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TIMISKAMING DAM CONSTRUCTION.

The second annual report of Mr. C. R. Coutlée, the engineer in charge of the construction of storage reservoirs on the Upper Ottawa River, has recently been published by the Department of Public Works. An abstract of the report dealing with the Timiskaming dam construction follows.

For several years prior to the commencement of the Georgian Bay ship canal survey in 1904, by the Department of Public Works, it was felt that something should be done to improve the conditions of low water on the Ottawa River, which made navigation difficult during the fall of low years, and crippled badly some of the power developments on the river. Representations were made to the Federal Government that the only possible remedy was to establish some system of storage reservoirs at the head waters of the Ottawa River, by which some of the surplus waters in the spring could be collected and conserved to be released gradually during the low period and thus augment the low flow.

In the report on that waterway, it was shown that conditions in the upper Ottawa River were favorable to a partial control of the surplus waters which could be used to increase the low water flow in time of deficiency, and that this control would not only be of benefit to navigation, but would be of great advantage to all commercial and industrial interests on the river depending on water for power and transportation.

Moreover the fact that large communities depend on an adequate and permanent river flow for the necessities of life, such as water supply for domestic purposes and fire protection, and the economical production of electrical energy for lighting tramways, industries, etc., gives to this control a national and vital importance. For these public utilities a shortage of water becomes a serious matter, as was exemplified in 1905 by the helpless condition of the powers at the Chaudière Falls on the Ottawa River on account of the long period of extremely low flow.

During the session of 1908-9, parliament voted the sum of $65,000 to commence the construction of storage dams on the Ottawa valley, previously recommended by Mr. G. P. Brophy, superintendent of Ottawa River works. Another sum of $20,000 was voted to continue the preliminary studies already commenced of the Ottawa River watershed.

Fig. 1.—Timiskaming Dam, November, 1910. Coffer Dams, Quebec Channel, Stopped by Autumn Floods.

In 1904, Mr. George Brophy, superintending engineer, Ottawa River works, was commissioned by the Department of Public Works to carry on a preliminary investigation of the storage possibilities, the work having been recognized as of Federal importance. The result of his investigations is published in the report of the Georgian Bay ship canal, page 303.

During the extensive surveys made for the proposed Georgian Bay ship canal, and in elaborating a project for a first-class waterway, it was soon seen that no satisfactory scheme could be devised unless it included an efficient partial control by storage of the spring floods of the Ottawa River throughout its watershed, in order to reduce the fluctuations in the different reaches, to eliminate swift and dangerous currents, and to establish practically slack water navigation.

Having been promoted to the position of Assistant Deputy Minister in the department, Mr. C. R. Coutlée, C.E., was appointed engineer in charge of the whole storage work, under the direction of the chief engineer, it being understood, however, that the work would be continued under my general supervision in an advisory capacity.

The report presented, after a brief review of the preliminary works performed in relation to storage during the survey for the canal, treats of the present waterpower development on the Ottawa River, the different lakes along its course, the characteristics of its watershed, its flow, etc., and gives figures as to the possible amount of water which can be stored in the natural reservoirs which it has been possible, so far, to investigate and study with a fair degree of accuracy.

It shows that storage so far in sight, and for which controlling dams are either under construction or sites fully surveyed and contract plans under way are:—

Basin.	Area. sq. miles.	Maximum Possible Depth. feet.	Storage. sq. miles feet.
Lake Timiskaming	100	20	2,000
Lake Kipawa	100	20	2,000
Lake Quinze and Expanse	100	20	2,000
Total			6,000

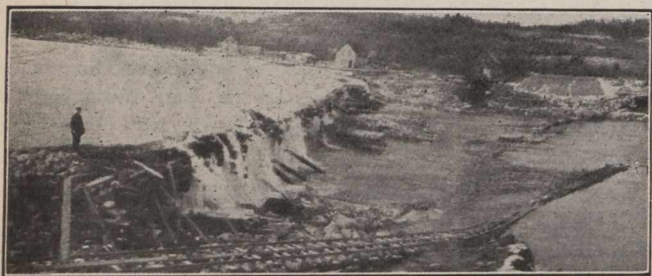


Fig. 2.—Timiskaming Cofferdam, Quebec Channel, 3rd May (Day Before Failure), Lake Surface Elevation 580.50. The Pit was Flooded from Below by Gordon Creek Water Several Days Before.

This represents a maximum possible reserve for each of these lakes of practically 56 billions cubic feet, or a total of 168 billions cubic feet of water, which instead of rushing to waste, would be pent up in these reservoirs and gradually let out during the low period.

Taking the low period at 150 days between October and March, it will then be possible to augment ultimately the low water flow at Ottawa for that period by 10,000 to 12,000 cubic feet per second. It can be seen, therefore, what immense benefits will be derived from these reservoirs. Their beneficial effect is admirably resumed in Mr. Coutlée's report, as follows:—

1st. They will improve the potability of the water.

2nd. They will increase the depth for navigation.

3rd. They will increase and steady the flow for power production.

These reservoirs, though large, would not, however, be sufficient to exert the full control that is required of the flood waters during the extreme years of flood flow, and further reserves may be had by other dams at the outlet of Lakes Turnback, Opasatika, Grand Lake Victoria, Birch, Barrière, Kakabonga and several other lakes on the main stream or on the tributaries, which are now under study, or will be investigated as soon as time and staff are available.

In relation to the reserve dams, the one at the foot of Lake Temiskaming and that on Kipawa River are under contract.

The progress of the work on the Timiskaming dam has not been as rapid as was desired and expected on account of heavy work in foundation. The Kipawa River dam is progressing satisfactorily. Both dams are of concrete with stop-log sluiceways, having an aggregate clear discharge sectional area at least as large as the original section of the river.

At the commencement of the fiscal year, $41,760 had been expended on the Timiskaming dam construction and a year's time. As stated in the last annual report, no adequate plant or force was employed on the contract at the commencement, so the summer of 1909 was lost. It was January, 1910, before a steam excavator began work, and February before concrete laying commenced.

The cold of this northern section created difficulties in excavating and concreting that had only been overcome when Timiskaming Lake, responding to a very early spring, flooded the foundations.

When driven from the base platform, however, the force was turned upon the island abutment, which was brought up to full height in May, 1910.

During June, new coffer dams were built across the Ontario channel and the section between pumped out by the 25th. This steam shovel resumed excavation and operated during July and August, but stopped for good during the first week of September with work still to finish. In May, two meetings with the contractors were held to discuss programs for hastening the work.

A couple more conferences were held in June, the hardness of the excavation and the unforseen difficulties of unwatering being discussed. With an active manager, a good scheme and better rate of progress were achieved during July and August, 1910; but this, the third, manager leaving at the end of July, the work became disorganized in a month. The time for completing the contract was extended from 22nd July to end of December, 1910.

Concrete.—When the foundation pit was pumped dry, 25th June, 1910, the concrete was found in good condition, although laid during the winter and flooded before the sun could hasten its set.

By the first week of July, forms were erected to half height for seven piers and concreting was resumed on the platform and aprons. A good speed was attained, and during August the most work was done, although the firm changed their manager on the first of the month.

In September, the concrete work on the Ontario sluiceways was finished and no more has since been done.

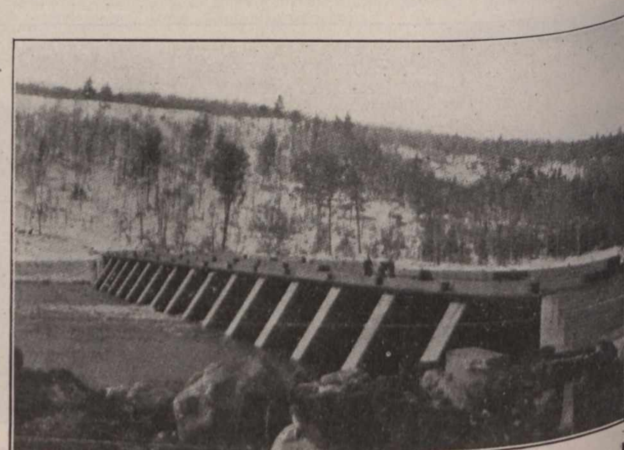


Fig. 3.—Timiskaming Dam. Ontario Sluiceways from Below, Showing Water on Lower Apron and Stop-Logs Piled on Roadway.

The piers and abutments are very fine samples of mass concrete work, the finish is good and the alignment particularly accurate.

The history of the concrete building in the Ontario sluiceways, during an unusually cold winter, is interesting.

Work began 12th February, 1910, and continued till April. Gravel of fair quality, but sandy, was the only available material and the mixing was done by machine. Large boulders were used as displacers in the concrete, each being thoroughly steamed to clean off ice before laying. The gravel and sand were stored in a bin that was heated by steam pipes and the water was also warmed. After laying, a movable steam radiator was set in place, and the mass covered with tarpaulins, so that all night the temperature was kept above freezing. The trench, into which the mixture, averaging 70° Fahrenheit, was placed, had, unfortunately, hard frozen sides and there must have been a loss of heat to the frozen ground.

After being flooded with water at 32° F. for 70 days till 25th June, when the water was 55° F., the concrete was still soft enough to penetrate easily with a steel bar or pick. In 30 days, however, the mass was hard enough to resist repeated blows of a pick and only a few inches of the surface required to be removed.

The following gives an idea of the weather during one cold period in February, 1910:—

Record of Temperature.

1910	Day		Night	
	Maximum	Minimum	Maximum	Minimum
February 5	0°	-16°	-10°	-23°
" 6	-13°	-16°	-10°	-26°
" 7	19°	-10°	12°	26°
" 8	32°	26°	28°	- 3°
" 9	5°	- 3°	2°	-18°
" 10	- 3°	-18°	- 8°	-30°
" 11	17°	-24°	6°	2°
" 12	18°	4°	12°	-14°
" 13	21°	-10°	20°	13°
" 14	31°	17°	18°	-18°
" 15	1°	-14°	2°	- 7°
16	9°	0°	2°	-22°

The chemical and physical action of setting is illustrated by the following temperature records of concrete built by the Department of Public Works at St. Andrews dam, north of Winnipeg in 1907.

A pipe with closed bottom and a screw top was placed low in the concrete, a thermometer being suspended inside from the screw top. As the wall or structure came up, additional lengths of pipe were added. For the sake of comparison the results in the accompanying table are given for three different parts of the work showing considerable range of condition of laying. In this table (A) is the pivot pier of lock, a heavy mass of concrete 35 ft. high and built in summer, during August, 1907; (B) is submerged dam, Span No. 1, winter work, January, 1908, working 11 hours a day, and (C) is submerged dam, Span No. 4, winter work, January, 1909, working night and day.

Table Showing Varying Temperatures of Setting Concrete.
(Fahrenheit Degrees Above Zero.)

(A) Pivot Pier, built Aug. 1907

Date 1907	Temperatures In pipes	Temperatures In Air
Aug. 28	Pipe set	65
Aug. 29	82.5	64
	84	69
Aug. 30	86.5	64
	82.5	68
	86	76
Aug. 31	91.5	66
	96	74
Sept. 2	98	77
" 3	99	60
" 9	104	64
" 11	103	......
" 12	103	......
" 19	105	......
Oct. 11	110	......
Nov. 5	102	......
	82	......
1908 Aug. 16	49	65
" 29	51	......
Sept. 25	52	43

(B) Span 1 of Dam, winterwork, 11-hour day.

Date 1908	Temperatures In pipes	Temperatures In Air
Jan. 18	Pipe set	50
" 19	65	50
" 20	75	50
" 21	77	......
" 24	76	......
" 27	78	......
Feb. 5	78	......
" 8	78	......
" 9	76	......
" 10	76	......
" 12	75	......
" 18	70	......
" 22	65	......
" 26	65	......
" 29	63	......
Mar. 2	62	......
" 4	61	......
" 6	60	......
" 9	57	......
" 13	54	......
" 17	50	......
" 24	45	......
" 31	42	......
April 3	42	......
" 6	40	......
" 8	39	......
" 9	38	......

Reading stopped by flood. Aug. 16 Pipes 62; Air 65; Water 67.

(C) Span 4 of Dam, winterwork, working night and day.

Date 1909	Temperatures In pipes	Temperatures In Air
Jan. 20	Pipe set	53
" 21	72	53
" 22	80	......
" 22	83	......
" 23	86	......
" 23	87	......
" 24	88	......
" 24	110	......
" 25	111	......
" 26	110	......
" 26	110	......
" 27	108	......
" 30	80	......
Feb. 2	80	......
" 3	80	......

No doubt, the Timiskaming concrete rose in temperature at some stage in setting.

For winter work, a new practice is to use very quick setting cement that hardens before it is cooled below chemical action temperatures. Work of this kind was done on the power plant near St. Timothee, Que., during this same cold winter of 1910. By mistake, a car of the quick setting cement, made at the International Works, Hull, Que., came to Timiskaming. Its hardening was so rapid that its surface could scarcely be smoothed over. The first batches being especially troublesome, because nothing of the kind was expected. The result was apparently as good concrete as any laid, however.

Designs of Sluiceways.—Plans and views of these sluiceways are shown in Fig. 5. The sill platform is at elevation 570, or 19 feet below standard level of reservoir. It would have been preferable to have the sill 5 feet lower, but the excavation necessary to cut down the approach channel would have doubled the cost.

Between the island and Ontario shore, the width was about 400 feet, so the design was made for 16 sluiceways each 20 feet wide with a pier 5 feet wide between. The piers have recesses to hold a movable curtain wall formed of horizontal timbers, 18 inches square, that can be hoisted out one by one. This is a removable dam and during spring floods all the timbers will be lifted out, leaving a larger exit than under natural conditions, because the Ontario channel has been deepened. To draw off the lower layer of storage during March, however, requires deeper sluice openings, and so advantage of the depth in the deep Quebec Channel was taken to place those sills at elevation 565, or 5 feet lower.

Minimum Discharge at Timiskaming Sluices.—The minimum through Timiskaming should be about 20,000 c.f.s. and lake surface must be 573.95 to discharge the total amount as shown by the following calculation made by H. H. Donnelly, assistant engineer:

Taking 572.1 as elevation of water below Timiskaming dam for a discharge of 20,000 c.f.s., then:—

16 Ontario sluices, each discharging with 0.95 feet head and 2 feet submergence at the rate of 20.5 c.f.s. per foot of crest, total 16 x 20.5 x 20 .... 6,560 c.f.s.

13 Quebec sluices, each discharging with 0.95 feet head and submergence at the rate of 52.5 c.f.s. per foot of crest; total 13 x 52.5 x 20 .... 13,650 c.f.s.

20,210 c.f.s.

If the Ontario sills were as low as the Quebec side, then, with Timiskaming lake surface elevation 573.05 and the surface below dam elevation 572.1, the discharge would be:—

16 Ontario sluices, each discharging with 0.95 feet head, and 7 feet submergence at rate of 35 c.f.s., total .... 11,200 c.f.s.

13 Quebec sluices, each discharging with 0.95 feet head, and 7 feet submergence at rate of 35 c.f.s., total .... 9,100 c.f.s.

20,300 c.f.s.

As designed, the lake surface can only be drawn down to elevation 573.95, instead of elevation 573.05, so a layer 0.9 feet thick is rendered unavailable.

As before stated, however, lowering the Ontario channel would double the cost which is not warranted at present.

Foundations.—The foundation of the sluices is shown in Fig. 5. It consists of a concrete platform, 3 feet thick, strong enough to support a pier, if undermined during a flood, till repairs could be made. To prevent under scour, a cut-off is made 10 feet deep across the upper face and another 5 feet deep across the lower side. In addition, a concrete apron, 25 feet wide, protects the bottom from scouring under the driving water at entry, and a 50 foot wide apron below prevents wearing away of material by the rapidly leaving flow.

The Ontario bed is boulder strewn with hard material beneath, but the work done in the Quebec channel, before the cofferdam failed (May, 1911), indicates a sand, hard, but easily saturated. Through this material, the seepage

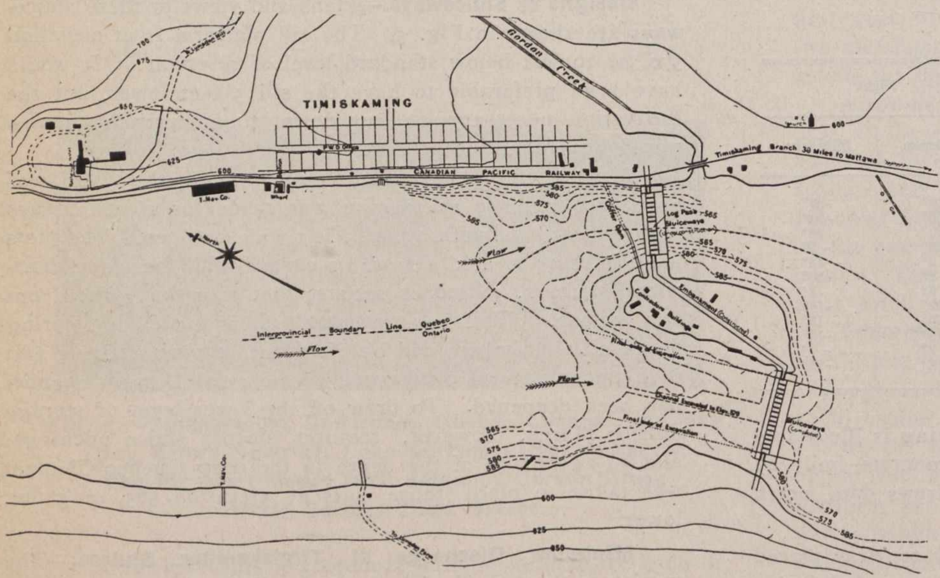


Fig. 4.—Plan Showing Timiskaming Regulation Works.

was all that four large pumps could conveniently manage. The foundation for the Quebec side will consequently be modified and include sheet piling beneath the cut-off wall. In fact, it proved impracticable to excavate the cut-off trench 10 feet deep in the sand, although the boring pipes were broken in piercing the undisturbed bed.

The depth to which a cut-off should extend in sand is debatable, but accepted practice is to go as far below the bed as the water surface is above.

Head water will soak the foundation, but cannot move the sand so long as it is boxed in or held by friction. If head water penetrates beneath the dam, then it buoys up the sand below and the tail water carries it away so rapidly that a cellar is formed.

Cofferdam, Quebec Channel.—After the middle of September, 1910, practically all the work was in connection with the cofferdam across the Quebec channel.

The type decided upon by the contractors was stone filled cribwork sunk to place and sheeted along the upstream face with plank. Round timber was procured from the Hawkesbury and Edwards limits near the work, and by the 17th October, the dam was half way across (210 feet). It was intended to unwater only half the channel and about 30 feet of cribwork was built down stream, but heavy rains caused an unusual rise of 5 feet and work had to cease. This brought most of the work on the dam to a stand-still, but sand was hauled and stone crushed which still remain stored upon the ground. The cable way was moved to the Quebec channel and put in working order by the middle of November, thus obviating the use of scows to cross material to the island. With a view to laying concrete during cold weather, arrangements were made to build a shed, 400 long and 60 wide, enclosing all the piers. Lumber was delivered for this, but owing to delays with unwatering, the shed could not be erected

To ensure immediate excavation of the foundation, orders were given to bring the steam shovel across the island. This machine had been left in the water since the Ontario cofferdam was cut in November.

Excavation continued in the island abutment, but leakage from the river through the fine sand stopped work several times, although a sheet pile bulk head was built, and a steam pump installed. Slips constantly occurred from the sides of the pit till finally, on 20th November, the river side burst in, when the excavation was to grade and only the cut-off trenches remained to be dug.

Lake Timiskaming continued extraordinarily high for the season, although the Kipawa River flow was shut flow was shut off by the Department's dam at that place. On 18th November, the Ontario cofferdam was blown out and the lake surface began to fall 2 inches per day. This had not been opened before, because the contractors were tendering for the excavation in the channel. The current soon scoured out between the south end of the dredge cut and the north end of the contractors' work passing a good flow through the sluiceways for the first time.

It was January, 1911, before the cofferdam was put under way again, when it was raised about two feet and track laid on top to carry stone filling and other material.

The lake had by then lowered three feet, so with a falling river, it was decided to cofferdam the whole channel and cribwork was begun from the Quebec shore. The advantage is that this method allows the foundation slab and cut-off walls to be built without joint. With a cofferdam half way across, the part parallel to the current requires to be a double crib with clay in the middle. Otherwise, the current will scour away staunching material from the exposed face, and in this case a boulder bottom prevents the driving of sheet piles.

An inexperienced force, cold windy weather, and the swift current made crib setting very slow and several cribs were lost by upsetting or breaking away of tackle.

By the first week of February, the new cribwork was connected to that built in October, and by the middle of the

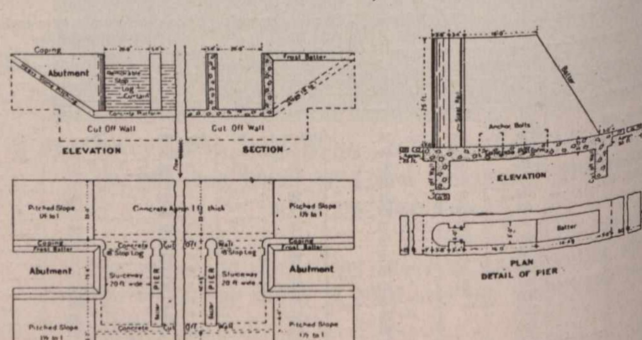


Fig. 5.—General Drawings of Concrete Sluiceways.

month the upstream face was sheeted with two thicknesses of boards. Large boulders upon the river bed made it difficult to closely fit the cofferdam to the bottom and cribs sometimes came to rest with one corner tilted over. No trench was dug in the river bottom into which to bury the ends of the face plank, because a diver could not work in the strong current. Instead, a bank was deposited along the front of the cofferdam, but the only earth available was fine sand that made a slurry in water.

The counterdam, across the lower end of the foundation area, to defend the pit from the lower pool, was finished by the end of February. There were only two small steam pumps, a six-inch and four-inch, on the contract and these could not lower the water below the lower pool, down to which it had run off naturally. Two large steam pumps, a twelve-inch and a fourteen-inch with boilers, were then rented and a pocket dam built just below the main dam. This was to intercept and collect the leakage which was led in box flumes over the work and emptied below the counterdam. The pocket dam was first a small earth bank, the sandy soil alone available, however, dissolved beneath the water, but froze hard in the air, bridging and obscuring leaky places. A sloping dam of planks, pointed and driven like sheet piling, was made but still the leakage kept the pumps fully engaged and water constantly burst beneath. Two more large pumps were added during March and every effort made to staunch leaks. It was not till the end of the month that four large pumps, working day and night, could keep the pit unwatered.

Meanwhile the spring rise was approaching, and to meet it the main cofferdam was raised 7 feet with continuous cribwork, which was filled with stone, adding weight to that already built. The cofferdam was of light section, but was well strutted on the down stream side. It was a question, whether stop-logs should be provided in this upper portion, but to arrange for them was difficult, and they could only pass 4,000 c.f.s., 5% of the flood. It seemed better instead, to blast out the Ontario side and increase by loosening and scour the space through which to get discharge, while the cofferdam blocked the Quebec channel.

The enlargement of the Ontario side by blasting and scouring was quite successful and aided the discharge greatly

Excavation in the Quebec foundation was possible during the last week of March and continued till the end of April. The lower pool then rose over the counterdam and operations had to cease, the plant being nearly all removed. On 4th May, the main dam failed by scouring under the Quebec end. The water was then overtopping it more than a foot.

Item	Unit	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Total
B. C. Fir 12" x 12"	C. ft.						1,200		8,600	11,650				21,450 c. ft.
White Pine 3" x 12"	Ft. b.m.								21,600					21,600 ft. B.M.
Steel Beams	Lb				11,800	30,900	2,500		33,900					79,100 pounds
Anchor Bolts	"	1,000			5,000	1,000								7,000 pounds
Common Excavation	C. yd			500	6,000	5,450		550	370					12,870 c. yds.
Rock Excavation	C. yd.			150	650	50	1,050	250	250	240				2,640 "
Boulder Excavation	"			60	540	300	700	300	180	220				2,300 "
Stone Protection	C. yd.				200		1,000	800						2,000 "
Concrete	C. yd.	600	250		1,150	2,660	320	4						4,984 "
Material on hand														
I Beams, Channels	Lb									100,500				100,500 pounds
Cement	Barrel									640				640 barrels
Sand	Cu. yd									2,400				2,400 c. yds.
Broken stone	"									4,200				4,200 "

Quantity of Contract Work in 1910-1911 on the Timiskaming Dam.

Ontario Channel Excavation.—The dredge Queen excavated in the channel during the autumn of 1909 and encountered much difficulty from boulders upon which the scows and tug frequently grounded. After work stopped for winter, a force of drillers was kept on to blast boulders over the ground to be dredged during 1910. Low water aided this, and half the approach channel had been well prepared for dredging and some excavation had been swung out with the derrick by the end of March, 1910.

It was 17th May, 1910, before the dredge started, and after making one cut the dipper arm broke 18th June, then teeth were removed, so before repairs were finished it was 5th July. The material was so hard that it had to be blasted at times and low water prevented through cuts being finished to the contractors' work. The autumn rise, however, aided matters and a cut was fortunately carried to the cofferdam before work stopped in the middle of November.

The blasting of surface boulders was continued all season by a small force with good results, and when the cofferdam was cut 18th November, a good opening quickly scoured to the already excavated sluiceway channel.

Item	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	Total
B. C. Fir 12" x 12"						$ 768		$ 5,504	$ 7,456				$ 13,728
" 6" x 12"													
White Pine 3" x 12								918					918
Steel Beams				$ 708	$ 1,854	150		2,034					4,746
Anchor Bolts	$ 60			300	60								420
Common Excavation			$ 150	1,800	1,635		$ 165	111					3,861
Rock Excavation			225	975	75	1,575	375	375	360				3,960
Boulder Excavation			45	405	225	525	225	135	165				1,725
Stone Protection				150		750	600						1,500
Concrete	5,100	2,125		9,775	22,610	2,720	34						42,364
	$ 5,160	$ 2,125	$ 420	$14,113	$26,459	$ 6,488	$ 1,399	$ 9,077	$ 7,981				$ 73,222
MATERIAL ON HAND.													
I Beams Channels									$ 3,015				3,015
Cement									640				640
Sand									1,200				1,200
Broken Stone									3,150				3,150
													$ 81,227

Value of Contract Work in 1910-1911 on the Timiskaming Dam.

During March, 1911, a force was placed blasting the material along the edge of the Ontario channel. The loosening allowed the current to scour the material and a large amount was quickly removed, increasing the flow way against the rising lake which was troubling Haileybury and New Liskeard.

Dredging.—The Department dredge "Queen" resumed work in channel on May 15th, 1910, and was taken off for the winter November 15th. The total excavation during this time was 6,150 cub. yds. scow measure. The dredge is too light for the work and has been in service for eight years, consequently, there were many breaks, and time taken for repairs was usually large. The total length of time on the work was 1,557 hours, viz.:—

Actual working time	870 hours	55.9%
Lost time, repairs, etc.	592 hours	38.0%
Lost time Saturdays cleaning up and fueling	95 hours	6.1%
	1,557 hours	

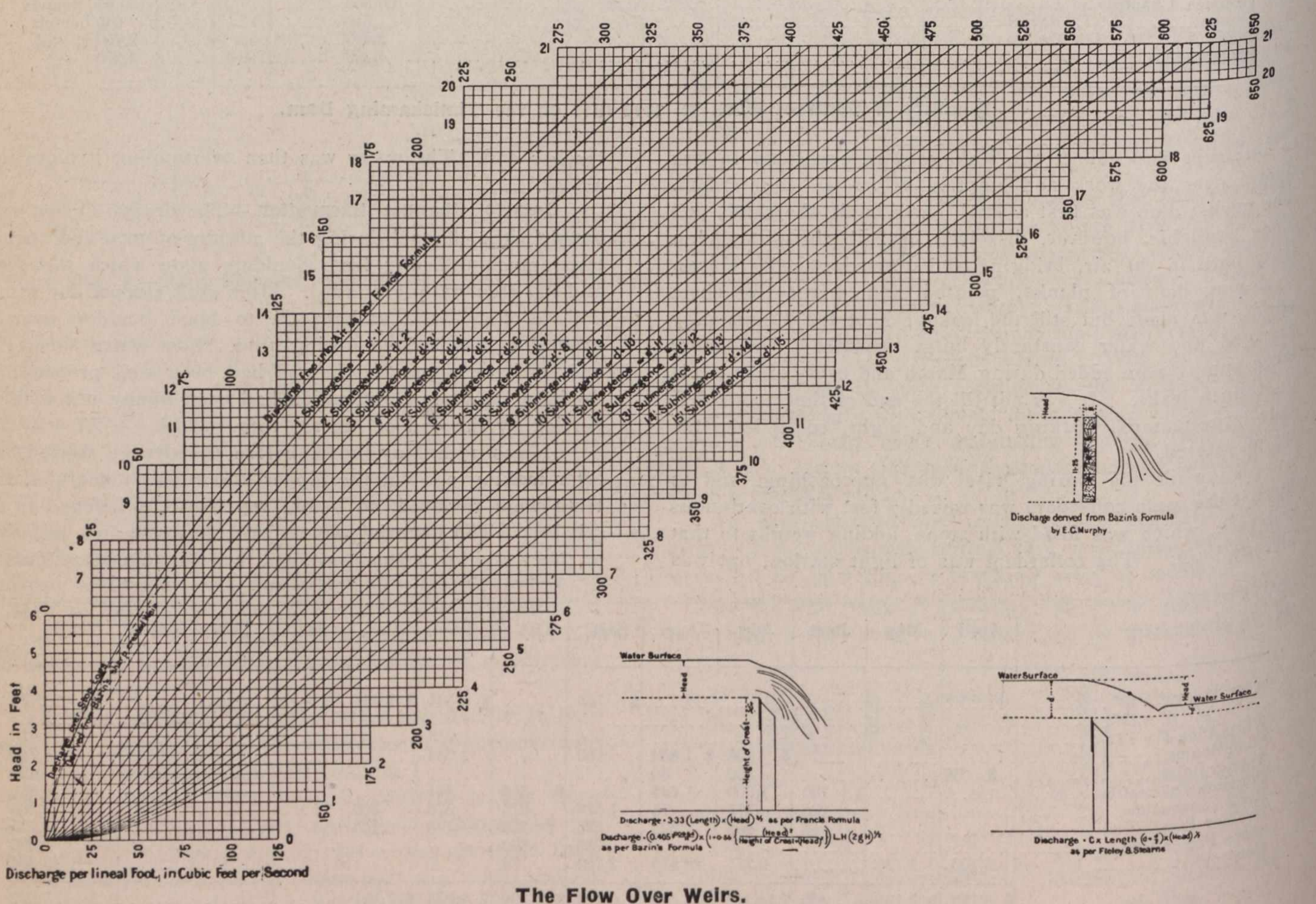
To open a channel through to the shovel cut excavated by the contractors, some work was performed lifting boulders. The dredge was also obliged to work in shallow water, where scows could not be used, and the excavation was taken away with a hand derrick. The extra labor cannot rightly be charged to drilling. The accompanying table shows the quantities and cost.

Summary of Cost of Drilling.

From October 6th, 1909, to November 30th, 1910.

Wages	$14,297	
Plant and accounts	6,863	$21,160
Less		
Clearing boulders to open channel	$840	
Taking away excavation from dredge to open channel, not chargeable to drilling	372	1,212
Net amount expended on drilling		$19,948

Area of channel drilled and blasted was 22,280 sq. yds., costing per sq. yd. of surface 89½ cents.



The Flow Over Weirs.

(From Report on Ottawa River Storage, Issued by the Department of Public Works, Canada).

The area of channel dredged in season 1909 was 583 sq. yds. During season of 1910 the area was 1,734 sq. yds., making a total area of 2,317 sq. yds.

Profiting by high water in November, 1910, the dredge was able to excavate close to the Ontario cofferdam, and when it was opened the water cut through between the contractors' shovel cut and the dredged channel.

Drilling and Blasting.—On March 1st, 1910, the area drilled and blasted was 7,700 sq. yds., since then 22,530 sq. yds., making a total to November 30th of 30,230 sq. yds.

Two No. 42 Little Giant steam drills were used for drilling on shore. Submerged work was drilled by hand from floats.

Area dredged, season of 1910, 1,734 sq. yds., which, at 89½ cents, cost for drilling $1,551.55.

Dredged during season of 1910	6,156 c. yds.
Cost of drilling per c. yd.	$0.175
Cost of dredging per c. yd. (dredge $5 per hour.)	$1.268
Cost of excavation	$1.443 per c. yd.
Cost of drilling operations, including removing boulders from channel, etc.	$0.187
Cost of dredging	1.268 per c. yd.
Cost of excavation	$1.455

POWER DEVELOPMENT IN COBALT.

By G. C. Bateman.*

In 1904, the rich silver mines of the Cobalt district were discovered, and while at first, believing that the deposits were not extensive, development was on a very limited scale, the camp gradually grew in size and importance, until it now occupies third place among the silver-producing communities of the world, the output being exceeded only by Mexico and the United States. During the year 1911 the output was approximately 33,000,000 ounces, and the production for 1912 will probably be about the same. The camp embraces an area of approximately seven square miles, in which there are thirty shipping mines, besides several non-shippers, and fourteen concentrators.

The running of mining machinery for comparatively small plants, as most of those in Cobalt were, does not readily lend itself to economical operation. The distance of Cobalt from the coal-producing centres is great, and as it is an all-rail haul, the cost of coal at the mines is necessarily high, averaging between $6 and $6.50 per ton. As a consequence, coal generated power is costly. A series of tests, carried on at the different mines over a considerable period, established the average cost for the camp at between 150 and $175 per horse-power year.

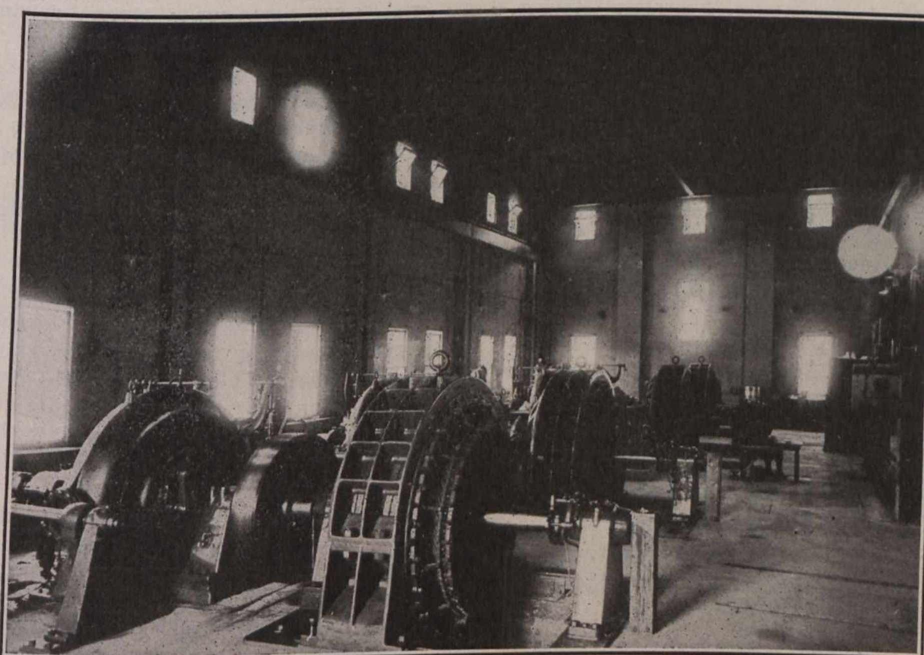
Within a comparatively short distance of Cobalt there were several good water powers, and when it was seen that the camp was firmly established as an important producer of silver, and that there was no question as to its permanence, companies were formed for the development and distribution of this power on a large scale. Considering the small area and the large number of consumers, the district lent itself very readily to this scheme.

Among these companies was the Mines Power, Limited, now known as the British Canadian Power Company, formed by E. A. Wallberg and F. John Bell, of Montreal, which secured a valuable water power on the Matabitchouan River, about twenty-two miles distant from Cobalt. Permission was also given by the Government to dam several of the lakes above the falls, thus providing for a large storage capacity, and eliminating as far as possible, the danger of a water shortage.

The main power dam is 50 feet high at its deepest point and 860 feet long. It raises the water about 40 feet above its former level, and gives a working head of 312 feet. It is estimated that a total of 10,000 horse-power can be developed if necessary.

By means of an intake canal the water is diverted to two steel penstocks, each five feet in diameter, and 1,075 feet long. Two turbines are supplied from each penstock. These turbines are of the horizontal reaction type, consisting of a single runner in a spiral case. They have a speed of 600 R.P.M., and are rated at 2,750 B.H.P. each. The power house is a solid concrete fireproof structure, 57 x 105 feet, and is fitted with all the latest appliances. It is also equipped with a travelling crane for handling the heavy machinery.

The electrical equipment consists of four alternating current generators, directly connected to the turbines, and having a capacity of 1,875 kw. each. There are two exciters, each directly connected to a Doble impulse water-wheel. These are rated at 180 horse-power, 475 R.P.M. High-power governors have been installed to ensure perfect regulation. The current is three-phase, 60-cycle, and is generated at a pressure of 2,200 volts. For transmission to the power stations at Cobalt and South Lorraine this potential is raised to 44,000 volts by means of step-up transformers.



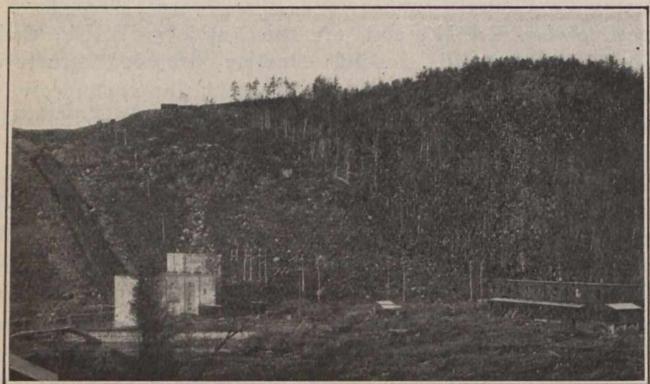
Interior of Concrete Power House on Matabitchouan River, showing four 1875 K.V.A. Generators, each being direct-connected to a 2,750 h.p. Turbine.

There are two separate three-phase transmission lines, 35 feet apart, over a right-of-way 135 feet wide. The right-of-way has been entirely cleared, and, to further minimize danger of breakage, all tall trees on each side of the line have been cut down. The conductors are stranded aluminium cables, and the poles are equipped with high-tension porcelain insulators, which were subjected to the most severe tests before being used. The conductors on each pole line are of sufficient capacity to carry the whole load, thus eliminating the danger of a shut-down due to a break in the line. The whole system has, in fact, as far as was possible, been constructed in duplicate. The main transmission line is equipped with a private telephone system, and patrolmen are stationed at intervals.

For the distribution of this power to the various mines three brick and concrete substations have been erected. Two of these are at Cobalt; one at Cobalt Lake having a capacity of 5,500 horse-power, and one at Brady Lake having a capacity of 3,200 horse-power. The third station is at South Lorraine for supplying the mines of that vicinity. Each substation is equipped with all the necessary step-down transformers, lightning arresters, switching devices, etc. The electrical current is delivered to the customer at 2,200 volts, and by means of pole transformers is reduced to 550 volts for motor service, and 110 polts for lighting. Power is sold to the consumer on a flat rate of $50 per

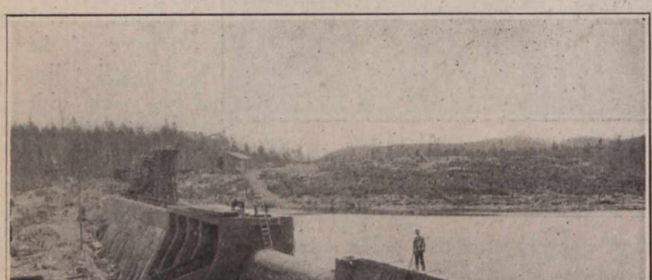
*Mine engineer, The Dome Mines Company, Limited, South Porcupine, Ont.

horse-power year, or on a meter basis, with prices varying for the class of service and the amount consumed. While this rate is high in comparison with the rates for similar service in industrial centres, it is eminently fair, considering the high cost of such an undertaking and the shorter life that must be looked for in a mining district.



General View of Concrete Power House, Operators' Houses, Penstock Covering, Tail-race and Double Pole Lines to Cobalt.

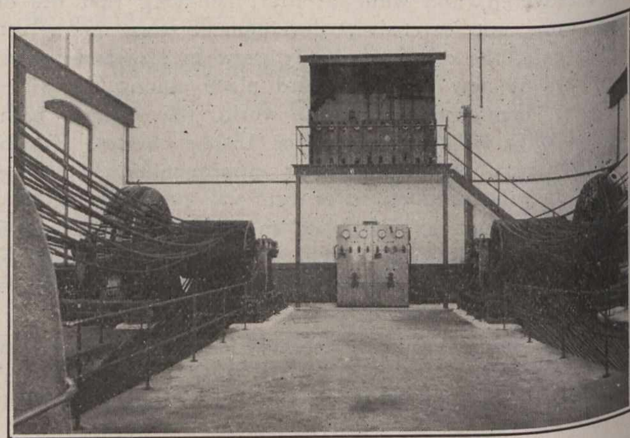
An interesting feature of this company's power development is its system for supplying compressed air to the various mines. At both the Cobalt Lake and Brady Lake substations are identical compressor plants, each consisting of two two-stage air compressors. Each machine has a capacity of 5,000 cubic feet of free air per minute, and is driven by a 1,000 horse-power motor. This gives a total capacity of 20,000 cubic feet of free air. The compressors are equipped with the regular intercoolers, and each substation has installed an extra large water after-cooling system. From this the air passes through a large separator, and then through an air-cooling system. On account of the high temperature in the summer this latter system is only in use during the winter months.



Main Concrete Dam, 50 feet high, on Matabitchouan River, showing Timber Log Slide.

The air is delivered through steel pipes, with diameters varying from three inches to ten inches, and the two substations are connected by a ten-inch main. All the pipes are lapwelded, and the larger sizes come in 40-foot lengths. They are fitted with wrought-iron forged flanges, welded on, and each pipe has a weld in the cross section, made by the oxyacetylene process. They have all been tested to a pressure of 300 pounds per square inch. All fittings, valves, etc., are made of steel, and the pipes have all been coated on the inside with "Doctor Smith's Solution."

When the construction of these pipe lines was first under consideration, the question of expansion joints was taken up, but it was finally decided not to install them as



Two 1,000 horse-power Motors driving Compressors at Cobalt Station.

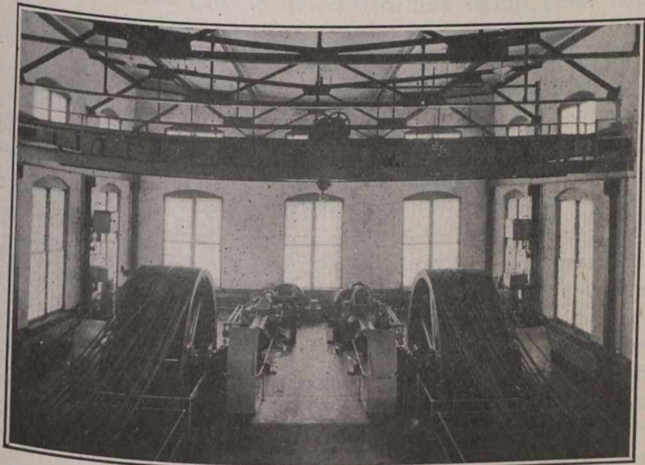
they were not considered sufficiently reliable. During a period of twelve months the extremes of temperature may amount to as much as 150 degrees Fahrenheit, and, in order to take care of the excessive expansion and contraction, the pipe lines were zig-zagged, and, although the plant has been in operation over two years, no trouble has yet been experienced.

There is at times in the pipe line a small accumulation of water, and, while this is not sufficient to affect the mines, it gave trouble by freezing in the winter time and stopping up the pipes. This difficulty was overcome by the application of an electric heater, the design of Mr. James Ruddick the former general superintendent of the company. At the lowest points of the pipes a ¾-inch cock is placed, so that the water will drain both ways to it. This cock is left slightly open all the time, and during the winter it is

View showing Ten-inch Pipe Line, with Electric Heater, 2,200 Volt Electric Pole Line, and 44,000 Volt Double Transmission Line, in Cobalt Camp.

kept warm and prevented from freezing by the use of the electrical heater. Automatic traps are being installed to take care of the accumulation of water in the warm weather.

The air is delivered to the mines at 100 pounds pressure, and practically atmospheric temperature. The company endeavored to get high-pressure air meters, with the intention of selling the air at 24 cents per thousand cubic feet of air compressed to 100 pounds pressure. These were found impracticable, however, and the air is now sold on the basis of $2 per drill per shift.



Two 1,000 horse-power Two-stage Air Compressors at Cobalt Station.

Operations in this plant were started in the first part of June, 1909, and power was first turned on March 17th, 1910, which is an enviable record for an undertaking of this size, considering the difficulties to be overcome.

As an evidence of the manner in which water development in Cobalt has succeeded in cutting down the consumption of coal, it may be stated that in 1909 the coal used in Cobalt amounted to 105,416 tons, while in 1910 and 1911 the consumption was 52,861 and 44,216 tons, respectively. Steam boiler plants are still in use for heating purposes, and the majority of hoists are still run by steam, so that a considerable quantity of coal is still brought into the camp.

AN ELECTRICALLY OPERATED LABOR-SAVING DEVICE IN LUMBER MILL.

The use of electrically operated machines in wood working plants has been the means of effecting many economies in their operation, so that it is not surprising to hear frequently of some new application of an electric motor in this industry.

The application illustrated and described herewith has proved to be so much more efficient in operation than the method it superseded that a description of it may prove of interest.

The apparatus consists of an automatic hydraulically operated door veneering machine installed in the plant of the Commercial Sash, Door and Blind Co., Beaver Falls, Penna.

This plant is most completely equipped throughout with individual electric motor drive, a total of 24 motors being used. Some are mounted on the ceiling and others on the floor in places most convenient for driving their respective machines. Those mounted on the floor are placed in enclosures to protect them from the dust and dirt such as is usually prevalent in plants of this kind. The veneer is placed on the door frames and when a sufficient number are ready they are placed in the compress as indicated in the illustration, which shows 110 1⅜ inch frames piled in five rows. Two sets of I-Beams are put in place one above and one below the frames, and turn-buckle clamps attached from one set to the other are tightened so as to hold the frame intact. After this has been done, the motor, mounted on the ceiling just above the compress, is started and the operator opens the valve which allows the hydraulic pressure to act. Gradually the carriage rises, compressing the frames until the pressure, as indicated by the gauge at the side of the machine, has reached the desired value. This value is usually from 1,300 to 1,600 pounds per square inch, depending on the nature of the wood to be compressed. A pneumatic safety valve automatically opens at any predetermined value, thus preventing any possibility of danger from excessive pressure.

It will be noted, on referring to the illustration, that the bottom portion of the compress is in the form of a truck. By means of this construction the material may be loaded directly on the truck which is then rolled to the compress on car tracks. When the desired pressure has been applied for a few minutes (about two, generally), the valve is opened; the pressure gradually relieved, and the truck returns to the normal position and is then rolled away.

As an example of the economy effected by this veneering machine, it should be noted that the time required for compressing is only about two minutes, while that required by the old hand-operated method was from four to five hours. With this method, the frames can be removed at once after they have been compressed, although it is generally customary to leave the clamps on for an hour or so, whereas in the older method it was necessary to have them on for several hours.

Automatic Hydraulically Operated Door-Veneering Machine.

The plant is equipped throughout with Westinghouse induction motors, taking current from the central station lines.

LUMBER PRODUCTION.

Two-fifths of the lumber of Canada is produced in Ontario, one-fifth in British Columbia, and one-fifth in Quebec; New Brunswick and Nova Scotia together make up the greater part of the remaining fifth, and but proportionately small quantities are manufactured in Saskatchewan, Manitoba, Alberta and Prince Edward Island.

THE COLLAPSE OF THE NEILSON BUILDING.

While an addition of three stories was being made to the Wm. Neilson Company's two-story chocolate factory on Gladstone Ave., Toronto, the south wall collapsed. Work commenced on the 28th March and the accident occurred on the 4th of May, when the wall was almost finished and part of the roof on.

As the plans show, the building was 90 ft. x 120 ft., and consisted of a basement and five stories. Mill construction was the type adopted for this building, and the rows of posts running east and west were spaced 14 feet apart; joists or floor beams, 5-in. x 12-in., 4 ft. on centres, spanned the 14 ft carrying three inch spruce flooring. This flooring was ploughed and a hardwood slip-tongue or spline used, and was securely blind-nailed to the Georgia pine joist. Duplex joist hangers were used throughout, and steel anchors every eight feet were fastened to the underfloor, i.e., over every other joist. Thus the beams ran east and west, the joists north and south, and the spruce underfloor east and west. The

View of Building After Collapse of Wall.

main beams were tied together with steel straps and the ends secured to the walls by wall boxes. From north to south during construction the tie consisted of the friction between the joists and hangers at the beam, and the rigidity of the floor platform, while the hardwood floor would complete the tie. The parapet wall of the old building (14-in. thick), was removed and the new wall started on top of the wall of the second story (18-in. thick). The new brick work, like the old, consisted of hard burnt clay facing brick, sand-lime lining brick with soft or salmon fillers laid up in lime mortar.

The old building was erected with the intention of adding two stories at some later date, and in order to satisfy to the city by-law, as part of a four-story building, the basement wall was made 22-in thick, and the first and second stories 18-in. thick. For the same reason the walls of the first story were designed to allow 30 per cent. of openings, while those of the second gave 40 per cent. Application was made, however, to the City Architect for a permit to erect the five-story building which was granted on condition that certain windows were to be blocked up to make the proper percentage of openings in the lower stories, and the first story wall was left 4-in. thinner than the City by-law requires.

In order that the Neilson Company might continue their business in the first and second stories, (in the old portion) the contractors agreed to arrange their work so as not to enter these stories and to hoist all of their material over the south wall.

For this work the bricklayers erected a double elevator hoist the full height of the intended structure, a couple of feet south from the street, staying it with guys. This hoist was operated by a small steam engine, and was so arranged that as a load went up on one platform the empty wheelbarrow came down on the other. This proved as it always does, to be a very efficient method of carrying the bricks and mortar. The carpenter had a gin wheel, with the fall passed through a snatch block made fast to a niggerhead, and a horse was then able to lift all the smaller material, including the 3-in. spruce flooring. For the heavier timbers there was a breast derrick mounted over the girder, nearest the south wall, with a 30-ft. boom which projected beyond the wall and as the timbers were swung over the floor they were lowered on trucks and wheeled to the required positions.

In order to permit of this hoisting the bricklayers left a section (some 30 or 35 feet long) of the south wall towards the western end open until the rest of the walls for that story was finished when they would fill this in. The carpenters would lay the new floor, raise the gin wheel and derrick to the new level and proceed as before. At the time of the accident the most of the roof and parapet wall was on, but this gap in the south wall on the top story was not filled.

The inquest was conducted by Mr. J. E. Elliott, who spent considerable time and took endless pains to make the investigation thorough, and the profession is indebted to the coroner and Crown Attorney Greer, for their efficiency in this matter.

It is a pleasure to see men in their positions anxious to get at the truth and at the same time sufficiently patient to listen to all.

The list of witnesses is a long one and may be classified as follows:

1. The medical experts.
2. Eye witnesses who were outside of the old portion of the building.
3. Eye witnesses who were inside of the old portion.
4. The contractors.
5. The architect of the building.
6. The city architect and staff.
7. Expert witnesses.

The medical expert testimony our readers are not particularly interested in, so that we will begin with the second class, viz., eye witnesses outside of the old building.

Of these examined was John Sole, who was the engineer in charge of the bricklayers' hoisting engine. He was at his post at the engine a few feet south of the centre of the south wall facing west and said that about 10.30, he heard a noise as of wood tearing and on looking up he saw some bricks falling about 30 feet behind the boiler. He fixes the position of the first failure very definitely as east of him i.e., the eastern part of the wall and towards the top. Several of his answers are very definite and full of information—"Gradually opened at the top and collapsed right straight down"—"The whole tearing was on the east side and it fell down and collapsed in a heap." "Did not fall out whatsoever, simply opened and collapsed."

Q. "How long did the whole break take from the time you first saw it until the finish?" A. "About a minute—it fell very slowly for a wall." Q. "Were the bricks thrown far to the south?" A. "No, I think about 30 or 35 feet." Q. "Your engine did not explode?" A. "Oh no, did not explode whatsoever." As this was the only boiler in addition to that supplying the factory with power and heat and which is still in good condition, in the immediate neighborhood of the building, it settles the theory proposed by the Assistant City Architect, that the accident may have been due to a boiler explosion.

Chas, Watman, a foreman for the Bell Telephone Company, who was working about 300 feet south of the building and had almost an unobstructed view of the fatal wall said, "I heard the noise and then I thought, silence and I could not hear anything. I thought it was inside, something falling; just sounded like as though it was a big timber or some lot of bricks had fallen." Q. "Perhaps what you heard was the first few bricks Mr. Sole speaks of." A. "Might be—very great noise." "I think they hit some boards if I am not mistaken." He was too far away, however, to observe any of the details other than those already mentioned.

Robert Harion, a street railway conductor, was walking south on Gladstone Avenue, and said that a few moments before the accident they were using the derrick. He saw the boom projecting over the wall. This agrees with the evidence of the carpenters, that they were dismantling the derrick and at the time of the accident had the boom lying on the fifth floor projecting slightly beyond the face of the wall.

Jas. Foley, bricklayers' laborer, was wheeling material north on the fifth floor when he heard a noise, looked around and saw the wall falling.

Wm. Palmer, carpenters' laborer, was standing on the fourth floor, three windows from the west end. Q. "First thing that called your attention was the noise?" A. "Yes." Q. "Could you see daylight?" A. "No, but I could see her open a little and she wobbled like that." Q. "So then Mr. Sole's impression of what happened is nearly correct, the east end fell completely and dragged the west end after it?" A. "Yes."

Albert Hamilton, a bricklayer working on the west wall, heard a noise, looked around and saw the south wall disappear from view going down straight.

These witnesses and others agree that their attention was first arrested by a noise of considerable magnitude. That the first failure was in the upper part of the eastern end of the new wall, that it buckled and fell vertically. It might be added here that the coping was found near the base of the wall.

The only evidence our readers are interested in as given by those witnesses who were inside the old building at the time of the accident, may be summed up in the statement that they all heard a great noise, looked up and saw bricks coming through the ceiling and ran.

The evidence of the contractors, i.e., brick-work and carpenter-work went to show, that they had entered into the agreement for certain consideration to supply material and labor as called for in certain plans and specifications and so far as they were concerned they believed they had lived up to their contract to the satisfaction of the architect, the City Architect and Mr. Neilson. They could not account for the accident, but Mr. Wood said that he would never build a brick wall, using lime mortar, as fast again. They did not consider the vibration from the machinery in the building, nor that from the three hoists of any serious consequence.

The architect of the building explained the plans, and the method of working as already indicated, and further said that this factory was of ordinary and not mill construction.

In order to make it clear to our readers, it would be well to mention here that the by-law defines ordinary mill construction, slow burning, fireproof, etc., and according to their definitions, the Neilson building was not mill construction, because, first of all, the joists were not of 60 sq. in. sectional area; second, the roof boarding was under 2¾-in.; third, wooden corbels were used; fourth, there were a number of wooden partitions less than 2¾-in. in thickness. These, and a few other minor details certainly bear out the architect's classification.

The transverse tie of the building from wall to wall (north to south) was criticised by some of the witnesses and commented on by the press at some length.

In his evidence the architect explained that during construction the tie was as follows:—

Every joist (40 ft. on c.) rested on a duplex wall hanger which had a lug ¾-in. high, so that the joist would have a tie equal to the straining resistance of 3 x 5 sq. inches of Georgia pine. The bearing plate of the hanger was 5 x 9 inches, so that this tie to the wall was at least fair. At every second joist a wall anchor was made fast to the top of the three-inch spruce floor, making fastening number two from the joist to the wall. The other end of the joist rested on a duplex hanger without a lug, so that the tie there was frictional only. The main tie, however, as he explained, consisted in the fact that the floor system in the first bay, 14-in. wide, formed a rigid platform of 5-in. x 12-in. joist to which was securely spiked three-inch spruce flooring in long lengths, and broken joists well fastened to the wall. He further pointed out that when the hardwood floor which would run north and south, was laid, it would complete the system of cross ties. When asked his opinion of the cause of the accident he said he could not tell. There were a number of causes such as vibration, handling material over this green wall, but none of them, nor all of them together, were sufficient, in his opinion, to cause the collapse. It was possible, however, that in handling some of the heavy timbers the wall had received a blow which would weaken it and finally cause the trouble. He said that he was well satisfied with the materials and workmanship of both contractors.

The City Architect in his evidence stated that he had issued the permit for the alteration, claiming that when the windows mentioned before were blocked up, the building would conform to the by-law. It would be well here to look at the reading of the by-law regarding the thickness of walls. Section 22, page 39 reads as follows: "The walls of all brick buildings shall not be built of less thickness than called for in the following tables." The table referring to this building gives the following thickness: basement, 22-in.; 1st floor, 22-in.; 2nd floor, 18-in.; 3rd floor, 18-in.; 4th floor, 14-in.; and 5th floor, 14-in. Sub-section 2, page 44, reads: "In the foregoing tables of thickness of walls the perpendicular distance from the top of joists in one story to the corresponding point in the next story is to be understood to mean not more than 12 feet in the basement or cellar, 19 feet for the first floor, 16 feet for the second story, and 15 feet for each for all stories above the second except the top story, which may have an additional 5 feet in height at the highest point. If any single story exceeds these respective heights the walls of such story and all the stories below the same shall be increased ⅛-inch, or about 4½ inches more than the thickness given in the tables."

Now, in his evidence the City Architect granted the permit knowing that the walls of the first story were only 18-in. and not 22-in., as required by the tables in the by-law, because the walls were old and well set and because the heights of the 1st, 2nd, and 3rd stories, when taken together, did not exceed the limit as set by the by-law. You have but to look at the wording of the by-law to see the very careless interpretation placed on it by the guardian of the public.

To him the collapse was a mystery because the materials used were excellent, the workmanship good, and the work regularly inspected, though not as frequently as he would have liked.

F. H. Sykes, of the Department, identified the plans and specifications of the building as those which he had pased through the office, and presented an elevation of the south wall, as it was just prior to the accident. The plan showed the windows that were to have been blocked up and gave a list of the loads per square foot on the various piers.

Mr. Tice, the inspector of the dictrict and Mr. Price, the Assistant City Architect, also gave evidence. Among other things, they said that the building rested on virgin soil and not made land. That the foundation walls went down some 8 feet and were still in good condition. That the materials used were perfect, the workmanship was first class. To them, as to their chief, the cause of the failure was a mystery.

A most remarkable statement was made by the Assistant City Architect, viz., that the floor load which would be placed on the wall by the hangers which went 5-inches into the wall would be distributed uniformly through the wall by the bonding courses. That after some four or five courses this would not be an eccentric load.

The Expert Witnesses.—R. Marshall, a demonstrator at the School of Science, made a number of tests in the different materials used throughout the building and pronounced them all as good.

Mr. Newall, an experienced builder, examined the ground and pronounced it virgin soil. He also stated that he had plumbed the walls left standing and said that they were plumb and true and that the posts were also plumb.

Robert W. King, a civil engineer, stated that in his opinion the wind blew the south wall out, and that the tie was not strong enough to hold it. The report of the weather as obtained from the Meteorological office, shows that at the time of the accident and for several days previous to it the wind was only a gentle breeze from the east or south so that this theory must be dispensed with.

He also criticized the use of wooden corbels and even though they had nothing to do with the failure of the wall, the point is well taken and in our opinion the by-law section 45, page 97, should be amended so as to include other kinds of construction as well as mill.

The section reads, "If wooden posts are used in **mill construction** they shall have cast, wrought-iron or steel caps of an approved pattern, so constructed as to form a base for the next post above." Certainly the words "mill construction" should be dropped from this by-law.

Prof, C. H. C. Wright, of the University of Toronto, in his evidence stated that he believed the building rested on virgin soil, that the foundation walls were in good shape, that the failure did not start in the old walls and that therefore, the failure to block up the windows in the old wall as required by the department, had nothing to do with the failure. The theory had been advanced by some that the swelling of the 3-in. spruce floor had pushed the wall out. But as he said, this wood went in wet and would shrink rather than swell, and as the boards were nailed on one side, the only effect of shrinking would be to open up cracks between the boards. He claimed that as the openings in the north wall were similar to those in the south it was absurd to talk of the wind forcing a pocket and blowing the south wall out. He agreed with Mr. King that where a system of wooden posts and girders are used, wooden corbels should not be permitted. It was a system that was gradually being done away with and he felt that the city of Toronto might reasonably prohibit their use.

He said that the transverse tie of the wall was sufficient during construction and with the hardwood floor laid, satisfactory.

He said that he considered the vibration from the light machinery in the old building was negligable, but that was due to the handling of the materials over the south wall of the three systems would retard the setting of the mortar. He pointed out that the base of the smaller piers in the fourth story, as the weak spots in the wall. The windows are arranged in groups of three with two small piers between them, while those between the groups are larger. The measurement of the piers on the inside between the wooden sills is two feet, while on the outside it is three, and the offset occurs a half inch back from the face of the wall which is 13½-in. thick.

At this point he stopped to explain that the authorities were often misguided in reference to the strength of brickwork, and masonry. The failure to classify brickwork properly and to distinguish between the piers as built in the laboratory and those built commercially were the reasons for much of the trouble. In the laboratory every brick is selected, they are thoroughly wetted, laid frog up, with even joints of from ¼-in. to ⅜-in. thickness, joints perfectly filled, etc.

To make allowance for this difference, Kidder and other authorities place the **safe** loan on brickwork masonry of hard burned clay brick laid in lime mortar at from 5 to 7 tons per square foot.

The wall under consideration was built of hard burned brick for facing, a good sand lime brick for the inner surface, and a soft brick filler. The bricks on the inner side were smaller than those on the outside, and hence the joints on the inside were thicker than those on the outside. The inside of this wall was therefore, weaker than the outside. The bricks were laid frog down thus losing one-third of the bearing area of the brick. (It is only fair to say here that this is quite a common practice in Toronto).

In his opinion the safe load on this brickwork is five tons per sq. ft. when set. As these piers were only from two to three weeks old, he felt that the safe load on them was not over half the safe load when set.

The weight of the floor and roof without considering any load on either, gives a load of 1,000 lbs. acting 2½ inches in from the inner face of the smaller pier, while that due to the brickwork was 13,000 lbs. acting at the centre of the pier. This gives a stress of between 3.5 and 3.75 tons per sq. ft., which he considered to be beyond the safe stress in these green piers; and whenever a load beyond the safe limit is used a chance is taken. These piers were weaker on the inside than the outside and under this loading they buckled and fell.

Speed, then, was in his opinion, the main cause of the accident. When asked about the material used he said that the materials were all good and the workmanship quite satisfactory.

It might be added here that by insisting on a better classification (i.e., not permitting hard surface brick with soft cores to be classed as hard burned brick) and a more rigid inspection, many cities have raised the safe load for hard burned brickwork with lime mortar, to, from 8 to 9 tons per sq. ft.

In summing up the evidence for the jury the coroner gave a very fair review of the facts as brought out by the investigation. The finding of the jury will, we are sure, prove to be very satisfactory to the profession. It will be agreed that recommendations Nos. 3 and 4 are good, but that Nos. 1 and 2 are weak.

The following is the finding of the jury:—

"It is the opinion of this jury that the collapse of the south wall of the Neilson building was due to a combination of circumstances.

Causes:—

"(1) Vibration caused by the working of the gin wheel, bricklayers' hoist, derrick and machinery in the occupied portion of the building, retarding the setting of the mortar."

"(2) Strain caused by the hauling of all materials over south wall while in a green state."

"(3) The green wall had the load put upon it before the mortar had time to set."

"(4) The above combined with a possible cause set as a jar or shock which the wall may have received while in a green state."

Riders:—

"(1) We are further of the opinion that walls of this height and length should be built of pier construction."

"(2) That in the construction of a building of this type a temporary tie should be used while under construction."

"(3) That buildings of this dimension should be more frequently inspected."

"(4) We would also suggest that cement be used for rapid construction."

When Coroner J. E. Elliott read over the finding, one juror rose to dissent to clause 3 of the causes. He wished it recorded that he did not think the wall was over-loaded.

Prof. Wright made what we consider a wise recommendation when, in his evidence he said that he thought the city should insist on having the staircase in every such factory building enclosed with brick walls or some other substantial fireproof construction.

It would also appear that Section 14, page 38, of the by-law is not enforced. It reads as follows:—"No pier buttress or pilaster shall be built in freezing weather, and all brick in such piers shall be laid frog up and pushplaced or grouted at each course." As Prof. Wright says, why not have bricks always laid frog up and get the bricklayers into a good habit?

GOWANUS CANAL PUMPING PLANT.

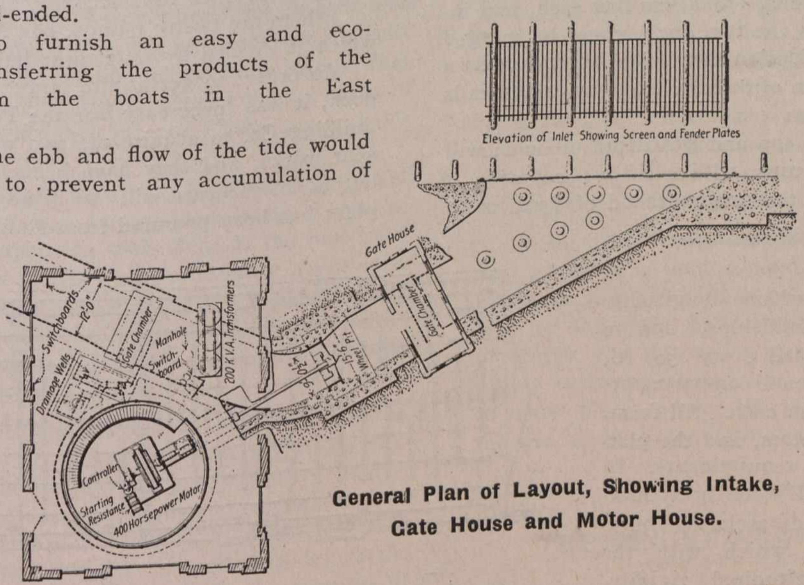
When the Gowanus Canal was constructed in Brooklyn a number of years ago it was heralded as one of the greatest engineering feats of the age.

But it was not long before the engineers were confronted with a serious problem which it has taken thirty years to solve; and only then through the aid of electricity.

The canal was built from the river, through a devious route to a point in the heart of the manufacturing portion of the city, and there dead-ended.

Its purpose was to furnish an easy and economical method of transferring the products of the shippers to and from the boats in the East River.

It was thought that the ebb and flow of the tide would cause enough circulation to prevent any accumulation of impurities which would be disagreeable or unhealthy. A large amount of surface water was drained from the streets and emptied into the canal through sewers, but due to increase of population and manufacturing industries, which are continually depositing waste matter in the canal, the water became most foul and unsanitary. It was also found that the action of the tide had little or no effect in removing the waste matter. This was especially true at the dead-end of the canal, where the stagnation was excessive. The odor was so foul that it could be detected for blocks around, and was so detrimental to the public health in that community that drastic measures were taken to effect more sanitary conditions.



General Plan of Layout, Showing Intake, Gate House and Motor House.

Finally, the city engineers decided on flushing the water from the dead-end of the canal into the river, where it would be carried away by the action of the tide. To accomplish this it was decided to install a screw propeller pump, which would simply pull the water along in the same manner that a propeller pulls a ship against the resistance of the water; in this case, however, the propeller being stationary, the water is forced to move. It was first proposed to employ steam to drive the pump, as had been done on one or two similar installations made in other places, but the engineers soon saw the advantages to be had by employing electric drive, and lost no time in convincing the city authorities of the advantages, and so an induction motor was selected.

The result was the removal of all the filth and polluted waters from the canal and a clean, healthy atmosphere now prevails. Property value in the immediate neighborhood which, under the old regime had sunk to almost nothing, has now increased to its proper value.

The motor and control apparatus are located in the circular pit 24 feet in diameter and 29 feet deep, built under the pump house.

The motor is rated at 400 h.p., and runs at 120 r.p.m. with full load, enabling the pump to deliver 30,000 cubic feet of water per minute. It is located 56½ feet from the propeller, to which it is connected by a shaft eight inches in diameter. The propeller consists of four blades having a pitch of 5 feet 6 inches, and the shaft runs through a water-cooled thrust bearing.

The tunnel is 12 feet deep and 50 feet wide at the canal but narrows down to 9 feet at the propeller, thus allowing ⅛ of an inch clearance for the propeller blades.

This water is discharged into what is known as Buttermilk Channel through a sewer 6,300 feet long. An interesting point in this connection is the fact that the water moved by the propeller weighs 64 pounds per cubic foot, or 2½ pounds per foot more than the weight of pure water.

Electric energy is delivered to the plant at 6,600 volts and is stepped down by means of three oil-cooled transformers at 550 volts, at which potential it is supplied to the motor through a suitable switchboard equipped with the necessary motors and control devices. The motor and control apparatus were furnished by the Westinghouse Electric and Manufacturing Company, East Pittsburg, Pa.

GOVERNMENT DRYDOCK IN TORONTO

In our issue of July 27th, 1911, mention was made of a drydock that was to be constructed at the yards of the Polson Drydock and Shipbuilding Company. When it became known that the Federal Government would give financial aid to the project, Mr. Wm. Newman, works manager, visited several drydocks in Europe and the United States with the result that the original plans and design were altered to a considerable extent.

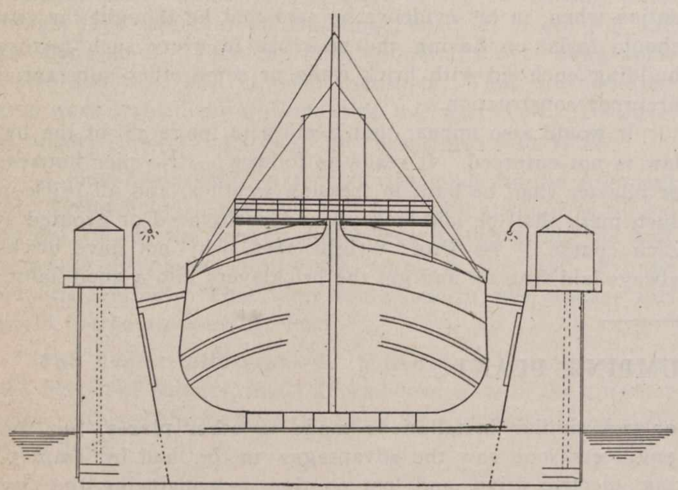


Fig. 1.—Section Through Drydock, Showing Vessel.

The plan as originally laid out called for the construction of the dock in two sections, 150 × 100 feet each, and included arrangements so that the two docks could be merged into one resulting in a combination that would accommodate a ship of 4,500 tons and a beam of 80 feet. The new design calls for a structure 330'0" long: 100'0" wide: 35'4" deep: 72'0" wide on deck: 88'0" wide on top and 8'6" depth of hold: will weigh approximately 2,400 tons, with a lifting capacity of 5,400 tons, and will cost in the neighborhood of $392,000.00.

A reference to Fig. 2 will make the main details of construction clear.

The structure consists of one longitudinal watertight bulkhead amidships, and a transverse watertight bulkhead every 50 ft., dividing the dock into 12 equal compartments 50 ft. square, with a pump in each. All framing is transverse, 30 in. centres, and the plating is in excess of Lloyd's requirements. In addition to the longitudinal watertight bulkhead, there are six longitudinal lattice bulkheads, equally distributed, which, with the sides, insure absolute longitudinal rigidity. There is a transverse truss frame fitted every 10 ft. of ample proportions, which support the bilge block cross tracks. The bilge blocks will have a relieving screw under the top block, and will be of British Columbia fir which will have a certain amount of floating power and will be retained in position by underhung wheels enabling one man to operate them with ease.

There will be a joint in the centre of the dock composed of 6" x 6" x ½" angles riveted round the inside of shell, by means of which the sections are held together by 1¼" machine bolts every 6" with a rubber gasket between to make watertight. Butt straps 30" x ¾" are bolted all around dock at joint above light water mark. Rolling fenders are placed on the inside of dock at the ends to protect dock corners from boats entering and leaving.

Four ship's capstans are situated on the upper deck to handle ship's lines when docking. Another feature is the mooring device of the dock itself. An I-beam is riveted on the outside of the dock, perpendicularly, opposite each bulkhead, which are held in loose clips on the edge of the wharf allowing the dock to raise or lower, or list if necessary, without adjusting.

There will be compressed air, steam, and electric power conduit systems run on both sides of the dock, with manifolds every twenty feet for operating the tools. Sixteen arc lights are hung from the upper deck with plugs for drop lights every ten feet, which will permit of continuous work on the dock when necessary.

The only opening in the dock is a small hatch into each compartment, from the upper deck, which, in case of accident, can be sealed and compressed air pumped in to expel the water.

One section of the dock can be used for docking the other section. This dock is large enough to take the largest and heaviest boat on Lake Ontario, which is the car ferry "Ontario No. 1"—317' 0", between perpendiculars, and 5,146 tons gross. The pumping equipment consists of twelve 12" centrifugal pumps with a capacity of 42,000 imperial gallons per minute, working in batteries of three in each quarter of the dock: each battery driven by a 75 h.p. D.C. motor, and all pumps being controlled from a central station ashore, which commands a view of the entire dock and is all handled by one man.

With this pumping equipment the dock may be emptied of water in twenty-four minutes. The equipment is entirely frostproof and is so designed that the absence of levers and piping is at once conspicuous.

There are twelve pumps, one in each section of the dock, which is divided by watertight bulkheads every fifty feet.

In order to get a site large enough to construct this dock, it was necessary for the Polson Drydock and Shipbuilding Co. to acquire the two water lots east of their present works, and they have been filling in all winter. The output of the yard will be in no way restricted as special plant has been procured from England to carry on the construction of this dock, which no doubt will fill a long-felt want in marine circles in the Port of Toronto. The structure will be located at the foot of Frederick Street.

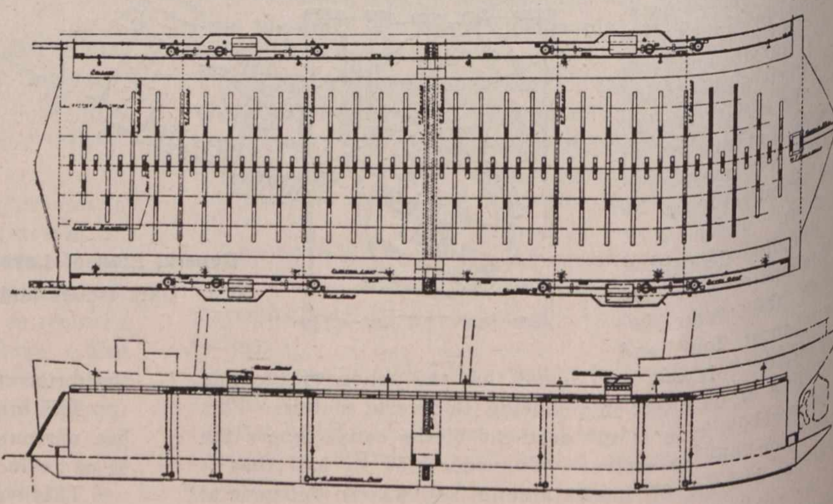


Fig. 2.—Plan and Elevation of Floating Drydock.

Sir Thomas Shaughnessy, of the Canadian Pacific Railway, has announced the intention of that company to double track their line through the Rocky Mountains, at a cost of $60,000,000.

STEAM TURBINE DEVELOPMENT.

The development of the steam turbine has been very rapid. Mr. A. G. Christie in a paper presented to the American Society of Mechanical Engineers recently, takes up the present state of development of large steam turbines. His view of the probable tendencies for the future are of interest and we present them almost in full.

Mr. Christie states that the cost of manufacture is a very important item in determining the future development of the steam turbine. Types such as the original Parsons and the Rateau, while inherently of very high efficiency, have too high manufacturing costs to compete with the newer combined types.

The writer offers as his opinion that the combined types, such as the Curtis-Parsons, the Curtis-Rateau, and also the Curtis-Rateau-Parsons, previously described, will very soon supersede the simple types. It is probable that the Curtis turbine will eventually be built only in horizontal units and will gradually be modified to a Rateau or even a drum impulse construction in the low-pressure sections. The freedom from close adjustment in impulse turbines and the recent improvements in blading materials will greatly increase the use of this type, although Curtis-Parsons turbines are said to be cheaper to manufacture. In actual operation, it is an open question among engineers whether the reaction turbine has a higher commercial efficiency than the impulse type, and hence buyers usually consider first cost and personal preference only.

Turbines will probably be made shorter with very stiff shafts. With this construction many of the earlier blading troubles will disappear. But the peripheral speeds will also be increased and this will involve the development of suitable blading material and methods of holding blades that will satisfy these new requirements. Recent results seem to indicate that improved efficiency may be looked for with increased blade speeds.

Several impulse turbines have been built recently in Europe where the expansion was not complete in the nozzle, so that a portion of the expansion took place in the first moving blades. Some large Curtis turbines recently installed in America are said to have Parsons blading in the last stage. These developments would indicate a movement to introduce reaction principles in impulse turbines, and further illustrate the tendency to merge types.

The hope of further improvement in efficiency lies in extensive study, particularly of the action of the steam during its passage through the moving and stationary blades, of the effect of form of blades, passages and casings and of various forms of baffles and balance pistons to prevent leakage. Such research work has not been carried out up to the present time by most manufacturers, largely on account of the extreme care and heavy expense involved in such tests. The present state of development has been largely one of cut and try. The increasing competition of the gas engine and the possible development of a satisfactory gas turbine will force manufacturers to develop their turbines to the greatest degree of economy.

With regard to detail, simplicity will be the leading consideration. With the introduction of Curtis high-pressure stages, nozzle governing will undoubtedly be used to an increasing extent, though the results obtained by Westinghouse, by Zoelly, and by Bergmann with simple throttling governors, raise a question as to whether the additional complication of nozzle governing will pay. Oil relays will probably replace all other systems of governing on account of their simplicity and reliability. The simple and efficient centrifugal oil pump governor of Sulzer appears to be an improvement of considerable moment, and will probably receive extensive use.

With the development of suitable gearing for steam turbines, their field of application has been greatly increased and turbines will shortly be used for purposes which engineers to-day would consider them utterly unfit.

Low-pressure turbines will continue to be installed in plants where reciprocating engines are still in operation and also where large quantities of waste heat are available. The low and mixed pressure types of turbines will find a very extended use in connection with heating systems, evaporators, etc.

The development of the past ten years has been truly marvellous. No great gain in thermal efficiency seems possible, so that future improvements will be largely along the line of detail construction and modification.

ADVANTAGES OF OIL AS FUEL.

In a recent discussion regarding the oil engine Mr. Wolcott Remington, the designer of the Blanchard Oil Engine, stated very clearly the advantages of oil as fuel. Mr. Remington stated that in general the cost of kerosene oils is approximately one-half the cost of gasolene, while the ordinary distillate and fuel oils may be obtained for about one-fourth of the cost of gasolene. He recommended that oil purchases be made direct from oil companies, as local retailers' prices are frequently twice as much as the former.

In the United States the total annual production of kerosene, fuel and distillate oils is about 6,500 millions of gallons, as against 720 millions of gallons of gasolene. Therefore it is fair to assume that the increasing use of internal combustion engines will not materially affect the cost of oils for a long time to come, since their production is so large and must continue to be so long as gasolene is used. On the other hand gasolene is continually increasing in price and becoming of inferior quality.

A most important advantage of kerosene and fuel oils over gasolene is their comparative safety. Kerosene is non-explosive and has a flash point of 150°F., or more. Gasolene, on the other hand, readily volatilizes at normal temperatures, and this vapor is not only very poisonous but is highly explosive when mixed with air. Insurance companies in many places permit the installation of oil engines where the use of gasolene engines is absolutely prohibited.

THE BEGINNINGS OF MONEL METAL.

About seven years ago one of the large smelting companies began investigating the chemical and physical properties of an alloy that had been reduced directly from nickel-copper matte without the previous separation of the two metals. This alloy was found to possess not only the valuable properties of nickel, but also other desirable properties in addition, that would insure a wide usefulness, and owing to the simple method of production, was obtainable at about one-third the cost of nickel. In 1905-6 the International Nickel Co. considering, no doubt, that for many purposes there was no need to separate the amicable metals nickel and copper, took up the problem of reducing them together and obtaining an alloy of the two metals in the proportions in which they occur in the ore. The alloy thus obtained was named Monel Metal, after Mr. Ambrose Monel, the president of the International Nickel Company.

Table for obtaining Weights of Pipes or Hollow Cylinders of any Substance.

By F. TISSINGTON.

NUMBER OF CUBIC INCHES IN ONE FOOT LENGTH.

Internal Dia.	Thickness of Substance							
	1/16	1/8	3/16	1/4	5/16	3/8	7/16	1/2
1/16	.294	.883	1.767	2.94	4.41	6.18	8.24	10.60
1/8	.442	1.078	2.20	3.53	5.14	7.07	9.27	11.78
3/16	.589	1.472	2.65	4.12	5.89	7.95	10.30	12.96
1/4	.736	1.764	3.09	4.71	6.62	8.83	11.34	14.13
5/16	.883	2.061	3.53	5.30	7.36	9.72	12.36	15.32
3/8	1.032	2.352	3.97	5.89	8.10	10.59	13.4	16.49
7/16	1.178	2.65	4.41	6.48	8.83	11.48	14.43	17.67
1/2	1.320	2.94	4.86	7.06	9.57	12.36	15.48	18.84
9/16	1.472	3.24	5.30	7.65	10.30	13.25	16.48	20.02
5/8	1.620	3.52	5.73	8.24	11.05	14.16	17.52	21.12
11/16	1.767	3.83	6.18	8.82	11.78	15.02	18.55	22.38
3/4	1.908	4.12	6.62	9.42	12.48	15.96	19.56	23.52
13/16	2.06	4.41	7.06	10.01	13.25	16.78	20.61	24.73
7/8	2.20	4.71	7.51	10.47	13.92	17.64	21.6	25.92
15/16	2.35	5.00	7.95	11.19	14.72	18.55	22.6	27.09
1	2.50	5.30	8.38	11.76	15.36	19.44	23.64	28.20
1 1/16	2.64	5.59	8.83	12.36	16.20	20.32	24.74	29 41
1 1/8	2.79	5.88	9.27	12.96	16.92	21.24	25.75	30.60
1 3/16	2.94	6.18	9.72	13.54	17.65	22.08	26.76	31.80
1 1/4	3.09	6.48	10.15	14.16	18.36	22.92	27.84	33.00
1 5/16	3.24	6.76	10.59	14.72	19.14	23.82	28.86	34.16
1 3/8	3.38	7.08	11.05	15.36	19.80	24.72	30.0	35.40
1 7/16	3.53	7.36	11.48	15.9	20.58	25.62	30.92	36.99
1 1/2	3.67	7.68	11.88	16.44	21.36	26.52	31.92	37.68
1 9/16	3 82	7.95	12.37	17.05	22.09	27.39	32.96	38.88
1 5/8	3.97	8.16	12.84	17.64	22.8	28.32	34.00	40.08
1 11/16	4.12	8 54	13.22	18.26	23.56	29.64	35.02	41.23
1 3/4	4.27	8.77	13.68	18.84	24.24	30.0	36.0	42.36
1 13/16	4.32	9.09	14.04	19.44	25.44	30.84	37.08	43.56
1 7/8	4.56	9.42	14.58	20.04	25.80	31.80	38.16	44.76

Internal Dia.	Thickness of Substance									
	3/16	1/4	5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4
2	15.48	21.12	27.24	33.6	40.20	47.16	54.36	61.80	69.6	77.7
2 1/8	16.34	22.38	28.71	35.34	42.26	49.47	56.98	64.8	72.9	81.2
2 1/4	17.16	23.52	30.12	37.08	44.28	51.84	59.64	67.68	76.2	84.8
2 3/8	18.10	24.73	31.65	38.86	46.38	54.19	62.29	70.68	79.3	88.3
2 1/2	18.96	25.92	33.12	40.68	48.48	56.52	64.92	73.56	82.5	91.8
2 5/8	19.88	27.09	34.6	42.42	50.52	58.92	67.59	76.56	85.8	95.4
2 3/4	20.76	28.00	36.12	44.16	52.56	61.20	70.20	79.44	90.2	98.8
2 7/8	21.64	29.46	37.56	45.96	54.63	63.62	72.9	82.47	92.3	102.5
3	22.56	30.60	39.00	47.64	56.64	65.88	75.48	85.32	95.5	105.9
3 1/8	23.41	31.81	40.5	49.48	58.76	68.34	78.20	88.36	98.8	109.6
3 1/4	24.3	32.98	41.97	51.25	60.82	70.69	80.85	91.3	102.1	113.1
3 3/8	25.17	34.16	43.44	53.01	62.88	73.04	83.49	94.3	105.3	116.6
3 1/2	26.06	35.34	44.91	54.78	64.94	75.39	86.16	97.2	108.4	120.1
3 5/8	26.95	36.48	46.32	56.52	66.96	77.76	88.8	100 08	111.7	123.6
3 3/4	27.84	37.70	47.86	58.32	69.12	80.16	91.44	102.96	114.9	127.2
3 7/8	28.71	38.88	49.32	60.12	71.16	82.44	94.08	105.9	118.2	130.8
4	29.60	40.08	50.88	61.92	73.20	84.8	96 72	108.9	121.5	134.4
4 1/8	30.48	41.28	52.32	63.6	75.24	87.12	99.36	111.9	124.7	137.8
4 1/4	31.44	42.48	53.76	65.4	77.28	89.52	102.1	114.8	128.0	141.3
4 3/8	32.28	43.56	55.2	67.08	79.32	91.92	104.6	117.8	131.1	144.8
4 1/2	33.12	44.76	56.64	68.88	81.48	94.2	107.4	120.7	134.4	148.4
4 5/8	33.96	45.84	58.08	70.68	83.4	96.0	109.9	123.6	136.8	151.9
4 3/4	34.8	47.04	59.64	72.36	85.56	98.88	112.5	126.6	140.8	155.5
4 7/8	35.76	48.36	61.08	74.28	87.60	101.2	115.3	129.6	144.2	159.0
5	36.72	49.44	62.64	75.96	89.64	103.6	117.9	132.6	147.3	162.6
5 1/4	38.52	51.84	65.52	79.56	93.8	108.4	123.2	138.4	153.9	169.6
5 1/2	40.2	54.2	68.5	83.16	97.9	113.1	128.6	144.3	160.4	176.7
5 3/4	42.0	56.64	71.4	86.64	102.1	117.8	133.9	150.2	165.9	183.8
6	43.68	58.92	74.4	90.12	106.2	122.5	139.2	156.1	173.2	190.8

This table may be used for any substance having the form of a hollow cylinder. If the weight is desired, all that is necessary is to know the weight per cubic inch of the material and multiply the values given in the table for a particular diameter and thickness of material and the answer will be in pounds per foot run.

Below are given values for a few of the common materials usually met with in the form of tubes:

Material	Wt. cub. in.
Wrought Iron Solid Drawn Tubes	.283 lbs.
Do. Lap Welded	.270 ,,
Do. Boiler Tubes	.277 ,,
Cast Iron	.263 ,,
Steel	.282 ,,
Copper, Cast	.314 ,,
Do. Sheet	.322 ,,
Do. Seamless	.329 ,,
Bronze Copper 8, Tin 1	.306 ,,
Brass, Cast	.297 ,,
Do. Sheet	.303 ,,
Aluminium	.092 ,,
Do. Bronze Al. 10%	.278 ,,

Material	Wt. cub. in.
Glass	.107 lbs.
Do. Common	.091 ,,
Platinum	.778 ,,
Silver	.378 ,,
Tin	.265 ,,
Zinc	.260 ,,
Lead	.410 ,,
Do. Composition 7 Lead, 1 Tin	.382 ,,
Do. do. 7 Lead, 1⅓ Tin	.373 ,,
Do. do. 7 Lead, 2 Tin	.363 ,,
Do. do. 7 Lead, 4 Tin	.340 ,,
Do. do. 7 Lead, 8 Tin	.315 ,,
Do. do. 7 Lead, 16 Tin	.300 ,,

The figures given above are intended to represent average values, and if very near results are required the weight per cubic inch of the material in question should be obtained specially.

The Canadian Engineer

ESTABLISHED 1893.

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EXPERT TESTIMONY.

Very often the engineer is called upon to give expert testimony in cases before the courts, and oftentimes he is asked to prepare reports on the values of properties and damages to properties by public undertakings or improvements. In compiling these reports the subject must be looked at from every viewpoint, and the engineer must take the utmost care to maintain a fair and judicial attitude towards the claims of both parties. A prominent consulting engineer, in a recent address, states that it is quite easy to set up a theory of damages, and, assuming such a theory to be correct, to make figures which are favorable to the interests for which the expert is working, and this he considers proper, provided the engineer believes the theory to be correct and to meet the conditions fairly.

Recent expert medical testimony given in some of the recent criminal cases in the United States makes the public feel rather critical towards expert testimony in general. The engineer, in dealing with cases which require a judicial atitude, has a perfect right to work in the legitimate interests of his client, but he should also keep in mind the right of the opposing party. It is only by so doing that the engineering profession can be kept from falling into disrepute in connection with court cases.

CHEMICAL ANALYSIS OF CEMENT.

Much has been said recently with regard to the value of chemical analysis for the testing of Portland cement. Many chemists claim that the chemical analysis of a cement will indicate its quality better than a standard physical test. An engineer stated in the hearing of the writer a few days ago that in his opinion the chemical analysis method had not received the recognition for testing purposes that it deserved, and he inferred that the reason for this was the natural conservatism of the engineer with regard to a new idea. The United States Bureau of Standards has just issued Bulletin No. 33, covering the United States Government specifications for Portland cement, including specifications, standard method of testing, methods of chemical analysis, investigation of results and auxiliary specifications. The opinions there expressed leave little doubt as to the opinion of the Bureau of Standards concerning the chemical analysis method for determining the quality of cement. A normal Portland cement which meets the standard specifications for soundness, setting time, and tensile strength has an approximate composition within the following limits:—

	Per cent.
Silica	19.0 to 25.0
Alumina	5.0 to 9.0
Iron oxide	2.0 to 4.0
Lime	60.0 to 64.0
Magnesia	1.0 to 4.0
Sulphur trioxide	1.0 to 1.75
Loss on ignition	0.5 to 3.00
Insoluble residue	0.1 to 1.00

It is also true that a number of cements have been made both here and abroad which have passed all standard physical tests in which these limits have been exceeded in one or more particulars, and it is equally true that a sound and satisfactory cement does not necessarily result from the above composition. It is probable that further investigation will give a clearer under-standing of the constitution of Portland cement, but at present chemical analysis furnishes but little indication of the quality of the material.

Defective cement usually results from imperfect manufacture, not from faulty composition. Cement made from very finely ground material, thoroughly mixed and properly burned, may be perfectly sound when containing more than the usual quantity of lime, while a cement low in lime may be entirely unsound, due to careless manufacture. The analysis of a cement will show the uniformity in composition of the product from individual mills, but will furnish little or no indication of the quality of the material. Occasional analyses should, however, be made for record and to determine the quantity of sulphuric anhydride and magnesia present.

The ground clinker as it comes from the mill is usually quick setting, which requires correction. This is usually accomplished by the addition of a small quantity of more or less hydrated calcium sulphate, either gypsum or plaster of paris. Experience and practice have shown that an addition of 3 per cent. or less is sufficient for the purpose. Three per cent. of calcium sulphate ($CaSO_4$) contains about 1.75 per cent. sulphuric anhydride (SO_3), and, as this has been considered the maximum quantity necessary to control the time of set, the specification limits the SO_3 content to 1.75 per cent.

The specification prohibits the addition of any material subsequent to calcination except the 3 per cent. of calcium sulphate permitted to regulate time of set. Other additions may be difficult or impossible to detect, even by a careful mill inspection, during the process of manufacture, but as the normal adulterant would be ground raw material, an excess of 'insoluble residue' would reveal the addition of silicious material, and an excess in "loss of ignition" would point to the addition of calcareous material when either is added in sufficient quantity to make the adulteration profitable.

The effect of relatively small quantities of magnesia (MgO) in normal Portland cement, while still under investigation can be considered harmless. Earlier investigators believed that as magnesia had a slower rate of hydration than lime, the hydration of any free magnesia (MgO) present would occur after the cement had set and cause disintegration. The effect of magnesia was considered especially injurious when the cement was exposed to the action of sea water. More recent investigation has shown that cement can be made which is perfectly sound under all conditions when containing 5 per cent. of magnesia, and it has also been found that the lime in Portland cement exposed to sea water is replaced by magnesia. The maximum limit for magnesia has been set at 4 per cent., as it has been established that the quantity is not injurious, and it is high enough to permit the use of the large quantities of raw material available in most sections of the country.

For some time, therefore, it will be better for the engineering profession to depend on the standard physical tests, at least until chemical analysis can furnish sure indication of the quality of the material.

EDITORIAL COMMENT.

Plumbers and gasfitters have arisen to the dignity of Sanitary Engineers. The advance guard who prepare the ground for a visiting circus class themselves as Circus Engineers. The profession is ever broadening.

A prominent contractor states that in one case the saving of concrete by reducing the size of columns on successive floors was $2.30 per column; on the other hand the increase in form cost was $5.70 per column, entailing a net loss of $3.40 per column. This is a very good example of why it is cheaper to use the same size column on successive floors than to reduce the dimensions. To avoid frequent changes in column sizes column reinforcement may be varied in successive stories.

* * * *

In this issue will be found the full report of the inquest into the collapse of the south wall of the Neilson building. We have endeavored to present the salient points of the evidence given by the several witnesses. Many matters of interest to the engineering profession were brought out, as may be seen by a perusal of the article. The evidence as given by Professor C. H. C. Wright was particularly clear, and his statements give a logical presentation of the reasons for the failure, with suggestions for changes in the city by-law, which the City Architect and the city will do well to heed.

EFFICIENT WATERWORKS.

The operation of the municipal waterworks of Berlin, Ont., under commission rule, has proved thoroughly successful. The plant was first installed in 1888, by Messrs. Moffett, Hodgkins and Clarke, of Syracuse, N.Y. They secured their supply from a pond, and had a ten-year franchise.

When it expired the ratepayers decided to take over the plant, at a valuation of $102,000. Then there were only 13 miles of mains, 104 hydrants and 732 consumers.

Under civic ownership, the system has grown to that stage where there are now 34 miles of mains, 218 public and 16 private hydrants, and 2,872 consumers, of which 2,229 are on meters.

The water supply has been greatly increased. Artesian wells have been sunk and the water is being pumped by the air-lift system.

But what affects the consumers most of all is the reduction in the rates and a purer supply of the drinkable.

Under private ownership, the rates for an ordinary house with full plumbing and lawn service, was $19 a year. Now, under municipal ownership, it is $4.59 for the same service, per year.

The minimum charge is now $1.12½ per quarter, for 6,250 gallons or less, and the rates for larger consumers range from 17 to 6 cents per thousand gallons, according to the quantity used.

In addition to the reduction of the rates to the private consumers, the charge for street hydrants, for protection from fire, have been reduced from $50 to $25, and there is now no charge for meter rentals.

The profits from the system, which have been used in extending the service, and the original debenture debt has been reduced to $85,465. And after writing off $32,000 for depreciation, the department shows a balance of assets over liabilities of $141,642.

The commissioners have the confidence of the citizens as there have been few objections—in the way of candidates to oppose members—raised.

The growing needs of the new city have made it necessary to enlarge and improve the system and the confidence of the ratepayers was shown when they passed a by-law to grant $100,000 for this purpose. Some of the contracts have been already awarded and it is expected that the work will be completed this year.

THE DESIGN OF INDUCTION MOTOR SHAFTS TO RESIST DEFLECTION.

By Mr. Bradley T. McCormick.*

The designer of electrical machinery is constantly confronted with the problem of reconciling the requirements of good electrical characteristics with reliability of service. A certain proportion of mechanical dimensions will give a machine which shows up best from the standpoint of electrical performance curves, but the proportions may be so extreme from the mechanical standpoint as to make the machine utterly unreliable.

A striking example of conflicting mechanical and electrical requirements is the polyphase induction motor as applied to industrial purposes.

In order to keep the power factor as high as possible it is necessary to design induction motors with the air gap or clearance between the rotor and stator as small as is consistent with reliable operation. Every precaution must be taken to obtain an accurate bore of the inside surface of the stator and a perfectly true rotor, with shaft and bearings of sufficient stiffness to limit the deflection to a small percentage of the normal length of the air gap.

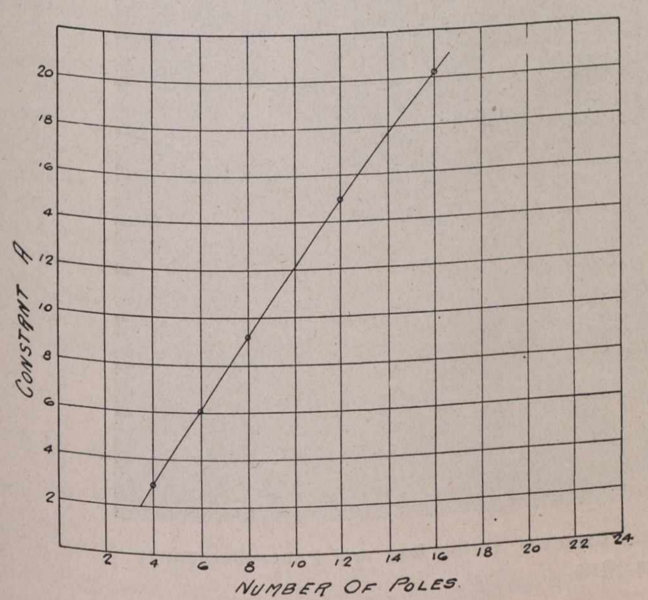


Fig 1

If the air gap is perfectly uniform, the radial magnetic attraction between the rotor and stator is the same at all points and is completely balanced; but if the clearance between the rotor and stator becomes reduced at any point, the decrease in reluctance of the air gap at this point and the increase in reluctance at a point diametrically opposite, set up an unbalanced magnetic attraction, tending to spring the rotor still more out of centre, and in some cases so far as to make it "rub" against the stator.

Fisher Hinnen, in his book entitled "Continuous Current Dynamos," gives the following formula for unbalanced magnetic pull:

$$z = \frac{\left(\frac{B}{1000}\right)^2 S}{72} \quad \frac{x}{\Delta\, k} A \qquad (1)$$

while Behrend, in a paper before the American Institute of Electrical Engineers, November 23rd, 1900, gives for induction motor, a formula which in a slightly modified form is as follows:

$$z = \frac{\left(\frac{B}{1000}\right)^2}{\alpha} \quad \frac{R\, c}{72} \quad \frac{2\, x}{\Delta} \% \qquad (2)$$

The meaning of the symbols is shown in the table at the end of the paper, all values being expressed in the inch system. The constant α is a fringing coefficient slightly greater than unity, and takes account of the higher reluct-

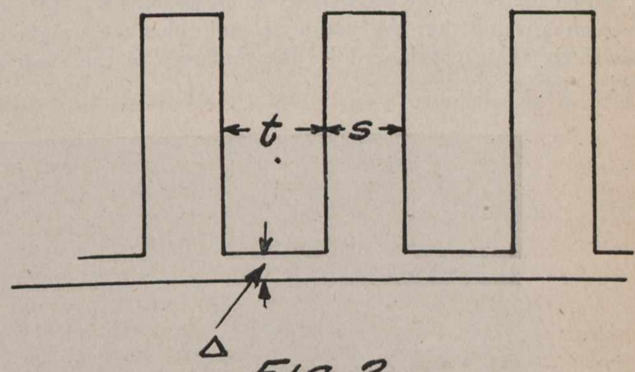


Fig 2.

ance of the air gap of a toothed armature as compared with a smooth core. The values of α given by Carter Electrical World and Engineer, (Vol. 38, Fig. 384), are recommended, but the following gives values of α which are close enough for all practical purposes. (See Fig. 2.)

$$\alpha = \frac{t + s}{t + \frac{5\,\Delta\, s}{5\,\Delta + s}} \qquad (3)$$

For direct current machines or alternators having salient poles, the flux density is fairly uniform over the pole face and may be taken as

$$B = \frac{\varphi}{\tau\, L\, \alpha} \% \qquad (4)$$

while in induction motors the flux density over a pole pitch approximates a sine distribution, so the square root of mean

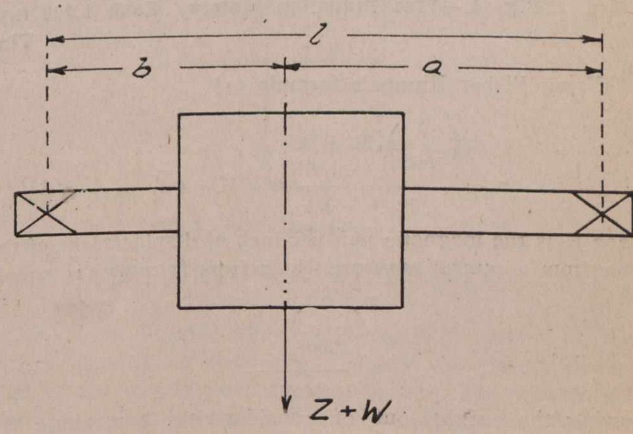


Fig 3

square value should be used for B, since it enters into the formula for unbalanced pull, in the second power. For induction motors use

$$B = \frac{\varphi}{\tau L} \; \frac{\pi}{2} \; \frac{I}{\sqrt{2}} \alpha = 1{\cdot}11 \frac{\varphi}{\tau L} \alpha \qquad (5)$$

* Electrical engineer for Allis-Chalmers-Bullock, Ltd., Montreal.

The following is used for air gap area, the factor % being unity in induction motors,

$$S = \frac{T L \%}{\alpha} \qquad (6)$$

Fisher Hinnen's formula (1) although evidently intended more for direct current machines, checks fairly well with Behrend's formula (2).

We shall first assume that, due to imperfect assembling or non-uniformity of the stator bore, there is an initial eccentricity equal to e. When the machine is excited this initial eccentricity gives rise to an unbalanced magnetic pull Z, which increases the eccentricity to an amount x = (e + d) to such a value that the magnetic pull, plus the weight of the rotor, is just balanced by the tendency of the shaft to resist further flexure.

And the deflection due to weight alone is,

$$\delta = \frac{W a^2 b^2}{3 l E I} \qquad (10)$$

The total eccentricity is,

$$x = d + e \qquad (11)$$

The stress in the shaft can be calculated from the total pull W + Z, while the deflection of the shaft from its natural unstrained position is,

$$\text{Total deflection in shaft} = d + \delta \qquad (12)$$

As a method of procedure in applying the above formulas, the writer would suggest that, having decided upon the length of the air gap Δ, a shaft be chosen that appears to be large enough and then checked for stiffness on the assumption of a reasonable initial deflection. As a first approximation in determining the size of the shaft, it is considered good practice to adopt a shaft large enough to limit the deflection due to weight alone, to one-tenth the normal air gap. For checking purposes, however, the initial eccentricity should preferably be assumed somewhat greater than $\Delta/10$.

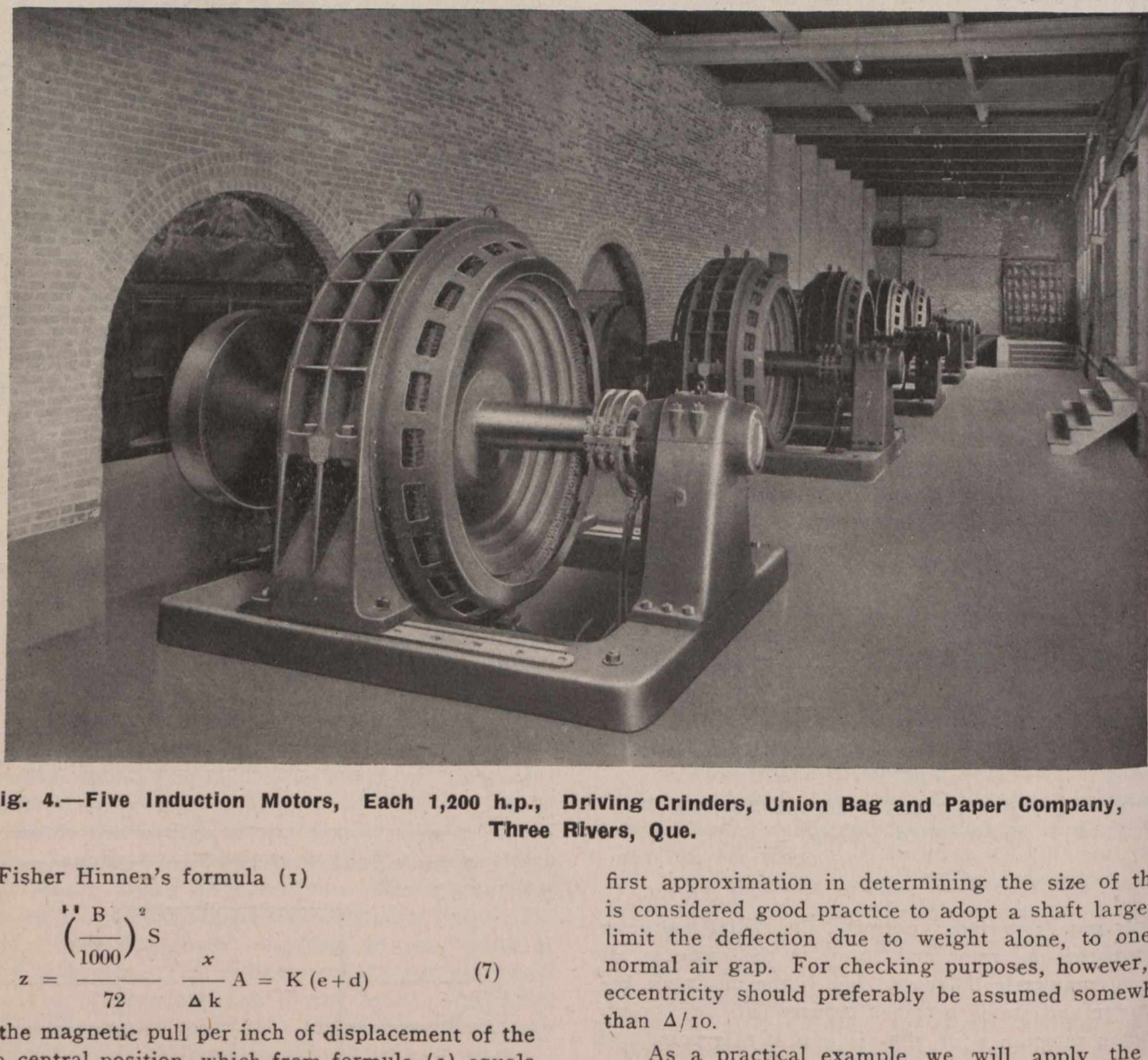


Fig. 4.—Five Induction Motors, Each 1,200 h.p., Driving Grinders, Union Bag and Paper Company, Three Rivers, Que.

Using Fisher Hinnen's formula (1)

$$z = \frac{\left(\frac{B}{1000}\right)^2 S}{72} \; \frac{x}{\Delta k} A = K (e + d) \qquad (7)$$

When K is the magnetic pull per inch of displacement of the rotor from a central position, which from formula (1) equals

$$k = \frac{\left(\frac{B}{1000}\right)^2 S A}{72 \, \Delta \, k} \qquad (8)$$

Leaving the weights out of consideration, but taking the deflection due only to the magnetic pull Z, we have. (See Fig. 3).

$$d = \frac{z a^2 b^2}{3 l E I} = \frac{K (e + d) a^2 b^2}{3 l}$$

Solving for d

$$d = \frac{e}{\dfrac{3 l E I}{K a^2 b^2} - 1} \qquad (9)$$

As a practical example we will apply the foregoing formulas to some 1,200-horse-power induction motors which the writer was recently called upon to design. The specifications called for motors constructed in such a way as to allow the yoke to slide along the base in a direction parallel to the shaft, far enough to completely uncover the rotor winding, in order that the coils might be readily accessible for repairs.

The motors were to be subjected to rather rough service as they were designed to drive grinders in a pulp mill, where the torque often suddenly rises to 50 or 100 per cent. above normal when the logs are fed too fast to the grinding stones. The wide space between bearing centres necessary to permit lateral movement of the yoke, and the small air gap necessary to obtain good power factor with open slots, requires that special consideration be given to the design of the shaft, in order to secure stiffness against deflection due to the weight of the rotor and unbalanced magnetic attraction between the rotor and stator. This point will be readily appreciated by reference to the heavy shaft and long

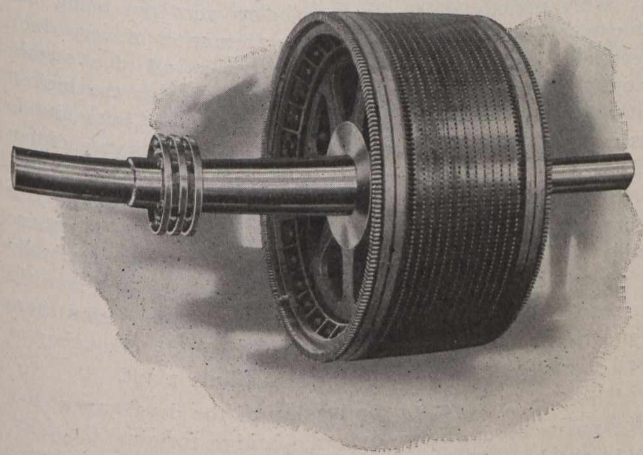


Fig. 5.—Rotor, Showing Long Space Between Bearing Centres.

space between bearings, as shown in Figs. 4 and 5. The following values apply to these motors:—

A = 17.5 for 14 poles (See Fig. 1).
L = 32.2 sq. in.
φ = 6.7 x 106.
Δ = .09".
k = 1.115 from calculated saturation curve.
Diam. of shaft 14" at hub.
I = 1880 = moment of inertia of shaft.
e = assume .02.
α = 1.37.
w = 15,000 lbs.
a = 72" (See Fig. 6).
b = 37" (See Fig. 6).

Calculated Values.

Form (5) $B = 1.11\dfrac{\varphi}{\tau L} = 1.11\dfrac{6.7\times10^6}{32.2}\times1.37 = 31700$

Form. (6) $S = \tau L \%/\alpha = 32.2\times1/1.37\times235$ sq. in.

Form. (8)

$$K = \frac{\left(\frac{B}{1000}\right)^2 S\ A}{72\ \Delta\ k} = \frac{31.7^2\times235\times17.5}{72\times\ .09\times1.115} = 560{,}000 \text{ lbs.}$$

Form. (9)

$$d = \frac{e}{\dfrac{3\,l\,EI}{K\,a^2\,b^2} - 1} = \frac{.02}{\dfrac{3\times109\times30\times10^6\times1880}{560000\times72^2\times37^2} - 1} = .0055$$

Form. (11) $x = d + e = .0055 + .02 = .0255$

Form. (10) $\delta = \dfrac{W\,a^2\,b^2}{3\,l\,E\,I} = \dfrac{15000\times72^2\times37^2}{3\times109\times30\times10^6\times1880} = .00577$

Form. (12) total deflection of shaft $= d + \delta = .0055 + .00577 = .01127$

Form. (7)

$$z = \frac{\left(\frac{B}{1000}\right)^2 S}{72}\ \frac{x}{\Delta\ k} A = \frac{31.7^2\times235}{72}\times\frac{.0255}{.09\times1.115}\ 17.5 = 14200$$

Total Pull on shaft = W + z = 15000 + 14200 = 29200 lbs.

Symbols.

B = density per sq. in. in air gap, the increase due to fringing being included.

S = air gap area per pole corrected for fringing $= \dfrac{\tau L}{\alpha}$ for induction motors $= \dfrac{\tau L}{\alpha}$ % for salient pole machines.

Δ = actual air gap (normal).

e = initial eccentricity with no excitation, due to imperfect centring.

d = additional deflection due to magnetic pull.

χ = total amount of eccentricity = d + e.

A = a constant depending upon the number of poles. (See Fig. 1).

For large number of poles, A = 1.25 x number of poles.

k = (gap + iron) A.T. ÷ gap A.T.

K = deflection per inch of eccentricity $= \left(\dfrac{B}{1000}\right)^2$ S.A./72 Δ k.

a and b = distance from armature centre to bearing centres, in inches.

l = distance between bearing centres, in inches.

E = modulus of elasticity of shaft.

I = moment of inertia of shaft about neutral axis = $1/64\pi D^4$.

W = weight of armature, in pounds.

δ = deflection of shaft due to weight alone.

φ = flux per pole.

τ = pole pitch.

α = Carter coefficient for fringing.

L = effective length of iron parallel to shaft. (Fisher Hinnen's formula).

R = radius of stator, inches.

c = effective length of iron parallel to shaft. (Behrend's formula).

% = pole arc ÷ pole pitch. This is necessary to make Behrend's formula applicable to alternators and D.C. machines.

D = diameter of shaft at hub.

t = width of tooth at air gap.

s = width of slot.

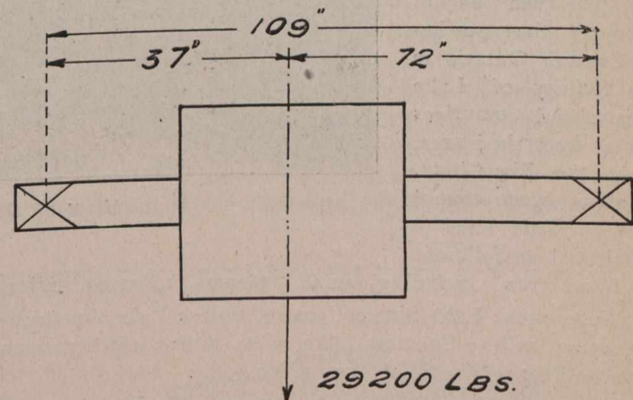


Fig. 6.

THE DRYDOCK AT QUEBEC.

Mr. F. G. Wilson, who has prepared a report on the proposed Quebec drydock, has placed his papers in the hands of the proper government officials. Mr. Wilson has gone over the ground and made a careful examination of all the plans, including the latest submitted by Mr. Cravin.

Besides examining the merits of the different plans and the different sites, he has taken information from a number of practical shipping men with regard to the ice conditions, etc., and has sounded them as to their opinions on the merits of the two sites. Naturally these opinions vary somewhat, but from what has been learned it is understood that the site will be on the south shore of the St. Lawrence. Mr. Wilson is from Great Britain and is considered an expert in matters pertaining to drydocks.

THE HYDRO-ELECTRIC PLANT OF THE SIMCOE RAILWAY AND POWER COMPANY.

An interesting hydro-electric installation which has been completed and in service for some months is the plant of the Simcoe Railway and Power Company, at Big Chute, on the Severn River. It serves with electric power the towns of Midland, Penetang, Victoria, Ontario Harbour, Port McNicholl, Coldwater, Barrie and Orillia, in the counties of Simcoe and Muskoka. The installation is the largest hydraulic development in the Georgian Bay District and has an ultimate capacity of 7,000 h.p.

Development was started in the fall of 1909, and in May, 1911, 4,200 horse-power was developed and commercially available in Midland. The power market will include the municipal and industrial operations in the towns in the vicinity and in addition the flour mills and immense grain elevators now constructed after the determination of the Canadian Pacific and Grand Trunk Railways to make the district the terminus of the lake carrying portion of the grain route from the West. The natural market possibilities are large and will doubtless soon necessitate the further extension of the Big Chute plant and the development of the Little Chute and the falls at Port Severn, in the near future: the latter sites are now held by the power company.

View of Generating Station.

The general location of the Severn River waterway system is such as to drain all that portion of Central Ontario in the vicinity of Lake Simcoe and comprises a total watershed area, above the Big Chute, of about 2,250 square miles. This area is constituted as follows:

Land area, including small streams, 1,800 sq. miles.

Water area: Lake Simcoe, 300 sq. miles; Lake Couchiching, 15 sq. miles; Sparrow Lake, 5 sq. miles; other various lakes and large rivers, 130 sq. miles.

The general nature of the country drained has two characteristics. The southerly portion of the area comprises rolling and flat country and the northerly portion, rough, rocky and hilly regions. At one time the area was wooded but recent lumbering operations have deforested the northerly portion very rapidly, only a portion at the extreme north-easterly end and isolated districts in the north-west still remaining. Probably seventy per cent. of the area may be generally termed settled, the southerly portion being fairly dense and the north, sparsely. Settlement, however, is proceeding in the north and the streams are consequently being improved and lands drained. Owing to the large proportion of lake area in the watershed the discharge of the Severn River is comparatively steady throughout most of the year, as the lakes act as regulating reservoirs.

Based on continual measurements during the last twelve years, the flow of the Severn above the Big Chute locality for practically the whole year will, it is estimated, not fall below 950 cubic feet per second excepting from the middle of January to the middle of March. Water control of the head lakes will effectually conserve the water supply and, deforestation having reached its limit, reforestation will gradually retard the run-off to benefit the continual flow.

Temperatures in this district run very low in the winter, short periods at 30 degrees below zero not being uncommon. The result of this is the formation of very thick sheet ice on the quiet waters of the river and of a certain amount of frazil ice in the falls and rapids as the broken water is exposed to the cold air. The Big Chute site is fortunately situated in this respect, as for a distance of ten miles above the chute the few very slight "swifts" are flooded out. At Ragged Rapids, ten miles above the Big Chute, the town of Orillia has developed power so that those rapids have been flooded and during the winter practically all the water is passed through their hydraulic system without coming in contact with the air. It is evident that there is practically no opportunity for the formation of anchor or frazil ice which would affect the Big Chute plant.

The Severn River in the locality of the development has three points of discharge over the bridge forming the falls. These are Lost Channel, Six Mile Channel, and Big Chute; the former are distant 2½ and 1 mile upstream from the Big Chute. The river at Big Chute makes a straight rapid series of falls through a narrow gorge for about 300 yards after which the stream divides, part going straight to the lower pool, the main part, however, passing to one side into a middle pool, thence out into the lower pool over a small cascade 2 feet in height. The total natural fall under normal conditions is 50 feet.

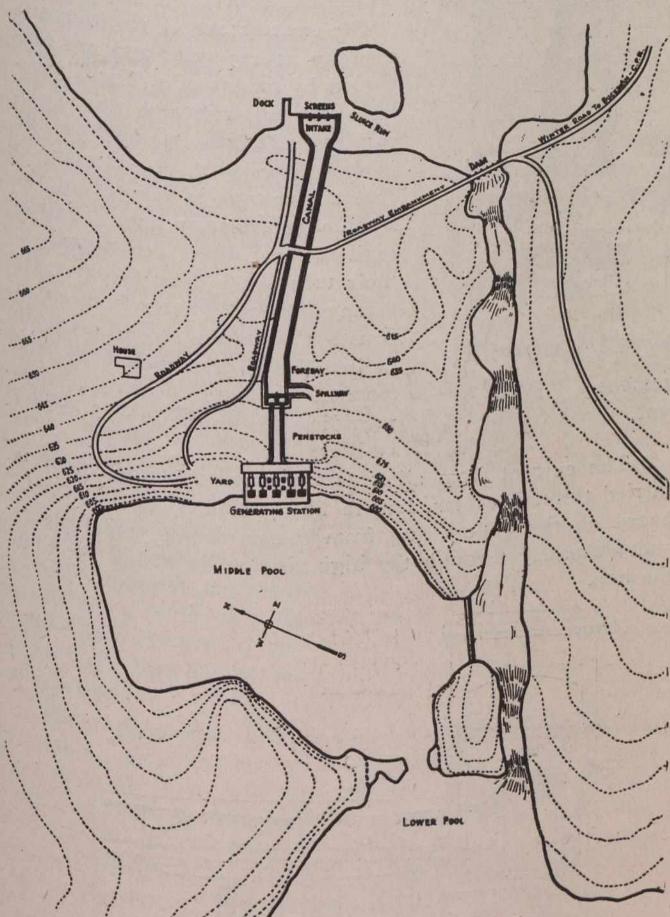
The general hydraulic portion of the development included the construction of dams, intake, canal, forebay, gates, spillway, penstocks, power station, hydraulic machinery and tail discharge, the whole providing for a development of 58 feet head.

The Big Chute dam consists of massive piers and concrete sills with stop logs and spill crests. The piers are bridged over and form the roadway bridge for the winter road and for the road from a boat landing some two miles below to which the river is navigable from Port Severn on the Georgian Bay; the winter road is direct to Buckskin Station on the Toronto-Sudbury line of the Canadian Pacific Railway.

Lost Channel dam is located in a narrow gorge and consists of stop logs seated in shore piers. The Six Mile Channel dam is of similar construction to the Big Chute dam.

The water is carried through a canal from the upper level to the forebay at the brow of the rocky ridge above the middle pool and from thence to the power house through steel penstocks and is discharged from the turbines into the middle pool underneath the power house and thence into the lower pool below the foot of the chute. The chute is dammed where dividing at the "Twin Falls" to compel the overflow water to go directly to the lower pool; the rocky ridge between the middle and lower pools has been removed and the difference in level gained for the lower head.

The canal entrance widens out to form an intake which is protected with four sets of racks supported by the concrete piers. The photograph of the intake shows the piers and framing for racks and further shows the canal in the background. Racks are of iron with wooden tops extending out of the water so that the frost from the air cannot be conducted to the iron portion in winter, thus preventing the freezing up of the openings between rack bars. The concrete is built up on the solid bed rock and continues along as lining for the canal to the forebay. Stoop log seats are arranged at the entrance from intake to canal so that the head-water can be shut off entirely from the canal. A sluice run has been excavated alongside the intake in the river bed to take care of the ice and debris.

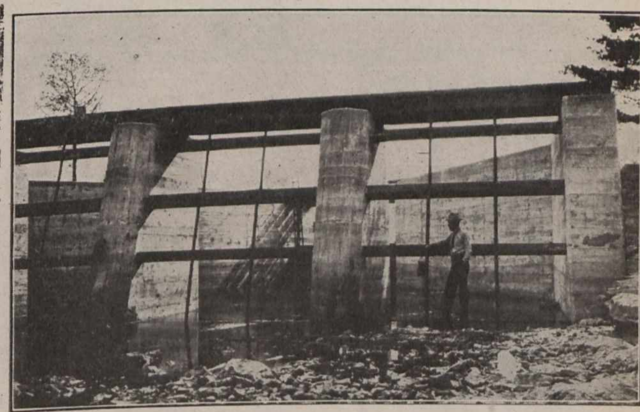


Plan Showing General Layout of Headworks and Generating Station.

The canal is about 500 feet long and terminates in a forebay from which two steel penstocks, nine feet in diameter, lead down to the power house. The forebay is protected by a housing which will be heated in extreme weather; a curtain of 8 x 10 timber extends from the housing sills downwards into the water and both encloses the air space in the forebay and acts as an ice and trash boom in front of the racks. A spillway with adjustable stop-logs, forward of the curtain, regulates the water level and discharges debris; a small sluiceway is placed in front of the racks, in the housed portion, and carries out any debris caught by the racks. Both spillway and sluice discharge into a natural gully in the rock and flow down to the lower pool. The racks are of iron bars arranged for easy handling and raking.

The penstock entrance has a large bell-shapel mouth about 13 feet in diameter; stop-logs with handling winches act as penstock gates.

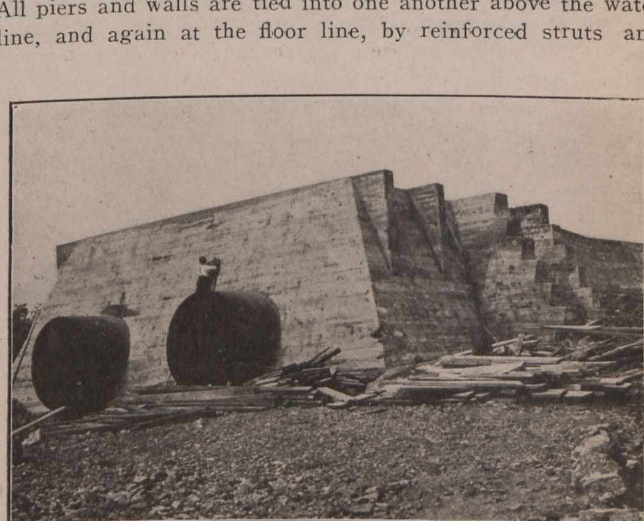
Up to this point the development is for the ultimate output, but at present but one of the penstocks is installed. The total machinery provided for will be 6,800 h.p. of hydraulic turbines; at present 4,200 of this is installed, in three main units and two exciters, leaving two main units to be installed later. The third power turbine will be fed ultimately from both penstocks with a Y connection and the exciter will be also arranged to connect to either source.



Intake to Power Canal, Unwatered—Severn River.

The penstock is carried on several concrete piers for about 150 feet down the slope and turns along the rear of the power house, terminating in a surge tank extending to an elevation four feet above that maintained in the forebay. Nos. 1 and 2 turbines are connected with the penstock by diverging feeders and No. 3, the centre unit, is connected by the present portion of the Y connection. No relief valves are installed on penstock or turbines, the surge tank being ample to take care of all pressure changes.

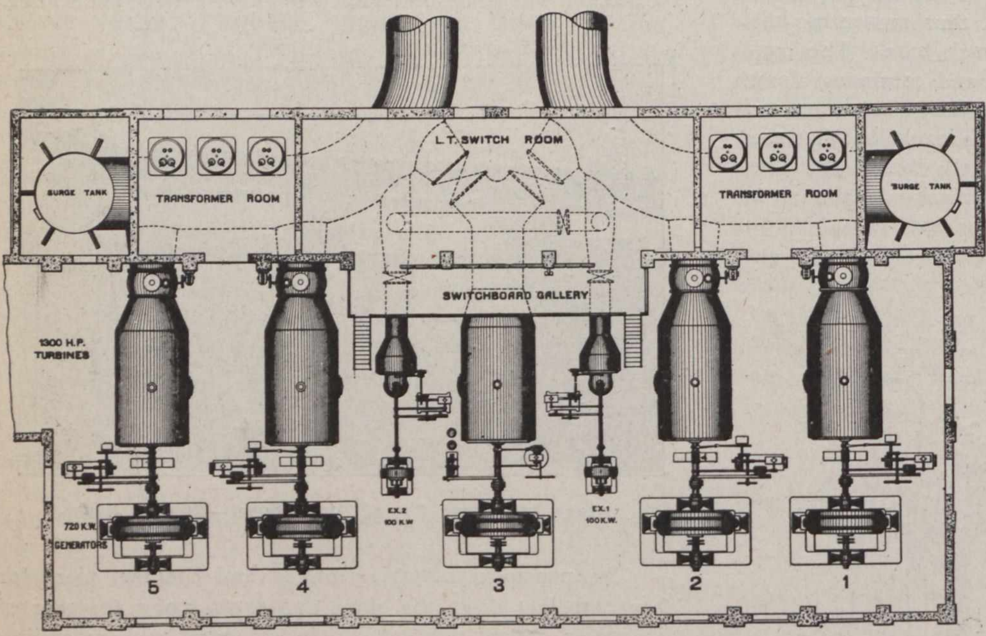
The power house is built on a ledge of rock extending into the lower pool and sufficient excavation was made into the cliff behind to allow the foundations to lie completely on the ledge. The piers and foundations are of massive concrete extending about 23 feet from bed rock to floor level. All piers and walls are tied into one another above the water line, and again at the floor line, by reinforced struts and



Diverting Dam at Big Chute, Severn River.

beams making an essentially homogeneous structure. The tail race extends longitudinally under the floor line and has large openings to the tail water between the generator piers and through arched openings in the outer wall.

The walls are of concrete slabs between heavy pilasters, the pilasters carrying the crane rail and roof trusses. The rear portion of the station has the floor eleven feet higher than the generating room floor leaving space for the penstock and feeders underneath; this floor contains the low tension switchboard and its equipment and the transformers while a second floor above the switching room contains the high tension switching and line equipment. The rear portion of the building has a heavy concrete roof carried on



Section Through Generating Station, Showing Arrangement of Turbines, Generators and Transforming Equipment.

reinforced beams while the roof of the generating room is 1¼-inch matched pine carried on heavy wooden purlins which are hung by wrought iron hangers from the steel roof trusses. Both roofs are covered with several layers of asbestos felt laid in asphalt cement; the Johns-Manville Company were the contractors for this portion of the work. The general works and the power station were constructed by Messrs. Pratt & MacDougall, of Midland.

The turbines were built by the William Hamilton Company, of Peterborough, Ontario, are are of the "Samson" type. The power turbines are designed for 1,300 horsepower capacity under 56 feet head and a speed of 300 revolutions per minute. The double runners, of the Francis type, are of bronze, 35 inches in diameter, and the water discharges into a single steel draft tube inclined towards the front of the power house. The turbine case is carried on a series of heavy "I" beams spanning the tail race.

A 66-inch vertical gate valve is set in the horizontal feed pipe between each turbine and the penstock; the valve is erect in Nos. 1 and 2 units while in No. 3 the stem is downwards and is protected by a concrete housing. All 66-inch valves are being arranged for alternating current motor operation while the auxiliary hand mechanism will allow for complete opening or closing in about two hours by one man. The valves have strongly ribbed cast iron bodies with bronze mountings on all bearing and rubbing faces. Each valve is tested to a working pressure of 50 lbs. per square inch and operation under 75 feet head. A six-inch by-pass with valve is provided with each.

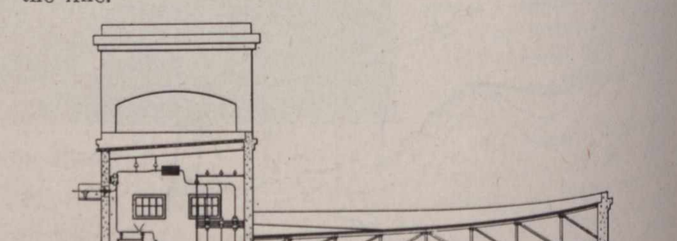
The exciter turbines are of the single runner type, 17 inches diameter, and are capable of producing 200 horsepower under 56 feet head at 580 revolutions per minute. The valves on exciter feeders are 30 inches in diameter.

The hydraulic turbine governors are all of Lombard oil pressure design, types N and Q 7½ being installed for power turbines and type P for exciters. The governors in combination with the surge tank on the penstock, and the heavy fly-wheel effect of the generators, have given excellent results on test while with the surge tank acting and full load thrown off the turbines the pressure rise in the turbine cases is hardly appreciable.

The power generators are of Canadian Westinghouse Company's manufacture, as is practically the whole of the electrical equipment. These generators are of 900 kv.a capacity, 2,200 volts, 60 cycles, three phase at 300 revolutions per minute. The armatures are wound in three slots per pole per phase, the slots being open; the field is revolving and the rotor will withstand the stresses of a runaway speed 75 per cent. in excess of normal.

The exciters are of 100 kilowatts capacity at 125 volts and are controlled by means of a Tirrill regulator to automatically produce a varying strength of field on the power generators to maintain a constant voltage at the end of the 25-mile transmission line. The two exciters are direct connected to their turbines. The turbines are arranged to take water from either penstock, when the second penstock is installed or for each to be fed from a separate penstock, thus providing for continuity of exciter current.

The current from all generators on the main floor is carried through cables, laid in fibre conduits, to the switchboard on the gallery and from thence to the transformers and ultimately through the high tension switching room to the line.



Plan of Generating Station.

The transformers are three single phase units aggregating 1,800 kilowatts capacity. These are connected in delta so that in case of accident to one unit the two other may be used for continuing the service. The voltage ratio is 2,200 to 25,000, the latter being the transmission voltage. Water for transforming cooling purposes is supplied through the station water piping from the stand pipe; a cleaning strainer is attached to the source.

The electrical circuits are arranged so that each generator may be switched on either of two sets of 2,200 volt bus-bars. Each of these bus-bars feeds into one 1,800 kw. transformer bank through a circuit breaker and the two transformer sets may then be connected in parallel by a tie oil switch. Each transformer set on the high tension side feeds to a 25,000 volt bus-bar to which the transmission line is connected through the line circuit breaker. When the second transmission line is constructed the high tension bus may be divided so that each of the two transformer sets may feed their corresponding lines independently.

The switchboard consists of twelve black marine finish marble panels which are arranged in three groups, spaced by the concrete columns which extend from the switchboard gallery floor, so that the five generator panels and the bus tie switch panel are between the columns while on the left is the direct current board of three panels, including the Tirrill regulator and on the right are the two transformer panels (one blank at present) and the line panel. The gallery extends six feet into the generator room while behind is ample room for the 2,200 volt bus and switch structure and the generator rheostats. The rheostats are carried on concrete pedestals to allow for ventilation, and are operated by shafts in a straight line between rheostat handle on the switchboard and the face plate on the rheostats.

In the transformer room disconnecting switches are arranged inside the low and high tension delta connections so that any single phase transformer can be temporarily cut out. The leads on the high tension side are carried through a wall opening into the line room where the three 25,000 volt oil switches, the electrolytic lighting arresters and the choke coils are located as shown in one of the accompanying photographs.

The transmission line outlets are at the rear of the power house and consist of porcelain outlet insulators in a 14-inch opening in the concrete wall. The outlet is protected outside by a hood of a one-half section of a 42-inch corrugated iron culvert carried on steel angle brackets inserted in the wall; this has proven a very cheap and effective outlet covering.

The transmission line is approximately 25 miles long, the route being south-west to Waubaushene on Georgian Bay, and thence to Midland, generally following the roadways along the Georgian Bay shore line. Half of the distance, from the Big Chute to Waubaushene, is over the company's right-of-way, which has been cleared and laid out for two parallel transmission lines.

The poles are generally 35 feet in length graded to conform to the profile of the route. The conductors are No. 00 B & S aluminum cable supplied by the Northern Aluminum Company and are carried on 35,000 volt porcelain insulators spaced in an equilateral triangle, forty-two inches apart with the apex at the top of the pole. A photograph shown herewith indicates a typical portion of the line. Special pole arrangements were made for railway and telephone crossings.

A telephone line extends from Big Chute to Midland, carried on the pole line. Heavily insulated transformers are placed at each terminal with the local services on the secondaries so that no accidental high voltage on the telephone line can be dangerous to the telephone operators.

At Waubaushene, the Matchedash Bay arm of Georgian Bay is about 2,000 feet across and two spans are made, 1,153 and 858 feet respectively. The longer span also crosses the ship channel which is close to the west shore and the Government requires 150 feet clear at this point between wires and water, necessitating a 175-foot tower; the centre and east shore towers are 88 feet high, giving a forty foot clearance on the 858 foot span. The long span is made with copper cable of 7 No. 9 B & S strands, while the 858-foot span is made with 300,000 c.m. aluminum cable, the copper and aluminum being spliced together at the centre tower with a special aluminum clamping device, while the other ends are clamped to a 2 unit suspension insulator. The cross arm decks of the shore towers are fitted with iron sheaves and turnbuckles, so that tension may be put on the steel cable supporting the insulators to allow for adjustment of the sag, should occasion demand. The connecting cables are attached to the span cables at the suspension insulators and are carried down the sides of the towers on insulators to within 50 feet of the ground, and from thence to the pole line. The towers are arranged with gusset plates at the top to accommodate an additional deck so that a second line may be eventually carried above the first.

At Midland the company has acquired a plot on the outskirts for the sub-station and construction yard. The sub-station is of brick arranged for extension as the market may demand. The present equipment has transformers, line apparatus and a switchboard similar to those of the generating station. Distribution is at 2,300 volts to Midland and the surrounding district. The Hydro-Electric Commission undertakes the distribution in Midland and Penetanguishene.

The Simcoe Railway & Power Company is formed of well known business men connected with the various large concerns in Midland, the officers being: W. J. Lovering, Toronto, president; W. Finlayson, Midland, secretary, and D. L. White, Midland, treasurer.

The engineering of the development was carried on by Messrs. C. H. and P. H. Mitchell from its inception. The resident engineers were Murray C. Hendry, B.A.Sc., during construction, and O. L. Flanagan, B.A.Sc., during installation.

EDMONTON NOTES.

The Allsip Brick and Supply Company have about completed installation of their plant at Edmonton at a cost of $100,000, and will in a few days begin turning out brick at the rate of 85,000 per day. The Hardstone Brick Company are busy installing extensive machinery. The Edmonton Brewing and Malting Company have let a contract for a fireproof building which will be equipped with the most thoroughly modern plant at a total cost of approximately $450,000. Work is progressing on a handsome $100,000 office for the Royal Bank. Rapid progress is being made on the $350,000 addition to the Tegler Block and the $250,000 office building for the Canadian Pacific Railway. Contracts aggregating over $250,000 have been let for an office block to be erected by the city.

Steel work is progressing rapidly on the big Canadian Pacific Railway bridge and the work of grading for their line into the heart of the city is proceeding. The Athabasca Landing branch of the Canadian Northern Railway has reached that point, and construction trains are now running. The Brazeau branch of the Canadian Northern Railway has been opened for traffic to Rocky Mountain House. The Grand Trunk Pacific branch to Calgary is being pushed.

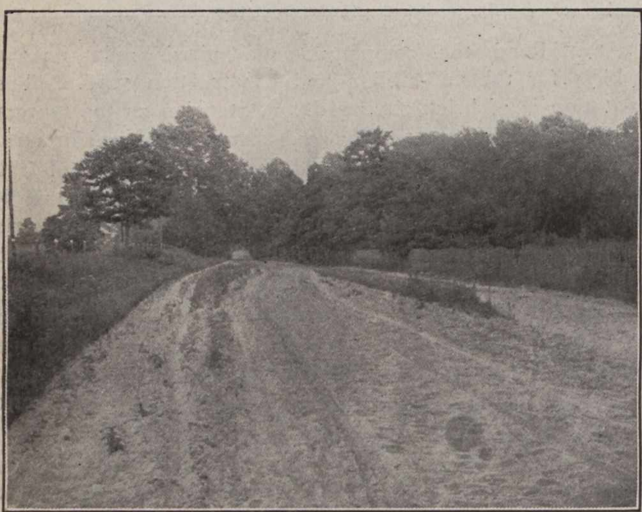
The Hudson's Bay Company's sale of a portion of their reserve, which opened on 14th May and closed to-day, was an extraordinary indication of confidence in Edmonton's continued development. Though the lots offered were in a district absolutely undeveloped, the entire 1406 lots offered were sold at figures aggregating $4,343,400. Lots averaged 50 x 150 feet.

PUBLIC ROADS, NEW JERSEY, U.S.A.

By E. A. James, B.A.Sc.*

Since the passage of the State Aid Law in New Jersey the Commissioners of Public Roads in that State have spent $3,230,336, and completed 1,778.896 miles, making an average cost of $2,045 per mile.

The class of road varies with the location, but out of 13,550,000 square yards built 6,082 square yards was macadam, 2,394,000 square yards Telford, 4,119,320 square yards gravel, 449,100 asphalt macadam and 244,851 square yards of amiesite, the balance being made up of small quantities of shell, bogore, etc., etc.



Yardville-Allentown Macadam Road, Before.

Many of their costs are very interesting, but as an example we will take the Yardville and Allentown Road, 3.04 miles long. This was built as a macadam highway and treated with heavy asphaltum oil, and was built under the following specifications:—

All stone must be as nearly cubical as possible, broken with the most approved modern stone crushing machinery. It must be of trap or approved native rock, free from all screenings, clay, soil or other objectionable substances, of uniform size and of the same kind and quality as sample. It must show a fresh, crystalline surface.

Macadam foundation or two and one-half-inch stone shall be broken stone, which must pass through a three-inch ring and catch on a two-inch ring.

Macadam second course or one and one-half-inch stone shall be broken stone, which must pass through a two-inch ring and catch on a one-inch ring.

Macadam surface or three-quarter-inch stone shall be broken stone, containing not over 5 per cent. of material retained on one-inch circular openings or 8 per cent. which will pass one-half-inch circular openings.

Dustless screenings shall be broken stone taining not over 5 per cent. of material retained on ⅝-inch circular openings or 8 per cent. which will pass one-quarter-inch circular openings.

Dust shall be broken stone and include all material which will pass one-quarter-inch circular openings, but must be free from soil, loam or clay.

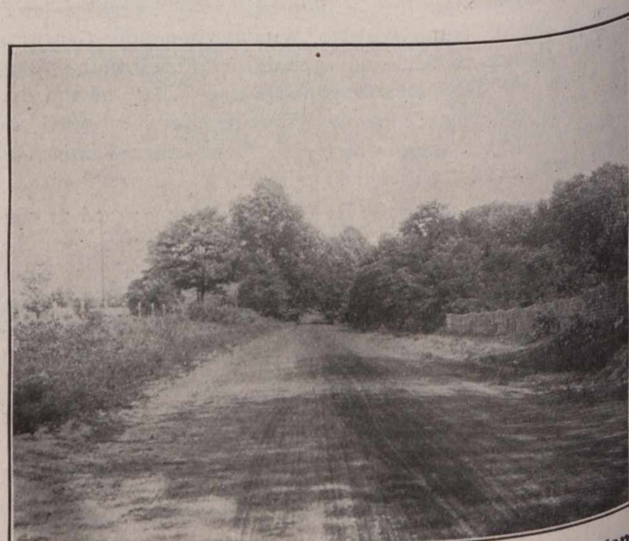
Length of stone-bed, 17,992.5 feet.
Width of stone-bed, 14 feet.
Depth of stone-bed, not less than 6 inches deep.
Average width of shoulders, 7 feet.
Average total width of improved roadway, 28 feet.

Excavations, 8,150 cubic yards., at 50 cents; total.	$ 4,075.00
Macadam, 28,736 square yards, at 94 cents; total.	27,011.84
Macadam driveways, 564 square yards, at 50 cents; total	282.00
Underdrains, extra, approved by State, 1,500 lineal feet, at 20 cents; total	300.00
Extra, reconstructing class B macadam, 42⅔ square yards, at 94 cents; total	40.11
Extra, reconstructing driveway, macadam, 16 1/9 square yards, at 50 cents; total	8.06
Extra, reconstructing driveway, macadam, 33⅔ square yards, at 50 cents; total	16.83
Total cost	$31,733.84
Maximum grade before	3.00 per cent.
Maximum grade after	2.35 per cent.

As was pointed out in the opening paragraph, gravel constituted an important material of construction. As an example of a gravel road the Monmouth Boulevard will serve to illustrate. This road is 2.6 miles long, and was built under the following specifications:—

Road gravel A is to be composed of pebbles, chert, sand, clay and oxide or hydrate of iron, in such quantities that the gravel will pack under pressure into a hard, dense pavement. It will be judged solely by comparison with the samples furnished.

Road gravel B is gravel not deemed suitable for surface work, but may, on approval of sample by the engineer and State Commission of Public Roads, be used for foundations of gravel roads.



Yardville-Allentown Road, After. Water-Bound Macadam; Surface Oil.

The gravel of which the road was built was spread to a width of from sixteen to eighteen feet, and the entire roadway was graded to a width of thirty feet.

The value of this improvement is well attested by the almost constant, continuous traffic passing over it.

* Chief Engineer for the York Highway Commission, Toronto, Ont.

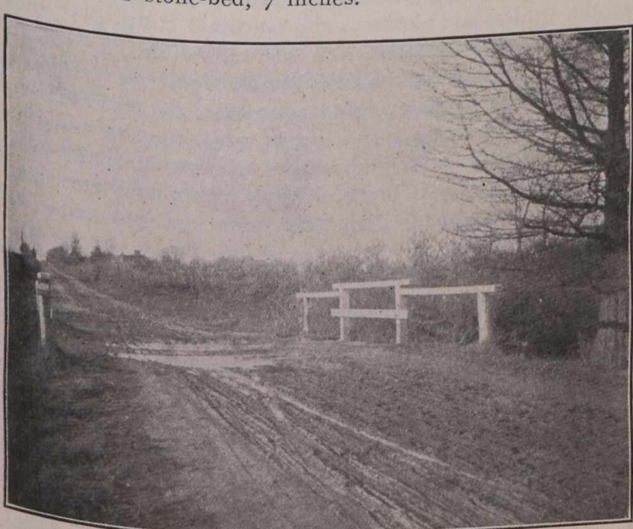
Width of gravel-bed, 16 and 18 feet.
Width of gravel shoulders, 6 feet.
Length of gravel-bed, 13,809 feet.
Depth of gravel-bed, 8 inches.
Depth or gravel shoulders, 4 inches.

Gravel (A), 6,081 cubic yards, at $2.25; total..	$13,682.25
Gravel shoulders (B), 1,729 cubic yards, at $2.25; total	3,890.25
Earth excavation (A), 10,944 cubic yards, at 25 cents; total	2,736.00
Earth excavation (B), 1,164 cubic yards, at 25 cents; total	291.00
Drain, 4,000 lineal feet, at 12 cents; total........	480.00
12-inch pipe relaid, 425 lineal feet, at 8 cents; total	34.00
Total	$21,113.50
Less difference between items and lump sum....	113.50
Total	$21,000.00
Supervisor's salary	606.00
Engineering expenses	630.00
Extras, 371 cubic yards excavation, at 25 cents; total	92.75
Total cost of road	$22,328.75
Maximum grade before	3.25 per cent.
Maximum grade after	2.75 per cent.

Although there are less than a quarter of a million square yards of asphaltic concrete used, yet, because of its long life and its dustless surface, asphalt concrete will be more largely used in the future. In Union county 1.5 miles was laid.

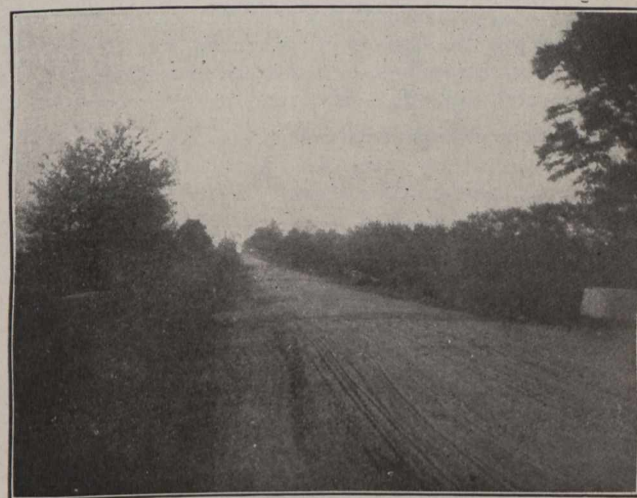
The pavement is sixteen feet wide while the road is graded to a width of from thirty-three to thirty-six feet.

Width of stone-bed, 16 feet.
Length of stone-bed, 8,362 feet.
Depth of stone-bed, 7 inches.



Cedar Avenue and Monmouth Boulevard, Gravel, Before.

Amiesite, 15,715.1 square yards, at $1.29; total..	$20,272.48
Macadam at driveways, 680.3 square yards, at 55 cents; total	374.17
Earth excavation, 16,460.2 cubic yards, at 35 cents; total	5,761.07
Cobble stone gutters, 252.8 square yards, at 60 cents; total	151.68
Total	$26,559.40
Supervisor's salary	321.00
Extras, paid by county, relaying pipe and moving stone pile	85.12
Total cost of road	$26,965.52
Maximum grade before	8½ per cent.
Maximum grade after	5.24 per cent



Cedar Avenue and Monmouth Boulevard, Gravel, After.

This pavement was laid under the following specifications:—

All pavements which are composed of a mineral aggregate held together with a bituminous cement, and are mixed without heating the mineral aggregate, and laid while cold, must conform to the following additional requirements:—

Pavements of this type must be prepared from bituminous cements..........and may be laid either in one or two courses. When laid in two courses the bottom course must not be less than 1½ inches thick after ultimate compression and contain not over 30 per cent. of material which will pass openings one-half inch in diameter. This course of stone must be uniformly coated with sufficient asphalt to bind it firmly together. It must be laid and rolled to the proper grade and curvature before the top course is applied.

The top course must not contain any material which will not pass openings three-quarter-inch in diameter. It must contain not less than five per cent., nor more than nine per cent., by weight, of bitumen soluble in cold carbon bisulphide, the exact amount to be determined between these limits by the State Department of Public Roads.

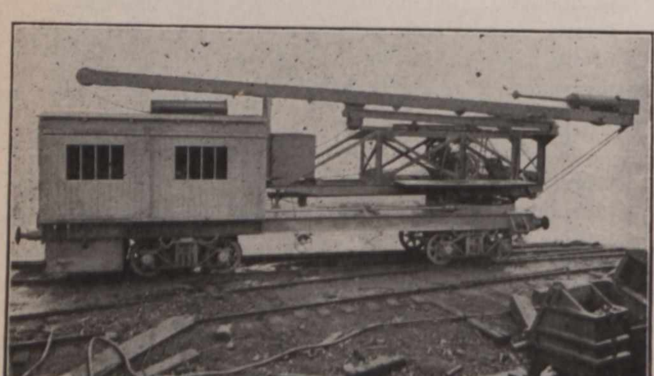
After the bottom course has been spread, it must be protected from all travel and kept free from dust or dirt until the top course has been spread and rolled into place or sealed in the manner specified hereinbelow. If the bottom course gets wet after being spread, it must be allowed to dry out before being rolled or covered with the top course. When dry it must always be covered with the top course at once, after being properly rolled, and in no case shall the bottom course be spread over three hundred feet in advance of the top course, nor shall over fifty feet be left uncovered during the night.

When pavements of this type are laid in one course, they will be sealed by painting the surface with a squegee coat of hot bituminous cement, when required by the State Department of Public Roads. This cement must be the same used in preparing the pavement, and must be applied at a temperature between 135° C. to 180° C. by a distributor which has been approved by the State Department of Public Roads. Immediately after this coat of bitumen has been spread, and while the same is yet hot, sand, fine clean gravel or screenings, or a mixture thereof, shall be spread over its surface and rolled at once.

These three classes of pavements give a good idea of the standards adopted by the New Jersey Commissioner of Public Roads, also of their costs.

A SELF-PROPELLED STEAM PILE-DRIVER.

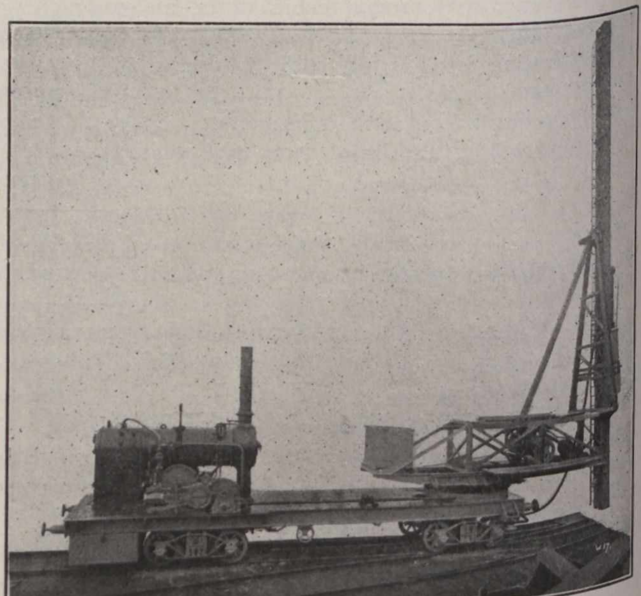
The photographs illustrate a locomotive steam pile-driving plant which has lately been completed by Messrs. Whitaker Brothers, Limited, of Horsforth, near Leeds, England, for service on the 5 ft. 6 in. gauge lines of the Central Argentine Railway. The equipment is claimed to be one of the largest and most complete machines of its kind ever constructed. It consists principally of a swivelling pile-driving frame with engine, boiler, winch, and all gearing and accessories mounted on a carriage running on two four-wheeled diamond-framed bogies. The machine is designed for driving piles up to 40 ft. in length and the pile-driving frame consists of a trussed steel beam, with a balance box at one end and short vertical struts at the other end, to the top of which the leaders are pivoted. The method of fixing the latter is such that piles may be driven on the latter up to 3 in. per foot, or the leaders may be hinged backwards into a horizontal position to clear the running gauge when the machine is traveling. The trussed beam is carried in roller guides and is mounted on a turntable, which allows the pile-driving frame to be moved backwards or forwards and rotate in either direction, so that the piles may be driven at distances varying between 7 ft. and 16 ft. in advance of the leading axle and at any distance up to 18 ft. on either side.



View of Pile-Driver Ready for Moving.

The turntable carrying the pile-driving frame is placed over the centre of the leading bogie and the boiler, engines and gearing are situated at the other end of the carriage, the hoisting ropes for the monkey and pile leading up to the frame through the centre of the turntable. The engines and boiler are rigidly mounted on the carriage platform, and are enclosed in a timber house fitted with sliding doors at each side and a small hinged door in front for giving access to the platform.

The traveling motion is of specially flexible type, so that the drive is unaffected by the extension or compression of the springs. Both axles of one bogie are driven by means of steel gearing and universal joints, and means are provided for disconnecting the traveling mechanism when the machine is required to be hauled by train. The bogies, wheels, axles, draw gear, and brakes are all made to the railway company's standards.



View of Pile-Driver Ready for Work.

The engines are of a special type, being totally enclosed with the working parts running in oil. The cylinders are fitted with a radial reversing motion, and gear is provided for performing the several functions, namely, propelling the machine, raising lowering the leaders, and hoisting the piles and monkey. The boiler is of the locomotive type, and is designed for a working pressure of 110 lb. per square inch. When the leaders are lowered the machine clears the company's construction gauge for rolling stock. A special hand winch is fitted on the pile-driving frame so that piles can be dealt with in the event of any part of the motive mechanism being temporarily out of order, while the slewing gear can also be disconnected and worked by manual labor. The 50 cwt. steam monkey is one of Whitaker Brothers' latest pattern and is capable of delivering from 40 to 60 blows a minute.

EDWARD PARTINGTON PULP AND PAPER COMPANY.

One of the largest business transactions in the history of New Brunswick was closed when deeds for the property of the Gibson Lumber Company were transferred to the Edward Partington Pulp and Paper Company, Limited, while the amount involved is said to be over two million dollars.

The property includes extensive lumber limits and licenses as well as mills, logs and lumber.

The Consolidated Pulp and Paper Company, through Senator N. M. Jones, of Bangor, Maine, had been negotiating to take over both the Gibson and Partington properties, but this has been abandoned, and Mr. Jones will now be associated with the Partington Company as manager of their pulp interests.

The capacity of the St. John pulp mill will be enlarged, and the establishment of another huge pulp mill on Nashwaak River, near Fredericton, will be considered.

WATER AND SEWERAGE SYSTEMS.*

By G. H. Altham.†

The development of modern waterworks began in Paris and London as early as the beginning of the 17th century, but little progress was made until the application of steam to pumping engines, first made in London in 1761. Since 1800 the development has been very rapid, both in Europe and America.

The first works in America for the supply of water to towns were those of Boston, built in 1652. Machinery was first used for pumping water at Bethlehem, Pennsylvania, where the works were put into operation in 1754. The first use of the steam engine was at Philadelphia in 1800, and in New York steam was applied in 1804. The principal development in this country has taken place since 1880, about 98% of all existing works having been constructed since that time. Nearly all towns of 2,000 inhabitants or more now have a public water supply, and the construction of works is progressing rapidly in many smaller towns and villages. While there is more work yet to be done in this direction, the chief work of the future will be in providing increased supplies for the rapidly growing cities and towns of this country, in developing new and better sources of supply and in the improvement of the quality of the existing supplies. There is also much opportunity for the engineer in the management of waterworks, in the direction of reducing cost of operation, prevention of waste and in the improvement of service in many other ways.

The most important use of a public water supply is that of furnishing a suitable water for domestic purposes. For such use the prime requisite is that the water should be pure. The transmission of certain diseases such as cholera and typhoid fever by polluted water is now universally recognized, and the value to the city of a pure supply when compared to one constantly polluted by sewage can scarcely be over estimated.

Another highly important function of a water supply is that of furnishing the necessary flushing water for a sanitary system of drainage. The most satisfactory and economical method yet found for disposing of the organic wastes of a community is by the water carriage system.

Besides furnishing an improved supply from the sanitary standpoint, a public works may often be made to furnish a water which for other reasons will be of greatly increased value to the domestic consumer; such as soft water in place of a hard well water,—a point of very considerable importance to both domestic and commercial users.

A good water supply is also of great value to the manufacturing interests of a town. Many establishments, such as sugar refineries, starch factories, cleaning and dyeing houses, chemical works, etc., require an abundant water supply, and in some cases water of a high degree of purity. The question of water supply indeed often determines the location of factories. Large quantities are also used for operating elevators, for boiler purposes, and for many other uses that may be classed as commercial.

The most important public use of water supply is in extinguishing fires. The economic value of a good fire-protection system is directly shown in the reduced rates of insurance which follow its introduction or improvement. Instead of distributing a heapy fire loss among the people of a community through high rates of insurance it is assuredly much better economy to distribute to the maintenance of a public water-works, which at the same time provides a suitable water for other purposes. To permit of the establishment of a certain class of factories it is absolutely essential that an efficient fire protection be furnished.

Other important public uses of a water supply are in street sprinkling and sewer flushing, in furnishing water for public buildings and for drinking and ornamental fountains. A real value exists in the improved appearance which may be given to a city by the use of water in fountains and for lawns and public parks; and, indeed, all the benefits accruing from a good water supply act indirectly to increase the desirability of a town for many purposes and to enhance the value of the property therein.

I do not intend to quote a lot of uninteresting statistics as to consumption, etc., but one thing does interest us and that is a good and pure source of supply. Our province is fortunate in possessing many beautiful streams of water and many, that besides furnishing water for public use, will be developed for power purposes. As the country is not densely populated the problems of pollution are not difficult, but as the population increases we shall be confronted with some of the difficulties that have and are being experienced by the large cities of the United States and Canada. The greatest objection to our water supply from the rivers is the turbidity of the water during the spring months and while the water may not be injurious it does not look very palatable, and I consider that the water supply for a town cannot be considered complete without an efficient filtration plant, as a plentiful and pure supply of water is an absolute necessity for the health and safety of the town.

Sanitary or Combined Sewers.—About equal in importance with a good water supply is the sewerage system, the sewer being the carrier for all the waste liquids and foul matter from the town.

Modern sanitary engineering especially as regards sewerage and drainage has had almost its entire development since 1850. It was not until 1873 that there was published a comprehensive treatise on sewerage, at about this time also much attention began to be paid in England to sewage purification. It was reserved, however, for America to put sewage purification on the road to a satisfactory scientific solution by the thorough investigations of the Massachusetts State Board of Health, began in 1887 and still under way. In America much was done in the third quarter of the 19th century to advance sewerage engineering through the studies of able engineers in connection with the design of systems for Chicago and other large American cities. About 1880 the separate system of sewage came strongly into prominence in America as advocated by the late Col. Geo. F. Waring and the construction of the Memphis sewers on this system at that time together with their great success in putting a stop to the fearful epidemics, which had so often desolated that city, did much to make sewerage possible for small cities. At present sewers have become so common and so necessary in modern life that towns of 2,000 population or even less are very generally taking up their construction. With the present wide adoption of sewers even by small communities, sewage disposal has come to be of very great importance and is now undergoing great development. Many discoveries remain to be made in this line in which the guiding principles have not yet been so thoroughly worked out as in the construction and maintenance of sewers themselves. The importance and value of the construction of sanitary engineering can hardly be exaggerated, upon them absolutely depends the health of every city. In this connection it should be said that pure water supply and good sewerage are both essential, and that it is impossible to separate the value of one from that of the other. A polluted water supply may

*Read at Union of Alberta Municipalities Convention in Macleod.

†Superintendent of Water and Light for the Town of Macleod.

spread the disease no matter how perfect the sewerage and an abundant water supply is essential to the proper working of sewers. On the other hand without sewers and drains, an abundant water supply serves as a vehicle to enable filth to saturate more deeply and more completely the soil under a city. Cess pools being very dangerous and objectionable for this reason. In addition to direct prevention of communication of disease by unsanitary conditions, modern sewerage facilities are so great a convenience that this advantage alone is usually more than worth the cost, this is shown by the increased selling and rental value of premises supplied with sewerage facilities. No sooner is a partial or complete sewerage system constructed in a town than prospective buyers or renters begin to discriminate severely against property not supplied with modern sanitary conveniences, and persons looking for new locations for business ventures or residence purposes discriminate in like manner in favor of towns having good sewerage.

From these few remarks it seems convincing that no town can afford to economize on the expense of making the water and sewerage systems as perfect as possible, they being so vital to the health and comfort of every inhabitant in a town.

STANDARDIZING OF TELEGRAPH BLANKS, BUSINESS CARDS AND CATALOGUES.

By Carl J. Printz.*

Business correspondence is now invariably made on sheets 8½" × 11", the so-called letter size, regardless of whether the letter is a long one or a short one, and up-to-date firms have also adopted this size for their specifications and tenders. This is done, of course, for the convenience of filing, as it is very hard, in any filing system, to file the "pap" size or to look through a file containing a variety of sizes.

The telegraph companies are slow in adopting the 8½" × 11" size for their blanks, and the reason for this is probably that they have their filing cabinets made for their usual size, but a change to letter size would be exceedingly welcomed by all business concerns, and it will undoubtedly come sooner or later.

As to business cards a standardization is highly desirable and the 3" × 5" size is gradually adopted by persons who use their cards for other purpose than simply an introduction. Business cards are continually referred to by purchasing agents and others as they, in a majority of cases, are substitutes for catalogues, and are much easier filed and looked over —if printed on some standard size.

The 3" × 5" is a convenient size for the vest pocket and it fits any standard filing case.

As business cards of this size generally have descriptive matter printed on both sides, it would be inconvenient to have them locked with the locking-rod in the card case, but as a card with perforations or cut for such locking device will suggest filing, it is found advantageous, and it also distinguishes such cards from the small blotters which are distributed as advertisements.

Catalogues are among the hardest things to file on account of their extreme variety in size and thickness, but even in this line there is a growing tendency to standardizing, and the 8½" × 11" seems to take the lead and will, no doubt, some day be generally adopted.

*Consulting Engineer, Toronto.

THE DISPOSAL OF TORONTO SEWAGE.

The question of the pollution of the Great Lakes is assuming more and more importance. From repeated analyses made during the past few years the amount of chlorine in the lakes appeared to be on the increase. The Board of Water Experts, who have just presented their report on the question of water supply for Toronto, state that if sewage pollution is not stopped or minimized it will in time render the westerly end of Lake Ontario unsafe for use as a public water supply. The Board's comments on the disposal of Toronto sewage are of interest in this connection. The following is abstracted from their report:—

The question of the disposal of the sewage of Toronto has such a close connection with the question of water supply, that it has demanded close investigation by this Board. Present conditions and proposals have been investigated, the results of which are hereto appended. The conclusions of this Board upon the investigation are herewith given:—

Assuming the Toronto sewage to contain 300 parts of dry residue solids per 1,000,000, then a dry weather flow of 45,000,000 gallons per day will represent approximately 60 tons of dry residue solid matter, or 3,000 lbs. per 1,000,000 gallons of sewage.

The amount of solids which will be primarily arrested by the screens will be insignificant.

At Providence, R.I., with gratings 1 inch apart, 41 lbs. per million gallons were retained. At Boston, with similar gratings, the rate was 300 lbs. With gratings .75 inch apart the average rate of retention at the South Metropolitan System for the years 1905-1908 was 324 lbs. At the London Northern outfall sewer in 1897, with similar gratings, 243 lbs. At Berlin, with bars spaced 0.6 inch apart, 212 lbs. were retained.

It can not be assumed that the screening apparatus as proposed for Toronto sewage will remove more than 100 lbs. of dry solid residue per 1,000,000 gallons of sewage. This leaves 2,900 lbs. per 1,000,000 gallons to be removed by sedimentation. Assuming an optimistic conclusion that 30 per cent. of the solids will be removed by sedimentation, then 2,030 lbs. of dry residue per 1,000,000 gallons will continue to enter the lake. This means that approximately 40 tons per day of dry residue will continue to enter the lake after treatment at dry weather flow.

The effluent out-take is to be 60 inches in diameter laid across and under the east end of Ashbridge's Bay for a distance of about 1,830 feet from the tank to the lake shore, and continued into the lake for a further distance of about 3,500 feet, finishing at a point of discharge in about 20 feet depth of water. This point of discharge will be located approximately 26 000 feet (or about 5 miles) to the east of the present water intake mouth, and approximately 24,000 feet (or about 4½ miles) west of the "Dutch Church" at Scarboro' Cliffs.

The total length of the effluent out-take is 5,330 feet. With the lake level at 40 and the tank level of sewage at 51, representing the height of sewage in the inlet channel at three times the dry weather flow, a hydrostatic head of 11 feet is effected, allowing of a maximum discharge of 100 cubic feet of sewage per second, or 1.2 times the dry weather flow at 45,000,000 gallons per day.

It is, therefore, apparent that under the above conditions, while 135,000,000 gallons of sewage are entering the works, only 54,000,000 gallons can be treated, while the balance of 81,000,000 gallons must be dammed back and pass over and through the storm overflow provided at the works direct into Ashbridge's Bay immediately south of the tanks.

It is only when the tanks are taking the dry weather flow at 83 cubic feet per second, with the sewage standing at an elevation of 47.50 in the inlet channel, that equilibrium is reached and that the effluent out-take is discharging an equal amount of sewage to that which is entering. Any increase in discharging can only be effected by backing up and increasing the head on the effluent out-take and thus increasing velocities and so deleteriously affecting the process of sedimentation.

The general conclusions which may be arrived at from the above statement are as follows:—

(a) That four times the dry weather flow of sewage (taken at 45,000,000 gallons per day, dry weather flow), will arrive at the sewage works.

(b) That the amount of sewage over and above four times the dry weather flow is variable and may reach 22 times the dry weather flow at a rainfall rate of 1.5 inches per hour. That 0.10 of an inch rainfall per hour will produce 5.2 times the dry weather flow. That a storm such as occurred on 27th August, 1911, will produce 60 times the dry weather flow. That for 400 hours of an average year the rainfall will reach or exceed 5.2 times the dry weather flow.

(c) That the sewage of Toronto normally contains about 3,000 lbs. of dry residue solid matter per each 1,000,000 gallons of sewage. That 100 lbs. of these solids will be retained by screening. That a further 870 lbs. will be retained by sedimentation. That 2,030 lbs of solids in comparatively finer particles than that which is retained will continue to enter the lake, or that 60 tons of dry residue matter per day is contained in normal Toronto sewage, and that 40 tons will continue per day to enter the lake at a point 3,500 feet from shore, about midway between the "Dutch" Church and the existing water intake pipe.

(d) That an optimistic view of the capacity of the tanks is that they are only equal to a dry weather flow of 45,000,000 gallons, and that even with this capacity and rate of flow, only 30 per cent. of the solid matter and only the grosser solids will be retained.

With respect to the effect the proposed intercepting sewers and disposal works will have on Lake Ontario water as a source of domestic supply in the neighborhood of Toronto, it must be at once conceded that it is out of the question to anticipate any greater purity of water for a radius of ten miles from the City Hall than has existed heretofore. The continued discharge of storm water by means of the present sewer outlets, the discharge of sewage treated only to the extent of a small proportion of the grosser solids direct into the lake five miles from the water intake, without any attempt to reduce and extinguish the cause of disease infection, will reduce the present nuisance to Toronto Bay and immediate shore neighborhood, but, on the other hand, such will in no way tend to bring about a class of water within ten miles' radius of the city suitable for domestic consumption, unless such water undergoes some efficient process of purification treatment capable of destroying the disease infection due to sewage pollution.

It is now generally conceded that all methods of sewage disposal such as screening, sedimentation and filtration, may remove nuisances which are due to the decomposition of organic matters, that is, nuisances which are apparent to the senses, but that such processes do not entirely and only to a very small extent remove the causes of disease infection peculiar to sewage discharges. In order to render sewage discharges pathogenically harmless, it is necessary that such be disinfected if discharged into a water used as a source of domestic supply.

It is an undoubted fact that dilution of sewage with water tends to its ultimate organic purity and that large bodies of water are capable of dealing with and purifying large quantities of organic matter; on the other hand the causes of disease infection are not so readily acted upon and may be carried for considerable distances. It must, therefore, be concluded that considering the present proposal of the city regarding sewage treatment, the present acknowledged contaminated character of the lake water in the vicinity of Toronto must remain the chief factor in reference to water supply.

IMPORTATION OF CEMENT.

In connection with the tariff reduction on cement, it will be interesting to see how the duty which has heretofore prevailed against United States cement was made up.

Barrels of 350 lbs., at 12½c. per 100 lbs.	.43¾
Bags valued at 40c. per (bbl.) at 20%	.08
Total duty per barrel against American cement	.51¾

Inasmuch as the government has concluded, for the time being at least, to reduce the duty 50 per cent., this would mean that 26c. per barrel will be reduced. Assuming that the price of United States cement at the factory is 60c. per barrel, and that the freight rate is 48c., we would have the following:—

American price per barrel at mill	.60
Freight	.48
Duty	.26
Total price	1.34

So far as the Montreal market is concerned, it would seem that this would have little effect, inasmuch as cement has been quoted here at the factory at 1.35 to 1.45, exclusive of package, and it is much more convenient to purchase from manufacturers on the spot than abroad. It is just possible, however, that the lowering of the duty to 26c. would mean the importation of British cement to some extent, inasmuch as the preferential would reduce this by one-third, which would mean about 17c. as against 34, which has prevailed up to the present.

It seems not unlikely also that 60c. at the factory in the United States is an exceptionally low quotation. Some quotations are 65c., and it is the opinion of many manufacturers that with the additional demand which the lowering of the duty may bring about, United States manufacturers may be able to ask a yet further advance. This, however, may be doubted, as the over-production in the United States is great.

NEW HEALTH OFFICERS IN ONTARIO.

Six of the seven district health officers have been appointed by the Provincial Government. They are:—Dr. D. B. BENTLEY, of Sarnia, for the district comprising Essex, Elgin, Kent, Lambton, Middlesex and Oxford; Dr. T. J. McNALLY, of Owen Sound, for the district comprising Bruce, Dufferin, Grey, Huron, Perth, Wellington and Waterloo; Dr. D. A. McCLENAHAN, of Waterdown, for the district comprising Brant, Haldimand, Halton, Lincoln, Norfolk, Peel, Welland, Wentworth, and York; Dr. GEO. CLINTON, of Belleville, for the district comprising Ontario, Durham, Northumberland, Prince Edward, Hastings, Peterboro', Victoria, Muskoka and Simcoe; Dr. P. J. MOLONEY, of Cornwall, for the district comprising Lennox and Addington, Frontenac, Leeds, Grenville, Stormont, Dundas, Glengarry, Prescott, Russell, Carleton, Lanark and Renfrew; Dr. R. E. WODEHOUSE, of Fort William, for the district comprising the districts of Manitoulin, Algoma, Kenora, Thunder Bay and Rainy River. The officer for the remaining district, comprising the districts of Parry Sound, Nipissing, Temiskaming and Sudbury, has not been named.

The appointments take effect on August 1st, when the doctors report for the prescribed course of study at the University.

PERSONAL.

MR. J. DARLINGTON WHITMORE, after a residence of nine years in Canada, principally spent in the West, passed through Toronto this week on his way to New Zealand.

MR. J. McD. PATTON, who this spring completed his post-graduate year for degree of B.A.Sc., at the University of Toronto, was recently appointed superintendent of waterworks for the city of Regina.

MR. JOHN MacDONALD, formerly a member of the engineering staff of the city of Medicine Hat, has been appointed district engineer for the district of Medicine Hat and Milk River, by the government of the province of Alberta.

COMING MEETINGS.

CANADIAN ELECTRICAL ASSOCIATION.—June 19th-21st. Annual meeting at Ottawa, Ont. Sec'y, T. S. Young, 220 King St. West, Toronto, Ont.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION.—June 26th-28th. Annual meeting at Boston, Mass. Sec'y, H. H. Norris, Cornell University, Ithaca, N.Y.

ONTARIO MUNICIPAL ASSOCIATION.—Annual convention will be held in the City Hall, Toronto, on June 18th and 19th, 1912. Secretary-Treasurer, Mr. K. W. McKay, County Clerk, St. Thomas, Ont.

THE UNION OF CANADIAN MUNICIPALITIES.—August 27, 28 and 29. Meeting at City Hall, Windsor, Ont. Hon. Secretary-Treasurer, W. D. Lighthall, K.C.

CANADIAN FORESTRY ASSOCIATION.—Convention will be held in Victoria, B.C., Sept. 4th-6th. Secy., James Lawler, Canadian Building, Ottawa.

CANADIAN PUBLIC HEALTH ASSOCIATION.—Second Annual Meeting to be held in Toronto, Sept. 16, 17 and 18.

ROYAL ARCHITECTURAL INSTITUTE OF CANADA.—Annual Assembly will be held at Ottawa, in the Public Library, on 7th October, 1912. Hon. Sec'y, Alcide Chaussé, 5 Beaver Hall Square, Montreal, Que.

ENGINEERING SOCIETIES.

CANADIAN SOCIETY OF CIVIL ENGINEERS.—413 Dorchester Street West, Montreal. President, W. F. TYE: Secretary. Professor C. H. McLeod.

KINGSTON BRANCH—Chairman, A. K. Kirkpatrick; Secretary, L. W Gill; Headquarters: School of Mines, Kingston.

OTTAWA BRANCH—
177 Sparks St. Ottawa. Chairman, S. J. Chapleau, Ottawa; Secretary, H. Victor Brayley, N.T. Ry., Cory Bldg. Meetings at which papers are read, 1st and 3rd Wednesdays of fall and winter months; on other Wednesday nights in month there are informal or business meetings,

QUEBEC BRANCH—Chairman, W. D. Baillairge; Secretary, A. Amos; meetings held twice a month at room 40, City Hall.

TORONTO BRANCH—96 King Street West, Toronto. Chairman, T. C. Irving: Secretary, T. R. Loudon, University of Toronto. Meets last Thursday of the month at Engineers' Club.

VANCOUVER BRANCH—Chairman, C. E. Cartwright; Secretary, W. Alan, Kennedy; Headquarters: McGill University College, Vancouver.

VICTORIA BRANCH—Chairman, F. C. Gamble; Secretary, R. W. MacIntyre; Address P.O. Box 1290.

WINNIPEG BRANCH—Chairman, J. A. Hesketh; Secretary, E. E. Brydone-jack; Meets every first and third Friday of each month, October to April, in University of Manitoba, Winnipeg.

MUNICIPAL ASSOCIATIONS

ONTARIO MUNICIPAL ASSOCIATION.—President, Chas. Hopewell, Mayor, Ottawa; Secretary-Treasurer, Mr. K. W. McKay, County Clerk, St. Thomas, Ontario.

SASKATCHEWAN ASSOCIATION OF RURAL MUNICIPALITIES.—President, George Thompson, Indian Head, Sask.; Secy-Treasurer, E. Hingley, Radisson, Sask.

THE ALBERTA L. I. D. ASSOCIATION.—President, Wm. Mason, Bon Accord, Alta. Secy-Treasurer, James McNicol, Blackfalds, Alta.

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

THE UNION OF NEW BRUNSWICK MUNICIPALITIES.—President, Councillor Siddall, Port Elgin; Hon. Secretary-Treasurer J. W. McCready, City Clerk, Fredericton.

UNION OF NOVA SCOTIA MUNICIPALITIES.—President, Mr. A. S. MacMillan, Warden, Antigonish, N.S.; Secretary, A. Roberts, Bridgewater, N.S.

UNION OF SASKATCHEWAN MUNICIPALITIES.—President, Mayor Bee, Lemberg; Secy-Treasurer, W. F. Heal, Moose Jaw.

UNION OF BRITISH COLUMBIA MUNICIPALITIES.—President, Mayor Planta, Nanaimo, B.C.; Hon. Secretary-Treasurer, Mr. H. Bose, Surrey Centre, B.C.

UNION OF ALBERTA MUNICIPALITIES.—President, Mayor Mitchell, Calgary.; Secretary-Treasurer, G. J. Kinnaird, Edmonton, Alta.

UNION OF MANITOBA MUNICIPALTIES.—President, Reeve Forke, Pipestone, Man.; Secy-Treasurer, Reeve Cardale, Oak River, Man.

CANADIAN TECHNICAL SOCIETIES

ALBERTA ASSOCIATION OF ARCHITECTS.—President, G. M. Lang Secretary, L. M. Gotch, Calgary, Alta.

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

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

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

BUILDERS' CANADIAN NATIONAL ASSOCIATION.—President, E. T. Nesbitt; Secretary-Treasurer, J. H. Lauer, Montreal, Que.

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

CANADIAN CEMENT AND CONCRETE ASSOCIATION.—President, Peter Gillespie, Toronto, Ont.; Secretary-Treasurer, Wm. Snaith, 57 Adelaide Street, Toronto, Ont.

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

CANADIAN ELECTRICAL ASSOCIATION.—President, A. A. Dion, Ottawa; Secretary, T. S. Young, 220 King Street W., Toronto.

CANADIAN FORESTRY ASSOCIATION.—President, John Hendry, Vancouver. Secretary, James Lawler, Canadian Building, Ottawa.

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

CANADIAN INDEPENDENT TELEPHONE ASSOCIATION.—President, W. Doan, M.D., Harrietsville, Ont.; Secretary-Treasurer, Francis Dagger, 21 Richmond Street West, Toronto.

THE CANADIAN INSTITUTE.—198 College Street, Toronto. President, J. B. Tyrrell; Secretary, Mr. J. Patterson.

CANADIAN MINING INSTITUTE.—Windsor Hotel, Montreal. President, Dr. A. E. Barlow, Montreal; Secretary. H. Mortimer Lamb, Windsor Hotel, Montreal.

CANADIAN PEAT SOCIETY.—President, J. McWilliam, M.D., London, Ont.; Secretary-Treasurer, Arthur J. Forward, B.A., 22 Castle Building, Ottawa, Ont.

THE CANADIAN PUBLIC HEALTH ASSOCIATION.—President, Dr. Charles A. Hodgetts, Ottawa; General Secretary, Major Lorne Drum, Ottawa.

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

CANADIAN STREET RAILWAY ASSOCIATION.—President, Jas. Anderson, Gen. Mgr., Sandwich, Windsor and Amherst Railway; Secretary, Acton Burrows, 70 Bond Street, Toronto.

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

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

DOMINION LAND SURVEYORS.—President, Mr. R. A. Belanger, Ottawa; Secretary-Treasurer, E. M. Dennis, Dept. of the Interior, Ottawa.

EDMONTON ENGINEERING SOCIETY.—President, J. Chalmers; Secretary, B. F. Mitchell, City Engineer's Office, Edmonton, Alberta.

ENGINEERING SOCIETY, TORONTO UNIVERSITY.—President, J. E. Ritchie; Corresponding Secretary, C. C. Rous.

ENGINEERS' CLUB OF MONTREAL.—Secretary, C. M. Strange, 9 Beaver Hall Square, Montreal.

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

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

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

INTERNATIONAL ASSOCIATION FOR THE PREVENTION OF SMOKE.—Secretary R. C. Harris, City Hall, Toronto.

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

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

NOVA SCOTIA SOCIETY OF ENGINEERS, HALIFAX.—President, J. N. MacKenzie; Secretary, A. R. McCleave, Assistant Road Commissioner's Office, Halifax, N.S.

ONTARIO PROVINCIAL GOOD ROADS ASSOCIATION.—President, Major. T. L. Kennedy; Hon. Secretary-Treasurer, J. E. Farewell, Whitby; Secretary-Treasurer, G. S. Henry, Oriole.

ONTARIO LAND SURVEYORS' ASSOCIATION.—President, T. B. Speight, Toronto; Secretary, Killaly Gamble, 703 Temple Building, Toronto.

THE PEAT ASSOCIATION OF CANADA.—Secretary, Wm. J. W. Booth, New Drawer, 2263, Main P.O., Montreal.

PROVINCE OF QUEBEC ASSOCIATION OF ARCHITECTS.—Secretary, J. E. Ganier, No. 5. Beaver Hall Square, Montreal.

REGINA ENGINEERING SOCIETY.—President, A. J. McPherson, Regina; Secretary, J. A. Gibson, 2429 Victoria Avenue, Regina.

ROYAL ARCHITECTURAL INSTITUTE OF CANADA.—President, F. S. Baker, F.R.I.B.A., Toronto, Ont.; Hon. Secretary, Alcide Chausse, No. 5. Beaver Hall Square, Montreal, Que.

ROYAL ASTRONOMICAL SOCIETY.—President, Prof. Louis B. Stewart, Toronto; Secretary, J. R. Collins, Toronto.

SOCIETY OF CHEMICAL INDUSTRY.—Wallace P. Cohoe, Chairman; Alfred Burton, Toronto, Secretary.

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

WESTERN CANADA IRRIGATION ASSOCIATION.—President, Wm. Pierce, Calgary; Secretary-Treasurer, John T. Hall, Brandon, Man.

WESTERN CANADA RAILWAY CLUB.—President, R. R. Nield; Secretary, W. H. Rosevear, 115 Phœnix Block, Winnipeg, Man. Second Monday, except June, July and August, at Winnipeg.

CONSTRUCTION NEWS SECTION

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

PLANS AND SPECIFICATIONS ON FILE.

The following Plans (P.) and Specifications (S.) are on file for reference only unless otherwise noted at the office of The Canadian Engineer, 62 Church Street, Toronto:—

Bids close		Noted in issue of
6-17—Electric Generating Station Equipment, Bassano, Alta.	(S.)	5-30
7-3—Storm Drain, Orillia, Ont.	(P. & S.)	6-20
7-1—Boilers, 300-h.p., Verdun, Que.	(S.)	6-20

(Bassano specifications also on file at the office of The Canadian Engineer, Montreal, and the Engineers, Messrs. Bowring & Logan, 322 Donald St., Winnipeg).

TENDERS PENDING.

In Addition to Those in this Issue.

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

Place of Work.	Tenders Close.	Issue of.	Page.
Arden, Man., bridge	July 3.	June 13.	78
Barrie, Ont., public buildings	June 27.	June 13.	67
Boswell, B.C., pile bent wharf	July 2.	June 6.	68
Carr's Brook, N.S., breakwater wharf	June 27.	June 6.	68
Gananoque, Ont., drill hall	June 22.	June 6.	68
Humb ldt, Sask., fittings in post office, etc.	June 24.	June 13.	68
Fort William, Ont., sewer	July 5.	June 13.	67
Kerrisdale, B.C., steel pipes	June 24.	June 6.	67
Kerrisdale, B.C., valves, castings and hydrants	June 24.	June 13.	67
Oshawa, Ont., sidewalks	June 19.	June 13.	78
Ottawa, Ont., mail contract	June 21.	May 23.	76
Ottawa Ont., designs for monument	Oct. 1.	Apr. 18.	60
Ottawa, Ont., sale of steamer	July 3.	June 6.	78
Ottawa, Ont., design and construction of steamship	June 30.	May 16.	76
Port of Quebec, Que., proposals for drydock	July 2.	Apr. 18.	60
Point Grey, B.C., plans for university	July 31.	Feb. 7.	60
Port Arthur, Ont., paving	June 24.	June 6.	80
Point Edward, Ont., operating house	July 1.	June 13.	68
Quebec, Que., leasing of water-powers	June 26.	May 2.	72
Regina, Sask., Torhill reservoir	June 21.	June 6.	78
St. Catharines, Ont., trunk sewer	July 3.	June 13.	80
Saskatoon, Sask., garbage incinerator	June 25.	May 2.	74
Tete de Point Barracks, Ont., stables	June 23.	June 13.	67
Toronto, Ont., high level interceptor	July 2.	June 13.	80
Vancouver, B.C., bridge construction	July 8.	May 30.	74

TENDERS.

Calgary, Alta.—Tenders for one 500 K.W. synchronous motor generator, to be delivered, erected and installed in the city, will be received up to noon of June 26th, 1912, by the City Commissioners. Specifications may be obtained from the Commissioners' office. J. M. Miller, City Clerk.

Carleton Place, Ont.—Tenders will be received by the Sewers and Water Commission of the municipality of Carleton Place, Ont., up to noon of July 1st, 1912, for the construction and supply of all materials in connection with about five miles of sewers and about five miles of watermains. Consulting Engineer, T. Aird Murray, Toronto; Resident Engineer, B. G. Michel, Carleton Place, Ont. (See advertisement in The Canadian Engineer of June 27th.)

Fort William, Ont.—Tenders for the construction of a concrete and tile sewer on Marks Street, will be received at the office of the City Clerk, until July 5th, 1912. Plans, etc., can be obtained at the office of John Wilson, City Engineer.

Kingston, Ont.—The Board of Works are calling for tenders for asphaltic block pavements to be laid on a number of streets in the city.

London, Ont.—Tenders for the construction of about 900 feet of concrete breakwater on the Medway River. Specifications, etc., at the office of F. W. Farncomb, Consulting Engineer, London. (See advt. in Canadian Engineer.)

Moose Jaw, Sask.—Tenders for the supply of material and erection of City Hall Annex will be received by the City Commissioners, Moose Jaw, up to noon of June 20th, 1912.

Napanee, Ont.—Tenders for the completion of about 10,000 lineal feet of tile sewers with manholes and junctions, will be received until noon of June 25th, 1912. Sewers to be constructed of 9 in., 12 in., and 15 in. standard vitrified sewer pipe. Plans and specifications may be seen at the office of the engineer, George C. Wright, Kingston, Ont. W. A. Grange, town clerk, Napanee, Ont.

Norwood, Ont.—The Department of Militia and Defence, Ottawa, is open to receive tenders for the construction of a new Drill Hall at Norwood, until July 3rd. Specifications may be seen at the offices of the Officer Commanding 3rd Division, Kingston, Ont.; Officer Commanding "E" Company, 40th Regiment, Norwood, Ont., and the Director of Engineer Services, Headquarters, Ottawa.

Orillia, Ont.—Tenders for the construction of approximately 16,200 lineal feet of sanitary sewers will be received until July 3rd, 1912. Plans, etc., on file in the Town Engineer's office, Orillia. (See advt. in The Canadian Engineer).

Orillia, Ont.—Tenders for the construction of approximately 2,450 lineal feet of reinforced concrete box storm drain and sidewalk top, will be received until July 3rd, 1912. Plans and specifications on file at the office of The Canadian Engineer, 62 Church St., Toronto, and at the Town Engineer's office, Orillia. (See advt. in The Canadian Engineer).

Ottawa, Ont.—Tenders will be received until June 25th, 1912, for a boom dredge required for the Rideau Canal. Plans, etc., can be obtained on application to L. K. Jones, secretary, Department of Railways and Canals, Ottawa.

Ottawa, Ont.—Tenders for the construction of fittings, finish, etc., at the Armoury, Niagara Falls, Ont., will be received until June 25th, 1912. Plans, etc., can be obtained on application to Mr. Geo. Seales, Clerk of Works, New Armoury, Niagara Falls, Ont., and at the office of R. C. Desrochers, Secretary, Department of Public Works, Ottawa.

Ottawa, Ont.—Tenders for certain alterations and additions to the Elkhorn Industrial School Buildings, will be received up to noon of July 9th, 1912. Plans and specifications may be seen at the Indian Office, Winnipeg; at the School, Elkhorn, and at the Postoffices at Brandon and Virden. J. D. McLean, Assistant Deputy and Secretary, Department of Indian Affairs, Ottawa.

Ottawa, Ont.—Tenders will be received until noon of June 22nd, 1912, for repairs to the Rifle Range at Pointe aux Trembles, P.Q. Plans and specifications may be seen at the offices of the Officer Commanding the 4th Division, Montreal, P.Q., and the Director of Engineer Services, Headquarters, Ottawa. Eugene Fiset, Col., Deputy-Minister, Department of Militia and Defence, Ottawa.

Ottawa, Ont.—Tenders for the construction of two 95 cubic yards' capacity wooden hopper scows, will be received until July 3rd, 1912. Plans, etc., at the Department of Public Works, Ottawa; offices of G. G. Scovil, Esq., Superintendent of Dredges, St. John, N.B.; G. M. Graham, Esq., Superintendent of Dredges, New Glasgow, N.S.; and J. N. McDonald, Esq., Superintendent of Dredges, Charlottetown, P.E.I. R. C. Desrochers, Secretary, Department of Public Works, Ottawa.

Ottawa, Ont.—Tenders will be received at the Department of Public Works, Ottawa, until July 4th, 1912, for the construction of a wharf at Brundage's Point, Westfield, King's County, N.B. Plans and specifications to be seen on application to J. K. Scammell, Esq., District Engineer, Chatham, N.B., and at the Department of Public Works, Ottawa.

Ottawa, Ont.—The Department of Railways and Canals, Ottawa, will receive tenders until August 1st, 1912, for the construction of the section of the Hudson Bay Railway from Thicket Portage to Split Lake Junction. Plans, etc., at the office of the Chief Engineer of the Department of Railways and Canals, Ottawa, and at the office of the Chief Engineer of the Hudson Bay Railway, Winnipeg.

Ottawa, Ont.—Tenders for dredging required at Port Arthur, Ont., will be received until July 2nd, 1912. Full particulars can be obtained on application to R. C. Desrochers, Secretary, Department of Public Works, Ottawa.

Ottawa, Ont.—The Department of Public Works, Ottawa, is open to receive tenders until July 10th, 1912, for the construction of a wharf at Cache Bay, District of Nipissing, Ont. Plans, etc., at the Department, and at the office of J. G. Sing, Esq., District Engineer, Confederation Life Building, Toronto, and on application to the Postmaster at Cache Bay, Ont.

Ottawa, Ont.—The Department of Public Works are calling for tenders for dredging required at Perry Point, N.B., tenders to be received until June 26th, 1912. Combined specifications and form of tender can be obtained on application to the Secretary, R. C. Desrochers, Department of Public Works, Ottawa.

Ottawa, Ont.—Tenders are invited for the construction of quarantine buildings upon the quarantine grounds at Windsor, Ont. Tenders to be in Ottawa by noon July 8th. Particulars may be obtained either from Inspector F. A. Jones, Windsor, or from the Acting Veterinary Director General, Ottawa. A. L. Jarvis, Asst. Dep. Minister and Secretary of Agriculture, Dept. of Agriculture, Ottawa.

Ottawa, Ont.—The Department of Indian Affairs will receive tenders up to noon of July 12th, 1912, for alterations, etc., at Indian boarding school buildings at Fort Frances, Sandy Bar and Fort Alexander. Plans, etc., at the Indian Offices, at Winnipeg and Selkirk, and at the offices of the Indian Agents at Kenora and Port Arthur.

Ottawa, Ont.—The Department of Militia and Defence will receive tenders up to noon of July 2, 1912, for the construction of a new Drill Hall at Omemee, Ont. Specifications may be seen at the offices of the Officer Commanding 3rd Division, Kingston, Ont.; Officer Commanding "D" Company, 46th Regiment, Omemee, Ont., and the Director of Engineer Services, Headquarters, Ottawa.

Ottawa, Ont.—The Department of Railways and Canals. Ottawa, will receive tenders until August 1st, 1912, for the construction of the section of the Hudson Bay Railway from Thicket Portage to Split Lake Junction. Plans, etc., at the office of the Chief Engineer of the Department of Railways and Canals, Ottawa, and at the office of the Chief Engineer of the Hudson Bay Railway, Winnipeg. (See advt. in Canadian Engineer.)

Ottawa, Ont.—Tenders for the erection of an operating house and double dwelling, at Alert Bay, at Cormorant Island, B.C., will be received until noon of July 1st, 1912. Plans, etc., at the office of the Superintendent of Radio-Telegraph Branch of Department of Naval Service, Ottawa, or at the office of the District Superintendent or Radio-Telegraph Service, Victoria, B.C., and office of the Postmaster at Alert Bay, Cormorant Island, B.C. G. J. Desbarats, Dep. Min., Dept. of Naval Service, Ottawa.

Regina, Sask.—Tenders will be received until June 21st, 1912, for the following:—

(1) Two reinforced concrete bridge abutments for a bridge over the Battle River, west of Battleford.

(2) Two reinforced concrete bridge abutments and two small reinforced concrete bridges west of Rosthern.

Plans, etc., may be obtained on application to A. J. McPherson, Chairman, Board of Highway Commissioners, Regina, Sask.

Saskatoon, Sask.—Plans have been filed and tenders are now being called for the new C.P.R. Building, which will involve an expenditure of over $200,000.

Shoal Lake, Man.—Tenders for the construction of a brick and stone municipal hall for the municipality of the village of Shoal Lake, will be received up to noon of June 25th. Plans, etc., at the office of the architect, Hooper and Hooper, 303 McIntyre Block, Winnipeg, or at the office of F. M. Dobbs, sec.-treas., municipality of village of Shoal Lake, Man.

Toronto, Ont.—Tenders will be received until noon of July 22, 1912, for the complete supply and installation of three hundred and seventy-one (371) opera chairs in St. Lawrence Hall, Toronto. Specifications, etc., at the offices of the Property Department, City Hall, Toronto. G. R. Geary (Mayor), chairman Board of Control, City Hall, Toronto.

Toronto, Ont.—Tenders for the construction of dairy barns to be erected on the grounds of the Ontario Agricultural College, Guelph, will be received up to noon of June 29th, 1912. Plans and specifications can be seen at the office of the Superintendent, Agricultural College, Guelph, and at the office of H. F. McNaughten, secretary Department of Public Works, Province of Ontario, Toronto.

Toronto, Ont.—Tenders for the laying and jointing of a 36-in. water main on Front Street, with connections, will be received up to noon of July 2nd, 1912. Specifications may be seen at the office of the Commissioner of Works, Toronto. G. R. Geary (Mayor), chairman, Board of Control, City Hall, Toronto.

Toronto, Ont.—Tenders for the laying and jointing of a 36-in. water main on Front Street, with connections, will be received up to noon of July 2nd, 1912. Specifications may be seen at the office of the Commissioner of Works, Toronto. G. R. Geary (Mayor), chairman, Board of Control, City Hall, Toronto.

Vancouver, B.C.—Competitive plans will be received up to noon, June 28th, 1912, for the proposed Georgia-Harris Viaduct. Specifications, plans and conditions of competition may be obtained at the office of the City Engineer, City Hall. Wm. McQueen, City Clerk, Vancouver, B.C.

Verdun, Quebec.—Tenders will be received at the Town Hall, Church Avenue, Verdun, until July 1st, 1912, for the supply and installation of two 300 horse-power water tube boilers. Specifications, etc., at the Town Engineer's office, Verdun, and also at the office of The Canadian Engineer, 62 Church Street, Toronto. (See advt. in The Canadian Engineer).

Winnipeg, Man.—Tenders for the manufacture and delivery f.o.b., Winnipeg, of approximately 70,000 duct feet of single vitrified clay conduit, will be received up to noon of June 21st, 1912. Full particulars may be obtained at the office of the City Light & Power Department, 54 King Street. M. Peterson, secretary, Board of Control Office, Winnipeg.

Winnipeg, Man.—Tenders will be received until June 20th, for all the trades required in connection with the erection and completion of a fireproof office building, for the Great West Permanent Loan Company. J. H. G. Russell, architect, McArthur Building, Winnipeg.

CONTRACTS AWARDED.

Berlin, Ont.—The contract for the new school building was awarded to Mr. Henry Braniff, his tender being the lowest. The cost will be in the neighborhood of $23,000.

Cheticamp, N.S.—Dredging; contractors, Vivian T. Bartram, 117 Stair Building, Toronto.

Hamilton, Ont.—The Des Moines Manufacturing Company, of Des Moines, Iowa, have received the contract to construct a water tower to cost $4,990.

Hillsborough, N.B.—Post office fittings; the J. T. Schell Company, of Alexandria, Ont.

Barrett Specification Roofs

On the "Concrete City."

IN the illustration below, the Turner Construction Company of New York, has brought together in a scale drawing an accurate representation of most of the important modern concrete buildings which they have erected during the past nine years, at an approximate cost of $12,000,000.

It is an imposing display of best types of modern construction—"*a concrete city*" indeed—scientifically designed for maximum service at minimum cost and minimum maintenance.

It is significant that 95 per cent. of the entire roof area is covered with the Barrett Specification type of roofing. The figures are as follows:

Barrett Specification type of roofs	1,490,523 sq. feet
Plastic Roofings	14,714 sq. feet
Slate Roofings	21,640 sq. feet
Tile Roofings	5,619 sq. feet
Ready Roofings	38,381 sq. feet
Copper Roofings	6,355 sq. feet
All other kinds	7,448 sq. feet

It is important to remember that while all these buildings were constructed by the Turner Construction Company, the specifications were drawn by a large number of architects and engineers.

Barrett Specification Roofs were almost unanimously selected for one reason only, namely that they would give *better* service at *lower cost*, than any other roof covering.

Barrett Specification Roofs require no painting or similar attention—in other words, there are no maintenance costs. They will last upwards of 20 years without any care.

The superior economy of Barrett Specification Roofs justifies their adoption not only on big first-class concrete buildings, but on every flat roofed building from a tenement to a skyscraper—from a small mill to a modern manufacturing plant costing millions. But be sure it's a real Barrett Specification Roof. The only way to be sure is to incorporate The Barrett Specification in full in your plans.

Copy of The Barrett Specification free on request. Address our nearest office.

THE PATERSON MANUFACTURING CO., LIMITED

MONTREAL TORONTO WINNIPEG VANCOUVER ST. JOHN, N.B. HALIFAX, N.S.

Kenora, Ont.—Fire hall; Messrs. S. C. Sharman and F. Gilbert, of Kenora, Ont. Price, $20,875, which covers all trades except heating.

Lethbridge, Alta.—The tenders submitted for the construction of the car barn and sub-station for the street railway system were as follows: Hotson and Leader, $51,410; Lussier Construction Co., $39,931; Smith Bros. and Wilson, $39,100. The contract was awarded to the latter firm.

Maple Creek, Sask.—The contract for the 7,000 yards of cement sidewalks, has been awarded to Mr. C. H. Campbell, Cavallier, N.D., his price being 19c. per sq. foot for sidewalks and 37c. per lineal foot for curb.

Moose Jaw, Sask.—Sewer pipe and specials; the Saskatchewan Glass & Supply Co., Moose Jaw.

Nanaimo, B.C.—Interior fittings, post office; the Berlin Interior Hardwood Co., Ltd., of Berlin, Ont.

Oakville, Ont.—The contract for the building of the high level bridge over the creek at Cemetery Hill, near Oakville, has been awarded to Mr. A. J. Gibson, of Oakville.

Ottawa, Ont.—Additions and alterations to fuel testing building; contractor, A. G. Marshall, 5 O'Connor Street, Ottawa.

Port Arthur, Ont.—The contract for the Hill Street Fire Hall has been awarded to the Alberta Land Co. Price, $22,000. H. J. Powers, Engineer.

The contract for the twelve-room school on Prospect Avenue, has also been awarded to the Alberta Land Company. Price, $75,000.

Saskatoon, Sask.—Messrs. E. M. Joyl and Company have secured a contract to supply 170,000 ties to Messrs. McArthur and Boyd to be used on the Hudson Bay Railway.

Saskatoon, Sask.—Messrs. Hoge & Marr, have received a contract to construct a moving picture theatre on 20th Street East. Mr. P. L. Sommerfeld, civic alderman, is a member of the company.

Stratford, Ont.—At a meeting of the market and hall committee, the tender of Mr. William Daly, for the market shelter at $12,070, was accepted.

Ste. Therese de Blainville, Que.—The work of installing a waterworks system to cost $75,000 for the Aqueduct Company of Blainville, Blainville, Que., is being done by the owners of the company under the supervision of Engineers Ouimet and Lesage, St. Lawrence Boulevard.

Toronto, Ont.—Messrs. J. E. Webb Company, general contracting, have been awarded the contract for the masonry work for the American Hat Frame Company, to be built at the corner of Bathurst and Wellington Streets. Material used will be concrete, pressed brick and steel.

West Toronto, Ont.—Messrs. Orr Brothers have been awarded the contract for the construction of a retaining wall at Annette School. The cost of this work is placed at $7,125.

Winnipeg, Man.—The National Construction Company have been awarded the contract for the erection of the new law courts, their bid being $760,000.

Winnipeg, Man. — Messrs. Clayton Brothers are the builders and C. Bridgeman the architect for the erection of two large apartment blocks involving an outlay of $252,000.

LIGHT, HEAT AND POWER.

Brockville, Ont.—The municipal gas and light committee have recommended that a number of additional incandescent electric lamps be placed on certain street corners; many of these are to replace gas lamps now in use. Mr. J. H. Bryson is the engineer of Brockville.

Northern Canada.—Messrs. E. M. Joyl and Company have secured a contract to supply 170,000 ties to Messrs. McArthur and Boyd to be used on the Hudson Bay railway. The contract calls for delivery of the ties early next October at which time the railway contractors expect to be in a position to complete that part of the road which is now being graded.

Penticton, B.C.—The council of this municipality will call tenders on a 200 h.p. Deisel engine to be used as motive power in the lighting plant of the town.

Toronto, Ont.—If the approval of the Fire and Light Committee is shown the Hydro-Electric Department will put a few flaming arc lamps at the railway crossing on Bay Street.

Welland, Ont.—A report states that the estimate of the Hydro-Electric Commission for a lighting system for this municipality is given at $45,000, inclusive of cluster lights.

GARBAGE, SEWAGE AND WATER.

East Toronto, Ont.—The ratepayers in a portion of this section are petitioning for annexation and an extension of the municipal water system. They claim their wells have failed them.

Brockville, Ont.—The municipal fire and light committee have recommended that the mains in the vicinity of the James Smart Manufacturing Co. be extended and additional hydrants for fire protection be connected to the same. Mr. J. H. Bryson is the engineer of this municipality.

Saskatoon, Sask.—The new system of rapid water filtration has been given a try-out with complete satisfaction.

St. Thomas, Ont.—The City Engineer has reported on the cost of a proposed 20-inch steel water main from the water works to Balaclava Street. He estimates the cost of this work at $13,000. M. H. Baker, City Engineer.

Toronto, Ont.—Dr. Hastings, municipal Medical Health Officer, has reported on his requirements for the bacteriological treatment of the sewage effluent. He has been instructed to install two chlorinating plants. There is a probability of slow filtration beds being added to the equipment.

BUILDINGS AND INDUSTRIAL WORKS.

Berlin Ont.—The management of the W. G. & R. Shirt and Collar manufacturers will erect a new building during the coming season.

Berlin, Ont.—The municipal council have looked with favor on a proposed rubber manufactory. If this is proceeded with two five story buildings will be erected and 1,000 h.p. required from the Hydro-Electric Commission.

Guelph, Ont.—The Ontario Agricultural College officials will erect two new buildings during the coming season.

Edmonton, Alta.—Mr. Kenneth McLeod is having plans prepared for a nine story office building to cost $500,000. Mr. John T. Gow, of Spokane, is the architect for this work.

Montreal, P.Q.—The congregation of the Church of St. Irene will spend the sum of $125,000 on the construction of a new building. The Rev. Father Bereard is the rector of this parish and the architects are Messrs. McDuff and Lemieux.

Peterborough, Ont.—The Board of Trustees of the Nicholls Hospital have decided to erect two new buildings. One being 90 x 40 feet will provide accommodation for 45 beds, the other will be used for laundry purposes.

Regina, Sask.—The municipal School Board will submit a by-law to the ratepayers calling for an issue of debentures of $275,000 to be used for school building purposes.

Saskatoon, Sask.—Messrs. Adams Bros.' Harness Company, Limited, of Toronto, are planning to erect a large building in this city. Mr. F. W. Adams, Winnipeg, may be addressed in the matter.

Saskatoon, Sask.—The management of the King George Hotel are preparing to erect a three story annex on 2nd Avenue.

Tormorden, Ont. — The congregation of St. Andrew's Church have approved plans for an addition to their building which will double the seating capacity. Mr. Fred. Smith is a member of the finance committee. Todmorden is near Toronto.

Toronto, Ont.—The Canadian National Exhibition has secured a permit to erect a $35,000 entrance to Exhibition Park, comprising pylons and gates.

Toronto Ont.—The Municipal Works Committee have adopted the so-called terrace route for the proposed Bloor Street viaduct, as favored by the special committee. The estimated cost is $2,221,760. It will cost $8,000 to make the necessary preliminary borings.

Toronto, Ont.—A Dominion Government purchasing agent has secured an option on property at the south-west corner of Saulter Street and Queen Street East. It is said that the property is wanted as a site for the new post office, which will cost about $200,000.

West Toronto, Ont.—The General Fire Extinguisher Company has taken out a permit for a two-story warehouse in Dundas Street near Chelsea Avenue. It will cost $40,000.

Wetaskiwin, Alta.—Construction work has been started on a new factory for the Vulcan Automobile Company.

BRIDGES, ROADS AND PAVEMENTS.

Brockville, Ont.—There is a probability of Main Street being paved at a cost of $53,000. Mr. J. H. Bryson is the engineer of this municipality.

Toronto, Ont.—As a means of lessening the traffic on Queen Street the municipal Works Committee have recommended that Sydenham Street be extended westerly to Shuter Street. The estimated cost of this work is given as $65,000.

Toronto, Ont. — The Works Commissioner will confer with the proper railway officials on the matter of constructing a bridge over the tracks near the ferry wharves on Bay Street.

Victoria, B.C.—The City Engineer will experiment on the dust laying properties of oil on the streets of this city.

FIRES.

Crescent Valley, B.C.—The planing mill of the British Canadian Lumber Company was destroyed by fire. Crescent Valley is near Nelson.

TRADE ENQUIRIES.

The following were among the inquiries relating to Canadian trade received at the office of the High Commissioner for Canada, 17 Victoria Street, London, S.W., during the week ending June 3rd, 1912:—

A Welsh firm of mineral water manufacturers desire to appoint as their agents a first-class Canadian house having branches all over the Dominion.

A London firm desire the representation of a Canadian wood pulp manufacturer.

A London correspondent is prepared to negotiate with Canadian manufacturers for the sole right to manufacture in the Dominion certain specialties in which he is interested, and which include paints, enamels, soaps, varnishes, soluble oil, distempers, disinfectants, etc.

A North of England firm of glass manufacturers are considering the appointment of Canadian agents.

A London firm make inquiry for the names of Canadian manufacturers of maple meat skewers.

From the branch for City Trade Inquiries, 73 Basinghall Street, E.C.:—

A Nottingham company manufacturing laces of all classes are open to consider the appointment of responsible resident agents in the principal Canadian centres.

A Yorkshire company manufacturing wire for brushes, meters, mattresses, cloth, and all purposes except fencing: also wire ropes, twines, and engineers' supplies, wish to make arrangements for the sale of their goods in Canada.

PATENTS.

The following is a list of patents recently issued through the agency of Messrs. Ridout & Maybee, Manning Chambers, Toronto, Canada:—B. R. Seabrook, tops for cans and the like (case 1); B. R. Seabrook, tops for cans and the like (case 2); J. T. Thompson, display devices; W. R. D. Innes, railway sleepers (tie); John Little, rail placing machine; Fred. McRea Bawden, molds for pneumatic tire covers.

United States:—Clifford Guise, swivel; George Fulton, wooden floor coverings; H. E. T. Haultain, weight recording mechanism; H. E. T. Haultain, registering weighing apparatus.

OBITUARY.

E. H. Keating, former municipal engineer of Toronto and later general manager of the Toronto Railway Company, died at his home, 9 Castle Frank Crescent, Toronto, on June 18th last.

Mr. Keating was a native of Halifax, Nova Scotia, and received his early education at the Dalhousie University and the Chicago Academy, after which he studied engineering under Mr. George Whiteman, Provincial Government Engineer of Nova Scotia, and Sir Sandford Fleming.

In his earlier engineering career Mr. Keating was assistant engineer of the Pictou Extension Railway in Nova Scotia, chief draftsman of the Windsor and Annapolis Railway, contractors' engineer for the European and North America Railway, N.B., assistant engineer of different divisions of the Intercolonial Railway, division engineer in charge of exploration for the Canadian Pacific, City Engineer of Halifax, N.S., and also engineer of the Halifax graving dock.

It was while City Engineer of Duluth that the then Mayor, R. J. Fleming, invited Mr. Keating to Toronto to become City Engineer, which position he held from 1892 to 1898.

Mr. Keating was recently honored by the Institution of Civil Engineers of Great Britain. He is a Past President of the Canadian Society of Civil Engineers, a members of the Engineers' Club, Toronto, and the American Society of Civil Engineers.

"ROCMAC" MACADAM BINDER.

Power was turned on at the new mill of the Rocmac Road Corporation at Thorold, Ont., last week and this firm is now prepared to fill orders for Rocmac solutions made in Canada.

Although distinctly a Canadian Company, the Rocmac Road Corporation has had a mill in operation at Tonowanda, N.Y., for over a year, and has met with considerable success in New York State. Originally Rocmac was an English road and was first laid in Halifax, England, on the Skircoat Green Road, in 1907. The results on this first road have been excellent, especially in contrast to an adjoining length of ordinary macadam. Rocmac has also worn well on roads in the United States and Canada and has shown up particularly well on a strip of road in Victoria Park, near the Horseshoe Falls, where it is almost continuously wetted by the spray from the falls.

The chief difference between Rocmac and the ordinary macadam is in the binding material. The requirements of a good road are far more exacting to-day than in Macadam's time, and automobiles require a dustless, durable road, formed with a binder which will not disintegrate or deteriorate and which eliminates, or greatly reduces, maintenance charges. It is said that the Rocmac solution fulfils these requirements of a good binder.

The materials used in the construction of Rocmac are limestone, containing a specified proportion of carbonate of lime, crushed to pass a ¼″ screen; any hard rock ordinarily used for macadam roads, preferably trap or granite of a size known as No. 2 or No. 3, mixed in about equal proportions of each; and the Rocmac chemical solutions.

The method of building the road is to form a matrix by thoroughly mixing the limestone dust with the solution; this matrix is laid upon the road and the macadam is placed upon the top of it and rolled in until the matrix entirely fills up the interstices and comes to the surface.

When the road has become thoroughly packed by the rollers, a grout appears from the matrix below, so proving that all cavities have been filled. A thin coating of limestone is spread over the road to absorb the excess of solution and to form a cushion for the horses' feet while the process of setting goes on. Traffic is not impeded during construction.

The Rocmac solution is a silico-saccharate. It contains no asphalt, pitch, tar or oil and is entirely harmless to surrounding property during the laying or after the completion of the road. There is no unpleasant odor or damage to vegetation, vehicles or clothing. The surface of the road when finished has the appearance of an ordinary macadam road. A point in favor of Rocmac which will be thoroughly appreciated by Canadian engineers in some sections of the country is that it can be laid in any weather.

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.

16270—April 10—Dismissing application of town of Battleford, Sask., re C.N.R. branch line passenger service.

16271—April 10—Dismissing complaint of Namaka Farmers' Association No. 122, of Namaka, Alta., re mail service by C.P.R.

16272—March 16—Directing C.N.O. Ry to construct foot subway of concrete through property of Deaf and Dumb Institute at station -396, near Belleville, Ontario.

16273—April 9—Approving revised location of C.P.R. Lacombe Easterly Branch, mileage 100.07 to 146.10, Alberta.

16274—April 10—Authorizing C.P.R. to reconstruct bridge No. 30.5 on its Temiskaming Subdivision.

16275—April 11—Amending Order 15995 of Feb. 16, 1912; by substituting "1-2 George V., Chapter 22, Section 10" for "8-9, Edward VII., Chapter 32, Section 10" in recital and operative parts of Order.

16276—April 11—Postponing effective dates of M.C.R. Tariff, C.R.C., No. 1874; G.T.R., C.R.C., No. E. 2376, as amended by Supp. No. 1; Wabash R.R., C.R.C., No. 566, as amended by Supp No 1; advancing rates on anthracite coal, Niagara Frontier to Canadian points.

16277—April 11—Authorizing South Ontario Pacific Rly. Co. (C.P.R.) to construct its Guelph Jct. to Hamilton Branch underneath power wires of Hydro-Electric Power Commission at mileage 13.32, from Guelph Jct.

16278—April 9—Approving locations of 8 G.T.P. Ry. stations in Coast and Cassiar Districts, British Columbia.

16279—April 11—Authorizing G.T.P. B.L. Co. to operate trains over crossing of its Melville-Regina Branch with C.P.R. Main Line in Sask. account interlocker completed.

16280—April 11—16281—April 12—Approving location of C.N. Alberta Ry., mileage 166.01 to 192.83, and to occupy portion of right-of-way of G.T.P. Ry. about mileage 185.5; and approving location from mileage 192.83 to 222.79, Alberta.

16282—April 12—Authorizing C.N.R. to construct bridge across Pembina River in S.W. ¼ Sec. 29, Twp. 53, R. 7, west 5 M.

16283—April 12—Approving revised location of C.N.O. Ry. in Twp. of Ferris, Dist. of Nipissing, mileage 339.5 to 340.72.

16284—April 12—Authorizing C.N.R. to construct bridge across McLeod River, in west half of Sec. 33, Twp. 52, R. 17, W. 5 M.

16285—April 10—Authorizing Esquimalt & Nanaimo Ry. (C.P.R.) to take lands for railways purposes Lots 54 and 55 of Lime Bay, Sec. 31, Victoria West, in British Columbia.

16286-87—April 11—16288-89—April 10—Authorizing C.P.R. to construct spurs for the Alsip Brick, Tile and Lumber Co., Ltd., at Parish, Lot No. 71, St. Boniface, Man.; for Wolverton Milling Co., Ltd., at Wolverton, Ont.; for H. Hilton & Sons, city of Winnipeg, Man., and for Ballast Pit, near Marquette, Man., and to cross 4 highways to same.

16290—April 11—Authorizing C.N.R. to cross public road between S.E. ¼ Sec. 3, T. 39, and N.W. ¼ of Sec. 33, T. 38, R. 27, W. 4 M.

16291-92—April 11—Authorizing C.N.O. Ry. to cross public roads (2) in Twp. of Fitzroy, County Carleton, Ontario.

16293-94-95-96—April 12—Authorizing C.P.R. to reconstruct 5 bridges on its McLeod, Sherbrooke, Ottawa, Mountain and Farnham Subdivisions, bridge No. 54.4, Muskoka Subdivision, Bridge No. 92.3 Boundary S.D., and Bridge 54.0 over new cut McLeod S.D.

16297—April 12—Authorizing Twp. of Roxborough to construct highway across C.P.R. near Mountain, Twp. Roxborough, Ont.

16298—April 12—Authorizing C.P.R. to construct spur into premises of Canadian Carbon Co., Ltd., Winnipeg, Man.

16299—April 12—Authorizing C.N.O. Ry. to cross public road between Cons. 1 and 2, Ottawa Front, Twp. Nepean, Ct. Carleton, Ont.

16300—April 12—Approving details of structure to be built by G.T.P. B.L. Co. authorized by Order 15088, Oct. 13, 1911.

16301—April 12—Authorizing C.P.R. to construct bridge 65.3 over Irrigation Siphon, Calgary Subdivision.

16302—April 13—Approving by-law of Midland Rly. of Canada (G.N.R.) authorizing Charles E. Dafoe, Supt. and Gen. Frt. and Pass. Agt. to prepare and issue tariffs of tolls.

16303—April 13—Authorizing C.N.O. Ry. to cross public road between Lots 10 and 11, Con. 4, Twp. of March, Ct. Carleton, Ont.

16648—April 23—Approving location of C.P.R. freight shed at Saskatoon, Sask.

16649—May 29—Authorizing Kettle Valley Ry. Co. to cross highway at mileage 10.5, northwest of Penticton, B.C.

16650—May 29—Authorizing Kettle Valley Ry. Co. to cross 6 highways in the municipality of Summerland, B.C.

16651—June 1—Authorizing C.P.R. to construct three spurs into premises of Union Stock Yards Co., Toronto, Ont.

16652—May 30—Relieving V.V. & E. Ry. (C.N.R.) from erecting and maintaining fences along certain portion of its line.

16653—May 31—Authorizing city of Hamilton to construct subway under G.T.R. near Sherman Inlet, (Birch Ave.)

16654—May 29—Authorizing G.T.P. Ry. to construct branch line into Secs. 18 and 7, Twp. 53, R. 23, W. 4 M.

16655—May 31—Authorizing C.N.O. Ry. to construct spur from point on joint section of C.P.R. spur in Parry Sound, Ont., into premises of Canada Chemical Co.'s smelter.

16656—May 31—Extending until Oct. 1st, 1912, time for installation of interlocker by C.N.O. Ry. to cross C.P.R. and G.T.R. near Ottawa, Ont. See Order 11386, Aug. 6th, 1910.

16657—May 30—16658—May 31—Authorizing Campbellford, Lake Ont. and Western Ry. to cross C.N.O. Ry. in Lot 27, Con. 2, Twp. of Pickering, Ont., and Pointe-Anne Railway Co. (Canada Cement Co.) in Lot 15, Con. 1, Twp. of Thurlow, Ontario. Interlocking plants to be installed.

16659—May 30—Approving location of Campbellford, Lake Ont. and Western Ry. (C.P.R.) from mileage 72 to 75.45, Ontario.

16660—May 27—Directing C.P.R. to file within 90 days plan showing location of junctions with C.N.R. and interlocking signalling system to govern movements over tracks of 2 Cos.

16661—May 31—Dismissing application of C.P.R. to construct its Lambton to Weston Line across certain highways in Twps. of York and Etobicoke, Ontario.

16662—May 31—Dismissing application of C.P.R. to construct Lambton to Weston Branch to connect with Toronto to Owen Sound line near Toronto, Ont.

16663—May 31—Refusing application of C.P.R. for branch line from its Toronto to London line to connect with Toronto to Owen Sound line near Toronto, Ont.

16664—May 30—Authorizing C.P.R. to take lands in civic St. Andrew's Ward, Montreal, Que., for railway purposes.

16665—May 31—Orders that crossing of C.P.R. of Dovercourt Road, Toronto, be protected by day and night watchman, one-half wages by city of Toronto and one-half by C.P.R.

16666—June 4—Authorizing G.T.P. Ry. to open for carriage of traffic its line from mileage 100 to 164 east of Prince Rupert, B.C., limited to speed of 25 miles an hour.

16667—May 31—Directing C.P.R. to install standard gates at crossing in village of Hartland, N.B., within 60 days, to be operated between 7 a.m. and 6 p.m. daily, 20 per cent. from Railway Grade Crossing Fund.

16668—June 1—Authorizing Vancouver, Westminster & Yukon Ry. Co. and C.P.R. to operate their trains over crossing at Burrard Inlet, Vancouver, B.C., without stopping.

16669-70—May 30—Approving location of Campbellford, Lake Ont. & Western Ry. (C.P.R.) from mileage 106.7 from Celn ray to mileage 123, and authorizing it to cross by means of an overhead bridge the Thurlow Railway Co.'s tracks to Canada Cement Co.

16671—June 1—Directing G.T.R. to compensate existing landowners on either side of Ferguson Avenue, Hamilton, Ont., who were owners prior to establishment of Cannon Street Yard, or to have option of purchasing same outright, etc. Application, city of Hamilton re shunting on Ferguson Ave.

16672—June 5—Authorizing C.P.R. to open for carriage of traffic second main line double track from St. Martin's Jct. to St. Therese, distance of 7.22 miles.

16673—June 4—Authorizing G.T.P. Ry. to construct two spurs to serve Alsip Brick & Supply Co., at Edmonton, Alta.

16674—June 7—Authorizing G.T.P. Ry. to cross and divert highway at mileage 58.3, Alberta.

16675—June 7—16676—June 4—Authorizing G.T.P. B.L. Co. to cross two highways on its Biggar-Calgary Branch, and to divert road from mileage 36.4 to 36.8 on its Regina-Moose Jaw Branch.

16677—June 5—Authorizing G.T.P. Ry. to cross highway at mileage 193.5, Range 6, Cassiar Dist., B.C.

16678—June 4—Approving location and detail plans of G.T.P. B.L. Co station at Bardo, on its Tofield-Calgary Branch.

16679—June 5—Authorizing G.T.R. to construct siding into premises of Canada Brick Co., Ltd., near Montreal, Que.

16680—June 6—Authorizing G.T.R. to reconstruct bridge 4.90 on 16th Dist., near Waterdown, Ontario.

16681—May 30—Authorizing G.T.R. to construct 2 additional tracks across Bay Street, Kingston, Ont.

16682-83—June 4—Authorizing G.T.R. to construct siding for Bronson Company, in Ottawa, Ont., and for Dominion Flour Mills Co., Ltd., Montreal, Que.

16684—June 8—Extending until 15th July, 1912, time for completion of transfer track at Minto, Man. See Order 16501, May 10, 1912.

16685—June 4—Granting extension to C.P.R. for construction of spur until 30th Nov., 1912. See Order 16289, Apr. 10, 1912.

16686—June 7—16687—June 6—Authorizing C.P.R. to construct spur for Frank H. Wiley, in Winnipeg, Man., and for Hub Roofing and Cornice Works, Co., Saskatoon, Sask.

16688—June 8—Approving location of C.P.R. station at Yahk, B.C.

16689—June 5—Authorizing C.P.R. to construct spur for National Portland Cement Co., Ltd., Twp. of Brant, Bruce County, Ont., (near Hanover, Ont.).

16690—June 8—Authorizing C.P.R. to reconstruct bridge 86.1 and 57.9 on its Havelock and London Subdivisions.

16691—May 4—Authorizing C.P.R. to construct branch line to premises of Winnipeg Supply Co., Ltd., Winnipeg, Man.

16692—June 6—Authorizing C.P.R. to reconstruct bridge No. 113.5 on its Cascade S.D., B.C. Division.

16693—June 4—Authorizing C.N.O. Ry. to cross two highways in Twp. of Ross, County of Renfrew, Ontario.

16694—June 4—16695—June 7—Authorizing Campbellford, Lake Ont. and Western Ry. (C.P.R.) to take possession of portion of C.N.O. Ry. right-of-way at mileage 79.5, in Twp. of Sydney, Ont., and approving revised location from mileage 140.63 from (Glen Tay) to mileage 147.89 in County of Durham, Ontario.

16696—June 7—Approving revised location of C.N.O. Ry. through unsurveyed territory, Dist. of Thunder Bay, mileage 142.8 to 148.4, from Port Arthur.

16697—June 4—16698—June 6—Authorizing C.N.R. to cross with its Swift Current Line 23 highways in Saskatchewan, and with its MacLeod-Calgary Branch, 24 highways in Alberta.

16699—May 31—Authorizing city of Hamilton to construct Dunsmure Road across spur of T.H. & B. Ry.

16700—June 1—16701—June 4—Authorizing city of Edmonton, Alta., to cross with its electric railway the tracks of G.T.P. Ry. at Spruce Ave., and at intersection of 21st Street, with Short and Nelson Avenues; half interlockers to be installed, etc.

16702—June 7—Directing G.N. Ry. to fence its right-of-way from Elko to International Boundary with exception of where it skirts the Kootenay River, etc. Complaint, Board of Trade, Elko, B.C.

16703—June 7—Authorizing Government of Alberta to construct highway across C.P.R. on north boundary of N.E. ¼ S. 3, T. 39, R. 27, W. 4 M.

16704—May 31—Authorizing Montreal Tramways Co. to reconstruct bridge over C.P.R. near Blue Bonnets, Que.

16705—June 5—Directing that Order 16479, May 10, 1912, be put into effect by Railway Companies not later than 15 July, 1912.

16706—June 5—Authorizing Peterborough Radial Railway Co. to cross C.P.R. and G.T.R. on Park Street, Peterborough, Ont.

16707—June 4—Amending Order 16451 of Mar. 6, 1912, to substituting words, "forty thousand pounds" for words "thirty thousand pounds," where they occur in said Order.

16708—May 31—Directing T.H. & B. Ry. to protect Walnut Street crossing by day and night watchman; gate question reserved.

16709—June 5—Recommending to the Governor-in-Council agreement between Atlantic, Quebec & Western Ry., and Quebec Oriental Railway for joint shops at New Carlisle, Que.