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The Canadian Engineer

ESTABLISHED 1893.

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Index of this issue will be found on page 538.

CONTRACT AND DIRECT LABOR.

One of the questions that was discussed at some length before the Irish Road Congress was the replacing of the contract system by direct labor.

The contract system had been compulsory in Ireland until 1907, but by an amendment to the local Government Board's Act direct labor was made permissible. The authorities, however, have been very slow to adopt the direct labor principle.

Just now, in Canada, the direct labor and contract systems are competing very keenly for municipal work. Ten years ago nearly all municipal work was done by contract. To-day, the city engineer's department figures very closely on municipal work, and the city engineers are competing in more varied lines of work this year than in previous years.

From the city engineer's point of view it would be much easier for him to continue the contract system, as this entails much less labor and supervision. The preparation of a workable scheme for direct labor is difficult because of the number of friends the municipal council, who are the employers of the engineer, have, and the additional instruction assistants and clerks require who have to do with the various branches of the work. Where a permanent staff can be employed and maintained throughout the year it is not difficult, but where, for the summer months, the engineer is to assemble a staff and train it, and then about the time they are doing efficient work in the autumn, he has to disband them, it is a question whether there is any saving to the municipality. When a permanent staff is necessary the year around, the organization may be perfected and efficient work done, the success of the assistant depending upon not only the class of men available, but upon their remaining in the service.

One danger that has to be avoided in the direct labor system is carelessness in bookkeeping. Unless a proper auditing and a proper distribution of labor is made, it is more than likely that the corporation will pay for work that should be charged to individual sections. It is so easy to cover up the leaks in each particular work this way. Another difficulty that is being met is the influence the whole body of laborers have in the district. They control the organizations and have a direct influence on municipal affairs, and occasionally to their own personal advantage. Councils have more than once been influenced by corporation employees to leave alone departments that should be reorganized. A corporation employing four or five thousand men who vote at annual elections will find it necessary to watch with care the organization under which they work.

ELECTRIC RAILWAY PROFITS.

It has been said that the rate of profit on hydro-electric enterprises has been gradually decreasing, and the same apparently holds true in connection with electric railways. The causes which are bringing about this

decrease in the rate of returns on investment are: increased operating costs due to increase in cost of labor and material; increase in cost of rolling stock, due to heavier and better-equipped cars; increased number of roads, causing in several cases competition and division of traffic. The possibility of increasing returns by reducing the operating costs are not great. Electric railways have reached a limit of economy in the management of their affairs consistent with safe and efficient operation. If the costs of labor and material continue to advance, the operating costs will increase.

The returns may be increased by the abolishing of passes, abolishing of transfers, the increase in rate tariffs, and by pioneer work developing more frequent and longer hauls. In 1902 the average percentage of net income to capital stock of American railways was two per cent. Five years later this had decreased to 1.6 per cent.

From evidence given before the Railway Commission of Wisconsin it would appear that the average dividends of the Milwaukee Electric Railway and Light Company was 3.23.

The longest ride possible in Milwaukee in 1890 was four miles, and the fare five cents or one and a quarter cents per mile. In 1910 the longest possible ride is twelve miles, and the fare four cents, or one-third of a cent per mile. That is, the length of ride in twenty years has increased two hundred per cent.; the time consumed in travelling the increased distance is one hundred per cent. more, and the rate of fare has decreased seventy-five per cent.; that is, the passenger to-day pays about a fourth of what the passenger paid twenty years ago.

In Glasgow, Scotland, the average rate of fare per mile is about nine-tenths of a cent, and, since this city is held up as a model for successful operation of tram cars, it will be noted that the fare is higher than in many American cities. The population is denser and the rate of wages lower than with us.

EDITORIAL NOTES.

An interesting matter of valuation has arisen in the matter of the South Station of Boston. It cost to construct a little over $15,000,000. The holding company is capitalized at $500,000, and the property is bonded for $14,000,000. During the last fiscal year the net loss to the corporations operating was $672,445. By agreement, one corporation is to pay 75 per cent. of the interest, taxes and operating cost, and another, 25 per cent. A new valuation has been made of the property, which will be several million in advance of the cost of construction. The new valuation may be justified from the returns, but in the matter of taxes the railways will fail to see the justice of the new rating. This case illustrates again the difficulty of properly apprising property separate from its surroundings and its value because of its connection with other property.

* * * *

The Universal Portland Cement Company, of Chicago, have recently adopted a voluntary accident relief plan for the benefits of its employees. Their plan of relief corresponds very closely to those that have been in operation among the subsidiary companies of the United States Steel Corporation. The money needed for the fund will be furnished entirely by the company without any contribution from the workmen. It is only an experiment for the year 1910, but should it work out successfully, it is expected it will be continued from year to year.

Two special trains conveying delegates from the Brotherhood of Locomotive Engineers' Convention at Detroit to Niagara Falls, and running half an hour apart, on May 21st, made record runs. No stops were made on the 224-mile trip, but there were three slow-downs. The first train covered the 224 miles in 224 minutes, while the second covered the distance in 217 minutes. Each train had twelve coaches. For heavy passenger trains, and for such a long distance, this is probably the worlds record.

* * * *

The Canadian Engineer wishes to extend to Dr. Charles A. Hodgetts, secretary of the Ontario Board of Health, congratulations upon his appointment as Medical Adviser to the Canadian Conservation Commission. The Commission are singularly fortunate in being able to secure the services of a man who is not only an able administrator, but a scientist.

NOTES ON THE DESIGN OF A RADIAL INWARD-FLOW HYDRAULIC TURBINE.

By Claud H. Hill, A.K.C.

In this type of turbine the water does the work partly by its pressure and partly by its velocity, exerting a couple on the wheel which rotates the shaft, thus making the energy in the water available. This working couple is arrived at in the following way (see Fig. 1):—

Let C = couple in foot pounds.
t = time in seconds.
Ω = angular velocity.
W = weight body.
g = acceleration due to gravity.
v_1 = velocity at A_1.
v_2 = velocity at A_2.
O = centre about which body is turning.
r_1 and r_2 = perpendicular distances from o.
p_1 and p_2 = distances of A_1 and A_2 from o.
μ_1 and μ_2 = resolved velocities perpendicular to p_1 and p_2.
α and β = angles between v_1 and μ_1 and v_2 and μ_2, respectively.

Let the couple C act on the body of weight W for t seconds, and in this time change its velocity from v_1 to v_2 and its position from A_1 to A_2.

The angular impulse = Ct, and if the change is reckoned for one second, angular impulse = C. Also, angular impulse = change of angular momentum.

$$\text{Therefore, } C = \frac{W}{g}(v_2 r_2 - v_1 r_1) \quad \ldots\ldots (1)$$

Now $r_1 = p_1 \cos \alpha$, $\quad r_2 = p_2 \cos \beta$.
and $v_1 = \mu_1 \sec \alpha$. $\quad v_2 = \mu_2 \sec \beta$.

$$\text{Therefore, } C = \frac{W}{g}(\mu_2 \sec \beta\ p_2 \cos \beta - \mu_1 \sec \alpha\ p_1 \cos \alpha).$$

$$C = \frac{W}{g}(\mu_2 p_2 - \mu_1 p_1) \quad \ldots\ldots (2)$$

Thus the water in passing through the turbine has its angular momentum diminished, and exerts a couple = — C, tending to rotate the wheel, which is equal and opposite to the couple C the wheel exerts on the water.

Hence, the couple C tending to rotate the wheel = $\frac{W}{g}(\mu_1 p_1 - \mu_2 p_2)$.

Now the work done per second = C Ω.

$$\text{Therefore, } C\,\Omega = \frac{W}{g}(\mu_1 p_1 - \mu_2 p_2)\,\Omega.$$

In a turbine designed for maximum efficiency u_2 should be zero; i.e., water should have no component in a direction perpendicular to radius of wheel, and then

$$C\,\Omega = \frac{W}{g}\mu_1 p_1\,\Omega.$$

Now p_1 = radius of wheel at inlet. Therefore, $p_1\,\Omega = V_1$ = velocity of rim of wheel at inlet.

$$\text{Therefore, work done} = \frac{W}{g}\mu_1 V_1 \quad \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Now let Q = volume of water passing per second.
H = available head for turbine.
and w = weight per unit volume of water = 62.A pounds per cubic foot.

Then $W = Q\,w$,

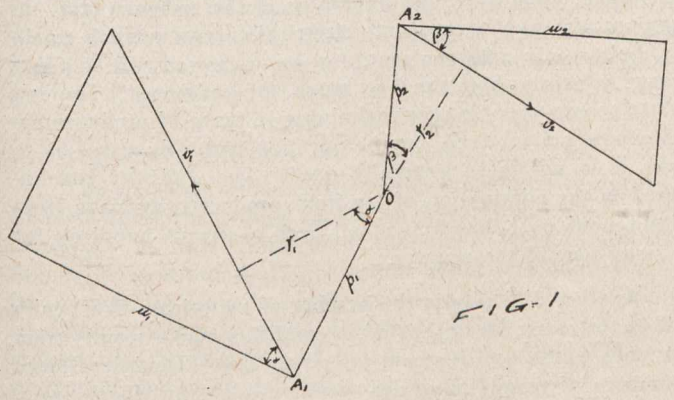
$$\text{and work done} = \frac{Q\,w}{g} V_1\,w_1 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Also work supplied = Q w H.

$$\text{Therefore, } E = \frac{Q\,w\,V_1\,\mu_1}{g\,Q\,w\,H} = \frac{V_1\,\mu_1}{g\,H} \quad \ldots\ldots\ldots\ldots\ldots\ldots (5)$$

Where E = the Hydraulic Efficiency μ_1 is often called the "velocity of whirl."

When a turbine is to be designed, the available head = H is known in advance. The preliminary assumptions usually



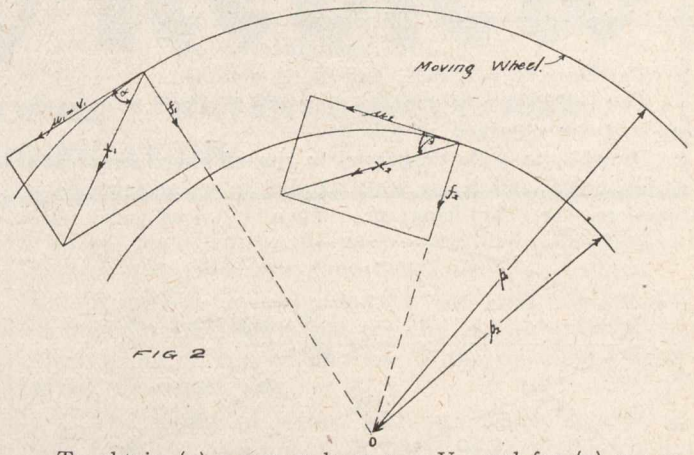
made are the volume of water passing per second, the angular velocity of wheel (*or* radius of wheel), breadth of wheel at inlet, and the circumferential velocity v_1. As the best speed of wheel partly depends on frictional losses, v_1 is often made $= 0.6\sqrt{2gH}$.

The following empirical values have been justified by experience:—

$\frac{p_2}{p_1}$ varies from 0.6 to 0.8, $V_1 = 0.6\sqrt{2gH}$ and $A_1 = A_2$

Let f_1 = velocity flow at inlet.
f_2 = velocity flow at outlet.
μ_1 = velocity whirl at inlet.
μ_2 = velocity whirl at outlet.
x_1 = abs. velocity jet at inlet.
x_2 = abs. velocity jet at outlet.
A_1 and A_2 = areas at inlet and outlet, respectively.
V_1 = velocity rim of wheel at inlet.
V_2 = velocity rim of wheel at outlet.
Q = volume passing in cubic feet per second.
w = weight per unit volume = 62.4 pounds per cubic foot.
α and β = angles between abs. velocity jet and velocity wheel rim at inlet and outlet, respectively.
b_1 and b_2 = breadth wheel perpendicular to paper at inlet and outlet.
p_1 and p_2 = radii at inlet and outlet.

The turbine, to be of maximum efficiency, necessitates: (1) No shock when water enters wheel, and (2) the water to leave the turbine radially.



To obtain (1) we must have $\mu_1 = V_1$, and for (2) $\mu_2 = 0$. Also $f_1 = f_2$ (neglecting friction on vane).

The work done per pound of water from equation (3) $= \frac{V_1\,\mu_1}{g}$ ..... (6)

$$\text{and work lost at exit per pound water} = \frac{f_2^2}{2g} \quad \ldots\ldots\ldots (7)$$

$$\text{Then } H = \frac{V_1\,\mu_1}{g} + \frac{f_2^2}{2g}$$

And since $\mu_1 = V_1$,

$$\text{Therefore, } H = \frac{V_1^2}{g} + \frac{f_2^2}{2g} \quad \ldots\ldots\ldots\ldots\ldots\ldots (8)$$

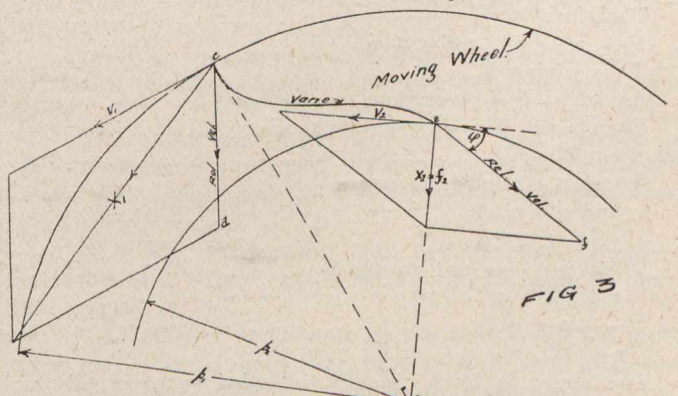
Since Ω = augmented velocity of wheel,

$$\text{therefore, } \Omega = \frac{V_1}{p_1} = \frac{V_2}{p_2}.$$

$$\text{Therefore, } V_2 = \frac{p_2}{p_1}.\ V_1 = 0.6\ V_1 \text{ say.}$$

Thus p_1, p_2 and V_2 are obtained.

X_1 is obtained from the equation $\frac{Q}{A_1} = X_1$.



Where $A_1 = 2\pi p_1\,b_1 - n\,b_1\,t = b_1\,(2\pi p_1 - n\,t)$,
and n = number of vanes (previously selected),
t = thickness of vanes: ¼-in. to ⅜-in. for steel and ½-in. when cast.

$$\text{And since (see Fig. 2) } \frac{\mu_1}{X_1} = \cos\alpha,$$

Therefore, α is determined from tables.

The velocity of flow f_1 is obtained from the equation $f_1 = X_1 \sin \alpha$.

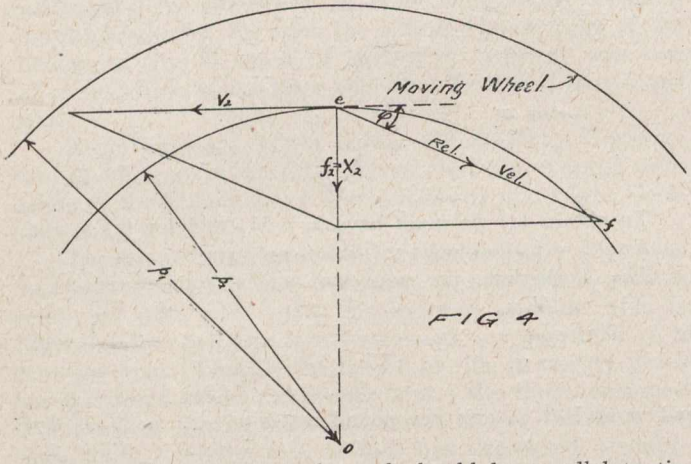
A very common value is $f_1 = 0.12 \sqrt{2gH}$ $f_1 = f_2 = X_2 \sin \beta$, and since for maximum efficiency $\mu_2 = o = X_2 \cos \beta$.

therefore, $\beta = 90°$.

Therefore, $f_1 = f_2 = X_2$ and X_2 is obtained.

The inclination of vane to tangents to wheel at entrance and exit are obtained as follows:—

Draw V_1 to scale tangential to rim of wheel at entrance at any point, and X_1 to scale parallel to jet at same point. Complete the parallelogram. Then c d = velocity water



relative to the vane to scale; c d should be parallel to tip of vane at entrance. (See Fig. 3.)

At exit, since $f_2 = X_2$ and $\beta = 90°$, the absolute velocity of the water is radial. Draw V_2 to scale tangential to rim of wheel at exit at any point, and $f_2 = X_2$ radially to scale, and complete the parallelogram. Then e f is the relative velocity of water and vane.

$$\frac{f_2}{V_2} = \tan \phi = \frac{X_2}{V_2}$$

and ϕ is the angle the vane makes with tangent to circumference of wheel at exit; i.e., e f is parallel to tip of vane at exit. (See Fig. 4.)

It should be noted that

$$A_1 = (2 \pi p_1 - n t)\ b_1$$

and $A_2 = (2 \pi p_2 - n t)\ b_2$;

and since $A_1 = A_2$,

$$\text{Therefore, } b_2 = \frac{2 \pi p_1 - n t}{2 \pi p_2 - n t} \times b_1 \quad \ldots\ldots (9)$$

Thus giving b_2.

Again, if N = revolutions per second,

Then $2 \pi p_1 N = V_1 = \mu_1$ ..... (10)

and $2 \pi p_2 N = V_2$ ..... (11)

Where n = number of vanes

and q = pitch,

then $q = \frac{2 \pi p_1}{n}$ at entrance

and $\frac{2 \pi p_2}{n}$ at exit..... (12)

The above is by no means intended to cover all the ground involved in designing a radial inward-flow turbine, but just to indicate the methods usually employed. The assumptions made at starting often have to be altered as the work proceeds, and the formulæ recalculated, in order to obtain the maximum efficiency. The other dimensions can afterwards be obtained by the usual rules of Machine Design.

UTILIZING PRODUCER GAS FOR HEATING

The application of producer gas to power plants is of such widespread interest that the United States Geological Survey has devoted several years to the investigation of the values of various kinds of coal as gas producer fuels. The results of this work appear in Bulletin No. 416. In a series of ten tests conducted at Norfolk, Va., the average amount of coal per brake horse power per hour was .92 pound and varied from .80 to .98.

These figures may very properly be compared with others published in the same bulletin: Mr. Stott, Superintendent of Motive Power, of the Interborough Rapid Transit Company, New York City, is therein quoted as saying that but 10.3 per cent. of the energy in fuel is utilized as electrical energy in the Interborough power house. He also presents in his paper before the American Institute of Electrical Engineers, 1906, a table showing the thermal efficiency of producer gas plants, concerning which he says: "The following heat balance is believed to represent the best results obtained in Europe and the United States in the formation and utilization of producer gas;" and in this table shows that 24 per cent. of the energy of the coal is converted into electrical energy. Mr. Stott's figures seem to show that 24 per cent. for the best producer gas plants should be compared with 10.3 per cent. for large steam plants.

In the tests conducted at St. Louis by the Government on smaller apparatus, and apparatus of the ordinary type, the amount of heat converted into electrical energy is much smaller, being only 4.86 per cent. for steam power and 13.5 per cent., or nearly three times as much, for gas power. The evidence seems to be so overwhelmingly in favor of producer gas as a power plant fuel that the question naturally arises as to why it is not more generally used. The difficulty encountered in the elimination of tar from producer gas made from bituminous coal, has first of all been a serious handicap for a large part of the country.

Another difficulty is the heating of factories. Practically all factories are steam heated, a condition which results from or leads to the use of steam for power also. Doubtless large numbers of small industries would use gas producers were it not for the heating problem. But this problem has recently been solved by the introduction of an "aertube heater" in which producer gas is used to advantage. In this apparatus manufactured by the Harrison Engineering Company, of New York City, the heat from the gas is transferred direct to the air which is forced through the tubes by means of a fan and is then distributed to the various parts of the building by means of ducts and flues. The direct transfer of heat eliminates all steam apparatus, and makes a licensed fireman unnecessary. It may obviously be used to advantage where gas engines are employed for producing power.

NEW INCORPORATIONS

Brantford, Ont.—Crown Electrical Manufacturing Co. of Brantford, $200,000; W. D. Schultz, J. S. Dowling, J. H. Ham. Thorntons, $100,000; E. C. Thornton, Woodstock; E. E. Thornton, Hamilton; P. S. Thornton, Brantford.

British Columbia.—H. H. Clarke Company, $50,000. Malahat Tug Company, $25,000.

Hartland, N.B.—Hartland Cement Block Co., $5,000; L. DeC. MacIntosh, A. D. Kennedy, A. G. Baker, Brighton.

THE

Sanitary Review

SEWERAGE, SEWAGE DISPOSAL, WATER SUPPLY AND WATER PURIFICATION

SOME EXTRACTS FROM AND NOTES UPON A RECENT REPORT ON THE PURIFICATION OF THE WATER SUPPLY OF SACRAMENTO.

Professor Hyde, who had charge of the construction and design of the now famous municipal filtration plant at Harrisburg, Pa., has recently reported in favor of treating the Sacramento River water by similar treatment, viz., rapid mechanical filtration, preceded by sulphate of alumina coagulation, and followed by disinfection by the use of calcium hypochlorite.

We take the liberty of quoting a few extracts from Prof. Hyde's report, which should be of interest to the readers of the "Review":—

"No source of supply should be favorably considered which cannot be readily made to yield at least 20,000,000 gallons at the first stage of development, 60,000,000 gallons, if necessary, in 1950, and ultimately a very large quantity—say, 100 or 200 million gallons."

The above amounts are per diem.

The question of quantity rather than quality appears to have been the ruling factor in determining the source of supply in this particular instance. It is practically taken for granted that, no matter what the quality may be in the raw state, as long as the quantity is sufficient to meet future wants the eventual quality can be guaranteed by the adoption of purification methods. Hence, a ground water supply from territory south-east of the city is ignored, although such a source is estimated at probably 20 million gallons per day.

The adoption of a "quantity basis" as the ruling factor in determining a water supply with reference to future needs estimated at forty years hence is sound civic economic policy. The presence of sediment, color, organic matter, bacteria, etc., in the water provide conditions which are now easily overcome, and are only of secondary importance as compared with quantity. Quoting again:—

"A filtered and sterilized water supply from the Sacramento River above the city would be the safest and most satisfactory source of supply. Such a supply can be made continuously perfectly clear, exceptionally soft, and wholly free from all disease-producing and other bacteria.

"The water of the Sacramento River is never really clear, and during considerable portions of the year it carries very excessive quantities of silt and clay.

"A percentage of mud or clay in the Sacramento River is composed of particles so extremely minute that they will remain suspended in the water for an almost indefinite period.

"The water is contaminated with sewage and other wastes of human existence and contains relatively large numbers of bacteria, including at times the germs of disease, particularly of such intestinal diseases as typhoid fever, dysentery and diarrhœa.

"A careful investigation of the vital statistics of Sacramento has shown that the city is constantly paying a heavy and burdensome tribute to the so-called "water-borne" diseases.

"The supply of water, however, which may be derived from the Sacramento River is inexhaustible, as far as the needs and rights of the city are concerned."

Among the modern requirements for a water supply Hyde notes as follows:—

"The supply must be abundant and unfailing.

"The water must be free from pathogenic germs.

"The water must be free from those allied organic forms which may not as yet be recognized as accompanying disease, but which may, nevertheless, not be conducive to health.

"The water must be uniformly clear and free from turbidity, both that which may be produced by suspended mineral matters, and also that which may be due to suspended organic impurities.

"The water must not be discolored.

"The water must at all times be free from tastes and odors."

It must be acknowledged that the requirements outlined above are decidedly rigorous, and represent the most advanced ideas of the present time. If a given water supply can fulfil them and at the same time be obtained at an at all rational cost, it would seem that real perfection, judged by highest present-day and probable future conceptions and standards, will have been obtained.

Just how Hyde is going to guarantee to produce this ideal water from the above-described Sacramento River is interesting and instructive.

For river waters subject to high degrees of turbidity he favors rapid mechanical filters rather than slow sand filters.

"The slow sand filter is primarily well adapted to the treatment of polluted waters which are relatively clear. The rapid sand filter is especially adapted to polluted turbid waters.

"It is the silt-bearing and not the bacteriological character of a stream which determines the type of filtration works.

"The general conditions of the Far West are much more favorable to rapid sand than to slow sand filtration.

"The Sacramento River is an exceedingly turbid stream, subject to wide fluctuations in its content of suspended matter. All of the conditions to be met by any filter plant installed for the supply of this city have been most carefully considered by the writer. The results of this investigation have been that rapid sand filtration is recommended, coupled with grit removal, coagulated subsidence and sterilization (to remove the last traces of bacterial life.)"

The conditions described relative to the Sacramento River have general application to many of our Canadian rivers, especially in the West, and the conclusion in favor of rapid filtration is in accordance with the opinion often expressed in these columns—an opinion which has also been greatly strengthened by the fact that rapid filters are much more easily protected from frost than the slow sand type because of the comparative small space occupied by the former.

"Properly designed, constructed and operated, rapid sand filters, under the conditions of preliminary treatment proposed for Sacramento, will without question produce a water absolutely and continuously free from all turbidity, and not only clear, but actually very sparkling and brilliant . . . and the supply so obtained will approach the ideal as nearly as it is possible to have any supply, when judged by the rigorous requirements which have been set forth"; and that "the adoption of sterilization as a finishing touch, so to speak, will produce a supply which will be peerless among the water supplies of the world."

In support of the efficiency of rapid filtration on river water, Hyde gives the average bacterial removal percentages at the Harrisburg plant as follows: In 1906, 99.24 per cent.; in 1907, 99.59 per cent.; in 1908, 99.62 per cent.; in 1909, 99.68 per cent. Daily maximum efficiencies have shown the water to be practically sterile. The average number of bacteria remaining in the filtered water each year were, respectively, 94, 44, 19 and 17 per c.c., while the average number of bacteria in the unfiltered water were, respectively, 12,400, 10,700, 4,900 and 5,800 per c.c.

The writer states generally: "The fact that about four million people in the United States are now supplied with water purified by rapid sand filtration shows that this scheme is thoroughly practicable, and far removed from the experimental stage. Indeed, no better criterion of the benefit due to water purification can be had than the splendid results with respect to the improvement of the public health which have been achieved in the cities where this type of filtration has been adopted. The vital statistics of these communities indicate very clearly a remarkable decrease in the prevalence of typhoid fever and other "water-borne" diseases and an attendant almost phenomenal improvement in the public health. Recently compiled statistics of merit show that for every person saved from death by typhoid fever by an improved water supply, three other persons are saved from death due to other causes, many of which have probably never been thought to have any direct connection with the public water supply."

In dealing with the question of disinfection, the writer states that practical sterilization can be obtained with amounts of calcium hypochlorite varying from 0.6 to 2.5 parts per million, and with the Sacramento conditions 1.0 part per million, the estimated cost being seventeen cents per million gallons.

The full text of Prof. Hyde's report will be found in the California Journal of Technology for May, 1910, which can be obtained from the University of California.

SEWERAGE AND SEWAGE DISPOSAL WORKS, LICHFIELD.

By W. B. Chancellor, City Engineer.

The treating of the Lichfield sewage is one of some difficulty on account of the following reasons: The large amount of trade waste discharge; the brook receiving the effluent is dependent for its existence on the sewage farm during the summer months; the water in the brook is pounded up daily for power purposes, thereby converting sections of the brook into sedimentation tanks.

Lichfield was one of the first towns to adopt the continuous-flow filter. Two sets of precipitation tanks were constructed in 1899 of a total capacity of 244,650 gallons; two filters were also laid down, which latter have been added to from time to time until there are at the present time twelve in all of a superficial area of 4,712 square yards and a cubical content of 7,460 cubic yards. The depths of the filters vary from 4 ft. to 5 ft. 6 in. On account of the subsoil being of a stiff clay the filters have simply been placed in the open ground, without any brick lining or concrete bottom. It is questionable whether it would not have been an advantage to have constructed the bottoms in concrete, and so permit of the effluent being got rid of more expeditiously than is now the case. The media of the filters, with one exception, is of coal, the last two laid down being 4 ft. in depth and made up as follows: 1 ft. of 2 in. to 1 in. and 3 ft. of ½ in. to ¼ in. One filter was emptied in March, 1908, and refilled with slag, and was made up in the following manner: 6 in. of 2 in. to 1½ in., 9 in. of 1 in. to ½ in., and 3 ft. 3 in. of ¼ in. to ⅛ in. This filter has been continually worked ever since, and up to the present time shows no signs of deterioration or pooling. The top 15 in. of media on the coal filters, which catches the suspended and colloidal matters still remaining in the tank liquor, is gradually being replaced by granite or slag chippings, as it has been found that coal is somewhat inclined to disintegrate when exposed on the surface. The system of distribution is by means of fixed sprays. A better method is now being adopted by means of the Bryan jet.

The quantity of land available for purification purposes is twenty acres. Owing, however, to the subsoil being of a stiff clay it is utterly worthless for the treatment of sewage proper. During the last three years, however, a portion has been somewhat improved and lightened by the ploughing in of spent coal media, in addition to which suitable crops are grown to allow of storm water and dilute sewage being treated, without fear of injury either to the crops or to the brook water.

When the author took up office in 1907 the sewage was treated on chemical precipitation methods at an annual cost of £1,400, the precipitant being aluminoferric and milk of lime, about 72 tons of each being used per annum. The effluent discharged was generally of good quality, but it rapidly deteriorated when mixed with the brook water, with the result that a considerable quantity of flocculent matter and sewage fungus collected in the brook, especially between the months of October and March. The author urged his committee to allow him to conduct experiments with the view of ascertaining whether it would be practicable to treat the sewage upon more economical methods. Various experiments were tried, the results being laid before Drs. Bostock Hill and Geo. Reid, who agreed to the following additions and alterations being made at a cost of £500:—

Tanks.—The original humus tanks to be converted into detritus tanks and worked in duplicate. The first four precipitation tanks to be utilized as septic tanks, the remaining two being used for storm-water purposes. A Dortmund tank to be constructed for the further purification of the tank liquor. The somewhat large amount of tank accommodation has been found to be necessary owing to the flow of sewage varying between 240,000 and 720,000 gallons.

Summary of the Capacities of the Tanks.

	Gallons.	Dry-weather flow in hrs.
Detritus tanks	51,800	3.108
Septic tanks	172,500	10.35
Dortmund tank	90,000	5.4
	314,300	18.858

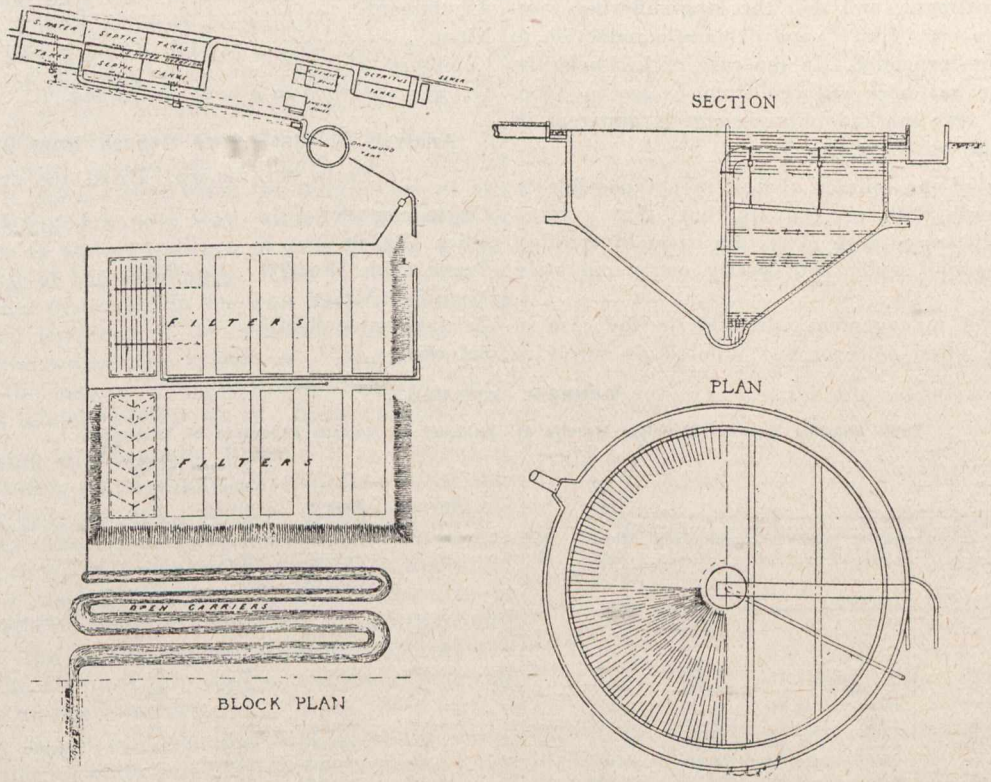
The dry-weather flow of sewage is at the rate of 400,000 gallons per twenty-four hours, or 45 gallons per head of the population. The high rate of flow is brought about by the three breweries in the city, all of which use a considerable quantity of water for refrigerator and temperature purposes. The system of treatment is on septic lines, with the exception of small quantities of precipitants being added when the sewage is of a particularly foul nature.

bears to the volume of the brook, a somewhat high standard of purification has been fixed, viz.: Organic ammonia, not exceeding 0.08 parts per 100,000; oxygen absorbed in four hours at 80 deg. F., 0.50 parts per 100,000; nitrogen in nitrates and nitrites, not less than 1.0 parts per 100,000.

Suspended Matter.—The standard fixed for suspended matter in the tank liquor is not exceeding 5 parts per 100,000.

Media.—The question of coarse or fine media is very debatable. When the first set of filters were laid down in Lichfield, in 1899, the finest coal slack was used, and with the exception of the top 15 in. of the filter the same material is still in use, and is in as good a condition as the day it was tipped into the beds.

Depth of Filters.—In the case of Lichfield the best results have been obtained with filters 5 ft. in depth.



Various Points Connected with the Treatment of Sewage.

It is now generally admitted that no hard and fast lines can be laid down for the treatment of sewage, but that every case must be treated entirely on its own merits.

Standard of Purification.—No standard of purification can be arbitrarily fixed without reference to local conditions. At Lichfield, owing to the proportion the volume of effluent

Treatment of Effluent.—The author has found, not only in Lichfield, but elsewhere, that effluent rapidly discharged by means of pipes into rivers and brooks not only carries along with it all suspended matter, but in addition flocculent matter is far more likely to collect and gather on the bottoms and sides of the river or brooks. In lieu of constructing intercepting or humus tanks the author has made a series of open carriers 10 ft. and 20 ft. wide of a total length of

TANK LIQUOR.

Table Showing General Chemical Results of Analyses by Various Processes of Treatment.

Date.	Total solids dried at 212° F.	Suspended Solids.	Solids in Solution.	Ammoniacal Nitrogen.	Albuminoid Nitrogen.	Nitric Nitrogen.	Oxygen absorbed in 4 hours at 80° F.	Rate of Flow at Time of taking Sample.	Percentage of Purification. Albuminoid Nitrogen.	Percentage of Purification. Oxygen absorbed.	Process of Treatment.
1908.											
May 11	65.7	9.16	56.54	0.833	0.166	0.120	1.148	596,322	71.28	75.53	Precipitation.
June 21	81.1	2.80	78.30	2.000	0.250	None	1.620	270,797	56.74	65.44	"
September 8	115.2	4.60	110.60	0.532	0.320	None	1.187	556,185	46.63	74.69	Septic.
October 6	109.4	9.90	99.50	2.500	0.250	None	3.996	404,948	56.79	14.77	"
November 11	92.5	8.10	84.40	2.020	0.348	None	2.665	404,948	39.75	43.16	Septic and Precipitation.
December 4	88.5	2.50	86.00	3.330	0.528	0.10	2.300	516,528	8.65	50.94	Small quantities of Alumino-ferric added to crude sewage.
1909.											
March 24	79.5	6.50	73.50	2.000	0.600	None	2.784	722,160	3.80	40.36	Precipitation (large quantity of Trade Waste present).

400 yards, which has not only prevented the growth of flocculent matter in the brook, but has, in addition, brought about further oxidation of the effluent.

Fish Pond.—Although it must be admitted that fish will in some cases live in water of inferior quality—one not sufficiently good to take as a standard of purification in the case of sewage effluents—yet at the same time there is no doubt that it is a distinct advantage to have a pond stocked with fish (not necessarily trout), and be able to say in the event of complaints being lodged as to cattle being affected by the water that "your fish are thriving and doing well." At Lichfield a small pond was put down last June, fed entirely by the effluent, and stocked with roach and perch, none of which up to the present time have been in any way affected by the water.

Annual Expenditure and Management.—There is no doubt that the high-water mark has been reached in the cost of sewage treatment, and that the long-suffering ratepayer is entitled to cry "Halt!" and demand a reduction in the very large sums expended. In the case of Lichfield the annual expenditure has been reduced from £1,400 to £960, and in addition a very marked improvement is apparent in the condition of the brook.

The author is of the opinion that it is not possible in all cases to dispense with precipitants, but that a large amount could be dispensed with in certain cases by treating the sewage partly on septic and partly on precipitation methods.

The question of management, although in the case of small installations, often more or less ignored, is surely of paramount importance. However well laid out any works may be, success cannot be attained without efficient management and constant supervision. At Lichfield it is not possible to keep a chemist at the works; but a few simple methods are adopted to endeavor to keep a systematic record as far as possible without going to any expense, such as taking samples of the effluent every three hours, gauging the flow of sewage, recording the filters or land under treatment, and the weather prevailing at the time.

Analysis of Crude Sewage. Mean Strength.

Parts per 100,000.

Total solids dried at 212 deg. F.	97.4
Suspended solids	27.44
Solids in solution	70.09
Ammoniacal nitrogen	2.38
Albuminoid	0.57
Nitric	None
Combined chlorine	8.7
Oxygen absorbed in 4 hours at 80 deg. F.	46.8

Analysis of Black Mud Deposit from Crude Sewage.

Parts per 100,000. Dried 100 deg. C.

Organic matter	44.44	per cent.
Silica (SiO_2)	49.150	" "
Ferric oxide (Fe_2O_3)	2.470	" "
Alumina (Al_2O_3)	1.470	" "
Calcium oxide (CoO)	2.250	" "
Sulphur	Trace.	

GENERAL EFFLUENT.

Table Showing General Chemical Results of Analyses by Various Processes of Treatment.

Date.	Total solids dried at 212° F.	Suspended Solids.	Solids in Solution.	Ammoniacal Nitrogen.	Albuminoid Nitrogen.	Nitric Nitrogen.	Oxygen absorbed in 4 hours at 80° F.	Rate of Flow at Time of taking Sample.	Percentage of Purification. Albuminoid Nitrogen.	Percentage of Purification. Oxygen absorbed.	Process of Treatment.
1907.											
May 16	55.00	.....	.....	0.500	0.061	0.950	0.395		89.44	91.57	Precipitation.
August 31	69.20	.....	.....	0.694	0.075	0.670	0.609	Gaugings	87.02	87.01	"
1908.											
January 23	70.10	.....	.....	0.350	0.093	0.500	0.492	taken.	83.91	89.50	"
March 18	67.70	.....	.....	0.833	0.062	0.400	0.470		89.27	89.90	"
May 11	50.10	4.12	45.98	0.416	0.063	1.250	0.477	596,322	89.10	89.82	"
June 21	75.80	2.68	73.12	0.363	0.043	1.192	0.530	270,797	92.56	88.69	"
September 8	98.68	1.12	97.56	0.540	0.087	0.740	0.400	556,185	84.94	91.45	Septic.
October 1	104.30	3.74	100.56	1.050	0.208	0.090	0.400	369,745	64.01	91.45	"
" 6	102.21	5.80	96.40	0.708	0.084	0.280	0.738	404,948	85.48	84.25	"
" 20	65.00	4.20	60.80	0.832	0.050	1.000	0.400	478,449	91.35	91.45	Septic and Precipitation.
November 11	89.00	5.84	83.16	0.744	0.083	0.800	0.753	404,948	85.64	83.93	" "
December 4	84.00	0.30	83.70	0.841	0.123	0.250	1.215	516,528	78.72	74.08	Small quantities of Alumino-ferric added to crude sewage.
" 16	60.80	3.82	56.98	0.780	0.086	0.500	0.747	369,745	85.12	84.06	Septic and Precipitation.
1909.											
January 7	85.50	4.08	81.42	0.500	0.117	4.000	0.900	596,332	79.75	80.80	" "
" 11	69.00	0.56	68.44	0.550	0.058	0.800	0.665	478,486	89.96	85.81	" "
February 17	86.00	1.60	84.40	0.833	0.102	1.100	1.035	369,746	82.35	78.05	" "
April 16	79.60	5.00	74.60	1.010	0.094	1.200	0.620	441,179	83.74	86.78	Precipitation (large quantity of Trade Waste present).
										86.82	" " "
May 4	83.40	5.00	78.40	0.200	0.035	1.250	0.625	369,746	93.95	85.67	Septic and Precipitation.
June 4	74.30	5.10	69.20	0.625	0.062	1.428	0.672	404,948	89.28	84.64	" "
August 12	73.00	2.60	70.40	0.833	0.080	1.000	0.710	370,430	86.16	85.05	" "
September 1	104.00	3.52	100.48	0.300	0.067	1.000	0.700	402,604	88.41		

PATENTS.

The following is a list of Canadian Patents granted on April 19, 1910, relating to Contractors' Appliances and Building Trades, and furnished by Fetherstonhaugh & Company. 5 Elgin Street, Ottawa, Canada, Russel S. Smart, Resident, from whom all information regarding same may be obtained.

125167—L. L. Knox, Ben Avon, Pa., Furnaces. Keystone Furnaces Construction Company.

125068—Frank D. Carney & Thos. T. McEntee, Steelton, Pa., Air and Gas Ports for Open-Hearth Furnaces. Keystone Furnace Construction Company.

125069—L. L. Knox, Ben Avon, Pa., & M. Murray, Wilkinsburg, Pa., Open-Hearth Furnaces. Keystone Furnace Construction Company.

125070—L. L. Knox, Ben Avon, Pa., & M. Murray, Wilkinsburg, Pa., Open-Hearth Furnaces. Keystone Furnace Construction Company.

125071—L. L. Knox, Ben Avon, Pa., Regenerative Reversing Furnaces. Keystone Furnace Construction Company.

125132—H. R. Harn, Minneapolis, Minn., Street Sweeping Machines.

125169—A. Skopinski, Jack Wade, Alaska, Means for Automatically Dumping Excavating Scrapers.

ELEMENTARY ELECTRICAL ENGINEERING.

L. W. Gill, M.Sc.

This series of articles will be continued for some months. They will be of particular interest to the student of electrical work and the civil engineer anxious to secure some knowledge of the simpler electrical problems.

Magnetic Hysteresis.—When a substance is magnetized in any particular direction, it follows from the theory above stated that its magnetism may be reversed by turning the molecules around. This may be done by reversing the direction of the magnetizing force which originally caused the molecules to point in one direction. For example, the iron bar referred to above may be reversed any number of times by simply reversing the direction of the magnetic field. The strength of the reversed field, however, must be sufficient to overcome the molecular forces which always oppose any change in the alignment of the molecules. To overcome these opposing forces a certain amount of energy must be expended, and this energy assumes the form of heat. As the molecular forces oppose **any** change in the molecular arrangement, it follows that **when the magnetism of any substance is changed in any way, either in direction or intensity, there is an expenditure of energy and a consequent heating of the substance.** This is the cause of much of the heat generated in the iron parts of electrical apparatus. The tendency of the molecules to resist any change of arrangement is known as "magnetic hysteresis," and the loss of energy, in the form of heat, because of this tendency is known as "hysteresis loss."

Transmission of Magnetic Force.—If a magnet is placed in a chamber made of any non-magnetic substance it will exert a force on any magnetic substance outside of the chamber, the same as if the chamber were not there. This proves that magnetic force is transmitted through all non-magnetic substances. If the chamber is made of magnetic material, the force will be only partially transmitted, or not at all, depending on the thickness of the walls of the chamber. A wall of magnetic material thus acts as a magnetic screen.

A magnet placed in a chamber will exert the same force on an external body when the air is removed from

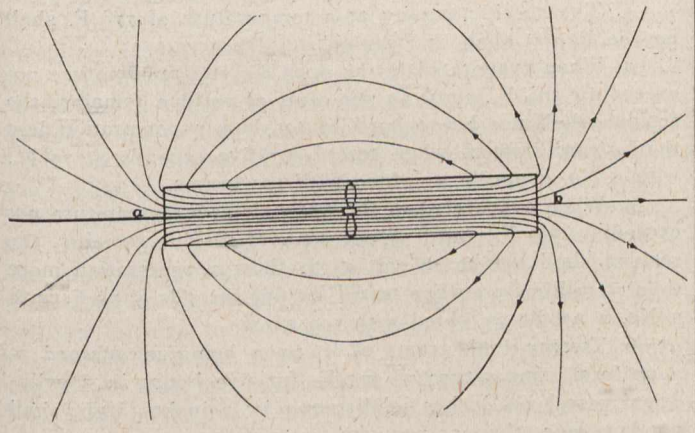


FIG. 17

the chamber as when the latter is open to the atmosphere. This indicates that the atmosphere takes no part in the transmission of the force, and brings up the question as to how the force is transmitted through space. The human mind cannot conceive a mechanical force being transmitted from one body to another without some intervening medium—some connecting link—because nothing of the kind has ever come within human experience, nothing even remotely analogous. But it has been shown that this force is transmitted across a space in which there is apparently no medium or connecting link. As this is beyond the human conception, the conclusion is reached that **there is a medium**, and that this medium pervades all space, moving with perfect freedom between and around the molecules of what is ordinarily recognized as matter. This medium, known as the "ether," serves to explain the transmission of light and magnetic force through a vacuum and many forms of matter. While very little is known about this medium at the present time, and there is no direct method of establishing its

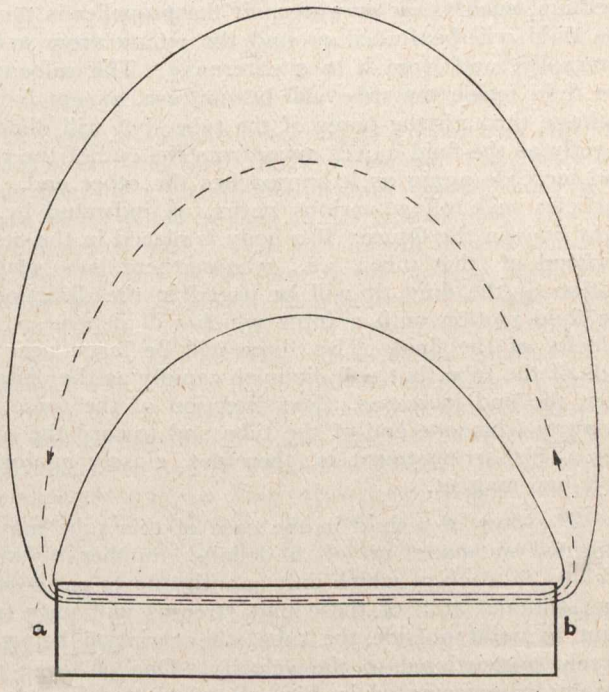


FIG. 18

existence, it offers a very satisfactory basis for the explanation of many phenomena.

Magnetic Flux.—It has been noted above that when a small two-pole magnet is suspended near a large magnet the north pole of the latter repels the north pole of the former and attracts the south pole. The north pole of the little magnet thus tends to move from the north to the south pole of the large magnet along a line of force (see Fig. 12), and the south pole tends to move in the opposite direction. If the axis of the small magnet is placed at right angles to the line of force and is free to turn in any direction, it will at once turn and point in the direction of the tangent to the line of force. The motion of the small magnet, by analogy, suggests the idea of a motion in the medium between the two magnets, for experience has taught us that when a body moves under the action of a mechanical force the medium which transmits the force always moves with the body. Assuming that the motion of the small magnet is caused by a motion of the transmitting medium, this motion, considering its effect upon the north pole of the little magnet, must be from the north pole to the south pole of the large magnet. The necessary complement to the above assumption is the idea of an **internal** motion or flow from the south to the north pole. Whether this hypothesis is correct or not, it serves to explain many

magnetic phenomena which cannot be easily explained in any other way. In any case it affords a basis on which the subject can be simply treated, and gives results which are in accord with experiment.

The above hypothesis, briefly stated, is that in connection with a magnet there is a flow of some medium around the circuit from north to south pole externally and from south to north pole internally. This circuit is referred to as the "magnetic circuit," and the quantity of flow around the circuit is known as the "magnetic flux."

To elucidate the above idea the mechanical analogy shown in Fig. 17 may be studied. A propeller, such as used to drive a steamboat, is placed in the centre of a porous tube **a b**, and the whole is surrounded by any fluid medium, such as air or water. If the propeller is turned, the fluid will be forced around the circuit from **a** to **b** internally, and from **b** to **a** externally. The velocity of the fluid inside the tube will be uniform, except for the leakage through the pores of the tube, but will diminish rapidly as the fluid moves away from the end of the tube, and increase again as it approaches the other end. The particles will follow various paths, as indicated by the light lines in the figure. If a body is placed in the neighborhood of this tube; i.e., where there is a sensible motion of the fluid, it will be urged in the direction of the fluid motion with a force which will depend on the velocity of the fluid. This force will be large near the ends of the tube, but will diminish rapidly as the distance from the end increases. The direction of the force will be away from one end of the tube and toward the other end. This arrangement is, therefore, closely analogous to a bar magnet.

The flow of a fluid in the case of this tube may be regarded as made up of a definite number of small streams, in each of which unit quantity flows per second. The sectional area of these unit streams will vary from point to point outside the tube, the variation being inversely proportional to the velocity. One of these unit streams is represented in Fig. 18. A dotted line drawn through its centre in the direction of flow may be conveniently taken to represent the stream, and such a line may be appropriately called a "stream line." If these lines are drawn to represent all the streams in one plane, the diagram will be identical with Fig. 17. Since the number of these stream lines per unit area, measured across the flow, will increase in proportion to the velocity, it follows that the force exerted on a body placed in the moving medium will depend on the number of stream lines per unit area.

In the case of the magnet there are streams or tubes of magnetic flux which may be conveniently represented by imaginary lines passing through the centre of each tube, as in the case of the tube. These lines are used merely as a symbolic representation of the magnetic flux, and are identical with "lines of force" as previously defined, except that there are an infinite number of the latter, while the number of the former is fixed by the number of streams of flux.

To deal quantitatively with these streams of flux some unit must be selected which will have some definite relation to the force exerted. The simplest unit is that which assumes one magnetic stream per unit area (sq. cm.) at a point where the force acting is one dyne. If the number of lines of force, instead of being infinite, is limited to those which represent the magnetic streams, there will be one line of force per unit area in unit magnetic field. From the above it follows that **at any point in a magnetic field the numerical value of strength of field, force exerted on unit pole, and lines of force per sq. cm. will be identical.**

SPECIFICATIONS FOR OILING ROADS IN NEW YORK STATE

Oil to be Applied at Air Temperature

The oil shall be delivered in barrels directly upon the work or in tank cars at some convenient railroad station near the work.

The road to be treated shall be carefully swept until it is thoroughly clean and no dust or foreign matter remains upon the surface. The greatest care should be exercised in doing this work not to displace the stone on the top course.

The oil shall be delivered on the road and applied cold.

The machine used in applying this oil shall be of such construction that the amount to be applied can be regulated and spread on the road in a thin sheet.

The apparatus for applying this oil shall be provided with a thin slot which can be opened to any desired width, or with holes of varying size and staggered so that the entire width of the strip will be covered at the same time.

The apparatus shall be provided with proper valves so that the flow can be regulated by the operator.

The amount to be applied shall be—gallons per sq. yd.

The oil shall be allowed to penetrate into the road for from three to five hours, depending upon the temperature and condition of the road treated.

For repair work after the oil has been applied, the ruts or any depressions shall be completely filled with ¾ stone or stone which will pass a 1½ inch ring and be retained on a ½ inch ring. This stone shall be tamped into the ruts thoroughly and allowed to absorb or become coated with oil in the depressions.

A good grade of fine gravel or screenings, from which the dust has been removed, shall be spread over the road to a depth of at least ½ inch. The road may then be thrown open to traffic.

The oil shall be of a heavy grade, fulfilling all the requirements enumerated below:—

1. It shall be free from water or decomposition products.

2. The various hydrocarbons composing it shall be present in homogenous solution, no oily or granular constituents being present.

3. The specific gravity at a temperature of 77° F. shall not be lighter than 22 Beaume.

4. When evaporated in the open air at a temperature not exceeding 500 F., until 65 per cent. of residue remains, the residue shall not be so hard as to show a penetration less than 10 millimeters when tested for five seconds at 77 F., with a No. 2 needle weighted with 100 grams.

5. When evaporated in the open air at a temperature not exceeding 500 F., until 55 per cent. of residue remains, the residue shall not be so soft as to show a penetration more than 10 millimeters when tested for five seconds at 77 F. with a No. 2 needle weighted with 100 grams.

6. Twenty (20) grams of it, upon being maintained at a uniform temperature of 325 F. for five hours in a cylindrical vessel 2½ inches in diameter by 2 inches high, shall not lose more than 15 per cent. in weight.

7. Twenty (20) grams of it, upon being maintained at a uniform temperature of 400 F. for five hours in a cylindrical vessel 2½ inches in diameter by 2 inches high, shall not lose more than 25 per cent. The character of the residue shall be smooth and nearly solid when cold, but not so hard that it may not be easily dented with the finer, and when soft it shall pull to a long, thin thread.

8. It shall be soluble in chemically pure carbon disulphide at air temperature to the extent of at least 99.5 per cent.

9. It shall be soluble in 76 Beaume petroleum naphtha air temperature, to the extent of not less than 75 per cent. and not more than 92 per cent. When 20 cc. of a naphtha solution obtained by treating one gram of the bituminous material with 100 cc. of cold naphtha is evaporated upon a glass plate, the residue shall be adhesive and sticky and not merely oily.

10. It shall not show more than 10 per cent. of fixed carbon.

11. It shall show a flashing point (N. Y. State closed oil tester) of more than 300 F.

12. It shall not contain more than 1.5 per cent. of paraffine scale, the Holde method of determining paraffine scale being used.

The oil was applied at the rate of from 3/10 to ½ gallon to the square yard and was covered after allowing for a period of three to four hours' penetration with from ½ to ¾ of an inch of screenings with the dust removed, ¾ inch stone, Lyon Mountain tailings or the best grade of gravel obtainable in that vicinity. Experience has demonstrated that it is very necessary to obtain a high grade of covering for the oil after this application. In many cases the gravel has not proved entirely satisfactory. The use of stone screenings with the dust removed and three-quarter-inch stone have given very satisfactory results. The material to be suitable for this purpose should be gritty. It is not essential that material should have any particular binding qualities. The success of the oil treatment depends largely upon the skill of the application. It is, of course, important to have first class materials, but the manner of application is also just as important. The use of asphaltic oil and cushion preserves the road form rapid deterioration and eliminates the dust nuisance.

The work throughout the State, which has been distributed in almost every county in the State, has been generally satisfactory and as a method of preserving macadam roads which have already been constucted and which are in comparatively good condition may be said to be a very successful treatment. Roads which would have been entirely destroyed by the end of the season are preserved and will go into the winter in good condition. The use of oil and covering is especially effective in preventing raveling. Many of the roads in the State of New York have been constructed with stone which has no special binding qualities and which have heretofore raveled badly during the hot months of the summer. A number of these roads were treated with asphaltic oil during the past summer and have given absolutely no trouble in this respect since the application. In most cases where the oil shown in the above analysis was applied, it was applied cold during the hot months. In some cases it was found necessary, especially in the fall of the year, to heat this oil. The oil was delivered in tank cars and pumped into oilers which were especially constructed for the purpose of distributing oil. A portion of road No. 241, running from Ballston Springs to Saratoga Springs in Saratoga county, was treated with this oil early in June. The remaining portion of the road was treated with a heavier oil, viz., New York State binder No. 1, and covered with gravel to a depth of about ¾ inch. Both portions of this highway have been subject to extremely heavy automobile traffic during the year and both sections were in exceptionally good condition this fall. While the portion covered by the heavy binder perhaps had little penetration, a surface coat was formed over the macadam which protected the roadway. The treatment with the heavier grade of asphaltic oil and covering is considerably more expensive than the treatment with the oil which can be applied cold. Time will demonstrate whether or not this form of repair work will or will not be the cheapest in the long run. One of the principal reasons for the selection of the treatment of the roads with a grade of oil which could be applied cold was the fact that this treatment was about the only treatment which would come within the appropriations available. It has been generally considered that the macadam surface to be treated should be absolutely dry. In a number of instances very good results have been obtained where the oil was applied when the road was damp, but not wet or muddy. (In some cases this condition occurred after rain; in one or two a sprinkler was used before the oil was applied). Greater penetration was obtained and less cover was needed and the final results were even better than many cases where the oil was applied to a dry surface. One of the most important points to be observed in this surface treatment or so-called painting method is that the surface should be swept as clean as possible. This can best be done by the use of a rotary horse sweeper.

The cost of this treatment varies greatly with cost and amount of material used, freight rates, etc. Experience has shown that for a sixteen-foot roadway approximately 3,700 gallons of oil should be used to the mile or about 4/10 gallons per square yard. This amount will depend somewhat upon the character of the stone in the roadway, some stone affording better penetration than others. The above figure of 3,700 gallons to the mile on a sixteen-foot roadway may be said to be a fair average. If an excess quantity of oil is used it will require more covering material, which will unite with the oil forming a thick cover which is inclined to rut and become sloppy in bad weather. The cost is also greatly increased and no advantage gained. It will require approximately 75 to 100 cubic vards of covering for the above application. The following may be considered an average estimate of the cost of the oil treatment upon one mile of sixteen-foot roadway.

3,700 gallons oil at 4c. F. O. B. station	$148.00
Applying 3,700 gallons of oil at 1½c. per gallon	55.00
100 cubic yards covering (gravel, screenings or three-quarter stone at $1.75 delivered on the road)	175.00
Sweeping	14.00
Sanding after oiling	30.00
Total	$422.00

This equals a cost of 4½c. per square yard.

The covering selected for this class of treatment should be of a gritty nature, free from dust. If gravel is used it should be of a superior quality, free from loam or dust. Gravels containing shale or slate should particularly be avoided.

REINFORCED CONCRETE TRESTLES.*

There are, on most roads traversing the Mississippi valley, a great many pile trestles in river bottoms, and over bayous or swamps, which may not be filled and which, if replaced with steel bridges on permanent supports, would be extremely expensive. The necessity for retaining the entire existing opening is, in many cases, perfectly obvious. In most of these cases there is no need for spans of great length, there being neither ice nor drift to catch upon supports placed closely together. For such bridges, having lengths from 100 feet to 1,000 feet or more, the writer has devised a reinforced

*From a paper read before the Western Society of Engineers on April 13th, by C. H. Cartlidge, bridge engineer, Chicago, Burlington & Quincy.

concrete construction, following the main features of the timber trestle.

The great economy of the pile trestle is largely due to the small amount of work necessary to be done in the field. There are no cofferdams, foundation pits, or falseworks, and little raw material has to be unloaded and cared for. All members are taken out and put in place, often largely by machinery, with a minimum of disturbance of the track and delay to traffic. A concrete structure embodying these features was built and tested, and after that had been completed a standard plan was drawn up, which plan is shown in Fig. 1.

This construction is suited only for shallow openings, and it is the writer's practice to limit the height of concrete pile trestles to 16 feet from ground line to base of rail. For greater heights it is his practice to substitute thin piers for

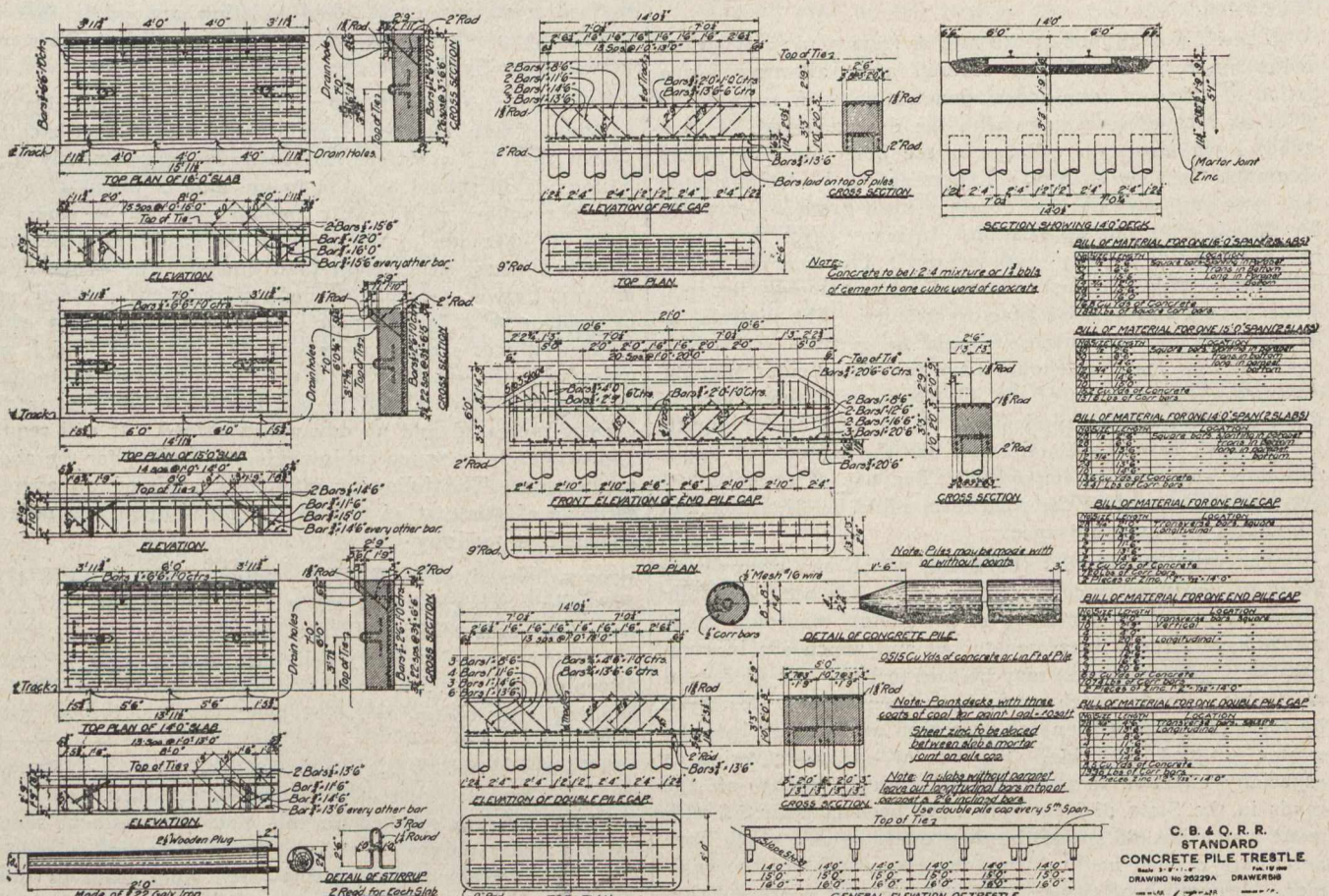


Fig. 1—Standard Concrete Trestle; Chicago, Burlington & Quincy.

the pile bents, although at considerably increased cost. In Fig. 2 is shown a view of the first trestle built, and experience in its construction led to some modifications in accordance with the standard plan of Fig. 1.

In the bridges so far built, concrete piles of two kinds have been used—one being molded in horizontal forms and the other made by rolling in a machine, under the Chenoweth patents. The molded piles were 16 in. sq. at the butt, had a 4-in. chamfer at each corner, a taper of 4-in. in 30 ft. on each face, and were pointed at the tip. The reinforcement was assembled on a mandrel and the spiral hooping wound around it by turning the mandrel. After the hooping was in place it was tied at frequent intervals with No. 16 soft wire, and the complete reinforcement was then withdrawn from the mandrel.

The forms were of wood, unlined and made so that the sides could be removed as soon as the concrete was firm; the pile was left on the bottom boards until hard enough to stand handling. The concrete, composed of one part of cement to four and one-half parts of gravel, mixed to a slushy consistency, was poured in. The gravel was generally screened so that all the sand and pebbles one-half inch in diameter or less were retained and used, the coarser aggregate being rejected. The piles were allowed to harden at least 30 days before being shipped. This seems to be about the least time which can be allowed, as attempts to ship and drive piles of less age have not been successful. More extended seasoning is often easily obtained and is to be preferred.

Rolled piles are made in a machine consisting essentially of a movable platform, a shaft or mandrel, and means for moving and turning the piles, together with rolls for holding them in line during fabrication. The piles, when fabricated, are stored in a seasoning yard and sprinkled frequently to assist the hardening of the concrete.

A somewhat incomplete comparison of the first year's costs of rolled and molded piling indicates that there is little difference in the cost of the two kinds. As the cost of making reinforcement for the molded piling was one of the principal items, it was decided to experiment with molded piling made without taper, the idea being to use a wire fabric, as reinforcement, which could be simply folded into a square and wired together at the lap, thus avoiding considerable labor. The cost of forms is also much reduced if they are not tapered. An efficient plant was designed, but in spite of the economy achieved no great difference in the cost has resulted, partly because of the difficulty of handling the square piles. On the whole, in the absence of definite comparative tests, the writer is inclined to favor the rolled pile. It is probable that

each form of pile will be found to have its own place and use.

As yet, no soil has been encountered in which wooden piles could be driven and in which it has not been possible to drive the concrete piles. It is necessary to lift the drop hammer somewhat more slowly for the concrete pile than for the wooden pile, in order not to set the driver in vibration. A cushion of some elastic material must be placed between the hammer and the pile, and with this precaution very little damage to the head of the pile results, even after long continued driving. It is surprising how much punishment a well seasoned pile will stand. When it is necessary to drive the pile below the leads, as is generally the case, the follower is placed on top of the cushion. As the loads on these piles are great it is necessary to drive them to refusal, so that accurate knowledge of the required length is necessary. In case it is found that the piles so driven do not reach the elevation called for on the plans, the depth of the cap is increased accordingly. If it is found impossible or impractical to drive the piles to the depth anticipated, they can be cut off without difficulty. The cut need not be a smooth one, as the casting of the cap will take care of all irregularities of the head of the pile. Should settlement occur in a finished bent, the strength of the cap is important, so that the loads may be equalized and even settlement result. Experience has shown that the design of Fig. 1 provides sufficient strength. Slight settlement has taken place in two bridges but without causing cracks or damage. As the settlement was doubtless due to the fact that the piles had not been driven to refusal, a mass of concrete was placed about each settled bent, extending from just below the ground line to about three feet below; the slabs were jacked up to grade and a layer of concrete was placed between them and the caps. This is shown in Fig. 3.

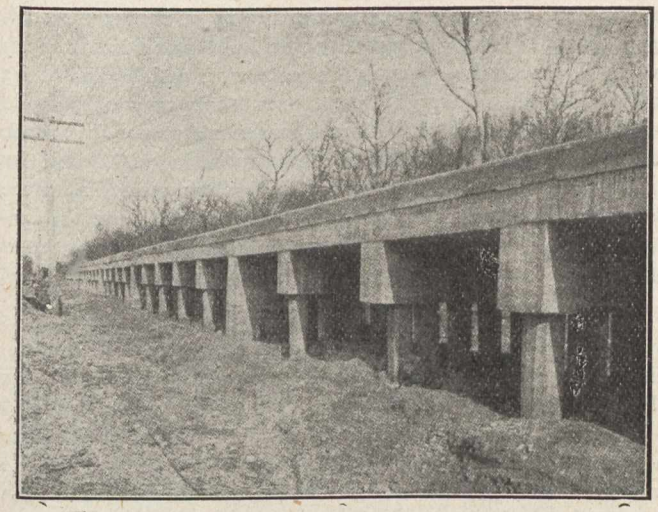


Fig. 2—Reinforced Concrete Pile Trestle.

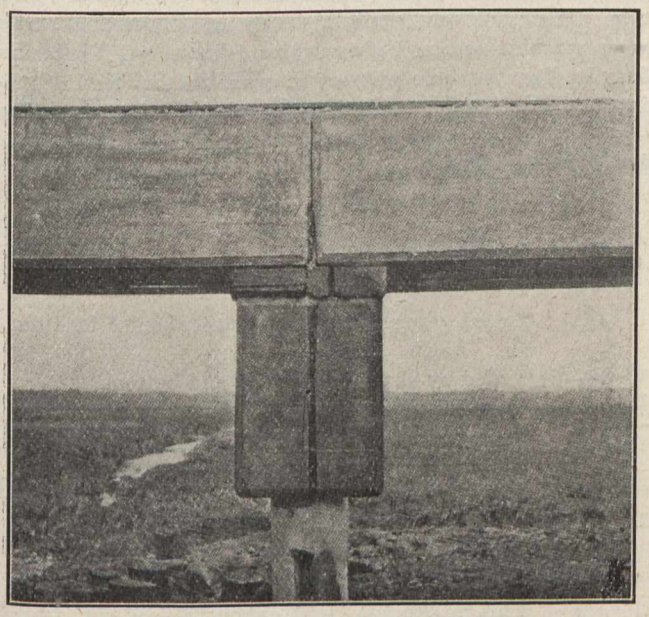


Fig 3—Concrete Girder Levelled Up After Settlement.

The manufacture of the floor slabs is best accomplished in a convenient yard, where advantage can be taken of economical methods. It is necessary to provide a firm, unyielding bed. The sides and ends of the forms are removable, and as one span consists of two slabs, a temporary partition is placed in each form to be removed after a half span has been completed. A layer of paper is placed against the slab and the remaining half is cast. Drainage holes are also cast along the dividing line.

By referring to Fig. 1 it will be seen that U-bolts or stirrups are set in the upper part of the slab to permit of its being easily handled. These are set at an angle so that there may be a direct pull when attached to a chain, obviating the necessity for a toggle-beam when lifting and placing the slabs.

After the slabs have remained in the forms for from two to four weeks, they are lifted by a locomotive crane and piled to one side until hard enough for service, the minimum time for seasoning being three months. When seasoned they are readily erected by the same crane, a mortar joint being placed between the bottom of the slab and the cap.

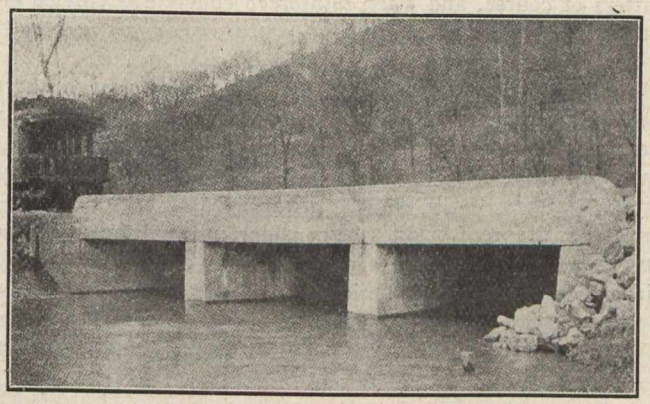


Fig. 4—Through Girder Concrete Trestle With Piers.

After being erected the slabs are painted on top with a waterproofing compound, and the joints over the caps are filled with a mastic of tar or asphalt and sand. It is better to fill these joints with such material than to allow them to fill with sand, as the former will admit of the slight expansion necessary. Thus far, the best material for waterproofing, with which experiments have been made on work under the direction of the writer, has been found to be a paint made of coal tar, Portland cement and kerosene. This compound not only covers the surface but sinks into and bonds with it, so that two or three coats are sometimes required. It is put on with paint brushes like ordinary paint. Another valuable attribute is its ability to adhere to moist or even wet concrete. Still another, and not its least recommendation, is its very low cost.

The double bents are designed to take up such longitudinal stresses as might be apt to place undue bending on the piling. As a matter of fact the stiffness and weight of the floor are such that it is somewhat questionable whether the double bents are necessary. It seems well to put them in, however, as an extra precaution.

With men experienced in this work, several bridges of lengths of from 80 to 250 feet have been built at a total cost of from $20 to $26 per lineal foot, and on lines carrying heavy traffic, while in one or two short bridges of two or three spans, the cost has been as high as $45 per foot. For estimating, a cost of $30 per lineal foot plus a constant of $300 will be ample for the design shown.

For bridges having a height above the ground line greater than 16 feet, a plan involving the use of thin piers is preferable. Photographs of such structures are shown in Figs. 4 and 5. The piers are heavily reinforced and are generally founded on wooden piles cut off five or six feet below the ground line. Because of the greater cost of these piers, it is generally economical to make the spans longer than 16 feet, spans of 18 to 25 feet being common. A great number of such bridges have been built and have so far developed no defects. When the spans are as long as 25 feet, however, it is impracticable to build the slabs in a plant away from the bridge, because of their great weight. In general, it has been found best to build them on false work adjoining their final position and jack them into position.

The writer wishes to lay especial stress upon the necessity for the use of the best materials and the most skilful labor on such work. The comparative novelty of reinforced concrete makes necessary a most efficient organization for the work, and the placing of all possible safeguards to insure its integrity. Such organizations and safeguards have been in effect in the case of steel construction for so long that they have become matters of course, and when reinforced concrete is carried on with similar care and scrupulous watchfulness, no fear need be felt as to its value as a material of construction.

It is possible under some specifications, to design short span steel bridges on concrete supports which will be as cheap as the designs described herein, but not, the writer believes, of equal strength to the bridges shown in these designs. Further, if the obvious advantages of ballasted, noncorrodible, fireproof bridges be considered, it will be seen that there is a prepondenance of good qualities on the side of the reinforced concrete construction.

Prof. Arthur N. Talbot (University of Illinois [by letter]): Concrete piles in foundations are usually placed in large groups and are so tied together by the structure itself that the individual responsibility of a single pile is much less than in a trestle. Concrete columns as frequently constructed are subject to possible variation in quality of concrete in different parts, giving opportunity for local weakness. Weak spots are especially apparent in a column which has to be driven as a pile. It might seem, then, that the concrete pile would be an element of weakness in a structure of this kind. To the writer the existence of weak spots in piles made by the rolling process seemed extremely probable, and, as there are others who may still hold this view, he presents the following tests of rolled concrete piles as having a bearing upon the strength and uniformity of this form of construction.

The rolled concrete piles were furnished for these tests by the American Concrete Company and were made at Racine, Wis., December 1st, 1908, at the plant which fabricated the piles used in a bridge foundation. The concrete was reported to be one part Universal Portland cement, two parts Torpedo sand and four parts broken stone, size 1 in. and less. The lengths ranged from 16 to 24 ft. The section was somewhat elliptical, but the average diameter was about 14 in.. The longitudinal reinforcement consisted of 5 or 6 half-inch square twisted steel bars spaced fairly uniformly and just within the light wire netting which surrounded the pile. There were several turns of No. 14 wire at intervals of about 16 in., which were for use in holding the concrete and netting in place after fabrication. It is seen that the steel reinforcement is light and will not give much additional strength. The piles were shipped to the laboratory when about two weeks old. They were fairly straight, with both ends square instead of having a point at one end. As is usual with this method, the irregular space at the end of the pile formed in the rolling process had been filled in with concrete at the time of fabrication. The tests were made in the 600,000-lb. vertical screw testing machine at the University of Illinois. A few hours before loading the pile was set in place in the testing machine and the ends were bedded in plaster of paris. The

Compression Tests of Rolled Concrete Piles.

Specimen.	Length, Ft. In.	Equivalent diam., ins.	Area, sq. in.	Maximum applied load, lbs.	Av. unit stress, lbs. pr. sq. in.	Age at test, mos.	Remarks.
1	24 4	14.4	163	280,000	1,720	4	Failed along a diagonal plane about 8 ft. from top.*
10	24 3	14.1	156	264,000	1,690	4½	Failed by shattering at top and bottom.
10A	19 9	14.1	156	401,000	2,570	12	This is No. 10, with the injured ends cut off.†
9	20 7	15.0	177	231,000	1,300	4	Shattered at top.
9A	19 3	15.0	177	350,000	1,980	12	This is No. 9, with the injured top cut off.‡
2	20 5	15.3	184	260,000	1,410	4	Failed at top by bulging and splitting. Wires broken at end.
7	20 3	14.4	163	271,000	1,660	4	Failed by shattering and splitting at top.
7A	17 0	14.4	163	319,000	1,960	4	This is No. 7, with about 3 ft. cut from top.§
7B	14 0	14.4	163	356,000	2,180	4½	This is No. 7A, with about 3 feet cut from bottom. Failed by splitting near top.
4	20 0	15.0	177	214,000	1,210	4½	Failed by shattering and splitting at bottom.
5	16 6	15.0	177	257,000	1,450	4	Failed by bulging and splitting at bottom. Long cracks extending 18-in. high.
8	16 6	14.8	172	176,000	1,020	4	Shattered at bottom.
3	16 6	14.1	156	279,000	1,790	4½	Top shattered.

*Many wires broke and long rods buckled at and near point of failure.

†Failed along diagonal plane about 3 feet from top.

‡Failed by shattering at bottom. (Original end.)

§Failed by shattering at bottom.

lower end rested on the bed of the testing machine. The load was transmitted to the top of the pile through a hemispherical bearing block. The results are given in the table.

As might have been expected, failure came generally at the ends, where the finishing of the pile by filling concrete into the irregular space between the folds of the wire netting leaves unfavorable conditions for strength. It is evident, then, that the failures at the end are not representative of the full strength of the pile. In the three cases where the failed end was cut off, the second test, 7A, 9A, and 10A, gave materially higher results, and where the second end was cut off, 7B, the test shows a still higher value and the pile broke near the end. The pile which broke away from the end, 10A, 3 feet from the top, gave a strength of 2,570 lbs. per square inch. One pile, No. 6, not given in the table, had been broken in

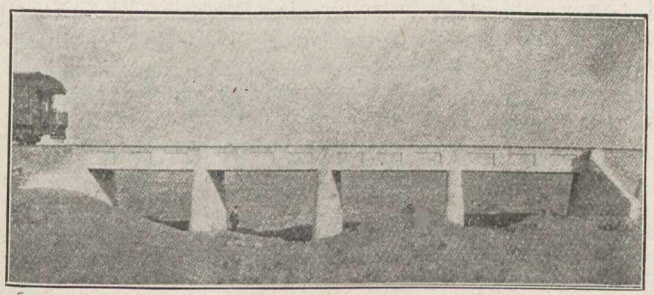


Fig. 5—Concrete Trestle with Piers over 16 Feet High.

three places in handling, but it carried a load of 156,000 lbs. and failed by shattering at the bottom of the concrete. It will be seen that the piles in which the original end had been removed carried high loads and that there was no indication of lack of uniformity of concrete throughout the length of the piece. In fact, the appearance of the concrete and the action of the piles during test were those of dense and uniform concrete. It would seem that the method of fabricating these under pressure gives the uniformity which is to be desired. So far as the possible weakness of the ends is concerned, it must be borne in mind that the lower point is in the ground and that with the type of construction described by Mr. Cartlidge the upper end may be cut off, or, at any rate, embedded in the concrete cap where it will be protected from lateral failure.

FACULTY OF APPLIED SCIENCE, TORONTO UNIVERSITY.

The results of the University of Toronto examinations in the Faculty of Applied Science and Engineering are announced as follows:—

Professional Degrees.

Mr. J. G. McMillan passed the examinations for the degree of mining engineer (M.E.).

Bachelor of Applied Science—The following candidates have passed the examinations for the degree of B.A.Sc. with honors; arranged in alphabetical order: R. M. Anderson, G. A. Bennett, G. E. Black, W. C. Blackwood, G. W. Coltham, H. A. Cooch, J. D. Cumming, F. A. Dallyn, A. G. Davis, W. A. Doods, C. B. Langmuir, A. E. Lennox, A. M. Petry, C. R. Redfern, L. T. Rutledge, C. E. Schwenger, H. W. Tate, W. E. Taylor, A. G. Trees, A. M. West, J. A. M. Williams.

Pass—W. H. Barry, E. Bartlett, W. D. Black, G. H. Bowen, C. E. Brown, T. W. Brown, E. W. Browne, J. Burns, M. G. Cameron, J. G. Collinson, W. H. Delahaye, W. P. Derham, S. L. Evans, F. S. Falconer, T. A. Fargey, A. T. Fergusson, O. L. Flanagan, C. Flint, T. E. Freeman, E. R. Frost, D. A. Graham, C. A. Grassie, G. E. D. Greene, W. W. Gunn, D. W. Harvey, A. E. Holmes, G. C. Hoshal, C. Hughes, A. E. Hunter, H. Irwin, J. Isbister, F. P. Jackes, E. W. James, C. C. Johnson, J. T. Johnston, J. B. O. Kemp, W. R. Key, H. N. Klotz, A. W. Lamont, P. J. McCuaig, V. McMillan, E. D. Macfarlane, N. W. Macpherson, N. H. Manning, A. B. Manson, C. A. Morris, G. Morton, F. V. Munro, C. G. Murphy, G. G. O'Hearn, C. J. Porter, F. L. Richardson, A. U. Sanderson, D. S. Stayner, S. Stroud, J. L. G. Stuart, R. G. Swan, J. W. R. Taylor, G. A. Tipper, C. G. Toms, W. G. Turnbull, A. Vatcher, J. A. Walker, C. E. Webb, O. T. G. Williamson.

The following must take supplemental examinations in subjects indicated before they are eligible for the degree: J. B. Ferguson and A. S. McArthur, strength of materials; J. Newton and J. E. Campbell, German; R. G. Wilkinson and B. A. Maclean, French; R. D. Beckstedt, C. R. McCollum and H. A. Ricker, thermodynamics; R. H. Cunningham, electricity; E. R. Birchard, thesis.

McGILL UNIVERSITY DEPARTMENT OF ENGINEERING.

The following were successful at the recent examinations held in the Department of Engineering, McGill University:—

Applied Science.

Robert Wilson Adrian (Me.), Goldie Fraser Anderson (Ci.), Max Stanfield Eaton Archibald (Mi.), Kenneth Roger Ayer, B.A. (Mi.), Thomas George Beagley (Me.), Victor St. Clair Blackett (Me.), George Kenric Boright, B.A. (Bishop's), (El.), Edmond Brégent (Mi.), Osburn Nicholson Brown (Mi.) James Stopford Lauder Brunton (Mi.), George Lewis Burland (Mi.), Alfred Sidney Buttenshaw (Me.), William Boyd Campbell (Ch.), Albert William Gardner Clark (Ry.), Joseph Harry Donavon Cloran (Ci.), Francis Thornton Cole (Ci.), Ashley Alexander Colter (Ci.), Eugene Pomeroy Cowles (Mi.), Arthur Thomas Noel Cowley (Ci.), John Raffles Cox (Mi.), Frederick Walter Dakin (Ci.), (in absentia), Charles Bruce Daubney (Ci.), James Edwin Daubney (Me.), Andrew Sidney Dawes (El.), Joseph Bertram deHart (Ci.), Thomas Clinton Dennis (Ci.), Donald Laird Derrom (Ry.), Arthur Alexander Dobson (Me.), Edward Douglas Donald (Me.), Kenneth William Dowie (Ar.), Robert Hart Bredon Elkins (Mi.), Douglas Marsden Ewart (Ci.), Tyrrell Ferrier (El.), Seymour Jost Fisher (Me.), Frank Scott Fowler (Mi.), John Henry Fregeau (El.), Gywnn Gilbert Gibbins (Mi.), Thomas Ernest Gilchrist (El.), Peter Clark Gill (El.), George Ackland Gillies (Mi.) (in absentia), Victor Lionel Gladman (Ar.), Arthur Simon Goodstone (Ci.), Harold Mitchell Graham (Me.), William Gordon Hanson (Ci.) (in absentia), Norman Charles Harris (Me.) (ægrotat), James Blake Hattie (Ci.), Alexander Gordon Haultain (Mi.), Richard Eyare Leslie Hollinsed (Me.), Donald Alphonse Jackson (El.), Leslie Gordon Jost, B.Sc. (Acadia), (Ci.), Frederick William Knewstubb (Ci.), George Hutton Kohl (El.), Wilfred Andrew Landry (El.), Gerald Bell Lomer (Me.), Ralph Evans MacAfee (El.), Archibald Alexander MacDiarmid (El.), James Harrison Macdonald (El.), Robert George Macfarlane (Mi.), Morris James McHenry (El.), Edward MacKay (Me.), Calvin Stowe McLean (Mi.), Lewis Grant McNab (Ry.), Andrew George L. McNaughton (El.), John Morrison Macrae (Me.), Charles Bolton Magrath (Me.), Francis Gibson Malloch (Ci.), Quintin Johnstone Maltby (Mi.), David Emilien Manny (Ci.), Victor Maitland Meek (Mi.), John Whyte Menzies (Ci.), Hugh Gordon Morison

(Mi.), Athos Maxwell Narraway (Ci.), Robert James Needham (El.), John Edward Openshaw (Ci.), Seabury Kains Pearce (Mi.), John Francis Watson Popham (Ry.), Gordon Douglas Powis (El.), Thomas Ernest Price (Ci.), Archibald Cumberland Reid (Ar.), Rupert Haddington Reid (El.), William Scott Robertson (Ci.), John Reginald Rutherford (Mi.), Alfred St. Clair Ryley (Ci.), Oswald Hayward Scott (Ci.), Harry Hutton Scovil (Ci.), Daniel Albert Shanks (El.), Alan Cradock Simpson, B.A. (Mi.), Reginald Victor Slavin (El.), Henry Slingsby (Ry.), Albert Wilmot Smith (Ci.), Stanley Macquana Sproule (Ci.), Robert Sam Stark (Ci.), Robert Bruce Stewart (Ci.), Horace R. F. Strong (Mi.), Samuel Sweetman (El.), John Newton Timberlake (Ry.), Alfred Saward Chenevix Trench (Ci.), Charles Henry vonPozer (Ci.), Harold Heard Vroom (El.), Francis George Maxwell Williams (Met.), Alexander Wilson (Me.), John Kirby Wyman (Ci.), Alexander Arthur Young (Ci.), Harry Robert Younger (Ci.).

Architecture.

Edward Stirling Blanchard, John Lyndhurst Kingston, James Cecil McDougall, Arthur James Carman Paine.

COST OF EXCAVATING 50,000 CUBIC YARDS OF SHALE IN RAILWAY CUT BY STEAM SHOVEL.

By F. C. Miles.*

The cut 70 ft. wide, 16½ ft. deep, and 600 yards long, is being dug for the new four-track line of the Nickel Plate Railway, and is located between Cornell Street and Cedar Avenue, in Cleveland, O. The excavation was done with a 75-ton steam shovel. Work was begun April 15th, 1909.

The level of the present single track is 18 ft. above the level of the four-track bed. To dump its burden into cars on the single track, the crane of the steam shovel must have a lift of nearly 20 ft. (allowing 4 ft. above the track to clear the dirt car). The crane, however, had a possible lift of but 18 ft. 6 ins. This circumstance necessitated digging a bed for the track of the dirt train 2 ft. below the level of the single track. Thus a mass of earth 2 ft. deep, 600 yards long, and 3 yards wide had to be excavated before the work on the cut proper could be commenced. This excavation consumed about three weeks.

The excavation of the main cut (600 yds. long, 70 ft. wide and 16½ ft. deep) began May 7th. Up to August 1st, 1909, over 50,000 cu. yds. had been dug and dumped, or two-thirds of the entire quantity to be disposed of. Between May 7th and August 1st there were 72 working days and in this time an average output of over 60 carloads daily is shown. Under normal conditions this average would be poor. But between Cornell Street and Cedar Avenue this showing is excellent considering the difficulties, of which there are three—(1) the disposing of the dirt, (2) the single track for the main line, (3) the character of the material excavated.

At present there are but two locations favorable for dumping the dirt—north of Euclid Avenue, some half a mile off, and near the Broadway Station, which is several miles distant. Up to July 24th, Euclid Avenue was available, but speed in unloading was impossible, due to difficulty No. 2 (explained later). Now the single dirt train must go to Broadway, dump and return while the shovel is idle. The single track for the main line allows the use of but one dirt train. Freights are scheduled every half hour or less, and thus if two dirt trains were in commission, while one was being loaded on its own track, the other, compelled to dump on the track of the main line, would hold up both freight and passenger traffic.

The material excavated at this cut between Cornell Street and Cedar Avenue contributed another stumbling block. Two-thirds of the excavating is hard Cuyahoga shale, while the upper layers of earth are well mixed with large boulders. When loosened, these boulders roll beneath the shovel, and the gang of laborers is constantly employed shoving them within reach of the dipper.

The rate at which the work is proceeding now will probably remain the same, allowing the 80,000 cubic yard excavation to be completed about October 1st.

This cut from Cornell Street to Cedar Avenue is the heaviest digging to be done in connection with the grade elimination by the Nickel Plate at Cleveland for its four-track road. Nearly 1½ miles more grading is necessary, but the work will be far easier and the facilities better. The whole grading job from 93rd Street East to Euclid Avenue is hoped to be finished in two years. Fifteen bridges will eliminate grade crossings.

The cost of digging and dumping the excavation of 50,000 cubic yards may be estimated as follows:—

Steam shovel engineer, 72 days at $5	$360
Steam shovel craneman, 72 days at $3	216
Steam shovel fireman, 72 days at $2	144
Steam shovel watchman, 72 nights at $2	144
6 laborers: 72 days at $9 per day	648
1 switch-engine engineer, 72 days at $3	216
1 switch-engine fireman, 72 days at $2	144
1 "ploughman" for unloading, 72 days at $2	144
450 tons of coal at $1.20 a ton	540
Total	$2,496

The time for excavating dirt train track was 18 days additional; 72 days ÷ 18 days = 4. Hence dirt train track excavating took ¼ as much time as main cut and cost ¼ as much.

Dirt train track (¼ × 2,496)	$624
Steam shovel rent for 90 days at $15 per day	1,350
Repairs, $2.50 per day for 90 days	225
Grand total cost	$4,695

The cost per cubic yard (reckoning 50,000 cubic yards dug) is 10 3-5 cents.

*In the Engineering-Contracting of Chicago, Ill.

COST OF CEMENT WALKS AND CURBS.

The report of A. F. Macallum, C.E., city engineer, Hamilton, Ont., gives interesting information in reference to cement walks and curbs.

In 1908 the average cost of cement curbs was 44.5 cents per lineal foot. In 1909 the average cost was 35.1 cents.

Cement walks were built in 1908 at a cost of 14.1 cents per square foot, and in 1909 the cost was 10.7 cents.

ASPHALT PAVEMENTS.

The average cost of asphalt pavements during 1909, in Hamilton, was 97.3 cents per square yard. The city paid for repairs to asphalt pavement at the rate of 95.5 cents per square yard.

ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

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

10451—April 28—Directing that within sixty days from the date of this Order the G.T.R. erect gates at Bourdage Street, St. Hyacinthe, Quebec.

10452—April 28—Directing that the C.P.R. put into proper condition the crossings through ranges of St. Mathieu South, St. Jean Baptiste North, St. Leon South, St. Leon North, St. Mathieu North, and St. Joseph.

10453—May 3—Directing that all passenger cars of the G.T.R. shall on or before June 1st, 1911, be equipped with marker sockets in the lower position, and where passenger cars are equipped with marker sockets in the lower position, markers shall be carried in such lower sockets.

10454—April 28—Dismissing application of the town of St. Louis, Quebec, for an Order authorizing the town to extend its highway across the C.P.R. track where said railway intersects Park Avenue, St. Louis, known as the Park Avenue Extension.

10455—April 28—Authorizing the town of St. Louis, Quebec, to extend its highway across the tracks of the C.P.R. where the railway intersects Park Avenue, St. Louis, by means of a subway.

10456—May 4—Approving location of the Vancouver, Fraser Valley and Southern Railway Company's line of railway from the east boundary of the city of Vancouver to the northwest boundary of the city of New Westminster.

10457—April 28—Directing the G.T.R. to construct an overhead bridge at the crossing of the Lachine Road at Rockfield, Quebec.

10458—May 3—Fixing the compensation to be paid by the C.P.R., the G.T.R., the city of Ottawa, and the County of Carleton, in connection with the Richmond Road viaduct, Ottawa, Ontario.

10459—May 4—Extending, until the first of June, 1910, the time within which the C.P.R. shall install an electric bell at Merry Street crossing, Magog, Quebec.

10460—April 28—Adding as parties in connection with the question of protection at the C.P.R. Crossings at Prud'homme Avenue and Decarie Avenue, the city of Montreal, and the Montreal Turnpike Trust.

10461—April 28—Directing the C.P.R. to continue a watchman at the crossing of Main Street, Farnham, Quebec.

10462—May 3—Directing that on or before June 1st, 1911, all electric railway companies under the jurisdiction of the Board, shall equip all rolling stock in use by them of thirty-seven (37) feet or over in length, or of 35,000 pounds or more, with power brakes, to be approved of by the Board, in addition to hand brakes and proper sending appliances. Immediately upon the completion of said equipment, the said railway companies shall notify the Board thereof and furnish a detailed account of the rolling stock so equipped.

10463—April 28—Directing that the C.N.Q.R. stop its trains both inbound and outbound at Pointe Aux Trembles, for the convenience of the public desiring to use the same.

10464—May 4—Amending Order No. 10285, April 21st, 1910, respecting highway crossings at Cote des Perrons, by the C.P.R., by inserting the following clause after paragraph 3 of the said Order: "And whereas, by 8-9 Edward VII., Chapter 32, an amendment to Section 275 of the Railway Act was made, of which the following forms a part."

10465—May 4—Directing that the G.T.R. within sixty days from date of Order install a "White" Signal Bell at crossing of Victoria Street, Thamesville, Ontario.

10466—April 28—Dismissing application of John Stuart Buchan, Montreal, for an Order or decree ordering the scale of assets of the Montreal Central Terminal Company.

10467—May 4—Extending until the First of June, 1910, the time within which the C.P.R. was directed to install an electric bell at the crossing at Lot No. 10, Con. 10, Township of Medonte, County of Simcoe, Ontario.

10468—May 4—Extending, until August 4th, 1910, the time within which the Branch Line of the G.T.R. to the premises of Wm. Knechtel & Son, Hanover, Ontario, shall be built.

10469-470—May 4—Authorizing the C.N.O.R. to construct its tracks across the public road between Lots 24 and 25, Concession A; between Lots 16 and 17, Concession A., Township of Haldimand, Ontario.

10471—May 4—Authorizing the C.N.O.R. to construct its line of railway across the public road between Lots 31 and 32, Concession 4, Township of Darlington, County Durham, Ontario.

10472 to 10476 Inc.—May 4—Authorizing the C.N.O.R. to construct its tracks across the public road between Lots 22 and 23, Concession A.; between Lots 34 and 35, Concession A.; between Lots 31 and 32, Concession A.; between Lots 4 and 5, Concession A.; between Lots 18 and 19, Concession A., all in the Township of Haldimand, Ont.

10477—May 4—Authorizing the C.P.R. to construct bridges at sixteen different points on its line of railway.

10478—May 3—Authorizing the C.P.R. to construct bridges at five different points on its line of railway.

10479—May 3—Authorizing the Bell Telephone Company of Canada to erect aerial wires across the track of the G.T.R. at public crossing ¾ mile east of Walkerville Station, Ontario.

10480 to 10486 Inc.—May 3—Authorizing the Farmers' Telephone Company of Windsor, N.B., to erect telephone wires across the track of the C.P.R. at seven different points.

10487—May 4—Authorizing the C.N.O.R. to construct its railway across the public road between Lots 16 and 17, Concession B., Township of Murray, County of Northumberland, Ontario.

10488—May 4—Authorizing the C.P.R. to construct a spur to the premises of the Crow's Nest Pass Coal Company, Limited, Kootenay District, B.C., being near Michel Station.

10489-490—May 6—Authorizing the C.N.O.R. to construct its railway across the public road between Lots 4 and 5, Concession A.; between Lots 18 and 19, Concession B., in the Township of Murray, County of Northumberland, Ontario.

10491—May 6—Authorizing the C.N.O.R. to construct its tracks across the public road on the Town Line between the Townships of Murray and Brighton, County of Northumberland, Province of Ontario.

10492—May 3—Dismissing application of the C.N.O.R. for approval of the location of its line of railway through the County of Lanark, Ontario, from mile 29 to mile 41.

10493—May 3—Dismissing application of the C.N.O.R. for authority to construct its railway across certain highways in the town of Smith's Falls, Ontario.

10494—May 3—Dismissing application of the C.N.O.R. for approval of the revised location of its railway through the town of Smith's Falls, from mile 38.3 to mile 42.1, and for authority to cross with its railway certain highways in the town of Smith's Falls.

10495—May 6—Authorizing the C.N.O.R. to construct its railway across the public road between Lots 12 and 13, Concession B., Township of Murray, County Northumberland, Ontario.

10496—April 28—Authorizing the municipality of the town of St. Lambert, Quebec, to construct a highway crossing at the intersection of Montreal and St. Lambert Terminal Development Company, Parish of St. Antoine de Longeuil, St. Lambert, Quebec.

10497—May 6—Authorizing the Nelson Telephone Company, Limited, to erect its telephone wires across the track of the G.T.R. at Ash Station.

10498—May 4—Authorizing the Manitoba Government Telephones to erect wires across the track of the C.N.R. at Stephenfield Station, Manitoba, to reach International Elevator Company.

10499—April 21—Authorizing the Seymour Power and Electric Company, Limited, to erect an electric transmission line across the track of the C.P.R. near Sulphide, Ontario.

10500-504 Inc.—May 6—Authorizing the Bell Telephone Company to erect wires across the tracks of various railways at five different points.

10505—May 6—Authorizing the Ruby Lake Lumber Company to erect electric light wires across the track of the C.N.R. Pas Mission Branch, near mileage 6.

10506—April 28—Authorizing the town of St. John's, Quebec, to open up the highway at Queen Street across the G.T.R., and requiring that the Railway Company install, within sixty days from the date of Order, a White Signal Bell at the crossing; also that the G.T.R., within 30 days from date of Order, file a plan showing the location of gates at St. James Street, in St. John's, Quebec.

10507—May 3—Directing that within sixty days from date of this Order the C.P.R. erect and maintain gates at the crossing of the railway near Matthews Pork Factory, Hull, Quebec.

10508—May 6—Directing that the G.T.R. shall install, within sixty days of the date of this Order, gates at the crossing of William Street, at Brockville, Ontario.

10509—April 21—Authorizing the C.N.O.R. to carry its tracks across Division Street, Cobourg, Ontario, and requiring that the G.T.R. shall construct a subway and approaches thereto to carry the said Division Street under its tracks and the tracks of the C.N.O.R.

10510—May 7—Ordering the Railway Company concerned in the crossing at the following point be relieved for the present from providing further protection at the crossing named, it appearing from an inspection made by the Board's Engineer and Operating Department, and from plans furnished, that the view at the crossing is excellent from both directions; that the crossing signboard is properly placed, and that there are whistling posts on the railway: G.T.R. crossing 1½ miles south of Hespeler, Ont.

10511—May 4—Amending Order No. 10036, dated March 31st, 1910, which authorizes J. A. Coleman to lay a gas pipe under the track of the M.C.R. at public highway at Montague Station, by striking out the words "not less than" in the second and third lines of paragraph 1 of the said Order, and substituting therefor the words "not greater than."

10512—May 6—Authorizing the C.P.R. to construct a bridge (No. 35.92) over the Alexandria River, on the White River Section of its line of railway.

10513—May 6—Authorizing the C.P.R. to construct Bridge No. 9.2 at the 4th crossing of Michel Creek on the Cranbrook Section of its line of railway.

10514—Approving revised location of the G.T.R. Company's branch line of railway from mile post 90 on said railway, from Colwell to Penetanguishene, and on the south half of Lot No. 13, in the Second Concession of the Township of Tiny, and extending northeasterly to point on the west half of Lot No. 92, First Concession of Township Tiny.

10515—May 4—Approving revised location of the G.T.R. Company's branch line of railway from a point on its line between Orillia and Midland, at or near Tiffin, and on Lot No. 16, in the 3rd Concession of the Township of Tay, and extending thence southwesterly through the Township of Tay, to a point on the west side of the road, between the east and west halves of Lot No. 92, 1st Concession Township Tiny.

10516—May 6—Authorizing the Toronto, Hamilton and Buffalo Railway Company to construct a branch line of railway to the premises of the Sawyer-Massey Company, Limited, Hamilton, Ontario.

10517—May 6—Authorizing the Bell Telephone Company to erect aerial wires across the track of the C.P.R. at public crossing one mile south of Guelph Station, Ont.

10518—May 9—Authorizing the Hydro-Electric Power Commission of Ontario to erect telephone wires across the tracks of the G.T.R. under the bridge at Lot 22, Concession 1, Township of West Flamboro.

10519—May 7—Authorizing the Montreal Light, Heat & Power Company to erect a nine-duct conduit under the track of the Lachine Canal Bank Siding of the G.T.R. at Cote St. Paul, Quebec.

10520—May 7—Authorizing the Montreal Light, Heat & Power Company to lay a gas main under the track of the G.T.R., Lachine Canal Bank Siding, connecting its Montreal Yard with the Canada Switch Co.

10521—May 6—Authorizing the corporation of the town of Renfrew, Ont., to lay a sewer under the track of the C.P.R. at Ann Street, Renfrew, Ont.

10522—April 27—Authorizing the C.P.R. to construct its tracks across 24 highways on its Weyburn to Lethbridge Branch, from mile 0 to mile 26.2.

10523-24—May 9—Directing that the C.P.R. install within sixty days from the date of this Order a White Signal Electric Bell at the crossing of Colborne Street and William Street, in the city of London, Ontario.

10525—May 9—Authorizing and approving of the proposed drainage works of the Township of Tilbury East across the lands of the C.P.R. as described in the report of J. J. Newman, C.E., dated August 14th, 1909.

10526—May 9—Authorizing the C.P.R. to construct bridge No. 91.7 over the Snake River on the Chalk River Section of its line of railway.

10527—March 1—Declaring that in the terms in the tariff of the Bell Telephone Company, on file with the Board, the Bell Telephone Company is entitled to compute the extra mileage and charge only from the city

(Continued on page 539).

ENGINEERING SOCIETIES.

CANADIAN SOCIETY OF CIVIL ENGINEERS.—413 Dorchester Street West, Montreal. President, Col. H. N. Ruttan; Secretary, Professor C. H. McLeod.

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

TORONTO BRANCH—

96 King Street West, Toronto. Chairman, A. W. Campbell; Secretary, P. Gillespie, Engineering Building, Toronto University, Toronto. Meets last Thursday of the month.

MANITOBA BRANCH—

Chairman, J. E. Schwitzer; Secretary, E. Brydone Jack. Meets first and third Fridays of each month, October to April, in University of Manitoba, Winnipeg.

VANCOUVER BRANCH—

Chairman, Geo. H. Webster; Secretary, H. K. Dutcher, 40-41 Flack Block, Vancouver. Meets in Engineering Department, University

OTTAWA BRANCH—

Chairman, W. J. Stewart, Ottawa; S. J. Chapleau, Resident Engineer's Office, Department of Public Works.

MUNICIPAL ASSOCIATIONS.

ONTARIO MUNICIPAL ASSOCIATION.—President, Mr. George Geddes, Mayor, St. Thomas, Ont.; Secretary-Treasurer, Mr. K. W. McKay, County Clerk, St. Thomas, Ontario.

UNION OF ALBERTA MUNICIPALITIES.—President, H. H. Gaetz, Red Deer, Alta.; Secretary-Treasurer, John T. Hall, Medicine Hat, Alta.

UNION OF NOVA SCOTIA MUNICIPALITIES.—President, Mr. A. E. McMahon, Warden, King's Co., Kentville, N.S.; Secretary, A. Roberts, Bridgewater, N.S.

UNION OF SASKATCHEWAN MUNICIPALITIES.—President, Mayor Hopkins, Saskatoon, Secretary, Mr. J. Kelso Hunter, City Clerk, Regina, Sask.

CANADIAN TECHNICAL SOCIETIES.

ALBERTA ASSOCIATION OF ARCHITECTS.—President, E. C. Hopkins, Edmonton; Secretary, H. M. Widdington, Strathcona, Alberta.

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

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

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

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

CANADIAN CEMENT AND CONCRETE ASSOCIATION.—President, Peter Gillespie, Toronto, Ont.; Vice-President, Gustave Kahn, Toronto; Secretary-Treasurer, R. E. W. Hagarty, 662 Euclid Ave., Toronto.

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

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

CANADIAN FORESTRY ASSOCIATION.—President, Thomas Southworth, Toronto; Secretary, James Lawler, 11 Queen's Park, Toronto.

CANADIAN MINING INSTITUTE.—Windsor Hotel, Montreal. President, Dr. Frank D. Adams, McGill University, Montreal; Secretary, H. Mortimer-Lamb, Montreal.

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

CANADIAN STREET RAILWAY ASSOCIATION.—President, D. McDonald, Manager, Montreal Street Railway; Secretary, Acton Burrows, 157 Bay Street, Toronto.

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

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

DOMINION LAND SURVEYORS.—President, Thos. Fawcett, Niagara Falls; Secretary-Treasurer, A. W. Ashton, Ottawa.

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

ENGINEERING SOCIETY, TORONTO UNIVERSITY.—President, A. D. Campbell; Corresponding Secretary, A. H. Munroe.

ENGINEER'S CLUB OF TORONTO.—96 King Street West. President, C. M. Canniff; Secretary, R. B. Wolsey. Meeting every Thursday evening during the fall and winter months.

INSTITUTION OF ELECTRICAL ENGINEERS.—President, Dr. G. Kapp; Secretary, P. F. Rowell, 92 Victoria Street, London, S.W.; Hon. Secretary-Treasurer for Canada, Lawford Grant, Power Building, Montreal, Que.

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

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

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

NOVA SCOTIA SOCIETY OF ENGINEERS, HALIFAX.—President, S. Fenn; Secretary, J. Lorne Allan, 15 Victoria Road, Halifax, N.S.

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

ONTARIO LAND SURVEYORS' ASSOCIATION.—President, H. W. Selby; Secretary, Killaly Gamble, 703 Temple Building, Toronto.

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

ROYAL ASTRONOMICAL SOCIETY.—President, Prof. Alfred T. de Lury, Toronto; Secretary, J. R. Collins, Toronto.

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

WESTERN CANADA RAILWAY CLUB.—President, Grant Hall; Secretary, W. H. Rosevear, 199 Chestnut Street, Winnipeg, Man. Second Monday, except June, July and August, at Winnipeg.

AMERICAN TECHNICAL SOCIETIES.

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

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

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION.—President, L. C. Fritch, Chief Engineer, Chicago G. W. Railway; Secretary, E. H. Fritch, 962-3 Monadnock Block, Chicago, Ill.

AMERICAN SOCIETY OF CIVIL ENGINEERS.—Secretary, C. W. Hunt, 220 West 57th Street, New York, N.Y. First and third Wednesday, except July and August, at New York.

AMERICAN SOCIETY OF ENGINEERING-CONTRACTORS.—President, George W. Jackson, contractor, Chicago; Secretary, Daniel J. Hauer, Park Row Building, New York.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—29 West 39th Street, New York. President, Jesse M. Smith; Secretary, Calvin W. Rice.

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

COMING MEETINGS.

CANADIAN ELECTRICAL ASSOCIATION.—July 6-7-8. Annual convention at Royal Muskoka Hotel, Muskoka Lakes, Ont. Secretary, T. S. Young, Confederation Life Building, Toronto, Ont.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION.—June 23-25. Annual meeting at Madison, Wis. Secretary, Henry H. Norris, Cornell University, Ithaca, N.Y.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.—June 27-30. Annual convention at Jefferson, N.H. Secretary, R. W. Pope, 33 West 39th St., New York City.

AMERICAN SOCIETY FOR TESTING MATERIALS.—June 28-July 2. Annual meeting at Atlantic City, N.J. Secretary, Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

THE ROYAL ARCHITECTURAL INSTITUTE OF CANADA.—August 24-27. Annual meeting at Winnipeg, Man. Alcide Chausse, Hon. Secretary, 5 Beaver Hall Square, Montreal, Que.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—May 31-June 3. Spring meeting at Atlantic City, N.J. Secretary, Calvin W. Rice, 29 West 39th St., New York City.

ENGINEERS' SOCIETY OF PENNSYLVANIA.—June 1-3. Annual convention at Harrisburg, Pa. Secretary, E. R. Dasher, Gilbert Bldg., Harrisburg, Pa.

MASTER CAR BUILDERS' ASSOCIATION.—June 15-17. Annual convention at Atlantic City, N.J. Secretary, Jos. W. Taylor, 390 Old Colony Bldg., Chicago, Ill.

AMERICAN FOUNDRYMEN'S ASSOCIATION.—June 7-9. Annual convention at Detroit, Mich. Secretary, Richard Moldenke, Watchung, N.J.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION.—June 20-22. Annual convention at Atlantic City, N.J. Secretary, Jos. W. Taylor, 390 Old Colony Bldg., Chicago, Ill.

AMERICAN SOCIETY OF CIVIL ENGINEERS.—June 21-24. Annual convention at Chicago, Ill. Secretary, Chas. W. Hunt, 220 West 57th St., New York City.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS.—June 22-24. Semi-annual meeting at Niagara Falls, N.Y. Secretary, J. C. Olsen, Polytechnic Institute, Brooklyn, N.Y.

CANADIAN GAS ASSOCIATION will meet at Hamilton, Ont., on June 9-10-11th. Secretary, Mr. A. W. Moore, Woodstock, Ont.

CANADIAN GAS EXHIBITORS will meet in the Alexandria Rink, Hamilton, Ont., June 6th to 11th. Secretary, A. W. Smith, 52 Adelaide Street East, Toronto.

TORONTO, CANADA, MAY 27, 1910.

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RAILWAY EARNINGS FOR PAST WEEK

Following are the only returns available at the time of going to press this week:—

Road	Wk. Ended	1910	Previous Week	1909
G. T. R.	May 14	$849,736	$822,937	$732,672
G. T. R.	" 21	851,044	849,736	751,983
C. N. R.	" 21	286,600	283,600	171,600
T. & N. O.	" 14	22,171	26,747	24,261
Halifax St.	" 14	3,499	3,521	3,261

MONTREAL STREET RAILWAY

April Net $104,787 Against $83,199 Year Ago; Seven Months $116,100 Increase.

The report of the Montreal Street Railway Company for the month of April and seven months ended April 30th, 1910 compares as follows:—

	1910	1909	1908	1907
April gross ...	$ 344,765	$ 294,374	$ 280,736	$ 274,635
Operating exp.	190,842	170,551	170,141	166 422
April net. ..	153,923	123,822	110,595	108,213
Chgs. and tax.	49,136	40,623	37,495	45,317
April surp..	104,787	83,199	72,100	62,896
7 mos. gross..	2,337,001	2,107,716	2,027,873	1,873,683
Operating exp.	1,407,826	1,320,135	1,316,007	1,240,079
7 mos. net.	929,175	787,581	711,866	633,604
Chgs. and tax.	264,114	238,666	224,109	284,196
7 mos. surp.	665,060	548,915	487,757	349,408

I.C.R. STATEMENT FOR 1909-10

The complete financial statement of the Intercolonial Railway for the fiscal year ending March 31st was issued last week.

The total revenue was $9,268,234.99 and the total operating expenditure $8,645,070.33, leaving a surplus of $623.164.66.

Included in the expenditure chargeable to revenue was $300,000 for renewal of equipment and $150,000 for rail renewal.

The expenditure on capital account totalled $1,278,409.45. Of the revenue two-thirds was from freight earnings and one-third from passenger, mail and express receipts.

C.N.R. EARNINGS

April gross, $1,153,100—An Increase of $411,900 Over 1909—Ten Months' Increase Over Two Millions.

The Canadian Northern Railway statement of earnings for April and ten months from July 1st follows:—

	1910	1909	Inc.
April Gross	$1,153,100	$741,200	$411,900
Expenses	821,900	517,300	304,600
April net	331,200	223,900	107,300
10 mos. gross	10,367,700	8,143,800	2,223,900
10 mos. expenses	7,402,200	5,763,800	1,638,400
10 mos. net	2,965,500	2,380,000	585,500

Mileage: 1910, 3,206; 1909, 3,094.

ONTARIO ELECTRIC RAILWAYS.

From week to week we propose to give, on our page devoted to transportation interests, particulars of the equipment, mileage, and other information regarding the railways of Canada, together with a list of the officials. This series of articles commenced in our issue of October 1st.

Previously given:—

Brantford and Hamilton Railway.
Chatham, Wallaceburg and Erie Railway.
Cornwall Street Railway.
Guelph Radial Railway.
Galt, Preston and Hespeler Railway.
London Street Railway.
International Transit Co., Sault Ste. Marie.
Kingston, Portsmouth & Cataraqui Elec. Ry., Kingston.
Toronto and York Radial Railway.
Windsor, Essex and Lake Shore Railway.
Ottawa Electric Railway.
Southwestern Traction Co., London.
Toronto Street Railway.
Niagara, St. Catharines and Toronto Railway.
Peterborough Radial Railway.
Berlin and Waterloo.
Sarnia St. Ry. Co.
Toronto Suburban St. Ry. Co.
Hamilton Street Railway.
Port Arthur and Fort William Electric Railway.

THE OSHAWA RAILWAY COMPANY.

President and General Manager, Mr. E. Walter Rathbun, Deseronto.
Purchasing Agents, The Rathbun Company.

Kind of Road:

Interurban, Suburban or Street Railway. Street Railway and Suburban.

Length of Road, in miles:

Single Track: Double Track.
Total in Single Miles, 8.83.

Character of Service:

Car Equipment No., 7.
Type, 2 open, 3 closed, 2 trailers.
Number of Motors, 10.
Power of Motors, 25 and 50 h.p.
Method of Controlling, thru s.s. 29 and k 11 Controller
Method of Braking, Hand.
Gauge of Track, Standard 4 ft., 8½ inches.
Weight of Rails, 60 lbs. to yard.

Power:

Direct Current, Direct.
Voltage of Transmission, 450 volts.
Trolley Voltage, same.
No. of Phases.
Current Collecting Devices.

ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

(Continued from Page 537).

limits of Ottawa as at present existing, in connection with complaint of Dr. J. T. Nelson, of Westborn, Ont.

10528—April 19—Dismissing application of the Canadian Lumbermen's Association in so far as it affects the rates of the railway companies on lumber for domestic uses, and directing that the C.P.R., G.T.R., and C.N.Q.R. companies publish and file tariffs effective not later than June 15th, 1910, showing rates on lumber to Montreal for export which in general shall be lower than the rates on lumber to Montreal for domestic uses.

10529—May 7—Directing that the time within which the inter-change track at the intersection of the lines of the C.P.R. with the lines of the G.T.R. at Brampton, was required by Order No. 9877, dated March 14th, 1010, to be constructed and ready for operation, be extended until the 1st of July, 1910.

10530—May 9—Approving plans of the proposed new station of the G.T.R. at Moose Creek, Ontario.

10531—May 7—Directing that the time within which the branch line of railway of Messrs. Davis and Doty, Oakville, Ont., as required by Order No. 10048, dated March 22, 1910, be removed, be extended for a period of six weeks from the 22nd of May, 1910.

10532—May 9—Authorizing the Hydro-Electric Power Commission of Ontario to erect its telephone and relay lines across the lines of the Bell Telephone Company at Lot 55, Concession 1, Township of Ancaster, County Wentworth, Ont.

10533 to 10535 Inc.—May 9—Authorizing the Bell Telephone Company to carry wires under the track of the G.T.R. at three different points in Ontario.

10536-537—May 9—Authorizing the Bell Telephone Company to erect its aerial wires across the track of G.T.R. at public roadway 1¼ miles north of Galt, and at public roadway 1½ miles south of Galt, Ontario.

10538—May 9—Authorizing Messrs. Stiver Brothers, of Stouffville, Ontario, to lay a four-inch drain across the lands and under the track of the G.T.R. at Stouffville, Ont.

10539—May 12—Approving revised location of the C.P.R. (Regina, Saskatoon and North Saskatchewan Branch), from a point in the south west quarter of Section 20, Township 17, R. 19, west 2nd Meridian, at mileage 0, to a point in Section 23, Township 20, R. 21, west 2nd Meridian, at mileage 21.9, Saskatchewan.

(Continued to Page 544).

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 informatinon may be had from the issues of the Canadian Engineer referred to.

Place of Work.	Tenders Close.	Issue of.	Page.
Ottawa, Ont., steel steamer	May 31.	Apr. 15.	367
Vancouver, B.C., garbage destructor plant	May 31.	Apr. 22.	50
Grimsby, Ont., High school	May 30.	Apr. 22.	398
Winnipeg, Man., railway bridge work	June 28.	May 6.	457
Ottawa, Ont., waterworks intake pipe	May 31.	May 13.	487
Colchester, Ont., extension to pier	June 3.	May 13.	487
St. John, N.B., sprinkler system	May 31.	May 13.	487
Regina, Sask., pavement	May 30.	May 20.	52
Regina, Sask., sewage disposal	June 6.	May 20.	52
St. John, N.B., paving	May 31.	May 20.	50
Fort William, Ont., concrete bridge	June 3.	May 20.	50
Regina, Sask., sidewalk	May 30.	May 20.	50
Toronto, Ont., pumping station	May 31.	May 20.	48
Girvin, Sask., telephone line	July 15.	May 20.	514
Cornwall, Ont., drain, culverts	May 31.	May 20.	514
Miscon, N.B., wharf extension	June 3.	May 20.	514
Florenceville, N.B., bridge	June 13.	May 20.	514

TENDERS.

Joggins, N.S.—Tenders will be received until June 10th for the construction of an extension to the breakwater. Napoleon Tessier, Secretary, Department Public Works, Ottawa, Ont.

Kingsport, N.S.—Tenders will be received until June 13th for the construction of an extension to pier. Napoleon Tessier, Secretary, Department Public Works, Ottawa, Ont.

Moncton, N.B.—Tenders will be received until May 28th for the construction of a sewer and catch-basins. J. Edington, City Engineer.

Angers, P.Q.—Tenders will be received until June 17th for the construction of a wharf. Napoleon Tessier, Secretary, Department Public Works.

Caughnawaga, Que.—Tenders will be received until June 1st for the erection of a two-storey brick veneer schoolhouse; also for a frame one-storey schoolhouse. J. D. McLean, Secretary, Department of Indian Affairs, Ottawa.

Fraserville, P.Q.—Tenders will be received until June 13th, for the construction of an armoury. Napoleon Tessier, Secretary, Department of Public Works, Ottawa.

Montreal Que.—Tenders will be received until June 2nd for the supply of about 4,000 tons of cast iron pipes. L. O. David, City Clerk.

Montreal, Que.—Tenders will be received until May 31st for the supply of 10,000 tons of fresh-mined, soft steam coal, run of mine, for the low level pumping station. L. O. David. City Clerk.

Montreal, Que.—Tenders will be received until June 6th for fittings, central post office. Napoleon Tessier, Secretary, Department of Public Works, Ottawa.

Maria, Que.—Tenders will be received until June 20th for the construction of an extension to the wharf. Napoleon Tessier, Secretary Department of Public Works, Ottawa.

Quebec, P.Q.—Tenders will be received until May 31st, for the supply of two thousand feet of cotton fire hose, lined with rubber, in lengths of fifty feet. Aug. Malouin, Secretary of Fire Committee.

Arnprior, Ont.—Tenders will be received until Monday, May 30th, for the erection of an addition to the High school. M. D. Graham, Secretary, Board of Education.

Castlemore P.O., Ont.—Tenders will be received until Monday, May 30th, for about 4,000 cubic yards of stone required for road improvements. J. G. Julian, Reeve of Toronto Gore Township.

Fort William, Ont.—Tenders will be received until June 3rd for sewer construction. H. S. Hancock, City Engineer. (Advertisement in The Canadian Engineer.)

Ottawa, Ont.—Tenders will be received until June 2nd, for asphalt block pavement. Newton J. Ker, City Engineer.

Ottawa, Ont.—Tenders will be received until May 28th for supplying and delivering the coal required for certain fog alarm stations in the Gulf of St. Lawrence, Strait of Belle Isle and Nova Scotia. C. J. Desbarats, Deputy Minister, Department of Marine and Fisheries.

Ottawa, Ont.—Tenders will be received until June 2nd for Mounted Police provisions and light supplies. Fred White, Controller of R.N.W.M. Police.

Ottawa, Ont.—Tenders will be received until June 14th for addition to the Eastern Departmental Building. Napoleon Tessier, Secretary, Department Public Works.

Orillia, Ont.—Tenders will be received until June 4th for the erection of a Public Library building. W. H. Croker, Architect.

Oshawa, Ont.—Tenders will be received until noon, Saturday, May 28th, for the construction of two reinforced concrete bridges of 32 and 22-foot spans. Hiram Gifford, Reeve, East Whitby, Cedardale, Oshawa; Bowman & Connor, Consulting Engineers, Toronto, Ont.

Peterborough, Ont.—Tenders will be received until May 30th, for the construction of additions and alterations to the Mount St. Joseph Convent. John E. Belcher, C.E., Diocesan Architect.

Port Arthur, Ont.—Tenders will be received until June 1st for fixtures for chemistry and physics room of the Collegiate Institute. J. W. Morgan, Secretary-treasurer, Board of Education.

Port Arthur, Ont.—Tenders will be received until May 28th, for clearing, ditching, grading and macadamizing. J. McTeigue, City Clerk.

Port Arthur, Ont.—Tenders will be received until May 28th, for excavating and re-filling a trench for sewer and water mains. J. McTeigue, City Clerk.

Port Colborne, Ont.—Tenders will be received until June 3rd for improvements on the Welland Canal at Port Colborne. L. K. Jones, Secretary, Department of Railways and Canals, Ottawa. (Advertisement in The Canadian Engineer.)

St. Thomas, Ont.—Tenders will be received until June 3rd for building a reinforced concrete culvert, also for grading, boulevarding and macadamizing. Jas. A. Bell, City Engineer.

Sault Ste. Marie, Ont.—Tenders will be received until June 20th for the construction of an extension to the Government wharf. Napoleon Tessier, Secretary, Dept. of Public Works, Ottawa.

Toronto, Ont.—Tenders will be received until May 31st for 2,500 tons of coarse screened coke. G. R. Geary (Mayor), Chairman Board of Control.

Toronto, Ont.—Tenders will be received until May 31st for the construction of asphalt pavements, concrete curbs, concrete walks, and sewers. G. R. Geary, (Mayor) Chairman, Board of Control.

Toronto, Ont.—Tenders will be received until May 28th for the delivery of coal. W. J. Hanna, Provincial Secretary, Parliament Buildings.

Weston, Ont.—Tenders will be received until June 2nd. for the construction of a reinforced concrete arch bridge of 119 ft. span, also tenders for grading and filling the ap-

proaches. Barber & Young, York County Engineers, Toronto, (Advertisement in the Canadian Engineer).

Rosser, Man.—Tenders will be received until May 28th for approximately 16,000 yards grading. W. H. Beachell, Secretary-treasurer.

Winnipeg, Man.—Tenders will be received until June 1st for the construction of granolithic walks, sewers and water mains. M. Peterson, secretary, Board of Control Office.

Strathcona, Alta.—The city of Strathcona will shortly require tenders on plank and concrete sidewalks and macadam highways. A. J. McLean, City Engineer.

Wainwright, Alta.—Tenders will be received until May 31st for building of a solid brick four-roomed school. H. V Fieldhouse, Secretary-treasurer.

Dalmeny, Sask.—Tenders will be received until May 28th for the erection of thirty-four miles of rural telephone lines and the installation of forty-four telephones and a switchboard. A. R. Friesen, secretary, the Dalmeny Rural Telephone Co., Limited.

Coquitlam, B.C.—Tenders will be received until June 6th for the construction of a transmission line for the purpose of furnishing electricity for the hospital. F. C. Gamble, Public Works Engineer, Department Public Works, Victoria, B.C.

Lytton, B.C.—Tenders will be received until June 1st for the erection of a lock-up and courtroom. F. C. Gamble, Public Works Engineer, Victoria, B.C.

Victoria, B.C.—Tenders will be received until June 6th for the erection of a brick house for engineer and pump station. J. C. Gamble, Public Works Engineer, Department Public Works.

CONTRACTS AWARDED.

Campbellton, N.B.—Council accepted the tender of S. D. Harriman to excavate for, and lay 500 feet of 4-inch water pipe on Government wharf. Contract price, $310.34. Pipes, specials and valves supplied by town cost $207.

Beith, Que.—For the construction of eight miles of macadamized road, O'Connor Bros., of Huntingdon, Que., have been awarded a contract by the municipality of Elgin at $2,975 a mile. Other bids were: Ross & Pregent, Beauharnois, $3,050 per mile, and J. C. Quinlan, Coteau du Lac, $2,946. The latter was received too late for consideration.

Montreal, Que.—For the trunk sewer to be laid from St. Lawrence Street to the Black River, eight tenders were received, the contract being given to L. Giguere & Co., whose offer of $115,655 was the lowest. The sum of $176,000 mentioned by W. Duquette, was the highest. M. Dinneen was the sucessful tenderer for No. 3 section of the Sherbrooke Street sewer, his figure being $43,730. The highest tender for this work was $49,082.50, made by L. Giguere, for No. 6 section on Sherbrooke Street, M. Dinneen was the only tenderer, but his figures of $90,660 were considered too high.

Amherstburg, Ont.—Contracts have been awarded as follows for the erection of an eight-roomed schoolhouse: Mason work, J. B. Wilson, $5,850; carpenter, V. Williamson, $5,419; heating, $2,169, etc

Berlin, Ont.—Pipe & Campbell were awarded a contract for the construction of a 35-foot concrete arch near New Dundee at $1,045. Other tenders were:—M. M. Hiles, $1,092; J. B. Lichty, $1,200; Walter Davies, $1,213; Fraser & Clemens, $1,283. For a concrete bridge floor near Ayr, the Hamilton Bridge Works Company secured the award at $387. Other tenders: Pipe & Campbell, $395; J. B. Lichty, $410; Walter Davies, $480; M. M. Hiles, $480. Herbert J. Bowman, County Clerk of Waterloo.

Humber Bay, Ont.—The Etobicoke Council awarded a contract for the four-foot sidewalk to be put down between the city limits and Mimico Creek, the lowest tender being accepted, that of Walter Buckhurst, of Toronto, at ten cents per square foot and 12c. for crossings. The highest tender was ten and half cents a foot and twenty cents for crossings.

North Toronto, Ont.—Tenders for 7,000 feet concrete sidewalk were as follows: Forcott Construction Co., 13½ cents a square foot; Royal Artificial Stone Co., of Guelph, Ont., 14 cents a square foot; Jennings & Johnson, Eglinton, 14 cents a square foot; J. Thompson, Toronto, 16½ cents a square foot. The contract was awarded to Jennings & Johnson, they being a local firm.

St. Thomas, Ont.—James Vincent was awarded the contract for the erection of the Union Pond bridge while the tender of Powles & Gunning was accepted for the Salt Creek bridge. Bids for concrete structures were as follows:—

	Union Pond.	Salt Creek.
Williams & Walker		$ 935
Powles & Gunning	$2,169	997
J. W. Chivers		1,100
Jas. Vincent	1,895	1,275
Jsa. Prew		1,225
C. C. Stafford	1,899	1,329
J. T. Leverton	3,100	.....

Southampton, Ont.—The Chippewa Lumber Company, were awarded the contract for the erection of a brick town hall here at $10,947.

Toronto, Ont.—The Board of Control referred to the engineer a tender for a heavy asphalt pavement for College Street from Manning Avenue to Dovercourt Road, for $27,000 from the Construction & Paving Company, and a tender for an asphalt block pavement from the Asphalt Block Paving Company for $42,000. Both are guaranteed for ten years.

Toronto, Ont.—The Provincial Government have awarded the contract for building the addition to the rear of Osgoode Hall to S. F. Whitham, Toronto and Brantford, the lowest tenderer. The contract comprises the whole work of construction and finishing with the exception of heating and plumbing. The contract price is $86,000. Fourteen bids were received.

Walkerville, Ont.—For the construction of concrete pavements the Cadwell Silex Stone Company received a contract, while the award for sewer construction was given to Thos. Chick. Tenders were as follows:—

Pavements

Cadwell Silex Stone Co., Windsor	$4,194
D. W. Mitchell, Niagara Falls	4,433
Thos. Chick, Windsor	4,856
David Todd & Co., Windsor	5,329

Sewers

Thos. Chick, Windsor	$7,107
John Corm, Windsor	7,287
G. W. Sewell, Windsor	7,466
Siemans Bros., Detroit	9,356

Brandon, Man.—C. H. Simpson & Co., of Winnipeg, have been awarded a contract for the construction of a $75,000 reinforced concrete building for Clement Bros.

Winnipeg, Man.—Frank Lee, division engineer of the C.P.R., has let the following contracts:—Ditching work between Fort William and Winnipeg to Jackson & Goldie of Winnipeg; construction of Stonewall station, E. J. McGreevy. Winnipeg; Fort William machine shop, W. H. Braden, Fort William; Yorkton station, T. E. Ames, Winnipeg.

Yorkton, Sask. — Conery & Mattaini of Guelph, Ont., were given the contract for the construction of cement sidewalks at 18 cents a foot.

Saskatoon, Sask. — Shannon Bros. & Cassidy, a local firm, were given the contract for the erection of a school building. Exclusive of plumbing, heating and ventilation, for which the contract was not let, tenders were:—

Shannon Bros. & Cassidy	$37,973
Saskatchewan Building & Construction Co., Regina	48,973
T. E. Farley, Saskatoon	41,700
Bigelow Bros., Saskatoon	38,000
Walter Bennett, Saskatoon	36,250

Calgary, Alta.—The contract for the extension of the Canadian Pacific Railway's company's irrigation system into the eastern section of the irrigation block, has been awarded to James McDonnell & Co., with whom are associated Winter, Boomer & Hughes, and Grant, Smith & Co., all of Spokane, Washington The work covers the removal of some 28,000,000 cubic yards in the construction of canals, and is one of the largest contracts which has been awarded in western Canada in recent years. The contract was let for $5,230,000 odd, about a quarter of a million under the company's estimate of cost. There is a time limit of five years for the completion of the work. The work will be started almost immediately. The completed system for the eastern section provides for the irrigation of some 540,000 acres. With a view to providing sufficient water for the irrigation

of the eastern section it will be necessary to construct an entirely new system, with dam, headgates, etc., located three miles southwest of Bassano, at a point generally known as the horseshoe bend of the Bow. The reservoir for the eastern section will be located southeast of Brooks, with storage capacity of 300,000 acre feet To allow the company's Calgary offices to keep in touch with the work being undertaken in the eastern section, it will be necessary to erect 369 miles of telephone lines

Calgary, Alta.—The contract for a twelve-room stone school building was awarded to the lowest tender, that of Peers & Macleod, for $98,000, while the plumbing, heating and ventilation went to a new Calgary firm, Messrs. Grant Bros. & Co., for $15,677. The following were the tenders received:

For the building—D. McDonald, $125,329; G. H. Archibald, $100,626; Groundwater & McFarlane, $99,504.60; Peers & McLeod, $98,000; L. R. Burn, $105,583; A. A. McPhail, $114,498.

For plumbing, heating and ventilation—E. J. Young, $16,011; E. L. Martin, $15,970.65; Wm. Head & Co., $16,716; and Grant Bros. & Co., $15,677.

North Vancouver, B.C.—This municipality recently awarded to the Canadian Pipe Co., Limited, a contract for 17,000 feet of wood pipe at $16,397.50.

Victoria, B.C.—Messrs. Hutcheson Bros. & Company, Limited, of Victoria, secured the contract for the supply and erection of a Volute sewage pump, electric motor and an automatic starter, at $885 each.

Middleton, Conn.—The Raymond Concrete Pile Co., of New York, has been awarded the contract for the complete foundations, including Raymond concrete piles, of the Middleton Electric Light Co.'s power house. Henry Floy, Engineer.

Lynn, Mass.—The Aberthaw Construction Company, of Boston, Mass., have been awarded the contract for a new fireproof building by the General Electric Company. The building will be 130 ft. long by 51 ft. wide, three storeys; floors and roof of the mushroom or girdless type of reinforced concrete and the exterior walls a concrete frame, panelled with brick and with very large window area.

RAILWAYS—STEAM AND ELECTRIC.

Quebec, Que.—The Provincial Legislature has decided that the Lachine, Jacques Cartier and Maisonneuve Railway must enter Montreal by a subway or elevated system if they build into that city.

Montreal, Que.—The C. P. R. is planning to replace the wooden snowsheds in the Rocky Mountains by steel structures.

Montreal, Que.—The C. P. R. are said to be preparing plans for the electrification of the Montreal terminals.

Montreal, Que.—It is said that when the tunnels of the Michigan Central Railway under the Detroit River are finished, on July 1, the Canadian Pacific will get the joint use of them. Two car-ferries, by which the company's trains are at present taken across the river, will, it is further said, be transferred to St. John, N.B., for use in a car-ferry service between that place and Digby, N.S., giving the company a through service under C.P.R. control. It is reported that the C.P.R. proposes to acquire the Nova Scotia Central road, and take steps to give an ample service to the people throughout the Province.

Ottawa, Ont.—Plans are being prepared at the Railway Department for the bridge over the Saskatchewan River, to be used on the new railway to Hudson's Bay. Tenders for the structure will be called for as soon as the drawings are completed. Reports received at the department are to the effect that the work is progressing and all of the initial Parliamentary appropriation of $300,000 will be spent or contracted for this season.

Toronto, Ont.—City Council have accepted the decision of the Ontario Railway and Municipal Board regarding new street car routes in this city. A list of the streets upon which the company proposed to construct lines was published in our issue of May 19th under the same heading.

Vancouver, B.C.—An early start on construction of Kootenay Central Railway is indicated by the decision of the C. P. R. to immediately call for tenders for work. It is reported that bids will be required to be in the hands of officials of the company in Vancouver by the end of the present month. It is understood that this means the starting of the work this summer. At the outset but 25 or 30 miles of work will be awarded and construction will be started on the south end of the line. Several years ago, 10 miles of grading was done south from Golden, on the main line of the C. P. R., but steel was never laid on that section. The Kootenay Central, following the valley of the Upper Columbia and Kootenay Rivers, will link the main line of the C. P. R. with the Crow's Nest branch. At its southern end, the railway will join the Crow's Nest branch at a point some miles to the east of Cranbrook, near Galloway. From Galloway the road will run to Fort Steele, thence along the valley of the Kootenay to Canal Flat, past the Upper Columbia Lake, and down the Upper Columbia River to Golden.

Vancouver, B.C.—A deal involving the expenditure of over $1,500,000, the transfer of some 54,000 acres of timber land in the Cowichan Lake district, from the Esquimalt and Nanaimo Railway Company, to the American Finance Company, of New York, the construction of 23 miles of railway and the erection of a large export sawmill on tidewater on the east coast of Vancouver Island, has just been concluded. The agreement between the American Finance Company and the railway company provides for the construction by the latter of a line of railway from a point on its main line near Duncan to Cowichan Lake, and another line from a point on the main line to tidewater, where the mill will be located. The railway is to be completed and ready for operation next year. The mill will be built and operated by the Empire Lumber Company. The railway will be built under Dominion charter, which carries with it the usual subsidy.

BY-LAWS AND FINANCE.

Bowmanville, Ont.—On May 31, a by-law to provide $12,000 for electric light plant extensions will be voted on.

Coldwater, Ont.—The citizens sanctioned the expenditure of $23,000 for the installation of a gravity system of waterworks.

Galt, Ont.—Two by-laws were carried on May 20th, one to provide $5,000 for waterworks extension, and the other to secure switching connection for several industrial concerns.

North Bay, Ont.—Council has passed a by-law to issue $65,835 debentures for the sewerage system.

St. Mary's, Ont.—By-law guaranteeing the bonds of the St. Mary's Cement Co. to the extent of $40,000 was passed.

Gretna, Man.—On June 1st, the ratepayers will vote on a $12,000 school by-law.

Elkhorn, Man.—A by-law authorizing an issue of debentures amounting to $20,000, for the erection of a six-roomed school-house, was carried.

Claresholm, Alta.—The $15,000 waterworks by-law was carried

Calgary, Alta.—Ratepayers will vote on a $126,000 by-law for the completion of the city hall.

Calgary, Alta.—Council decided to support the Calgary University movement, by agreement to submit to the ratepayers a $150,000 by-law. The money would go to the building fund.

St. John, N.B.—A $11,000 water mains by-law will be submitted to the ratepayers.

Edmonton, Alta.—A $175,000 public hospital by-law will be voted on at an early date.

Peterborough, Ont.—A $30,000 sewerage and drainage system by-law will be voted on at an early date.

Welland, Ont.—On June 30th, the ratepayers will vote on a $5,000 fire alarm system by-law, also one for $13,000 for sewers.

Melville, Sask.—Until June 15th tenders for $16,500 debentures will be received by H. D. Wilson, secretary-treasurer.

Sawyerville, Que.—Until May 26th tenders for $15,100 debentures will be received by W. J. Bartholomew, secretary-treasurer.

LIGHT, HEAT AND POWER.

Renfrew, Ont.—Ratepayers have voted $117,000 to purchase water privileges and develop power on the Bonnechere.

Portage la Prairie, Man.—C. Chamberlain, of the Great Falls Power Company, has presented a proposition to furnish power to the city for a term of thirty years, beginning January, 1912, the city to take a minimum of 2,500 horse power. The proposition will be accepted and council will prepare a contract for submission to the company.

SEWERS, SEWAGE AND WATERWORKS.

New Glasgow, N.S.—Engineer Mitchell has completed the survey in connection with the proposed waterworks.

Toronto, Ont.—Board of Control will recommend that E. H. Keating, formerly city engineer of Toronto, and Geo. H. Benzenberg, of Milwaukee, be engaged to report on the advisability and practicability of extending the waterworks intake pipe.

Welland, Ont.—Wm. Kennedy, jr., of Montreal, has recommended improvements and extensions to the Welland waterworks estimated to cost $60,000. Among the changes recommended in the report, which was adopted, are a new 3,000,000-gallon per day pumping unit, estimated to cost $11,500; two new water-wheels, $2,300; 2,900 feet of 14-inch pumping main, stop-valves and special castings, $7,100; flexible pipe, $2,000; 2,300 feet of 20-inch pure water pipe (wood), $10,700. The report neither provides for a settling basin nor a purification plant, but these will be dealt with later. A by-law will be submitted to the ratepayers.

Edmonton, Alta.—Alexander Potter, C.E., of New York, has been engaged to prepare a report on the problem of sewage disposal in Edmonton and Strathcona.

MISCELLANEOUS.

Montreal, Que.—Tenders for the superstructure of the Quebec bridge will be called for within ten days, announced Hon. G. P. Graham, on his return from an inspection of the bridge work. He says, also, that there will be tenders from at least seven firms in Great Britain, Germany, United States, France and Canada. Since the removal of the surtax there has been a German engineer studying the plans.

Hamilton, Ont.—The Oliver Chilled Plow Works Co., Ltd., of South Bend, Ind., will establish a plant in Hamilton, to cost over a million dollars, and it is said two thousand men will be employed at the outset.

Ottawa, Ont.—The Government will shortly send out several survey parties to look into the proposed routes for shortening the Welland Canal.

Ottawa, Ont.—In a recent interview, Mayor J. E. Fontaine, of Hull, Que., stated that the city of Hull would shortly purchase a fire engine similar to those used in Ottawa.

Toronto, Ont.—The Provincial Government will offer prizes of $1,000 and $500 for plans for Ontario's new Government House, to be erected on Bloor Street. All architects may compete, and the plans are to be in the hands of Hon. Dr. Reaume by July 15th.

Toronto, Ont.—The Board of Management of Knox College are desirous of obtaining plans for their proposed new college buildings, to be erected on St. George Street. Conditions of the competition, with all information, can be had on application to the Rev. John Sommerville, Confederation Life Building, Toronto. Plans must be sent in by the 1st of November next.

Wingham, Ont.—C. Lloyd & Son will erect a $15,000 addition to their door factory.

Brandon, Man.—Ratepayers are considering the paving of a number of main thoroughfares.

Winnipeg, Man.—Plans are being prepared by James Chisholm & Son, for a $300,000 six-storey building for the Sterling Bank, to be erected on the corner of Portage Ave. and Smith St. The same firm will shortly invite tenders for an $80,000 reinforced concrete warehouse, to be erected for Gowans, Kent & Co.

North Vancouver, B.C.—This municipality is discussing the construction of a bridge over the Second Narrows estimated to cost $1,250,000.

Vancouver, B.C.—City Council have authorized the regrading and block paving of Pender St. East, estimated to cost $105,735, and the block paving of Granville St. South, to cost $741,030. A double-track tram line will be constructed on this street.

Montreal, Que.—The Foundation Company, Limited, has recently opened offices in the Bank of Ottawa Building, Montreal. This concern is more particularly interested in the construction of bridge piers, mining shafts, tunnels, power plants, sea-walls, wharves, dams, heavy building foundations and work of a similar nature, and is evidently in close touch with the American company of the same name which has carried out numerous undertakings of the character mentioned in the United States. The Montreal office is under the management of Mr. Alexander Allaire.

SOCIETY NOTES.

Regina Builders' Exchange.—The contractors of the city have formed a Builders' Exchange. The following officers were elected for the ensuing year: President, R. J. Leckie (P. Lyall & Sons); Vice-President, Gordon Bishop, (Saskatchewan Construction Co.); Treasurer, Walter Martin (Murphy & Martin); Directors, D. Smith (Smith Bros. & Wilson), H. Potts (Potts & Smith), F. Crapper and J. M. Taylor (Northwestern Electric, Ltd.).

Sherbrooke Branch, Canadian Mining Institute.—On Friday, May 20th, a meeting was held at Sherbrooke, Quebec, for the organization of a branch of the Canadian Mining Institute in that city. The meeting was enthusiastic and the outlook at present is bright. Several prominent outside speakers were present, among whom were Dr. Adams, McGill University; Mr. T. Denis, recently appointed superintendent of mines in Quebec; Prof. Nicol, Dr. Barlow, J. A. Dresser, Mr. Campbell, and other members of the Geological Survey. Dr. Adams outlined the history of the Canadian Mining Institute, beginning with the organization of the Asbestos Club, which afterwards became the Quebec General Mining Institute, formed in Montreal in 1891. The Nova Scotia Mining Institute was formed two years later, and two years after that the Ontario Institute was formed. Two years after the organization of the Ontario Institute all the mining institutes were united into the Canadian Federation of Mining Institutes. Two years later, in order to take in British Columbia, this federation was formed into the Canadian Mining Institute as it exists to-day. Branches are established in British Columbia, Alberta, Toronto, Cobalt, Montreal and Sherbrooke. After other members had spoken the election of officers was proceeded with and resulted as follows: Chairman, Lieut.-Col. J. J. Penhale; Secretary, W. H. Smith, Thetford Mines; Committee, T. H. Crabtree, L. N. Adsit, J. Greenshields, J. R. Pierson. This committee will later be increased to eight members.

PERSONAL.

Mr. Hugh Walkem, M.Can. Soc. C. E., assistant division engineer of the Canadian Pacific Railway, at Vancouver, will probably succeed Mr. C. E. Cartwright, the division engineer, who will retire at an early date.

Mr. D. P. Roberts, city electrical engineer of London, Ont., has resigned to accept a position with a large electrical concern.

Messrs. Macdonald, Gibbs & Co., consulting engineers, 3 and 4 Great Winchester St., London, E.C., have taken up new quarters at Capel House, 54 New Broad St., E.C.

Mr. Alex. K. Robertson, C.E., of the McAlpine-Robertson Construction Company, a large British railroad contracting firm, with offices in London and Glasgow, is visiting Canada with a view to establishing a branch here. Mr. Robertson was in Winnipeg last week.

The John Galt Engineering Co., which for so many years had an office at the corner of Jordan and Melinda Streets, Toronto, recently removed to No. 2 Toronto Street. From this new office they will carry on the Eastern consulting work with which they have been so long identified. In addition to their Toronto office, they have branches in Winnipeg and other Western cities.

Mr. E. M. Ashworth, B.A., who is at present with the Canadian General Electric Co., at Toronto, will probably resign to accept a position in the City of Toronto's electrical engineering department.

Mr. Geo. I. Sturges, formerly of New Haven, who recently came to Belleville, Ont., to superintend the rolling mills, has been compelled to resign on account of ill health.

OBITUARY.

Mr. James B. Spence, engineer in the Department of Railways and Canals, died on Friday, May 20th, at Ottawa, following a stroke of paralysis. Mr. Spence, who was a member of the Canadian Society of Civil Engineers, had been 34 years in the Department, and superintended the engineering works of the Sault Ste. Marie Canal, and also assisted in preparing the plans for widening the Welland Canal. He was 78 years of age.

Mr. Dennis Calvin, roadmaster of the Quebec Railway, died at Richmond, Que., last week-end.

ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

(Continued from Page 539).

10540—May 12—Authorizing the C.N.O.R. to construct its railway across public road between Lots 28 and 29, Concession "B," Township Brighton, County Northumberland, Ontario.

10541—May 12—Authorizing the Wahnapitae Power Company, Limited, and the Dominion Nickel Copper Company, Limited, and Moose Mountain, Limited, to erect three wires for the transmission of electric power, and two telephone wires across the track of the C.N.R. between Toronto and Sudbury, at or near mileage 255.8, north from Toronto.

10542—May 12—Directing that, within sixty days from the date of this Order, the C.P.R. install a White Signal Electric Bell at the crossing of Saskatchewan Avenue, Winnipeg, Manitoba.

10543—May 12—Authorizing the G.T.P.R. to construct its railway across Aldboro and Westcana Streets, West Winnipeg, Parish of Headingly, District of Winnipeg, Manitoba.

10544—May 12—Authorizing P. F. Quinlan, of Stratford, Ontario, to erect telephone wires across the track of the G.T.R. at public road between the 8th and 9th Concessions of the Township of Ellice, County Perth, Ont.

10545-46—May 12—Authorizing the Greenwood Telephone Association of Steelton, Ontario, to erect wires across the track of the Algoma Central and Hudson Bay Railway at second and third people's crossings from Sault Ste. Marie.

10547-48—May 12—Authorizing the Bell Telephone Company to erect aerial wires across the track of the Pere Marquette at two different points in Ontario.

10549—May 13—Authorizing the T. H. & B. Railway Company to construct a branch line of railway to the premises of the Union Draw Steel Company, Limited, Hamilton, Ontario.

10550—May 13—Approving the location of the G.T.P. Branch Lines Company's Tofield-Calgary Branch from mile 50 to mile 99.804, Alberta.

10551—May 13—Approving location of the C.N.R. from mileage 170 to 238.41 of its Humboldt-Calgary Division, Alta.

10552—May 12—Authorizing the C.P.R. to construct four bridges on its line of railway, viz.: No. 20.42, Pays Plant River; No. 33.2, Gravel River, Nipigon Section, Lake Superior Division, and No. 64.4, Haslam Creek, Esquimalt & Nanaimo Railway, and No. 73.6, Magaguadavic River, St. John Section, Atlantic Division.

10553—May 12—Authorizing the C.P.R. to lay an extra track across the road allowance between Sections 7 anl 8, Township 16, Range 2, west 2nd Meridian, Whitewood, Sask.

10554—May 12—Authorizing the C.P.R. to construct an industrial spur and branch thereto to the premises of the Canada Linseed Oil Mills, Limited, Toronto, Ontario.

10555—May 12—Authorizing the G.T.R. to construct certain branch lines of railway from a point on its railway at or near Lots 27 and 28, in the 1st Concession of Township of Williamsburg ,to the River St. Lawrence, in front of the said township, Lot No. 28.

10556—May 12—Authorizing the C.P.R. to construct and operate three industrial spurs across Manitoba Street, Moose Jaw, for the Saskatchewan Flour Mills Company.

10557—May 11—Authorizing the C.P.R. to construct an industrial spur to the premises of the University of Saskatchewan, Saskatoon, Sask.

10558—May 10—Approving location of the C.N.O.R. Company's Sudbury-Port Arthur Division from mile 140 to mile 160.

10559—May 10—Approving location of the C.N.O.R. Company's Sudbury-Port Arthur Division from mile 460 to mile 480.

10560—May 10—Authorizing the G.T.R. to construct an additional or passing track across Yonge Street, Harriston.

10561—May 10—Dismissing the complaint of Messrs. Auger & Son, of the city of Quebec, complaining of the failure of the Quebec Central Railway Company to supply cars of not less than thirty-five feet in length for pulp-wood shipments.

10562—May 7—Directing that the complaint of the Dominion Park Company in so far as it deals with (a) short term rates for telephones, and (b) increase of guarantee for pay station, be dismissed, and further directing that the maximum tolls to be charged by the Bell Telephone Company from and including the 15th day of June, 1910, for short terms service of Long Distance Wall, or Desk, Extension Telephone Sets, shall bear the same proportion to the yearly tolls therefor as the tolls charged by the company for short terms service of "Initial Sets" bear to the yearly tolls therefor, subject to a minimum charge of not more than $5, the said tolls to be published and filed in accordance with the provisions of the Railway Act.

10563—May 10—Extending the time within which the C.P.R. was directed by Order No. 8936, dated December 7th, 1909, to construct and complete the station at Eganville, Ont., until the 1st day of August, 1910.

10564—May 13—Recommending to the Governor-in-Council for sanction the agreement between the C.N.R. and the Saskatchewan Midland Railway Company, dated the 9th day of May, 1910, amalgamating the two companies.

10565—May 10—Authorizing the corporation of the town of Owen Sound, to lay a water main under the track of the C.P.R. for the purpose of increasing the water supply to the premises of the Carney Lumber Company.

10566—May 10—Authorizing the Goderich Township Telephone System to erect its wires across the track of the G.T.R. at the 16th Concession Road, in the Township of Goderich, County Huron, Ontario.

10567—May 11—Directing that within sixty days from the date of this Order the M.C.R. shall install a Whyte Signal Electric Bell at the crossing of the highway at York Mines Station, Township of Oneida, County of Haldimand, Ontario.

10568—February 26—Directing that the crossing of the M.C.R. at the first highway crossing east of Welland Station, be protected by gates to be installed by the Railway Company, not later than the 1st of May, 1910, said gates to be operated between the hours of 7 o'clock a.m., and 7 o'clock p.m., daily.

10569—April 21—Authorizing the C.N.O.R. to construct its railway across Main Street, Orono, at station 1274.35.

10570—May 6—Authorizing the C.N.R. to construct and operate a branch line of railway known as the De Lourdes Spur, Township 6, Range 9, west Principal Meridian, Manitoba.

10571—May 16—Directing that the time provided in Order No. 9114, dated December 30th, 1909, within which the C.P.R. was required to complete the construction of the subway at Iberville St., Montreal, be extended until the 15th day of June, 1910.

10572—May 16—Authorizing the C.P.R. to construct a spur to the premises of the Standard Sanitary Manufacturing Company, across Royce Street, Toronto, Ontario.

10573-74-75—May 10—Ordering the Railway Company concerned in the crossing at the following points be relieved for the present from providing further protection at the crossings named, it appearing from an inspection made by the Board's Engineer and Operating Department, and from plans furnished that the view at the crossings is excellent from both directions; that the crossing signboards are properly placed, and that there are whistling posts on the railway:—C.P.R. crossing highway south of Lang Station, Sask.; C.P.R. crossing highway east of Moose Jaw; C.P.R. crossing highway at Staughton Village, Sask.

10576—May 10—Authorizing the C.P.R. to construct three bridges on its line of railway, as follows: No. 117.6, Bow River, Laggan Section, Western Division; No. 22.5, Moose Jaw Section, Western Division, and No. 63.33, Lac du Bonnet Branch, Central Division.

10577—May 10—Authorizing the Canadian Niagara Power Company to erect transmission line across the lines of the Great North-Western Telegraph Company, on the Chain Reserve, Bridgeburg, Ont.

10578—May 10—Authorizing G. A. Burgess, of Carleton Place, to erect wires across the track of the C.P.R. at Albert Street, Carleton Place, Ont.

10579—May 10—Authorizing the Ontario Power Company, of Niagara, to erect wires for the transmission of electrical energy across the track of the G.T.R., Welland Division at George Street, Port Colborne, Ontario.

10580—May 16—Authorizing the Bell Telephone Company to erect underground conduit under the track of the G.T.R. at Neeve Street, Guelph, Ontario.

10581—May 16—Authorizing the Bell Telephone Company to erect its aerial wires across the track of the G.T.R. at public highway crossing two miles north of station, Vankleek Hill, Ont.

10582—May 16—Authorizing the Bell Telephone Company to erect underground conduit under the track of the G.T.R. at public-crossing on Main Street at Ferguson Avenue, Hamilton, Ontario.

10583-84—May 16—Authorizing the Bell Telephone Company to erect wires across the track of the G.T.R. at public crossing, East Street, Clinton, Ontario, and at public road 3⅛ miles north of Harrisburg, Ont.

10584—May 13—Authorizing the C.P.R. to construct a branch line of railway or siding crossing Stickland Place, and Earnbridge Street, Toronto.

10586—May 6—Approving the location of the New Union Station at Orillia, for the joint use of the Georgian Bay and Seaboard, and C.N.O.R. companies; the location of the proposed lines of railway of the Georgian Bay and Seaboard, and C.N.O.R. companies into and through the town of Orillia, and the crossing of the railway of G.T.R. at Atherley Junction by the Georgian Bay and Seaboard Railway.

10587—May 3—Directing that the crossing of the G.T.R. on Park Street, Brockville, be protected by watchmen appointed and maintained by and at the expense of the Railway Company, who shall be in attendance at the crossing both day and night.

10588—May 3—Authorizing the Corporation of the Township of Ferris, District of Nipissing, Ont., to construct its highway across the railway of the C.P.R. where it intersects a proposed road upon Lot No. 29, in the 14th Concession of Township of Ferris.

10589—May 13—Authorizing the C.P.R. to construct an industrial spur to the premises of the International Harvester Company, of America, across 18th Street, Brandon, Man.

10590—May 13—Authorizing the C.N.O.R. to construct its railway across the public road between Lots 12 and 13, Concession 4, in Township of Clarke, County Durham, Ontario.

10591—May 9—Directing and requiring the C.P.R. at Snow Shed No. 19, 1¾ miles west of Rogers Pass Station, B.C., to erect Tell Tales at a distance of not less than 100 feet from all bridges, tunnels, or other structures which are not constructed so as to afford an open and clear headway of at least 7 feet between the top of the highest freight car used on the railway, and the lowest beams, members, or portions of that part of such bridge, tunnel or structure, which is directly over the space liable to be traversed by such car in passing thereunder.

10592—May 9—Directing that the G.T.R. within sixty days from the date of this Order shall install gates at the crossing of Broadway Street, the first public highway crossing east of the G.T.R. at Wyoming, Ont.

10593—May 16—Authorizing the C.N.R. to construct its railway across certain streets in the town of Stettler, Alta.

10594—May 16—Authorizing the C.N.R. to construct the lines and tracks of its Vegreville Extension, across the lines and tracks of the C.P.R. Moose Jaw-Lacombe Branch, at Stettler, Alberta.

10595—May 16—Approving Bridge No. 16.16 of the C.P.R., Webbwood Section, Soo Branch, Lake Superior Division, over the Vermillion River.

10596—May 16—Authorizing the C.P.R. to construct an industrial spur to the premises of Messrs. Austin and Nicholson, mileage 24.06, west of Chapleau, District of Sudbury, Ontario.

10597—May 16—Authorizing the C.P.R. to construct a spur to the premises of the Alberta Clay Products Company, Limited, at Coleridge, Alberta.

10598—May 16—Authorizing the Quebec Railway, Light and Power Company to construct a branch line of railway from Quebec towards Sillery.

10599—May 2—Authorizing the C.N.O.R. to construct its railway across the public road between Lots 8 and 9, Concession 1, Township of Brighton, County Northumberland, Ontario.

10600—May 2—Authorizing the C.N.O.R. to construct its railway across the public road between Lots 30 and 31, Concession "B," Township of Brighton, County Northumberland, Ont.

10601—May 16—Approving the location of the C.N.O.R. through the Townships of Hamilton and Hope, Counties of Northumberland and Durham, mileage 176.86 to 180.64, from Ottawa.

10602—May 2—Authorizing the C.N.O.R. to construct its railway across the public road between Townships Haldimand and Cramahe, Ontario.

10603—May 16—Approving location of a portion of the Calgary and Edmonton Railway Company's branch from Strathcona to Edmonton.

10604—May 13—Authorizing the Bell Telephone Company to erect aerial wires across the track of the C.P.R. at public crossing 150 yards east of station, Vankleek Hill, Ont.

10605-606—May 13—Authorizing the corporation of the city of St. Thomas, to erect wires for the transmission of electric power and energy across the telephone lines of the Bell Telephone Company at Kains St., and St. Catharine St., St. Thomas, Ontario.

10607-608-609—May 13—Authorizing the corporation of the city of St. Thomas to erect wires for the transmission of electric power and energy across the telegraph lines, and across the track of the G.T.R. at three different points on Flora Street, St. Thomas, Ontario.

10610—May 16—Directing the Michigan Central Railroad Company to install a Whyte Signal Electric Bell at the crossing of the Moote Road, and the M.C.R., in Township of Canboro, Ontario.

REINFORCED CONCRETE STORAGE BUILDING FOR THE PIERCE-ARROW MOTOR CAR COMPANY.

There was recently completed for the Pierce-Arrow Motor Car Company at Buffalo, N.Y., a four-storey reinforced concrete warehouse, covering a ground area of 24,200 square feet, which was placed under roof in less than three months after the signing of the contract, though the work was continually hampered by adverse weather conditions, and was completely suspended for one period of three weeks.

The building has a skeleton reinforced concrete frame, with brick curtain walls, and mushroom floors designed for live loads of 150 pounds per square foot. It was placed near the existing manufacturing and assembly buildings, and the former was extended 25 feet and the latter 24 feet to close the gap between them and the new structure. The new bay of the manufacturing building is of the one-storey, saw-tooth roof type, similar to the rest of that structure, while the addition to the assembly building is one storey high, serving as a covered passageway between the buildings.

The area of the main part of the new building is 308 x 62 feet, and has a 102 x 50-foot wing extending toward the assembly building. The storey heights are as follows: Ground floor, 16.29 feet; second and third floors, 14 feet; fourth floor, maximum, 15 feet 8⅜ inches; minimum, 14 feet 5⅜ inches. The floors are built in square panels, 20½ feet in each direction, and are supported by square columns. The column reinforcement consists of vertical round rods, the number depending upon the load, with ⅜-inch hoops on 12-inch centres for the full height. The column heads begin to flare as a support for the mushroom top at a distance of 2 feet 3 inches from the bottom of the flat floor slab. The radial reinforcing rods of the mushroom head are of 1-inch round steel, placed vertically in the columns, and extending down into them for a depth of 4 feet beneath the bottoms of the floor slabs. Eight of them are used for each mushroom, and are bent at somewhat more than a right angle over a ⅝ x 2-inch band placed just above the bottom of the floor slab. From this band the rods flare radially into the slab and extend outward for a distance of about 3 feet 9 inches, so that their ends are on the circumference of a circle about 8 feet in diameter. Resting upon these radial bars are two circles of steel rod with diameters of 8 feet 4 inches and 4½ feet. One-inch rods are used in the larger circle and ¾-inch in the smaller. These are wired to the radial bars at intersections, and across them are strung the right-angled and diagonal bars of the mushroom slab system. The flaring tops of the columns are octagonal in shape, with sides 6 feet apart.

The floor slabs are 8 inches thick, and are reinforced with strips of seventeen ½-inch bars, 8 feet wide, running at right angles, parallel with the lines of columns, and also diagonally thereto. In the ground and first floors the 8-inch structural slab is covered with a 1-inch granolithic finish made of one part of cement, one part sand and one part granite dust. On the structural slab in the two upper floors is a wooden floor. Nailing strips of 3 x 4-inch lumber with bevelled edges are laid across the building on 16-inch centres, 1-16 x 1 x 12-inch steel strips being securely fastened to the under side every 12 inches, the spaces between them filled with 1:3:6 concrete, and 1-inch maple top flooring laid upon them.

The roof is covered with standard five-ply felt and slag roofing. Provision was made in concreting the floors for the attachment of shafting and trolley hangers. U-bolts, with both ends threaded, were hung over the slab rods, with the threaded ends projecting below the concrete.

The building is provided with two elevators and two stairways. The elevators and one stairway are in a fireproof tower in a corner adjacent to the assembly building, and the other stairway is in an interior tower at the other end of the building. Toilet rooms are placed in exterior stacks, so located on the outside of the building that they will form part of the future extensions, and thus be able to serve these wings as well as the main building.

The contract for this building was placed with the Aberthaw Construction Co., of Boston, Mass., September 24th, 1909, and excavation commenced immediately. There followed three weeks of almost continual rain, so that actual building operations did not commence until October 15th.

The rapidity with which the construction was carried on from this date is best illustrated by the accompanying photographs.

The building was ready for occupancy January 15, 1910. The arrangement of the construction plant and the methods of handling materials are of considerable interest.

A spur track from the main line of the railroad was paralleled by an industrial track carried on trestles about the height of the car body. Except for stock piles of aggregate for use in case of car shortage, all sand, gravel and stone was unloaded from freight cars directly into Koppel dump-cars running on the industrial track to a switch, which turned into the platform above the mixer mouth.

An elevator tower was located as shown in the photograph, and a Smith mixer, with a capacity of 46 cubic yards per hour was placed at the bottom.

The cement shed was located between the elevator and the railroad siding, the cement being unloaded directly from the cars into the shed at one end taken out of the other end on to the mixer platform. The aggregate was dumped from the Koppel cars directly into the mixer-mouth along with the cement. A tipping water barrel was used to put in the water.

The steel was unloaded into stock piles, sorted as to size and separated as to position in the building.

When wanted, this was carried to the foot of the elevator tower, hoisted to the proper floor level by a derrick seated on the elevator tower.

The bars were then dragged into place by hand, spaced evenly and wired together into sections, so as to remain rigidly in place when concreting.

The forms were of very simple design, and made in units that could readily be handled by two men. The units were made of a few boards cleated together, and they were intended to remain as a unit, and to be transferred to the

corresponding position vertically above. Cutting and fitting for special work was, of course, necessary, but as little loose timber as possible was used around the job.

In freezing weather the stone and gravel were heated by live steam at low pressure from the central power plant. There was a flexible steam connection, with outlet, which was buried in the material, and the steam allowed to percolate through until it was hot enough to use. The water for mixing the concrete was heated by passing through pipes coiled in a salamander.

Lehigh cement was used throughout, and the aggregate was largely dredged gravel, which proved exceptionally good concrete material. When the proportion of sand was excessive, it was mixed with some crushed stone.

The remarkable speed attained in the erection was only made possible by the perfect planning of the construction plant. This was arranged in such relation to the work and the position of delivered material as to avoid all confusion and interference among the labor gangs and waste of time by unnecessary handling.

The delivery of materials and the carrying of stock piles were arranged so that steel, cement, sand, stone and timber for forms were always on hand when needed.

The building, containing 107,500 square feet of floor space, was turned over to the owner ready for occupancy in three months from the time active work was started. There was no Sunday work and practically no night work.

The contractors were the Aberthaw Construction Company, and the architects, Lockwood, Greene & Co., both of Boston.

Tenders Called For

SEALED TENDERS addressed to the undersigned, and endorsed "Tender for addition to the Eastern Departmental Building, Ottawa," will be received at this office until 5 p.m., on Tuesday, June 14th, 1910, for the construction of an addition to the Eastern Departmental Building, Ottawa.

Plans, specifications and form of contract can be seen and forms of tender obtained at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, made payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

NAPOLEON TESSIER, Secretary.

Department of Public Works,
Ottawa, May 18th, 1910.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.

MARKET CONDITIONS.

Following the quotations of the various articles listed in the markets will be found in brackets numbers, thus (10). These numbers refer to the list number of advertisers on page 3 of this issue and will assist the reader to quickly find the name and address of a firm handling any particular article. Buyers not able to secure articles from these firms at the prices mentioned will confer a favor by letting us know.

Montreal, May 26th, 1910.

Reports from the pig-iron markets of the United States are generally more encouraging. The market shows considerable improvement, and it is claimed that a very fair tonnage is about to be closed in the Eastern district, while additional buying is reported from all over the country. Prices are easy, however, Valley furnaces having accepted $15 and slightly less, at the furnace, for a large quantity of iron to be delivered during the first half of the year and, in one instance, during the next two months. A large sale of Bessemer steel is also reported to have taken place at $16 per ton, at the furnace. Transactions during the past week have been larger than for any similar period since the beginning of the year, but it should not be forgotten that this increased business has been done at the expense of prices. It is pointed out, however, that a basis at which business can be done seems now to have been reached, and from the way buyers are acting, there are indications that around present prices heavy trading is apt to develop within a short time. Hence it looks as though the point had been reached which makers have been looking forward to for some time past, and it is now predicted that the market is at the bottom, and the situation will begin to mend. Accumulations, however, continue larger than before, and these will have to be worked off before there will be any marked recovery in price levels. It is said that contracts for nearly 10,000 tons are pending the granting of concessions of a matter of 25c. per ton, but it remains to be seen whether buyers or sellers will give way. It is thought that the argument is still in favor of the buyers.

Cables from China report the placing of some large orders for railway supplies, with American manufacturers, the total value of such orders since the first of the year amounting to about $1,000,000. Export orders have been taken for Cuba and Mexico, while additional large orders for domestic use have also been placed.

The volume of the output of coke has changed very little, but sellers appear more willing to meet buyers' views, the result being that a larger volume of business has been booked than previously. It is said that there are over 30,441 ovens in active operation in the Connelsville district, so that the number would appear to have increased during the week.

The ceremonies attending the funeral of the late Sovereign have occasioned much interruption to the plants and industries of Great Britain, and the result is that the market fails to furnish evidences either of weakness or strength. There is no news of importance.

The local market is a little uninteresting from its very steadiness. There is no change in any of the various finished or semi-finished products. Consumption continues good, though not specially active. The more encouraging news from the United States is appreciated, and should it result in advanced prices there, the local market would show more firmness than it does at this moment.

Quotations are repeated as follows:—

Antimony.—The market is steady at 8c. to 8¼c. (111).

Bar Iron and Steel.—The market promises to advance shortly. Bar iron $1.90 per 100 pounds; best refined horseshoe, $2.15; forged iron, $2.05; mild steel, $1.90; sleigh shoe steel, $1.90 for 1 x ⅜-base; tire steel, $2.00 for 1 x ⅜-base; toe calk steel, $2.40; machine steel, iron finish, $1.95; imported, $2.20 (111, 119).

Building Paper.—Tar paper, 7, 10, or 16 ounces, $1.80 per 100 pounds; felt paper, $2.75 per 100 pounds; tar sheathing, 40c. per roll of 400 square feet; dry sheathing, No. 1, 30 to 40c. per roll of 400 square feet; tarred year will be the largest in the history of the country. Prices on foreign fibre, 55c. per roll; dry fibre, 45c. (See Roofing; also Tar and Pitch). (164).

Cement.—Canadian cement is quotable, as follows, in car lots, f.o.b., Montreal:—$1.30 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 2¼ cents extra, or 10c. per bbl. weight. (26, 164).

Chain.—The market has advanced again, 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; 9-16-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, $6.75 per ton, net; furnace coal, $6.50, 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 strong at 13¾ to 14c.

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 10,000, 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. (111).

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

Iron.—First boats are now arriving at Montreal, and importers are quoting prices, ex-wharf, about $1 per ton under prices ex-store. Following are the prices, on cars, ex-wharf, Montreal:—No. 1 Summerlee, $20.50 to $20.75 per ton; selected Summerlee, $20 to $20.25; soft Summerlee, $19.50 to $19.75; Carron, special, $20 to $20.50; soft, $19.50 to $20; Clarence, $17.25 to $17.50; Cleveland, $17.25 to $17.50 per ton.

Laths.—See Lumber, etc.

Lead.—Prices are easier, at $3.35 to $3.45.

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, $18 to $22 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, $13 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 carring $1.50 freight rate to Montreal, $2 to $3. Shingles: Cedar shingles, same conditions as laths, X. $1.50; XX, 2.50; XXX, $3. (112).

Nails.—Demand for nails is better and prices are firmer, $2.40 per keg for cut, and $2.35 for wire, base prices. Wire roofing nails, 5c. lb.

Paints.—Roof, barn and fence paint, 90c. per gallon; girder, bridge, and structural paint for steel or iron—shop or field—$1.20 per gallon, in barrels; liquid red lead in gallon cans, $1.75 per gallon.

Pipe.Cast Iron.—The market shows a steady tone although demand is on the dull side. Prices are firm, and approximately as follows:—$32 for 6 and 8-inch pipe and larger; $33 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. (74, 188).

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 59 per cent. off for black and 44 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 71½ per cent. off for black, and 61½ per cent. off for galvanized; ¾-inch, $11.50; 1-inch, $16.50; 1¼-inch, $22.50; 1½-inch, $27; 2-inch, $36; 2½-inch, $57.50; 3-inch, $75.50; 3½-inch. $95; 4-inch, $108.

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. (111).

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. (73).

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. (See Building Paper; Tar and Pitch; Nails, Roofing). (164).

Rope.—Prices are steady, at 9c. per lb. for sisal, and 10½c. for Manila. Wire rope, crucible steel, 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. (132).

Spikes.—Railway spikes are firmer at $2.45 per 100 pounds, base of 5⅝ x 9-16. Ship spikes are steady at $2.85 per 100 pounds, base of ⅝ x 10-inch, and ⅝ x 12-inch. (132).

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, $3.50 per barrel of 40 gallons, weighing about 500 pounds; roofing pitch, No. 1, 70c. per 100 pounds; and No. 2, 55c. per 100 pounds; pine tar, $8.50 per barrel of 40 gallons, and $4.75 per half-barrel; refined coal tar, $4.50 per barrel; pine pitch, $4 per barrel of 180 to 200 pounds. (See building paper: also roofing).

Tin.—Prices are firm, at $34 to $34.50.

Zinc.—The tone is easy, at 5¾ to 6c.

CAMP SUPPLIES.

Beans.—Prime pea beans, $2 to $2.25 per bushel. (74).

Butter.—Fresh made creamery, 25 to 26c.

Canned Goods.—Per Dozen.—Corn, 80 to 85; peas, $1.05 to $1.15; beans, 85c.; tomatoes, 85 to 90c.; peaches, 2s, $1.65, and 3s, $2.65; pears, 2s, $1.60, and 3s, $2.30; salmon, best brands, 1-lb. talls, $1.87½, and flats, $2.02½; cheaper grades, 95c. to $1.65. (74).

Cheese.—The market ranges from 11c. to 11½c., covering all Canadian makes.

Coffee.—Mocha, 20 to 25c.; Santos, 15 to 18c.; Rio, 10 to 12c. (74).

Dried Fruits.—Currants, Filiatras, 5¾ to 6¼c.; choice, 8 to 9c.; dates, 4 to 5c.; raisins, Valentias. 5 to 6¼c.; California, seeded, 7½ to 9c.; Evaporated apples, prime, 8 to 8½c. (74).

Eggs.—New laid, 20 to 22c. (74).

Flour.—Manitoba, 1st patents, $5.60 per barrel; 2nd patents, $5.10; strong bakers, $4.90. (74).

Molasses and Syrup.—Molasses, New Orleans, 27 to 28c.; Barbadoes, 40 to 45c.; Porto Rico, 40 to 43c.; syrup, barrels, 3½c.; 2-lb. tins, 2 dozen to case, $2.50 per case. (74).

Potatoes.—Per 90 lbs., good quality, 45 to 50c. (74).

Rice and Tapioca.—Rice, grade B., in 100-lb. bags, $2.75 to $2.80; C.C., $2.65. Tapioca, medium pearl, 5½ to 6c. (74).

Rolled Oats.—Oatmeal, $2.20 per bag; rolled oats, $2, bags. (74).

Sugar.—Granulated, bags, $5.05; yellow, $4.65 to $5. Barrels 5c. above bag prices.

Tea.—Japans, 20 to 38c.; Ceylons, 20 to 40c.; Ceylon, greens, 19 to 25c.; China, green, 20 to 50c.; low-grades, down to 15c. (74).

Fish.—Salted.—Medium cod, $7 per bbl.; herring, $5.25 per bbl.; salmon, $15.50 per bbl., for red, and $14 for pink. Smoked fish.—Bloaters, $1.10 per large box; haddies, 7½c. per lb.; kippered herring, per box, $1.20 to 1.25. (74).

Provisions.—Salt Pork.—$27 to $34 per bbl.; beef, $18 per bbl.; smoked hams, 16 to 20c. per lb.; lard, 16½ to 17½c. for pure, and 12½ to 14c. per lb. for compound. (74).

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Toronto, May 26th, 1910.

Almost all trades report a good business passing. Dealers in metal are generally busy, and building materials find steady demand. Importers of steel sheets tells us of a scarcity in both Britain and the United States, makers asking from two to four months to fill orders.

The ingot metals generally have moved actively, the copper consumption is enormous, lead and tin is selling very freely, antimony and zinc are comparatively quiet.

There are no changes in the list of camp supplies, except in flour and butter, which are lower.

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

Antimony.—Trade is quiet, market steady at 9c. per lb.

Axes.—Standard makes, double bitted, $8 to $10; single bitted, per dozen, $7 to $9. (217, 377).

Bar Iron.—$2.00 to $2.10, base, per 100 lbs., from stock to wholesale dealer. Market supply limited (332).

Bar Mild Steel.—Per 100 lbs., $2.10 to $2.20. (372).

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. (241, 362, 456).

Boiler Tubes.—Orders continue active. Lap-welded, steel, 1¼-inch, 10c.; 1½-inch, 9c. per 10 foot; 2-inch, $8.50; 2¼-inch, $10; 2½-inch, $10.60; 3-inch, $11 to $11.50; 3½-inch, $18 to $18.50; 4-inch, $19 to $20 per 100 feet. (514).

Building Paper.—Plain, 27c. per roll; tarred, 35c. per roll. Demand is moderate. (518).

Bricks.—In active movement, with very firm tone. Price at some yards $9 to $9.50, at others, $9.50 to $10 for common. Don Valley pressed brick are in request. Red and buff pressed are worth $18 delivered and $17 at works per 1,000. (518).

Broken Stone.—Lime stone, good hard, for roadways or concrete, f.o.b., Schaw station, C.P.R., 75c. until further notice, per ton of 2,000 lbs., 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 $3 per ton for good Oshawa. (518).

Cement.—Car lots, $1.75 per barrel, without bags. In 1,000 barrel lots $1.60. In smaller parcels $1.90 is asked by city dealers. Bags, 40c. extra. Demand good. (61, 518).

Coal.—The price of anthracite has dropped for the spring season, and opened at $6.75; pea, $5.75. From these prices a cash discount of 25c. per ton is given on any quantities purchased. 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, $3.65 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; cook, Solvey foundry, which is largely used here, quotes at from $5.75 to $6.00; Reynoldsville, $4.90 to $5.10; Connellsville, 72-hour coke, $5.25.

Copper Ingot.—The consumption of copper everywhere is enormous, and production keeps up also. The market may be termed steady at 14c., firm here.

Detonator Caps.—75c. to $1 per 100; case lots, 75c. per 100; broken quantities, $1. (212)

Dynamite, per pound, 21 to 25c., as to quantity. (212).

Felt Roofing.—The spring trade has opened very well at an unchanged price, which is $1.80 per 100 lbs. (518).

Fire Bricks.—English and Scotch, $30 to $35; American, $25 to $35 per 1,000. Fire clay, $8 to $12 per ton. (518).

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. (212, 217, 377).

Iron Chain.—¼-inch, $5.75; 5-16-inch, $5.15; ⅜-inch, $4.15; 7-16-inch, $3.95; ½-inch, $3.75; 9-16-inch, $3.70; ⅝-inch, $3.55; ¾-inch, $3.45; ⅞-inch, $3.40; 1-inch, $3.40, per 100 lbs. (217, 377).

Iron Pipe.—A steady request at former prices:—Black, ¼-inch, $2.03; ⅜-inch, $2.25; ½-inch, $2.63; ¾-inch, $3.28; 1-inch, $4.70; 1¼-inch, $6.41; 1½-inch, $7.70; 2-inch, $10.26; 2½-inch, $16.30; 3-inch, $21.52; 3½-inch, 27.08; 4-inch, $30.78; 4½-inch, $35.75; 5-inch, $39.85; 6-inch, $51.70. Galvanized, ¼-inch, $2.86; ⅜-inch, $3.08; ½-inch, $3.48; ¾-inch, $4.43; 1-inch, $6.35; 1¼-inch, $8.66; 1½-inch, $10.40; 2-inch, $13.86, per 100 feet. (185).

Pig Iron.—We quote Clarence at $20.50, for No. 3; Cleveland, $20.50; Summerlee, $22; Hamilton quotes a little irregular, between $19 and $20. A fair quantity is moving. but the fresh inquiry is not large. (332, 372).

Lead.—A very fair demand exists; price, $3.75 to $3.85.

Lime.—Retail price in city 35c. per 100 lbs. f.o.b., car; in large lots at kilns outside city 22c. per 100 lbs. f.o.b. car without freight. Demand is moderate. (518).

Lumber.—Dimension stuff is in brisk demand, for present or later delivery. Prices are generally firm, especially in pine. We quote dressing pine $32.00 to $35.00 per M; common stock boards, $26 to $30; cull stocks, $20; cull sidings, $17.50; Southern pine dimension timber from $30 to $45, according to size and grade; finished Southern pine according to thickness and width, $30 to $40. Hemlock in car lots, $17 to $17.50; spruce flooring, car lots, $22 to $24; shingles, British Columbia, are steady, we quote $3.10, lath growing scarce and stiffening, No. 1, $4.40, white pine, 18-inch: No 2, $3.75; for 32-inch, $1.70. (333).

Nails.—Wire, $2.35 base: cut, $2.60; spikes, $2.85 per keg of 100 lbs. (217, 377).

Pitch and Tar.—Pitch, unchanged at 70c. per 100 lbs. Coal tar dull at $3.50 per barrel. (518).

Plaster of Paris.—Calcined, New Brunswick, hammer brand, car lots, $1.05; retail, $2.15 per barrel of 300 lbs. (518).

Putty.—In bladders, strictly pure, per 100 lbs., $2.25; in barrel lots, $2.10. Plasterer's, $2.15 per barrel of three bushels. (518).

Ready Roofing.—An active demand; prices are as per catalogue. (453).

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 per square of 100 square feet, f.o.b., cars, Toronto; seconds, 50c. less. Mottled, $7.25; green, $7, with a prospect of advance. Dealers are fairly busy. (518).

Rope.—Sisal, 6½c. per lb.; pure Manila, 10½c. per lb., Base. (217, 377).

Sand.—Sharp, for cement or brick work, 90c. per ton f.o.b., cars, Toronto siding. (518).

Sewer Pipe.—

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

Business moderate; price, 73 per cent. off list at factory for car-load lots; 65 per cent. off list retail. (96, 211, 421).

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. (65, 77, 94, 241, 362, 363, 372, 454, 551).

Steel Rails.—Current price for rails at the Soo, $32 to $34 for weights 60 to 100 lbs.

Sheet Steel.—The market has advanced 10c.; American Bessemer, 10-gauge, $2.60; 12-gauge, $2.65; 14-gauge, $2.45; 17, 18, and 20-gauge, $2.55; 22 and 24-gauge, $2.60; 26-gauge, $2.75; 28-gauge, $2.95. (65, 77, 94, 241, 362, 363, 372, 454, 551).

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. A very large tonnage of all sorts has been booked. (332).

Tank Plate.—3-16-inch, $2.40 per 100 lbs. (241, 362).

Tool Steel.—Jowett's special pink label, 10½c. Cammel-Laird, 16c. "H.R.D." high speed tool steel, 65c. (3, 372).

Tin.—The market is steadier, and feeling very firm, price unchanged at 35c., and a good deal selling.

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. (217, 377).

Zinc Spelter.—The market can no longer be described as lively; a steady but limited movement goes on at $5.65 to $5.90 per 100 lbs.

CAMP SUPPLIES.

Butter.—Dairy prints, 18 to 20c.; creamery prints, 22 to 23c.; the creamery output is now increasing every week.

Canned Goods.—Peas, $1.10 to $1.50; tomatoes, 3s, 85c. to 95c.; pumpkins, 3s, 85 to 90c.; corn, 80 to 85c.; peaches, 2s, white, $1.50 to $1.60; yellow, $1.90 to $1.95; strawberries, 2s, heavy syrup, $1.50 to $1.85; raspberries, 2s, $1.50 to $1.95 (74).

Cheese.—Moderately firm; large, 12c.; twins, 12¼c. (74).

Coffee.—Rio, green, 11 to 12½c.; Mocha, 21 to 23c.; Java, 20 to 31c.; Santos, 11 to 15c. (74).

Dried Fruits.—Raisins, Valencia, 5¾ to 6½c.; seeded, 1-lb. packets, fancy, 7¼ to 8c.; 16-oz. packets, choice, 7 to 7½c.; 12-oz. packets, choice, 7c.; Sultanas, good, 5 to 6c.; fine, 6 to 7c.; choice, 7 to 8c.; fancy, 8 to 9c.; Filiatras currants, 6¼ to 7c.; Vostizzas, 8¼ to 9c.; uncleaned currants, 4½

Flour.—Manitoba Flour.—Quotations at Toronto are:—First patents, $5.40; second patents, $5; strong bakers', $4.90. Ontario Flour.—Winter wheat patents, $4.30 per bbl. (74).

Lard.—Tierces, 16¼c.; tubs, 16½c.; pails, 16¾c. (74).

Molasses.—Barbadoes, barrels, 37 to 45c.; West Indian, 27 to 30c.; New Orleans, 30 to 33c. for medium. (74).

Pork.—Market very firm, short cut, $29 to $30 per barrel; mess, $27 to $28. (74).

Rice.—B. grade, 3½c. per lb.; Patna, 5 to 5¾c.; Japan, 5 to 6c. (74).

Salmon.—Fraser River, talls, $2; flats, $2; River Inlet, $1.55 to $1.75. (74).

Smoked and Dry Salt Meats.—Long clear bacon, 15 to 15½c. per lb., tons and cases; hams, large, 17 to 17½c.; small, 17½ to 18c.; rolls, 15 to 15¼c.; breakfast bacon, 19 to 20c.; backs (plain), 20 to 21c., backs (peameal), 21 to 22c., shoulder hams, 13½c.; green meats out of pickle, 1c. less than smoked.

Spices.—Allspice, 15 to 19c.; nutmegs, 30 to 75c.; cream tartar, 22 to 25c.; compound, 15 to 20c.; pepper, black, pure Singapore, 14 to 17c., pepper, white, 20 to 30c. (74).

Sugar.—Granulated, $5.20 per 100 lbs., in barrels; Acadia, $5.10; yellow, $4.80; bags, 5c. lower. (74).

Syrup.—Corn syrup, special bright, 3½c. per lb. (74).

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

Vegetables.—Beans, hand-picked, $2.35; prime, $2.25; stocks light, market firm; beets, 85c. a bag; carrots, 60 and 65c. a bag; onions, $1.25 a bag; potatoes, best, 65 and 70c. a bag; turnips, 45c. a bag. (38).

TORONTO HORSE MARKET.

There were not as many horses as expected at the Horse Exchange of the Union Stock Yards this week, and prices were good. A good pair of drafters sold for $525 for the two. General purpose horses sold at $170 to $200; express and wagon horses $150 to $210, drivers $100 to $250, and serviceably sound $35 to $80.

AMERICAN HORSE MARKET.

There was rather less competition than usual at the Chicago horse market last week, but owners for choice heavy drafts were still in ample volume, with prices running from $225 to $275 for the best, with medium slow at $175 to $220.

Expressers ran from $110 to $215, drivers $100 to $300, and carriage pairs $225 to $650.

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Winnipeg, May 26th, 1910.

The past week witnessed a lull in almost every branch of business, due in some measure to the unsettling effect of the King's death. Building operations were also retarded to some extent by a difficulty in securing sufficient labor and to the inflated cost of materials. The shortage of labor is being rapidly filled up by the immigration from Europe, and all classes of building material are becoming plentiful. Brick making plants of the city and suburbs have been working overtime, and with the delivery of new brick this week there has been a noticeable increase over the operations of the forepart of the previous week. From now on there will be renewed activity of even greater proportions than anticipated. Track laying all over the prairie provinces is progressing rapidly, and bridge construction is keeping pace with the advance of the line of railway. The general situation all over the West is most satisfactory, labor conditions are