	per sq. ft.
Cement washing walls	.70	per 100 sq. ft.
Structural steel in roof	2.94	per ton.
Placing column reinforcement	.70½	per 100 sq. ft.

The walls cost for labor in placing concrete—

$ .30½ per cu. yd. for the first 9 ft. in height.
.47 per cu. yd. for the second 9 ft. in height.
1.05 per cu. yd. for the third 9 ft. in height.

The City Works Commissioner (Mr. L. A. Thornton) took an active interest in the work, which was managed by Mr. J. M. MacKay, the Waterworks Superintendent.

Mr. H. Gibson had charge of the execution of the work, and Mr. I. Ormond Riddell was the resident engineer, and Mr. Theo. Brockmann checked the design.

WATER WASTE AT ST. JOHN'S, NFLD.

A recent investigation of water consumption at St. John's, Newfoundland, showed that about 300 gallons per capita per day were being consumed by the population connected with the distribution district. A study of the conditions showed also that 75 to 80 per cent. of this waste was in the house services and the balance in the water mains. A recommendation was made that meters be installed as rapidly as possible. A plan was outlined involving an expenditure of about $10,000 a year for five years, on the metering of the system.

Plans are being prepared in Calgary, Alta., for the making of Bowness Park into a summer resort, and as soon as the plans are ready the whole scheme will be submitted to the city council for consideration.

THE EDUCATION OF THE PUBLIC.

By C. D. Norton.

IN the technical press a continual complaint is being made to the effect that the public do not appreciate the work of the engineer, and, in municipal matters especially, greater attention is paid to the demagogue, and the professional politician. Is this not to a great extent the fault of the engineer himself? Is he not too silent in regard to the work that he does, or to that which he should be doing?

Due consideration will reveal that the engineer has not been giving the public an opportunity of correctly gauging his worth, that he has been too busy in the details of his daily work to correctly analyze the thoughts of his fellow citizens. When a man boasts of his home town, of which does he talk the most, the ornamental street lights, or the sewers? The former, to be sure, for it is the more tangible to him of the two. While ill-lighted streets are mainly an inconvenience, poor sewers are a menace, but this is a little beyond him.

The gist of the matter is that, as a whole, the public are ignorant of the work that the engineer does for them; and until they know and appreciate this work, the engineer will not get the full credit that he deserves. Take a parallel case as an example: Ask any doctor what patients give him the most trouble. In all probability he will answer, "The ignorant ones; not necessarily the poor, though they are in the majority." During the past few hundred years the average man has been educated to place more faith in the physician's word than in charms. He has learned by experience that what his medical advisor does is based on knowledge and reason, and, in its literal sense, is truly scientific. Yet the same man who will pooh-pooh the idea of carrying a potato in his pocket for the prevention of rheumatism, will try to defy all natural laws when building a wall, a road, or a bridge.

Take the council in the average small town, practically all the members in their younger days worked out their annual statute labor, and by virtue of the experience thus gained consider themselves competent to design, and superintend up-to-date construction work, of which concrete is a good example, for because unskilled labor is used in mixing, and placing, it is built by anyone, in any old way at all, and every once in a while a building falls down and kills someone.

It must have been a good many centuries ago when it was discovered that some men could make clothes better than others; and as the science of engineering as we know it, has only been in existence for about 100 years, it is hardly to be expected that the average citizen has as yet found out that there are men specially fitted by training and experience for this work. Many a local politician who would hesitate to cut his own hair, or to make his own clothes, will advocate civic improvements which as parallel cases in private business he would not dare to touch.

The public need to be educated as to the worth and ability of the engineering profession, and the only person who can do this is the engineer himself. It is not meant that the man on the street is to receive instruction in civil engineering, but he must be shown that the engineer does not work haphazardly, and that in all his work he follows certain natural laws and principles which, although their general working may be easily explained, yet their application is a matter for years of study and experience. And he must be shown the pitfalls into which he may fall if he tries to work without competent advice.

In any scheme of education, the best results are secured when

(*a*) The pupil has absolute faith and confidence in his teacher;

(*b*) The teacher can present facts to his pupil in a condition that he can most readily understand.

To attain the first essential, the engineer must possess the character of undoubted integrity and honesty, and the utmost capability; his opinion must be known to be impartial, and he must not dabble in politics.

The first step in fulfilling the second essential is the realization that the man on the street is possessed of only a common school education, and though there are large numbers of business men who are college graduates, in the election of municipal officials they are in the minority.

In older countries many schemes have been tried out for the purpose of uplifting the working class, most of which have been unsuccessful because they did not take the working man into account. If an educational campaign is to be undertaken in this country, as it most certainly should be, then, to obtain any results at all, the temperament of the general public must be considered, and methods of teaching adopted with which they will be in sympathy.

The most effective means of reaching the public is through the newspapers. At the present time, one of the best-known periodicals in the States, publishes articles on good business methods. These articles are well written, up-to-date, and are interspersed throughout with anecdotes illustrating and emphasizing the points that the writer wishes to impress upon his readers. Many public utility corporations also use this means of reaching both their patrons and the general public—in fact it is an axiom with them, that the public must be kept informed as to how they run their business.

This outline of education through the agency of the press is a matter that might well be taken up by the engineering societies. About a year ago a series of articles appeared in a weekly published in Northern Ontario with such headings as "Building By-laws," "Fire Prevention," "Bridges," etc. These were written very much on the lines of those described above, and were fair examples of what might be published all over the country.

There is one way in which every individual engineer can help, and that is in his daily conversation with his fellow citizens, or better still, by an informal lecture at the local business association, or board of trade. The public-minded business man is not much interested in specific gravity or penetration, but will pay full attention when he hears that the city is floating 20-year bonds to build a pavement, the surface of which will wear out in ten or twelve years. Very few men would care to go into the details of a proposed sewage disposal plant, but the fact that if all the down-town roofs were connected with the sanitary sewer every heavy rain storm would put the plant out of commission would undoubtedly be of interest to them.

In municipal matters especially, the great bug-bear to be overcome is "Parochialism." Each community surrounds itself with a wall of prejudice, and refuses to see what is being done in other parts of the world, by others in exactly the same circumstances as themselves. And it will depend upon the engineering profession to demonstrate to each community that by virtue of the knowledge that the engineer has collected from innumerable sources, and by the training that he has received, he is the one person who can help them out of their troubles, and tell them how to lay out their money to the best advantage.

THE COMING ROAD CONVENTION IN TORONTO.

As announced in our issue of January 21st, the second Canadian and International Good Roads Convention and Exhibition will be held in Toronto, March 22 to 28. Arrangements are being made for space in Convocation Hall, University of Toronto, for the meetings and on the adjoining campus for the exhibits.

Apart from the stimulus given this convention, due largely to the success which attended the first convention of this nature in Canada, held in Montreal last spring, a feature of special interest is that this year's convention has been arranged under the joint auspices of the Dominion Good Roads Association and Ontario Good Roads Association. In addition, the support of other leading good roads organizations throughout Canada and United States have been enlisted. The co-operation of the Ontario Good Roads Association will be of material assistance towards a successful meeting, as this organization has done good work during the past several years to stimulate better roads in Ontario.

Several of the provincial governments are taking an active interest in the matter and will be represented at the convention.

The committee proposes to depart to some extent from the usual style of lecture, which has been delivered at most of the road conventions held in the United States and Canada in the past. Taking it for granted that the public are unanimous for road improvement, the committee will undertake an educational campaign with the idea of placing before the meeting in a clear and concise manner all available cost data and facts on the practical side of road improvement, in the matter of financing, traffic considerations, location, standard types of foundations and their cost, wearing surfaces and their cost, maintenance, machinery, bridges, culverts, etc. The compiling of the cost data will be obtained, as far as possible, from districts in which the various types of roads have been constructed, and will be included in the papers to be delivered by prominent speakers from Canada and the United States. Thus "opinions" will largely disappear, and the delegate will be given facts to carry away with him.

Invitations are being forwarded to all parts of the Dominion and with the co-operation of government representatives, engineers, county and township councils, boards of trade, agricultural societies, engineering societies, automobile clubs, manufacturers' associations, an important and representative gathering of delegates interested in the good roads movement is assured from all parts of the Dominion.

The officers and committee in charge of the convention are as follows: President, W. A. McLean, commissioner and chief engineer of highways for the province of Ontario; vice-president, J. A. Sanderson, president, Ontario Good Roads Association; secretary-treasurer, Geo. A. McNamee, secretary-treasurer, Dominion Good Roads Association. Committee: B. Michaud, deputy minister of roads, province of Quebec; S. L. Squire, 1st vice-president, Ontario Good Roads Association; Geo. S. Henry, M.P.P., secretary-treasurer, Ontario Good Roads Association; O. Hezzelwood, president, Canadian Automobile Federation.

The secretary's office is 909 New Birks Building, Montreal.

NEW STEAM PLANT OF THE DOMINION POWER AND TRANSMISSION CO., LTD., HAMILTON.

THE East End power station now being built by the Dominion Power and Transmission Company, Limited, of Hamilton, Canada, is situated on the Lake Ontario water-front at the extreme north-east end of the city of Hamilton. The company's present principal source of power is the hydro-electric generating

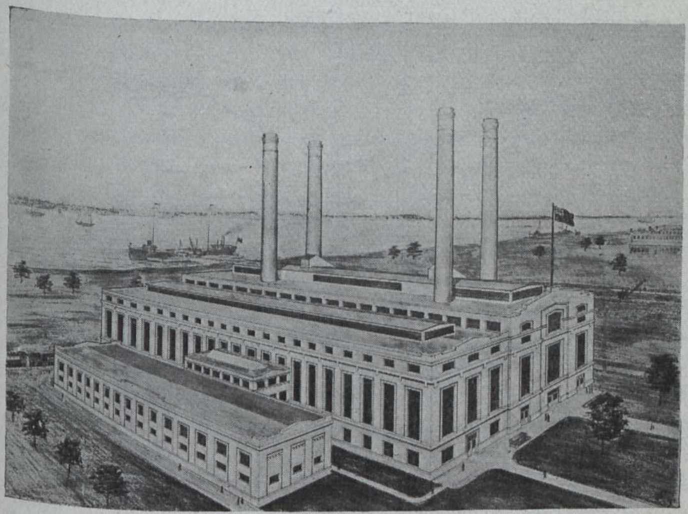


Fig. 1.—View of Plant as it will Appear when Completed.

plant at Power Glen, near St. Catharines, and about 35 miles distant from Hamilton. At this development there is a head of 265 feet, the water used coming from Lake Erie, via the Welland Canal.

Power is supplied to subsidiary companies in Welland, St. Catharines, Thorold, Port Colborne, Grimsby, Dundas, Brantford, Oakville and Hamilton districts, but by far the largest portion goes to the city of Hamilton. Three separate transmission lines, at 45,000 volts, connect the Power Glen plant with the main switching station at Bartonville. No high voltage transmission line is absolutely free from troubles, and in spite of having three separate lines, following different routes, the service is occasionally interrupted. The new steam plant is only one mile distant from the switching station, and because of this short distance, the service between the steam plant and the switching station should be practically free from interruption.

The steam plant will be free from the ice troubles to which all hydro-electric plants are subject in cold weather.

Fig. 3 is a map of the district served by the Dominion Power and Transmission Company, and shows the central location of the steam plant, as well as its proximity to the greatest demand for power.

The plant has been designed for a capacity of 75,000 kv.a., and when completed will appear as shown on Fig. 1. The foundations are of concrete supported on piles, walls are of skeleton steel frame construction, filled in with pressed brick, and having terra cotta decoration, and concrete roofs will be used throughout. Only one-half of the building is at present under construction, the progress to date being shown on Fig. 2.

The plant has been laid out so as to be operated, under normal conditions, on a strictly unit system, and the general arrangement is shown by the cross-section on Fig. 4. Each turbine generator is supplied with steam from its own boilers, with the piping arranged so that one set of spare boilers is sufficient for the whole plant.

The boilers are Edge Moor type, fitted with Taylor stokers, and have radial brick chimneys 240 feet high, a combination which will allow of the boilers being forced, if necessary, to 300 per cent. of normal rating.

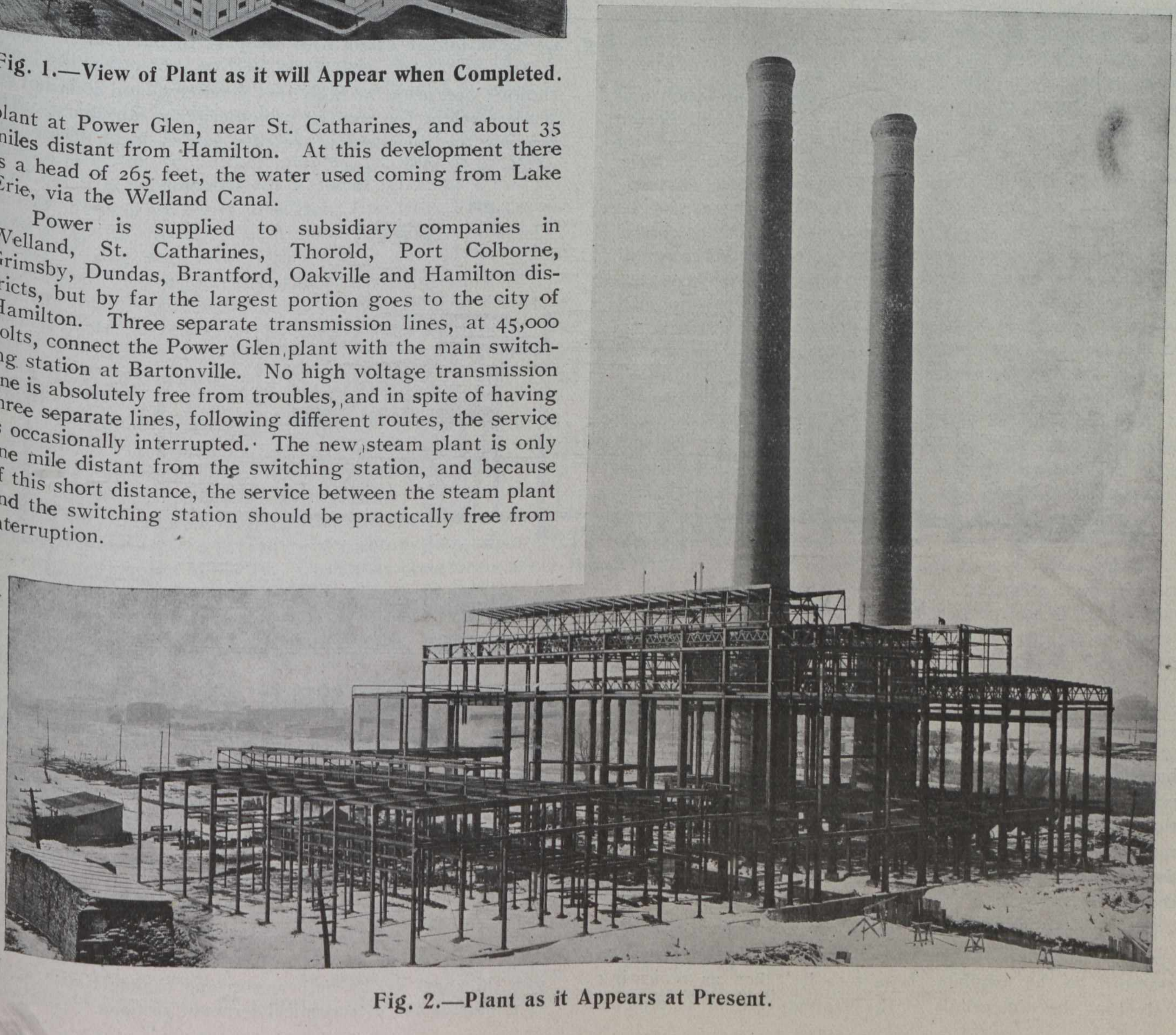


Fig. 2.—Plant as it Appears at Present.

Weather conditions during the winter months make it necessary to house in the coal unloading and handling equipment, and an entirely separate building is being provided for this purpose, into which the cars are run and dumped, or unloaded, into a large receiving hopper. From this hopper the coal is fed to the crusher, and then elevated to storage bins above the boilers, from which it goes to a travelling weigh hopper, is weighed and delivered to the stokers as required.

The turbine generator units are each of 12,500 kv.a. capacity, operating 6,600 volts, 3 phase, 66⅔ cycles, 2,000 revolutions per minute, and are of the Westinghouse Parsons-Curtis type, equipped with surface condensers and Le Blanc air pumps. The circulating water for the condensers is supplied by pumps placed below the level of the water in the intake, which will always be self-priming and in condition to start up immediately in case of emergency.

The control room for the plant is situated in the centre of one side of the engine room, with windows extending into the latter, to enable the operator to have a clear view of the whole floor. A signal system is being installed with electrically operated Klaxons in both engine and boiler rooms, and with illuminated signs in control room, engine room and boiler room, each unit having its own pedestal. The arrangement will permit of the switchboard operator calling the attention of the machine operator or vice versâ.

The current, being generated at 6,600 volts, has to be stepped up to 40,000 volts for transmission, the transformers and switching apparatus being placed in a building separated from the main plant.

It is to be noted that the plant is designed for continuous operation at high fuel economy, and it is not intended solely for use as an emergency auxiliary. The reasons for this design are of a purely local nature and of no general interest.

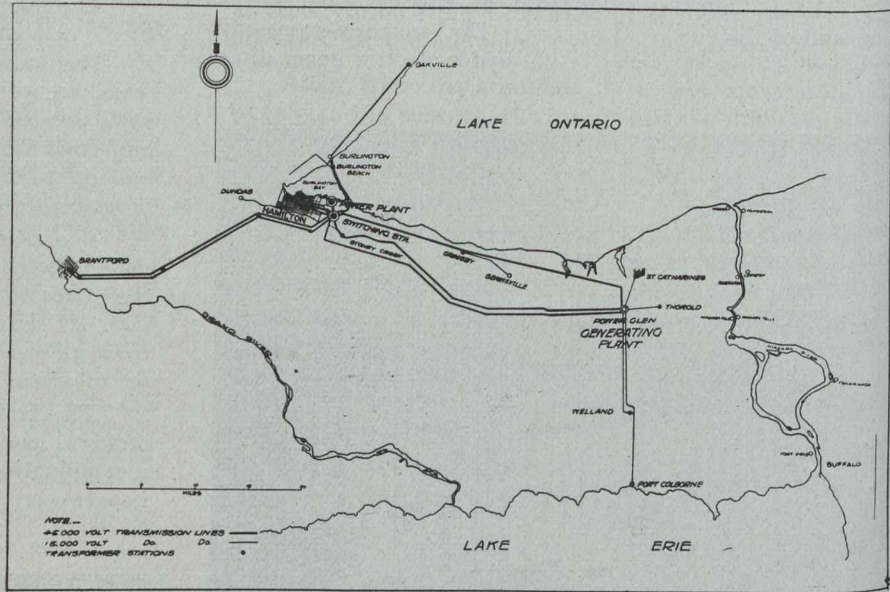


Fig. 3.—Location of Plant with Respect to Service.

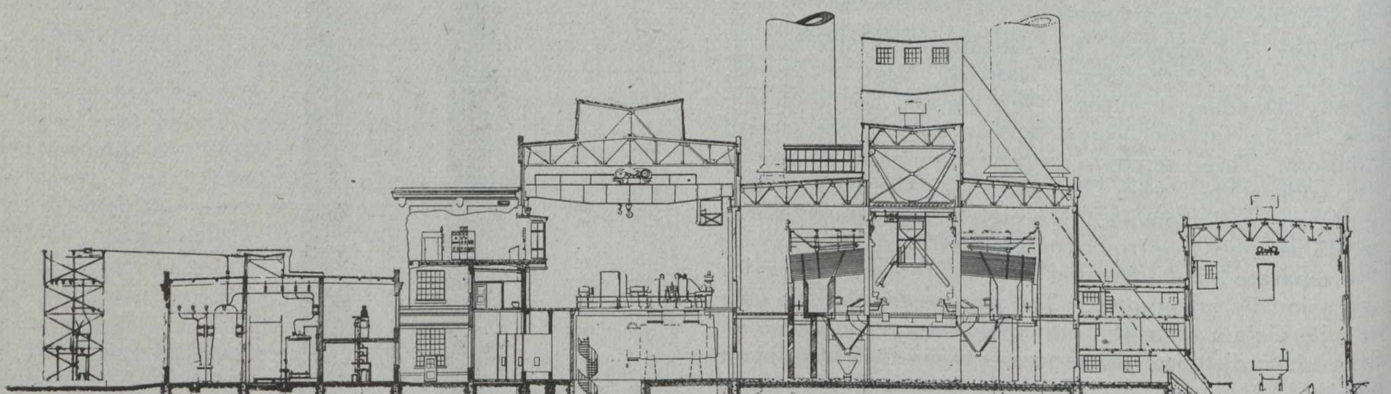


Fig. 4.—Sectional View Showing Arrangement of Equipment.

REVISED STANDARD SPECIFICATIONS FOR STEEL.

The British standard specifications for steel fishplates for bull-head and flat-bottom railway rails contains several important revisions. Among the points dealt with are an alteration in the cold bend test for angle fishplates, which are now required to be bent through an angle of 45 degrees instead of flat on themselves as heretofore, and a slight modification in the tensile strength.

In consequence of a ruling in connection with the standard specifications for railway rails the brand rolled or stamped on the fishplates is now to be taken as indicating only that the dimensions of the fishplate are in accordance with the British standard, and Clause 16 has been modified to give effect to this view.

The British standard rolled sections have also been revised. Four unequal angles, three bulb angles, and two Z-bars have been added to the lists, all of which are in demand primarily for shipbuilding purposes. It has not been found practicable to delete more than one standard section from the lists, as those sizes which are not now required for shipbuilding are considered essential for bridge and underframe work. Certain reductions have also been made in the minimum web thickness of the bulb angles and channels with a view of producing more economical forms of sections.

Editorial

ELECTROLYTIC THEORY OF CORROSION.

About six years ago an explanation of the corrosion of iron and steel was offered in the electrolytic theory. Since then there have been many revisions of opinions respecting the factors controlling the rapidity or extent of corrosion. Factors previously regarded as unimportant have been found to exert a strange and forceful influence upon the reactions involved. It is not surprising, therefore, that many conflicting results have been obtained and published from the investigators now interested in this work. Upon only those tests which have been carried on under identical conditions of surface finish, temperature, access of oxygen and moisture, general atmospheric conditions, etc., should reliance be placed.

One of the conclusions reached by a consideration of the electrolytic theory of corrosion which has proved misleading is that homogeneity in the material insures protection, while heterogeneity leads to rapid attack. While this is a corollary which may be logically drawn from the electrolytic theory and is doubtless in itself true, there are evidently other factors which superimpose themselves upon those due to differences in structure, producing a final effect contrary to that predicted. So states Mr. W. H. Walker in an address to the Society of Chemical Industry, in which address he refers to the iron of an old chain bridge in Massachusetts which has withstood corrosion in a truly remarkable manner for the last 98 years; and yet it is conspicuous for its heterogeneous structure. Large areas of perfectly pure iron, free from both carbon and slag, are mixed up with areas showing at least two kinds of slag and very high carbon; yet all withstand atmospheric corrosion. On the other hand, Burgess has shown that iron free from all contaminating elements which could segregate or produce a lack of uniformity does not withstand rusting so well as the same iron to which has been added a little manganese or copper or nickel.

This behavior is observed also in the case of the so-called pure irons made in an open hearth furnace, which are relatively free from carbon, manganese, sulphur, and other constituents prone to segregation. While theoretically a very pure iron should withstand rust, there are apparently some factors present which more than offset any advantage inherent in purity. Obviously conditions affecting the surface of the material so soon as rusting has started are important causes which have largely been overlooked and which demand more thorough investigation.

The most important advance in this field made in recent years is a knowledge of the effect of the addition of small amounts of copper to normal open hearth or Bessemer steel. While tests do not show that any steel, however poorly made, will, with the addition of copper, withstand atmospheric corrosion, they prove that it is the copper, and not the absence of manganese and the other "impurities," which is the controlling factor. Several hypotheses have suggested themselves as explaining this marked effect of copper in causing steel to resist atmospheric corrosion, but as yet none is sufficiently tangible to afford a working theory.

Careful tests with galvanized work show that an even coating of zinc is the all-important factor. The common practice of clean wiping galvanized ware is fatal to durability, since the protecting layer is not metallic zinc, but a thin deposit of a zinc-iron alloy. While, therefore, much has been accomplished in the way of making a more resistant base, there is still a necessity for a uniform substantial coating of spelter over the entire surface of the material.

THE CITY ENGINEER AND THE PUBLIC.

Last week Mr. A. J. Latornel, city engineer of Edmonton, gave an interesting address to the members of the Civic Service Association of that city on municipal engineering problems in general, and those in particular which confronted his department in Edmonton. The scope of the engineer's duties was briefly reviewed, and reference made in each department to the problems peculiar to that city in comparison with other cities.

The average city of the Canadian west embraces within its limits a large area and the difficulty in attempting to serve the widely scattered population with the public utilities it desires, has made the problem an immense one for the city engineer. In the accuracy of estimate and forecast lies, in a very large measure, the value and economy of the work done, and the usual practice to design and construct on the basis of the estimated population that a city will have, say, twenty years hence, is, at best, taking a flying chance with the city whose development is so dependent upon conditions beyond its control.

Interesting figures were quoted by Mr. Latornel to show that Edmonton, in spite of its large area, has as many miles of paving and sewers according to population as the older and more closely settled cities such as Hamilton and Winnipeg. The area of Edmonton is 27,000 acres with a population of 70,000 as compared to Hamilton with 6,450 acres and a population of 100,000 and Winnipeg with an area of 16,000 acres and a population of 234,000.

In his address Mr. Latornel discussed briefly the present engineering problems of the city, paying particular attention to the sewage disposal system for which plans have been prepared and are now awaiting action. Such topics as, methods of laying out sewerage systems, the size of the pipes required, their cost, problems of water supply, and of transportation, were referred to.

The above reference to Mr. Latornel's address is not made with any view of drawing attention to Edmonton's problems or its advantageous or disadvantageous ratio of area in population. We are thinking particularly of the article on page 289 of this issue, which states: "The public needs to be educated as to the worth and ability of the engineering profession, and the only person who can do this is the engineer himself." No doubt this has been recognized by the above city engineer; at least, his lengthy tenure of office in Edmonton would lead one to infer that the citizens have formed some conception of the work which the engineer does for them.

We think the above example might well be followed by many city and town engineers who are more or less disposed to refrain from daily conversation with fellow citizens respecting their work, not to mention an informal address now and then to a local organization interested in the welfare of the municipality.

ENGINEERS' LIBRARY

Any book reviewed in these columns may be obtained through the Book Department of The Canadian Engineer.

CONTENTS.

BOOK REVIEWS.

Structural Steel Drafting and Elementary Design. By Chas. D. Conklin, Jr., C.E., A.M.Am.Soc.C.E. Published by John Wiley & Sons, New York; Canadian selling agents, Renouf Publishing Co., Montreal. First edition, 1915. 154 pp., 149 illustrations, 8 x 11 ins., cloth. Price, $2.50 net.

In this book the author has endeavored to give the young draftsman, whether associated with structural steel companies or taking a university course, useful information respecting the practical method of preparing shop detail drawings. He points out in his preface that while some of the best works on design devote a certain amount of space to methods and while some of the large bridge companies have complete books of standards, there is no complete book covering the methods of making detail drawings.

The subject is presented under the following chapter headings: The Drafting Room; Estimating and Designing; Equipment, Lettering, Assembling Marks; Ordering Material, Detailing Elementary Shapes; Rivets and Riveted Connections; Beam and Column Detailing; Wall Girder and Column Design and Detail; Design and Detail of Steel Roof; Design and Detail of Deck Plate Girder R.R. Bridge; Shop Detail of Through Girder Bridge; Design and Detail of Country Highway Bridge; Design of a Through Riveted Railway Span; Detail Drawings for Railway Truss Bridges; Hip and Valley Details; Index.

In the text a number of typical simple designs are worked out completely and shop drawings prepared for them. The designs are those most commonly met in drafting room work, and should form an excellent basis for a careful study of drafting and structural design.

Civil Engineering Types and Devices. By T. W. Barber, M.Inst.C.E. Published by Crosby Lockwood & Son, London, England. First edition, 1915. 245 pp., 1,760 illustrations, 6 x 9 ins., cloth. Price, $2.25.

This book is a classified and illustrated index of plant, machines, materials, forms of construction, means and methods adopted and in use in civil engineering works of various classes. This collection of data has been prepared for the use of civil engineers, builders and contractors. It covers a broad scope, the different sections indexed being as follows: Foundations, wet and dry; Masonry and brickwork; Drainage; Motive-power; Bridges and girders; Iron buildings; Wood framing; Columns, struts, and ties; Anchorages; Constructional steelwork; Floors and partitions; Roof coverings; Roads and Streets; Rolled iron and steel bars and plates; Materials of construction other than iron and steel; Retaining walls; Railways, earthworks, permanent way, signalling and telegraphs, stations, tunnels and culverts; carriages and rolling stock for road and rail; Tramways; Canals, aqueducts; Heating and ventilation; Plate work; Gas supply; Hydraulics; Sea and river structures; Irrigation, and docks, harbors.

Each item is illustrated diagrammatically on the page opposite the reference to it. These references are necessarily very brief,—some of them a single line in length. Iron and steel plates are given the most lengthy description of any, the reference comprising about four pages.

In all, the book is a sort of graphical dictionary and, as such, will be found a very useful index to the methods, devices and machines which the civil engineer uses.

Manual of Railroads, 1915—48th Annual Number. Published by Poor's Railroad Manual Company, 535 Pearl St., New York City. 2,060 pp., illustrated by numerous maps, 62 pp. of index, 6 x 9 ins., leather. Price, $7.50.

This work, devoted exclusively to the steam railroads of the United States and Canada, contains statements of all 1914 reports of the various roads, and general information of every kind, revised to December 31st, 1914. Its publication this year is earlier than ever before, but the standard of former years for accuracy and completeness has been well maintained. This manual is one of three which, taken together, comprise 6,500 pages of information respecting railroads, industrials and public utilities.

Telephone Hand Book. By D. P. Moreton, B.S.E.E., Assoc. Prof. of Electrical Engineering, Armour Institute of Technology. Published by Frederick J. Drake & Co., Chicago. First edition, 1915. 286 pp., 161 illustrations, 4 x 7 ins., cloth. Price, $1.00.

This is a book for the practical man, describing, in a manner conducive to ready comprehension, the various phases of the telephone industry and the numerous applications of the instrument. It treats of the principles upon which telephonology is based; it describes the various telephone systems, the construction of lines and the locating and remedy of telephone troubles. The book is divided into ten chapters. They are well illustrated, although few of the illustrations have not previously appeared in the technical press.

The subject matter is descriptive throughout, and there is undoubtedly a great deal of information which the telephone engineer and lineman will be glad to have in such a suitable form.

American Sewerage Practice. By Leonard Metcalf and Harrison P. Eddy. Vol. 2, Construction of Sewers. Published by McGraw-Hill Book Co., New York. First edition, 1915. 564 pp., 181 illustrations, 78 tables, 6 x 9 ins., cloth. Price, $4.00.

This book, devoted to the construction of sewers, is Volume 2 of Messrs. Metcalf and Eddy's work on American Sewerage Practice. Volume 1 on The Design of Sewers was reviewed in *The Canadian Engineer* for January 28th, 1915, page 201. Volume 3, devoted to the disposal of sewage, is in preparation.

The authors, who have had a wide experience, as designing and supervising engineers, on sewerage work, executed both by contract and by day labor, have here presented a work which should go a long way toward a needed improvement in sewer work in general, an improvement in both day labor and contract methods, and in inspection as well as in labor. From their work it is evident that the importance of accuracy in alignment and grade, smoothness of interior surfaces of sewers, and numerous other features, are clearly understood by the writers. At any rate, the book under consideration shows, in order to avoid such defects, what things the field engineering and inspection force must insist upon.

A fair conception of the scope of the work may be obtained from the following summary of chapter headings: Preliminary Investigations; Engineering Work and Inspection During Construction; Excavation; Machinery for Trench Excavation; Methods of Rock Excavation; Explosives and Blasting; Quantity and Cost of Excavation; Rate of Progress in Building Sewers; The Sheeting and Bracing of Trenches and Tunnels; Sizes of Sheeting, Rangers and Braces; Purchasing, Handling and Laying Sewer Pipe; Jointing Sewer Pipe; Construction of Brick and Block Sewers; Construction of Concrete Sewers; Profiles, Templates, Forms and Centres; Contracts, Specifications and Drawings; Technical Specifications; Operation and Maintenance of Sewerage Systems, and Explosions in Sewers.

Structural Engineering. By J. E. Kirkham, professor of structural engineering, Iowa State College. Published by the Myron C. Clark Publishing Co., Chicago, and E. & F. N. Spon, London, Eng. First edition, 1914. 669 pp., 452 illustrations, numerous tables, 6 x 9 ins., cloth. Price, $5.00.

The author, who was formerly designing engineer for the American Bridge Co., has presented a text-book that will be found of great value by engineering students, and at the same time an excellent self-explanatory manual for practical structural men. In his introductory remarks he relates to 19 years of experience in which he was frequently called upon to "break in" many students from various schools, and his knowledge of the importance of elementary mechanics has induced him to incorporate a considerable amount in his book. It is evident that the subject-matter has been arranged specially for college use. The designs which the book includes were worked by the author entirely for this purpose.

The following list of Chapter headings is indicative of the scope of the work: Definitions—Structural Drafting; Fundamental Elements of Structural Mechanics; Theoretical Treatment of Beams; of Columns; Rivets, Pins, Rollers and Shafting; Maximum Reactions, Shears and Bending Moments on Beams and Trusses, and Stresses in Trusses; Graphic Statics; Influence Lines; Design of I-beams and Plate Girders; Design of Simple Railroad Bridges, of Simple Highway Bridges; of Skew Bridges, Bridges on Curve, Economic Height and Length of Trusses and Stresses in Portals; and Design of Buildings.

The book treats only of simple structures. In the preface the author states that it is the first volume of his work on Structural Engineering. A second volume, to be known as Higher Structures and treating of movable bridges, cantilever arch and suspension bridges, secondary stresses, etc., is in preparation.

Pocket Diary and Year Book, 1915. Published by Emmott & Co., Manchester, and Norman Remington & Co., Baltimore, Md. 28th edition. 439 pp., illustrated, 4 x 6 ins., cloth. Price, 50c.

This "Mechanical World" pocket book and diary is presented this year with new sections on structural iron and steel work, strength of flat plates, limit gauges, cost of power, Morse tapers, etc., while numerous other sections have been revised considerably, and tables extended. The pocket book is quite up-to-date in its information and will no doubt continue to prove a distinct service.

Electrical Pocket Book, 1915. Published by Emmott & Co., Manchester, and Norman Remington & Co., Baltimore, Md. 303 pp., illustrated, 4 x 6 ins., cloth. Price, 50c.

The 1915 edition of this pocket book, one of the "Mechanical World" series, is the usual collection of electrical engineering notes, rules, tables and data, brought up to date. New sections are given on a number of features of electrical plant and machinery operation. Older sections have been revised and condensed. The improvements to the work would indicate that its increase in price has been well warranted by the added value to the electrical engineer.

Elements of Hydraulics. By S. E. Slocum, Professor of Applied Mathematics in the University of Cincinnati, New York and London. Published by McGraw-Hill Book Co., New York. 294 pp., 210 illustrations, 6 x 9 ins., cloth. Price, $2.50 net.

The author states in the preface that this text "is intended to be a modern presentation of the fundamental principles of hydraulics, with applications to recent important works such as the Catskill aqueduct, the New York State barge canal, and the power plants at Niagara Falls and Keokuk." This statement is apt to be misleading, as the references to these engineering works are only of the most cursory nature, the Niagara Falls power plants being covered in a six-line reference to the plant of the Ontario Power Company, with three illustrations.

A serious objection to the text as it now stands is the incomplete presentation of such subjects as the friction loss in pipes, and water hammer. These are covered in so brief a manner as to leave the impression on the reader's mind that the author was either not familiar with recent engineering practice or did not appreciate the necessity for an adequate treatment. For water hammer in pipes, Church's, Joukovsky's and Gibson's formulae are given, with no comment whatever on the limitations of their use; no mention is made of Allievi's treatment of the subject. This material, in the shape it is presented, is likely to be dangerous in the hands of an inexperienced engineer.

In far too many cases throughout the volume, the methods by which certain formulae are obtained, are not given. On the other hand, there are certain features which will make the book appeal to the student. The whole field of hydraulics has been covered in 292 pages; the book is well and clearly written; the illustrations are good, and carefully chosen. The engineering students in the colleges will probably find it a useful reference.

Principles and Practice of Electrical Engineering. By Alexander Gray, B.Sc., assistant professor of electrical engineering, McGill University, Montreal. Published by the McGraw-Hill Book Co., New York. First edition, 1914. 391 pp., 449 illustrations, 6 x 9 ins., cloth. Price, $3.00 net.

This book, by the author of "Electrical Machine Design," is based upon a lecture and laboratory course given to the senior civil, mechanical and mining students at McGill University. From a review of the contents it would appear that the book is not intended for students other than those who, having a limited amount of time to spend upon the subject, desire only a broad idea of principles and practice. A summary of chapter headings will enable the reader to form an impression of the manner in which the book presents these fundamental principles and elaborates upon them so that the student may be "able thereafter to make intelligent use of the data contained in the electrical hand-books, or take up with advantage a further study of the special treatises on the subject." The work is arranged as follows: Magnetism and magnetic units; electromagnetism; electromagnetic induction; work and power; electric circuits and resistance; rheostats and resisters; magnetic circuits and magnetic properties of iron; solenoids and electromagnets; armature winding for d.c. machinery; construction and excitation of d.c. machinery; theory of commutation; armature reaction; characteristics of d.c. generators; theory of operation of d.c. motors; characteristics of d.c. motors; losses, efficiency and heating; motor applications; adjustable speed operation of d.c. motors; hand-operated face plate starters and controllers; drum type controllers; automatic starters and controllers; electrolysis and batteries; storage batteries; operation of generators; operation of generators and batteries in parallel; car lighting and variable speed governors; alternating voltages and currents; representation of same; inductive circuits; capacity circuits; alternators; their characteristics; synchronous motors and parallel operation; transformer characteristics; their connections; polyphase induction motors; induction motor applications and control; single-phase motors; motor-generator sets and rotary converters; electric traction; transmission and distribution; electric lighting; and, laboratory course.

This laboratory course makes reference to the theory and purpose of each experiment, as outlined in the foregoing text.

The work should be found of interest by instructors and students of electrical engineering. To what extent either would find it of material use in academic work, would depend, of course, upon the degree of conformity between the method outlined by Prof. Gray and the course being followed.

Sewage Purification and Disposal. By G. Bertram Kershaw, M.Inst.C.E., consulting engineer to the Royal Commission on Sewage Disposal. Published by the Cambridge University Press. First edition, 1915. 340 pp., 56 illustrations, 4 tables, 6 x 9 ins., cloth. Price, $3.00.

This book is one of the Cambridge Public Health Series, presented under the able editorship of Messrs. G. S. Graham-Smith, M.D., and J. E. Purvis, M.A. Mention of this fact is important, otherwise the interested reader would fail to find in the book a treatment of several phases of the sewage disposal and purification question that are either omitted entirely or briefly touched upon, in view of the fact that other books of the Series have dealt more comprehensively with the subjects. The parts of the subject dealt with in this work are as follows: Conservancy methods, composition of sewage, etc; sewerage systems, variations in sewage flow, storm water, etc.; removal of suspended matter; sludge disposal; land treatment; contact beds; percolating filters; sterilization; and trade wastes. The book closes with indices of subjects, authors and places cited. Each chapter closes with a bibliography of sources of detailed information upon particular points covered in the concise treatment of the subject.

Some of the chapters cover such a great deal that, if it were not for the fact that the book has been written for physicians and bacteriologists as much as for engineers and laboratory students, one would be inclined to suggest, in several cases, a different treatment of the subject. It should be stated, however, that considering the aim in view, the information which the book imparts is concise and carefully written. The works of other authors are drawn upon to a certain extent with full credit given, and the matter composed in an easily read and absorbing style.

One significant remark of the author should be widely quoted: "In the treatment of sewage so as to yield a satisfactory degree of purification, the cost must always be a predominant factor; any degree of purification can be obtained if the expense is no object."

The author does not touch upon methods of treatment in early stages of experiment, and wisely so, as initial and working costs are as yet unobtainable. The disposal of sewage or sewage liquors by dilution is not discussed, this subject being treated in detail in another volume of the Series.

The Circular-Arch Bow-Girder. By A. H. Gibson, D.Sc., and E. G. Ritchie, B.Sc., University College, Dundee. Published by Constable & Co., Limited, London. First edition, 1914. 80 pp., 46 illustrations, 7½ x 11½ ins., cloth. Price, $2.75.

This study of the state of equilibrium and of stress of the circular-arch bow-girder, such as is often used, for instance, to support the balcony of a theatre, has for its foundation a detailed analytical and experimental investigation of the problem carried out by Prof. Gibson and his assistant, Mr. Ritchie. The chief difficulty in the solution of the problem centres around the values of the various end fixing moments and reactions. The authors show that these values for a given loading depend on the relative values of the flexural and torsional rigidity of the section. An important feature of the work is the data published for the first time on the values of the torsional rigidity for commercial sections used in structural engineering. These were worked out by Mr. Ritchie from a series of experiments on commercial sections. The subject is treated in five chapters. The first presents introductory theorems upon which Chapter II., which deals with the equilibrium of the bow-girder, is based. The torsion of non-circular sections is next considered, followed by a study of the stresses involved by such torsion alone or combined with bending. The closing chapter deals briefly with the general principles of design of a bow-girder exposed to both bending and twisting. As much calculus is involved in dealing with the equilibrium of the bow-girder, an appendix is added giving a list of integrals useful in its investigation. Another appendix gives a table of moments of inertia of various sections.

The drawings are clear and the formulas throughout the chapters are carefully arranged. The presentation is concise and logical and the whole work should meet with approval on the part of structural engineers. The reviewer cannot refrain from calling attention to the admirable way in which the complex formulas have been mechanically presented. While the dimensions of the book are not in conformity with what should be standard practice, the length of line in this particular case, 5½ ins., does away with a great deal of breaking up of lengthy formula in the analytical calculations involved.

Installing Efficiency Methods. By C. E. Knoeppel. Published by Engineering Magazine Co., New York City. First edition, 1915 (Works Management Library). 258 pp., 103 illustrations, 7 x 10 ins., cloth. Price, $3.00.

Throughout the work the author uses as an example, and follows the reorganization of, in sequence, a typical large manufacturing concern. He outlines the attitude of the management toward the efficiency engineer, or the introduction of any radical change from the old system. The possibilities and arguments in favor of scientific management are set forth by a "self-examination," a series of broad general questions and answers. On the engineer being retained, his procedure in a preliminary investigation to determine the existing organization is dealt with, followed by an enumeration of the various conditions liable to be met with in a plant, whereby time is wasted. By analyzing and summarizing these conditions, he shows how the engineer may determine where the greatest factor of inefficiency occurs. The next step, that of the organization for putting efficient management into operation, is thoroughly outlined in detail, with the duties and responsibilities of each branch, and their relation to each other.

In dealing with the investigation of the plant itself, he begins with the difficulties encountered with the workmen, due to their aversion to change of routine, and his methods of securing co-operation. By following the line of least resistance, he determines the logical place to begin making time studies. A chapter is devoted to time study of various operations, and systems of compiling data by graphical and card forms.

In his chapters on the functions of the planning department, the author shows by numerous examples, how the progress of work may be followed by the management from the receipt of the order until its completion. He devotes two chapters to methods of raising the efficiency of the workmen by improving conditions in the plant itself, and the application of time study data to the operations.

The chapter on the bonus system of remuneration is an analysis and discussion of several methods of computing the bonus from efficiency curves. In the closing chapter on the "Efficiency Clearing House," he establishes a chain of responsibility through the various branches of the organization, and shows how the records of each may be prepared in composite form.

The book is a broad treatise, well written and fully illustrated by examples from practice. Each principle stated is thoroughly analyzed with a view to suggesting a line of thought, rather than to prove the statement. It warrants the study of the executive head or management of concerns interested in the betterment of conditions in their plants, as well as the student of scientific management and its application. It is a valuable addition to the literature published on this subject.

Summary of Investment News. Published by Poor's Manual Service, New York. First edition, 1915. 558 pp., 6 x 9 ins., cloth.

This is a reprint of a daily summary from April 1st to December 31st, 1914. These items were taken from a large number of daily and financial papers in the United States and Canada and are presented in alphabetical order for quick reference.

Directory of Cement, Gypsum and Lime Manufacturers. Published by the Cement Era, Chicago. Ninth edition, 1915. 202 pp., illustrated, 3 x 5 ins, leather. Price, $1.00.

This directory lists the operating companies in the cement, gypsum and lime industry; machinery and supply manufacturers of products used in the construction and operation of plants; list of brands, officers of companies, mills, etc., and statistics on the output of the products.

PUBLICATIONS RECEIVED.

Report, 1913-14, Marine Department.—Forty-seventh annual report, Department of Marine and Fisheries. 361 pp.; 6 x 9 ins.

Report, 1914, Transcontinental Railway.—Tenth annual report of the commissioners, containing the report of the chief engineer, mechanical engineer, bridge engineer, and district engineers.

Report, 1913, Geological Survey, Department of Mines.—This summary report of 417 pp. contains the reports from the geological, topographical, biological and other divisions. Illustrated.

Huronian Formations of Temiskaming Region, Canada. By W. H. Collins. Bulletin No. 8, Geological Survey, Department of Mines. 27 pp:; illustrated with maps and plates; 6 x 9 ins.

Progress of Stream Measurements.—Report for 1913, prepared by P. M. Sauder, chief hydrographer, Irrigation Branch, Department of the Interior. 414 pp.; illustrated by maps and diagrams.

Pocket Diary, 1915.—Issued by the Siemen's Company of Canada, Limited, Montreal, containing useful and convenient tables of weights, measures, etc. It is a handy and durably bound, self-opening diary.

Building and Ornamental Stones of Canada: Quebec.—Vol. 3 of a report prepared by W. A. Parks, B.A., Ph.D., for the Mines Branch, Department of Mines. 304 pp.; maps and plates. Deals with limestones, sandstones, granites, etc.

Experimental Levees, with Concrete Paving and Sheet-Pile Cut-Off, Mississippi River.—By C. O. Sherrill. A reprint from the Engineering News, published as Bulletin No. 50, Cement-Gun Company, New York. 4 pp.; illustrated.

Smithsonian Institution.—Annual report for 1913, showing operations, expenditures, etc., for the year. 804 pp.; illustrated; 6 x 9 ins.; cloth. Contains detailed reports by those in charge of the various scientific activities of the Institution.

Railway Belt Hydrographic Survey.—Water Resources Paper No. 1 of the Water Power Branch, Department of the Interior. Report for 1911-12, prepared by P. A. Carson, D.L.S., chief engineer. 551 pp.; numerous maps, diagrams and tables.

Aluminium Facts and Figures.—A book 4 x 6½ ins. in size, loose leaf, with leather binding, containing some very useful tables relating to aluminium round rod, wire, strand, cables, fuse wire, connectors, tappings, strip, sheets, tubes and sections. Price, 90 cents.

San Francisco-Oakland Cantilever Bridge.—By Charles Evan Fowler. Published by the author, 1915. 18 pp.; illustrated by photos and diagrams; 6 x 9 ins.; bound in paper. Price, 50 cents. It contains a complete description of the designs prepared by the author for the above bridge. It also contains editorials from a number of engineering journals commenting upon the designs. Illustrations are included of numerous other bridges designed by the author.

CATALOGUES RECEIVED.

Terry Turbines for Pump Drive.—A 64-page descriptive catalogue, issued by the Terry Steam Turbine Company, Hartford, Conn., illustrating types for various services, capacities, dimensions, etc.

Barrett's Paving Pitch.—A 40-page illustrated booklet, issued in Canada by the Paterson Manufacturing Co., describing this plastic waterproof filler and its application in the construction of brick or block pavements.

Peebles Motor Converters.—A pamphlet devoting twenty pages, with up-to-date illustrations and explanatory diagrams, including characteristic curves, etc. The pamphlet is issued by Bruce Peebles and Co., Limited, Edinburgh, Scotland.

Automatic Sewage Ejectors.—Catalogue 17 of the Pacific Flush-Tank Company, Chicago and New York, describing this type of ejector and its appurtenances. Well illustrated to show various arrangements and complete with tables of capacities, etc.

Ice Tools, Elevators and Conveyers.—1915 catalogue of the Difford-Wood Company, Limited, Hudson, N.Y., describing ice elevators, conveyers, tools, lowering machines and other icing station equipment. Fully illustrated with plates and diagrams. 180 pages.

Water Meter Rates and Regulations.—A 12-page illustrated booklet, published January, 1915, by the Buffalo Meter Company, containing some useful information on how to establish a meter rate, high and low rates of 709 waterworks, model meter regulations, etc.

Concrete Road Appurtenances.—A 16-page leaflet issued by the Trussed Concrete Steel Co. of Canada, Limited, Walkerville, Ont., describing the Kahn steel expansion joint protectors, armor plates and installing devices, pavement reinforcing curb bars, and steel side forms. Illustrated.

Cochrane Multiport Valves.—A 72-page catalogue from the Harrison Safety Boiler Works, Philadelphia, describing this type of valve, introduced for back-pressure relief and vacuum service, flow service in connection with mixed flow turbines, and check-valve service with bleeder or extraction turbines.

Patent Steel Pipes.—A very interesting 42-page illustrated booklet, issued by Stewarts and Lloyds, Limited, Glasgow, describing the material, dimensions, joints, coatings, etc., of steel pipes for gas, water, sewage, etc. It includes standard specifications for steel pipes, notes on corrosion and on costs of laying.

Swing Hammer Pulverizers.—A 40-page bulletin, No. 147, issued by the Jeffrey Manufacturing Co., Columbus, O., giving full information regarding capacities, speeds, horsepower, general dimensions, etc. Also Bulletin No. 143, issued by the same firm, relative to malleable and steel elevator buckets. 19 pp.; illustrated.

Cast-Iron Pipe.—A handsomely-illustrated, printed and bound, 222-page catalogue, published by the United States Cast-iron Pipe and Foundry Co., Burlington, N.J., containing much information of interest to engineers, contractors and municipal and industrial officials relative to cast-iron pipe of various kinds, its protection, types of joints, jointing materials, etc. It contains tables of dimensions and weights for both Bell and Spigot pipe and flanged fittings for different purposes. Specifications of the American Waterworks Association and of the American Gas Institute, for pipes and specials, are also included, in addition to miscellaneous tables most useful to the engineer.

PERSONAL.

J. FRATER TAYLOR, president of the Algoma Steel Corporation, gave a very interesting address before the Sault Ste. Marie Board of Trade upon the prospect and advantages of a deep waterway between that city and Atlantic ports.

GERALD O. CASE, Civil Engineer, Vancouver, was recently elected a member of the Council of the Society of Engineers of Great Britain, and not a member of the Institution of Civil Engineers, as stated in our issue of January 14th.

ARTHUR N. JOHNSON, M. Am. Soc. C.E., Highway Engineer, Bureau of Municipal Research, New York City, on February 5th delivered a lecture on "Methods of Cost-Keeping for Highway Engineers and Contractors" before the graduate students in highway engineering at Columbia University.

E. M. BREED, who for the past eight years has been district manager of the Canadian Allis-Chalmers, Limited, with headquarters at Vancouver, has been appointed district manager of the Pelton Water Wheel Company. He will continue his headquarters at Vancouver. Mr. Breed is a graduate of the University of Maine, College of Technology, and is a member of the American Institute of Electrical Engineers. Previous to becoming manager for the Canadian Allis-Chalmers Company, he was with the sales force of the Canadian Westinghouse Company at Montreal.

OBITUARY.

The engineering press of Great Britain has recently reported the death of Mr. Edgar Allen, founder of the Edgar Allen Library of Sheffield University, and president of the firm of Edgar Allen and Co., founded in 1868 for the manufacture of steel.

The death occurred in Hamilton last week of Mr. James A. Woodland, superintendent of construction for the Hamilton Hydro-Electric Department.

An explosion of dynamite in the process of thawing caused the death of Mr. William Feaver, a resident engineer at North Bay for the Canadian Northern Railway. The accident occurred at a construction camp near Sturgeon Falls.

CANADIAN MINING INSTITUTE.

The provisional programme for the 17th annual meeting of the Institute, to be held in Toronto, March 3rd, 4th and 5th, has been announced. It includes the presentation and discussion of the following papers:—

"The Zinc Industry in America," by J. A. Van Mater, President of the New Jersey Zinc Company, New York, N.Y.,

"The Hall Sulphur Process," by H. F. Wierum, New York City.

"The Stimulation of Prospecting," a symposium, by H. E. T. Haultain, Toronto, Ont.; J. M. Bell, Montreal, Que.; and J. E. Hardman, Montreal, Que.

"Safety Engineering at the Canadian Copper Company's Works and Mines, Copper Cliff, Ont.," by E. T. Corkill, Copper Cliff, Ont.

"Recent Developments in the Gold-Dredging Industry in the Yukon," by O. B. Perry, New York City.

"The Economic Possibilities of the Yukon," by D. D. Cairnes, Ottawa, Ont.

"The Ore Deposits of the Copper Mountain, Similkameen, B.C.," by Frederic Keffer, Greenwood, B.C.

"The Smelting of Titaniferous Ores in the Blast Furnace," by Bradley Stoughton, New York City.

"The Oxygen Torch," by David H. Browne, New York City.

"The Weedon or McDonald Mine, Weedon, Que," by L. D. Adams, Weedon, Que.

"Certain Canadian Minerals for which a Demand has been Created as a Result of the War," by R. A. A. Johnston, Ottawa, Ont.

"Some Notes on Modern Hoisting Machinery," by J. B. Porter, Montreal, Que.

"Some Recent Developments in Metallurgy," by A. Stansfield, Montreal, Que.

"Gold on the North Saskatchewan River," by J. B. Tyrrell, Toronto, Ont.

"The Beaver Lake Gold District," by E. L. Bruce, Ottawa, Ont.

"The Conservation of our Mineral Resources," by F. D. Adams, Montreal, Que.

"The Alberta Oil Fields," by D. B. Dowling, Ottawa, Ont.

"The Ore Deposits of the Ainsworth Mining Camp," by S. J. Schofield, Ottawa, Ont.

MANITOBA LECTURES IN GOOD ROADS.

A course of lectures in highway construction is to be given in the Manitoba Agricultural College, Winnipeg, on March 3rd, 4th and 5th. Among the speakers will be S. R. Henderson, president, Manitoba Good Roads Association; E. M. Wood, deputy municipal commissioner, Manitoba; Prof. W. J. Gilmore, Manitoba Agricultural College; A. McGillivray, provincial highway commissioner; Thos. H. MacDonald, Iowa State Highway Engineer; Hon. Dr. Montague, minister of public works, Manitoba; Col. C. E. Ivens, president, Union of Manitoba Municipalities; J. H. Mullen, Minnesota Deputy State Engineer; W. F. Tallman, Winnipeg street commissioner; Prof. L. J. Smith, Manitoba Agricultural College; Hon. George Lawrence, minister of agriculture; P. P. Sharples, road expert, New York; T. R. Deacon, ex-Mayor of Winnipeg, and Mayor Waugh.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS.

At the annual meeting of American Institute of Consulting Engineers, Inc., held January 19th, 1915, the following gentlemen were elected to fill vacancies in the Council:— Mr. Allen Hazen, Mr. George Gibbs, Mr. Charles E. Lucke, all of New York.

The following officers were chosen for the coming year:— Dr. E. L. Corthell, president; Mr. Charles Sooysmith, vice-president; Mr. Frederic A. Molitor, 35 Nassau Street, New York, secretary and treasurer.

INTERNATIONAL ENGINEERING CONGRESS, 1915.

The technical success of the International Engineering Congress is now well assured. Notwithstanding the difficulties arising as a result of the present European war, the committee of papers is able to count on from 200 to 250 papers and reports covering all phases of engineering work and contributed by authors representing some 18 different countries. The Congress will therefore be quite international in scope and character, although the representation from the countries involved in the European war will naturally be less than originally planned. The papers are rapidly coming in and their character gives full assurance that the proceedings will form a most important collection of engineering data and a broad and detailed review of the progress of engineering during the past decade.

The committee of management is now issuing to all important engineering societies, invitations to appoint official delegates to attend the sessions of the Congress, and the presence of a considerable body of such delegates is well assured.

COMING MEETINGS.

ANNUAL CONVENTION SASKATCHEWAN RURAL MUNICIPALITIES' ASSOCIATION.—To be held in Saskatoon, March 10th, 11th, and 12th. Secretary-Treasurer, E. Hingley, Regina.

CANADIAN MINING INSTITUTE.—Seventeenth annual meeting, to be held in Toronto, March 3rd, 4th and 5th. Secretary, H. Mortimer-Lamb, Ritz-Carlton Hotel, Montreal.

AMERICAN RAILWAY ENGINEERING ASSOCIATION.—Annual meeting to be held in Chicago, March 16th to 18th, 1915. Secretary, E. H. Fritch, 900 South Michigan Avenue, Chicago.

CANADIAN AND INTERNATIONAL GOOD ROADS CONGRESS.—Second Annual Convention, Toronto, March 22 to 26, 1915. Secretary, Geo. A. McNamee, Dominion Good Roads Association, Montreal.

TORONTO ELECTRICAL SHOW.—The second annual exhibition, to be held in the Arena, Toronto, April 12th to 17th. Secretary, Mr. E. M. Wilcox, 62 Temperance Street, Toronto.

AMERICAN WATERWORKS ASSOCIATION.—The 35th annual convention, to be held in Cincinnati, Ohio, May 10th to 14th, 1915. Secretary, J. M. Diven, 47 State Street, Troy, N.Y.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION.—Annual meeting to be held at the Iowa State College, Ames, Iowa, June 22nd to 25th, 1915. Secretary, F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA

Each week on this page may be found summaries of orders passed by the Board of Railway Commissioners, to date. This will facilitate ready reference and easy filing. Copies of these orders may be secured from *The Canadian Engineer* for small fee.

23231—February 2—Suspending until further ordered by the Board, 12 tariffs of the New York Central and 7 tariffs of the Ottawa and New York Railway, in so far as they increase the rates now being charged from stations in Canada to stations in Canada.

23232—February 2—Suspending until further ordered by the Board, 2 tariffs of the Boston and Maine and three tariffs of the Maine Central Railroad Cos. in so far as they increase the rates now being charged from stations in Canada to stations in Canada.

23233—January 30—Authorizing the City of Montreal to construct an extension of Cadillac St., in Longue Pointe Ward of the said City, across the right of way of the C.N.Q.

23234—February 2—Amending Order No. 23013, dated December 18th, 1914, by striking out the words "at its own expense," in the second line of paragraph 1 of the Order, and by adding at the end of said paragraph the words, "the cost of constructing the crossing to be borne and paid by the C.N. Ry. Co."

23235—February 1—Authorizing the C.P.R. Co. to construct branch line of railway for Philias Lariviere, Montreal, across public road, in Concession of St. Frederick, parish of St. Elizabeth, County of Joliette, Que., at mileage 13.4, St. Gabriel Subdivision, said branch be completed within six months from this date.

23236—February 1—Certifying that plan of the Regina-Saskatoon and North Saskatchewan Branch, mileage 43.2 to mileage 132.69, "as constructed," should show the measurement of 968.9 feet along the easterly limit of Sec. 21, Tp. 31, Range 26, W. 2 M., from centre line of Ry. northerly to the northeast corner of said Sec., instead of 959.9 ft.

23237—February 1—Granting C.P.R. leave to remove the regular agent at Flower Station, Ont., upon condition that a caretaker be appointed, whose duty it shall be to meet the passenger trains, keep station warm, and handle less than carload freight and express.

23238—February 2—Authorizing the C.P.R. to close station at Newtonville, Ont., as a regular agency station and appoint caretaker to keep the station properly cleaned and heated, etc.

23239—February 1—Amending Order No. 23091, dated January 7, 1915, by striking out the figures "332" after the word "No.," in second last line of recital to said order, and substituting therefor the figures "322."

23240—February 3—Authorizing the G.T.R. and Erie and Ontario Ry. to operate their trains over said crossing in Tp. of Moulton, County Haldimand, Ontario, without their being first brought to a stop.

23241—February 2—Authorizing the Erie and Ontario and G.T. Ry. Cos. at mileage Erie and Ont. 14.28 from Smithville and G.T. 42.37 from Buffalo, Dunnville, County of Haldimand, Ont., to operate their trains over said crossing without their being first brought to a stop. (Order 22466.)

23242—February 1—Recommending to the Governor-in-Council for sanction Indenture of Lease dated 4th of October, 1914, entered into between the Fredericton and Grand Lake Coal and Ry. Co., by the C.P. Ry. Co.

23243—February 1—Approving agreement entered into between the Bell Telephone Company, and the Roman Catholic Episcopal Corporation of the Diocese of Kingston, dated January 2nd, 1915.

23244—February 1—Approving agreement entered into between the Bell Telephone Company and Plummer, Aberdeen and Galbraith Rural Telephone Association, Limited, dated January 15th, 1915.

23245—February 3—Authorizing C.P.R. to operate bridge No. 9.3 on Edmonton Subdivision, Alta. Div., near Red Deer, Alta.

23246—February 4—Approving agreement entered into between Bell Telephone Co., and Apsley Telephone Co., Limited, dated January 21st, 1915; and rescinding Order No. 11926, dated October 11th, 1910.

23247—February 3—Approving revision of C.N.O.R. Co.'s completed railway between mileage 89.22 and 90.47, Tp. North Orillia, Ont.

23248—February 3—Relieving C.N.R. from providing further protection at crossing of highway between Secs. 21 and 22, Tp. of Crozier, Ont., about 12 posts east of mileage 236, Port Arthur Subdivision.

23249—February 2—Directing that, within 60 days from date of this Order, G.T.R. install improved type of automatic bell at crossing immediately west of Oakville Station, Ont., for protection of its main tracks, and thereafter maintain bell at own expense: 20 per cent. of cost of installing bell be paid out of Rly. Grade-Crossing Fund, remainder by Rly. Co.; all train movements on siding be flagged over crossing.

23250—February 1—Directing that tracks of C.P.R. and G.T.R. Cos., at Arnprior, Ont., be so connected as to provide reasonable receiving, forwarding, delivering, and interswitching of traffic between their respective railways; materials to be supplied, and work be done by G.T.R.; cost of construction be paid, ½ by G.T.R., and ½ by Gillies Bros., Limited; cost of maintenance, and cost of protection, if any, be paid by G.T.R.; work herein required be commenced by May 1st, 1915, and completed within 30 days from said May 1st, 1915.

23251—February 3—Authorizing G.T.R. to construct or reconstruct following bridges:—No. 69, mileage 3.06, over Fairchilds Creek, near Harrisburg, Ont.; No. 28, M. 82.55, over Government Road, near Paris, Ont.; No. 27, M. 82.24, over Private Road, near Paris, Ont.; No. 26, M. 81.84, over Private Road, near Brantford, Ont.; and No. 22, M. 76.14, over Clarence Street, Brantford, Ontario.

23252—February 6—Approving and authorizing clearances between poles and nearest rail of London and Port Stanley Ry. Co., subject to due performance of undertaking to keep employees off the sides of cars next to poles. 2. Authorizing and requiring, with respect to poles to be erected, a clearance of 7′ 6″.

23253—February 5—Authorizing London St. Ry. Co., and G.T.R. to operate half-interlocking plant on Dundas St., London, Ont.; operation of G.T.R. over crossing be as provided under Order No. 20665; London St. Ry. Co., be at liberty to pass over said crossing without bringing its cars to a stop.

23254—February 5—Authorizing C.N.R. to open for traffic its line from junction with Camrose-Strathcona Line to Junction with Edmonton-Yukon and Pacific Railway, at Strathcona, a distance of 0.6 miles.

23255—February 5—Establishing collection and delivery limits of Can. Nor. Express and American Express Cos., in town of Fort Frances, Ontario.

23256—February 5—Approving agreement entered into between Bell Telephone Co. and the Thamesville Telephone Co., Ltd., dated Jan. 25th, 1915; and Rescinding Order No. 6892, dated April 26th, 1909, in so far as it approved agreement between Bell Telephone Co. and Thamesville Telephone Co., dated November 27th, 1908.

23257—February 5—Authorizing C.P.R. to operate bridges Nos. 2400, Eastern Div., Brockville Subdivision, near Jasper; and 3.6 Eastern Div., Prescott Subdivision, near Chaudiere Junction.