Canadian Engineer

(Including THE CANA... & CONCRETE REVIEW)

A WEEK... AL

For CIVIL, MECHANICAL, ELECTRICAL and RA... NGINEERS and CONTRACTORS

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THE CANADIAN ENGINEER

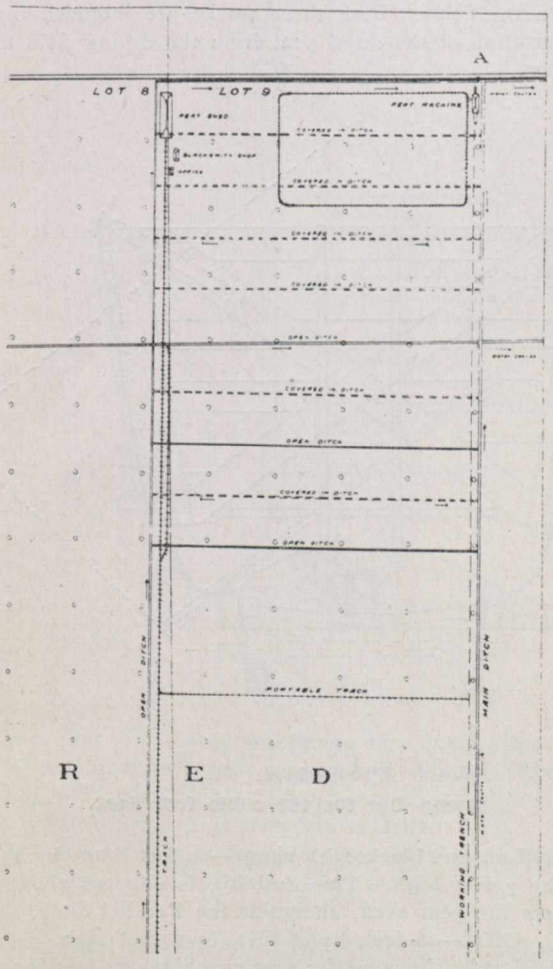
An Engineering Weekly.

GOVERNMENT PEAT BOG AT ALFRED, ONTARIO.

This part of the bog is situated two miles from Alfred station, and about one mile from Alfred village, in Alfred township, Prescott county, and covers more or less of lots 8-9 concession VII.

The total area which is owned by the Dominion Government is, approximately, 300 acres. Of this area:—

2 acres have a depth of less than 5 feet, with an average depth of 2'-8".



135 acres have a depth of 5 to 10 feet; average depth, 9 feet.

160 acres have a depth of more than 10 feet; average depth, 10'-8".

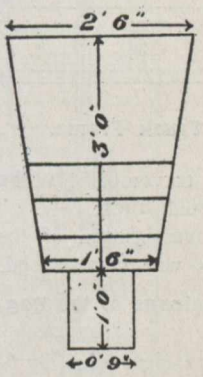
The volume of the peat contained in the area is, with a depth of less than—

5 feet	7,407	cubic yards.
5 to 10 feet	1,950,667	" "
More than 10 feet	2,674,395	" "

The peat is principally formed by sphagnum, and slightly mixed with eriophorum and hypnum. The bottom layer is mostly compounded of carex, grasses, and aquatic plants.

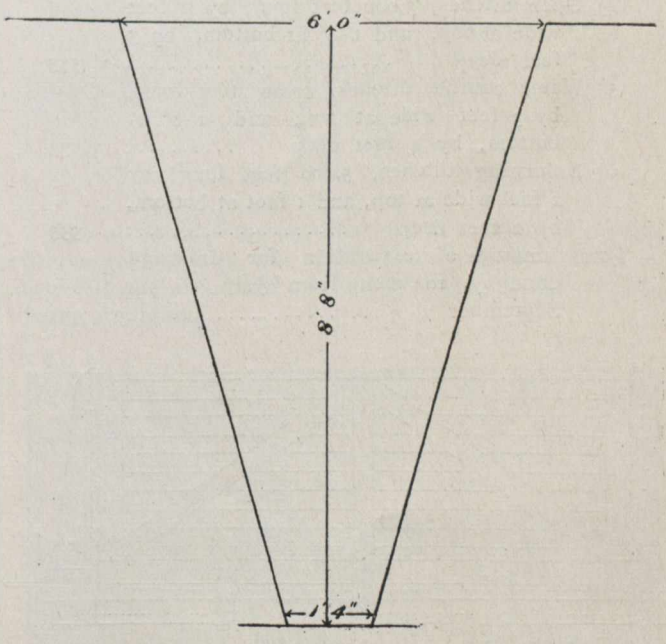
The peat is well humified, and uniform in quality, and with proper arrangement will produce a comparatively good and heavy peat fuel.

This part of the bog is intermixed with small roots, and occasionally logs and stumps occur, which to a certain extent render the digging of the peat more difficult.



Part of the surface is covered with young spruce and tamarack, which can be removed easily, and the surface levelled.

Deducting the 2 acres with a depth of less than 5 feet, and allowing for the decrease in depth through drainage, we have left: 135 acres, with an average depth of approximately



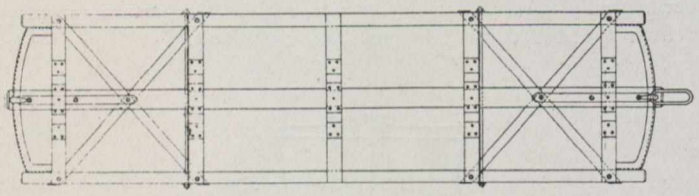
Main Ditch.

7 feet; 160 acres, with an average depth of approximately 9 feet, with a total volume of 3,774,496 cubic yards of peat fuel. Supposing that one cubic yard of such drained bog will furnish 200 pounds of dry peat substance, the total tonnage of dry peat substance available is 327,450 tons of 2,000 pounds, or 409,312 tons of peat fuel, with 25 per cent. moisture.

ANALYSES OF PEAT (ABSOLUTELY DRY).

Volatile matter	68.23
Fixed carbon	26.00
Ash	5.77
Nitrogen	1.76
Sulphur	0.218
Phosphorus	0.033
Calorific value, B.T.U.	9005

The content of ash is low, and the calorific value satisfactory.



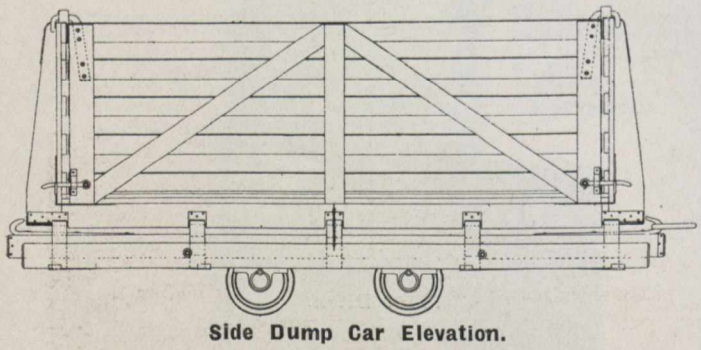
Truck Frame.

This property is traversed by the Canadian Pacific railway (Ottawa-Montreal line).

As soon as the investigation of the bog was finished, digging of the ditches was commenced.

Drainage of the Bog.

	Cubic Yards.
(1) Main ditch, 3,125 feet long, by 6 feet wide at top, and 2 feet at bottom, by 9 feet deep	4,166
(2) Ditch, parallel to the main, 2,800 feet long, by 4 feet wide at top, and 2 feet at bottom, by 4 feet deep	1,615
(3) Covered in ditches, 6,000 feet long, by 2 feet wide at top, and 1′-5″ at bottom, by 3 feet deep	1,111
(4) Open ditches, 3,000 feet long, by 2 feet wide at top, and 1′-4″ at bottom, by 3 feet deep	555
(5) Water course ditches, 4,000 feet long, by 3 feet wide at top, and 1′-6″ at bottom, by 4 feet deep	1,333
6) Enlarging ditches, 5,000 feet long, by 2 feet wide at top, and 1 foot at bottom, by 2 feet deep	555
Total amount of excavation for drainage done by 10 men from July 16, to September 7	9,335



Side Dump Car Elevation.

The main ditch is situated on the east side of the bog, and runs in a northerly direction from the road to the railway. This ditch receives the water from the drained part of the field.

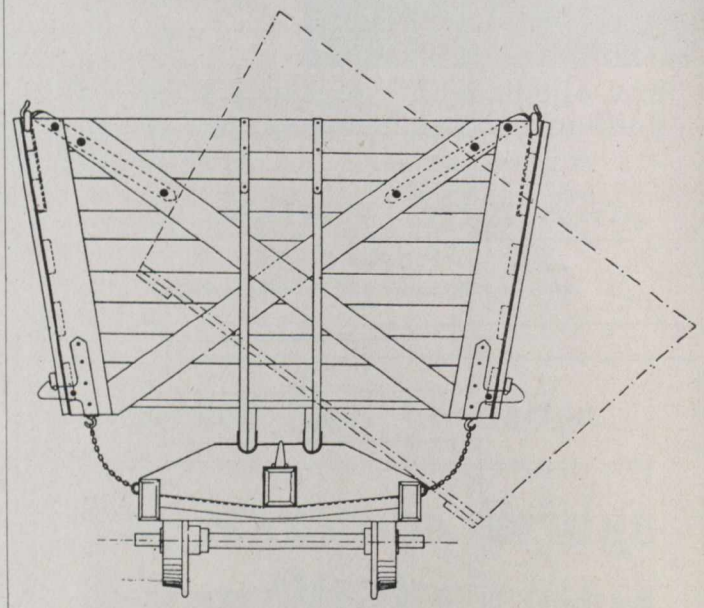
The ditch known as the "Parallel ditch" is situated at a distance of 1,000 feet from the main, and runs parallel with the same. On the north side of the bog, and at right angles to the above-mentioned drains, another ditch has been dug; which receives the water from the drained part of the field, and empties it into one of the concession ditches.

Between the main ditch and the parallel, ditches are dug at an interval of 160 feet. Some of these are covered in, the others are open.

While the ditches were being dug, the following peat plant buildings were constructed and erected, by Daoust and Belanger, of Alfred, Ontario, in accordance with my plans and specifications:—

Buildings.

(1) Peat shed, for storage of dried peat 160 feet long, by 22 feet wide, by 18 feet high. This building is erected alongside the ditch known as the Parallel ditch. A track runs through the building up to the railway, parallel with the ditch. This track is connected by a curve with a portable track in the fields. Both these tracks are intended for the transportation of the dried peat from the drying field to the peat shed.



End Elevation.

Dump Car for 150 cubic feet Peat.

(2) Tool and blacksmith shops—22 feet long, by 13 feet wide, by 7 feet high. This building is situated about 100 feet from the peat shed, alongside the Parallel ditch.

(3) Office—16 feet, by 16 feet, by 8 feet high.

(4) Movable housing for peat machine—22 feet long, by 8 feet wide, by 10 feet high.

Levelling.

One-third of the field—about 25 acres—has been levelled and cleared from trees, roots, and stumps. The remaining part of this field work will be done next summer.

Machinery Equipment.

This peat machine, with cable transportation, round track, was imported from Sweden in 1908, and was used for manufacturing peat fuel at Victoria Road was moved during the summer to Alfred, where it was installed along with other machinery imported recently from Sweden and Germany, making a complete modern plant for the manufacturing of air-dried peat.

This peat machine, with cable transportaion, round track, and Jakobson's field press, is installed on the north side of the bog (see Fig. 2), and will, during the summer of 1911, be in operation along the main ditch. (See Plate I.) The 35 horse-power engine is provided with a specially constructed grate and ash pan.

The productive capacity of the machine varies from 25 to 30 tons per day, employing a working staff of thirteen men and two boys. By using machinery of a large capacity the cost of manufacturing peat can, undoubtedly, be reduced.

The peat machine and steam engine are placed on the same platform; which is movable on rails.

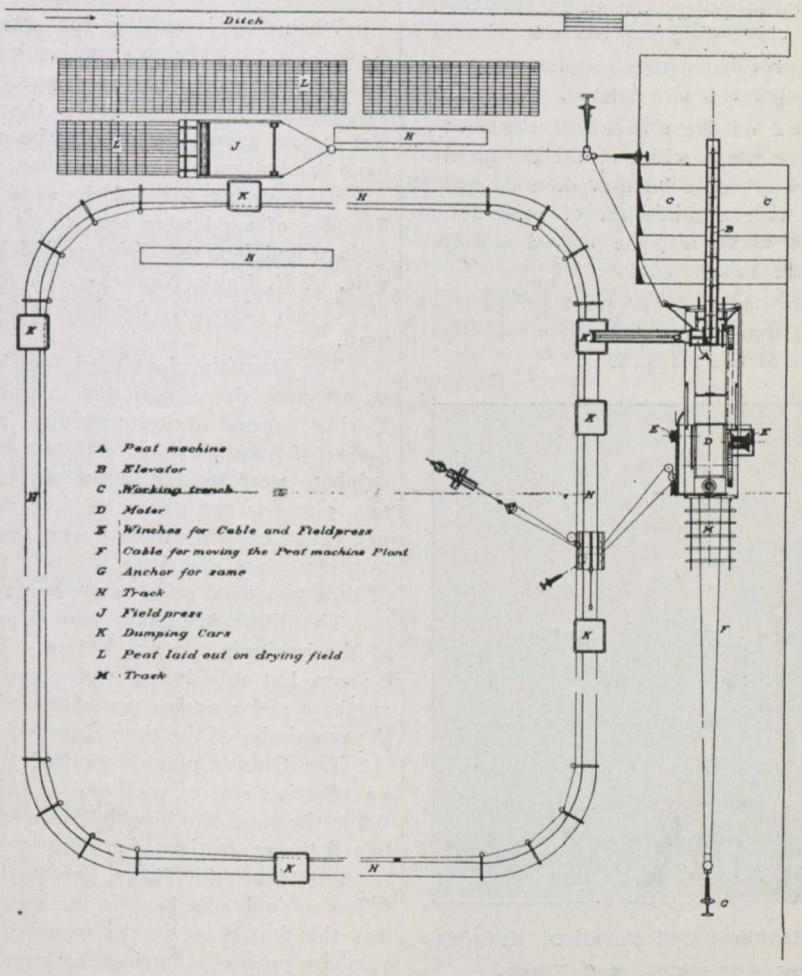
The end elevator is dragged after the peat machine, and is fastened by bolts to the hopper frame.

For a larger plant, where a number of peat machines are in operation, it is cheaper to use electric power; since in this case, the employment of skilled engineers is unnecessary.

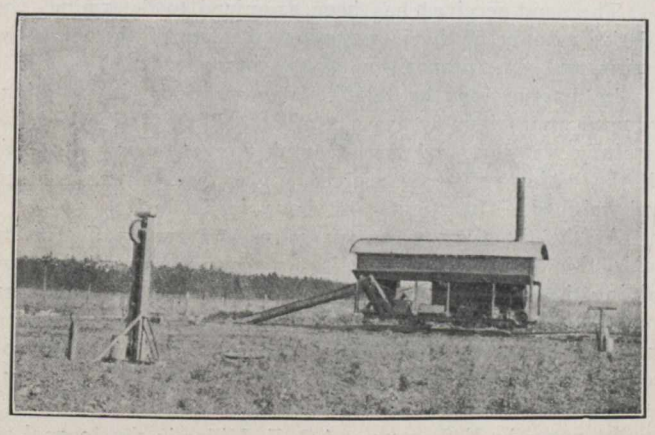
The platform is moved forward by engine power.

Anrep's Round Track, with Mechanical Transportation.

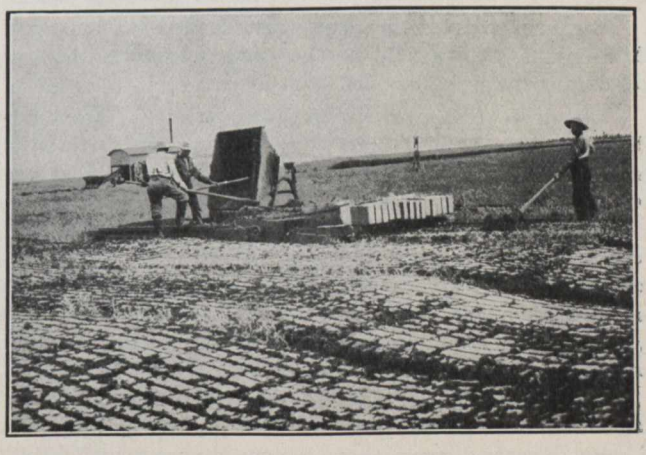
The dumping cars for transportation of the peat to the drying field, are transported by means of an endless cable, driven by the same engine as the peat machine.



The platform of the peat machine and engine is provided with two rope pulleys, one of which is driven by a chain and cogwheel, and connected or disconnected by means of a friction coupling.



Mechanical Transportation Device: Guide Frame.



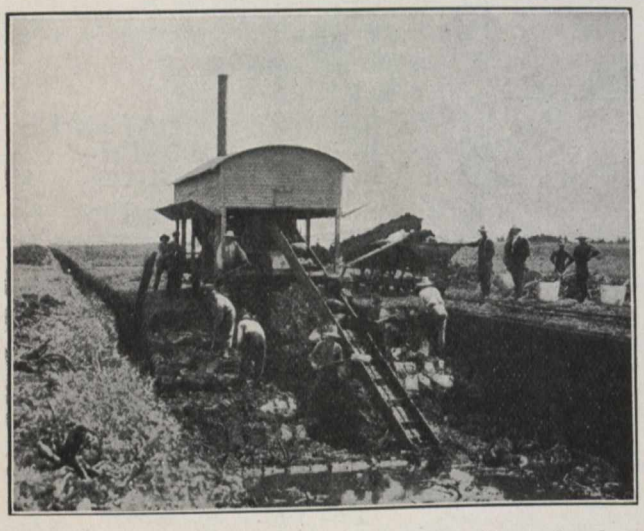
Perspective View of Drying Field: showing Method of Air-drying the Peat Briquettes.

The cable—0.36 inch in diameter—runs over two rope drive pulleys, and over two guide pulleys located on the truck, to the peat machine. From thence it runs to a so-called station car, provided with one smaller and three larger guide pulleys. One part of the cable runs from the station car to a horizontal block, which is kept in place by a chain running over two vertical pulleys fixed in a frame, and kept tight by a weight. The frame is kept in place by means of a square, pointed pole. The cable runs from the block, back to the station car, over a large pulley, and around the track: which is provided at each curve with four rollers.

The dumping cars are provided with a coupling apparatus constructed of wood, and operated with a lever.

Double tracks are used on the side where the peat is unloaded; so that when the whole width of the drying field is covered, only the curves need to be moved, and general operations can continue with a minimum of interruption. The stretching apparatus must, also be moved simultaneously in order to keep the cable tight.

When the lengths of two sides of the track in the direction in which the peat machine is moved become too short, the whole track has to be moved forward.



30-ton "Anrep" Peat Machine: end elevation, showing Elevator, Trenching Operations, and Track.

Anrep's Mechanical Transportation System, Combined with Jakobson's Field Press.

The peat machine is provided with a belt conveyer, which conveys the peat from the machine to the dumping cars.

One man couples the cars—when loaded—to the cable; while on the drying field another man uncouples the cars, and dumps the peat into the field press.

The field press consists of three parts; (1) front part, which receives the peat mass; (2) middle part, for levelling the mass to a layer of uniform thickness; and (3) rear part, for cutting this peat layer into parallel rows. When the press is hauled forward the peat layer is cut through by means of wooden knives, placed behind, and pressed down by weights; the mass is then divided into fifteen continuous rows. The peat rows laid out by the press are cut in suitable lengths by a special tool. The press is moved only in one direction, namely, towards the working trench.

The cable used for hauling the press is fastened in a ring connected with the front side of the press by two chains of equal lengths. From there it runs over a pulley held in place by two anchors, and also over two pulleys placed to the frame of the platform and fastened to a winch at the engine. When the end of the line is reached, the press is loaded on a low truck and brought back to the beginning of the next line.

Five cars are built for transportation of dried peat from the drying field to the shed.

EXTENT AND COMPOSITION OF THE INCRUSTATION ON SOME FILTER SANDS.*

When lime is used in connection with water purification there is a tendency to form an incrustation in the pipes or on the sand grains of the filters. In some cases the sand grains have become so large that it has been necessary to put in new sand. Cases have been reported where the sand near the bottom of the filters has caked into a solid mass.

We have investigated the sand in some filters in Illinois. Samples of sand were sent to us from Danville, Kankakee, Quincy and Moline. We are indebted to H. M. Ely, Danville, C. H. Cobb, Kankakee, W. R. Gelston, Quincy, and to M. Olson, Moline, for information concerning the sand used.

The Danville plant used Red Wing, Minn., sand having an effective size of 0.31 and a uniformity coefficient of 1.8. During periods of low turbidity from 0.27 to 0.7 grain per gallon of lime and from 0.58 to 1.5 grains per gallon of iron sulphate were used. In periods of high turbidity from 0.8 to 2.5 grains per gallon of lime and from 2.5 to 4.0 grains per gallon of iron sulphate were used. Filter No. 8 has been in use 7 years and filter No. 6, 5 years. A large proportion of lime was used prior to the last 15 months.

The Kankakee plant uses Mount Tom sand. The size at the beginning is not known. The sand has been in use 9 years, but only during 1 year has 1 grain per gallon of iron sulphate and 2 grains per gallon of lime been used. During the remainder of the time alum has been the coagulant.

The Quincy plant uses Red Wing, Minn., sand having an effective size of 0.38 and a uniformity coefficient of 2.1. While the sand has been in use a long time, it is not possible to tell the exact time, for about two years ago the sand was removed from the filters, screened and the finest replaced. It has undoubtedly been in use more than 7 years, for Quincy was the first plant in the country to use the lime and iron sulphate process. During the last 4 years an average of 2.05 grains per gallon of iron sulphate and 2.84 grains per gallon of lime were used.

The Moline plant has been in operation without removal or change of the sand for five years. Alum has been used about nine months; previous to that, lime and iron sulphate were used regularly, 1 grain per gallon of iron sulphate and 3 grains per gallon of lime being used.

The sand received has been examined to determine the relative amount of the incrustation, the size of the incrusted grains and the composition of the incrustation.

In determining the relative amount of the incrustation, we used approximately 250 c.c. of each filter sand, which we carefully weighed and treated with hydrochloric acid until all the carbonate was dissolved. The residue was washed and weighed. The results are shown in Table I.

As the filter sands are of quartz and are unaffected by acids, this treatment gives quite an accurate means of determining the increase. It is hard to realize what an enormous increase these figures imply. An incrustation amounting to 71 per cent. means that there is an increase by weight of 249 per cent., and an incrustation amounting to 84.7 per cent.

*A paper by E. Bartow and C. E. Millar in the Journal of Industrial and Engineering Chemistry for February, 1911.

TABLE I.

Name of sand.	Danville, No. 8.	Danville, No. 6.	Kankakee.	Quincy.	Moline.
Weight of sand taken	343.0	351.0	383.0	325.0	330.0
Weight of residual sand	232.0	238.0	330.0	49.0	94.0
Weight of incrustation removed	112.0	113.0	53.0	276.0	236.0
Per cent. of incrustation	32.4	32.2	13.7	84.7	71.4
Per cent. of increase by incrustation	47.9	47.7	15.9	633.0	249.0

represents an increase of 633 per cent. With this increase in the size of the grains there has been an equivalent loss of sand, which has been carried in to the sewers. The increase in the size of the grains is accompanied by loss of efficiency. As the grains increase in size, the interstices between the grains are larger and fine particles more readily pass through.

A sand with an "effective size" above 40 would not be chosen for a filter sand. We can, from the table and by comparison with the original effective size, see that considerable deterioration has taken place. A calculation of the volume of the sand from Quincy before and after the incrustation formed shows a seven-fold increase. This corresponds to the 655 per cent. increase by weight shown by treatment with acid.

The size of the incrusted grains has been determined by the ordinary sieve method. The results are shown in Table II:—

TABLE II

	Effective size.	Coefficient of uniformity.
Danville, No. 6	0.52	1.30
Danville, No. 8	0.55	1.50
Kankakee	0.61	1.68
Moline	0.60	1.90
Quincy	0.77	1.67

the Kankakee River water contains the least carbonate and the greatest amount of sulphate.

The formation of incrustation on the sand grains is due to incomplete precipitation of calcium carbonate before the water reaches the filters. While the greater part of the calcium carbonate is precipitated quickly, an appreciable quantity remains at the end of six hours. The precipitation will take place more rapidly if the water is agitated. The after-precipitation on the sand grains may be prevented by increased sedimentation, which often cannot be done because of the expense, by agitation of the treated water or by the addition of carbon dioxide. The carbon dioxide can be added directly or can be made by the addition of iron sulphate or aluminium sulphate. Carbon dioxide has been successfully used at Winnipeg. It was prepared by burning coke in the furnace used to run the filter machinery.

Sulphate of iron is being used in some of the newer installations as at New Orleans,[3] where the iron is added after the lime and where the water treated with lime is thoroughly agitated.

The reactions with the sulphates of iron and aluminium are double, for both calcium sulphate and calcium acid carbonate are formed. Neither of these substances will form an incrustation on the sand grains.

Laboratory experiments along the above lines indicate that the action of the iron and aluminium sulphates following lime is immediate, so that very little time need be allowed its addition and the application of the water to the filters.

Experiments with carbon dioxide, either pure or as found in purified flue gases, show there is a removal of the incrustation; blank experiments with air showed no removal. The substitution of purified flue gases for the air now so generally used in washing filters would probably prevent the formation of an incrustation.

TABLE III.—COMPOSITION OF INCRUSTATION ON FILTER SANDS.

Determinations made.	Danville, No. 6.	Danville, No. 8.	Kankakee.	Quincy.	Moline.
Insoluble matter	5.89	7.58	1.83	0.32	1.20
Oxides of iron and aluminium, $Fe_2O_3+Al_2O_3$	2.20	3.15	7.20	0.42	0.94
Magnesium oxide, MgO.	1.16	1.00	1.09	0.83	0.12
Calcium oxide, CaO	49.58	47.70	47.75	54.03	53.10
Sulphur trioxide, SO_3	0.17	0.17	0.31	0.14	0.12
Hypothetical combinations:—					
Magnesium sulphate, $MgSO_4$	0.26	0.25	0.48	0.21	0.18
Magnesium carbonate, $MgCO_3$	2.23	1.90	2.00	1.63	1.37
Calcium Carbonate, $CaCO_3$	88.53	85.17	85.26	96.48	94.83
Ferrous carbonate, $FeCO_3$	3.19	4.57	10.44	0.61	1.37
Insoluble matter	5.89	7.58	1.83	0.32	1.20
Total	100.10	99.47	100.01	99.25	98.95

The composition of the incrustation was determined by evaporating to dryness a portion of the hydrochloric acid solution and analyzing the residue. The results obtained are shown in Table III:—

It will be noticed that calcium carbonate is the predominant substance. This corresponds to the composition of the incrustation found in the pipes at Quincy.[1] The incrustation at Kankakee contains the smallest proportion of calcium carbonate. This may be due to the composition of the mineral content of the water, or to the fact that lime had not been used for some time before the sample was taken. According to the analyses of the mineral content of the river waters,[2]

[1]Proc. Am. W. W. Assn., 1908, 172. Univ. of Ill., Water Survey Series, Bull. 7, 35.

[2]U. S. G. S. Water Supply, Paper 239, p. 89.

[3]Eng. Rec. Apr. 23, 1910. Eng. and Min. J. May 6, 1908.

POLLUTION OF WATER IN PUBLIC BATHS.

Investigations in Hamburg, Germany—Pollution of Water After Various Intervals of Use—Sand Filtration Effective—Aeration Unnecessary.

Detailed investigations have been conducted for several years at the Hamburg (Germany) public baths and swimming tanks to determine what increase in the impurity of water may be occasioned by its use for bathing, the object being to determine just how long the same water could be used with safety. The tests were divided into two series, the first dealing with bath water not artificially purified, the second with waters purified continuously by aeration and filtration. The results of these investigations are described in an article by Drs. Kister and Fromme in the December 17th issue of Gesundheits Ingenieur.

Drs. Fürth and Schwarz began these investigations in 1905. Chemical and bacteriological analyses were made when the swimming tanks were first filled and at regular intervals thereafter. There were two baths from which samples were taken. Bath A had two tanks, the one for men being 40 by 75 feet and from 2.4 to 10 feet deep, with a capacity of 20,000 cubic feet; and the women's tank being 40 by 62 feet and from 2.4 to 9 feet in depth, and containing 14,000 cubic feet. In bath B the men's tank was 39 by 75 feet and from 2.4 to 10 feet deep holding 14,600 cubic feet. Bath C was from 7 to 9 feet deep and had a capacity of only 10,00 cubic feet.

These tanks were filled with reservoir water raised to a temperature of 72 degrees Fahr. by means of steam coils. In winter the water was entirely renewed three or four times a week; in summer, daily or as often as the number of bathers made it necessary. During the bathing hours in bath C, fresh water flowed into the tank continuously from supply pipes above the water level, about 1,050 cubic feet of fresh water being admitted every 12 hours. In the other two baths there was no continuous flow of water, but the surface layer of dirty water was removed by allowing the water to overflow for one-half hour both morning and evening, the water being drawn off at the deepest places, fresh water being at the same time delivered to the tank by pulsometers. This produced a circulation of the water twice in each 12-hour period.

In bath C the supply pipe is at the shallowest part of the bath. This is considered important, as sediment might be stirred up if the supply pipe were near the bottom of the tank. The inflow is at the upper edge of the tank, while the outlet opening is a little above the opening provided for draining off dirty water at the deepest part of the tank. In cleaning the tanks they were emptied and scrubbed and then rinsed off with fresh water. In some cases the tank was flushed with a solution of H.Cl in the proportion of one to four, and then scrubbed. All the baths have showers in which all bathers must take shower baths before being allowed to enter the swimming tank.

The analyses of water in bath A were made both summer and winter. During December and January the fresh supply of water showed 57 germs ("keime"). With 10 c.c. of water at 99 degrees F. no B. coli or other bacteria were discovered. Tests for oxygen absorption gave 32 mmg. (parts per million) of permanganate; chlorine, 88 mmg.; ammonia, no traces. After 74 persons had bathed, the germs were found to have increased to 1,800 and B. coli were found in 10 c.c. of water. After 296 persons had bathed the number of germs remained constant, but the number of bacteria growing at 99 degrees, including the B. coli, increased. The afternoon of the first day, after 494 persons had bathed, the number of germs rose to 64,400, but the number of B. coli found at 99 degrees was the same. At the end of the first day, after 820 persons had bathed, the number of germs was only 15,400, but the number of those growing at 99 degrees had increased. Traces of ammonia also were found.

The second day, after an initial increase of germs to 36,700, the number decreased to 6,500, although a considerable number of persons had bathed in the meantime. The number of bacteria developing at 99 degrees acted similarly. The surface of the water was purified by the overflow method described. Following this the number of germs rose again to 101,000 and the third day fell to 2,900. The deposit at the bottom of the tank, when analyzed, was found to be a grayish blue, finely flaked mass, consisting of iron flakes, hairs, small dark brown grains, microscopic wool and cotton threads, sand, detritus and many protozoa. Investigations of the women's tank showed a similar deposit, but the number of germs was higher. Fourteen hours later, after 855 persons had bathed, the number of germs averaged 61,050 in the women's baths as against 43,050 in the men's. During the night the germs in the men's bath increased to 185,850, and that in the women's baths to 160,500. After 959 men had bathed during a second fourteen-hour period, the number of germs averaged 125,000; while the number in the women's baths, after 381 women had bathed, was 170,350.

In bath B similar conditions were found, the overflowing method of renewing the water being found to decrease the number of germs from 123,200 to 46,600 and 28,000. Chemical analysis at the end of the first bathing day showed ammonia amounting to 0.5 to .11 parts per million. The percentage of oxygen saturation varied between 90.7 and 95.6 in summer and between 89.8 and 104 per cent. in winter.

In bath C the water before admission was found to contain 30 to 46 germs, but after flowing into the basin this number rose to from 600 to 1,700. At the beginning of the second day of bathing the number rose to from 14,250 to 40,000 and fell again to 2,900 to 5,400. B. coli were found only after several days of bathing.

These results apparently demonstrate that germs do not increase in water in proportion with the number of persons bathing, but the number is subject to sudden increases and just as sudden decreases. The increase in the number of 99-degree bacteria and of coli is more gradual, but the former in some cases decrease after the second day. This decrease would seem to be similar to the self-purification of rivers and is due to physical, chemical and biological processes. There was little change in the water from a chemical standpoint, even after a great many persons had bathed. Oxygen consumed and ammonia, however, increased. In most cases after the water had been bathed in the number of germs was high, but B. coli were found only in 10 c.c. or more of water, although in some cases they were found in .1 and in some cases even in .01 c.c.

The purification plant used in these investigations, which was operated night and day, consisted of eight coke beds seven inches thick, over which water was sprayed, and two sand filters. The purpose of the coke beds was to aerate the water and remove the coarse suspended matter. Later a 24-inch bed of gravel was substituted for the coke. Under these aerators were two sand filters 20 and 40 inches thick respectively, and each seven by six feet in area. Water was filtered through these at the rate of 1,050 cubic feet per hour, or about one and one-half times the capacity of the tank in 24 hours. The filtered water was conveyed back to the tank

by a pulsometer during the earlier part of the test, and later by centrifugal pumps. Tests were made during 7, 14 and 21-day periods. Examination was made of the turbidity of the water, the bacterial contents of the water both before and after application to the coke aerators and sand filters, and also of the water in the tank. Both number and types of germs were investigated, and the water was tested for oxygen contents, ammonia, nitric acid, chlorine, oxygen consumed, residue on evaporation, loss on ignition and total nitrogen.

After twenty-one days of use the water was transparent down to a depth of 10 feet and the bottom was plainly visible. In fact the color became even better as the original yellow color disappeared.

The sediment contained from 864,000 to 1,360,000 germs, and B. coli were found in .001 c.c.; the loss on ignition was 8.6 per cent. and the matter insoluble in H.Cl. was 95 per cent. The water which had not been filtered contained a finely flaked deposit, which contained from 2,740,000 to 3,980,000 bacteria per c.c., 64.2 per cent. loss on ignition and 22 per cent. insoluble in H.Cl. Also a large number of protozoa.

The top layer of the coke aerator was fairly clean, but the under layers contained hairs glued together by a brownish mass of amorphous plant-like growths, with numerous infusoria, anguilila and bacteria. Numerous worms and larvæ also were found.

The effect of filtration in the elimination of bacteria is indicated by four tests made three days apart, which showed the bacteria in the raw and in the filtered water respectively to be as follows for each of the four tests: 35,025 and 1,300; 30,750 and 744; 58,530 and 558½; 10,475 and 392½. Tests made at periods of 2, 7, and 14 days showed a great decrease in bacteria after the third or fourth day, after which the number in the effluent remained low. During seven-day runs the average elimination of germs was 66.23 per cent., and during 14-day runs the average decrease was 81.93 per cent. The actual figures for the first case were as follows:—

Germs During Seven-Day Tests.

	Tank water.	Supply water.	Decrease %.
Average of all tests	11,683	3,945	66.23
Average first three days	24,075	8,307	65.49
Average last four days	1,061	206	80.58

Germs During Twenty-One-Day Tests.

	Tank water.	Supply water.	Decrease %.
General average for tests	1,296	234	81.93
Average first three days	3,727	598	83.94
Average last four days	385	78	79.71

At times there was no great difference between the tank and the supply waters as to B. coli contained. Even after 21 days, during which 13,155 baths had been taken, there was no marked increase in bacteria. In comparing water analyses at morning and evening of the same day, it was found that in the evening, after an average of 776 baths had been taken, the number of germs was greater than in the morning.

During the tests the filters were changed often so as to get different results. In the case of each filter, treating the water with the coke and spraying it over 40 inches of sand gave better results than when 20-inch layers were used. When the 40-inch sand layers were used, without previous aeration on the coke beds, better results were obtained than with filtration through 20-inch layers preceded by such aeration. When the coke spraying was omitted and the tank water passed through a 24-inch gravel layer, the 21-day tests showed the treated water to be equivalent to drinking water so far as bacteria were concerned. The experiments apparently demonstrated that aeration by the coke filter is unnecessary and that a 40-inch sand filter is sufficient for all purposes. Chemical tests showed no difference between the two methods. The tests also showed no great deterioration of the bathing water on the basis of soluble matter. After 3,471 baths had been taken analysis showed the following:—

	First day.		After four days.	
	Supply.	Tank.	Supply.	Tank.
Residue on evaporation	436	432	440	445
Loss on ignition	28	52	55	60
Ammonia	0	0	0	trace
Nitrites	0	0	0	0
Nitrates	4.6	5.7	10	8.8
Chlorine	121	124	124	124
Oxygen absorbed	14.56	15.24	12.64	15.17

These tests led to the conclusion that tank water, if filtered continuously on plain sand filters, can be kept hygienically clean for three weeks. But a constant supply of fresh water must be added in addition to the water coming from the filters.

CONSTRUCTION AND CARE OF EARTH ROADS.*

By Geo. W. Cooley, State Engineer of Minnesota.

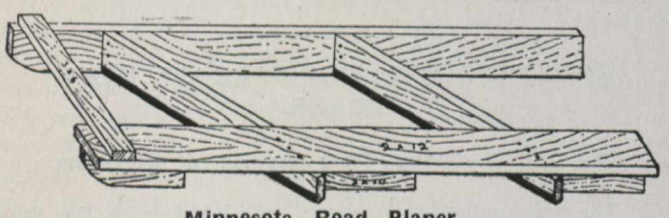
The true value of a system of highways to the State depends upon many conditions, among which may be cited continuity, thus providing for the requirements of transportation over distances greater than can be economically traversed on inferior and sometimes nearly impassable roads; hardness and smoothness of surface with easy grades, permitting a reduction in the cost of haul, and an administration that will furnish an economical and judicious expenditure of the funds used in construction and maintenance. It has been shown that 95 per cent. of all products carried by rail or steamship must first be transported over the primary roads of the country, and it is therefore to these, the most important of which at this time are the common earth roads, that our attention is at present directed.

The records of the United States Office of Public Roads show that we have in the United States about two and a quarter millions of miles of roads, which mileage may be approximately subdivided as follows: Of common, ordinary earth roads, the result of continuous travel, but unscientific and unsystematic methods of maintenance, about 90 per cent.; of fairly improved roads, i.e., roads which under our present system have been turnpiked or graded according to the various methods in vogue in the different States, about 10 per cent.; and of good roads in the latter class built to a permanent grade line and properly surfaced with gravel or broken stone, not far from 7 per cent. of the whole. This small proportion of permanent roads embraces only those which under the regulations of the various highway commissions, or under the supervision of competent local authority have been so constructed as to do away with the future necessity of regrading, or of resurfacing, except so far as may be made necessary by the ordinary wear and tear of travel. One of the greatest mistakes generally made with

* Address delivered January 26th, 1911, at the Omaha Land Show.

the opening up of a road system in a new country is that induced by the belief that no engineering skill is necessary, and that any man versed in the handling of tools or road machinery is thoroughly competent to build a road. Such a mistake frequently finds its legitimate fruitage in expensive changes of location, regrading, or insufficient drainage, and requiring, after the expenditure of large amounts of money for construction, that much more must be provided to remedy the errors originally made.

The subject of road building on a plan commensurate with the necessities and financial ability of the people then resolves itself into but three parts: First, sufficient engineering skill to properly locate and drain our highways; second, competent supervision in construction, and third, money to pay the bills. It is not always necessary to procure from long distances such material as gravel or broken stone with which to construct first-class modern highways, for the earth road must be first made, and well made, and the surface continually maintained, so that, when conditions permit, there may be found a solid roadbed on which to place a finished surface capable of withstanding the wear and tear of the heaviest or most rapid travel it may be called on to stand. Our system of surveys, by which the State is divided into sections a mile square, makes it appear ad-



Minnesota Road Planer.

visable, and in many cases necessary, to locate our roads along the section lines, so that farms will not be cut into irregular tracts, and the cost of the right-of-way held down to the minimum. This system is not always objectionable, and in many cases gives the best results with the least cost, especially in those portions of the State which lie comparatively level; but even under such conditions not sufficient attention is paid to the drainage systems, and many miles of road have been built by merely carrying the earth from the so-called ditches at the side to the so-called road between, building a so-called turnpike. Such a method of construction provides our ordinary earth road, which, when partially packed and made reasonably smooth under the effect of travel, becomes a passable and satisfactory highway for a time, and during the continuance of favorable weather; but such a road has no lasting qualities; its surface becomes softened by rains and by standing water in the ruts and side ditches; frequent repairs are necessary to keep it in passable condition and eventually, when the road funds permit of further expenditure for improvements, it is found necessary to regrade, redrain, or in many cases to rebuild, so as to enable it to carry a permanent surface of harder and more lasting material. For many years to come the people of this State must content themselves with the common, ordinary earth road, built of the material at hand, whether it be clay, sand or vegetable loam, and it is proper that we should carefully study that problem first, and eliminate from our future those practices which have united in giving us such a vast mileage of inferior roads.

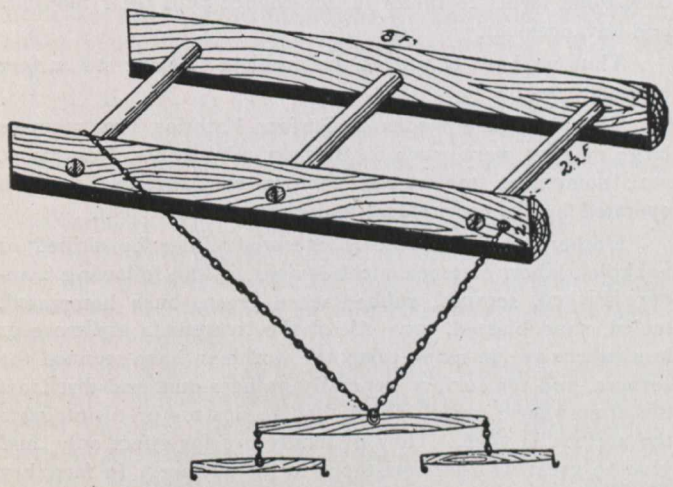
There are two primary considerations in the construction of an improved system of highways: first, thorough drainage; second, a permanent foundation; considerations that have to a great extent been ignored in the conduct of the internal improvement system of all our Western States.

The temporary methods of road work for so many years in use in this State, and, in fact, all through the West, must be done away with and a more careful system adopted before we can have roads of such a character as to bear the traffic of a progressive agricultural community, and enable them to market their produce at a minimum of cost in time and labor, not only during the most favorable times of the year, but at all times and under all circumstances. Roads have been built, and can be built again that will comply with such requirements, but in order to accomplish such results we must abolish all antiquated methods and invoke the aid of improved machinery and the assistance of the modern road builder. No progressive farmer uses to-day the flail or sickle of fifty years ago; but on every farm we hear the melodious noise of the reaper and listen to the rumble of the steam thresher as it delivers to waiting hands the golden products of Nebraska's fields. If we had advanced in our system of road construction as we have along the lines of agricultural development there would be no necessity to urge the people to put forth greater efforts in that line. But this we have not done and it becomes our duty now to take up the road question and carry it on unceasingly until the primary transportation facilities of the State are equal to the reasonable demands of an up-to-date and progressive community.

Legislative enactment should prepare the way for intelligent supervision and an individual responsibility by providing for the appointment of a highway commission for the State a superintendent of highways in each county, and a road inspector in each town, men whose duties require them to understand the condition and requirements of every mile of highway under their supervision. We want the people of the Western States to give this system a fair trial, believing that as soon as such officers become acquainted with their duties and the needs of the roads in their particular districts they can much more intelligently use the road funds entrusted to their care and make every dollar expended count at least one hundred cents toward permanent road construction. The work required of these men should be not to build, even with the aid of the State, expensive macadam roads, but only such roads as are suitable to the condition and requirements of the people, and such as they are able to properly maintain, and so for many years our energies must be directed to the construction and maintenance of the common earth road. We must see to it that our roads are well drained, ditches kept open and free from weeds so that in those portions where the slope of the land is very slight the waterway may have free access to, through, and away from the side ditches into some previously constructed or natural line of drainage. Hence, it becomes necessary to employ in many cases a competent engineer to secure a suitable slope to the ditches, and a few dollars so expended will insure success in this most important work. Culverts should be provided wherever needed so that no water be allowed to stand for any length of time on the road, in the ruts, or in the ditches. On such soil as you have here, water is an ever-working factor in the destruction of your roads, and the road surface should be kept as hard as possible to prevent the formation of ruts; high and round, so that the water may find ready access to the ditches; and as smooth as possible, so that no depression shall afford a chance for standing water to soften and destroy the surface. Do not be discouraged by the fact that the land is level, or nearly so, and that apparently drainage is impossible; set your engineer at work and he will soon find a way to get the water off. In the original construction of many of our roads you will find that sod and vegetable matter of different kinds have been worked up in the preparation of the foundation of the roadbed, a grievous mistake that it will

take years to remedy. No sod or vegetable matter of any kind should be allowed in a road within three feet of the surface. (See Rules and Regulations of the Minnesota Highway Commission and of all good road States in the country.)

In the construction of a permanent road through a prairie country the sod that covers that part of the right-of-way where the ditches are to be, should be taken off and carried out of the way, and only the solid earth used to raise the roadway. If this sod could be laid smoothly and uniformly down on the surface between the ditches at the bottom of the turnpike there would be little objection to that



Split Log Drag.

use of it, but it is generally cheaper to waste all such material. The main objection to the use of sod is in its uneven distribution, and when it is thrown up indiscriminately into a turnpike, as when a road is built with an elevating grader, its use is fatal to good road construction and cannot be too strongly condemned.

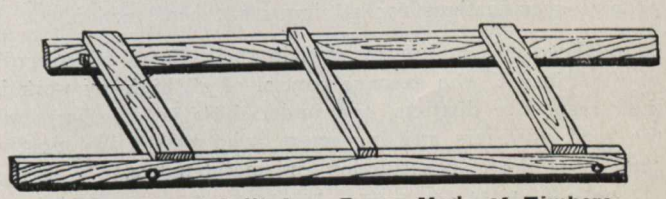
Bear these two rules in mind: "Get good drainage, and make your roadbed high, round, smooth and of solid earth." These are very simple rules, easily understood, and there is not an intelligent road overseer in your State that does not know their value just as well as I do, but, having been handicapped every year with lack of funds and many pieces of bad road requiring some repairs, it is hardly to be wondered at that they have failed to put in practice these simple principles of construction. But the time has come when the people demand of their road officials something better than yearly patching and temporary repairs. My advice to your road inspectors is to pick out some bad pieces of road in your district and apply the proper principles of road work to that single piece. Do not be content with merely making it passable for the present, but rip out that old, rotten corduroy or brush, or whatever was used last spring to help teams over the bad spots and fill up the holes with something that will stay there. See that the water gets into the ditch, and then follow that ditch down and find out why the water does not get out. Do not worry if some fellow over in the other side of the township kicks because you are not working on his road; tell him to be patient and you will reach him some day. Stick to it; what you do, do well, and you will find not only satisfaction in doing a good piece of work, but before long you and your neighbors will realize the fact that you are at last on the right track.

Now, as to keeping up your roads. You have heard me talk of road drags; there are several kinds of them, all illustrated in the Minnesota Road Red Book. You can make them easily and at only a trifling expense, and there is no known appliance that is so economical or convenient or satisfactory when properly used as any one of the different kinds shown. Use them right after a rain when the roads are soft, draw them up one side and back on the other; all they do is to keep the ruts out of the road and restore the crown, and that is the whole secret of earth road maintenance. Keep the ruts out of the road, let the water off quickly into the ditches, keep the ditches clear, and if you have previously built your road of proper material you will always have a good road. One thing I would like to call your attention to: do not make your drags too heavy; they are not intended for grading a road, only for keeping it in condition. One pair of horses is enough; if your drag is too heavy for one team it is unnecessarily heavy. Send to the office of Public Roads at Washington for a "Drag" pamphlet and read it up. You may not find very much in it that you did not know before, but if you get one new idea and put it into practical use, the whole people will get the benefit of it, and you will have the satisfaction of knowing that your work has the endorsement of men who have worked on the roads for many years.

No matter how unimportant a structure be, whether a building or a highway, it cannot be expected to endure the wear and tear of occupation or travel unless the foundation is secure and permanent. Without such security the superstructure must fail, either immediately after the work is put into commission, or within such a short lapse of time as to demonstrate the folly of an inadvised and incompetent beginning.

Roads are built for all time, not for a day or for a year, and when once located are very seldom changed. It would seem advisable, then, that all work done on them should be so done as to render it unnecessary to rebuild; but we find thousands of miles of our public roads constructed without due regard to these primary principles which have to be entirely rebuilt before they can be put into proper condition to carry a permanent surfacing.

In all the roads of continental Europe as well as those in the Scandinavian peninsula, one rule is absolute, and invariably enforced, that no perishable material of any nature is allowed to be placed in the roadbed. So important is this requirement considered that the utmost care is taken during the construction to remove all such material and all sod containing vegetable matter that may be turned out in grading the side ditches is carried away for other purposes and only the solid earth used for carrying up a grade. This care in the preliminary work of providing suitable drainage through careful engineering and the construction of a solid, substantial base has made it possible for the countries of the Old World to secure a system of highways that has excited the admiration of engineers and travellers from all other nations. It has done more: it has provided an object lesson for us, and placed before us an example worthy to be followed if we would secure as good a system of highways as is enjoyed by the people of less favored lands.



Modification of Split Log Drag—Made of Timbers.

The methods now in vogue in this country on a large percentage of our road mileage are simply a continuation of those methods adopted when we were without experience in road building. Since the introduction of road machinery much better work has been done, but in many cases a lamentable lack of intelligence and experience in the use of such machinery is indicated by a condition of surface vastly inferior and less adapted for travel than before its application, and it is the common practice of those who use the highways to avoid those stretches which have just been subjected to a so-called improvement. This condition arises as much from a lack of intelligent supervision as from any other cause, and such conditions will continue until the system is so changed as to require that all such work be put in charge of competent road builders. This cannot be done without a radical change in the laws. As the law now stands we elect or appoint in each town every year from four to twenty or more road overseers, none of whom is required to be qualified in that particular line although many of them are; but even those qualified may be removed at the end of their term and the work placed the following year in the hands of others who may be no improvement on their predecessors. How differently such affairs are managed in other countries is shown by an extract from Bulletin No. 6, lately issued by the Highway Commission on the "Highway Systems of Foreign Countries," referring particularly to the roads of Scandinavia:—

Stoopes Lap Drag—Wearing Surfaces Shod with Angle Iron.

"In the work of laying out or constructing new roads, accurate surveys are imperative. Drainage being of primary importance is provided for by a system of levelling, and grade lines are established the same as required in the construction of a railroad. No plea of lack of funds, or urgent need of the road for use is available to prevent this preliminary work, and no public moneys are put into any highways until such work is accomplished to the satisfaction of the county engineer and his superior officer. In grading, no perishable material of any character is allowed in embankments, and ample time is given for such portions of the work to become thoroughly settled before a finishing surface is applied.

"In each of the kingdoms, after passing the preliminary stages of appropriation and allotment of funds, the work passes under the control of the director of public works or engineer-in-chief, in whose office are prepared plans and general specifications for all important construction.

"These officers are assisted in their duties by subordinate engineers, who exercise control of all highway work in their respective districts, and under these latter officers are the road overseers and inspectors, who personally superintend all works of construction and maintenance.

"No work of any nature involving the use of highway funds is permitted unless the same is put in charge of some officer or his assistant duly qualified by experience to superintend the work."

There is a vast difference between the methods cited above and those that obtain in our country, and there is no good reason why we cannot adopt such a policy in the expenditure of our road and bridge funds as would give us an adequate return for the money paid in as road taxes.

CONCRETE SURFACE TREATMENT.*

By Robert Cathcart, Cleveland, Ohio, U.S.A

The Cement Age is in its primitive stage, and its future is destined to eclipse all modern idea or thought. In the natural sequence of things and conditions, no other building material offers such advantages to the builders of our national homes and factories.

A primitive age usually has many things to discover and work out for the future knowledge of the coming generations, but as we live in an age of progress in Art, Literature and Science, the world looks to us to make those primitive conditions ideals to theirs in accordance with their thoughts and advancement.

Thus we have before us the problem of Concrete surface treatment:—

The plans and modes of Surface Exterior Treatment to large massive work, such as Bridges, Abutments, Reservoirs, etc., sometimes to exterior factory construction are both operated by the mechanical and chemical treatment.

Mechanical Treatment is executed either by skilled or unskilled labor, or mechanical devices, in the following manner: Picked, scraped, rubbed when green, bush hammered, tooled, sand blasted, etc. All of the treatments are more or less expensive; in many cases the workmen have stunned the corners, and the surface generally gathers dust and dirt from the atmospheric gases, which tend to destroy or disintegrate the surface in time. They generally are for effect only, and give no great weather resistance to the surface. In fact they are unfavorable to many conditions of construction and in some cases only a make-shift to betterment.

Chemical treatment is also an unskilled or skilled labor treatment, with commercial muriatic acid, acetic acid, etc., diluted with water, consisting of cutting the scum surfaces to relieve the hidden aggregates. It is also a more or less expensive operation and the nonuniformity of the surface, combined with its chemical action does not put it into special favor, although such processes have been patented. The muriatic acid is liable to stain the surface, and leave salts that will form a soluble alkali in combination with the concrete and produce an efflorescence on the surface.

The Veneer Treatment to outside walls, with plaster has proven quite unsatisfactory for many reasons. The bond to the concrete has generally been weakened by the percolation of water, through the plaster to the concrete surface and caused a loss of adhesion, strength and permeability.

The outward influence, such as the sun's rays, frost, rapid wetting and drying, cause shrinkage of the veneer surface, loosening all soundness of adhesion, causing cracking and scaling.

Thus it would look as if no plaster should be applied to exterior walls, where dampness could possibly lodge itself.

Coated surfaces are those generally speaking that have had Cement grouts or washes applied to them. They are never stable, and generally used to fill up the unevenness of the surface without regard to their lasting qualities. In fact they are dangerous surfaces to apply any surfacing materials to because of the unstableness of the bond.

Floor surfaces are tricky, because no man finishes the entire area of surface, and they should be rigidly covered by inspection before operating any treatment.

Obstructions or obstacles to Concrete surfaces that demand treatment for preservation and service:

*A paper read before the Canadian Cement Association, Toronto, March, 1911.

External influences on concrete surfaces, such as heat, cold, sunshine, water pressure, percolation, show their effects in two forms of disintegration—Mechanical and Chemical, defined as follows:—

Mechanical: A consequent washing away of the softer constituents from the surface by the softening action of water due to frost, the alternating action of the sun's rays, resulting in a periodical expansion of the other surface.

Chemical: The proportion of carbonic acid gas, oxygen water and gaseous products of combustion in the atmosphere, a separation of scales, sometimes thin and thick, which by accumulation and an infiltration of strange matter into the pores cause a peeling from the surface. In other words you get a condition of disintegration or corrosion, both from within and without, which has been termed "Wall Rot Proper."

The lodging of the soluble salts upon the surface is efflorescence, and mainly due to such conditions as above mentioned, although local conditions and materials govern its area of trouble.

Coatings: The need of, and kind of materials:

To produce a material for surface coating on concrete has been widely discussed pro and con by all scientific bodies. Plaster has been found to be unreliable for exterior surfaces. Grouts are unstable.

To obtain an alkali and acid-proof vehicle with a pigment that will have sufficient wearing body, has been the aim of the Engineer, Contractor, Consumer and Manufacturer. Thus we will consider a few of the essential factors:—

1st. Materials should contain a vehicle and pigment working in harmony with the conditions upon the surface.

2nd. They should contain an acid and alkali sun-proof color and pigment.

3rd. They should have a sufficiently hard wearing surface to allow successive coats, without further treatment of the surface.

4th. They should be sufficiently heavy to fill the surface voids and stop suction.

5th. They should produce a finish sufficiently close to the texture and originality of the surface.

Treatments: Treatments of concrete surfaces are divided into two divisions as follows:—

The shallow or superficial method of treatment is a filling of the voids near the surface without discoloration. It is one that was much sought after in the early stages of concrete work, especially on Concrete Blocks, etc.

Although the monolithic type of construction has gained more favor in larger construction, the Mechanical and Chemical treatments of surfaces, as outlined are the surfaces most in need of a shallow or superficial treatment.

Cement bricks, blocks, cast stone are also surfaces that need a light treatment.

The Physical or External method of treatment is a coating of natural materials as a prevention of contact between the elements and the construction. The treatment should be defined under two divisions.

1st. Damp-proofing and decorative without complete obliteration of the texture of the surface.

2nd. Water-proofing only—without the decorative feature, and complete obliteration of the texture of the surface.

Under the first division you have a combination of results, against the mechanical and chemical disintegration of the surface, as defined for exterior surfaces. The operation should be twofold in its purposes. Damp-proofing and decorative in one operation, without destroying the texture of the surface.

Under the second division comes the subject of water-proofing, (Defined by Webster as proof against penetration), which may mean everything or anything—and we are sure the word has been handled improperly as to its meaning, because of our undying enthusiasm on the subject—although it may only mean damp-proofing, instead of water-proofing.

Water-proofing is an engineering problem of much discussion pro and con and does not enter into the subject of concrete surface treatment.

Specifications.

The following essentials should be strictly adhered to to insure results for the surfacing of concrete:

All exterior or interior surfaces must be free from loose scales, sand, grit, grease, oil or other foreign matter.

Surfaces can be freed of such materials by either scraping, wire-brushing, or scrubbing with carborundum brick.

No Muriatic acid or other acid treatment should be used, unless the surface is thoroughly neutralized by water or a light alkiline solution.

Green surfaces should be treated with a thin coat of surfacing materials to aid the neutralization of the free lime, and fill the voids on the surface.

After the first coat is applied, evaporated patches should be re-coated to insure evenness on the future coats.

All surfaces should be dry and free from moisture to give perfect adhesion.

Exterior surfaces of buildings should be protected from rain or heat while drying.

Costs.

Physical or External Treatment:—The figures including the cleaning and preparing the surface under ordinary conditions on two-coat work are generally estimated at 25 cents to 40 cents a square yard.

The covering of a concrete surface is about one-half that of lead and oil on wood—first coat—and two thirds of lead and oil on wood—second coat—and equal to lead and oil on wood on the third coat for exterior surfaces.

The labor for the Physical coat treatment is about one third greater than the application of lead and oil on wood for exterior surfaces.

The non-uniformity of surfaces, filling of voids and suction explains the covering coats.

On concrete floors the covering of a concrete coating or dressing runs from 200 square feet per gallon—first coat—to 400 square feet—second coat—according to condition of surface.

No one job is an example of guide—they all differ in uniformity of conditions.

The shallow or superficial method or treatment on coating two coats—costs about ⅓ to ½ per square yard less than the Superficial or External treatments depending upon conditions.

The operator must be careful of the first or priming coats as these are the foundations for a perfect bond and neutralization of the surface for successive coats.

The operator should produce a surface texture without destroying the originality of the surface.

Warning.

No surface is free from dirt and foreign matter and it requires the removal of such substances either by wire brushing or a light acid treatment to remove stained portions in order to secure a firm bond and penetrating quality to the surface.

In conclusion, I have endeavored to lay before you a few of the various methods for surfacing concrete and their treatment for a decorative structure.

THE PEDESTAL PILE.

Piling has been used by engineers for more than two thousand years; it is the simplest and most natural means of obtaining firm foundations in soft and unreliable soils. Until recently wooden piles were chiefly used and where kept constantly wet, they have been known to last for hundreds of years. On the other hand, in a great many cases wooden piles have rotted away in a very short time, causing thereby serious settlement and failure of foundations.

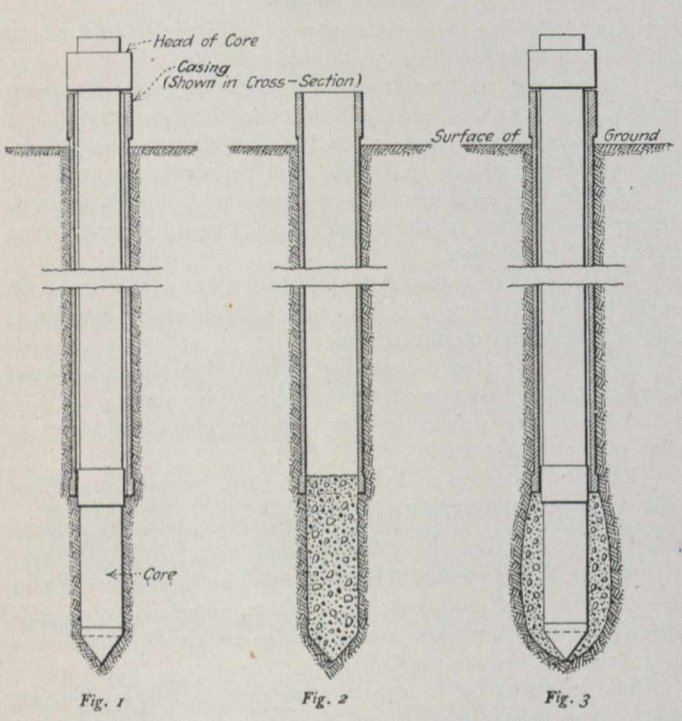


Fig. 1 Fig. 2 Fig. 3

Concrete, being impervious to the action of the elements, forms therefore a valuable substitute for wooden piling. Concrete piles, formed and seasoned above ground, or cast down in the ground by various means, have been used to considerable extent both in this country and abroad, and in general have proved an economical and reliable foundation. However, so far as concerns carrying capacity, none of these piles represent any intrinsic improvement over the wooden pile. They are either cylindrical or tapering in shape and support the load imposed upon them in the same way as do wooden piles, i. e., almost entirely by frictional adhesion.

The pedestal pile, which we describe at some length, is a distinct and radical change in piling construction. It differs from the ordinary wood or concrete pile in that a large carrying capacity, in addition to that due to frictional adhesion, is derived from the direct bearing power of a broad base resting in firm and compacted subsoil. The advantage of a pile with a broad base has long been recognized. More than a hundred years ago screw and disk piles were used in England and in the United States. Rankine mentions some cast-iron piles, from 20 to 45 feet long, with screws 2 ft. 6 in. in diameter, which carried a working load of 67 tons per pile without settlement. Evidently the placing of these piles was both laborious and expensive.

It remained, however, for Hunley Abbott to devise a method of mushrooming or bulging out this foot in so simple a manner that the completed pile, while capable of supporting large loads, is no more costly than piles of the ordinary type.

The apparatus necessary to form this pile consists of a casing and a core. The casing is a steel pipe, 16 in. in diameter and ⅜ in. thick, with outside reinforcing bands, top and bottom. The core is a smaller and longer pipe, with a cast-steel point and an enlarged cast-steel head. The core fits inside the casing, its enlarged head engaging the top of the casing and its lower pointed end projecting some 4 or 5 ft. below the casing. In the head of the core there is an oak driving block which receives the blows of the hammer. The core is fitted into the casing and both are driven into the ground to the desired depth, as indicated in Fig. 1.

The core is then pulled out, and a charge of concrete is dropped to the bottom of the casing, as in Fig. 2. The rammer is now lowered into the casing and driven down through this concrete, as shown by Fig. 3. As a result the concrete is compressed and is forced out against the soil, pushing back and compacting the surrounding earth. The operation is now repeated. The rammer being withdrawn, another charge of concrete is dropped down inside the shell and the rammer again driven through it, causing the concrete to be forced out still further into the surrounding earth. This process is continued until a sufficient volume of concrete has been rammed down to insure a footing of the desired size. The ram is then removed, the casing is filled to the top with wet concrete and the pile has the form of Fig. 4.

The casing is then removed slowly and evenly, the concrete falling into position and filling out the thin space formerly occupied by the casing. For this reason, after the casing has been completely removed, the surface of the concrete in the shell will be found to have sunk some 3 to 6 ft., according to the length of the pile. The volume of concrete represented by this sinkage has been found to agree exactly

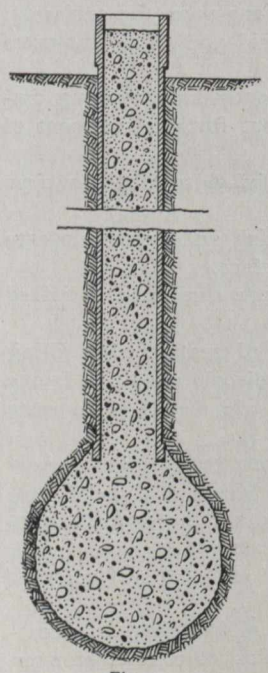


Fig. 4

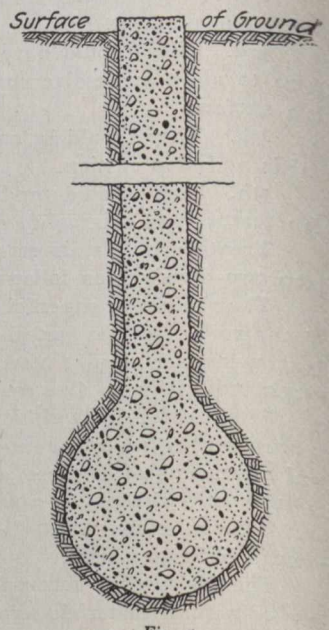


Fig. 5

with the volume of the casing wall which it replaces. This fact has been confirmed with Pedestal Piles placed in mud, soft clay, trash fills and quicksand, proving conclusively that there is no flowing in of the earth after the casing is withdrawn. The resulting pile is a column 17 in. in diameter with an enlarged base or Pedestal, as shown in Fig. 5 and Fig. 6.

The formation of the enlarged base or footing is simple and direct. Little additional labor is required and but small added time. The total time required for the complete formation of the pile is about 30 minutes.

Where a structure is to be built on soft or unreliable ground, spread footings cannot be depended upon to carry the weight without undue and unequal settlement. Under such conditions, some type of piling is usually found to be the most economical foundation. Piles provide increased

Fig. 6.

carrying capacity by transmitting the load to the firmer and more reliable subsoil underlying the surface soil. A pile develops this carrying capacity in two ways: by the frictional resistance of its surface with the soil penetrated and by the direct bearing of its base upon the subsoil.

In "A Practical Treatise on Foundations," by Patton, the following equation is given for the total carrying capacity of a pile:

$$L = bA + fS, \text{ in which}$$

L = the safe supporting power of the pile.,
b = the safe bearing power per sq. ft. of the soil at the point or base of the pile,
A = the area, in sq. ft., of the base of the pile,
f = the safe frictional resistance per sq. ft. of soil penetrated by the pile, and
S = the number of sq. ft. of surface in contact with the soil.

Patton further states that, as A and S are known from the size and shape of the pile, if we know b and f, we can determine the supporting power of the pile under any conditions. For most cases b, the bearing power of the soil at the foot of the pile, can be quite accurately predetermined, but f, the frictional resistance, is of a somewhat less determinate nature. It ranges in general from 100 lbs. per sq. ft. in the softest soils to 600 lbs. per sq. ft. in compact sand and gravel.

From Patton's equation we can now compute the carrying capacity of different types of piles and compare them with one another. As, however, the conditions existing with single piles and group piles are somewhat different, we shall consider them separately.

A straight or tapered pile supports its load almost entirely by friction. The surface area in frictional contact with the earth penetrated is from 50 to 150 sq. ft., depending on the length and shape of the pile, while the area of its base, transmitting a load by direct pressure on the subsoil, is seldom greater than one square foot. With the average wooden pile, the area of the point or base is about .275 sq. ft., and with the ordinary tapered concrete pile it is about the same, while with a large straight concrete pile it may be as much as 1.4 sq. ft.

Because of this small base area, an ordinary pile does not derive much bearing power from the soil at its foot. A plain straight or tapered pile must depend almost entirely on frictional resistance to transmit load to the subsoil, and as natural conditions usually limit this resistance to low value. the load finally placed upon the subsoil is far less than its safe bearing power.

Regarding the manner in which a pile supports its load by friction, E. P. Goodrich (Trans. A.S.C.E. XLVIII No. 921), points out that "When a pile is supported entirely by frictional resistance, the actual region supporting the load is some deep ground level at which the frictional resistance holding the pile has been transferred through the earth in the shape of a conoid of pressure, the base of which gives a total bearing value equal to the load and a unit bearing value which the earth at that lower level will support. Each kind and degree of compactness will give a different angle for the slope of the conoidal surface."

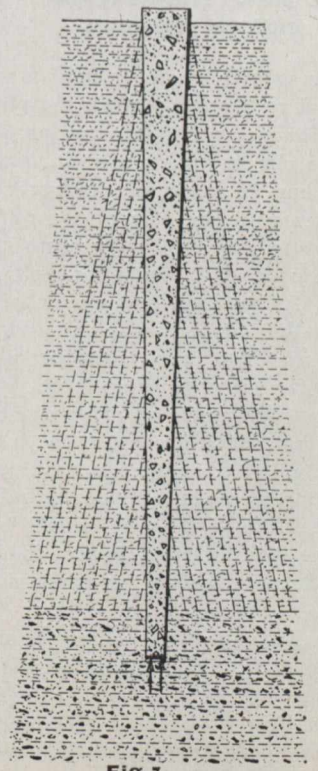


Fig. 7.

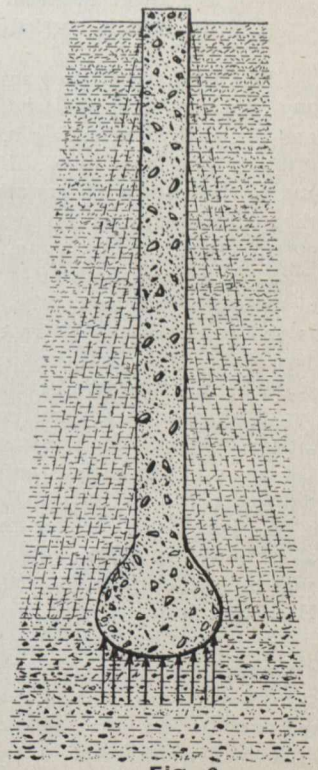


Fig. 8.

By assuming the existence of a conoid of earth, distributing the pressure from the pile over a broad surface of subsoil, it is possible to explain why a pile supports a fairly large load by frictional resistance alone. Referring to Fig. 7,

we see that the pressure transferred by the surface of the pile to the earth penetrated, is in turn transmitted by the cone of earth to a broad area of subsoil. As the depth increases the unit pressure per sq. ft. on the subsoil becomes less and less.

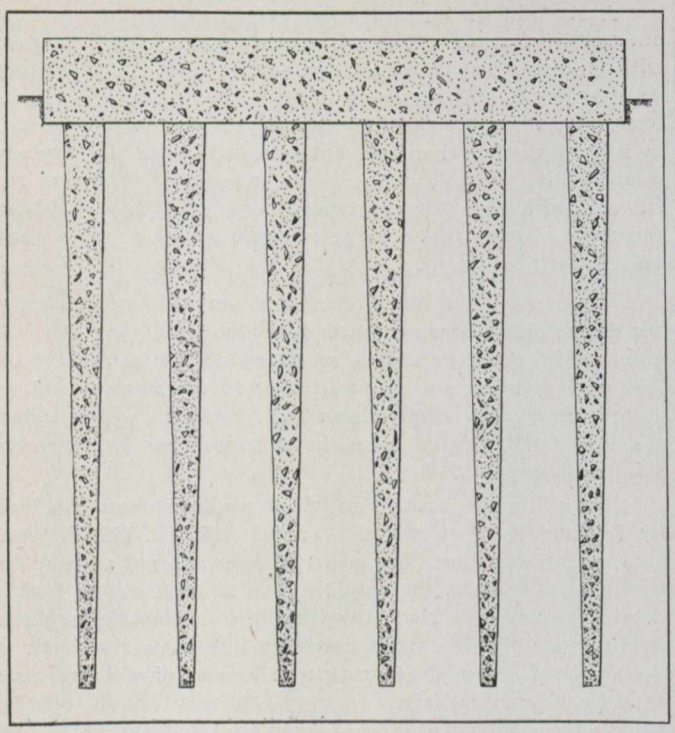


Fig (9) A group of ordinary piles driven together. The load supported depends upon the closeness with which they are driven, thus determining the compression of the earth between the piles. Practically all the load is carried by frictional resistance.

The load transmitted to the subsoil by this conoid is in any case limited by the frictional resistance between the pile and the earth surrounding it. For instance, a fair load on an ordinary pile is 20 tons. If the pile in Fig. 7 is 30 ft. long and if the conoid of pressure has an angle of 15 degrees, that is, an angle of 7½ degrees with the axis of the pile, corresponding to a certain texture and degree of compactness, the area of the base of the cone, 30 ft. below the surface of the earth, will be 63.6 sq. ft. As the total load on the pile is 20 tons, it is evident that at this depth the unit pressure per sq. ft. of subsoil will be only about ⅓ of a ton per sq. ft. The pile therefore develops far less than what is the safe bearing power of the soil even under the most adverse conditions. Again, if we assume that conditions are such that the angle of the cone is only 6 degrees, namely an angle of 3 degrees with the axis of the pile, then the area of the base of the cone, 30 ft. below the surface of the soil, would be about 10 sq. ft. If the pile were again carrying 20 tons load, each sq. ft. of subsoil would then be loaded to two tons. Even this figure is quite low.

It is evident then, that the limitations to loading of an ordinary pile by reason of the small frictional adhesion which can be developed between its surface and the earth penetrated, results in the subsoil being greatly underloaded. Accordingly the most promising method of increasing the carrying capacity of a pile is to make it of such shape that the subsoil surrounding its base is loaded to the fullest extent. The frictional loading is transferred to the subsoil by a conoid of pressure similar to that obtained with the pile in Fig. 7 and in addition the subsoil is directly loaded by the pressure of the broad base upon the subsoil.

The carrying capacity of a group of ordinary piles depends upon the closeness with which they are driven. The less the distance between their centers, the more the soil between them is compressed and compacted and the more frictional resistance will be developed between the earth and the surface of the piles. Referring to Fig. 8 we see that when a group of tapered piles are driven into the earth, their load is transferred to the subsoil by the columns of earth between them and the conoid of earth surrounding the outside of the group. Around the outside of the group of piles, the load on the subsoil depends upon how close the piles are driven and upon the amount of frictional carrying capacity resulting from the adhesion of the pile surface to the earth penetrated.

The subsoil beneath the first group of piles is loaded by the direct pressure of the base area of the piles, which has already been shown to be practically negligible, especially with tapered piles, and by the pressure of the bases of the columns of earth between the piles. The pressure which these columns of earth can transmit to the subsoil is in turn limited by the loading which the piles can transmit to the earth columns by frictional resistance.

The closer the piles are driven, the more compact the earth between them becomes. Thus the frictional resistance between the pile surface and the earth penetrated is increased, and the more capable are the columns of earth of transferring load to the earth down in the region of their bases.

However, regardless of the number of piles in the group and the closeness with which they are driven, the texture of the earth and the pile surface limits the frictional loading to a low figure. Furthermore, while by reason of the compression of the soil between the piles, the frictional resistance in that region may be somewhat increased, still around the outside of the group no such advantage is obtained.

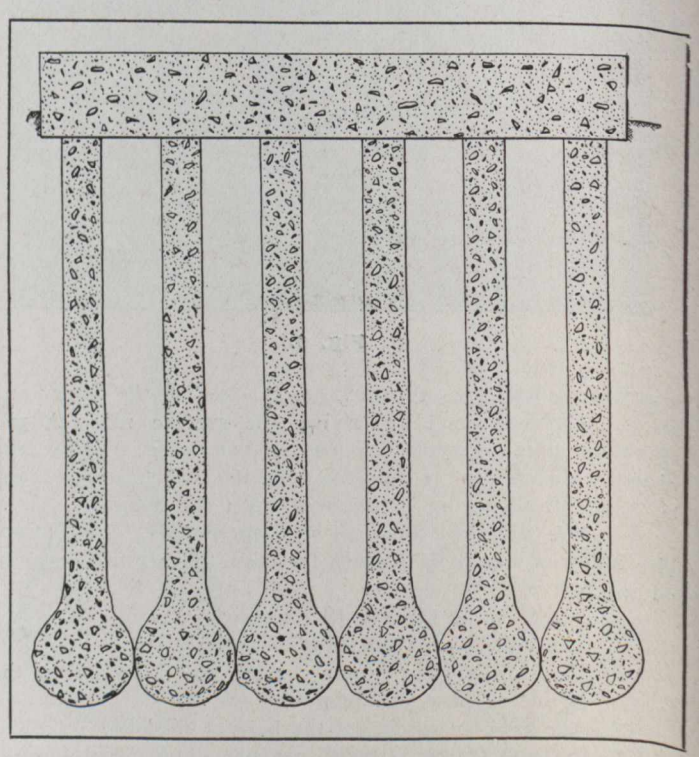


Fig. (10) A group of Pedestal Piles. The broad bases of the piles run together and form a continuous footing on the subsoil, thus developing the full bearing power of the earth. The strength of this foundation is equivalent to a masonry pier.

On the other hand, the carrying capacity of a group of Pedestal Piles is practically equivalent to that of a masonry

footing on the subsoil. Fig. 9 shows a group of pedestal piles on the same centers as the piles in Fig. 8. The strength of the foundation depends only to a slight degree upon the carrying capacity of the columns of earth between the piles and the frictional resistance of the surface of the piles with the earth. The load is directly transmitted to the firmly compressed subsoil by concrete footings and the full strength of the subsoil is developed around the outside of the group of piles as well as inside. Thus, with a group of pedestal piles the load which can be carried is far in excess of the loading possible with a similar group of ordinary piles. Or, looking at the matter from the other point of view, with a small group of pedestal piles, as much load can be carried as with a group consisting of two or three times as many ordinary straight or tapered piles.

The patent for these pile is held by MacArthur Concrete Pile and Foundation Co., of New York, who also furnish the pile in place.

CRACKING OF CEMENT GROUTED BRICK PAVEMENTS.*

By Earle R. Whitmore, City Engineer, Port Huron, Mich.

The first essential to be recognized in the study of the cause of the failure of cement filled, or "grouted," brick or block pavements by cracking of the paved surface, is that these failures are due not to a single cause, but to several distinct and widely differing causes. A fairly careful investigation of available literature on brick pavement construction has failed to bring to the writer's attention any competent analysis of these various causes of failure and the corresponding remedies.

The following are causes of cracks in brick or block pavements which the writer has observed; and they are placed, he believes, in the order of their importance and frequency of occurrence, and will be discussed separately in that order:

1. Frost.
2. Expansion.
3. Settling of sand cushion.
4. Settling of sub-grade.
5. Contraction between transverse expansion joints.

1. **Frost.**—The writer's observations seem to him to prove beyond doubt that the longitudinal crack along the crown of the pavement (or sometimes several feet to one side of the crown) is nearly always, if not always, caused by frost. This is the cause which the average layman usually assigns, and perhaps that is the reason that the average engineer, in his assumption of wisdom, is convinced that it is the wrong solution. The following observations support the layman's theory:

(a) These longitudinal cracks invariably first appear in the form of a very small and insignificant appearing crack, when the snow goes off in the spring.

(b) Where the sub-soil is clay, the cracks are found where ample expansion joints are provided next the curb, as well as where there are no expansion joints.

(e) Where the sub-soil is sand, or on fills where there is good natural drainage, these cracks are "conspicuous by their absence," even where there are no expansion cushions.

(d) The cracks follow along the line of travel on the street usually along near the crown, where the snow is packed by traffic during the winter and the frost penetrates deepest. Where there are one or more car-tracks on the street, there is usually a crack along the driveway each side of the tracks, if the subsoil is impermeable clay or of such a nature as to retain water. At intersecting streets which cross the paved street, the crack does not continue across the intersection, presumably because the travel across street and around the corners packs snow and permits the frost to penetrate over sufficient area to raise the pavement uniformly without breaking it; but where the intersecting street comes in from one side only, the crack runs off toward the opposite curb as it approaches the intersection, and continues across the intersection, coming back to the crown again on the other side.

(e) A careful examination of the concrete foundation under the longitudinal crack will reveal the fact that the foundation is also cracked. Is this expansion? And yet the specifications of the National Paving Brick Manufacturers' Association, admirable and complete in most respects, make no provision for drainage except the statement that "If the ground is spouty clay, tile drainage should be provided to carry off the accumulation of wet;" and even this meagre suggestion is modified by the statement that "Underdrainage is not absolutely essential, but in wet and spouty clay under-stratum much is added to the durability of the structure by keeping the sub-foundation dry, and under foregoing wet conditions is the only way to accomplish the best results." No mention of frost. The report of the Asphalt Committee of the Organization for Standardizing Paving Specifications provides for drainage "when the soil is of such a character that it retains an excessive amount of moisture, such as clays subject to swelling or heaving under the action of frost;" but the report of the Brick Committee makes no mention of underdrainage. Technical books also are uniformly vague on this subject, and the inexperienced engineer has little indeed to warn him of the danger of frost.

Inasmuch as it is an established fact that frost has no tendency to swell or heave any kind of soil from which the moisture is thoroughly drained, the writer ventures the opinion that the best way to prevent this form of cracking is to provide a suitable drain under each curb where the subsoil is clay, and connect same with sewer inlets. Such drains should be placed about three feet below the top of the curb, and the trench over the drain filled up to the bottom of the curb with coarse material such as cinders or small field-stone. Placing cross-drains under the pavement is probably to be discouraged, as water cannot penetrate through the pavement after it is once built, and there seems to be little necessity for making provision for carrying water from the middle of the pavement toward the curbs; and these cross-drains tend to carry water under the pavement during the wet season, where it may percolate through the sub-grade, rather than to remove it. Too shallow side-drains are also to be guarded against.

Also, the writer does not consider his observations sufficiently final to warrant the omission of expansion cushions next the curb, in view of the fact that all modern paving specifications require such expansion cushions. His personal opinion, however, is that they seldom if ever serve any useful purpose except on very wide pavements. It is undeniably true that after the crack is once started it continues to widen from the action of alternate expansion and contraction; but I have never seen a crack of this kind that appeared to have been caused by expansion originally.

2. **Expansion.**—Expansion cracks occur on a hot day in summer, usually at a crown in the longitudinal grade of the paved street, where several courses of brick are sometimes thrown into the air with considerable violence, and when the repair gang comes to relay them they find that

*From a paper before the Michigan Engineering Society.

there is at least one row of the blocks which were thrown out that cannot be relaid. This form of cracking is quite spectacular, and furnishes exceptional opportunities for advertisers of bituminous fillers. At the same time the damage to the pavement is comparatively slight and easily repaired.

Where there is no abrupt change of grade to permit the pavement to buckle, the observations of the writer seem to indicate that the filler between the brick courses is sometimes crushed in places, and the surface cracked into diamond-shaped or triangular divisions, the cracks following the joints and seldom breaking a brick. If there is a bend or angle in the paved street, the effect of expansion will be carried to this point of weakness, and will shove the angle considerably out of line.

The specifications of the National Paving Brick Manufacturers' Association provide expansion cushions along the curbs only, no transverse joints. The report of the Brick and Granite Block Committee of the Organization for Standardizing Paving Specifications also provides for longitudinal expansion joints only, being practically copied from the specifications of the National Paving Brick Manufacturers Association. I understand that the secretary of the association, Mr. Will P. Blair, maintains that the longitudinal expansion, failing to find room to act longitudinally, is in some mysterious manner transformed into transverse expansion, and is then taken care of by the side cushions. This may be true to the extent that the breaking of the surface into diamond-shaped or triangular areas probably has a tendency to force the brick apart and outward toward the curb to some extent; but this is taking care of the expansion after it has done its damage.

These diagonal cracks, zig-zagging along the brick joints, are inconspicuous, and in fact are often not visible except at such times as foggy mornings, when each crack is outlined by a line of moisture. They are not conspicuous like the longitudinal crack caused by frost, and make no spectacular expansion like the failure by buckling of the paved surface; but they extend over the whole surface of the pavement, tending to destroy its waterproof condition, and forming starting points for the jar of heavy traffic to begin its destructive action; and no doubt shorten the life of the pavement much more than the widely advertised buckling, which is all in one place and easily repaired.

It is believed that the most logical method of preventing this form of failure is to provide frequent transverse expansion joints, and that these joints are best formed by laying several courses of brick about one-fourth inch apart and filling these quarter-inch joints with a suitable bituminous filler before grouting the balance of the pavement. The use of single expansion joints one-half inch or more in width is to be condemned for several reasons: it makes a bump for loaded vehicles, causing a hammering action on the adjoining brick which soon loosens them, and the fault thus started spreads rapidly under traffic; the bituminous filler is very apt to run in a wide joint from the crown toward the curbs in warm weather; the expansion sometimes forces the bottoms of the blocks next the expansion joint together, while the tops are held apart by earth, etc., which has become packed into the joint, causing the brick to heave up next the joint.

3. **Settling of Sand Cushion.**—This occurs from several sub-causes:

(a) If the sand cushion is spread on a macadam foundation, it is apt to work down into the foundation in places and cause unequal settlement, thereby breaking the paved surface. One or two cities, at least, have had disastrous results from attempting to lay brick pavements on macadam foundation in this manner. It could probably be avoided by filling and rolling the macadam foundation in about the same manner as for a finished macadam pavement, but there would usually be no economy in that. It is believed that a good concrete foundation is the most economical in the long run, except possibly under some very exceptional conditions.

(b) If sufficient care is not exercised in forming the surface of the concrete foundation parallel with the plane of the required pavement surface, the sand cushion will be of varying thickness, and therefore liable to settle unevenly.

(c) The foundation having been properly laid, if the cushion is carelessly luted it will still be of unequal thickness; or if spread with a templet, and the templet is not carried back and drawn over the surface several times, the surface will invariably be wavy and cushion of unequal thickness. It is a serious mistake to leave the sand cushion uneven, depending on the rolling to level it. The roller will probably make it appear quite level, but some of the blocks will be well bedded while others will have received practically no benefit from the rolling, and these will naturally settle later under traffic.

(d) If the sand is partly dry and partly moist when spread, it will naturally settle unevenly. If the sand were all uniformly moist, the settlement would perhaps be as uniform as though dry sand were used; but a pile of sand is often dry on the outside and damp inside, or vice versa, and may not be thoroughly mixed in spreading. When such sand is used it should be dried, or if it were moistened uniformly by sprinkling the same purpose might be served.

Cracks caused by settling of sand cushion are usually roughly rectangular, do not break across the bricks, and the inclosed rectangle drops below the balance of the pavement. These rectangles vary in size from two or three bricks to several square yards. They go down under traffic sufficiently heavy to break the bond of the grout, and if the bond does not break an arch is formed, giving rise to the rumbling noise so often complained of. If not repaired at once the fault spreads rapidly, under the hammering action of traffic, over the surface of the adjoining pavement.

The proper thickness of the sand cushion has been the subject of much discussion. The writer believes that any thickness from one to two inches is all right, if properly applied. Some have claimed that a mortar-bed, in place of the sand cushion, is the panacea for all these difficulties. It is probable that a mortar-bed properly prepared would give satisfactory results, as it has been extensively and successfully used for creosoted wood block pavements. The sand cushion is probably equally good, or better, if carefully and properly handled.

4. **Settling of Sub-Grade.**—This fault is also due to various sub-causes:

Pavements laid across fills are very apt to settle. It is only with the greatest care that a fill can be made so that it will not settle more or less.

Improperly filled trenches for sewer, water and gas pipes, etc., often cause settlement many years after the pavement is laid. The pavement arch is strong enough, perhaps, to bridge the trench when settlement first starts, but as the earth from the sides of the trench is gradually jarred down the span widens until it becomes too broad to support the load of traffic. Too great care can hardly be exercised in properly back-filling such trenches.

Very wet and undrained sub-grade sometimes is the cause of this trouble. Suitable side drains would usually remedy the matter when moisture is the cause.

(Continued on Page 477.)

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CONTENTS OF THIS ISSUE.

TWO JOBS WAITING FOR EVERY MAN.

With the above heading one of our leading Canadian dailies devoted some considerable space to informing their readers of the good time in store for the laboring men, the splendid prospects for emigrants receiving employment, and the usual good wages that are attendant upon scarcity of labor.

Such headings are bound to attract to Canada a number of unemployed from other countries, but it should be pointed out that, although there is a scarcity of labor, the scarcity exists largely in men specially trained. Unfortunately, many of the newcomers are not in any way suited for this new work.

The coming season is likely to be a trying one for the contractor because of the labor problem, and it will not be so much because he cannot get men as because he cannot get men who are willing and able to do the work he has in hand.

CANADIAN TREE VALUES.

Within ten years the price of Canadian forest productions have in some cases doubled, and in some cases quadrupled, and, for those uses to which cement cannot be adapted and timber is necessary, the values are likely to go even higher. In ten years pine has trebled in price, elm quadrupled, and cedar more than doubled. Such timbers as walnut and hickory are becoming almost unknown.

The Ontario Legislature has given some considerable attention to the forestry problem, and a very interesting bill is presented to the House by the Honorable the Minister of Agriculture, entitled "An Act Respecting Reforestration by Counties."

The Act states that

> 2. The municipal council of a county may pass by-laws:—
>
> (a) For acquiring by purchase, lease or otherwise such lands designated in the by-law as the council may deem suitable for reforestration purposes;
>
> (b) For planting land so acquired and for preserving and protecting the timber thereon;
>
> (c) For the management of such lands and the sale or other disposal of the timber grown thereon;
>
> (d) For the issuing of debentures from time to time for the purpose of providing for the purchase of such lands to an amount not exceeding $25,000 in any one year.
>
> 3. No by-law shall be finally passed under this Act until the same shall have been approved in writing by the Minister of Agriculture.

There are thousands of stony or sandy hillsides and thousands of creek banks now valueless that could be turned to profitable account in the growing of timber. There are innumerable wood lots that could be made a source of mixed timber supply. There are marshy locations in which cedar, elm and spruce could be well and profitably grown, and not only would these reserves form a source of future timber supply, but they would be a great aid in the regulation of our water supply systems.

Investments in timber areas and in the growth of trees, although profitable, are so slow at bringing results that it is only the occasional individual who will chance the investment. For that reason we think it a very wise movement on the part of the Government to make it permissible and possible for the county councils to take up the matter of reforestration.

CANADA CEMENT COMPANY, LIMITED.

Annual Report.

The first annual report of the Canada Cement Company, Limited, which is the statement of the affairs of the company up to and including December 1st, 1910, has been issued to the shareholders.

This report is of interest to others than the shareholders because of the comments and criticisms made of the company at its formation over a year ago.

The report states that the consumption of cement during 1910 was not nearly so large as it was anticipated; and, because of the falling off in consumption and the inability of the railroads to furnish sufficient cars at the height of the shipping season, the company were compelled to carry over to this coming season over 780,000 barrels of cement.

Contrary to the criticism made a year ago, the price of cement during 1910 was at a lower figure than ever before, except during a short period in 1909, when prices were generally slashed. This lowering in the price of cement was due principally to improved methods of manufacture and improved methods of distribution, which prevented long hauls.

During the season of 1910 the mills were only operated to 57.6 per cent. of their capacity, but during the coming year there is such a good prospect for large work where cement will be used that they anticipate considerable increase in the consumption.

To look after the trade of Manitoba and the middle West the company have purchased a site near Winnipeg, where, during the coming season, they expect to produce cement.

With the view of educating the public and popularizing the use of cement, in addition to the ordinary advertising, the company has published a small book illustrating some of the many uses to which cement may be put, for which there has been a great demand, 25,000 applications for same having been received during the past six months.

For the purpose of stimulating interest in the company on behalf of the employees, both in efficiency and cheapening production, as well as creating a feeling of good-will, the directors think that it may be expedient to introduce a system, already adopted by several large industrial corporations with beneficial results, viz., to enable employees to become the possessors of preferred and common stock at prices which will be attractive to them, the employees paying a fixed amount per share per month out of their earnings, and the company carrying the stock for them, charging a rate of 5 per cent. interest. If the plan is put into effect, all dividends will be credited to the employees applying for the stock. This stock will be held in trust for the employee for a term of five years, excepting in exceptional cases, such as death, when his heirs will receive what benefit a deceased employee has derived from subscribing to the stock.

Considering that this is the first year of operation, we consider the company are to be congratulated upon their favorable report.

THE HYDRO-ELECTRIC SITUATION IN ONTARIO.

Some years ago Niagara Falls were spoken of as Ontario's "White Coal Supply." The phrase was catching, and soon the water powers of the province became valuable both as means of producing electric energy and as valuable propositions for brokers to exploit.

It was felt by some that the high charges for electric energy was unfair, since the province held in their own rights some of the most valuable of the water powers.

To insure the people of the province of receiving the greatest benefit from their water privileges an Ontario Hydro-Electric Commission was formed who had administered the distributing of electric energy. Although there has been several clashes between several corporations and the Hydro-Electric Commission, yet the most serious one is in the city of Toronto, and on page 475 of this issue we publish some interesting information bearing on the situation in Toronto, partly because of the interest it creates in that city, and also because it was a fair indication of what will likely occur in a number of Ontario municipalities, in which situation a number of our engineers are interested.

In addition to what has already taken place, the Hon. Mr. Cochrane has introduced a bill, which was given on page 433 of our last issue, and it is understood that Mr. McNaught (Toronto) will this week put through another bill enlarging the power and scope of the Ontario Hydro-Electric Commission. Altogether the situation is very unusual, and requires very careful handling in the immediate future.

TESTS FOR DRAIN TILE.

Some of the most interesting exhibits at the Canadian Cement Show recently held in Toronto were machinery in connection with the manufacture of cement tile. We refer now more particularly to smaller sizes, such as may be used for underdraining or weeping tile under and around walls and foundations.

Standard specifications for cement and clay tile for drainage work are something that are very much required in Canada. In the past, clay tile have had the field entirely to themselves, and the tile have been disposed of mostly on the salesman's recommendation.

With cement and drain tile competing, it will be far more necessary that careful specifications be used in the purchase when the purchase of such material is required, and the Canadian Society of Civil Engineers should co-operate with the Cement Association in the formulating of such specifications, so that the purchaser may have something to work under and the manufacturer have a standard to work to.

The set standard of quality would do a great deal to minimizing failure and to place these two materials on a fairer basis where they come into competition.

A total of 21,305,500 bricks were manufactured at the different brick yards of the Province of Nova Scotia during the last year. This quantity is practically the same as the quantity manufactured during the previous year.

THE GRADING OF MATERIALS IN THE AGGREGATE.*

H. P. Bowes.

The firm with which I am connected, namely the Warren Bituminous Paving Co., have made a specialty of the grading of the materials used in the surface coat of roadways and have met with a great deal of success.

The specifications for the grading which they have adopted call for the mineral aggregate being proportioned to size so as to produce a mass having 21% or less of voids at the time of construction. They have found that any method of construction calling for the use of mineral aggregate will reach a degree of perfection proportional to the ability in so grading or arranging the mineral constituents as to reduce to a minimum the existing voids. Then with the addition of the proper mortar a mass will result which will not only be dense but will be nearly waterproof.

Upon the other hand the farther these principles are receded from, the more certain failure is courted.

It would then seem that the paramount principle is the proper grading of the mineral constituents.

Perhaps this subject really applies more forcibly to reinforced concrete work where great strength is required for the least possible weight for large and important structures, it pays from an economic standpoint to make very thorough studies of the materials of the aggregates and their relative proportions. This fact I fear has been seriously over-looked in the past and thousands of dollars have sometimes been wasted on single jobs by neglecting laboratory studies or by errors in theory.

Since cement is always the most expensive ingrediment the reduction of its quantity which may very frequently be made by adjusting the proportions of the aggregate so as to use less cement and yet produce a concrete with the same density, strength and impermeability together with the reduction of size, is of the utmost importance.

If gravel or stone having particles of uniform size, is used, it must be recognized that the work will cost 10% or upwards more on account of the additional quantity of material required to make a given volume of concrete.

In measuring the gravel or stone before mixing there will be less solid matter in the measure and consequently more sand and cement will be necessary to fill the spaces between the stones. This fact is often overlooked even by experienced men.

It is obvious that the uniform stone measured contains less solid stone than the graded stone. The spaces between the stones in the first case are very nearly equal to the volume of the solid particles and as the measure of sand is one half that of the stone and the particles of cement fill the voids in the stone, this sand and cement mixes in between the stones filling the spaces or voids and resulting in a mixture but very slightly greater in volume than the stone alone.

In the second case the spaces between the large stones in the stone measure are filled with graded smaller stones so that there is a much smaller volume of space or voids. Hence when the sand and cement are mixed with it the volume of the mixture becomes considerably larger than the original bulk of the stone. Consequently if we are tied to definite proportions of materials more concrete will be made with graded stone than if the stone has been screened to a uniform size.

*Paper read before the Canadian Cement Association, Toronto, Ont., March, 1911.

If on the other hand the proportions of the materials are changed on account of the fewer voids in the mixed stone and less sand and cement are used a saving in these materials results.

Proportioning by Void Determination.

The method often used in determining the voids in stone and sand by finding the quantity of water that can be poured in to the voids of a unit measure of stone or sand and then the amount of sand or cement as the amount required to fill the voids in the stone or sand is not satisfactory. The greatest inaccuracy of this method is due to the difference in compactness of the materials under varied methods of handling and to the fact that the actual volume of voids in a coarse material may not correspond to the quantity of sand required to fill the voids. For the grains of sand separate the stone and with most aggregate a portion of the sand is too coarse to get in to the voids of the coarser material. That is in a mass of graded stone many of the individual voids are so small that the larger grains of natural bank sand will not fit into them but will get between the stones and increase the bulk of the mass, this increase in bulk means that more sand is required than the actual volume of voids in the coarser material.

Perhaps the most practical way of obtaining the desired proportions after all is by;

Volumetric Proportioning by Trial Mixtures.

An accurate and simple method to do this is by trial batches. The apparatus is easily obtained at any time consisting as it does of a scale and a cylinder which may be a piece of wrought iron pipe 10 to 12 inches in diameter capped at one end. Measure and weigh the cement and stone and water and mix on a piece of sheet steel or other non-absorbent material. The mixture having the constituency the same as intended to be used in the work. The mixture is placed in the cylinder carefully tamped and the height to which the pipe is filled is noted.

The pipe should be weighed both before and after being filled so as to check the weight of the material. The cylinder is then emptied and cleaned.

Mix up another batch using the same amount of cement and water slightly varying the ratio of the sand and stone but having the same total as before. Note carefully the height in the cylinder again which will be a guide to the other batches to be mixed. Trials are made until a mixture is found that gives the least height in the cylinder and at the same time works well while mixing, all the stones being covered with mortar, and which makes a good appearance.

This method gives fairly good results but does not give the changes in the physical sizes of the sand and stone so as to secure the most economical composition as would be shown by a thorough mechanical analysis.

Mr. A. E. Schuite in studying the proportions of materials for Bituminous Macadam Pavement for the Warren Bros. Co. has very effectively developed the method of volumetric synthesis with dry materials. His experiments included various classes and sizes of stone sand and screenings ranging from three inches in diameter down to that which passes a 200 mesh sieve. He found that the best method for compacting dry materials such as sand gravel of broken stone, is to place them in a vessel the shape of a cone, with the largest diameter at the bottom. The cone is filled with the coarsest material and taken by a laborer who compacts it by repeatedly striking the cone against the ground keeping the measure full by adding new material of the same kind. When it ceases to settle the contents are emptied and mixed with a portion of a finer material, replaced in the measure and compacted as before.

By repeated trials the exact size and maximum volume of successive finer materials which may be added without appreciably increasing the bulk of the coarsest after thoroughly compacting are determined. Mr. Schutte has found that for different shapes of particles the proportions of each size must be varied, but, having determined the required percentages for a certain stone, that is for a stone from a certain quarry, the proportion of the sizes from day to day need be varied but little.

Effect of Grading Aggregate on the Density of Concrete.

The fact that the densest mixture is secured with particles of different sizes is very evident from the slides which we have here and needs no other proof. It follows that the least density and hence the greatest percentage of voids occurs when the grains are all of one size. The converse in this proposition that the smallest percentage of voids occurs in a mixture graded so that the voids of each size are filled with the largest particles which will enter them, is also illustrated by the next slide and hence is very important in its application to the selection of materials for concrete. The mass of this last mixture is evidently denser, that is, contains more solid material. This relates directly to the difference between mortar and concrete. The substitution of stones for small masses of sand reduced the voids and consequently the quantity of cement required. Extending this principle to the fixing of the proportion of sand and stone it is evident that for maximum economy and equal strength there should be used the largest possible quantity of stone in proportion to the sand.

Mr. Fuller who has experimented a good deal along this line found that by grading the materials of his aggregate, figuring at a point where he only required one part of sand to five parts of stone, that for this mix the modulus of rupture was 504 lbs. per square inch; as he increased the amount of sand the strength decreased; when he reached equal parts of sand and stone the modulus of rupture was 355 lbs. per square inch and when he had twice as much sand as stone the modulus of rupture was 210 lbs. per square inch. The total amount of aggregate in each case was the same, namely 1 part cement to 6 parts sand and stone.

In 1910 tests were made at the New Jersey Water Co's reservoir on the comparative strength of different proportion of concrete aggregate. These tests indicated that for the materials used there was a certain mixture of sizes of the aggregate which with a given percentage by weight of cement to the total aggregate gave the highest breaking strength. In practice it was also found that the concrete made with this mixture worked more smoothly in placing. These tests led to a more extended series of experiments by Mr. Sandford Thompson and Frederick Taylor at Jerome Park Reservoir, New York. The method of procedure and results of tests are given by Wm. B. Fuller and Sandford Thompson: Transactions of American Society Civil Engineers, Vol. 59, page 67, 1907. The Mechanical analysis diagram of their tests furnished a ready means of studying the effect of various sized particles on the density of concrete. For this purpose crusher run stone and bank gravel were screened into twenty-one sizes ranging from 3" down to that passing a 100 mesh sieve and over 400 tests were made with different combinations of the sizes of stones to obtain the proportions which would produce the densest concrete mixture. From these tests they derived the following laws:—

(1) Aggregate in which parts have been specially graded in sizes so as to give when water and cement are added an artificial mixture of greatest density produces concrete of higher strength than mixtures of cement and natural materials in similar proportions. The average improvement in strength by artificial grading under the conditions of tests was about 14%. Comparing the tests of strength of concrete having different percentage of cement it is found that for similar strength the best artificially graded aggregate would require about 12% less cement than like mixture of ungraded materials.

(2) That the strength and density of concrete is affected but slightly, if at all, by decreasing the quantity of medium stone of the aggregate and increasing the quantity of coarsest stone. An excess of stone of medium size on the other hand appreciably decreases the density and strength of the concrete.

Perhaps it might be worth while calling attention to the effect which dampness has on the volume of sand and stone screenings and stone, especially sand and stone screenings, and hence of the allowance necessary to make for this. This diagram was plotted by Mr. Fuller from experiments from a single sample of natural sand mixed by weight with varying percentages of water and illustrates the effects of moisture upon the actual percentage of voids in sands loose and tamped. The volume produced by varying degrees of compacting are located between two curves. It is noticeable that both loose and tamped sands increase in volume with the addition of water and reach a maximum at about 6% of water, then decrease to finally return to slightly less than their original bulk. The same sand it may be seen may contain from 27% to 44% of absolute voids according to the percentage of water and degree of compacting. The percentage of water by weight which will give the greatest bulk corresponding of course to the largest percentage of voids varies with different sands from 5% to 8%.

Here is a slide showing an ordinary stone crushing outfit with a sectional screen of three different sizes of mesh. The screen used by the Warren Bros. Co., is composed of one screen within the other. The stone is delivered into the end of the screen of course which contains the smallest openings. The inside screen of the first section would be about ¼" mesh, the outside about a ten mesh and not quite so long as the ¼" section so that the fine material passing the ten mesh would fall directly into a bin below and the ¼" be delivered from the end of the outside screen to another bin. Similarly with the other two sections, the second section would be about ¾" inside and ½" outside and the third 1½" inside and 1" outside. This only permits of course of the grading of the stone into six different sizes.

The bins for receiving have a chute at the bottom and a slide to control the flow of the stone. Below these bins is a hopper set on a six beam scale so that the desired amount of each size of stone can be drawn into the hopper without changing the weights on the beams. Of course this method would not be applicable to concrete work unless the mixer was set directly below the hopper, for if the materials are loaded into wagons or carts and dumped in piles the large stones roll to the outside of the pile and very little good would result from the previous grading.

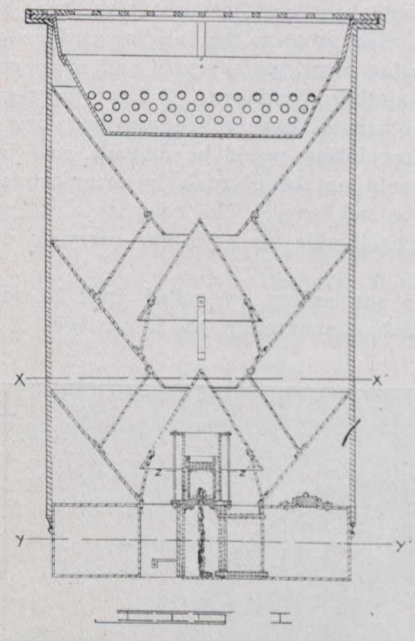
The only feasible manner to take care of the different sizes of stone if the screens are not near the work is to use bins to hold the different sizes of stone.

During the year ending Sept. 30th, 1910, 322,974 tons of gypsum were quarried in Nova Scotia: this being an increase of 23,929 tons over the amount quarried during the previous year. Of the gypsum quarried 10,500 tons were used in the manufacture of gypsum products in the Province, the balance was shipped to the United States.

SEWER GAS AND THE BEEMAN DEODORIZING MACHINE.

The high levels in sewerage systems have usually had trouble with sewer gas. The city of Winnipeg for some years has been experimenting with different devices to entirely eliminate or to lessen this objection.

Some four months ago the City of Winnipeg allowed the Sewer Deodorizing Company, Ltd., of Winnipeg, to install the Beeman Sewer Deodorizing Machine, a cross-section of which is given herewith.



The machine consists of a reservoir containing wood alcohol, fumes from which impinge upon a disc one and a half inches in diameter, this disc being composed of platinized porcelain and varying in size from 1½" according to amount of fumes required. This disc when heated to cherry redness remains in a state of incandescence as long as the alcohol fumes are supplied to it, the alcohol fumes being changed into formaldehyde during their passage through the disc. The machine consists of this disc or burner and reservoir used in connection with baffles and protectors, which secure the thorough admixture of the sewer air with the formaldehyde; whole machine measuring about 20" x 40" being suspended within the sewer air shaft.

The cost of operation is very slight. In the machines used in Winnipeg it is found that one gallon of wood alcohol costing 62½ cents will last for nine days. This will make the cost of material approximately 7 cents a day. The machine would probably take care of a number of manholes by closing the others up so that the fumes would have to go through the machine. Probably at least five manholes could be served by the one machine.

The contract price with the city of Winnipeg is $75.00 each machine ready for installation and one great advantage of the Beeman machine is that there is no special preparation of the manhole shaft required, which makes it possible to move the machine to different parts of the city or install it at any point at no expense. The cut of the machine will probably explain the different parts sufficiently.

In connection with the three months' test for the city of Winnipeg, completed the end of January, City Engineer Ruttan reported in part as follows: "Ten machines were placed in sewer manholes at locations stated. These machines were operated for a period of three months. The combustion of the alcohol fumes produces formaldehyde in sufficient quantities to deodorize the sewer air when it emerges from the manhole. The machines will deodorize sewer air.

The advantages of the Beeman Sewer Deodorizing machine might be put in short form as follows:——

Small cost of machine; no interference with sewer air shafts; economy in operation as the burners run automatically as long as the supply of wood alcohol lasts, possibly attention once a month being amply sufficient to take care of; small cost of materials used and, most important of all, absolute efficiency. In Winnipeg, as the City Engineer stated to the Board of Works, machines had been placed at points where most complaints had come from, so that a thorough test was made of the machines.

Recently a contract from the city for fifty of the Beeman Sewer Deodorizing machines, which are to be supplied at once to the Board of Works of Winnipeg, was given. These machines are fully protected by patents issued and applied for.

NEW INCORPORATIONS.

Regina, Sask.—Provincial Securities Co., $50,000.

Edmonton, Alta.—Magrath Holgate Co., $200,000.

Montebello, Que.—Owens Lumber Co., $100,000. N. Dickson, A. Holden, J. Buchanan.

Fieldholme, Alta.—Fieldholme Mining & Development Co., $150,000.

Saskatoon, Sask.—Canadian Farms, $50,000. Saskatchewan Agencies, $50,000.

Brandon, Man.—National Brick Co., $20,000. J. Bower, G. Ruller, S. Kyle.

Toronto, Ont.—North American Exploration & Development Co., $50,000. H. J. Macdonald, A. A. Gard, E. A. Lewis.

Winnipeg, Man.—Canada West Townsite Co., $50,000. H. A. Burbidge, F. M. Burbidge, R. C. McPherson. Intercolonial Land Co., $40,000. H. H. Hinch, C. G. Stewart, A. McCurdy. Empire Investment Co., $200,000. T. R. Slagsvol, C. M. Simpson, T. H. Simpson. Metropolitan Investment Co., $1,000,000. F. H. Stewart, W. H. Collum, R. M. Thomson.

Montreal.—Gael Shipping Co., $27,000. G. I. Dewar, Ottawa; W. A. Taft, Arlington; W. H. Chandler, Newton. National Brick Company, of Laprairie, $2,000,000. C. G. Greenshields, E. R. Parkins, W. Taylor. J. Alphonse Ouimet, $100,000. J. A. Ouimet, J. L. Patenaude, R. Frigon. Beaubien, $150,000. Hon. L. Beaubien, J. Beaubien, C. P. Beaubien. Montreal General Contracting Company, $200,000. E. G. Evans, R. Moffat, G. G. Hyde. W. McNally & Company, $200,000. W. McNally, W. H. McNally, A. C. McNally, E. Cantelo White & Co., $50,000. F. C. Reynolds, Westmount; M. Alexander, D. Burley-Smith, Montreal.

Toronto,—Stone, Limited, $2,000,000; E. N. Armour, S. H. Slater, W. V. Carey. America Realty Co., $50,000; E. W. Wright, I. S. Fairty, G. Cooper. Dominion Axminster Co., $250,000; B. D. Hall, L. M. Hayes, Hopkins Manufacturing Co., $50,000; G. B. Balfour, R. Wherry, F. S. Buck. George Thomson Lumber Co., $100,000; G. Thomson, Goderich; F. Thomson, Southampton; F. H. Hurlburt, Toronto. George Rathbone, $200,000; G. Rathbone, T. E. Rathbone, C. Marshall, W. E. S. Savage. Crown Reef Mines, $1,000,000; H. N. Chauvin, W. S. Stewart, R. E. Fisher. Dominion Bowling & Auto Club, $40,000; T. A. Ovens, C. Perkin, A. Boyd. Nash Bay Mining Co., $1,000,000; D. Lackie, W. G. McCrimmon, W. Maguire.

CONCRETE FILLED STEEL ARCHES.*

By Henry H. Quimby.

The bridge carrying Forty-second Street over the main line of the Pennsylvania railroad in Philadelphia is believed to be the first example of a new type of construction that will be found by designers to be economical and applicable in a number of cases.

The bridge is a pure unbraced arch with suspended floor, the arch being in two ribs of steel plate box construction of rectangular section 15¼ ins. inside width and varying depth, filled with concrete. The floor is of structural steel and concrete, built girder cross floor beams with cantilever extensions for outside sidewalks, and under the driveway floor rolled beam stringers with concrete jack arches, the sidewalks being rod reinforced concrete slabs.

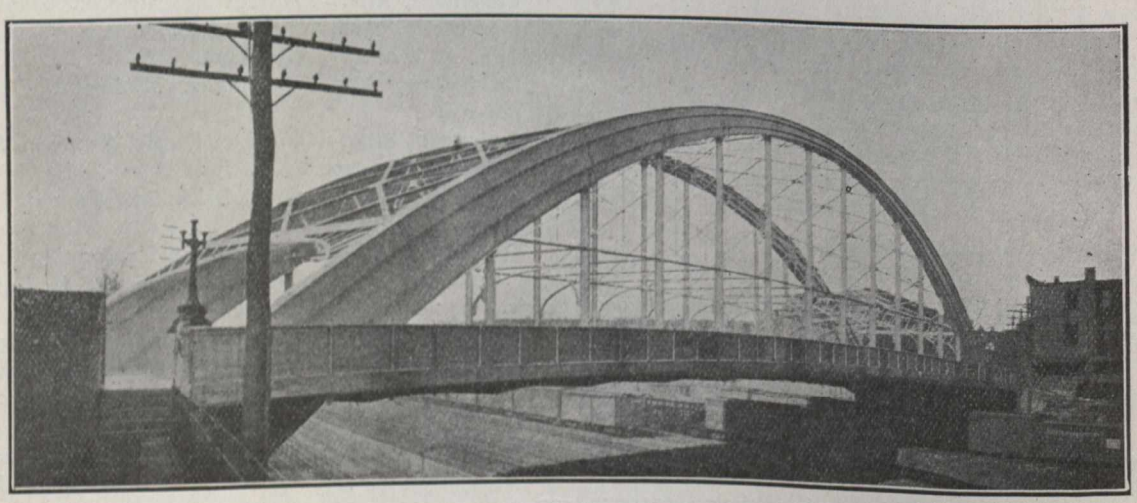
The arch ribs are not hinged and yet are not quite hingeless. They are fixed—or rather square ended—at the spring; and at the crown; though 3 ft. deep, are keyed with a steel plate that gives a bearing depth of only 16 ins. The depth of the arch ring at the spring is about 10 ft. and at the crown 3 ft., abruptly reduced to 16 ins. on the key. This "semi-hingeless" construction was adopted for the purpose of obtaining stiffness against variable loads without excessive depth at the quarters and without inducing very high temperature stresses.

If hinges had been used at the spring the arch would have required to be made much deeper at the quarters than at the ends, giving a very ungraceful appearance, and besides, the construction would have cost considerably more. Hinges practically eliminate temperature stresses and enable us to determine more accurately the line of pressure for any given condition of loading, but in arches with good pitch—ratio of rise to span—the temperature stresses are not so severe as in flat arches, and, therefore, the advantages of hinges do not, in such cases, compensate for the increased cost and awkward appearance which they entail.

The economy of the arch type of bridge in this case is found in dispensing with a tension chord and a web shear system, the excess of the arch section at the spring over a compression truss chord being slight in comparison, and the greater cost of the masonry being also considerably less than the saving in steel. In fact, the total cost of the masonry as built in this case was less than that of tension chords would have been for a truss span, and it had to be carried down about 40 ft. to get satisfactory bottom for foundations.

The office of the concrete filling of the arch ribs is threefold. It takes the place of interior steel diaphragms, an extensive system of which would be required to make the wide web plates available throughout as section to carry compressive stress and to prevent buckling and distortion, and which would have cost just about as much as the concrete did. It also protects the interior surface of the box against corrosion more permanently and more conveniently than would painting, for means of future access to the interior would otherwise have to be provided, and even then the work of repainting would be difficult, and because the need of it would not be obtrusively conspicuous, it would be likely to be neglected. The concrete also gives to the arch very considerable strength for carrying compressive stress.

The floor suspenders are rolled steel I-beams (15-in., 60-lb.) with webs transversely, the advantages of this shape being that the suspenders could be used as posts for temporary support of the arch segments in erection, and are competent to transmit to the rigid floor one-half of the wind loads on the arch. They also make very sightly, clean limbed truss members, no lacing or other trimming being needed.



Concrete Filled Steel Arch Bridge Carrying Forty-Second Street Over the Tracks of the Pennsylvania Railroad in Philadelphia, Pa.

The arch ribs are carried upon independent concrete abutment piers, the railroad bank being sloped between them, and the floor of the bridge extended back to the crest of the bank. It was found to be more economical to span the slope with the floor than to construct a retaining wall and abutment wings and fill the space over the slope. It was also desirable to keep all foundation excavation away from the houses which, at the four corners of the bridge, were standing at the street line, and whose foundations were in two cases on filled ground, and in all cases far less in depth than was required for the pier foundations.

The floor over the slope is similar to that suspended from the arch ribs—steel floor beams and stringers with concrete jack arches—except that the diagonal end floor beam which was built directly on the ground is a rod reinforced concrete beam.

*Paper delivered at the seventh annual convention of the National Association of Cement Users, New York City.

The abutment piers are of rubble concrete founded on a good grade of micaceous rotten rock, the pressure being about 4 tons per square foot. The piers are 10 ft. wide at the bottom and 8 ft. at the top, with a transverse grillage of twelve steel beams, 20-in., 80-lb., 7 ft. long, in two groups of six each, and two additional beams at the middle to take the bearing of the temporary erection blocking.

The span of the arch is 262 ft., c. to c. of bearings on the grillage in the skewbacks, crossing fifteen railroad tracks on an angle of 28 degrees. The rise to the centre of the rib at the crown is 52 ft. The intrados line is a parabola of 252 ft. span and 53 ft. rise. The extrados line is a segmental curve of 200 ft. radius between points 11 ft. above the floor, and tangents from there to the skewbacks, which are at an angle of 45 degrees. The ribs are 37 ft. 6 ins. apart c. to c., giving a driveway, which is asphalt paved, 34 ft. wide between curbs. The sidewalks are granolithic, 11 ft. 3 ins. wide from curb to centre of railing, the overhang from centre of arch rib being 9 ft. 6 ins.

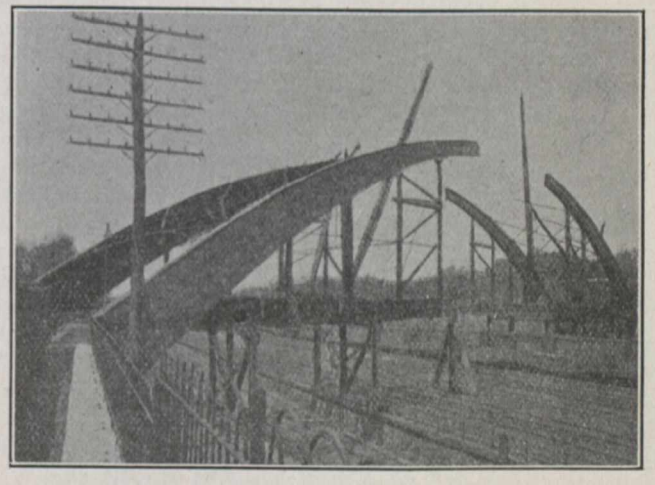
The floor, with the paving, forms the greater part of the load. The horizontal thrust in each rib from the steel work alone was 117 tons, and the resultant delivered to the abutments 150 tons. With the concrete filling in the arch the thrusts were 165 and 256 respectively. With all dead load they are 614 and 800, and with a distributed live load of 100 lbs. per sq. ft. over driveway and sidewalks 857 and 1,100 tons.

The stresses produced by the steel work and arch filling together constitute the initial stresses on the steel ribs. All subsequent loading must be borne by the steel and concrete jointly, because time was given the filling to set hard before any additional load was placed. As the crown keys were well fitted to an even bearing and the bearing at the spring was evenly keyed up with the steel weight alone, the line of pressure passed very close to the middle at both points, and the initial stress on the steel was therefore fairly uniform at about 3,000 lbs. per sq. in. The distribution of subsequent loading between the steel shell and the concrete core must be in direct proportion to the moduli of elasticity of the two materials, whatever they may actually be, multiplied by the area of available cross section, for neither material can shorten under stress without, or any more than, the other. If the ratio between the moduli be 15 then at maximum load the total stress on the steel, including 3,000 initial, will be 11,000 lbs. per sq. in., and on the concrete 560 lbs. The concrete core itself produces a thrust that causes 1,085 lbs. of the 3,000 initial on the steel, or would, if it carried itself, cause a unit stress of 240 lbs. on the concrete alone, showing that the core has a carrying capacity far beyond its own dead load.

The web plates are tied together at intervals of about 2 ft. with ⅞-in. stud bolts that resisted the hydrostatic pressure of the soft concrete during casting, and serve to prevent the plates from buckling away from the concrete in compression. These bolts also afforded needed and convenient roosting places for the men who spaded the concrete as the filling proceeded and for the inspector who supervised the operation. The clear space between webs was 15¼ ins. to permit free insertion of the 15-in. beam hangers, and it afforded just about enough room for working.

The filling was accomplished by means of sheet iron spouts through 3-in. round holes in the top cover plate at intervals of about 8 ft. As the filling proceeded these holes were closed with hexagonal plates tap bolted to the cover. Near the crown the top cover plate was sprung up and propped open enough to admit the men to the interior until the filling reached the opening, when it was permanently closed and riveted. The spading to the crown was then done through the holes with rods, and the filling was finished with grout using sink-head hoppers on tap holes at the highest point. The filling of the opposite halves of a rib was carried forward simultaneously to avoid unbalanced and distorting stresses.

The erection of the steel work was by means of partial false work below the floor and two long beam stiff-leg derricks on it. Each rib was shipped in eight sections, and each section—except the two middle ones—when placed in position was propped on the 15-in. beam hangers as posts. The ribs were started on narrow bearings on the skewbacks that acted as temporary hinges to facilitate control of the camber until the connection was made at the crown, which was accomplished by keeping the false work wedging high and lowering it as needed. This temporary bearing, which was at the mid-line of the arch ring, was composed of two 7-in. by 1¼-in. cast zinc blocks side by side on the two middle beams of the grillage. Zinc was adopted as the material of the temporary blocks because it will squash out



Forty-Second Street Bridge, Philadelphia, Pa.—Steel Arches in Process of Erection.

under about 3,000 lbs. pressure and thus prevent excessive stress coming on the middle of the arch ring due to the initial load being carried there.

After the steel work was all placed a time of mean atmospheric temperature was awaited for the final keying at the skewback in order to divide the temperature stresses evenly between winter and summer and thus minimize the extreme. It was found by trial stress diagrams of the arch with various distributions of dead loading that with all the steel work in place, but no concrete either in arches or floor, the line of pressure passed through the middle of the arch ring at the spring. This was then the proper stage of the work for fixing the bearing on the skewback.

A temperature of from 55 to 58 degrees F. was found very early one morning and the bearing wedges were then driven up firmly with steel mauls. These wedges were 7 ins. by 30 ins. tapering in thickness from ⅜ to ⅝ in.; one pair on each of the twelve grillage beams in each skewback. The aim in driving was to make them all equally tight, not necessarily to take up all the load at that time, but it was found that such wedging as was done released the pressure on some of the blocks—150 tons. Then holes were drilled through the wedges and tapped into the grillage beams, and

tap bolts were screwed in within ⅛-in. of the heads and so left, the purpose being to avoid any possible lift or anchorage effect on the grillage if temperature or other force should open the skewback joint at either intrados or extrados.

Careful examination since, in both extremes of heat and cold, has failed to discover loosening of any of the wedges, though a difference in pressure on them was perceptible by sounding with a hammer. This indicates that the line of pressure has not yet wandered to either edge of the middle third of the bearing.

The live load for which the bridge was designed is a general load of 100 lbs. per sq. ft. over the whole floor, or a concentration of 110 lbs. per sq. ft. on sidewalk members, and of 40 tons on two truck axles 20 ft. apart, or two lines of street railway cars, and various combinations of these loads to find maximum possible stresses. Each arch rig is composed of two web plates 15¼ ins. apart in the clear, varying in thickness from 7/16 in. at the lower section to ⅝ in. at the crown section, four flange angles and four intermediate angles 5 ins. by 3½ ins. by 11/16 in., and one top and one bottom cover plate 27 ins. by 11/16 in. The intermediate angles are counted in as section, and they

Forty-Second Street Bridge, Philadelphia, Pa.—Steel Arches Completed and Suspenders and Floor Beams in Place.

both stiffen the web plates and relieve the blank plainness of the exterior surface, breaking it up with graceful shadow lines.

The lateral bracing along the extrados is designed for a wind pressure of 50 lbs. per sq. ft. on the arch ribs, and the flange is reinforced against bending at the portal by carrying the end strut angles down to the skewback. In addition to this the transverse sway bracing at every hanger is designed to be competent to carry to the floor one-half panel of the wind load on the arch. The floor, being a monolith 57 ft. wide, constitutes a very rigid lateral beam to resist wind pressure. It has two expansion joints with steel aprons, one at each intersection of the floor with the intrados of the arch. The floor beam at this point is fixed to the arch and the floor stringers rest upon and slide on seat brackets to which they are bolted through slotted holes. As this joint is exposed to locomotive gases it was desirable to encase it as completely as possible in concrete, and this was accomplished by the use of a coating of clay 1 in. thick over the floor beam casing when the stringer casing was cast, which was in hot weather, and the clay was in large part picked out afterwards. A board form would have been very difficult to remove from the narrow space.

The light longitudinal struts connecting the floor hangers to reduce vibration are bolted to the arch through slotted holes.

The railing or parapet is a composite construction of zinc plate and concrete filling. The panels are solid webs of stamped sheet zinc ⅛ in. thick. The hand rail and the base rail are formed of ⅛-in. sheet zinc and filled with concrete. The hand rail is circular, 4 ins. in diameter, and the base is triangular in shape, 3 ins. wide. The concrete core was intended to give stiffness and prevent denting by accidental or other blows. Both objects have been attained.

The ornamental finials of the posts are zinc castings, and the posts themselves are heavily galvanized steel angles. The railing is rigid and ornamental and protects the bridge deck from the clouds of railroad smoke and steam, and is no more costly than the closed cast iron railings heretofore used in such circumstances, and it is believed to be durable without requiring painting.

The total cost of the bridge was $78,500, which included considerable street and sidewalk paving on the approaches. The cost of the bridge proper per square foot of floor was $4.30.

With the floor exposing only concrete to the action of the locomotive gases, and the railing presenting a surface that is only slightly corrodible, and all exposed steel work easy of access for painting, the structure should entail very slight expense for permanent maintenance.

ASBESTOS INDUSTRY WAS ACTIVE

The value of the mineral output of Quebec province last year was $7,072,244.

The following table gives the annual value of the mineral production of the province for the last decade:—

Year.	Value.
1901	$2,997,731
1902	2,985,463
1903	2,772,762
1904	3,023,568
1905	3,750,300
1906	5,019,932
1907	5,391,368
1908	5,458,998
1909	5,542,062
1910	7,072,244

Details of Production.

The following are details of the mineral production of the province last year:—

	1910.	1909.
Bog iron ore	$ 24,773	$ 4,668
Ochres	33,185	28,093
Chromite	6,190	26,604
Copper and sulphur ore	145,690	215,580
Asbestos	2,535,664	2,296,584
Asbestic	17,613	20,468
Mica	57,617	27,034
Phosphate	13,905	4,800
Graphite	8,865	10,339
Mineral waters	72,420	17,246
Titaniferous iron ore	5,394	.....
Slate	18,492	24,000
Cement	1,954,646	1,314,551
Magnesite	2,160	2,508
Marble	151,103	130,000
Flagstone	890	8,500
Granite	251,447	149,064
Lime	236,948	105,480
Limestone	483,447	457,143
Bricks	946,011	584,371
Sewer pipes, tiles and pottery	103,771	125,000
Quartz	2,013	.....
Totals	$7,072,244	$5,552,062

ONTARIO'S ELECTRIC SITUATION.

[The Monetary Times].

There is much in the Ontario electric situation which strikes the average onlooker as unfair. The Hydro-Electric Commission, a provincial government department, will do good work in transmitting and distributing electric power throughout the province. The city of Toronto thought there was room for a municipal electric department. This was established, and will shortly receive power from the Hydro-Electric Commission. The Toronto Electric Light Company, a private corporation, until now has enjoyed a monopoly, though not oppressive. The creation of the municipal plant immediately inaugurates competition. The city authorities and the corporation have discussed, more or less pleasantly, the question as to whether the monopoly shall be transferred to the city by the purchase of the Electric Light Company or whether the two shall follow their individual courses, competing for business.

From the company's standpoint there are good reasons for selling. Government and municipal enterprises are not invariably managed economically. They are not faced with the necessity of paying dividends to satisfy shareholders. The capital invested is the people's money, of which the municipality or the government is trustee, and often extravagant trustee. A private company, given a contract for lighting the Queen City, would deem it extravagant to place the handsome and costly cluster lights at every few yards on the main streets. This has been done by the municipal authorities. The Monetary Times favors well-lighted cities. The ratepayers must bear the expense, but if a corporation did its business on a similar basis it would be compelled for ever to pass dividends. The popular phrase puts it in this way, "The city can afford it." We may admit the benefits of public ownership, although, as a rule, it is expensive, and sometimes inefficient. One need not go beyond the borders of Toronto for an example. If a private corporation were operating the waterworks as the municipality is doing, there would probably be a revolution. There is not the slightest excuse for serving sewage instead of water to the consumer, who pays for pure water. Were a private corporation doing that, it would have answered judicial questions long ago.

Between the lines, then, one may read wherein are differences in operation by public ownership and by private capital. If the Toronto Electric Light Company competes with the civic plant, the city "can afford" to cut prices without much regard to profitable operation. The public sometimes forgets that cut-rate prices are considerably increased by the rates paid for the maintenance of a municipal department. The competition between the city and the company is vastly different to that between two private corporations.

The company's position is not improved by the powers possessed by the Hydro-Electric Commission, by the authority it seeks or by the jurisdiction it may obtain. The bill introduced in the provincial legislature this week is undeniably drastic. When first prepared, it applied to such a small area that critics suspected the legislation a weapon for fighting the Toronto Electric Light Company particularly. To meet that objection the scope of the bill has been enlarged, although it is not clear exactly how such enlargement changes the basic situation.

In brief, Mr. McNaught's bill places the Toronto Electric Light Company under the jurisdiction of the Hydro-Electric Commission. In other words, the company is to compete with the Commission and at the same time be subject to its authority, which may be changed in the legislature at any time to suit the Hydro-Electric Commission's needs. The Monetary Times has taken, we think, a fair and reasonable view of the situation ever since the Commission was inaugurated. The position now has assumed a somewhat dangerous phase. The Commission has introduced competition, at the same time creating power to strangle, if it so desired, its competitor. That is obvious.

It is of little avail for civic heroes and their supporters to mount their steeds, draw swords, arouse popular enthusiasm, and rush at the company shouting, "Off with its head." In certain quarters there is a disposition to regard discussion and arbitration as waste of time. This is an incorrect view. The matter is not purely of local importance. Upon its decision rests the honor of a progressive provincial government, a leading city of Canada, and an important private corporation. It is easy enough to sniff at suggestions as to injury to provincial or municipal credit. While credit is not supersensitive, it does recoil from injustice. The Ontario government and the city of Toronto must maintain good credit in London. It is imperative, even in their selfish interests, that the Toronto Electric Light Company be given the maximum of discussion, investigation and fair play. If Sir Henry Pellatt wants the government to inquire into the entire situation, Sir James Whitney should grant his request. We care not how the matter is settled so long as all parties to the discussion feel satisfied at the opportunities given for that discussion. This should mean general satisfaction, and in turn a confident feeling in the money markets that the Ontario government is not a manufacturer of legislative big sticks. We may then expect the provincial government's coming loan of $5,500,000 in London to meet with a full measure of success. It is clear that the investor will not stake his money in Ontario if legislation runs amuck whenever the provincial goverment gives the sign.

The electric situation in Toronto has become acute and unfortunately some bitterness has been injected into the discussion. Briefly the position is this: The Hydro-Electric Department of Toronto for the distribution of power, will undertake that work for the city of Toronto, it being supplied to Toronto as well as for other municipalities in the province, by the Hydro-Electric Commission of Ontario. This immediately brings the city into direct competition with the Toronto Electric Light Company. Conferences have been held between representatives of the city and the company with a view to the purchase of the latter's plant by the municipality. As is usual in such cases, there have arisen considerable differences as to values. To complicate matters further, Mr. W. K. McNaught has introduced a bill into the Ontario Legislature extending the jurisdiction of the Hydro-Electric Commission. The proposed legislation gives the Commission absolute jurisdiction over the poles, conduits and wires of any electrical power company competing with a municipal system operating or about to be operated.

The city's offer to purchase the Electric Light Company's plant and business at $125 for the stock, and to take over the bonded indebtedness, has not been received with favor by the company's directors. They complain that the report of Mr. R. A. Ross was published simultaneously with the announcement of the city's offer. The publication of this report, Sir H. M. Pellatt says, is a breach of faith, and has wronged the shareholders and prejudiced their rights to obtain fair value. He also contends that the efforts now being made in the legislature to put the company under the control of the Hydro-Electric Commission is a serious handicap and unfair to the company. Sir Henry has sent a lengthy letter to Sir James Whitney, requesting

the Provincial Government to intervene in the matter, in order that the interests of the shareholders may be safeguarded. He also requests that a commission be appointed to investigate the whole situation, in order that justice may be done to all parties. Further, that the city be compelled to carry out its agreement with the company and to arbitrate for the purpose of ascertaining the real value of the company's assets.

Mr. R. A. Ross, E.E., of Montreal, the expert of the Hydro-Electric Commission, has reported on the value of the Toronto Electric Light Company's plant. The main feature of the report was that the city could offer as a maximum $125 per share for the $4,000,000 common stock of the company, provided arrangements were made for the proper adjustment of the contract the company had made to take power from the Electrical Development Company. Mr. Ross shows that if the company accepts the city's offer the shareholders would virtually save $3,000,000, because they would have $1,000,000 clear out of the $5,000,000 the city offers for the $4,000,000 worth of stock and they would also save the $2,000,000 they must find soon for increases and renewal of plant if the company remains in the field as a competitor for business.

Could Cut the Rates.

The rates could in 1915 be cut 33⅓ per cent. on present figures and at the same time put aside five per cent. to meet the depreciation of the company's plant.

If the company refuses the city's offer and no amalgamation takes place, Mr. Ross points out that the company could cut the rates now by the 33⅓ per cent. contemplated by city and company in 1915 and still keep an adequate reserve for depreciation, but could pay no dividends.

The company could cut rates by 47 per cent., but if it did it could not maintain its plant in proper condition or pay dividends, although it would be able to meet its other obligations.

If the company had no competition it would still require $2,000,000 more bonds for extensions. Its gross revenue would be increased seventy-five per cent. in 1915 and then its working expense would be fifty per cent. of its gross revenue. In the period to 1915 the company could issue bonus stock of $4,000,000, which, with its present issue of $4,000,000, would mean $8,000,000 earning eight per cent.

Provided competition is to continue Mr. Ross calculates that with a reduction of 33⅓ per cent. in rates the company will be self-supporting, can pay no dividends, and its stock will have no intrinsic value.

He calculates that in 1915 the city's plant with the company's competition will be self-supporting and have a fair surplus.

Concurs in Ross Report.

Mr. Alexander Dow, E.E., of Detroit, has also made a report to the city in which he states he has read the report of Mr. Ross and that the sources of information which Mr. Ross consulted are adequate. He concurs in the opinion as to the company's standing as a business enterprise and thinks that the estimates of Mr. Ross as to the limits to which rates can be cut are conservative. He also concurs in the opinion of the Montreal expert as to the value of the company's physical properties. Dealing with the value of the company's stock, Mr. Dow says that the probable market price of 6 per cent. preference stock in the near future would be 140 to 150, especially if it is quoted in London.

City Makes Offer.

After considering these two reports, the Toronto civic board of control determined that the property and effects of the company should be purchased by the city on the following terms:—

"Paying the present shareholders at the rate of $125 for their stock holdings, subject to the consent of the Hydro-Electric Commission, and such a rearrangement of the city's obligation to the Commission and other municipalities as will enable the city to take a maximum of 15,000 horsepower and a minimum of 7,500 horsepower from the Electrical Development Company, and a rearrangement of that company's contract with the Toronto Electric Light Company, so as to limit the liability of the Toronto Electric Light Company and of its successors, the city, to take only a minimum of 7,500 horsepower at the contract rate up to the expiration of the company's franchise in 1919."

The Toronto Electric Light Company has issued a statement, stating that the value of the company's physical assets was placed by two independent experts in the United States at $7,500,000, the value of the stock being placed at $200 per share. Mr. Dow made an investigation, admitted the value of physical assets to be $6,000,000 and the value of the stock $150 per share. (Mr. Dow's report quotes only $135 per share.) Mr. Ross, continues the company's statement, found that the replacement value of the company's property was $6,500,000, and the value of the stock $125 per share.

Divergence in Real Values.

"In the case of a property like that of the Toronto Electric Light Company," he says, "it is impossible that there should be a divergence in real values to such an extent as between $200 per share and $125 per share.

"The company has brought an action denying the right of the city to compete without first complying with the terms of the agreement and submitting to arbitration, and also to restrain the city from proceeding with the erection of poles and wires and the placing of underground conduits in a manner dangerous to life and property, which action is now proceeding to trial. The city has introduced a bill in the legislature, which, if passed, will place the company entirely under the jurisdiction of the Hydro-Electric Commission, and will render all its legal proceedings abortive.

City and Its Agreement.

"The position of the company is that the legislature should not pass this bill until the city has first complied with its agreement, and consented to fix a purchase price by arbitration. The company is willing to arbitrate in any of the following ways:—

(1) By the usual arbitration contemplated by the agreement between the parties.

(2) By the speedy arbitration of three independent parties, to be selected one by the city, one by the company and one by the government.

(3) By reference to three of the most noted American engineering firms:—Westinghouse, Church, Kerr & Company, New York; Stone & Webster, New York, and Sergent & Lundy, Chicago, or by any three other engineering firms of high standing, to be nominated jointly by the President of the American Institute of Electrical Engineers and the President of the University of Toronto."

Wants a Commission.

Sir Henry Pellatt, president of the Toronto Electric Light Company, has also addressed a lengthy letter to Sir James Whitney, premier of Ontario. He complains that the case of the company has been deliberately misrepresented and asks for the appointment of a commission to inquire into and investigate the whole matter and report to the legislature in order that justice may be done.

Additional interest is centred on the bill introduced in the Ontario legislature extending the jurisdiction of the Hydro-Electric Commission. As stated above, it gives the Commission jurisdiction over the poles, conduits and wires of any electric power company coming into competition with a municipal system operating, or about to be operated. The private company's poles might, upon the order of the Commission, be made to carry the wires of a municipal company, and the only court in case of dispute is the Commission.

The officers of the Toronto Electric Light Company hold that the bill was introduced on behalf of the city for the purpose of rendering the company helpless and blocking the litigation now in progress, by which the company is seeking to restrain the city from competing in the sale of power.

On Tuesday notice was given that the bill introduced by Mr. McNaught ten days ago would be withdrawn and a new one substituted. The new bill gives the commission absolute control over all power and electric companies in the province. Thus the commission will have supervision over the plant, equipment, operation, erection of poles, stringing of wires, and laying of conduits.

All disputes arising between municipal and private electric light companies will in future be settled by the commission, and all business carried on by any electrical company will be done under the direction and supervision of the commission.

COPPER, LEAD AND NICKEL

Production Last Year Was Maintained—Ontario and British Columbia Are Big Nickel Producers.

No refined copper is produced in Canada, but the copper ores are mostly reduced to a matte or blister copper carrying values in the precious metals. In Quebec where the copper is recovered subsequently to the extraction of the sulphur from pyritic ores, there was increased activity during the year. A small quantity of ore was exported from British Columbia coast mines and the Yukon to United States smelters for treatment. In Ontario, where the copper is chiefly recovered from the nickel-copper ores of the Sudbury district, there is a very large increase in production. In British Columbia the most important events during the year were the acquisition of a controlling interest in the Dominion Copper Company by the British Columbia Copper Company, with the subsequent re-opening of several of the properties, and the destruction by fire of part of the head works of the Granby Mines at Phoenix, British Columbia, which noticeably affected the output, although the Boundary district as a whole shows an increased production.

Statistics are not available at the present time to show the total quantity of copper contained in ores shipped from the mines. The total production of copper contained in blister and matte produced and estimated as recoverable from ores exported was in 1910 approximately 56,598,074 pounds. In 1909 the production of copper estimated on the same basis was 52,493,863 pounds, an increased production of about 7.8 per cent., being therefore shown in 1910.

Copper in the Provinces.

Of the production in 1910, Quebec is credited with 957,178 pounds; the production in Ontario was 19,259,016 pounds; and in British Columbia the production is estimated at about 36,000,000 pounds. Ontario shows an increased production of about 3,512,317 pounds, or 22.3 per cent., while British Columbia shows a slight increase, the production in 1909 being estimated at 35,658,952 pounds.

The New York price of electrolytic copper during the year varied between the limits of 12 cents and 13¾ cents per pound, the average being 12.738, as compared with an average of 12.982 cents in 1909.

The total exports of copper contained in ore, matte and blister according to Customs Department returns were 56,964,127 pounds, valued at $5,840,553. It will be noted that the exports agree very closely in number of pounds with the record of the production which would be expected since practically all the copper is exported.

Where Lead is Produced.

The total production in 1910 of pig and manufactured lead was 32,987,508 pounds, valued at the average price of refined lead in Toronto at $1,237,032. The production of refined lead and lead contained in base bullion exported in 1909 was 45,857,424 pounds. A decreased production in 1910 is therefore shown of 12,869,916 pounds. The production of both years was entirely from British Columbia. The falling off in the output of that province is due largely to the curtailment of production by several of the important Slocan mines, consequent to the destruction of railway facilities and of several mines buildings by forest fires.

The Blue Bell Mine also, one of the leading shippers of lead in 1909, suspended operations early in 1910. Against these decreases may be placed the advent of the Sullivan mine, East Kootenay, into the list of shippers. The exports of lead in ore during the year were 23 tons, and of pig lead 3,856 tons, or a total of 3,879. About 12,614 tons of domestic production were, therefore, available for home consumption. The imports of lead in 1910 were 8,305 tons, valued at $525,265, in addition to which were manufactures valued at $107,688, and litharge, white and red lead, et cetera, $200,790, or a total value of $833,743.

The price of lead in Toronto during 1910 averaged about 3.750 cents per pound, in New York 4.446 cents per pound, and in London £12.920 per long ton. The amount of bounty paid during the twelve months ending December 31, 1910, on account of lead production was $318,308.28, as compared with a payment of $346,527.98 in 1909.

There has been a large increase in the production of nickel-copper ores in Ontario during the past two years, and it is perhaps not generally realized that the production of nickel in this province is now almost as large, pound for pound, as the production of copper in British Columbia, while the market price of the metal is from two to three times that of copper. A portion of the production is, however, now recovered with copper as monel metal and sold at a much lower price than fine nickel. Active operations are being carried on by the same companies as formerly, viz.: the Mond Nickel Company, at Victoria Mines, and the Canadian Copper Company, at Copper Cliff.

The ore is first roasted and then smelted and converted to a Bessemer matte containing from 77 to 82 per cent. of the combined metals, copper and nickel; the matte being shipped to the United States and Great Britain for refining.

The total production of matte in 1910 was 35,033 tons, valued at the furnace at $5,380,064, an increase of 9,188 tons, or 31.6 per cent. over the production of 1909. The metallic contents were copper, 19,259,016 pounds, and nickel, 37,271,033 pounds.

Some Comparative Statistics.

The aggregate results of the operations on the Sudbury District nickel-copper ores during 1908 and 1910 were as follows in tons of 2,000 pounds:—

	1908.	1910.
Ore mined	409,551	652,392
Ore smelted	360,180	628,947
Bessemer matte produced	21,197	35,033
" shipped	21,210	.....
Copper contents of matte shipped	7,503	9,630
Nickel " "	9,572	18,625
Spot value of matte shipped	$2,930,989	$5,380,064
Wages paid	$1,286,265	$1,748,153
Men employed	1,090	.....

Exports of nickel contained in ore, matte, et cetera, as compiled from Customs reports have been, for the twelve months ending December 31, as follows:—

	1908.	1909.	1910.
	Pounds.	Pounds.	Pounds.
To Great Britain	2,554,486	3,843,763	5,335,331
To United States	16,865,407	21,772,635	30,679,451
	19,419,893	25,616,398	36,014,782

The price of refined nickel in New York remained practically constant throughout the year—the quotation being "Large lots, contract business, 40 to 45 cents per pound. Retail spot from 50 cents for 500 pound lots up to 55 cents for 200 pound lots. The price for electrolytic is 5 cents higher."

CRACKING OF CEMENT GROUTED BRICK PAVEMENTS.

(Continued from Page 466.)

5. **Contraction Between Transverse Expansion Joints.** When expansion joints are placed a considerable distance apart, it is noted that fine cracks appear at intervals, following the grouted joint from curb to curb. Where expansion joints are fifty feet apart two such cracks appear in the fifty feet, dividing the pavement into sections of about one rod in length. These cracks are hardly noticeable, and sometimes can only be observed at certain times when outlined by moisture.

It is believed that they should be obviated by placing the transverse expansion joints only about fifteen feet or a rod apart. It would then be necessary to fill only one or two joints with the bituminous filler at each place.

It is hoped that these suggestions and the discussion which they may bring out at this time may be of value to those of our profession who, like the writer, must rely largely upon the experience of others for guidance in their work.

THE ENGINEERS' LIBRARY

BOOK REVIEWS.

Books reviewed in these columns may be secured from The Canadian Engineer Book Department.

Engineering Index Annual, published by The Engineering Magazine, 140 Nassau Street, New York, size 6 x 9; pages 500; price $2.00.

This volume is the fifth annual issue of a continuous index devoted to the indexing of Engineering and Technical Literature of Europe and America.

The articles indexed are first grouped under the general division of engineering practice to which they belong—Civil, Mechanical, Electrical, Mining, etc., and under these again they are sub-grouped according to the recognized special divisions of each field.

The chief purpose of the classified plan of indexing is to collate for each specialist the entire current literature of his subject and to assemble it in a small space where it may be readily found and completely explored.

The comprehensive scope of the index will be recognized when it is known that the index comprises articles from 250 publications representing seventeen nations and colonies and six languages. With each entry a brief descriptive note is given defining the scope and purpose of the article, and in many cases this is sufficient for the purpose of the reader and saves him the labor of further search. In general, the index is a guide to the otherwise overwhelming mass of information contained in the files of engineering periodicals.

It is a work of reference that will be valuable in every engineer's library.

Mechanical Engineering, Leather size, by Charles M. Sames, B. Sc. Fourth edition for 1911. Size 4 x 6⅝ in., 220 pp., illustrated. Leather, price $2.00. This book contains a vast amount of useful information for the mechanical engineer, and in fact for all who in any way have to deal with mechanics or mechanical contrivances from an engineering standpoint. It is a ready reference in a convenient form and so can be constantly referred to without difficulty or loss of time. Every page is full of valuable explanations, definitions and suggestions for the use of the engineer. The author states that in this edition new matter has been added upon nearly one hundred subjects. It touches the fields of mathematics, chemistry, mechanics, electricity and in fact all branches of science that are to-day in any way connected with mechanical engineering.

Railroad Field Geometry, by William G. Raymond, C. E., 242+ix. pp., 138 figures. Leather bound, price $2.00. In this book the author has given problem after problem in railroad geometry, but not as mere geometric problems to be merely learned, so much as practical problems arising in actual field work and calculated to help and supplement the field work. Following an explanation of the elementary principles of railroad survey, the author takes simple curves and explains them by the use of problems and he then follows this discussion by giving field problems in the simple curves. He treats the subject of compound curves in a similar manner. An interesting and instructive chapter upon canting the track on curves is given, in which the author explains very simply the mechanics of the situation from the standpoint of centrifugal force. Spirals are discussed at length and many concrete examples and problems of them are given. An instructive chapter is devoted to the subject of switches and frogs, being well supplied with explanatory drawings and problems. Chapters devoted to the re-running of old lines and making right of way descriptions and maps contain valuable hints and while perhaps not always included in a work on railway geometry they are well placed. Chapters on staking out, earthwork and haul are written clearly to be easily understood but at the same time demonstrated in a practical way which would enable one to grasp the problem by a little study. Computations by the average end Areas and Prismoidal Correction are explained and demonstrated, as also are special forms. A chapter on earthwork tables gives the method of application and the derivation of the tables though the tables are not attached in this work. The author evidently is aiming to get the proper use of these methods well grounded in his reader's mind rather than give the mere tables, although, of course, the tables would not have hurt the work. Reference is made to good tables for practical use. Although this book would bear many valuable hints for field work, the author says he has not intended it primarily for a field book. A chapter on diagrams or graphic representation might be mentioned. It may be called a chapter in analytical geometry and is not the least instructive of this book, and as graphic representation and calculation plays considerable part in this work it is important. Furthermore, it is an aid to the chapter on mass diagrams with which the book closes. Taking the book as a whole it is a convenient, practical and well arranged book full of useful hints for the young railroad engineer.

Standard Specifications for Structural Steel, Timber, Concrete and Reinforced Concrete, 93 pages, by John C. Ostrup, C. E. Published by McGraw-Hill Book Co., New York. Price $1.00.

This book is one of the most convenient books dealing with these subjects with which the writer is familiar. It is impossible of course to give minute specifications for all subjects covered, but considering the space, there is a great deal covered.

Under structural steel, specifications are given for steel framework for buildings, highway and railroad bridges, plate girders, workmanship, erection and painting. Specifications for timber for trestles, bridges and building frames are given.

Cement, concrete and reinforced concrete specifications are given in separate chapters. One who is obliged to prepare specifications for structures will find tnis book very useful and convenient for reference. All unnecessary material has been omitted and the information condensed into such a form as one can locate the required data without reading several pages.

The allowable stresses and methods of computation allowed are in general standard, with the exception possibly of those applying to reinforced concrete. The moments of resistance of concrete beams are greater than those allowed by some municipal building laws, but no doubt the values are not excessive providing great care is taken in preparing and placing the concrete and steel.

The writer can strongly recommend this book for a place on the desk of any designing engineer on account of its conciseness and reliable nature.

Power and Its Transmission, Thos. A. Smith, Published by E. & F. M. Spon, London—75 cents, 71 pages (pocket book size).

This small hand book describes in general different types of transmission, such as belt, and rope drive. The book would be extremely useful to a shop superintendent.

Information is given for determining the necessary belts, pulleys, shafting, rope, etc., required for different service, in addition to instructions regarding care of same.

A chapter is devoted to electric power for shop service describing different terms used in electrical work as well as power required for several types of machines.

The book is too small to go into any one subject dealt with in detail. It will be useful, however, as stated above, for shop foremen and superintendents.

Civil Engineers' Pocketbook, by Mansfield Merriman, published by J. Wiley of New York, Renouf Publishing Co., Montreal; size 5 x 7; pp. 1380; figures 944; tables, 495; Morocco $5.00.

This volume has been in course of preparation since the fall of 1908, and is the work of Mr. Merriman, Editor-in-Chief, and twelve associate editors, who are each specialists in their department.

Pocket books are consulted by engineers because facts, formulas, tables, and methods can be found more quickly than by referring to text books or treatises. A pocket book must be prepared from this point of view. It should cover the ground with great conciseness and clearness, and be thoroughly up to date.

The work is on a higher plane than former American Pocket Books. While Taschenbuch Hütte may generally be taken as a model regarding the presentation of mathematical matter, it is certain that this new Pocket Book should be very much better in respect to practical subjects. The reader is supposed to have a good knowledge of elementary mathematics, so that it is unnecessary to express formulas in words.

Demonstrations are not required, but methods which cannot be expressed by formulas should be clearly explained and usually be illustrated by numerical examples. Logical order is not so important as in text-books, and there should be no hesitation in deviating from it when deemed desirable. This is a reference book only.

The fundamental principles kept in mind in preparing the copy are these: (1) Select those topics to which civil engineers desire to refer. (2) Condense the matter so that the greatest amount may be put in the assigned space and at the same time be clearly presented.

The thirteen sections of the book contain 75 chapters, 620 articles, 495 tables, and 944 numbered figures which are equivalent to about 1200 ordinary cuts since in many cases several similar figures are grouped together. The number of tables is so large that it is impracticable to mention them in the table of contents, for the mere list of their titles would occupy over eight pages of fine type, but references to all will be found in the index.

Mathematical Tables by Mansfield Merriman, Member of American Society of Civil Engineers.

Surveying, Geodesy, Railroad Location by Chas. B. Breed, Associate Professor of Civil Engineering in Massachusetts Institute of Technology.

Roads and Railroads by Walter Loring Webb, Member of American Society of Civil Engineers.

Materials of Construction, by Rudolph P. Miller, Supt. of Buildings, Borough of Manhattan, New York City.

Plain and Reinforced Concrete, by Frederick E. Turneaure, Dean of the College of Engineering, University of Wisconsin.

Masonry, Foundations, Earthwork, by Ira O. Baker, Professor of Civil Engineering in University of Illinois.

Masonry and Timber Structures, by Walter J. Douglas, Member of American Society of Civil Engineers.

Steel Structures, by Frank P. McKibben, Professor of Civil Engineering in Lehigh University.

Hydraulics, Pumping, Water Power, by Gardner S. Williams, Professor of Civil, Hydraulic, and Sanitary Engineering, University of Michigan.

Water Supply, Sewerage, Irrigation, by Allen Hazen, Member of American Society of Civil Engineers.

Dams, Aqueducts, Canals, Shafts, Tunnels, by Alfred Noble, and Silas H. Woodard, Members of American Society of Civil Engineers.

Mathematics and Mechanics, by Edward R. Maurer, Professor of Mechanics in University of Wisconsin.

Physics, Meteorology, Weights and Measures, by Louis A. Fischer, Chief of Division of Weights and Measures, U. S. Bureau of Standards.

An Investigation of Built-up Columns Under Load, by Arthur N. Talbot and Herbert F. Moore, is issued as Bulletin No. 44 of the Engineering Experiment Station of the University of Illinois.

In the course of this investigation, laboratory tests were made on steel and wrought-iron built-up columns, such as are used in bridges and other structures, to determine not only their strength, but also the way in which the compressive stresses vary over the cross-section of the channels or other component parts of the column and throughout its length. The amount of stress in lattice bars and its variation from bar to bar was also measured. The distribution of stress over the cross-section of a lattice bar was studied. Field tests were conducted on the columns of a railroad bridge under the load of a locomotive and train, and the distribution of stresses over various parts of the columns was measured. The investigation shows that the variations from the ideal column which result from shop and erection processes may be more important than the influence of length, and that on account of such causes the stresses at one or more points in a column may be as much as 50% in excess of the average stress. This investigation may be expected to have an important bearing on structural engineering practice.

Copies of Bulletin No. 44 may be obtained gratis upon application to W. F. M. Goss, Director of the Engineering Experiment Station, University of Illinois, Urbana, Illinois.

PUBLICATIONS RECEIVED.

Industrial Plans, by Chas. Day; published by The New York Engineering Magazine, 140-142 Nassau St., New York City; size 5 x 8; pp. 294.

Preliminary Report of Oil & Gas Developments in Tennessee, by M. J. Munn, published by Nashville Foster & Parks Co.; size 6 x 9; pp. 46.

Gas Engines, by W. J. Marshall and Capt. H. R. Sankey, R. E. Published by Constable & Company Ltd., 10 Orange Street, Leicester Sq., London, Eng., size 9 x 6; pp. 292; price 6/ net.

Elementary Electrical Engineering, by L. W. Gill, published by the Jackson Press, Kingston. Size 9 x 6; pp. 157.

Civil Engineers' Pocketbook, by Mansfield Merriman, published by J. Wiley of New York, Renouf Publishing Company of Montreal; size 5 x 7; pp. 1380; figures 944, tables 495. Morocco, $5.00.

The Cement Worker's Hand-Book, by W. H. Baker, published by Industrial Press Publishing Co., Atlanta, Ga.; size 4 x 6; pages 98; price 50 cents.

Report of the Pittsburgh Transportation Problem, by Bion J. Arnold, Consulting Engineer, 181 La Salle St., Chicago, Ill.; size 9 x 6; pages 202; published by the Republic Bank Note Company, Pittsburg, Pa.

New Species of Shells, by William H. Dall and Paul Bartsch, published by the Ottawa Government Printing Bureau. Size 10 x 7; pp. 29.

Preliminary Memoir of the Lewes and Nordenskiold Rivers Coal Dist., Yukon Territory, by D. D. Cairnes, published by the Ottawa Government Printing Bureau. Size 7 x 10; pp. 70.

The Edmonton Coal Field, Alberta, by D. B. Dowling, published by the Ottawa Government Printing Bureau. Size 7 x 10; pp. 67.

Geology of the Nepigon Basin, Ontario, by Alfred W. G. Wilson, published by the Ottawa Government Printing Bureau. Size 7 x 10; pp. 159.

Report of a part of the North West Territories, by Wm. McInnes, published by the Ottawa Government Printing Bureau. Size 7 x 10; pp. 58; also **Report on a Traverse through the Southern Part of the North West Territories from Lac Seul to Cat Lake in 1902,** by Alf. W. G. Wilson, pp. 26.

Smoley's Parallel Tables of Logarithms and Squares, by Constance Smoley, C. E. Published by The Engineering News Publishing Co., New York; size 5 x 7; pp. 501; price $3.50.

Aerial or Wire Rope-Ways, by A. J. Wallis-Tayler, published by Crosby Lockwood & Son, 7 Stationers' Hall Court, Ludgate Hill, E.C., London, Eng. Size 9 x 6; pp. 278; price 7/6 net.

Three-Phase Transmission, by W. Brew, M.I.E.E., published by Crosby Lockwood & Son, England; size 6 x 9; pp. 210; price 7/6 net.

Sewerage Systems, by Hugh S. Watson, published by Crosby Lockwood & Son, England; size 7 x 10; pp. 314; price 10/6 net.

Current Railway Problems, by Samuel O. Dunn, published by the Railway Age Gazette; size 5 x 6½; pp. 84; price

Investigation of the Peat Bogs, and Peat Industry of Canada, by Aleph Anrep, Jr., published by the Government Printing Bureau, Ottawa. Size 6½ x 10; pp. 49.

Magnetic Concentration Experiments, by George C. MacKenzie, B. Sc., published by the Government Printing Bureau, Ottawa; size 6½ x 10; pp. 32.

Scientific Management, by Louis D. Brandeis, published by The Engineering Magazine, 140-142 Nassau St., New York; size 7 x 9½; pp. 92; price

The Engineering Index Annual for 1910, published by The Engineering Magazine, 140-142 Nassau Street, New York; 7 x 9; pp. 496; price

CATALOGUES RECEIVED.

Catalogue of Eugene Dietzgen, published by Eugene Dietzgen Co., 10 Shuter St., Toronto; size 6 x 9; pp. 555; price 50 cents.

Concrete Reinforcement—Published by the American Steel & Wire Company, 30 Church St., New York. Its tables and information are to be made use of in the design of concrete structures which have triangle mesh reinforcement. The book is 6 x 9, and contains 115 pages.

Cement Sidewalk Tools—Published by T. Slack & Co., 145 Brock Avenue, Toronto. This booklet contains the 1911 price list of this firm, and in addition to the price list, gives considerable information as to the tools to use and the mixtures to make in securing good concrete sidewalks.

Indicators.—Dobbie McInner, Limited, of 57 Bothwell St., Glasgow, are issuing a catalogue descriptive of their indicators, together with the attachments, and an explanation of their workings.

Friction Clutch—The Dodge Manufacturing Co., Toronto, in a small booklet describe various Friction Clutch Mechanisms put on the market by this concern together with price list and sizes of their product.

Pulverizers—The Sutcliffe, Speakman & Co., Ltd., Leigh, Eng., have for distribution catalogues describing the Briquetting and Pulverizing machines, their specialty being machines for the reduction of Iron Ore. In another catalogue they describe their Clinker and Lime Brick products, their machinery for this product having developed great efficiency.

Centrifugal Pumps—The John McDougall Caledonian Iron Works Co., Ltd., Montreal, in Bulletin 106 describe the various types of the Volute Pump which they put on the market. The bulletin gives capacity and efficiency as well as a general description.

Mineral Pipe Coating—The Canadian Mineral Rubber Company of 1 Toronto Street, are distributing a bulletin showing the advantage of "Pioneer" Mineral Rubber Pipe Coating as a coating against Electrolytical Depreciation.

Cables—St. Helens Cable & Rubber Co., Ltd., of Warrington, England, in a folder which they are distributing bring to the attention of engineers the different classes of cables which they produce.

Furnaces—The Rockwell Furnace Company, 26 Cortlandt Street, New York, in bulletin 27 describe their Portable Rivet Heating Furnaces. These furnaces have been found very convenient and efficient in the heating of rivets for all classes of steel work. In bulletin No. T., the same company describe the Moyer Tramrail and show its adaptability for modern foundry practice.

Concrete—The Canada Cement Company of Montreal in a booklet entitled "What the Farmer can do with Cement" have devoted 160 pages to instructing the farmer in the purchasing, mixing and building of almost everything that has to do with construction work on the farm. Not only are illustrations given of what has been accomplished, but examples and diagrams of how the work should be done are given. A very valuable work to those who expect to have concrete work to do.

Castings—The Bayonne Casting Company, of East Tenth Street, Bayonne, N.J., are distributing a booklet describing Monel Metal, telling how the metal may be used and what it will accomplish in the matter of castings.

Sewage Distributors—Adams-Hydraulics, Ltd., York, England, are distributing a description of the Revolving Distributors which they manufacture for use in connection with Bacterial Sewage Purification works.

Cement Sidewalks—The Vulcan Portland Cement Company, Land Title Bldg., Philadelphia, Pa., are distributing an interesting booklet on Cement Sidewalk Pavement. This booklet, in addition to describing the construction of walks and method of construction, also has several interesting chapters on mixing composition.

"Electric Meters: How to Read Them" is the title of a very attractive and instructive booklet just issued by the Westinghouse Electric & Manufacturing Company. As the title suggests, the booklet is intended as an instruction in the reading of watthour meters for the layman. It is written in a popular style, easily understood by anyone.

The Pedestal Pile is the name of a new book on foundations recently issued by The MacArthur Concrete Pile & Foundation Company, 11 Pine Street, New York. After briefly touching upon the various aspects of the problem of attaining permanent and reliable piling foundations, the method of forming the Pedestal Pile is fully described.

CONSTRUCTION NEWS SECTION

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

TENDERS PENDING.

In addition to those in this issue.

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

Place of Work.	Tenders Close.	Issue of.	Page.
Brantford, Ont., pavement	Mar. 30.	Mar. 16.	66
Brantford, Ont., residence	Mar. 25.	Mar. 16.	449
Brantford, Ont., four bridges	Apr. 3.	Mar. 16.	449
Calgary, Alta., chalets	Apr. 1.	Mar. 16.	450
Calgary, Alta., pipe and conduits.	Mar. 24.	Mar. 16.	450
Calgary, Alta., one or more stations	Mar. 22.	Mar. 9.	420
Calgary, Alta., machinery and plant	Mar. 22.	Feb. 23.	69
Chapleau, Ont., engine and boiler	Mar. 27.	Mar. 9.	419
Guelph, Ont., pavement	Mar. 30.	Mar. 9.	66
Hamilton, Ont., works on House of Refuge	Mar. 22.	Mar. 16.	449
Kingston, Ont., steel bridge	Apr. 5.	Mar. 16.	66
Leeville, Sask., schoolhouse	Apr. 15.	Mar. 9.	420
Minnitonas P.O., Man., bridge and piers	Apr. 15.	Feb. 23.	70
Moose Jaw, Sask., sewer and water extensions	Apr. 10.	Mar. 2.	70
Moose Jaw, Sask., warehouse	Mar. 25.	Mar. 16.	450
Moose Jaw, Sask., main drainage works	Apr. 10.	Feb. 23.	66
Niagara Falls, Ont., bridges and roadway	Mar. 28.	Mar. 9.	64
Oak River, Man., debentures for hall	Mar. 29.	Feb. 23.	54
Ottawa, Ont., concrete bridge	Mar. 31.	Mar. 2.	390
Ottawa, Ont., station at Campbellton	Mar. 25.	Mar. 9.	419
Ottawa, Ont., wharf	Mar. 28.	Mar. 16.	449
Ottawa, Ont., hot water heating apparatus	Apr. 4.	Mar. 16.	449
Ottawa, Ont., public building at Portage la Prairie	Apr. 3.	Mar. 16.	449
Ottawa, Ont., armoury	Apr. 5.	Mar. 16.	449
Ottawa, Ont., wharf	Apr. 4.	Mar. 9.	419
Prince Albert, Sask., intercepting sewer	Apr. 15.	Mar. 16.	66
Regina, Sask., church	Mar. 24.	Mar. 16.	450
Rouleau, Sask., mains, valves, etc.	Apr. 4.	Mar. 9.	64
Saskatoon, Sask., material for connections	Mar. 24.	Mar. 16.	70
Saskatoon, Sask., electrical unit.	Mar. 27.	Mar. 9.	64
Saskatoon, Sask., intercepting sewer	Apr. 14.	Mar. 9.	66
Saskatoon, Sask., water filtration plant	Mar. 31.	Mar. 9.	66
Saskatoon, Sask., franchise for street railway	Apr. 3.	Mar. 2.	70
Swan River, Man., steel bridge	Apr. 15.	Feb. 16.	66
Toronto, Ont., right to cut pulpwood	Apr. 10.	Jan. 19.	203
Toronto, Ont., rails and ties	Apr. 4.	Mar. 2.	64
Toronto, Ont., extensions for manholes	Mar. 28.	Mar. 9.	66
Toronto, Ont., engine house	Mar. 25.	Mar. 9.	66
Victoria, B.C., school building.	Mar. 29.	Mar. 16.	450
Vancouver, B.C., supply of pipe, valves, etc.	Mar. 22.	Feb. 23.	54
Winnipeg, Man., cast iron pipe	Mar. 29	Mar. 9.	420
Welland, Ont., waterworks pumps	Apr. 3.	Mar. 16.	66
Winnipeg, Man., frames and covers	Apr. 4.	Mar. 16.	450

TENDERS.

St. John, N.B.—Tenders will be received until March 25th, 1911, for material to repair S. S. Western Extension. Geo. H. Waring, Supt. of Ferries, Water St., St. John, N.B.

St. John, N.B.—Tenders will be received until March 29th, 1911, for excavation, backfill and cartage for water mains on Simonds and Camden streets, Strait Shore road, and Watson street west. Plans and specifications to be seen in the office of Wm. Murdoch, City Engineer, Room No. 5, City Building, St. John.

Fredericton, N.B.—Tenders are asked by the Hon. Chief Commissioner of Public Works for rebuilding the Centreville bridge in Studholm, King's County, and will be received up till March 27th.

Westmount, Que.—Tenders will be received until March 30th 1911, for the road supplies, cement, sand, etc., required by the department for the year commencing 1st May, 1911. Information as to quantities, conditions and specifications may be obtained at the office of the city surveyor. A. D. Shibley, city clerk, Westmount.

Montreal, Que.—Tenders will be received until March 29th, 1911, for a ferry wharf and approaches, to be built in the harbor of Montreal, on the west side of St. Helen's Island. Plans and specifications may be seen on application to Mr. F. W. Cowie, Chief Engineer. David Seath, Secretary, Montreal.

Ottawa, Ont.—Tenders will be received until March 23rd, 1911, for the charter of a tugboat to tend elevator dredge at First Narrows, Vancouver, B.C. Plans and specifications can be seen at the office of William Henderson, Res. Architect, Victoria, B.C., H. A. Bayfield, Supt. of Dredges, New Westminster, B.C., and from the postmaster at Vancouver, B.C. R. C. Desrochers, Secretary, Dept. of Public Works, Ottawa.

Ottawa, Ont.—Sealed tenders will be received until April 8th, 1911, for the purchase of the old Custom Buildings and lot on Stuart street, Hamilton, Ont. Property has frontage of about 122 feet on Stuart street by a depth of about 145 feet. R. C. Desrochers, Secretary, Dept. of Public Works, Ottawa.

Ottawa, Ont.—Tenders will be received until the 28th day of March, 1911, for concrete walls and building of roads, etc. Plans and specifications may be seen at the office of the superintending engineer of the Quebec Canals, No. 2 Place d'Armes, Montreal. L. K. Jones, Secretary, Dept. of Railways and Canals, Ottawa.

Ottawa, Ont.—Tenders will be received until the 10th April, 1911, for the sale and delivery of a twin tank automobile combination chemical fire engine and hose wagon. Any further information will be given by the chief of the fire department. John Henderson, City Clerk, City Hall, Ottawa.

Ottawa, Ont.—The corporation of the city of Ottawa, Municipal Electric Department, calls for tenders up till the 6th day of April, 1911, on meters, transformers, incandescent lamps, arc lamps, globes, carbons, hardware and sundry supplies. J. E. Brown, Electrical Superintendent, No. 12 Sparks St., Ottawa.

Ottawa, Ont.—Tenders will be received until March 27th, 1911, for alterations and additions to 40 old buckets for dredge "Fielding." Plans and specifications can be seen at the offices of J. K. Scammel, Dist. Engineer, St. John, N.B.; C. E. W. Dodwell, Esq., Dist. Engineer, Halifax, N.S.; also office of R. C. Desrochers, Secretary, Dept. of Public Works, Ottawa.

Jennings & Ross, of Toronto, the price of contract for the bridge on the second concession of Huntley being $2,795.

Ottawa, Ont.—Tenders will be received until April 3rd, 1911, for the construction of a plaza between Dufferin and Sapper's bridges, alterations to Dufferin bridge and demolition and reconstruction of Sapper's bridge. R. C. Desrochers, secretary, Department of Public Works, Ottawa.

Ottawa, Ont.—Sealed tenders will be received until April 10th, 1911, for the erection of a public building at Fairville, N.B. Plans and specifications may be seen on application to Mr. D. H. Waterbury, superintendent of public buildings, Public Works Department, St. John, N.B., at the post office at Fairville, N.B., and at the office of R. C. Desrochers, secretary, Department of Public Works, Ottawa.

Kingston, Ont.—Tenders will be received at the office of the Secretary, School of Mining, Kingston, until April 1st, 1911, for the cabinet work, comprising tables, etc., and also plumbing and fitters' works required in the completion of the Chemistry Building for the Governors of the School of Mining. Power & Son, Architects, Merchants Bank Chambers, Kingston.

Brampton, Ont.—Tenders will be received until April 17th, 1911, for the construction of approximately 8,000 square yards of pavement and 3,500 lineal feet of concrete curb and gutter. Plans and specifications may be seen at the office of the town engineer or the town clerk, also office of the Canadian Engineer, 62 Church Street, Toronto. W. C. Young, town clerk. W. M. Treadgold, town engineer, Brampton, Ont. (Advertisement in the Canadian Engineer).

Toronto, Ont.—Tenders will be received until March 28th, 1911, for integrating Wattmeters. Specifications may be seen and forms of tender obtained from the Toronto Hydro-Electric System, City Hall, Toronto. G. R. Geary, (Mayor), Chairman Board of Control, Toronto. (Adv. in the Can. Eng.)

Toronto, Ont.—Tenders will be received until March 28th, 1911, for the laying and jointing of water pipes, valves, hydrants and special castings. Specifications and forms of tender may be obtained at the office of the City Engineer, Toronto. G. R. Geary (Mayor), Chairman Board of Control, City Hall, Toronto.

Toronto, Ont.—Tenders will be received until March 28th, 1911, for electric light and power wiring in the Exhibition Buildings. Plans and specifications may be seen at the Police Station, Exhibition Grounds, from 9 a.m. to 12 noon, and at the business office of the Toronto Hydro-Electric System, City Hall, from 2 to 5 p.m. each day. G. R. Geary, (Mayor), Chairman Board of Control, City Hall, Toronto.

Toronto, Ont.—Tenders will be received until April 1st, 1911, for all the various trades required in the erection and completion of a Club House for the Toronto Hunt, Limited. Darling & Pearson, 2 Leader Lane.

Toronto, Ont.—Tenders will be received until noon on the 27th March, 1911, for the dredging required for this season. Specifications can be seen and form of tender obtained at the office of C. W. Postlethwaite, Harbor Master, 508 Board of Trade Bldg., Toronto.

Toronto, Ont.—Tenders will be received up to noon on March 28th, 1911, for insulated copper wire. Specifications may be seen and forms of tender obtained from the Toronto Hydro-Electric System, City Hall, Toronto. G. R. Geary (Mayor), chairman, Board of Control, City Hall, Toronto. (Advertisement in the Canadian Engineer).

North Toronto, Ont.—Tenders will be received until March 30th, 1911, for pole line supplies. W. C. Norman, Clerk, Eglinton. (Adv. in the Can. Eng.)

Toronto, Ont.—Tenders will be received until March 28th, 1911, for the construction of sewers on seven streets. Plans and specifications can be seen at the office of the city engineer, Toronto. G. R. Geary (Mayor), chairman, Board of Control, City Hall, Toronto.

Goderich, Ont.—The municipal council of the town of Goderich will receive plans for a proposed new municipal building (combined town hall and fire hall), up to and including April 15th, 1911. L. L. Knox, Town Clerk, Goderich.

Winnipeg, Man.—Tenders will be received until March 27th, 1911, for the construction of substructures for bridges and culverts on the Manitoba Division, and for subway at Main street, Kenora. Plans and specifications can be seen at the office of Frank Lee, Division Engineer, Winnipeg.

Winnipeg, Man.—Tenders will be received until March 29th, 1911, for laying approximately 5,000 feet of 18-inch water pipe running west from Well No. 7, Lot 19, Kildonan. Plans and specifications can be seen at the office of the City Engineer, 223 James Ave., Winnipeg. M. Peterson, Secretary, Board of Control Office, Winnipeg.

Winnipeg, Man.—Tenders will be received until the 1st day of May, 1911, for the supply and delivery f.o.b. cars to Winnipeg or ornamental lighting standards of approved designs. Plans, specifications, and forms of tender may be obtained at the office of the City Electrician, City Hall, Winnipeg. M. Peterson, Secretary, Board of Control Office, Winnipeg.

Winnipeg, Man.—Tenders will be received until April 19th, 1911, for supply of labor and materials required in the construction of wooden stave conduit for extension of water pipe line, northerly from Well No. 7, Lot 19, Kildonan. Plans, specifications, and forms of tender may be obtained at the office of the City Engineer, 223 James Ave., Winnipeg. M. Peterson, Secretary, Board of Control Office, Winnipeg.

Winnipeg, Man.—Tenders will be received until April 5th, 1911, for the manufacture and erection of a horizontal turbine pump. Plans and specifications may be obtained at the office of the city engineer, 223 James Ave., Winnipeg. M. Peterson, secretary, Board of Control office, Winnipeg. (Advertisement in the Canadian Engineer).

Winnipeg, Man.—Tenders will be received until March 30th, 1911, for the erection of the Bannatyne Public School. Plans and specifications may be seen at the office of Secretary Duncan Macdonald, c/o Lewis Furniture Co., or J. N. Semmens, architect, 903 McArthur Building, Winnipeg.

Moose Jaw, Sask.—Tenders will be received up to April 1st, 1911, for the erection of car barns and power house to be built on High St. West, for the Moose Jaw Electric Railway Co., Ltd. R. G. Bunyard, Moose Jaw.

Saskatoon, Sask.—Tenders will be received until April 7th, 1911, for the construction of cement sidewalks. Plans and specifications will be seen at the office of the City Engineer, Saskatoon, and also at the following places:

Office of the "Canadian Engineer," 62 Church St., Toronto.
" " " " Board of Trade Bldg., Montreal.
" " " " 315 Nanton Building, Winnipeg.

Jas. Clinkskill, W. B. Neil, City Commissioners, Saskatoon. (Adv. in the Can. Eng.)

Saskatoon, Sask.—Tenders will be received for the whole of the work required in the erection of a departmental store on 21st Street, up to March 31st, 1911. Storey & Van Egmond, architects, Saskatoon.

Moose Jaw, Sask.—Tenders will be received until the 5th day of April, 1911, for all labor and certain material in connection with the laying of 18-in., 14-in., 12-in., 8-in. water mains and making and installing the necessary connections, valves, hydrants and manholes. John Wilson, city engineer, Moose Jaw.

Calgary, Alta.—Tenders will be received until April 8th, 1911, for digging, laying and back filling pipe line for water supply at Wetaskiwin. J. T. Brown, Resident Engineer, Calgary.

Calgary, Alta.—Tenders will be received by the Canadian Pacific Railway Company, up to March 31st, 1911, for the drilling of domestic wells at nine different points. Further information can be had at the office of T. J. Brown, Resident Engineer, Calgary.

Victoria, B.C.—Tenders will be received until April 3rd, 1911, for the erection and completion of a new Court-house at Grand Forks, B.C. Plans and specifications may be seen at the offices of the government agents at Grand Forks, and at the office of F. C. Gamble, Public Works Engineer, Dept. of Public Works, Victoria.

CONTRACTS AWARDED.

Quebec, Que.—The firm of O'Neil & Loney have been awarded the contract for the construction of the new bridge over the River Chaudiere at St. George, Beauce.

Montreal.—The contract for the excavation work of the C.P.R. irrigation system in the west has been let to Janse, McDonald & Co. Walker, Fyshe & Co. will do the concrete work.

Ottawa, Ont.—The road and bridge committee of the County of Carleton has awarded contract for the construction of three concrete bridges in the county, to Messrs.

$2,960 for the one on the third concession of the same township and $3,960 for the one on the 10th concession of Osgoode.

Ottawa, Ont.—Mr. John Avery has been awarded the contract for the new building in Mitchell, the amount of contract being about $21,000.

Ottawa, Ont.—The contracts awarded for supply of military buildings with fuel in the various cities are as follows:

Name.	Residence.	Hard Coal. Furnace.	Egg.	Nut.	Soft Coal double screened.
		$	$	$	$
*The Connell Anthracite Mining Co., Ltd.	Toronto	5.20	5.40	....	3.75
Elias Rogers Co., Ltd.	"	6.20	6.40	....	3.75
P. Burns & Co.	"	6.50	6.50	....	4.50
	Hamilton	not yet awarded.			
*Wilson Coal Co.	Brantford	5.75	5.75	....	
The Gibson Coal Co.	"	5.94	6.19	....	
W. H. McCordick	St. Catharines	6.50	6.50	....	
D. Dittrick	"	6.50	6.75	....	
H. M. Rogers	"	6.50	6.50	....	
*W. Cowper & Co.	Dundas	5.90	....	....	
James A. Sturrock	"	6.00	....	....	
	Burford	not yet awarded.			

*Accepted.

Toronto, Ont.—Tenders have been received and opened for lubricating oils, etc., required by the Works and other Civic Departments. The board adopted the report of the city engineer, and in accordance therewith awarded contracts as follows:—

Gasoline—To the Queen City Oil Co., 15c. per imperial gallon.

Cylinder oil, 500 degrees flash test—To the Sovereign Varnish and Oils, Limited, price 35c. per imperial gallon, being the lowest.

Cylinder oil, 700 degrees flash test—To McColl Bros., price 53c. per imperial gallon.

Engine oil—To the Sovereign Varnish and Oils, Limited, price 23½c. per imperial gallon.

Canadian coal oil—To the Empire Refining Co., price 11c. per imperial gallon, being the only tender submitted.

American coal oil—To the Empire Refining Co., price 14c. per imperial gallon, being the only tender submitted.

Toronto, Ont.—Tenders have been received and opened for a supply of 60-inch and 66-inch reinforced concrete pipe, required in connection with the low level interceptor sewer, as follows:—

Tender	60-inch pipe, per 4-ft. length.	66-inch pipe, per 4-ft. length.
No. 1	$21 64	$20 56
" 2	19 40	21 48
" 3	23 80	24 80
" 4	24 60	26 80
" 5	25 16	25 16
" 6	24 36	26 32
" 7	Informal	Informal

The board concurred in the report of the city engineer, and in accordance therewith awarded contracts as follows: 60-inch pipe—To the Lock Joint Pipe Company (tender No. 2), price $19.40 per length, being the lowest. 66-inch pipe—To Jennings & Ross (tender No. 1), price $20.56 per length, being the lowest.

Toronto, Ont.—Tenders have been received and opened for pipe fittings required by the Toronto Hydro-Electric System, as follows:—

Tender.	Figure No. 1. Bulk Sum.	Figure No. 2. Bulk Sum.
No. 1	$4,212 00	$421 20
" 2	4,212 00	421 20
" 3	1,586 00	.....
" 4	4,212 00	421 20
" 5	1,824 48	211 90
" 6	4,212 00	421 20
" 7	Informal.	

The board concurred in the report of the city engineer, and in accordance therewith awarded a contract to E. A. Greene & Co. (tender No. 3).

Guelph, Ont.—Messrs. Cowan and Walker have secured the contract for the new building to be erected in St. Patrick's ward for the Canadian Gate Company. The total cost for erecting the new factory will be about $5,000.

Guelph, Ont.—A contract for the erection of "The Shelter" for Guelph Humane & Children's Aid Society, has been awarded to Cowan & Walker, 149 London Road, $9,951.00 being the price.

Fort William, Ont.—Russell Bros. have been awarded contract for construction of addition to Central School, 64 ft. x 145 ft., $74,492.

Brandon, Man.—The Brandon Construction Company has been awarded the contract for the East Ward school, at a price of $42,256. The building will be eight-roomed, of reinforced concrete, pressed brick and cut stone, with all floors and staircases fireproof.

Brandon, Man.—A contract for waterworks supplies has been awarded to the following:—James Robertson & Co., Winnipeg, for headpipe, $4.86 per 100 lbs.; pig lead $4.03 per 100 lbs. Johnson & Co., Brandon, for brass goods, "Mueller" manufacture.

Winnipeg, Man.—The contract for building the concrete piers for the bridge which is to be erected over the Macleod River for the Grand Trunk Pacific Edson-Brazeau branch railway, has been awarded to Collins Bros. and Hamilton, of Heatherwood, Alta.

Lethbridge, Alta.—The Canadian Pacific have let the contract for the grading of 55 miles for the line northwest from Estevan. The work will be done by J. D. McArthur Co., Ltd.

Winnipeg, Man.—The C.N.R. has awarded contracts to the Cowan Construction Company and the Northern Construction Company for $3,000 000 worth of new lines in the west to be completed this year.

Point Grey, B.C.—Contracts for the laying of pipes for the Point Grey Waterworks System, have been definitely awarded, contracts No. 6 and 7 being secured by Mr. McAdam, and No. 8 by Messrs. Kilber & Moore. No. 6 is for the laying of a 25-inch main from the reservoir on Whitehead Road, to the proposed reservoir in D. L. 540; No. 7 is for laying distributing mains through Kerrisdale, Magee and the surrounding section, and No. 8 is for laying distributing mains in Eburne and district. The total amount of the tenders is something like $145,000.

Rossland, B.C.—A contract has been made between the C.P.R. and the Doukhobor settlement at Brilliant, for the supply by the latter of a hundred thousand railway ties this year.

RAILWAYS—STEAM AND ELECTRIC.

Halifax, N.S.—The Railway Commission was here recently to meet the Halifax Board of Trade and discuss plans for a new terminal. Mr. Kennedy, engineer of Montreal harbor, was present with the plans he has prepared. Mr. Campbell, chairman of the Railway Board, told the Canadian press that the board would recommend to Parliament that the terminals as per Mr. Kennedy's plans, perhaps slightly modified to meet Halifax requirements, be built. He estimates that the total cost would be from one million and a half to two million dollars.

St. John, N.B.—In addition to the completion of the equipment of the Grand Trunk Pacific Railway in New Brunswick during the present year, two local railway projects have been organized. It is proposed to construct a road from Hartland on the St. John River to Sparkle, a point on the Grand Trunk Pacific and on the Miramichi River, a distance of forty miles through a fine agricultural country. It is also proposed to build a branch railway from the Canadian Pacific to Southampton in York County, a distance of thirteen miles.

Montreal, Que.—Mr. Thomas Malcolm, who has just completed the International Railway from the I.C.R. at Campbellton to St. Leonard's, on the St. John River, will build the road which is to be constructed between Quebec, St. John and Moncton. This railway would bring down the distance from Point Levis to St. John, N.B., to 402 miles or

a little over 150 miles less than by the existing lines. A report is current that he will not only construct the St. John River Valley Railway, but will also complete the larger scheme of a railway from Levis eastwards to Grand Falls, N.B., and to Moncton, Fredericton and Halifax.

Ottawa, Ont.—The Hudson's Bay Railway will be built by the government. This was the announcement made recently by Hon. G. P. Graham in his annual railroad budget in the House of Commons. When the road is built, a plan for its operation will be submitted to Parliament.

Stratford, Ont.—Every indication points to an early entrance of the Canadian Pacific Railway into this city. Apparently it is now only a question of route. The south side of the river Avon as an entrance is favored by the company. It will likely be opposed on account of the partially completed park and driveway improvements, made there by the park commissioner.

Hamilton, Ont.—The Canadian Pacific Railway is preparing to let contracts for a line from Hamilton to Guelph Junction, giving Hamilton connection with seven hundred miles of the C.P.R. road to the Goderich district. It is expected that the line will be completed by Christmas.

Winnipeg, Man.—That the Grand Trunk Pacific Railway is making preparations to tap the Brazeau coal fields, far to the south of its main line, west of Edmonton, is indicated from the fact that recently one of their engines was loaded with the coal from the mines there and made a long trip to test its burning qualities. From reports of the engineer who had charge of the train, it proved successful. The railway company has already awarded the contract for the construction of a branch south from the main line to the Embarrez River, to tap the coal fields of the Pacific Pass and the Yellowhead coal companies. The branch is to be completed in September by the contractors, who are Phelan and Shirley. The railway company is also making preparations to survey an extension of this line, which will carry down into the Brazeau coal fields, a distance of 25 miles further on.

Winnipeg, Man.—Over 600 miles of new lines, it is announced by the president of the Canadian Northern Railway, will be constructed by that company's construction department during the present year throughout the three western prairie provinces alone. This 600 miles applies to lines in the provinces of Manitoba, Saskatchewan and Alberta, and specifically includes the following lines and branches of the Canadian Northern Railway System: Rossburn, Moose Jaw, Delisle, Prince Albert to Battleford, Jackfish Lake, Thunderhill, Greenway, Vegreville-Calgary, Brazeau coal fields and the main line west to Edmonton.

Winnipeg, Man.—It is stated that the G.T.R. will build 140 new stations on its lines this summer.

Edmonton, Alta.—C.P.R. surveyors are in the field working west on the line to Peace River. The C.N.R. recently announced the completion of 80 miles of line to the same point.

Port Alberni, B.C.—District Engineer Hughes of the Canadian Northern Railway has been in Port Alberni making arrangements for the placing of a large party of surveyors on the Alberni Canal. Now that construction is under way on the east coast of the island, it is the intention of the company to have the location of the line to this port commenced as early as possible in order that there may be no break in the continuity of building operations.

Vancouver, B.C.—Approximately $8,000,000 will be spent on the Pacific division of the Canadian Pacific Railway this year, of which close on $1,000,000 will come to Vancouver. This was the announcement at the C.P.R. general offices at Vancouver recently. There will be no new station here this year, and no wharf extensions; neither will the proposed tunnel through the business section of the city be constructed, but the other improvements in connection with the company's facilities here will mean, it is said, the expenditure of a large sum of money. Vancouver improvements include the following: Installation of a complete drainage system for the False Creek yards, with concrete sewers leading down from Nelson and Dunsmuir streets; replacing yard lead tracks of 56-pound steel with 85-pound steel; installing pipe line and hydrants for fire protection for the freight sheds; building twelve additional storage tracks for the False Creek yard; extending the inward freight shed in the False Creek yard by another 250 feet. Huge sums are to be spent this year, it is announced, in the improvement of the company's facilities west from Field in the Pacific division. One of the most far-reaching of these is the double-tracking of the bridges between Mission Junction and Westminster Junction in preparation for two lines of rails from Vancouver through to Westminster Junction. All the new steel and concrete bridges which are to replace the present structures between these points will be built in readiness for double tracks, and it is predicted that by next year the company will start double-tracking from Vancouver eastward to accommodate the increasing traffic, building the additional two tracks as far as Mission Junction next season. Thirteen wooden bridges on the Thompson section, extending from Kamloops to North Bend, are to be replaced by steel and concrete structures, while 30 new bridges of the same type are to be built this year on the Cascade section, from North Bend to Vancouver. All the sidings from Vancouver to Kamloops are to be lengthened to 3,000 feet each.

Montreal, Que.—The Canadian Pacific will shortly call for tenders for the construction of a new ten-stall addition to the engine house at their False Creek, B.C., yards. Construction will commence in a few days and it is the intention to have the building completed early in July. Ten old stalls of the present engine house are to be demolished to make way for the new addition. The company is also going to build a wharf at Nanaimo. The wharf will be a considerable addition to the present shipping facilities at Nanaimo and will be ready for use this season.

SEWAGE AND WATER.

North Toronto, Ont.—The electors of North Toronto voted for the issuing of debentures to the amount of $265,500 last Saturday for the construction of a sewerage system for the town. The by-law carried by a majority of 194. A total vote of 464 was cast.

Ottawa, Ont.—The civic waterworks committee recommend to the city council the adoption of the suggestion of City Engineer Ker for the appointment of a commission to report on the best source of water supply for the city. The men suggested are Dr. C. A. Hodgetts Dr. J. W. McCullough, Mr. Allen Hazen, Mr. C. H. Keefer, C.E., and Mr. Frank T. Shutt. The idea is that these men should consider both the McGregor Lake and the Ottawa River purification systems and report as to which would be the better for the city.

New Westminster, B.C.—The city has received an application from the C.P.R. to supply 200,000 gallons of water daily to the company at Coquitlam. The application can not be considered until the new main is constructed to Coquitlam Lake, after which the city will have to consider what effect the withdrawal of such a large quantity of water would have on its supply.

LIGHT, HEAT AND POWER.

Kingston, Ont.—The civic Light, Heat and Power Committee has received more favorable terms from the Seymour Electric & Power Company of Campbellford, for power than at first offered, and has decided that the proposition is far enough advanced to call in an expert to advise the city whether to accept the offer or not. The Seymour Company's offer is on the basis of twenty-five dollars per horsepower, with provision for the selling of whatever the city wants over a certain amount at one and one-half cents a kilowatt hour.

Sault Ste. Marie, Ont.—The Lake Superior Paper Co., recently incorporated with $8,000,000 capital has secured the consent of the city council to the release of twenty acres of land purchased from the Lake Superior Corporation, the town holding a mortgage on this property. The land includes the buildings on it, which consist of a frame rear extension of the pulp mill, the sulphate mill and the smelting and reduction works. The buildings are to be incorporated in the new works and it is stated the company is planning the construction of another power canal and a plant capable of developing 40,000 horse power.

BY-LAWS AND FINANCE.

Kingston, Ont.—The ratepayers by a majority of 103 recently decided to sanction the raising of debentures of $40,000 for a new Public school.

PERSONAL.

Hon. Thomas Taylor, Revelstoke's representative in the Provincial Legislature, was sworn in recently by His Honor, Lieutenant-Governor Paterson as British Columbia's first minister of railways, there being present at the informal ceremony Premier McBride, Hon. Dr. Young and Hon. William R. Ross.

Sergt.-Major Robert McCallum Lyle, M.O., will be one of the three representatives of the Fourth Field Company, Canadian Engineers, at the Coronation. There is still another vacancy, as the regulations allow two men per field company. The names of Sergt.-Major Doherty and Sergeant T. M. Antle are mentioned in connection with the appointment.

Mr. Chas. W. Ward, chief tests engineer of Reavall & Co., Ltd., of Ipswich, England, is at present in Canada.

Mr. John B. Croley has been appointed city engineer of Chilliwack, B.C.

Archibald Curry, C.E., who has just been appointed to the position of city surveyor, at Westmount, Que., has had a wide experience in many parts of the world. He was born at Glasgow, Scotland, and received his education there. He graduated at the Glasgow and West of Scotland Technical College, in 1890, after which he was appointed assistant engineer of the firm of Sir John Aird and Sons, contractors, London, and was engaged on the construction of the West Highland Railway, in the west of Scotland. He was next engaged as engineer by the Imperial Chinese Government,

Wm. Archibald Curry, C.E., Engineer for Westmount.

in Northern China. After carrying out various engineering works, the Boxer outbreak, in 1900, put an end to his activities with Chinese government. He took service with Admiral Seymour, as his engineer, in his attempt to reach Pekin from the coast, after which he returned to Scotland for a period. Later he went to South Africa and was engaged as assistant engineer by the Johannesburg municipality. He was here engaged in the work of building electrical tramways, power stations and car sheds in reinforced concrete, besides road building and customary municipal work. After taking part in the war, he returned to England and took up work as a consulting engineer, with headquarters at Glasgow. He supervised the water supply and sewers for Clydebank, Scotland; Swansea, in South Wales and Belfast, Ireland. He then concluded to come to Canada where he arrived not long since and received the appointment already referred to.

Mr. Angus Smith, city engineer, of Victoria, B.C., formerly of Stratford, has been re-engaged by the city council of Victoria.

Mr. Henry M. Tait, formerly travelling passenger agent of the Canadian Pacific Railway at Seattle, has been appointed general agent of the C.P.R. Atlantic steamship lines at Minneapolis. Mr. Tait entered the service of the C.P.R. in October, 1907, and was transferred to Seattle in January, 1909.

Mr. Charles M. Jacobs, of Jacobs & Davies, the well-known New York subway engineers, was in Montreal recently. The firm to which Mr. Jacobs belongs occupies a leading place amongst American subway engineers. They have also been identified with the construction of the New York subways. Mr. Jacobs' visit is supposed to be in connection with the proposed Montreal subways.

Mr. H. B. Muckleston has been appointed assistant chief engineer of the irrigation department of the C.P.R., reporting direct to the chief engineer.

Mr. Norman S. Braden of the Canadian Westinghouse Co. has been elected a director of The B. Greening Wire Co., Limited.

Mr. B. S. Smith has been made assistant engineer in charge of right-of-way townsites and architecture on the C.P.R.

OBITUARY.

Mr. John B. Macdonald, the eminent contractor, died in New York City on March 17th. Mr. Macdonald's most noted undertakings were the building of the first underground railway in New York and the tunnelling under the city of Baltimore for the Baltimore and Ohio Railroad. He also built the Georgian Bay section of the Canadian Pacific Railway. He was born in Ireland in 1844.

SOCIETY NOTES.

Engineers' Club of Toronto.—The dinner marking the formal opening of the Engineers' Club of Toronto was a decided success. The function which was held in the new quarters of the club at 96 King Street West, Toronto, on March 16th, was attended by about ninety members. The toast to "The King" was proposed by the president, Captain Kirally Gamble. Speeches were also delivered by the vice-president, Prof. H. E. T. Haultain, who was chairman of the evening, Dr. Ellis of Toronto University, Dean Galbraith of Toronto University, Mr. C. M. Canniff, City Engineer Rust and Mr. A. D. Macallum, city engineer of Hamilton. Recitations were given by Mr. Alexander and by Secretary Wolsey. Musical selections were rendered by Messrs. Fred Weavey, J. J. Salmond and Ellis Thompson. The aims of the club admirably set forth in the remarks of the former president, Mr. Canniff, seem to have been realized to some extent in its successful start. The scope of the club is broad and is intended to form a closer bond between all engineers and those of allied professions, both from a professional as well as from a social standpoint.

Saskatchewan Municipal Union.—The municipalities convention, held at Moose Jaw, March 16th, 1911, elected officers as follows:—President, J. H. Smith, Yellow Grass, re-elected for fourth time; first vice-president, A. H. Salmon, Moosomin, re-elected; second vice-president, A. F. Dickson, Saskatoon; third vice-president, Jas. Bell, Eagle Creek; executive:—District 1, E. Slater, Stoughton; District 2, B. Bullis, Weyburn; District 3, J. Burns, Key West; District 4, J. R. Mitchell, Grenfell; District 5, H. Armison, Mosart; District 6, E. R. Ketcheson, Yorkton; District 7, M. Malcolm, Henley; District 8, H. B. Powell, Oliver; District 9, T. J. Ryan, Scott; District 10, U. B. Ayles, Vonda.

The next business was the selection of next year's meeting place. Estevan, Melville and Regina have sent formal invitations. Regina was selected by a large vote.

Books for Railway Engineers

Trautwine's Civil Engineers' Pocket Book.—Total Issue, 100,000 revised. 16mo. Morocco $5.

Earthwork Tables.—By R. S. Henderson. Heavy paper, oblong, 32 pages, $1.00.

Field Manual for Railroad Engineers.—By Prof. J. C. Nagle. 2nd edition. 403 pages, 99 figures, Morocco, $3.00.

Railroad Structures and Estimates.—By J. W. Orrock. 260 pages. 93 figures, cloth, $3.00.

Field Engineering.—By Wm. H. Searles, 503 pages, Morocco, $3.00.

Manual for Resident Engineers Containing General Information on Construction.—By F. A. Molitor and E. J. Beard. 16mo., iv. + 118 pages, cloth, $1.00.

Surveying Manual.—By Profs. W. D. Pence and Milo S. Ketchum. Flexible leather 4½ x 6½, 252 pages, illustrated, $2.00.

Surveyor's Handbook.—By T. U. Taylor, Professor of Civil Engineering, University of Texas. An invaluable pocketbook for the field or office. Flexible leather, gilt edges, 4½ x 7, illustrated, 328 pages, $2.00.

Economics of Railway Operation.—By M. L. Byers. Buckram, 6 x 9, 672 pages, many illustrations. Diagrams and forms showing standard and most recent practice, $5.00.

Field Practice of Railway Location.—By Willard Beahan. Cloth, 6 x 9, 260 pages, 43 illustrations and 7 folding plates, $3.00.

Railway Track and Track Work.—By E. E. R. Tratman. Cloth, 6 x 9, 520 pages. 232 illustrations: 44 tables and an Appendix of Statistics of Standard Track Construction on American Railways. Third edition, revised and enlarged, $3.50.

Railway Transition Spiral.—By Prof. A. N. Talbot. Flexible leather, 4 x 6¾, 110 pages, fifth edition, revised, $1.50.

Railroad Curve Tables.—By R. S. Henderson. Cloth, 5 x 7, 69 pages, 10 diagrams, $1.00.

Earthwork and Its Cost.—By H. P. Gillette. Cloth, 5 x 7½, 256 pages, illustrated, $2.00.

***Railroad Curves and Earthwork.**—By C. Frank Allen. 225 pages, illustrated, limp leather, $2.00.

***Field and Office Tables.**—By C. Frank Allen. 293 pages, leather, $2.00.

*The above two Books, complete, bound in one volume, pocket size, limp leather. price, $3.00.

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MARKET CONDITIONS.

Halifax, March 20th, 1911.

Generally the markets are very steady. The demand in the hardware business being particularly strong, continued advances in the price of the linseed oil and turpentine has necessarily effected the prices of paints. The purchases for the spring work have hardly commenced yet, and, therefore, the trade is not particularly brisk, although the outlook is good.

Axes.—Ordinary chopping axes, single bit, $6.50 per dozen, double bit, $11. Special brands, prices on application to jobbers.

Bar Iron.—The market for bar iron is open, but the situation is firm, and prices range as high as $2.25 base.

Black Sheet Iron.—This commodity is in good demand. We quote 24-gauge, $2.40.

Cast Steel.—The market is steady at 10 to 15c., according to makers.

Cement.—Stocks are low and market is steady, $2 per bbl.

Coil Chain.—The jobbing prices of English proof chain in Halifax are as follows: 3-16 x 4, $7.15; 3-16 x 3, $6.25; ¼, $5.35; 5-16, $4.30; ⅜, $3.90; 7-16, $3.85; ½, $3.60; ⅝, $3.60; ¾, $3.50; ⅞, $3.50; 1, $3.50; 1⅛, $3.50.

Fencing Wire.—We quote: Plain, twisted and galvanized at $3.25 per 100 lbs.; barb at $2.75 per 100 lbs.; bright staples in 100-lb. kegs at $3, and in 50-lb lots, $3.25. Galvanized staples are 25c. extra.

Galvanized Sheet Iron.—The wholesale prices are as follows: 16 to 20-gauge, $3.45; 22 to 24, $3.80; 26, $4.30; 28, $4.55. These prices are for less than case lots.

Ingot Tin.—The tin market as usual is a fluctuating one, and the present price is about 38c. net cash.

Lead Pipe.—Quotations here are open, and the price quoted to-day is about $4.75 for ordinary jobbing quantities.

Linseed Oil.—Raw is fully worth $1.20, and boiled, $1.25 per gallon. Orders are small, stocks low, and the outlook firm.

Nails.—Nails are firm. Wire nails, $2.45, and cut nails, $2.60. Business in this line is reported fairly active.

Peavies.—There is a better enquiry than last year. Prices are unchanged at $11 to $13 per dozen, according to make, but we are advised that there will be an advance.

Pig Lead.—We quote $4.25 for English and $4 for Canadian. The outlook is for higher prices.

Pipe.—Wrought iron, 1-in., $5.25.

Roofing Paper.—The demand is good. Tarred paper, $1.70 per 100 lbs.; three-ply roofing 90c. per 100 lbs.; two-ply roofing, 65c.; sheathing paper, 30 cents per roll; tarred sheathing, 40 cents per roll.

Rope.—The price of cordage for next spring's supplies is unchanged. For large lots dealers should write jobbers for quotations. Small lots are as follows: Sisal, 9½c. base; lobster rope, 9¾c.; British manilla, 9½c.; base, best manilla, 10½c. base.

Sheet Lead.—The price of sheet lead is also very firm, 3 lbs. and heavier, $4.75 per cwt., in rolls, and $5.75 in smaller quantities.

Steel.—Tire, $2.50; spring, $2.70; machine, $3.25; toe caulk, $3.50; sleigh shoe steel, $2.50; the above are all base prices.

Tin Plates.—I. C. coke, $3.95 to $4.10; I. C. charcoal, $4.75; I. X. charcoal, $5.50.

Turpentine.—Prices now quoted are as high as $1 to $1.10 in bbls., and $1.05 to $1.15 in smaller quantities. The market is open.

White Lead.—For Canadian pure, in 50 and 25-lb. irons, $6.25 is being asked. Brandram's B.B. genuine in 25, 50, and 100-lb. irons, $7.35, and B.B. No. 1, $6.10. The trade expect prices to be much higher before long.

Zinc.—This commodity is very firm, $7.50 for casks and $8 for smaller quantities. Spelter is $2.75 per cwt.

Montreal, March 21st, 1911.

Advices from the United States say that some sales of pig-iron on a $11.50 basis for delivery during the first half of the year have been made at Birmingham, and no sales for that delivery under that price. Only a fair volume of business has been done recently, but there is every indication that nothing below $11.50 can be had in the near future for any kind of delivery. The Southern furnace men are absolutely confident of better conditions, and equally determined to hold down the output until they materialize.

The February output of pig-iron in Alabama tells an interesting tale. There were only seventeen furnaces in action, and they turned out a total of 118,699 tons. The production in February, 1910, was 134,099 tons. This shows that the production is being held to a minimum until better prices are more freely obtained and the demand is brisker. Compared with the production per furnace of a few years ago, this shows an immense increase in furnace capacity. The output of the furnace was almost altogether of high-grade stuff, so much so that low-grade irons have been commanding a premium. All the entire Alabama furnaces are practically new, having been rebuilt from time to time, and furnace methods have greatly improved.

While manufacture has been held down, shipments have been quite heavy. The stocks on Alabama yards were reduced during the month by 25,000 tons.

In the Pittsburg district, the iron market has held firm within the last week. Buying continues of a hand-to-mouth character. Prices in this district are firm. A number of inquiries have been withdrawn since the 1st of March. Inquiries for between 15,000 and 18,000 tons are reported.

Philadelphia reports about 7,000 tons of basic sold during the last week, one lot of 4,000 tons going to an eastern concern for second and third-quarter delivery at $15.25 delivered.

In the New York district, sales of foundry and pipe iron only were reported during the week. About 3,000 tons of foundry and 3,000 tons of pipe iron were sold, both at private terms.

Cincinnati reports prices firmer and demand for basic quite pronounced. There was a sale of 2,500 tons of No. 3 Northern Foundry for second-quarter delivery, on a basis of $14, iron ton.

The report of the United States Steel Corporation for the year ended December 31st, 1910, is out. The statement is notable for the completeness of its figures and details covering operations. The magnitude of the corporation is evident from the fact that its gross business in 1910 exceeded $700,000,000. The income account shows a surplus of 12.25 per cent. available for dividends on the common stock.

Advices from Great Britain are fairly encouraging. At the same time, nothing of an unusual character has taken place, demand being of the character noted for some time past. Prices show customary fluctuations, but no changes which would indicate a strong tendency one way or the other.

In the local market, demand is reported light. Very little is going on. This, however, is not unexpected at this time of year. The situation will alter at the opening of navigation, but is likely to continue quiet enough in the meantime. The low prices in the United States undoubtedly have a considerable effect on the prices obtainable here.

Bar Iron and Steel.—Trade is reported first-class. Bar iron, $1.90 per 100 pounds; best refined horseshoe, $2.15; forged iron, $2.05; mild steel, $1.95; sleigh shoe steel, $1.95 for 1 x ⅜ base; tire steel, $2.05 for 1 x ⅜-base; toe calk steel, $2.75; machine steel, iron finish, $2.00; imported, $2.05.

Antimony.—The market is steady at 8¼c.

Building Paper.—Tar paper, 7, 10, or 16 ounces, $1.80 per 100 pounds; carpet felt, $2.50 per 100 pounds; tar sheathing, 36c. per roll of 400 square feet; dry sheathing, No. 1, 28c. per roll of 400 square feet; tarred fibre, 55c. per roll; dry fibre, 45c. (See Roofing; also Tar and Pitch).

Cement.—Canadian cement is quotable, as follows, in car lots, f.o.b., Montreal:—$1.35 to $1.40 per 350-lb bbl., in 4 cotton bags, adding 10c. for each bag. Good bags re-purchased at 10c. each. Paper bags cost 2½ cents extra, or 10c. per bbl. weight.

Chain.—The market is unchanged, being now per 100 lbs., as follows:—¼-in., $5.30; 5-16-in., $4.70; ⅜-in., $3.90; 7-16-in., $3.65; ½-in., $3.55; ⅝-in., $3.45; ⅝-in., $3.40; ¾-in., $3.35; ⅞-in., $3.35; 1-in., $3.35.

Coal and Coke.—Anthracite, egg, stove or chestnut coal, $7 per ton, net; furnace coal, $6.75, net. Bituminous or soft coal: Run of mine, Nova Scotia coal, carload lots, basis, Montreal, $3.85 to $4 per ton; cannel coal, $9 per ton; coke, single ton, $5; large lots, special rates, approximately $4 f.o.b., cars, Montreal

Copper.—Prices are easy at 13¾c.

Explosives and Accessories.—Dynamite, 50-lb. cases, 40 per cent. proof, 15c. in single case lots, Montreal. Blasting powder, 25-lb. kegs, $2.25 per keg. Special quotations on large lots of dynamite and powder. Detonator caps, case lots, containing 5,000, 75c. per 100; broken lots, $1; electric blasting apparatus:—Batteries, 1 to 10 holes, $15; 1 to 20 holes, $25; 1 to 30 holes, $35; 1 to 40 holes, $50. Wire, leading, 1c. per foot; connecting, 50c. per lb. Fuses, platinum, single strength, per 100 fuses:—4-ft. wires, $3; 6-ft. wires, $3.54; 8-ft. wires, $4.08; 10-ft. wires, $5

Galvanized Iron.—The market is steady. Prices, basis, 28-gauge, are:—Queen's Head, $4.10; Colborne Crown, $3.85; Apollo, 10¾ oz., $4.05. Add 25c. to above figures for less than case lots; 26-gauge is 25c. less than 28-gauge, American 28-gauge and English 26 are equivalents, as are American 10¾ oz., and English 28-gauge.

Galvanized Pipe.—(See Pipe, Wrought and Galvanized).

Iron.—The following quotations are now given, basis of carloads, ex-store:—No. 1 Summerlee, $21.50 to $22 per ton; selected Summerlee, $21 to $21.50; soft Summerlee, $20.50 to $21; Carron special, $21 to $21.50; Carron soft, $20.50 to $21; Clarence, $18.50 to $19; Cleveland, $18.50 to $19.

Laths.—See Lumber, etc.

Lead.—Prices are firm at $3.65.

Lead Wool.—$10.50 per hundred, $200 per ton, f.o.b., factory.

Lumber, Etc.—Prices on lumber are for car lots, to contractors, at mill points, carrying a freight of $1.50. Red pine, mill culls out, $17 to $21 per 1,000 feet; white pine, mill culls, $16 to $17. Spruce, 1-in. by 4-in. and up, $15 to $17 per 1,000 ft.; mill culls, $12 to $14. Hemlock, log run, culls out, $12 to $15. Railway Ties; Standard Railway Ties, hemlock or cedar, 35 to 45c. each, on a 5c. rate to Montreal. Telegraph Poles: Seven-inch top, cedar poles, 25-ft. poles, $1.35 to $1.50 each; 30-ft., $1.75 to $2; 35-ft., $2.75 to $3.25 each, at manufacturers' points, with 5c. freight rate to Montreal Laths: Quotations per 1,000 laths, at points carrying $1.50 freight rate to Montreal, $2 to $3. Shingles: Cedar shingles, same conditions as laths, X. $1.50; XX, 2.50; XXX, $3.

Nails.—Demand for nails is steady and prices are: $2.40 per keg for cut, and $2.30 for wire, base prices. Wire roofing nails, 5c. lb.

Paints.—Roof, barn and fence paint, $1.25 to $1.45 per gallon; girder, bridge, and structural paint for steel or iron—shop or field— $1.45 to $1.55 per gallon, in barrels; liquid red lead in gallon cans, $2 per gallon.

Pipe.—Cast Iron.—The market shows a firm tone and trade is said to have been most satisfactory. Prices are firm, and approximately as follows:—$33 for 6 and 8-inch pipe and larger; $34 for 3-inch and 4-inch at the foundry. Pipe, specials, $3 per 100 pounds. Gas pipe is quoted at about $1 more than the above

Pipe.—Wrought and Galvanized.—Demand is about the same, and the tone is firm, though prices are steady, moderate-sized lots being: ¼-inch, $5.50, with 63 per cent. off for black, and 48 per cent. off for galvanized; ⅜-inch, $5.50, with 63 per cent. off for black, and 48 per cent. off for galvanized; ½-inch, $8.50, with 69 per cent. off for black, and 59 per cent. off for galvanized. The discount on the following is 72½ per cent. off for black, and 62½ per cent. off for galvanized; ¾-inch, $11.50; 1-inch, $16.50; 1¼-inch, $22.50; 1½-inch, $27. On the following the discount is 73½ per cent. for black, and 63½ per cent. for galvanized: 2-inch, $36; 2½-inch, $57.50; 3-inch, $75.50. Discount on the following is 71½ per cent. off on black, and 61½ per cent. off for galvanized: 3½-inch, $95; 4-inch, $1.08.

Plates and Sheets.—Steel.—The market is steady. Quotations are: $2.20 for 3-16; $2.30 for ⅛, and $2.10 for ¼ and thicker; 12-gauge being $2.30; 14-gauge, $2.15; and 16-gauge, $2.10.

Rails.—Quotations on steel rails are necessarily only approximate and depend upon specification, quantity and delivery required. A range of rails, per gross ton of 2,240 lbs., f.o.b. mill. Re-laying rails are quoted at $27 to $29 per ton, according to condition of rail and location.

Railway Ties.—See lumber, etc.

Roofing.—Ready roofing, two-ply, 70c. per roll; three-ply, 95c. per roll of 100 square feet. Roofing tin caps, 6c. lb.; wire roofing nails, 5c. lb. Roofing cement in bbls., of 40 gallons, 15c.; in 5-gallon tins, 20c. per gallon. (See Building Paper; Tar and Pitch; Nails, Roofing).

Rope.—Prices are steady, at 9c. per lb. for sisal, and 10½c. for Manila. Wire rope, crucible steeel, six-strands, nineteen wires; ¼-in., $2.75; 5-16, $3.75; ⅜, $4.75; ½, $5.25; ⅝, $6.25; ¾, $8; ⅞, $10; 1-in., $12 per 100 feet.

Spikes.—Railway spikes are steady, at $2.45 per 100 pounds, base of 5/8 x 9-16. Ship spikes are steady at $2.85 per 100 pounds, base of 9/16 x 10-inch, and 5/8 x 12-inch.

Steel Shafting.—Prices are steady at the list, less 25 per cent. Demand is on the dull side.

Telegraph Poles.—See lumber, etc.

Tar and Pitch.—Coal tar, $4 per barrel of 40 gallons, weighing about 500 pounds; roofing pitch, No. 1, 75c. per 100 pounds; No. 2, 55c. per 100 pounds; pine tar, $9.50 per barrel of 40 gallons; refined coal tar, $4.50 per barrel, pine pitch, 3c. per lb.; rosin, 3¼c. (See building paper, also roofing).

Tin.—Prices are firm at $44.

Zinc.—The tone is easy, at 6¼c.

CAMP SUPPLIES.

Beans.—Prime beans, $1.85 to $1.90.

Butter.—Held creamery, 24 to 26c.

Canned Goods.—Per Dozen.—Corn, $1.00; peas, $1.20 to $2.00; beans, $1.00; tomatoes, $1.45; peaches, 2s, $1.90; and 3s, $2.90; pears, 2s, $1.80; and 3s, $2.40; salmon best brands, 1-lb. talls, $2.07, and flats, $2.25; other grades, $1.40 to $2 10.

Cheese.—The market ranges from 12 to 13c., covering all Canadian makes.

Coffee.—Mocha, 22 to 30c.; Santos, 18 to 21c.; Rio, 15 to 18c.

Dried Fruits.—Currants, Filiatras, 6¾ to 9½c.; dates, 5½c.; raisins, Valentias, 7¾ to 8¼c.; prunes, 8½ to 12c.

Eggs.—New laid eggs, 23 to 25c.

Flour.—Manitoba, 1st patents, $5.60 per barrel; and patents, $5.10, strong bakers', $4.90.

Molasses and Syrup.—Molasses, New Orleans, 27 to 28c.; Barbados, 34 to 36c.; Porto Rico, 40 to 43c; syrup, barrels, 3c.; 2-lb. tins, 2 dozen to case, $2.25 per case.

Potatoes.—Per 90 lbs., good quality, 90c. to $1.

Rice and Tapioca.—Rice, grade B, in 100-lb. bags, 3¼ to 3½; Tapioca, medium pearl, 5½ to 8c.

Rolled Oats.—Oatmeal $2.45 per bag; rolled oats, $2.20, bags.

Sugar.—Granulated, bags, $4.60; yellow, $4.20 to $4.45; Barrels 5c above bag prices.

Tea.—Japans, 20 to 38c.; Ceylons, 20 to 40c.; Ceylon, greens, 19 to 25c., China, green, 14 to 50c.

Fish.—Salt fish.—No. 1 green cod, $8 to $9 per bbl.; herring, $4.50 per bbl.; salmon, $8.50 per half barrel. Smoked fish.—Bloaters, $1.25 per large box; haddies, 8c. per lb.; kippered herring, per box, $1.20 to $1.40.

Provisions.—Salt Pork.—$24 to $31 per bbl.; beef, $18 per bbl.; smoked hams, 14 to 19c per lb.; lard, 14 to 15c. for pure, and 11½ to 12c. per lb. for compound; bacon, 13 to 18c.

Toronto, March 23rd, 1911.

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

Antimony.—The market is controlled by a syndicate, and the price is advanced to $9.

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

Bar Iron.—$2.05 to $2.15, base, per 100 lbs., from stock to wholesale dealer. Free movement.

Bar Mild Steel.—Per 100 lbs., $2.15 to $2.25. Sleigh shoe and other take same relative advance.

Boiler Plates.—¼-inch and heavier $2.20. Boiler heads 25c. per 100 pounds advance on plate. Tank plate, 3-16-inch, $2.40 per 100 pounds.

Boiler Tubes.—Orders continue active. Lap-welded, steel, 1¼-inch 10c.; 1½-inch, 0c. per 10 foot; 2-inch, $8.50 to $9; 2¼-inch, $10; 2½-inch, $10.60; 3-inch, $12.10; 3½-inch, $15; 4-inch, $19.

Building Paper.—Plain, 27c. per roll; tarred, 35c. Nothing doing.

Bricks.—In active movement, with very firm tone. The price is $10.50 to $11.00 for half-and-half. Don Valley pressed brick are in request. Red and buff pressed are worth $18 delivered and $17 at works per 1,000.

Broken Stone.—Lime stone, good hard, for roadways or concrete, f.o.b. Schaw station, C.P.R., 70 to 75c. per ton of 2,000 lbs., either 1-inch, 2-inch, or larger, price all the same. Rubble stone, 55c. per ton, Schaw station, and a good deal moving. Broken granite is selling at $2 per ton for good Oshawa, or Quebec Province. At Washago, $2.50 per ton for small and $1.15 for large; freight to Toronto, 60c.

Cement.—Car lots, $1.65 to $1.70 per barrel, without bags. In 1,000 barrel lots, $1.55. In smaller parcels $1.00 is asked by city dealers. Bags, 40c. extra.

Coal.—Anthracite egg and stove, $7.25 per ton; chestnut, scarce, $7.50; pea coal $6.00 per ton. In the United States there is an open market for bituminous coal and a great number of qualities exist. We quote: Youghiogheny lump coal on cars here, $3.75 to $3.80; mine run, $3.60 to $3.70; slack, $2.75 to $2.85; lump coal from other districts, $3.55 to $3.70; mine run 10c. less; slack, $2.60 to $2.70; cannel coal plentiful at $7.50 per ton; coke, Solvey foundry, which is largely used here, quotes at from $5.75 to $6.00; Reynoldsville, $4.90 to $5.10; Connelsville, 72-hour coke, $5.00 to $5.25. Shipments falling off on account of season drawing to a close. Dealers are buying only such quantities as are actually required so as to facilitate stock taking on April 1st. Nut coal still continues scarce, being held at a premium by miners. The soft coal market is unchanged and prices are expected to remain firm. Contracts for better grades being written up in some cases at a higher figure than last season, subject to any change which may be made in duty.

Copper Ingot.—The market has reached a firm basis, and holders are quite stiff at $13.50 per 100 lbs. Demand is active, and a large quantity moving.

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

Dynamite.—The price is determined by the point at which it is to be delivered. Here we quote 21 to 25c. as to quantity.

Felt Roofing.—Not much moving, price continues as before, $1.80 per 100 lbs.

Fire Bricks.—English and Scotch, $30 to $35; American, $25 to $35 per 1,000. Fire clay, American, $8; Scotch, $12.

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

Iron Chain.—¼-inch, $5.75; 5-16-inch, $5.15; 3/8-inch, $4.15; 7-16-inch, $4.05; ½-inch, $3.75; 9-16-inch, $3.70; 5/8-inch, $3.55; ¾-inch, $3.45; 7/8-inch, $3.40; 1-inch, $3.40, per 100 lbs.

Iron Pipe.—At present quotations are lower, thus:—Black Pipe, ¼-inch, $2.03; 3/8-inch, $2.25; ½-inch, $2.63; ¾-inch, $3.16; 1-inch, $4.54; 1¼-inch, $6.19; 1½-inch, $7.43; 2-inch, $9.54; 2½-inch, $15.24; 3-inch, $20.01; 3½-inch, $27.08; 4-inch, $30.78; 4½-inch, $35.75; 5-inch, $40.75; 6-inch, $52.85. Galvanized Pipe, ¼-inch, $2.86; 3/8-inch, $2.86; ½-inch, $3.48; ¾-inch, $4.31; 1-inch, $6.19; 1¼-inch, $8.44; 1½-inch, $10.13; 2-inch, $13.14, per 100 feet.

Lead.—A fair business is doing at prices unaltered from $3.75 to $4, and there is more demand.

Lime.—Retail price in city 35c. per 100 lbs., f.o.b., car; in large lots at kilns outside city 23c. per 100 lbs. f.o.b. car without freight. Demand is beginning.

Lumber.—Demand less brisk, because of the late season of the year, but prices are not materially altered. Pine is good value at $32 to $40 per M. for dressing, according to width required; common stock boards, $28 to $33; cull stocks, $20; cull sidings, $17.50. Southern pine dimension timber from $30 to $45, according to size and grade; finished Southern pine, according to thickness and width, $32 to $42.50; hemlock is in demand and held quite firmly, we quote $17.50 to $18.00; spruce flooring in car lots, $22 to $24; shingles, British Columbia, are steady, we quote $3.30; lath, No. 1, $4.60; white pine, 48-inch, No. 2, $3.75; for 32-inch, $1.85 is asked. The factories are all busy; the yard trade necessarily more slack, because of the season of the year.

Nails.—Wire, $2.35; cut, $2.60; spikes, $2.85 per keg of 100 lbs., base.

Pig Iron.—We quote Clarence at $20.50, for No. 3; Cleveland, $20.50; Summerlee, $22; Hamilton quotes a little irregular, between $10 and $20. Midland, No. 1, $19; No. 2, $18.50. Any change must be upward.

Pitch and Tar.—Pitch, unchanged at 70c. per 100 lbs. Coal tar, $3.50 per barrel. Season is over.

Plaster of Paris.—Calcined, New Brunswick, hammer brand, car lots, $1.05 to $2, f.o.b. cars, Toronto; retail, $2.15 per barrel of 300 lbs., delivered in 5 barrel lots; $2.10 at warehouse.

Putty.—In bladders, strictly pure, per 100 lbs., $2.60; in barrel lots, $2.10. Plasterer's, $2.15 per barrel of three bushels, at warehouse.

Ready Roofing.—Prices are as per catalogue.

Roofing Slate.—Most of the slate used in Canada comes now from Pennsylvania or Maine, the Canadian supply being slender and mostly from the Rockland quarries of the Eastern Townships in Quebec. There is a great variety of sizes and qualities, so that it is difficult to indicate prices. But No. 1 Bangor slate 10 x 16 may be quoted at $7.75 per square of 100 square feet, f.o.b. cars, Toronto; seconds, 50c. less. Mottled, $7.50; green, $7.75, with a prospect of advance. Dealers are fairly busy.

Rope. Sisal, 9½c per lb.; pure Manila, 10½c. per lb., Base.

Sand.—Sharp, for cement or brick work, $1.15 per ton f.o.b., cars, Toronto siding.

Sewer Pipe.—

	4-in.	6-in.	9-in.	12-in.	24-in.
Straight pipe, per foot	$0.25	$0.40	$0.65	$1.00	$3.25
Single junction, 1 or 2 ft. long	1.00	1.60	2.60	4.00	13.00
Double junctions	1.25	2.00	3.25	5.00	16.25
Increasers and reducers	....	1.60	2.60	4.00	13.00
P. & H. H traps	2.00	3.20	6.50	15.00	.....
Bends	0.75	1.20	1.95	3.00	9.75

Above is the October list, as changed. The retail price is less 65 per cent. off these figures on all sizes, 9 inches and under, or less 60 per cent. off these figures on anything over 9 inches. For car-load lots a greater discount.

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

Sheet Steel.—American Bessemer, 10-gauge, $2.40; 12-gauge, $2.45; 14-gauge, $2.30; 17, 18, and 20-gauge, $2.45; 22 and 24-gauge, $2.55; 26-gauge, $2.65; 28-gauge, $2.80. A very active movement is reported at unchanged prices, and an advance is not unlikely.

Sheets Galvanized.—Apollo Brand.—Sheets 6 or 8 feet long, 30 or 36 inches wide; 10-gauge, $3.00; 12-14-gauge, $3.00; 16, 18, 20, $3.20; 22-24,

$3.35; 26, $3.50; 28, $3.95; 29, $4.25; 10¾, $4.25 per 100 lbs. Fleur de Lis—28-gauge, $4.10; 26, $3.80 per 100 lbs. Active and firm at these prices.

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

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

Tin.—The market is lower; we quote 43c.

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

Zinc Spelter.—Demand not so brisk, and the market easier at $6.

CAMP SUPPLIES.

Beef.—by carcases, $8.50 to $9.50.

Butter.—Dairy prints are 20 to 24c.; creamery prints, 26 to 28c.; do. fresh made, 29 to 30c. Splendid demand for fresh made.

Canned Goods.—Peas, $1.35 to $1.75; tomatoes, 3s, $1.45 to $1.50; pumpkins, 3s, 97½c.; corn, 95c. to $1.00; peaches, 2s, $1.87½; yellow, $1.82½ to $1.87½; strawberries, 2s, heavy syrup, $1.80; raspberries 2s, $1.80 to $1.97½.

Cheese.—Moderately firm, large, 13¾ to 14c.; twins, 14 to 14¼c.

Coffee.—Rio, Green, 15½ to 16c.; Mocha, 23 to 25c.; Java, 25 to 31c.; Santos, 16 to 17c.

Dried Fruits.—Raisins, new, Valencia, 8 to 8½c.; seeded, 1-lb. packets, fancy, 8c.; 16-oz. packets, choice, 7½c.; Sultanas, good, 8½c.; fine, 9½c.; choice, 10 to 11c.; fancy, 12c.; Filiatras currants, cleaned, 7½ to 8c.; Vostizzas, 9 to 10c.; uncleaned currants, 7 to 7¾c.

Eggs.—Strictly new-laid, 21 to 22c.

Flour.—Prices unchanged thus far; thus, Manitoba flour, first patents, $5.20; second, $4.70; strong bakers', $4.60; Ontario flour winter wheat patents, $3.90; $4 per barrel.

Feed.—Bran, $22 to $23 per ton; shorts, $23 to $24 per ton.

Lard.—Tierces, we quote 11¼c. here; tubs, 11½c.; pails, 11¾c.

Molasses.—Barbados, barrels, 37 to 45c.; West Indian, 27 to 30c.; New Orleans, 30 to 33c. for medium.

Pork.—Not much doing, short cut, $26 to $26.50 per barrel; mess, $1 off, heavy, $22 to $22.50.

Rice.—B. grade, 3¼c. per lb.; Patna, 5 to 5¾c.; Japan, 5 to 6c.

Salmon.—As before stated. We quote Fraser River, talls, $2.05; flats $2.20; River Inlet, $1.90; cohoes, $1.75.

Smoked and Dry Salt Meats.—Long clear bacon, 11 to 11½c. per lb., tuns and cases; hams, large, 12 to 13c.; small, 14 to 15c.; rolls, 12 to 13c.; breakfast bacon, 17 to 18c.; backs (plain), 18 to 19c.; backs (peameal), 19 to 20c.; shoulder hams, 13c.; green meats out of pickle, 1c. less than smoked.

Spices.—Allspice, 18 to 19c.; nutmegs, 30 to 75c.; cream tartar, 28 to 30c.; compound, 18 to 20c.; pepper, black, pure Singapore, 14 to 17c.; pepper, white, 25 to 30c.

Sugar.—Granulated, $4.35 per 100 lbs., in barrels; Acadia, $4.25; yellow, $3.95.

Syrup.—Corn syrup, special bright, 3¼c. per lb.

Teas.—Japans, 20 to 35c. per lb.; Young Hysons, 16 to 35c.; Ceylons, 17 to 38c. per lb.

Vegetables.—Potatoes—Ontario, $1 per bag, on railway track, Toronto; Ontario Delawares bring $1, and New Brunswick Delawares $1.10; onions by crate, Spanish, $3; Canadian, $1.85; cabbages bring from $1.25 to $1.50 per barrel; carrots, 60c. per bag; beets, 75c. per bag; turnips, 40c. per bag.

Winnipeg, March 20th, 1911.

The situation in Winnipeg and throughout the West continues to be very bright, and it looks as though there would be a record breaking season in all lines of building trades. Things in Winnipeg are better for this time of year than for years past.

The market remains steady, and there is no changes in quotations worthy of mentioning. The weather is coming in fine and warm, and an early spring is looked for. Large orders, we are told, are being placed for cement, but from reports there are large stocks on hand.

Builders' supply firms have orders already for a great deal of work and supplies, and local architects are extremely busy.

Quotations are steady in this market, and are as follows:—

Anvils.—Per pound, 10 to 12½c.; Buckworth anvils, 80 lbs., and up, 10¾c.; anvil and vice combined, each, $5.50.

Axes.—Chopping axes, per dozen, $6 to $9; double bits, $12.10 per dozen.

Barbed Wire.—4 point and 2 point, common, $3.15 per cwt.; Baker, $3.20; Waukegan, $3.30.

Bar Iron.—$2.50 to $2.60.

Bars.—Crow, $4 per 100 pounds.

Beams and Channels.—$3 to $3.10 per 100 up to 15-inch, (4, 30, 41, 50, 118, 119, 127, 132, 145, 176.)

Boards.—No. 1 Common Pine, 8 in. to 12 in., $38 to $45; siding, No. 2 White Pine, 6 in., $55; cull red or white pine or spruce, $24.50; No. 1 Clear Cedar, 6 in., 8 to 16 ft., $60; Nos. 1 and 2 British Columbia spruce, 4 to 6in., $55; No. 3, $45.

Bricks.—$11, $12, $13 per M, three grades.

Building Paper.—4½ to 7c. per pound. No. 1 tarred, 84c. per roll; plain, 60c.; No. 2 tarred, 62½c.; plain, 56c.

Coal and Coke.—Anthracite, egg, stove or chestnut coal, $0.75 large lots to $10.50 ton lots, net; Alleghany soft coal; carload lots, basis, Winnipeg, f.o.b., cars, $6 per ton; cannel coal, $10.50 per ton; Galt coal, $2 f.o.b., carload lots, $9 single ton; coke, single ton, $7 at yard; large lots special rates. American coke, $11 to $11.50 a ton; Crow's Nest, $10 a ton.

Copper Wire.—Coppered market wire, No. 7, $4 per 100 lbs.; No. 6, $4; No. 10, $4.06; No. 12, $4.20; No. 14, $4.40; No. 16, $4.70.

Cement.—$2.40 to $2.75 per barrel in cotton bags.

Chain.—Coil, proof, ¼-inch, $7; 5-16-inch, $5.50; ⅜-inch, $4.00; 7-16-inch, $4.75; ½-inch, $4.40; ⅝-inch, $4.20; ¾-inch, $4.05; logging chain, 5-16-inch, $6.50; ¾-inch, $6; ⅞-inch, $8.50; Jack iron, single, per dozen yards, 15c. to 75c.; double, 25c. to $1; trace-chains, per dozen, $5.25 to $6.

Copper.—Tinned, boiler, 26½c.; planished, 29½c.; boiler and T. K. pits, plain, tinned, 45 per cent. discount.

Dynamite.—$11 to $13 per case.

Hair.—Plasterers', 90c. to $1.15 per bale.

Hinges.—Heavy T and strap, per 100 lbs., $6 to $7.50; light, do., 65 per cent.; screw hook and hinge, 6 to 10 inches, 5¼c. per lb.; 12 inches up, per lb., 4¼c.

Galvanized Iron.—Apollo, 10¾, $4.90; 28, $4.70; 26, $4.30; 22, $4.10; 24, $4.10; 20, $4; 18, $3.95; 16, $3.90; Queen's Head, 28, $4.90; 26, $4.70; 24, $4.30; 22, $4.30; 20, $4.10 per cwt.

Iron.—Swedish iron, 100 lbs., $4.75 base; sheet, black, 14 to 22 gauge, $3.75; 24-gauge, $3.90; 26-gauge, $4; 28-gauge, $4.10. Galvanized—American, 18 to 20-gauge, $4.40; 22 to 24-gauge, $4.65; 26-gauge, $4.65; 28-gauge, $4.90; 30-gauge, $5.15 per 100 lbs. Queen's Head, 22 to 24-gauge, $4.65; 26-gauge English, or 30-gauge American, $4.90; 30-gauge American, $5.15; Fleur de Lis, 22 to 24-gauge, $4.50; 28-gauge American, $4.75; 30-gauge American, $5.

Lumber.—No. 1 pine, spruce, tamarac, 2 x 4, 2 x 6, 2 x 8, 8 to 16 feet, except 10 feet, $29; British Columbia fir and cedar, 2 x 4, 2 x 6, and 2 x 8, 12 to 16 feet, $32; 2 x 20, 4 x 20, up to 32 feet, $42.

Nails.—$4 to $4.25 per 100. Wire base, $2.85; cut base, $2.90.

Picks.—Clay, $5 per dozen; pick mattocks, $6 per dozen; clevishes, 7c. per lb. (132.)

Pipe.—Iron, black, per 100 feet, ¼-inch, $2.50; ⅜-inch, $2.80; ½-inch, $3.40; ¾-inch, $4.60; 1-inch, $6.60; 1¼-inch, $9; 1½-inch, $10.75; 2-inch, $14.40; galvanized, ½-inch, $4.25; ¾-inch $5.75; 1-inch, $8.35; 1¼-inch, $11.35; 1½-inch, $13.60; 2-inch, $18.10. Lead, 6½c. per lb.

Pitch.—Pine, $6.50 per barrel; in less than barrel lots, 4c. per lb.; roofing pitch, $1 per cwt.

Plaster.—Per barrel, $3.25.

Roofing Paper.—60 to 67½cc. per roll.

Rope.—Cotton, ¼ to ½-in., and larger 23c. lb.; deep sea, 16½c.; lath yarn, 9½ to 9¾c.; pure Manila, per lb., 13¼c.; British Manila, 11¾c., sisal, 10½c.

Shingles.—No. 1 British Columbia cedar, $4; No. 2, $3.50; No. 1 dimension, $5; No. 1 band saw, $6.

Spikes.—Basis as follows:—1¼, 5 and 6, $4.75; 5-15 x 5 and 6, $4.40; ¼ x 6, 7 and 8, $4.25; ⅜ x 8, 9, 10, and 12, $4.05; 25c. extra on other sides.

Steel Plates, Rolled.—3-16-in., $3.35 base; machinery, $3 base; share, $4.50 base; share crucible, $5.50; cast share steel, $7.50; toe calk, $4.50 base; tire steel, $3 base; cast tool steel, lb., 9 to 12½c.

Staples.—Fence, $2.40 per 190 lbs.

Timber.—Rough, 8 x 8 to 14 x 16 up to 32 feet, $38; 6 x 20, 8 x 20, up to 32 feet, $42.

Tool Steel.—8½ to 15c. per pound.

TENDERS CALLED FOR

TENDERS FOR INSULATED COPPER WIRE.

TENDERS will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on Tuesday, March 28th, 1911, for wire.

Envelopes containing tenders must be plainly marked on the outside as to contents

Specifications may be seen and forms of tender obtained from the Toronto Hydro-Electric System, City Hall, Toronto.

Tenderers shall submit with their tenders the names of two personal sureties (approved of by the City Treasurer), not members of the City Council or officers of the Corporation of the City of Toronto; or, in lieu of said sureties, the bond of a Guarantee Company, approved as aforesaid.

The usual conditions relating to tendering, as prescribed by City By-law, must be strictly complied with, or the tenders will not be entertained.

The lowest or any tender not necessarily accepted.

G. R. GEARY (Mayor),
Chairman Board of Control.

City Hall, Toronto, March 15th, 1911.

TENDERS FOR SUPPLY OF PUMPING MACHINERY.

Sealed tenders addressed to the Chairman, Board of Control, Winnipeg, will be received at the office of the undersigned up to 11 a.m., on Wednesday, April 5th, 1911, for the manufacture and erection of Horizontal Turbine Pump of two and a half (2½) Million Gallons Capacity per 24 hours. Specification and form of tender, together with conditions governing tenders as prescribed by By-law, may be obtained at the office of the City Engineer, 223 James Avenue, Winnipeg. The lowest or any tender not necessarily accepted.

M. PETERSON,
Secretary.

Board of Control Office,
Winnipeg, March 18th, 1911.

TOWN OF BRAMPTON, ONTARIO.

Pavement Construction.

Sealed tenders addressed to the Town Clerk will be received up to 6 p.m. on Monday, April 17th, 1911, for the construction of approximately 8,000 square yards of pavement and 3,500 lineal feet of concrete curb and gutter. The different classes of pavement to be considered are:—

1. Asphalt Block.
2. Vitrified Brick.
3. Bitulithic.
4. Bituminous Macadam.

Plans and specifications may be seen at the office of the Town Engineer or the Town Clerk, also at the office of The Canadian Engineer, 62 Church Street, Toronto. Marked cheque for $500.00 or 5% of the tenders submitted must accompany each tender. Lowest or any tender not necessarily accepted.

W. C. YOUNG, Town Clerk.
W. M. TREADGOLD, Town Engineer.

Brampton, Ont., March 21st, 1911.

WELLAND, ONTARIO.

Sealed tenders will be received until Monday noon, April 3rd, for the construction, delivery and erection in place in Welland, Ontario, of one unit of waterpower driven waterworks pumps, three millions imperial gallons daily capacity, including turbine, pipes, valves, etc.

Specifications, prepared by Mr. Wm. Kennedy, Jr., Engineer, Montreal, may be obtained from the undersigned.

Envelopes to be marked "Tenders for pumps."

R. COOPER,
Chairman Water Commissioners,

Welland, Ont.

(Tenders continued on pages 68, 70, 73.)

Tenders Called For

(Continued from page 66.)

CITY OF MOOSE JAW, SASKATCHEWAN.

Main Drainage Works.

Sealed tenders endorsed "Tender A" and "Tender B," will be received by the undersigned City Clerk until 8.30 o'clock p.m. on Monday, April 10th, 1911. Any tender received after the above stated time be declared informal.

Contract "A."

Supplying materials for and constructing a Sewage Disposal Plant complete, including a Pump House, Sedimentation Tanks and Percolating Filters, also the supplying of materials for and the laying of a Trunk Sewer and Water Main.

Contract "B."

Supplying two Electrically-driven Centrifugal Pumps and Auto Starters complete with all piping, connections, etc.

Plans and specifications for contract "A" may be obtained from the City Engineer, Moose Jaw, upon receipt of a marked cheque for the sum of $25, to be held until return of plans and specifications; and for contract "B" plans and specifications will be sent upon request.

The lowest or any tender not necessarily accepted.

J. M. WILSON, City Engineer.
W. F. HEAL, City Clerk.

Moose Jaw, February 18th, 1911.

CIVIC CAR LINES.

TENDERS FOR RAILS AND TIES.

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on Tuesday, April 4th, 1911, for delivery of thirteen hundred and forty (1,340) tons of open hearth steel rail, 80-lb. section, also thirty thousand (30,000) untreated wood ties, white cedar preferred, although other woods will be considered.

Envelopes containing tender must be plainly marked on the outside as to contents.

Specifications and forms of tender may be obtained upon application to the office of the City Engineer, Toronto.

The lowest or any tender not necessarily accepted.

G. R. GEARY (Mayor),
Chairman Board of Control.

City Hall, Toronto, February 28th, 1911.

TENDERS FOR A STEEL BRIDGE.

THE RURAL MUNICIPALITY OF SWAN RIVER, in Manitoba, invite tenders for one ninety-four (94) foot centre to centre of end bearings Steel-riveted Pratt Truss Bridge and two Concrete Piers with (Steel) Stringers, and three (3) inch Tamarac Plank Floor. To be erected over the Woody River, east side of Section 36, Township 37, Range 27, west of the Principal Meridian in Manitoba, in accordance with Specifications, which can be obtained from the Provincial Department of Public Works, Parliament Buildings, Winnipeg, Manitoba.

The bridge site is within one mile of Bowsman Station on the Canadian Northern Railway.

Sealed Tenders to be delivered to the undersigned on or before the 15th day of April, A.D., 1911.

JOSEPH ARMSTRONG,
Secretary-Treasurer, Municipal Council,
Swan River, Manitoba.

NOTICE TO CONTRACTORS.

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, up to noon on TUESDAY, MARCH 28th, 1911, for the supply of STEEL EXTENSIONS FOR MANHOLES ON 6-FT. STEEL PIPE-LINE.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications and forms of tender may be obtained at the office of the City Engineer, Toronto.

The tenderers shall submit with their tender the names of two personal sureties (approved of by the City Treasurer), not members of the City Council, or officers of the Corporation of the City of Toronto, or in lieu of said sureties the bond of a Guarantee Company, approved as aforesaid.

The usual conditions relating to tendering, as prescribed by City By-law, must be strictly complied with, or the tenders will not be entertained.

The lowest or any tender not necessarily accepted.

G. R. GEARY (Mayor),
Chairman Board of Control.

City Hall, Toronto, March 7th, 1911.

CITY OF SASKATOON.

INTERCEPTING SEWER.

Sealed tenders addressed to the undersigned city commissioners and marked as to contents, will be received until 12 o'clock noon on Friday, April 14th, 1911, for the following work:—

Contract No. 78—Pipelaying.
" " 79—Furnishing concrete sewer pipe.
" " 80—Furnishing cast-iron sewer pipe and specials.

Plans, specifications, etc., may be seen at the office of the City Engineer, Saskatoon, also at the following places:

The Canadian Engineer—62 Church St., Toronto.
" " " —315 Nanton Bldg., Winnipeg.
" " " —Board of Trade Bldg., Montreal.
Engineering News. —220 Broadway, New York City.

The lowest or any tender not necessarily accepted.

JAS. CLINKSKILL (Mayor),
W. B. NEIL,
City Commissioners.

Saskatoon, Saskatchewan, Canada,
March 1st, 1911.

TENDERS FOR A STEEL BRIDGE.

The Municipal Council of THE RURAL MUNICIPALITY OF MINNITONAS invite TENDERS for the supply and erection of a Steel Warren Truss Bridge, and Two Concrete Piers. Bridge to be 60 feet centre to centre, of end bearings with Steel Stringers and Three-inch Plank Floor in accordance with Plan (No. F 10), and specifications on file at this Office, and also at the Office of the Chief Engineer, Department of Public Works, Parliament Buildings, Winnipeg, Manitoba.

Tenders under Seal to be delivered to the undersigned on or before the 15th Day of April, A.D. 1911.

The lowest or any Tender not necessarily accepted.

E. WIDMEYER,
Secretary-Treasurer, Municipal Council,
Minnitonas, P.O., Manitoba.

(Tenders continued on pages 70, 73.)

Tenders Called For

(Continued from pages 66 and 68.)

CITY OF MOOSE JAW, SASKATCHEWAN.

SEWER AND WATER EXTENSIONS.

Sealed tenders endorsed "Tender 28," "Tender 29," "Tender 30," and "Tender 31," will be received by the undersigned City Clerk until 8.30 o'clock p.m., on Monday, April 10th, 1911.

Any tender received after the above stated time will be declared informal.

CONTRACT 28—

The laying of approximately 30,700 lineal feet of tile pipe sewer, building manholes, etc.

The laying of approximately 29,700 lineal feet of cast iron water main, placing valves, valve boxes, hydrants, etc.

CONTRACT 29—

The supplying of approximately:

29,600 lineal feet of 6-in. C.I. Water Pipe.
112 " " of 4-in. " " "
132 6-in. cast iron reverse curves.
34 6-in. cast iron crosses.
72 6-in. cast iron tees.
29 4-in. off 6-in. cast iron tees.
28 4-in. cast iron tees.
95 6-in. cast iron plugs.

CONTRACT 30—

The supply of approximately:

28,000 lineal feet of 6-in. Vitrified Tile Sewer Pipe.
26,600 " " of 8-in. " " "
5,225 " " of 10-in. " " "
1,100 " " of 12-in. " " "
25 8-in. Tees.
75 6-in. Tees.
25 8-in. ¼ Bends.
100 6-in. ⅛ Bends.
25 8-in. Stops.
25 10-in. Stops.
400 4-in. to 6-in. Increasers.

CONTRACT 31—

The supply of approximately:

65 6-in. 3-way Hydrants.
147 6-in. Gate Valves.
29 4-in. Gate Valves.
150 6-in. Valve Boxes.
29 4-in. Valve Boxes.
88 Manholes, Frames and Covers.

Plans and specifications for Contract 28 may be seen at the office of the City Engineer, Moose Jaw, Sask., and at the offices of the Canadian Engineer at Toronto and Winnipeg.

Plans and specifications for Contracts 29, 30, and 31 will be sent upon request.

The lowest or any tender not necessarily accepted.

J. M. WILSON, City Engineer.
W. F. HEAL, City Clerk.

Moose Jaw, 24th February, 1911.

QUEEN VICTORIA NIAGARA FALLS PARK.

Boulevard Bridges.
Boulevard Roadway.

Sealed Proposals endorsed "Proposal for Boulevard Construction," will be received until Tuesday, March 28th, 1911 at noon, for the construction of (a) 5 Steel Concrete Bridges and (b) a Macadam Roadway, with the necessary drainage being Section 4B, 5,182 feet, commencing at Miller's Creek, and extending to the southerly limit of the Shipyard, according to plans and specifications for the several works on file at the Administration Building, Queen Victoria Park, Niagara Falls, Ontario.

JOHN H. JACKSON,
Superintendent.

Niagara Falls, Ontario, March 2nd, 1911.

CITY OF SASKATOON.

Tender for Material for Connections—Contract No. 85.

Sealed tenders addressed to the undersigned City Commissioners and marked as to contents, will be received until 12 o'clock noon, on Friday, March 24th, 1911, for the following material:—

(a) Tile Pipe and Specials.
(b) Galvanized Iron Pipe.
(c) Lead Pipe.
(d) Brass Fittings.
(e) Service Boxes.
(f) Water Meters.
(g) Tapping Machines.

All information may be obtained on application to the City Engineer.

The lowest or any tender not necessarily accepted.

JAS. CLINKSKILL (Mayor)
W. B. NEIL
City Commissioners.

Saskatoon, Sask., March 1st, 1911.

CITY OF SASKATOON.

WATER FILTRATION.

Sealed tenders addressed to the undersigned and marked "Water Filtration," will be received until 12 o'clock noon on Friday, March 31st, 1911, for the installation of a Mechanical Water Filtration Plant for the city of Saskatoon.

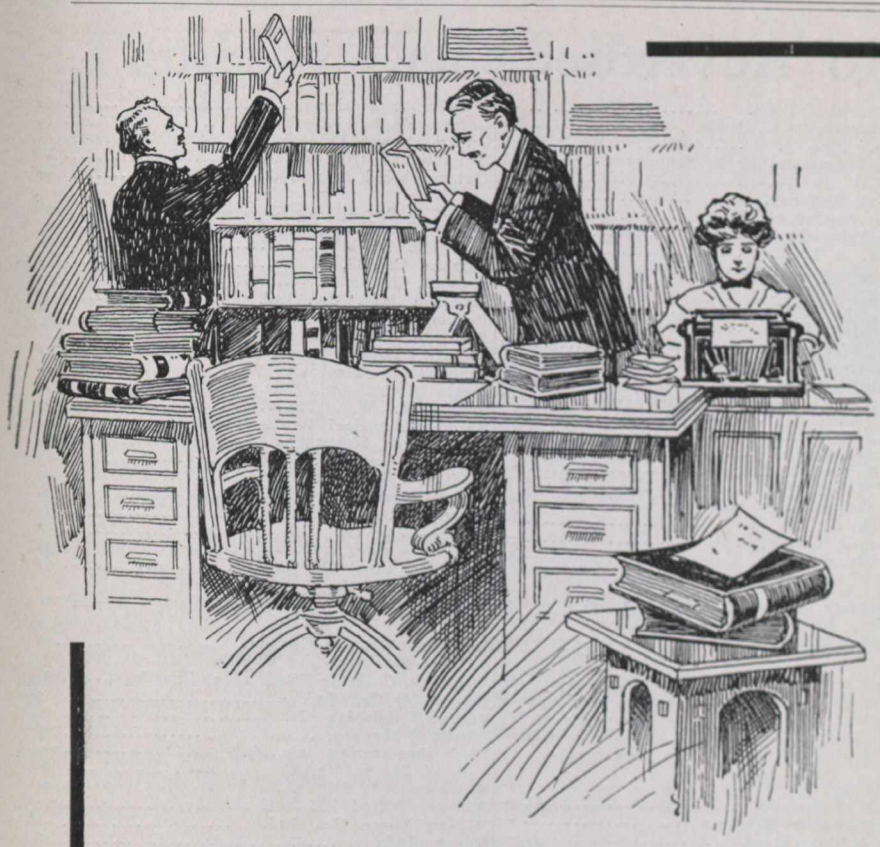
All information may be obtained on application to the City Engineer.

The lowest or any tender not necessarily accepted.

JAS. CLINKSKILL (Mayor),
W. B. NEIL,
City Commissioners.

Saskatoon, Saskatchewan,
February 28th, 1911.

(Tenders continued on page 73.)



It is perhaps not generally known

that we have an Information Department consisting of trained and practical men, whose time is employed solely in answering enquiries from people interested in cement.

Now it will be readily understood

that out of the mass of enquiries that come to us, there are a number that include questions as to what might be termed Allied Industries. These we now answer to the best of our ability, but we could answer them still more satisfactorily, if manufacturers of materials used in conjunction with cement would co-operate to the extent of sending copies of their catalogues and other literature, to be placed on file in our office for reference.

We should like to obtain

the names and addresses, together with catalogues, and any other obtainable information of manufacturers of and dealers in:—

1. Concrete Machinery
2. Building Blocks
3. Cement Bricks
4. Tile Molds
5. Fence Posts
6. Reinforcing Material
7. Waterproofing Compounds

It is not alone for our own convenience that we make this suggestion: Firms who manufacture or deal in such articles, will find it to their own advantage to have this information in the hands of our Information Department, thereby enabling us to hand on to them, from time to time, enquiries for such materials as they severally make.

In sending catalogues, literature or information, please address same to "Sales Department."

The

Canada Cement Co., Limited

Banque National Bldg. - MONTREAL

Index to Advertisements

Tenders Called For

(Continued from pages 66, 68 and 70.)

CITY OF BRANTFORD.

Tenders for Pavement.

Sealed tenders addressed to Alderman C. H. Hartman, Chairman of the Board of Works, in care of the City Clerk, Brantford, Ont., will be received until 12 o'clock noon on

THURSDAY, MARCH 30th, 1911,

for the construction of a pavement on South Market Street.

About 5,000 square yards of top surfacing, of which 800 square yards will be on a ten per cent. grade.

Tenders for different kinds of surfacing will be received.

Concrete foundation for this pavement will be laid by the city.

Single track line of street railway on street.

Plans and specifications may be seen, and instructions to bidders and forms of tender obtained at the City Engineer's Office.

Each tender must be accompanied by a marked cheque for 5 per cent. of the amount of the tender.

The lowest or any tender not necessarily accepted.

T. HARRY JONES,
City Engineer.

City Engineer's Office,
Brantford. March 13th, 1911.

CITY OF PRINCE ALBERT.

Tenders for Intercepting Sewer.

Sealed tenders addressed to the Commissioners of the City of Prince Albert and marked "Tender for Sewer," will be received until noon on Saturday, the 15th day of April, 1911, for the construction of a main intercepting sewer, as follows:—

5,749	lin.	ft.	4′ 6″ x 3′ 0″	concrete	sewer.
4,640	"	"	4′ 3″ x 2′ 10″	"	"
2,798	"	"	4′ 0″ x 2′ 8″	"	"
19	manholes.				

Alternate bids for reinforced concrete pipe will be considered.

Plans and specifications may be obtained at the office of the City Engineer, also at office of Canadian Engineer, Winnipeg, after April 1st.

A marked cheque for $2,500, in favor of the treasurer of the City of Prince Albert must accompany each tender submitted.

Andrew Holmes,
C. O. Davidson,
F. A. Creighton,
Commissioners.

Prince Albert, Sask.,
March 7th, 1911.

NORTH TORONTO.

Tenders marked and addressed to Wm. C. Norman, Clerk, Eglinton, Ont., will be received up to and including March 30th, 1911, for

(a) Cross Arms.
(b) Galvanized Iron Braces.
(c) Bolts and Steps.
(d) Wooden Pins and Side Blocks.
(e) Insulators, Glass and Porcelain.

for an electric light system for the town of North Toronto. Specifications may be seen at the office of the Canadian Engineer, 62 Church Street, Toronto, or the town hall, Eglinton, Ont.

A. J. BROWN,
Mayor.

WM. C. NORMAN,
Clerk.

CITY OF SASKATOON.

TENDERS WANTED.

CONSTRUCTION OF CEMENT SIDEWALKS.

Sealed tenders, addressed to the City Commissioners, Saskatoon, Sask., and endorsed "Tender for Cement Sidewalks," will be received up to 12 o'clock noon on Friday, 7th April, 1911.

Plans, specifications, instructions to bidders, general conditions, forms of tender and forms of agreement, may be seen at the office of the City Engineer, Saskatoon, and also at the following places:

Office of "The Canadian Engineer," 62 Church St., Toronto.
" " " " Board of Trade Bldg., Montreal.
" " " " 315 Nanton Building, Winnipeg.

Copies of instructions to bidders, and forms of tender will be furnished on application to the City Engineer, but not plans or specifications.

The lowest or any tender not necessarily accepted.

JAS. CLINKSKILL,
W. B. NEIL,
City Commissioners.

Saskatoon, Sask., March 15th, 1911.

TENDERS FOR INTEGRATING WATTMETERS.

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on Tuesday, March 28th, 1911, for Integrating Wattmeters.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications may be seen and forms of tender obtained from the Toronto Hydro-Electric System, City Hall, Toronto.

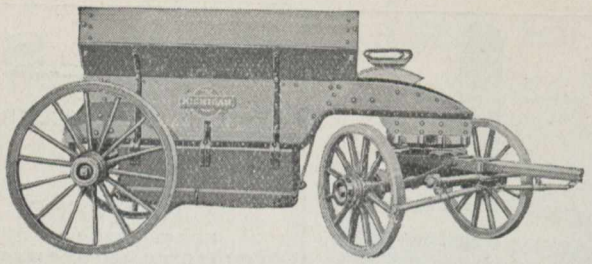
Tenderers shall submit with their tender the names of two personal sureties (approved of by the City Treasurer), not members of the City Council, or officers of the Corporation of the City of Toronto, or in lieu of said sureties the bond of a Guarantee Company approved as aforesaid.

The usual conditions relating to tendering as prescribed by city by-law must be strictly complied with or the tenders will not be entertained.

The lowest or any tender not necessarily accepted.

G. R. GEARY (Mayor),
Chairman Board of Control.

City Hall, Toronto, March 15th, 1911.



Short turns — quick handling.
Short wheel base—full capacity.
Quick and easy dumping.
Extra rugged construction.
Does away the constant expensive breakdowns of ordinary wagons.
AND PRICED RIGHT.

Write us for full information.

American Road Machine Co., Ltd., of Canada, Coderich, Ont

ADDRESS CORRESPONDENCE TO

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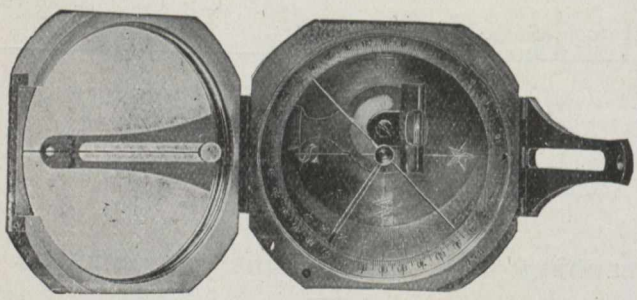
HAMILTON, ONT. LIMITED

Sole Agents for the above Company.
(Also Canadian Distributors for the INTERSTATE AUTOMOBILE)

"CHAMPION"

"Standard for 20 Years."

5,500 Brunton Patent POCKET TRANSITS



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$2\frac{3}{4}$ x $2\frac{3}{4}$ x $1\frac{1}{8}$ inches. Weight, 8 ounces.

Used by Civil and Mining Engineers throughout the world—by whom it is recognized as the most convenient, compact and accurate pocket transit for preliminary surveying on the surface or underground.

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by members of the United States Geological Survey alone.

Fully described in bulletin B-I.

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We can supply every office and field requisite of the

Civil, Mechanical, Hydraulic ENGINEER AND SURVEYOR

The Buckeye Blue Printing Machine

Its arrangement provides a great variety of speeds which is essential in making blue prints where the time of exposure has to be varied to suit the condition of the tracings, drawings or blue print paper.

The mechanism is exceedingly simple.

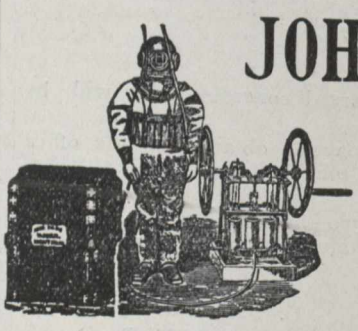
It transmits no jerk or jar to the lamp.

In simplicity of construction this machine surpasses all others and with reasonable care it is practically indestructible.

Catalogues on Request

The Art Metropole, Ltd.
149 Yonge Street - - Toronto, Ont.

Hughes Owens Co., Ltd.
Montreal, Que. and Winnipeg, Man.



JOHN DATE

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Hamilton Powder Co.

Manufacturers of

EXPLOSIVES

Blasting Appliances of all kinds

OFFICE
No. 4 Hospital Street, MONTREAL
Magazines and Branch Offices at the Chief Distributing Points in Canada.

AMONG THE MANUFACTURERS

A department for the benefit of all readers to contain news from the manufacturer and inventor to the profession.

FOR MINE HAULAGE.

In the coal mining industry especially, the Milwaukee gas-driven locomotive, manufactured by the Milwaukee Locomotive Manufacturing Company, Milwaukee, Wis., has so far demonstrated its superiority for haulage purposes in and around mines that a number of companies have adopted it as their sole form of motive power. Mining operations require that a large, constant output be transported from the workings with ease and despatch, and in addition require a haulage system that is economical, entirely safe and flexible. In these respects the gas-driven locomotive best meets the practical requirements of hard, actual service.

In mines where this type of locomotive has displaced mules it has bettered the service, increased the output and reduced expenses materially. The gas-driven locomotive is also superior to a rope haulage system as applied in mines, because it is not so costly to operate and maintain, eliminates expensive delays, besides admitting of greater flexibility as the mine workings expand.

Gas-driven locomotives are used extensively in the mining regions of Germany and Austria, indicating beyond any doubt that this form of motive power is no longer in a state of development, but is practical and economical in actual service. The merits of the gas-driven locomotive are worthy of the most serious consideration of those who contemplate installing an industrial transportation system.

NEW INCORPORATIONS.

Brooks, Alta.—New Lumber Co., $25,000.

Wetaskiwin, Alta.—McNamara, $10,000.

Kemptville, Ont.—Johnston Foundry Co., $40,000. W. S. Johnston, G. H. Ferguson.

Berlin, Ont.—Ontario Farming Co., $40,000. J. A. McAllister, A. C. Bender, A. Grauel.

Sparta, Ont.—Sparta Rural Telephone Co., $4,500. W. F. Smith, F. A. Schooley, C. A. Bailey.

Cobalt, Ont.—Cobalt Planing Mills, $40,000. J. Joanisse, F. D. Connor, T. R. Jones.

Thessalon, Ont.—North Channel Lumber Co., $100,000. G. H. Sedgewick, A. G. Ross, L. Davis, Toronto.

Bromhill, Man.—Goss Brothers, $10,000. A. H. Goss, Flint, Mich.; H. W. Bailey, C. W. Hockett, Detroit.

Saskatoon, Sask.—Last West Investment Co., $100,000. Universal Land Security Co., $60,000.

Moose Jaw, Sask.—Moose Jaw Blacksmith and Carriage Repair Co., $10,000. Western Press, $15,000.

St. Perpetue, Que.—Lafontaine Lumber Co., $45,000. U. Bard, L. Gagnon, T. McCarron.

Fort Frances, Ont.—Quetico Improvement Co., $40,000. J. A. Mathieu, Rainy River; A. M. Shaw, J. E. Shaw, Fort Frances.

Port Arthur, Ont.—Mackie & Taylor, $50,000. N. Mackie, J. Taylor, W. F. Langworthy.

Ottawa, Ont.—Carribbean Petroleum, $10,000,000. J. H. Spence, M. C. Cameron, D. D. McLeod. Power Specialties, $50,000. J. K. Paisley, F. W. Bindon, G. H. Bindon.

Calgary, Alta.—Securities and Development Co., $100,000; Prairie Fuel Gas Co., $8,000,000; Sunnyvale Fruitland Co., $35,000; Lougheed & Taylor, $100,000.

Montreal.—Bronsdon's, Limited, $30,000. A. H. Campbell, C. R. Bronsdon, J. G. Veith. Stevenson & Bray, $25,000. J. A. Stevenson, E. C. Bray, R. C. Common. Caron & Pilon, $50,000. C. J. Caron, J. O. Proulx, H. J. Pilon.

Toronto.—Fisher Electric and Manufacturing Co., $250,000. F. C. L. Jones, L. W. Nurse, F. H. White. British Columbia Steel Corporation, $10,000,000. W. Gilchrist, A. M. Garden, W. C. Davidson. Natural Resources Exploration Co., $100,000. J. S. Lovell, W. Bain, R. Gowans. Kennedy Spring Wheel Manufacturing Co., $200,000. C. Grasley, E. J. Griffiths, J. H. Hoffman. Mulholland Mines, $1,500,000. G. H. Sedgewick, A. G. Ross, L. Davis. Art Printers, $40,000. J. Barrett, S. G. Waller, A. V. Wagner.

Winnipeg, Man.—Western Canada Chemical Works, $60,000. F. S. Nugent, A. C. Loton, W. B. Press. Permanent Building and Investment Co., $500,000. C. H. Locke, K. R. Daly, R. H. Griffith. Gainsford Coal Co., $750,000. W. Pace, H. McLennan, J. Osborne. Lake Winnipeg Shipping Co., $500,000. E. B. Eadie, R. Siderfin, W. J. Allen. Lennox-Mackie Co., $20,000. J. Mackie, E. Lennox, G. Burwash. Campbell & Brick, $40,000. A. D. Campbell, W. J. Brick, A. E. Bowles. Burlington Investment Co., $500,000. J. Thomson, W. H. Collum, H. Mackle. Weld Publishing Co., $50,000. C. O. Smith, A. K. Dysart, D. M. Wemyss.

Edmonton, Alta.—Peoples Coal Co., $250,000; North-West Trust Co., $50,000; Hudson Oil Co., $10,000; Lindsay Oil Co., $10,000; Guelph Oil Co., $10,000; Great Falls Oil Co., $10,000; Roman Oil Co., $10,000; English Oil Co., $10,000; Boston Oil Co., $10,000; Quincy Oil Co., $10,000; Port Arthur Oil Co., $10,000; Fortune Oil Co., $10,000; Kalkaska Oil Co., $10,000; Glory Oil Co., $10,000; Okanagan Oil Co., $10,000; Richmond Oil Co., $10,000; London Oil Co., $10,000; Forest City Oil Co., $10,000; Hartford Oil Co., $10,000; Jasper Oil Co., $10,000; Orange Oil Co., $10,000; Rock Island Oil Co., $10,000; Pittsburg Oil Co., $10,000; Peterboro' Oil Co., $10,000; Arizona Oil Co., $10,000; Prince Albert Oil Co., $10,000; Commonwealth Co., $500,000; Owners Realty Co., $10,000; Donnelly, Watson & Brown, of Edmonton, $25,000; Louisville Oil Co., $10,000; Monarch Oil Co., $10,000; Muskegon Oil Co., $10,000; Quebec Oil Co., $10,000; Geneva Oil Co., $10,000; Kootenay Oil Co., $10,000; Norway Oil Co., $10,000; Kansas City Oil Co., $10,000; Halcyon Oil Co., $10,000; Oshkosh Oil Co., $10,000; Norwich Oil Co., $10,000; Brandon Oil Co., $10,000; Butte Oil Co., $10,000; Oxford Oil Co., $10,000; Berlin Oil Co., $10,000; Kew West Oil Co., $10,000; Jersey City Oil Co., $10,000; Lethbridge Oil Co., $10,000; Pueblo Oil Co., $10,000; Huron Oil Co., $10,000; Milwaukee Oil Co., $10,000; Medicine Hat Oil Co., $10,000; Minneapolis Oil Co., $10,000; Holyoke Oil Co., $10,000; Atlas Oil Co., $10,000; Buffalo Oil Co., $10,000; Niagara Oil Co., $10,000; Findlay Oil Co., $10,000; Newark Oil Co., $10,000; Galt Oil Co., $10,000; Espanola Oil Co., $10,000; Nashua Oil Co., $10,000; Houston Oil Co., $10,000; Fort Garry Oil Co., $10,000; Mikado Oil Co., $10,000; National Realty and Investment Co., $10,000.

CATALOGUE INDEX

Some of the most valuable information on engineering and contracting subjects is to be found in the trade literature of the large supply houses.

The Canadian Engineer maintains a card index upon which is kept an up-to-date list of manufacturers of contractors supplies and engineering equipment. If you want the catalogues of any of these firms all you need do is to send us a postal giving your address and the list numbers (as printed below) of the catalogues you wish sent. This will save you time and labor and insure prompt service. This department can put you in direct communication with the principal manufacturers of and dealers in engineering equipment of all kinds.

1 Air compressors.
2 Air lift pumping machinery.
3 Alloys.
4 Aluminum.
5 Angles (see structural steel).
6 Architects' supplies.
7 Asbestos and Asbestos Products.
8 Asphalt.
9 Asphalt plants and tools.

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11 Bearing Metals.
12 Bearings, ball and roller.
13 Belt dressing.
14 Belt tighteners.
15 Belting, chain, link, canvas, etc.
16 Benders (rail).
17 Blacksmiths' tools.
18 Blast furnaces and fittings.
19 Blasting powder.
20 Blocks and tackle.
21 Blowers.
22 Boiler fittings, mountings and tubes.
23 Boiler tubes.
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25 Boilers (water-tube).
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27 Bolts (machine).
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