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MISSING

The Canadian Engineer

WEEKLY

ESTABLISHED 1893.

VOL. 19. TORONTO, CANADA, JULY 28th, 1910. No. 4.

The Canadian Engineer

ESTABLISHED 1893.

Issued Weekly in the interests of the

CIVIL, MECHANICAL, STRUCTURAL, ELECTRICAL, MARINE AND MINING ENGINEER, THE SURVEYOR, THE MANUFACTURER, AND THE CONTRACTOR.

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Present Terms of Subscription, payable in advance:

Canada and Great Britain:		United States and other Countries:	
One Year	$3.00	One Year	$3.50
Six Months	1.75	Six Months	2.00
Three Months	1.00	Three Months	1.25

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Changes of advertisement copy should reach the Head Office by 10 a.m. Friday preceding the date of publication, except in cases where proofs are to be mailed to distant points, for which due time should be allowed.

Printed at the Office of The Monetary Times Printing Company, Limited, Toronto, Canada.

Index of this issue will be found on page 112.

GOOD ROADS FOR THE WEST.

The Good Roads Association of Western Canada have just concluded a Good Roads Convention in Winnipeg.

Western Canada, with her great areas of prairie country without rock or gravel, find road-making a difficult problem. The split-log drag has been used with good effect on the Western roads, and, considering the cost of road metal, it is doubtful if, for some time to come, anything will be found more suitable for the rural roads in Western localities.

Western Canada has spread over that great district miles and miles of a telephone system. This telephone system as supplemented by good roads will do much to build up homes on the prairie and make habitable the year around, districts, that in the past, have only been populated during the summer months.

THE GRAND TRUNK STRIKE.

The threatened strike of the Grand Trunk trainmen commenced on July 26th. It is unfortunate that the difference of opinion between employer and employee was not amicably settled. A railway operating three and a half thousand miles and carrying each month a million passengers and a million and a quarter tons of freight cannot cease to operate without inconveniencing a great body of the community, to say nothing of the loss of money to their Board of Directors and to the employees.

Disturbances of business and loss to individuals and the country has led the community to look to the Dominion Government to make an effort to settle the disturbance.

An investigation of the dispute by a Board of Conciliation resulted in an award which it was hoped would be acceptable to both parties. The award did not meet the views of either the men nor the company, and, although it called for a considerable increase in the men's wages, yet there were certain schedules and conditions contained in the way that the men did not think went far enough.

PENSION PLANS ON RAILWAYS.

The large Canadian railways have been generous in the arrangement of their pension list. Faithful employees, after long years of service, or men incapacitated in the service of the railways have been generously dealt with by the management.

In the recent G.T.R. strike many of the older men were much opposed to the strike because it meant the losing of their pension should they quit the company's service. Some men who in a few months would be entitled to a pension of $15 per month, felt they were in duty bound to leave the company's service. It seems unfortunate that these older men should have to sacrifice so much to meet the demands of the younger and more restless in the service. On the other hand, the railways doubtless had in mind such situations as arise from strikes when they provided for a pension list.

The Minneapolis, St. Paul and Sault Ste. Marie Railroad have recently adopted a pension system, the principal features of which are somewhat unusual. No employee is to receive less than $15 per month pension, but the basis on which pensions are paid is one per cent. for each year that the employee has been in service, so it will be seen that the railways have been generous in their minimum pension. It is also provided that the employees shall not be required to pay into the general pension fund. Sixty-five years is the age limit, but if a

man while in the service becomes incapacitated he may go on the pension list.

Pension lists have the effect of making the men feel interested in the concern which provides for them, and is a step towards co-operation, which is being tried out in so many industrial concerns.

EDITORIAL NOTES.

The fight of the recent eight-hour law in Vancouver on municipal work was ended recently when all the men on the contract left work as soon as the order was enforced. The men as well as the contractors find under many conditions the eight-hour labor law a hardship.

* * * *

One of the interesting balance sheets recently issued is that of the Hudson's Bay Company. The company's profits for the year ending May, 1909, amounted to over $800,000, and for the year ending May, 1910, nearly $600,000. Their export of fur and sale of land was as great as during any year in the last ten.

ELEMENTARY ELECTRICAL ENGINEERING.

L. W. Gill, M.Sc.

CHAPTER IV.

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.

The symbols used in the following represent the same quantities as in the case of the generator:—

The armature current is $Ia = I - Ie$.

Armature copper loss = Ia^2Ra.

Shunt copper loss = EIe.

If the motor is series wound the series copper loss is Is^2Rs.

The total copper loss is $W = I^2R + EI + I^2R$.

The efficiency of the motor is

$$F = \frac{\text{Output}}{\text{Intake}} = \frac{\text{Intake—Losses}}{\text{Intake}} = \frac{EI-(Wf+Wi+Wc)}{EI} \quad (20)$$

The efficiency of motors is sometimes determined by measuring the mechanical output directly by means of a brake or dynamometer and the electrical intake by means of meters. A brake is not always available, however, and in any case this method involves the use of an amount of power equal to the capacity of the motor. The determination of efficiency by measuring losses, known as the "indirect method," requires less time and only a small amount of power.

Rating of Direct Current Machines.—It has been previously noted that the heat generated in any conductor increases as the square of the current. From this it follows that if the current passing through the armature of any machine—motor or generator—is increased indefinitely, the temperature will rise until deterioration and subsequent destruction of the insulation takes place. To avoid this the current must be restricted to a definite limit. In other words, the current should not exceed that value which will cause a certain definite rise of temperature in the armature. The general practice is to allow a maximum temperature rise of 45° C. in the armature and exciting coils and 50° in the commutator. These values are always based on continuous running at full load for at least ten hours and a room temperature of 25° C. If the temperature of the room is higher or lower than 25° C., the observed temperature rise should be decreased or increased one-half per cent. for each degree the room temperature differs from 25°. Manufacturers of the higher grades of machinery usually guarantee a temperature rise not exceeding 40° C. in the armature and 45° C. in the commutator, except in the case of small machines. Measurements of temperature are usually taken after a ten hours' run by placing a thermometer on the various parts, a small pad of cotton waste or cotton wool being placed over the thermometer bulb to prevent radiation. Nearly all modern machines are rated so that they are able to carry an overload of 25 per cent. for two hours without destructive heating. The additional temperature rise caused by this overload, after the machine has reached a constant temperature with normal load, should not exceed 10° to 12° C. in any part.

From the above it follows that the capacity of a machine is practically fixed by its ability to carry current without destructive heating. In the case of a modern generator, the current which it can deliver continuously to the **external circuit** without excessive heating and the corresponding terminal voltage is always stamped on the

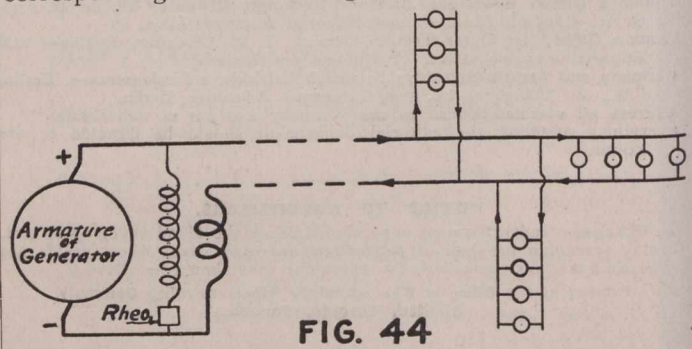


FIG. 44

name-plate. The capacity or rating of a generator is the product of these two, and is the power output which it can maintain continuously. In the case of the motor the rating is the mechanical power which it can deliver continuously without excessive heating. This is always stamped on the name-plate, as well as the voltage, speed, and current capacity.

In some cases the capacity of a machine is fixed by its ability to carry current without sparking at the brushes, but this is very rarely the case with machines manufactured at the present time. Sparking at the brushes is usually due to improper design, assuming that the connections are properly made and the brushes properly set.

Regulation of Direct Current Machines.—The "regulation" of a machine with respect to any characteristic quantity (such as voltage, speed, etc.) is the ratio of the maximum deviation of that quantity from its intended value to the full load value. Thus if a direct current generator is compounded with the object of maintaining a constant voltage at its terminals, and its voltage varies 2 per cent. from the full load value, the regulation is said to be 2 per cent. In the case of an over-compounded generator which is intended to give a gradual increase of terminal voltage from no load to full load, the regulation is the ratio of the maximum variation from the intended voltage at any load to the full load voltage.

For example, if a generator is designed to give a terminal voltage of 115 at no load and 125 at full load, it should give 120 at half load. If the voltage at half load were 122, the regulation would be 2/125 = 1.6 per cent. The term regulation as applied to constant speed motors refers to speed, and is the maximum percentage variation from the full load speed.

Distributing Systems.—The earlier systems of distribution, which were used principally for lighting, consisted of two wires, between which, as far as possible, a constant potential of 50 or 100 volts was maintained. This system is still in use, and is quite suitable for small, isolated plants not exceeding 100 horse-power, where no

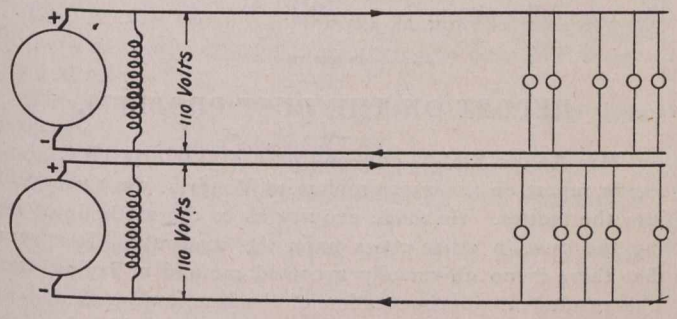


FIG. 45

large amounts of power have to be transmitted over distances exceeding 500 feet. With this system the lights and other apparatus are connected in parallel as shown in Fig. 44. As the demand for electric lighting increased, the distance over which current had to be carried also increased, and to avoid an excessive cost for transmission wires or an excessive loss of power if the size of wires were limited, it became necessary to increase the voltage of the system. The first step in this direction was to combine two of the "two-wire" systems to form a "three-wire" system as shown in Figs. 45 and 46. In Fig. 45 two 110 volt two-wire systems are shown running side by side, but independent. In Fig. 46 the negative or return wire of one system is combined with the positive

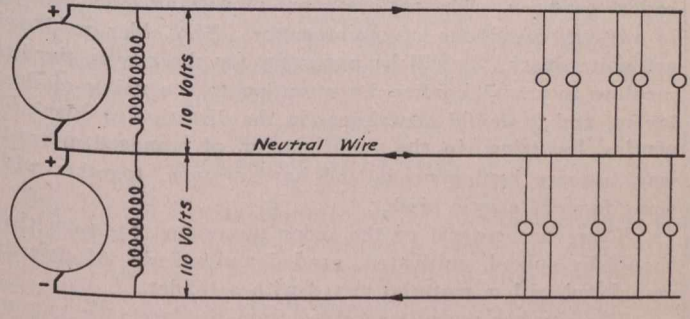


FIG. 46

wire of the other system. As the currents in the wires when separate run in opposite directions, it follows that when the two are combined the resultant current is equal to the difference between the separate currents. If the number of lamps lighted on each of the separate systems were equal, there would be no current in the middle or "neutral" wire when the two systems are combined, and the whole of the current would flow under a potential of 220 volts. In actual operation, however, the number of lamps lighted on each side is never the same at any one time, and it is, therefore, necessary to have the neutral wire to maintain the same voltage between the terminals of all the lamps. Without this wire the voltage would always be too high on the side with the smaller number of lamps and too low on the other side. As the difference between the number of lamps which are usually lighted on either side at one time may be kept within narrow limits, and as the current flowing in the neutral is only equal to that required by the excess of lamps on either side, the capacity of this wire may be limited to about 25 per cent. of that of the outside wires, for in a properly designed system the excess of lamps or load on either side should not reach even this amount. This applies only to circuits of large capacity where a reduction in the size of wire means a considerable saving of copper. In the case of branch circuits of small capacity it is usual to make the wires all the same size.

When a single generating plant is to supply power for lighting purposes, and also for motors or other apparatus of large capacity, it is usual to run separate transmission lines directly from the station to supply such apparatus independently of the lighting circuits. In the case of a three-wire system these "power" circuits may be two-wire or three-wire. The latter are used only when it is desired to vary the speed of large motors over a considerable range. The purpose of installing separate power circuits is to avoid the disturbance to lamps due to the varying voltage drop caused by the large momentary currents taken by apparatus of large capacity, especially when starting. In addition to avoiding such disturbances, a larger voltage drop may be allowed on the power circuits than is allowable on lighting circuits. This point will be referred to again in connection with the calculation of transmission lines.

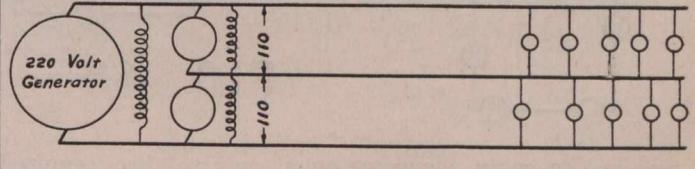


FIG. 47

When the three-wire system was first introduced two separate generators working in series were used, as shown in Fig. 46. At the present time such systems are operated by a single machine designed to give a terminal voltage equal to that of the two separate machines in series, and the voltage between the outside wires and the neutral is maintained at a constant value by means of a "balancer," as shown in Fig. 48. This balancer consists of two 110 volt shunt motors (or generators), the shafts of which are direct connected, and the armatures of which are connected electrically in series. The terminals of the combination are connected to the outside wires of the system, and the neutral wire is joined to the connection between the two motors. When the number of lamps in use on either side is the same, the system is said to be "balanced," and in this case the two motors will run idle, each generating 110 volts, while the current passing through the armatures is just sufficient to overcome the friction. If, however, there is an excess of lamps in use on one side, this balance of voltage is destroyed, the voltage tending to rise on the side with the smaller number of lamps and fall on the other side. This will cause the motor on the side with the higher voltage to speed up, while the motor on the other side becomes a generator. Thus it will happen that half of the current flowing through the neutral wire will pass through one of these machines working as a motor, and the other half

will pass through the second machine working as a generator. As these machines are identical in all respects, either will act as motor or generator according as the necessity arises, and in this way maintain a balance in the voltage. On account of the voltage drop in the armatures of the balancer, the simple arrangement shown in Fig. 48 will not maintain a perfect balance. To effect this compounding must be resorted to. Various other arrangements are used for balancing, but the system above described is perhaps the most satisfactory, although a little more expensive than some others.

Generators for suppying current to three-wire systems are usually compounded to give 220-230 terminal volts at no load and 240-250 at full load. Any number of such generators may be operated in parallel.

In the systems above described, commonly known as "constant potential" systems, the lamps and other consuming devices are all connected in parallel. Any one lamp can thus be turned off without affecting others on the same circuit. When, however, a large number of lamps or other devices, each of which requires the same amount of current, and all of which may be turned on and off together, it is more convenient and economical to connect them in series. Street lamps, for example, are all the same size, and require to be turned on and off at the same time. In this case the transmission wire is

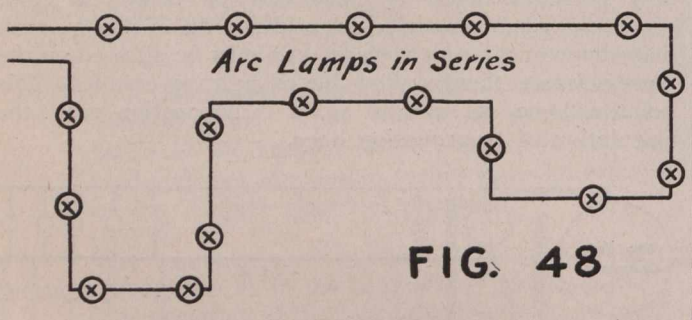


FIG. 48

required to carry a current equal only to that required by a single lamp, and, since the lamps are in series, the out-going wire may pass along one street and the return wire may be placed on another street. A considerable saving of copper is thus effected. The voltage which must be impressed on the terminals of such a system must obviously be equal to the voltage required by one lamp multiplied by the number of lamps. If one or more lamps are taken from or added to the circuit, the voltage at the terminals must change in proportion, but the current must be maintained at a constant value. For this reason such systems are known as "constant current" systems. Generators for supplying current to these systems are of special design, and are known as "constant current" machines, for the reason that they are usually equipped with some device which automatically maintains the current at a practically constant value. A constant current system is shown in Fig. 48.

When electric power was applied to the propulsion of street cars it was necessary to increase the voltage above that used for lighting and other purposes to avoid the excessive cost of transmission wires. Accordingly the voltage of 500-550 was adopted for railway service, this being the highest that was considered practicable at the time. As the electric service was extended and the traffic became heavier, the voltage was gradually increased up to 650, and at the present time some systems are operating at a voltage of over 1,000. In the case of very large systems, where the amount of power involved and the distances are great, the transmission of power is effected by means of alternating current at high voltage, the power being first transmitted to substations placed along the railway line. At these substations the alternating current is converted into direct current, which is utilized on the cars at a comparatively low voltage. Within recent years there has been a tendency to eliminate the substations and use the alternating current directly on the cars (or electric locomotive), which are equipped with alternating current motors. This point will be discussed more fully in a later chapter.

While the voltage on railway systems varies considerably, these systems are essentially of the constant potential class. The trolley wire or third rail is the positive wire while the track rails serve as the return, and the cars all operate in parallel.

REPORT ON THE DUST PROBLEM.

Mr. Angus Smith, city engineer of Victoria, B.C., in a recent report on the dust problem of Victoria, went very fully into the matter. He made enquiry as to the methods of laying the dust in other cities upon the roadways. It appears that there is no universally accepted method of laying dust. The results of experimentation of the last few years and the study devoted to it by highway engineers and chemists, demonstrate that the road surface is constructed to advantage with bituminous binders exclusively. The experiments for the last year or two, both in Great Britain and in the United States, demonstrate that the laying of the dust can be satisfactorily accomplished by the calcium chloride method and by the application of oil.

During the year 1909 the city of Bedford, Mass., spent $14,000 on dust-laying preparations. It was a popular expenditure, although there were some complaints from owners of bicycles that the oil caused a rapid deterioration of the rubber tires. The press recorded a few complaints of injury to carpets, but the general opinion was one of approval. The city was unable to comply with the requests for oil. The dust layers were dustoline and a heavy asphalt oil and standard road oil.

The city of Victoria has approximately 23 miles of macadam roadway. The roadways are of varying ages and are in various conditions of maintenance. The older roadways are quite dusty. It will be necessary for the city in the immediate future to confine its attention to the using of dust layers, and it should experiment in the direction of dust prevention by using, in the construction of a macadam roadway, a more homogeneous and harder stone, together with some form of elastic binder.

There are several of the older macadam roadways that should be spiked, cultivated, graded and rolled. Afterwards resurfaced with a material mixed with a binder.

The city has recently received from England, ten tons of calcium chloride. The solution used for watering is made by dissolving 100 lbs. of calcium chloride in 100 gallons of water. The roads should be watered thoroughly twice with this solution, an interval of one day being allowed to elapse between the first and second watering. Three hundred gallons should be made to cover 800 square yards at each watering. For subsequent waterings, one thorough watering will suffice, using 300 gallons for 800 square yards. The solution may be applied with the ordinary street sprinklers. Calcium chloride is a chemical and in its ordinary commercial form is a solid mass, and is handled in hermetically sealed drums. It is a deliquescent salt with the property of absorbing water from the air and retaining it in solution. The quantity of this

(Cotinued on page 104.)

THE

Sanitary Review

SEWERAGE, SEWAGE DISPOSAL, WATER SUPPLY AND WATER PURIFICATION

PROPER CHARGING OF WATER RATES.

One of the most difficult departments of municipal affairs to properly charge in finance has been the waterworks system.

Public water supplies may be divided into four classes:—

(1) Water used for domestic purposes.

(2) Water used for manufacturing and mechanical purposes.

(3) Water used for street sprinkling and fire protection.

(4) Water wasted.

In the early days of waterworks systems flat rates were charged. The district served was small, and a flat rate gave a fairly uniform method of assessment. With the growth of the city conditions changed; certain sections became manufacturing districts and called for exceptionally large water consumption. Usually, the manufacturer paid by the meter rate, but the different residential sections, irrespective of the cost of distribution in each section, continues to pay the same rate.

The introducing of meters on private services in a measure equalizes the charges, but in many municipalities of any size a uniform meter rate is very little fairer than a flat rate.

The water for some sections of the city requires pumping two or three times. The ratepayer in the first section frequently pays in a higher assessment, and yet his water rate is as high as the man who secures the water after the second or third pumping.

We expect to see, in the matter of water rates, a revision that will recognize the difference in cost of delivery because of location.

REDUCING SEEPAGE.

The United States Department of Agriculture have recently conducted a very interesting series of experiments on small earth reservoirs, having in view the idea of reducing seepage. These experiments were conducted at Cheyenne, Wyo., where a reservoir constructed of porous, sandy soil, which would not puddle readily, was divided into three compartments.

In the first compartment, nine sacks of cement were spread over the surface with a view to sealing the voids in the soil, but very little gain in tightness was noticed.

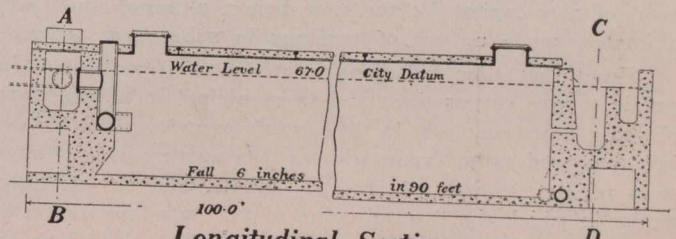
The second compartment was treated with tar. About 0.121 gallons per square foot was applied and then sprinkled with about two inches of sand. This treatment was not any more effective than the cement.

The third compartment was well packed, the reservoir filled and the water allowed to seep away, and after the material had dried, tar was added in two coats, using altogether one gallon per square foot. This greatly reduced the loss.

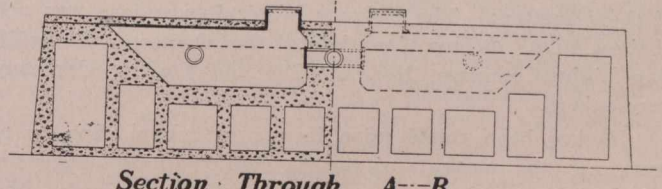
SEPTIC TANK, OTTAWA, ONT.

In 1909 Mr. N. J. Ker, City Engineer, Ottawa, Ont., formed for the purpose of installing a sewerage system what is now known as the south drainage system. This system, in which are used reinforced concrete, brick and tile sewers, drains an area of 150 acres with an outlet into the Rideau River. As the Provincial authorities would not allow untreated house sewage to be discharged into the river it was decided to provide septic tanks, and construction on these was begun September 1, 1909.

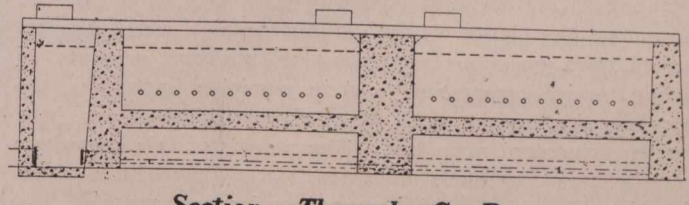
Slow progress was made at first with the excavation, as water was found one foot below the surface of the ground, necessitating continuous pumping to allow the men to work. The tanks are 90 feet long, 14 feet wide and have an average



Longitudinal Section



Section Through A—B



Section Through C—D

depth of 7 feet, with a grit chamber at one end and an aerating weir and effluent channel at the other. The tanks were constructed entirely of concrete, the mixture being 1 cement, 3 of sand and 6 of stone. For the reinforcement of the roof standard 56-pound railroad rails were used as cross-beams, the intermediate spans being reinforced with expanded metal. The general construction of the tanks is shown in the accompanying sections.

Access to the tanks is obtained by six standard manholes. As the sewers are on the combined system, a storm overflow

is provided, 24-inch vitrified pipe being used, which extends to the Rideau River, at the bank of which it is continued by a 24-inch steel pipe which extends into the river for a distance of 120 feet and discharges through an outlet 12 feet below the surface of the water. The construction of the tanks was completed about the first of December.

DEPRECIATION IN WATER-WORKS ACCOUNTS WITH REFERENCE TO UNIFORM REPORTS.*

Harvey S. Chase.

Some twenty years ago, the writer was superintendent of a water-works in one of the smaller cities of New England, and subsequently became treasurer, and was also manager of the gas plant in the same municipality. During his administration the water-works were rebuilt, new pumps were installed, a water tower erected, a filter introduced, and the mains extended in many streets. At the same time a complete reorganization of the gas plant went on, with new works and holders. The process was changed from coal gas to water gas, and the mains throughout the town were repaired and relaid. This was the first practical experience with questions of depreciation on a considerable scale with which the writer had to do, for, as may be surmised, no allowances for depreciation had ever been made in the accounts of the water-works or of the gas-works prior to that time. All these renewals and reconstructions required the investment of new capital for the time being, although this was ultimately made up out of earnings in subsequent years.

From that time questions relating to depreciation in public service corporations and in municipal industries have played a prominent part in the writer's experience, as he has been engaged as an expert witness in a number of important suits relating to water-works, gas plants, and electric light works in which the determination of fair rates for depreciation was fundamental. In each case, in fact, the result of the suit depended almost wholly upon a correct setting forth of these matters. The Holyoke Water Power case was one of these suits. Boston Consolidated Gas Company, Haverhill Gas Light Company, Norwich Gas and Electric Company were others.

Having been called upon in a professional capacity to reorganize the accounts of various municipalities during the past ten years, the accounting of public water-works and electric light works has been drawn forcibly to the writer's attention. Moreover, a chairman of a committee of the American Association of Public Accountants which has reported upon questions pertaining to uniform accounts in public service corporations and in municipal industries, the necessity for correct accounting of depreciation has been further impressed upon him. The reports of this committee may be found, by those interested, in the Proceedings of the American Association of Accountants for past years.

In connection with the Bureau of the Census, special attention has been given by the writer to water-works accounts, while in 1907 a report was submitted by him to the New England Telephone and Telegraph Company which pertained especially to depreciation and kindred questions in the telephone field. These matters have been mentioned here in order to show how wide a field, in the experiences of public accountants as well as of water-works, gas, and electric engineers, is covered by matters related to depreciation.

*Read at meeting of New England Water-works Association.

Albert H. Wehr, at the annual convention of the American Water-works Association last June, presented an admirable paper relating to uniformity in the accounts and reports of water-works, in which he refers to the recent work of the United States Census Bureau and to the conclusions of Dr. Powers of the census in the bureau's bulletin, "Statistics of Cities," published early in 1909.

It may be advisable for me to summarize the statements of Mr. Wehr and Dr. Powers before proceeding to my own conclusions concerning the subject of this paper.

Mr. Wehr's considerations in favor of a uniform classification of accounts are as follows:

"The evolving of any uniform classification of accounts for water supply or any other form of public service enterprise must be based on certain considerations of purely practical utility, of which the five following are the most important, viz.:

"1. To afford managers such detailed information relative to the operation of their properties as to enable the making of careful analyses of income and expense, both separately and as compared with previous similar periods.

"2. To afford accurate comparability of the operating results of such enterprises with those of any other similar enterprise.

"3. To so divide and subdivide the expenses as to easily enable the ascertainment of the separate and distinct elements of cost which make up the total cost of service.

"4. To so devise the scope of the classification as to place the enterprise, whether privately or municipally owned and operated, on a basis which will disclose all income earned by the enterprise, whether actually received or not, and show the actual expense of operation or cost of service, whether actually paid or not.

"5. To so devise the classification as to divide the various branches or departments of such classification into certain fixed and clearly defined centers of division, from which all subdivisions radiate. . . ."

In this connection, Mr. Wehr has devised a scheme of enumeration for the classified accounts which is simple, effective, and cleverly arranged. Mr. Wehr's paper sets forth definitions of the classifications, following in the main the terms accepted by the Census Bureau, and gives a complete scheme of the classified accounts under these heads:

1. Income Accounts.
2. Expense Accounts.
3. Allocation and Profit and Loss Accounts
4. Outlay, or Property Accounts.
5. Asset Accounts.
6. Liability Accounts.
7. Proprietary Interests, or Proprietorship.

In this classification depreciation appears under various headings, the first of which is 214, "Expenses for General Depreciation," with subdivisions as follows:

2140. Undistributed Expenses for General Depreciation.
2141. Depreciation of Administrative Property.
2142. Depreciation of Accounting and Commercial Property.
2143. Depreciation of General Operating Property.

Also under the heading 224, "Expenses for Water Service Depreciation," appear the following subdivisions:

2240. Undistributed Expenses for Water Service Depreciation.
2241. Depreciation on Sources of Supply Property.
2242. Depreciation on Intakes and Aqueducts.
2243. Depreciation on Purification System.
2244. Depreciation on Pumping Station.

2245. Depreciation on Transmission and Distribution Storage System.

2246. Depreciation on Distribution System.

2247. Amortization of Preliminary Expenditures.

And under 23, "Miscellaneous Expenses," appear:

23115. Depreciation on Tools and Appliances—Plumbing.

23125. Depreciation on Buildings, Tools and Appliances —Shops.

23136. Depreciation on Buildings, Teams and Equipment —Stables.

23144. Depreciation of Rental Property.

23155. Depreciation on Tools and Appliances—Meters.

23164. Depreciation of Forest Lands and Reservations.

23174. Depreciation of Other Accessory Enterprises.

Under 232, "Expenses of Invested Funds," there is an item 2322, "Expenses of Depreciation Funds;" also 325, "Depreciation in Invested Funds Values;" and 342, "Depreciation and Amortization Funds." Among the assets under the general heading 5 appears 563, "Depreciation and Amortization Funds."

No accounts appear among the liabilities under general heading 6, where we should expect to find "Depreciation Reserves." This fact particularly appeals to me, as it is the special point on which I must criticize the otherwise admirable and exhaustive classification of Mr. Wehr. No explanations of Mr. Wehr's views concerning depreciation reserves appear in the text of his paper, but in the Census Bulletin, on page 334, the term "depreciation" is defined as given below. In the census classification, depreciation accounts appear under the following headings:

VII. Expenses for Water Service Depreciation.

208. On general Administrations, Buildings and Equipment.

209. On Accounting Equipment.

210. On Operating Management, Buildings and Equipment.

211. On Sources of Supply.

212. On Intakes and Aqueducts.

213. On Purification System.

214. On Pumping System.

215. On Transmission and Distribution Storage System.

216. On Distribution System.

There are also accounts for depreciation of pumping, rental property, meters, stables, etc., these being in accord with Mr. Wehr's classification. The census definition or depreciation is as follows:

"**Depreciation.** Depreciation is a general designation of the gradual diminution in value which is caused by wear, decay, displacement, of obsolescence in the value of buildings and equipment, and of the sudden diminution which results from fire or other destructive forces. It is never actually or relatively the same for any two establishments, even of the same industry. For this reason it is impossible to frame concise, general rules for making allowances for depreciation which will not in their application be attended with a large margin of possible error. To use such rules without causing errors those employing them must have for each individual establishment exact data based upon inspection, showing how far and in what respects its actual depreciation differs from that of the average establishment of its class. For this reason, a physical examination and appraisal of water-works should be made every ten years, or even more frequently, in order to provide the basis for an approximate statement of the annual loss chargeable, as an expense, to depreciation. In the absence of such exact data for each water-supply system, however, it is to be assumed that depreciation takes place according to the average life of the several parts of such system and of water-supply plants as a whole. The knowledge at the command of the bureau of the census leads to the conclusion that this average life is approximately as follows: For horses, carriages, automobiles and laboratory fixtures and meters, ten years; office furniture and general equipment, fifteen years; boilers, steam pipes, and filtration equipment, twenty years; engines, pumping machinery, and wood pipes, twenty-five years; masonry of filtration plants, cribs, iron water pipes, intake pipes, fire hydrants, stand-pipes, and buildings, fifty years; reservoirs, tunnels, and aqueducts, one hundred years; and for the water system as a whole, fifty years.

"There are many methods which may be employed in the computation of depreciation from data such as are above referred to, all of which involve the assumption that depreciation proceeds either with a uniform or with a geometrically accelerated rate throughout the life of the plant or fixture. The actual rate of depreciation unquestionably increases geometrically, and for this reason the best method of computing the amount of depreciation which has taken place during a series of years, or during a particular year, is that which is sometimes called the sinking fund or compound annuity method. The depreciation during the first year of any property having an expected life of fifty years is represented by a quantity equal to the annual payment which would have to be made each year during the fifty years, and invested at some specified rate of interest, to amount at the expiration of the fifty years to a sum equal to the original value of the property. The depreciation for any subsequent year would be the same quantity plus an amount equal to the interest on the prior payments and accumulated interest earnings at the specified rate. . . By means of tables and diagrams, the depreciation for each particular portion of the water-supply system can be computed for any given year of its life, and thus the total depreciation for the system be ascertained, provided the enterprise has a detailed statement of its property and equipment as explained later under 'tentative instructions for accounts, with cost and present value;' and, provided further, that the probable life of each division of the system has been ascertained by physical inspection, and that the rate of depreciation has also been determined in the same manner. The depreciation taking place in the water-service system in a given year, calculated as above, should be charged as an expense in primary accounts 208 to 216. This depreciation, however, is primarily an entry in the accounts with property and equipment, as shown in the accompanying summary of the cost and value of the water-supply system and of its extensions, additions, and renewals. When detailed data are lacking for computing depreciation as outlined above, it may be assumed that the aggregate depreciation to be included in the accounts mentioned or in sub-general account VII, is 2 per cent. of the present value of the water system."

The census classification for water-works accounts does not set up a complete balance sheet of assets and liabilities, nor does it give a detailed list of liability accounts, in which should appear, according to the writer's opinion, a series of depreciation reserve accounts. It is owing to this omission, both in the census classification and in Mr. Wehr's, that the present paper has been written, and the writer will, therefore, give a brief explanation of his reasons for urging the inclusion of depreciation reserves in all such classifications.

Much experience under the conditions in which public service corporations are acting in most municipalities convinces the writer that it is fundamentally necessary that questions of depreciation should be carefully considered,

accurately worked out, and regularly entered upon the books of all such corporations. This being the case in private works, it is also necessary that municipally managed public services should have similar accounts. The reason in both cases is the same, viz., in order that fair rates may be established, that is, rates which will be just to the consumers and also fair to the plant. Such rates cannot be just unless full allowances shall have been made for deterioration of the plant, or, in other words, for the capital losses which arise from depreciation. Such losses must be provided from income, or otherwise they will require new capital. Therefore, they should be handled in the accounts as regular charges against income. This is most forcibly true in all plants which have to do with electricity, for in such plants depreciation during past years has been rapid, and changes in the art have frequently demanded that machinery should be scrapped even though the machines themselves might be in excellent physical condition. Electric street railway companies, electric lighting companies, and telephone companies are fast coming to see the necessity for proper and complete provisions for depreciation. Gas companies are next in importance in this particular, while water-works may be considered last. It must be noted that it is frequently the fact that "appreciation" in the general value of any water-works, due to increase of population in its territory, may offset in great part, and sometimes may even exceed, the losses by depreciation which occur during a given period. Therefore, while the emphasis which is here laid on depreciation accounting is accepted in full by electrical concerns to-day, and accepted in part by gas companies, it is nevertheless true that water-works have not as a rule acknowledged the necessity for such accounting, or, at least, have not adopted such accounts in their bookkeeping systems. The same arguments which have compelled the use of depreciation accounts in electrical concerns will, in my opinion, compel their use ultimately in water-works. This will come about mainly through the instrumentality of state supervising boards, which will require uniform reports from all municipalities and from their departments, in which a water department is frequently included.

Just as the gas commissioners of Massachusetts have required definite allowances for depreciation in the accounting of municipally operated plants, so, in due time, similar requirements will be promulgated for municipal water-works

If the writer has stated the facts correctly, and if his deductions in regard to the future are true, it is evident that proper accounting for depreciation should be undertaken promptly in all such plants. The best way to handle these matters, in the writer's opinion, is by a series of depreciation reserve accounts, that is, by reserve accounts which correspond to the different classes of assets, and which appear in the balance sheets as liabilities (credit balances). Every monthly closing should provide for items to be charged to expense and at the same time credited to these various reserve accounts. Each of these charges should be based upon a carefully calculated percentage which will vary according to the estimated life of the particular class of a set. Wherever depreciation is made good by actual expenditure for renewals or reconstruction, such amounts should be charged against the corresponding depreciation reserves and thereby the balances remaining in these reserve accounts will show w' ether or not sufficient monthly allowances are being made year by year to provide for depreciation losses, shown by the actual expenditure for renewals and reconstructions. The necessity for depreciation reserve accounts being evident, the writer urges that particular attention be given to them in all public service accounting, and trusts that, in future editions of the census classifications, statements of liability accounts will be included in which will be set forth in detail a depreciation reserve for each of the various classes of deteriorating assets.

If what he says here will, in some measure, bring the importance of such reserves forcibly to the attention of practical book-keepers and managers of public services, the writer will have accomplished all that was intended by the preparation of this paper.

REPORT ON THE DUST PROBLEM.

(Continued from page 100.)

chemical when exposed will absorb a definite quantity of water, varying with the humidity of the atmosphere.

Pasadena, California, has used asphaltic oil for laying the dust to a great extent in the past few years. The best results were obtained by using as heavy an oil as would be used by heating the oil with live steam. This oil contained about 80 per cent. asphaltum. The method now used in Pasadena in the construction of macadam roadways in to incorporate the oil into the crushed rock which forms the surface, and which automobile traffic will not ravel, and which has the appearance of a sheet asphalt street. Spraying with oil has also been used as a dust preventive. Oil costs at Pasadena and Los Angeles about $1.10 per barrel of 42 gallons. At Los Angeles it was found necessary to add a layer of fine rock or screenings mixed with oil to the old macadam surface. The old macadam was swept clean and made as open as possible before oiling.

San Francisco in Golden Gate Park has satisfactorily solved the dust nuisance by the use of oil on macadam roadways. The city, during the coming year, proposes sprinkling most of the macadam roadways with a solution of calcium chloride. Last summer they used calcium chloride on the paved streets with considerable success.

Toronto uses a petroleum residue, a portion of which comes from Pennsylvania and the balance from Canada. This oil is of a paraffin base, and is not so suitable as the Californian oil, which has an asphalt base. The cost of the latter precludes its use in Toronto. The ordinary street sprinklers are used with the exception that the bore of the sprinkler proper is decreased and made uniform throughout. Toronto has had its macadam roadways well surfaced and crowned with oil five times a year.

Tacoma, Wash., has had very little experience with this question, but purposes trying oil on the macadam roadways.

Portland uses oil on its macadam roadways, applied with a sprinkler. One hundred and twenty-five barrels is made to cover one mile of roadway 20 feet wide. The oil costs $1.05 per barrel. This city does not oil the full width of the streets, but where a street is 30 feet wide only oils 20 feet in the centre. The oil is used cold, but better results are obtained on a warm day.

NEW INCORPORATIONS.

Ottawa, Ont.—Jaques Transportation Co., $250,000. C. A. Jaques, R. Bickerdike, A. M. Jaques, Montreal.

Toronto.—Hare Engineering Co., $400,000. J. O. Sharp, T. B. Williams, S. L. Gibson. Little Turtle River Improvement Co., $20,000. R. B. Henderson, A. H. Royce, A. M. Boyd. Ontario May-Oatway Fire Alarms, $100,000. W. Gilchrist, A. W. Garden, T. Moss. Canadian H. K. Porter Co., $50,000. H. K. Porter, W. E. Lincoln, W. E. Martin, Pittsburgh, Pa.

THE RAPID TRANSIT PROBLEM IN PITTSBURGH.

Abbreviated from a Preliminary Report by Bion U. Arnold, C.E., Chicago, U.S.A.

The problem of transporting the people of a modern city from home to office and shop and back again is the most difficult of the various questions that arise.

Mr. Bion U. Arnold in his report to the city of Pittsburgh, Pa., considers three means.

1. The Improvements Available at the present time to provide better "rapid transit" facilities for the District are

(a) Elevated roads,
(b) Subways, and
(c) Electrification of suburban terminals of steam railroads.

II. Elevated Roads.—The only available location for an elevated system in the down town business district would be upon the outlying streets along the rivers, as the structure would not be tolerated in the narrow streets of the more congested central areas. This out-of-the-way location would place an elevated road at a disadvantage.

Elevated structures designed to carry the surface cars around Herron Hill would be expensive and the operation of single car units would so limit the capacity of the tracks that it is doubtful if sufficient additional car miles could be operated to justify the investment.

III. Subways.—A subway between the down town business district and certain centers in the outlying districts appears to be a natural development. It is probable that one section of the city will be ready for a subway before the other sections, but eventually all parts of the city should be connected by some unified system of sub-surface transportation.

A subway is admirably adapted to overcome the natural divisional obstacles, such as hills, ravines, and rivers which now separate the various communities. And as a civic improvement, the building of a subway will eventually become a necessity in order to remove the increase in passenger traffic from the surface of the streets. The present questions however, are where and how soon should subways be built and under what financial restrictions.

IV. Technical Elements of Subway System.

(a) First Cost.—The first cost of a double track subway, fully equipped, may be estimated as between $1,000,000 and $2,000,000 per mile of single track, depending upon the physical difficulties, size, elaborateness of design, number of stations, amount of rolling stock and other equipment, value of real estate necessary for stations, terminals, shops, yards, etc. A subway system for Pittsburgh should hardly be undertaken unless an expenditure of at least $30,000,000 is contemplated, half of this amount, at least, to be spent for the sections first built.

(b) Operating Expense.—Experience has shown that the ratio between operating expenses and gross earnings, under subway conditions, varies between 40 and 60% with a fair average of 50%. The average operating expense of a surface system is from 60% to 70% of passenger earnings, and it is the fact that subways can be operated at a relatively lower percentage that justifies the larger investment in situations where the density of traffic is great.

(c) Earnings.—The annual earnings from operation should amount to not less than 10% of the first cost, and seldom will amount to more than 15%, for before reaching this latter figure there no doubt would arise demands for extensions. These figures indicate on what narrow margins enterprises of this character must be financed. Under Pittsburgh conditions, I believe that average annual earnings from passengers equal to at least 12% of the first cost of the system will be necessary to make a subway practicable.

(d) Earnings per Capita.—If the first section of the subway must earn an amount equal to 12% on $15,000,000 or $1,800,000 per year, the question is when will it be possible to build it?

The earnings per capita of the surface system are now about $10.00 as an average, but certain residence sections of the city run as high as $28.00 per unit of "sleeping population" of the district.

Earnings per capita increase at a rate not less than the rate of increase in population, and often at a greater rate, depending on the riding habits of the community. Therefore at $10.00 per capita, the subway must serve 180,000 people in order to earn $1,800,000 yearly; at $20.00 per capita, only one-half this number or 90,000 people would be required. A conservative estimate would be that if a subway can be designed to serve 150,000 people contributing $12.00 each per annum to the subway in addition to their use of the surface system, then an initial investment of $15,000,000 would be justified, or at the rate of $100 per person served.

(e) Density of Population.—At present the maximum density of population in Pittsburgh over any considerable area is about 100 persons per acre, although one ward, the old Seventh, had a density of nearly 200 per acre; but in many residence districts, such as the East Liberty section, the density is as low as 30 per acre. In New York the density per acre for the lower "East Side" is about 700 per acre, and in Harlem, which is the best contributing district for the New York subway, the density is 150 per acre, which is the same as the average for the entire island of Manhattan.

At 100 per acre, 150,000 people would occupy 1,500 acres or 2.35 square miles, while at 50 per acre, the district required for 150,000 people would be twice as much or 4.7 square miles. It is very probable that, with the opportunities which Pittsburgh has of spreading out, that there will not be sufficient increase in land values to justify whole blocks of high apartment buildings such as are found in New York City. But there, no doubt, will be considerable development in the line of apartment dwellings, which will raise the present average density of population in many sections, although it will not be safe to count on large contiguous residence areas where the average density will reach as high as 100 per acre. This would indicate that the first section of the subway should be designed to serve an area of about four square miles.

(f) Combined Surface and Subway Systems.—In order to reach the amount of territory that will secure patronage to justify a subway, it will be wise to count on a combined system using the subway as a main trunk line and the subway railway as a means of collecting and distributing the passengers over a wide area. Furthermore, in order to use the tubes to best advantage, they should be located and designed so as to accommodate suburban trains coming into the city over the various lines of the present railroads, which may be electrified eventually. With these two auxiliary systems contributing to the earnings of the subway, it will be unnecessary to be so dependent upon the earnings of the territory directly contiguous to the main trunk line.

However, to secure this "transfer" and "through" business, it will be necessary to design a subway for real rapid transit by eliminating the stops in the short haul territory just outside the business center of the city and to operate trains instead of single car units.

(g) Successful Subway Design in Pittsburgh will apparently involve the location of the subway in territory which is capable of being built up with apartment houses, the selection of station sites convenient to transfer to a surface system, and the design of terminals which will make connections with

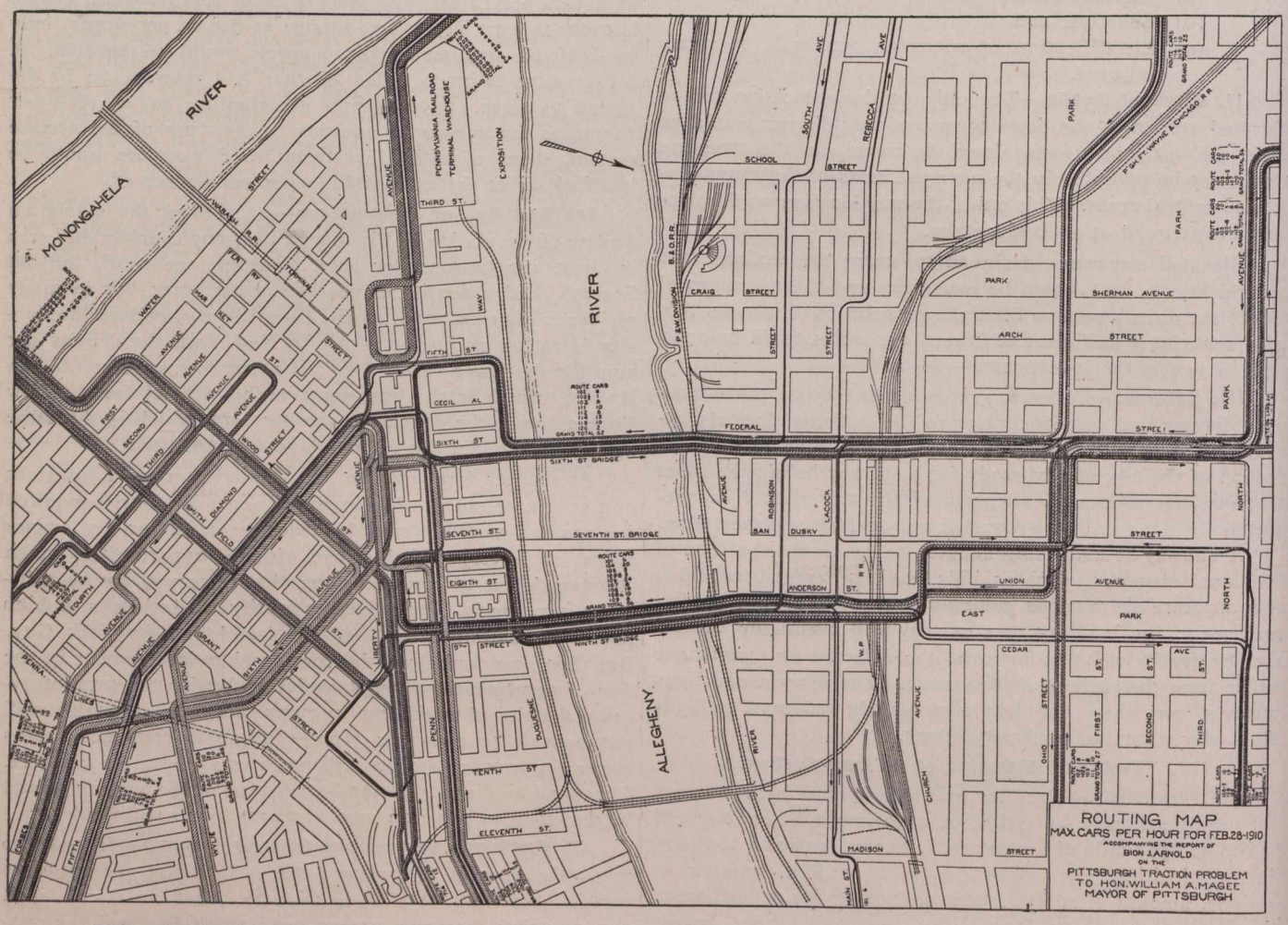
electrified suburban lines. The configuration of Pittsburgh with its probable growth in population lends itself to the successful meeting of all these conditions. But to disclose the exact location of a subway before the property is secured for stations and terminals, will unnecessarily hamper the enterprise with a too heavy real estate burden. In general, it may be said that the first section of the subway should connect the down town district with East Liberty, with two stations in the business center and about three stations in the East Liberty district. The second section of the subway should be built under the river to Allegheny, and the next two sections should consist of loops in the business center and an extension to the South Side.

4. A Contingent Reserve Fund to take care of extraordinary accidents and other unforeseen contingencies, which should accumulate and be kept invested until it reaches about 5% of the total cost.

5. Interest on Cost, which at present may vary from a maximum of about 8% with private capital down to about 4% with municipal credit.

6. Discount Fund, which should offset the discount on bonds or other similar indebtedness in about twenty years.

7. Surplus Profits, which in case of private ownership, should be divided with the city on some equitable and agreed basis or used for building extensions.



RUSH HOUR CAR MOVEMENT—PRESENT ROUTING AND WINTER SCHEDULE—DOWN TOWN TERMINAL DISTRICT.

This diagram, by means of shaded lines varying in width with the number of cars on each street during one rush hour, shows the amount and location of the congestion in the down town district. The system of turning back the cars on the various routes in the down town business centre is by means of loops with no stub end terminals except one at the Union Depot. This loop routing results in many conflicting crossings at street intersections on account of the converging layout which was brought about by the two systems of streets developing parallel to the rivers. The maximum number of cars scheduled to leave the down town section of Pittsburgh is 598 per hour.

V. Financial Consideration.

Any sub-surface transportation system, to be permanently successful, should be able to carry the following financial burdens:

1. Operating expenses including taxes, damages, insurance and maintenance, which will vary from 40% to 60% of the passenger income, depending upon the volume of traffic.

2. An annual Depreciation Fund which will vary from 3% to 5% of the cost of equipment only.

3. An Amortization Fund which, at 1% per year on cost of construction (compounded at 2.5%), will retire the investment in structure in fifty years; or at ½% per year, would amount to the first cost of construction in seventy-five years.

VI. Methods of Financing Subways.

Four subway systems have been built in this country: those in Boston, New York and Philadelphia.

The first Boston subway was constructed by the city, and was rented to the local railway company on a basis of not less than 4⅞% annual rental upon its total first cost. Arrangements recently have been made, however, for the Boston Elevated Railway Company to finance the Cambridge extension from Boston with its own capital.

The original subway of the Interborough Company of New York was built with money raised upon bonds guaranteed by the city's credit. This money was used in the construction of the subway itself, but the equipment was furnished

by a private company which was given the privilege of operating the subway for a period of 50 years with a possible extension of 25 years. The subway of the Hudson and Manhattan Company was built entirely with private capital, but the company pays an agreed varying annual rental for the use of such streets as it occupies on Manhattan Island.

The Philadelphia subway was built entirely by private capital and is used as a down town terminal for both elevated and surface cars of the Philadelphia Rapid Transit Company.

The various methods which have been recognized or suggested for financing the cost of subways may be briefly recapitulated as follows:

(a) Private Capital for Building, Equipment and Operation.—Length of franchise may be for (a) short term, (b) long term or for (c) indeterminate term. Right to purchase should be retained by the city.

(b) City Credit for Construction, Private Capital for Equipment.—To be operated by contractor for a term of years. Sinking fund should be provided to retire city bonds used in construction. City should have the right to purchase equipment at a fair valuation at the end of the contractor's lease.

(c) City Credit for both Construction and Equipment, Private Operation.—To be operated by contractor on bonus principle. Sinking funds to be provided for retiring cost, for depreciation and for operating reserve.

(d) City Credit for both Construction and Equipment, Municipal Operation.—Municipal construction and operation without the use of any private enterprise whatsoever.

(e) Assessment.—Part or all of the cost to be raised by long term assessment on the property benefited, preferably without accumulation of interest. In case of very poor territory the loss from operation during the first years, while business is being developed, should also be financed by assessment.

VII. Return on Investment in Subway.

The earnings and net returns will depend on the following:

1. Density of population served, and rides per capita.
2. Equitable arrangement for exchange of transfers between the subway and the collecting and distributing surface system.
3. Use of subway as a down town terminal by electrified branches of present steam lines.

In my opinion a subway in Pittsburgh will pay eventually, but there will be a loss during the first years of operation, and particularly so if it be built too soon or upon too large a scale. To insure the stability of the enterprise, this deficit must be offset by the profits made during subsequent years. Therefore, in order that the turning point, when earnings exceed operating expenses plus annual fixed charges, be not deferred too long, the subway should not be constructed until definite arrangements have been made with existing transportation systems for the joint use of the subway to the mutual advantage of the companies and the traveling public.

The operating expenses may be controlled, to a certain extent, as the service rendered may be made to suit, within limits, the traffic available. But the annual fixed charges will be the result of preliminary arrangements which cannot be reduced without financial loss to the original investors.

For instance, the First Cost will depend upon

(a) The actual cash cost of the property.
(b) The profit to be allowed the contractor.
(c) The interest paid during construction.
(d) The discount for underwriting funded debt.
(e) The profit to be allowed the promoter.

And the Annual Fixed Charges, after paying operating expenses, (including maintenance, taxes, damages, and insurance) will depend on what is allowed for the following items:

(a) Interest on funded debt.
(b) Depreciation.
(c) Sinking fund for retiring cost of construction.
(d) Reserve fund for contingencies.
(e) Discount fund to offset discount on bonds.
(f) Dividends to reward enterprise or to cover a fair return on the investment.
(g) Percentage, if any, to be paid the city for its share of gross or net earnings.

VIII. Problems Requiring Investigation.

In order to determine, more definitely, the prospects of building a subway in advance of actual needs, so that it may become an important factor in influencing the extent and character of the growth of the city and district, it will be desirable to proceed along the following lines of inquiry:

1. Ascertain the "best terms" which private capital will offer or accept for building, equipping and operating the subway and for giving the city the right to purchase.

2. Secure by legislation the right for the city to issue bonds of a type self supporting and independent of the debt limit, so that money for purchasing or constructing a subway and possibly for equipping it also, may be secured by means of the city's credit, and thus reduce to a minimum, the fixed charge for interest.

3. Determine what the present street surface railway company will do in regard to interchanging transfers with the subway.

4. Determine what the steam railroad companies will do in regard to electrification of their suburban tracks and renting the use of the subway as a down town terminal or for a through passenger connection for suburban trains.

5. Determine, by comparing the present census with others, the rate of growth of the sections which may be affected by rapid transit development.

6. Ascertain the probable increase in value of real estate in the districts to be served in order to determine whether or not this increase in value of land will justify the building of apartment houses in sufficient numbers to result in a density favorable to subway operation.

7. Investigate the possibilities of raising all or part of the first cost of a subway by assessment on the land benefited by the improvement.

THE RE-ROUTING PROBLEM.

Fully as important as the development of a comprehensive plan for the rehabilitation and improvement of the physical plant of the system is the question as to how, when and where to run the cars. This is a problem of such far-reaching importance that it should not, in fact, cannot, be satisfactorily settled by any one man. The President of the Railways Company or his officials cannot alone make the decisions without exposing themselves to criticism; and the service cannot be successfully regulated by any representative of the city without the co-operation of the Railways Company. The problem, therefore, is one that should be worked out by means of an official conference; and until the fundamental principles of re-routing have been determined and an equitable balance between the various interests has been established in such a way that the balance can be maintained, there can be little real progress made towards securing adequate service by means of re-routing.

To Improve the Routing on a permanent basis, the following steps are suggested:

1. Determine the relation that should exist between income and service by agreeing that a certain percentage of the gross earnings from operation shall be used in giving service; the balance to be retained by the company for fixed charges and profits. A discussion of what this ratio should be under Pittsburgh conditions has been prepared and will follow in a later report.

2. Study the requirements of each section of the city and district and the physical difficulties to be contended with.

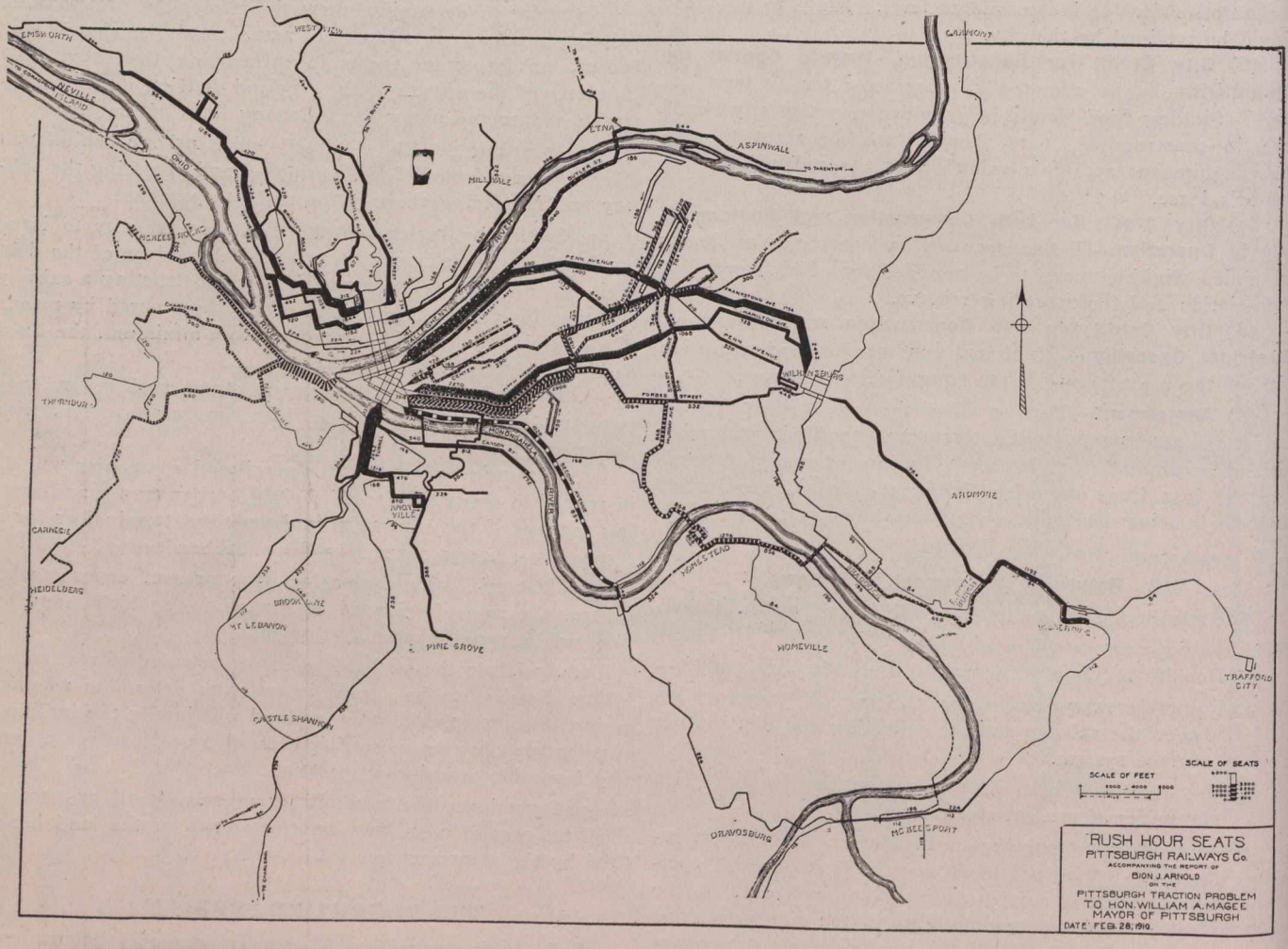
3. Establish the principles of routing that will result in the most economical distribution of the car miles available with a given income.

Data Required For Routing Problem.

Any rearrangement of routes, to be of permanent benefit, must be based on facts and not on assumptions. Among the records which should be available to those charged with the responsibility of working out an improved schedule are the following:

1. Monthly Records of the number of passengers, number of car miles and earnings per car mile on each route for several past years.

2. Continuous Daily Records showing the earnings of each car on each route, the total number of passengers carried by each car and the actual time of each trip as compared to the scheduled time.



RUSH HOUR SEATING CAPACITY—PRESENT ROUTING AND WINTER SCHEDULE—ENTIRE SURFACE SYSTEM.

The relative widths of the lines indicate the number of seats **scheduled** one way on each route during a rush hour. The main line and the branch lines are plainly shown. The total number of seats due to leave the central business district at "The Point" and on the North Side is 23,942 during the peak hour of the evening rush. This diagram shows where these seats go and how the system is routed on the "direct" principle, with most of the cars running from the centre of the city to the outlying districts with very few cross town lines.

4. Provide a system for the recording and the checking of schedules, delays and accidents. These records should be constantly used for improving the service and should be public.

5. Make provision for extending and altering the tracks and routes to take care of constantly growing and shifting demands.

It will be decidedly ineffective work to approach the re-routing part of the transportation problem without an equipment for securing the information needed as well as a definite understanding that a comprehensive plan is to be developed, which will be acceptable to and accepted by the majority of interests affected.

3. The Physical Limitations of each route showing length of line, curves, width of streets, obstructions at corners, distance between tracks, overhead obstructions, grades, terminal facilities and connections with other routes.

4. The Present Schedule showing the number of cars scheduled at different times of the day for summer and winter service, and the time required for each run during rush hours and non-rush hours.

5. The Location of Car Houses and Storage Tracks and a statement of the dead mileage which the present arrangement entails in running empty cars to and from the ends of their routes when placed in or taken out of service.

6. Records of Counts on passenger and seats which have

been made from time to time by the city and by the company at various checking stations.

7. Records of Individual Car Trips which have been made and which ought to be made to ascertain when the passengers board the car, how far they travel and when they alight, and the ratio between the maximum number of passengers using the car on a given one-way trip and the maximum number on the car at any one time.

8. A Study of Transfers showing the total number and the character and size of the transfer load at the transfer points.

9. Record of Franchise Requirements and agreements between underlying companies which affect the number and location of the cars on the various lines.

10. Copies of Working Agreements with operating men as to hours of work, tripper or swing back runs, etc.

11. Full List of Car Equipment available, ordered and contemplated, with data as to possible changes which will allow for double-ended operation.

Principles of Routing.

Before much progress can be made in re-routing the cars, an agreement will be desirable covering the fundamental principles involved, some of which may be outlined tentatively as follows:

1. Measure of service on any route should take into account the ratio between the total number of passengers in the car for the entire one way trip and the maximum number on the car at any one time. This "loading factor" is different for different routes, and if the continuous records for individual car loading is to be an indication of the relative demands for seats, this factor should be determined for each route and used intelligently.

2. To determine whether any part of the system should be on a through line or on a transfer route, the demand for seats during the rush hour on that line should be sufficient to call for say six large cars per hour; otherwise it will probably be found that better service may be supplied by a small car operating more frequently in a shuttle service.

There may be routes or lines upon which shuttle service might be provided to the best advantage at all times except during rush hours, when "through" cars can be provided.

4. Transfers are not a hardship if the passengers get something in return to compensate them for the inconvenience of transfer—for instance more frequent service in large comfortable cross seat cars for at least part of the ride.

5. The small single truck cars should be operated on the hills, and on cross town transfer lines, but should be kept out of the terminal district and off the main thoroughfares.

6. In the down town district, the long haul routes should make use of the short loops and the short haul routes should use the long loops, as the long haul passengers will walk further to get a seat than the short haul passengers.

7. Through routing can be established gradually, by first connecting the short haul routes on different sides of the city in such a way as to form through routes, and as these first routes prove successful, more through routes may be added.

8. Transfers should be given in an effort to cut out useless car miles and by concentrating traffic on through routes secure the efficiency that comes with the most efficient density.

9. If it can be agreed that the service to be supplied is measured by the income, then the one city, one fare principle and a very liberal transfer policy can be adopted, and there will be no question as to whether or not the patrons of the system will get back in service their share of the fare.

The working out of the whole problem of routing, therefore, starts with determining definitely how much of the income is available for service, then how many car miles this appropriation will supply, and finally what disposition of this service will best supply the demands for seats.

This program presupposes that the records of the present routing and service will be available, that the results of a complete system of checking future operations will be made public and that there will be continuous and effective co-operation between the company and the city in considering and carrying out the proposed changes and eventual improvements.

A STEAM HEATING SYSTEM UNDER MODULATED CONTROL.

A seven-day test conducted last winter on a Warren Webster Modulation Heating System in an office and warehouse building in Montreal, demonstrates how successfully heat can be supplied when, where and in the amounts wanted by a steam heating system in which the steam admission to each radiator is regulated and the discharge of water and air is under proper automatic control. The installation on which

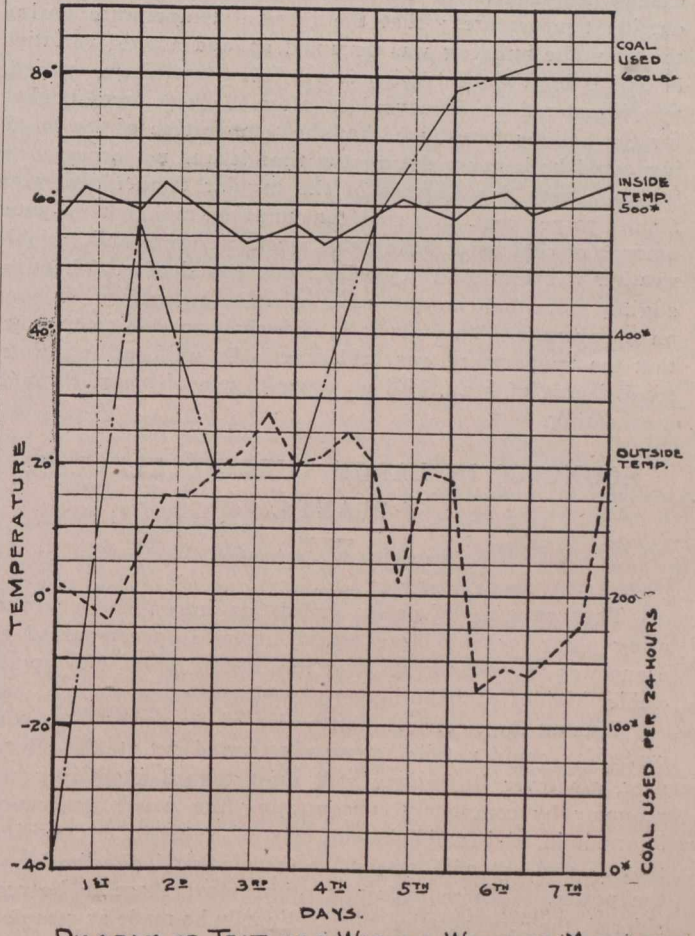


DIAGRAM OF TEST OF A WARREN WEBSTER MODULATION HEATING SYSTEM IN AN OFFICE AND WAREHOUSE BLD., IN MONTREAL. DESIGNED BY DARLING BROS. LTD. AND INSTALLED UNDER THEIR SUPERVISION.

the test was conducted was designed by and installed under the supervision of Darling Bros., Limited, of Montreal, sole manufacturers in Canada of the Warren Webster apparatus, and was a standard two-pipe Webster Modulation System.

The test ran from a Thursday to the following Wednesday, the offices being closed all day Saturday. The building in question has a cubical content of 120,000 feet, is exposed

on three sides, the total wall exposure being 7,843 sq. feet; the roof area is 2,860 and the exposed glass area is 1,239 sq. feet. Because of its location in Montreal it was obviously exposed to very severe weather conditions; all windows were provided with double sash. The radiating surface was figured on the basis of steam supplied at a pressure of 6 to 8 ounces, the total installed being 1,500 sq. feet.

Each radiator is equipped with a self-indicating Webster modulation inlet valve having a figured dial conveniently located at the top on one end with a Webster water seal motor at the return end. By the inlet valve the effective area of heating surface can be quickly changed and the temperature of the room perfectly modulated. The usual fault in steam heating systems, of having the steam either all on or all off is entirely avoided. The water seal motor, requiring no adjustment, automatically ejects water and air from the radiator without permitting the escape of steam.

How closely the temperature in a building can be controlled by the modulation system in spite of wide variations in the outside temperature is well shown by curves in the accompanying plot, derived from figures obtained during the test.

It will be seen that the amount of coal burned was almost exactly proportional to the difference between the inside and outside temperatures; that the internal temperature during the days the building was occupied showed a total variation of only 6 deg., and in reality it was less than this, as 59 deg. was registered on Friday night after the fires were banked for the holiday Saturday; that the temperature of the building could be kept up during the time it was not occupied to within a very few degrees of the regular temperature with almost 50 per cent. less coal consumption, and that the total amount of coal used during this week of severe and variable weather was less than 3,500 lbs., one pound of coal heating slightly more than 72 square feet of radiating surface per hour on an average. This result is directly traceable to the fact that the temperature was held practically uniform at the desired degree of heat, with no wasteful use of steam through overheating.

ECONOMY IN LARGE TURBINE ELECTRIC PLANTS.

Dugald C. Jackson*

The centering of power generation into a single generating plant for any large establishment is accompanied by economies in power generation that are of themselves appreciable, besides contributing to reliability.

Without the electrical distribution of the power, such concentration could not be adequately carried out at all. Moreover, whatever limitations still exist toward improving the economy by completely concentrating the power generation in any industrial establishment, exist with respect to the prime movers and not with respect to the electrical distribution of the power. Where hydraulic prime movers are to be considered, the concentration may ordinarily be made as complete as the conditions of the water supply will permit; since the charges on account of first cost of installation and the labor cost of operating practically dominate the cost of the power developed, and these may ordinarily be expected to decrease per unit of output as the capacity of the plant is increased, under conditions of equal or improved load-factor. An equivalent condition has not heretofore existed where steam prime movers have been used. Since neither labor, cost nor steam economy are much improved by increasing a steam-electric generating plant over a size of a few thousand kilowatts capacity when reciprocating engines are used, the need of extreme concentration of individual plants has not heretofore been acutely felt.

But the advent of large steam turbines has altered the conditions. Plants equipped with these machines installed in association with boilers provided with adequate labor-saving appliances may be operated with labor costs that vie with the labor costs pertaining to hydraulic generating plants equipped with machines of equal size; and the steam economies derived from the newer steam turbines are remarkably satisfactory. The operating economies of large steam-turbine plants, either in respect to the use of labor or the use of fuel, do not, however, seem to be exhausted within the limits of capacity yet attained in even the largest generating plants now in commission. Moreover, the first cost per kilowatt of capacity of plant, including land, buildings and machinery, falls off in an important degree for the larger steam turbine plants, until such a plant may nearly rival a hydro-electric plant in the gross cost per kilowatt-hour of energy delivered at the switchboard, through the fact that the fuel cost pertaining to the steam-turbine plant has an offset in the charges caused by larger first cost per kilowatt of capacity of hydraulic plant.

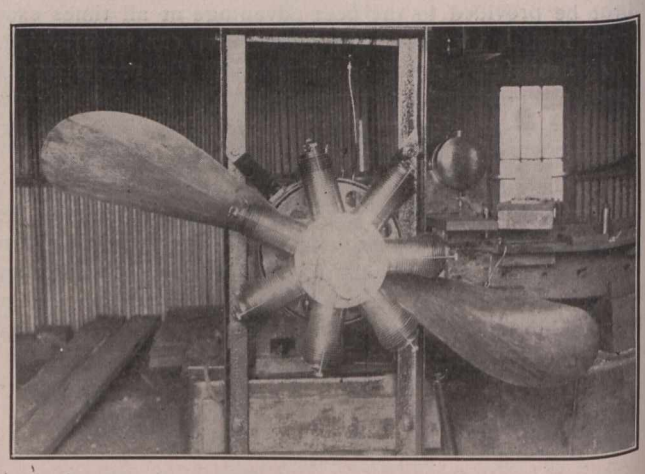
*Newly elected president of the American Institute of Electrical Engineers.

THE NEW FARMAN BIPLANE AND GNOME MOTOR.

By Frank C. Perkins.

Gasoline motors of the air-cooled as well as the water-cooled types have been favored by various aviators for operating aeroplanes, both monoplanes and biplanes. Without question without the gasoline motor the heavier-than-air machine would never have been successful, as no other form of prime mover combines great power with the necessary lightness.

Many successful flights have been made by Henry Farman in his biplane, equipped with Omega revolving cylinder air-cooled motors, of the Gnome type, shown in the accompanying illustration, Fig. 1. The motor is of very light con-



struction, highly efficient, and most satisfactory in operation for aeroplane service. It is constructed at Paris, France, by the Societe des Moteurs Gnome, and has seven cylinders directly coupled to the aeroplane propellers. A peculiar form of propeller is utilized, designed and constructed by L. Chauviere, of Paris, and said to have an efficiency of from 90 to 97 per cent. The diameter is 8½ feet, and the two blades are constructed of walnut and highly polished. The cutting edge is straight and radial, and the aim is undoubtedly to cut the air with a perpendicular stroke. The section of the

blade is a sharp D, with the oval side forward, following approved aeroplane outline. The propeller was designed for a peripheral speed of from 100 to 200 metres per second.

The Farman biplane, the latest design, has a total area of 410 square feet and a total weight of 1,212 pounds without the aviator. The main planes have a span of 32½ feet, measuring 6 1-3 feet on the chord. The total length is about 40 feet, and the tail is a biplane of about 7 feet span.

The Gnome 7-cylinder rotary motor is situated behind the propeller, and the inlet valves are in the piston heads, the mixture being admitted to the hollow stationary crank shaft.

In the development of this French engine one of the principal problems has been the balancing of the valve against the disturbing influence of centrifugal force. This difficulty has been overcome, and on account of the efficient cooling system is said to give excellent service for aeroplane work.

The outside diameter of the revolving cylinders forming the motor fly-wheel is 80 millimetres, from the head of one cylinder to that of the one diametrically opposite. This French engine operates at a speed of 1,200 revolutions per minute, and weighs only 76 kilograms, developing a normal load of 50 horse-power. The seven cylinders are each 110 millimetres in diameter, and have a stroke of 120 millimetres. The fuel consumption is said to be 2 kilograms per hour, or about 300 to 350 grammes per horse-power hour.

On account of the rapidly revolving cylinders being in a continual blast of air they are efficiently cooled and the weight usually required for radiators and cooling water is avoided. For small aeroplanes a light engine has been designed, having five cylinders and developing 30 horse-power. This motor operates at a speed of 1,300 revolutions per minute, and weighs only 60 kilograms. The bore is of 100 millimetres, and the stroke 100 millimetres. The bearings are lubricated as well as the cylinders by the oil pumped under considerable pressure.

A large engine of great horse-power has been constructed of the Gnome type with 14 cylinders, and weighing only 100 kilograms, yet having an output of 100 horse-power. The cylinders of this engine have a bore of 110 millimetres, and a stroke of 120 millimetres, the speed being 112 revolutions per minute.

ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

11089—July 7—Authorizing the Seymour Power and Electric Company, Limited, to erect electric transmission lines across the wires of the Bell Telephone Company, at Lots 22 and 23, Township Thurlow, Ont.

11090—July 7—Recommending to the Governor-in-Council for sanction By-law No. "F" of the Algoma Central and Hudson Bay Railway Company, (spitting in cars).

11091—July 7—Recommending to the Governor-in-Council for sanction By-law No. "D" of the Manitoulin and North Shore Railway Company, (spitting in cars).

11092—June 27—Dismissing application of the Grand Valley Railway company for authority to cross with its railway the tracks of the B. & H. Electric Railway Company at Murray Street, Brantford, Ont.

11093—June 28—Authorizing the T. N. & W. Railway Company to construct its railway across twenty-four highways in Toronto.

11094—June 27—Dismissing application of the Grand Valley Railway Company for authority to cross with its railway the tracks of the T. H. & B. Railway Company at Cayuga St., Brantford, Ontario.

11095—June 27—Dismissing application in the matter of protection to be provided at the crossing of the Ontario Division, London Section, of the C.P.R. at Dundas and Waterloo Road, Galt, Ont.

11096—June 27—Authorizing the T. N. & W. Railway Company to take certain portions of Lot 35, Con. 3, and part of Lots 14 to 24, inclusive, Toronto, Ontario, for its railway.

11097—June 27—Dismissing application of the Grand Valley Railway Company for authority to cross with its railway the Western Cos. Electric Company's Canal at Murray Street, Brantford, Ontario.

11098—June 27—Dismissing application of the municipality of Colchester South, Ont., alleging inadequate passenger and freight service furnished by the P.M.R.

11099—June 27—Dismissing application of the Hamilton Radial Electric Railway Company for an Order directing the city of Hamilton to provide safety appliances and to erect an overhead crossing at the east end of the city's bridge on the east side of Sherman Inlet, Hamilton.

11100—June 28—Authorizing the Canada Southern Railway Company to take as additional lands for its railway certain lands in the city of Windsor, being the property of Frank Pawloski.

11101—June 27—Dismissing application of the corporation of the city of Toronto, Ont., for an Order directing the Grand Trunk to provide protection at its crossing at Woodbine Avenue, Toronto, Ontario.

11102—June 30—Dismissing application of the Grand Valley Railway Company for approval of location of the proposed Grand Valley Railway Company's terminal connecting the railway of the Applicant Company, the B. & H. Electric Railway, and the T. H. & B. Railway with the Homedale Factory District, Brantford, Ont.

11103—June 27—Directing that the C.P.R. install a Whyte Signal Electric Bell at the crossing of the railway at Weston Road, Township of York, Ontario.

11104—July 9—Directing that the C.N.R. do forthwith erect stop-order boards to be placed 100 feet on each side of the crossing at Pembina Street, Winnipeg; that all trains of the C.N.R. be brought to a full stop before being flagged over the crossing at Pembina Street; and that the Winnipeg Electric Railway Company do forthwith construct a single track under the tracks of the C.N.R. at said Pembina Street crossing.

11105—July 8—Amending Order No. 10998, dated the 24th June, 1910, authorizing the R. Forbes Company, Limited, to lay a water pipe under the track of the G.T.R. at Forbes Crossing, Hespeler, by striking out the words "at its own expense" in the 5th line of the 4th paragraph of said Order, and substituting in lieu thereof the words, "at the expense of the applicant."

11106—July 12—Authorizing the corporation of the city of Winnipeg, to erect a conduit under the track of the C.P.R. on King Street and Higgins Avenue, Winnipeg.

11107—July 8—Authorizing the Lincoln Paper Mills Company to lay a 12-inch water main under the track of the G.T.R. in Merritton, Ont.

11108—July 7—Authorizing the corporation of the city of Ottawa to lay a water main under the C.P.R. track at Beechwood Avenue crossing, near St. Patrick Street Bridge, Ottawa.

11109-10—July 7—Authorizing the corporation of the city of Peterboro to lay a sewer under the track of the G.T.R. at Dalhousie Street crossing, and at Ware Street crossing, Peterboro, Ont.

11111—July 12—Authorizing the United Fuel Supply Company to lay a natural gas pipe under the track of the M.C.R. on Main Street in Brigden, Ontario.

11112—July 6—Declaring that the crossing of the C.P.R. of Dundas Street, Woodstock, is protected to the satisfaction of the Board.

11113—July 8—Directing that the C.P.R. provide and construct a suitable farm crossing where its railway passes through the farm of Wm. Hutchin, of Brownsburg, Quebec.

11114 to 11116 Inc.—July 7— Authorizing the C.N.Q.R. to construct its railway across the public road between Lots 20 and 21, Parish of Ste. Foye, County Quebec; across the public road between Lots 2363 and 2365, Parish of Little River, County Quebec; and across the Gros Pin Road, on Lot 4144, Parish of Limoilou, in Quebec.

11117—July 7—Extending until the 1st of December, 1910, the time within which the G.T.P. Railway Branch Lines Company was required by Order No. 10613, dated the 12th and 13th days of May, 1910, to install interlocking plant at the crossing of its tracks by the crossing of the C.P.R. at Alix, Alta.

11118—July 12—Authorizing the N. B. & S. Railway Company to construct the following bridges on its line of railway:—1. No. 50.54, Pocologan River; 2. No. 30.5, Linton Stream.

11119—July 9—Authorizing the G.T.P. Branch Lines Company to divert the road on its Calgary Branch between Sections 20 and 21, Township 33, Range 23, west 4th Meridian, District of South Alberta, Alta.

11120—July 12—Authorizing the C.P.R. to construct the following bridge on its line of railway:—1. No. 125.2, Hastings, B.C.; 2. No. 45.3, Alliston, Muskoka Section, Ontario Division.

11121—July 12—Authorizing the C.P.R. to construct an industrial spur across Champagne Avenue and Ducharme Street, and across the land of Pariseau Freres, Outremont.

11122—July 12—Authorizing the C.P.R. to construct an industrial spur for the city of Winnipeg, in Parish Lot 28, St. John, in the city of Winnipeg, said spur to connect with the easterly gas house spur of the Winnipeg Electric Railway Company.

11123—July 12—Authorizing the C.P.R. to construct the following bridges on its line of railway:—1. No. 62.8, Coat River, Sirdar Section, Western Division; 2. No. 37.4, Overhead Farm crossing, Toronto Section, Ontario Division; 3. No. 120.79, Chapleau Section, Lake Superior Division; 4. No. 107.92, Cartier Section, Lake Superior Division.

11124—July 7—Authorizing the Department of Lands and Works of British Columbia to use and operate interlocking plant and signal apparatus on the bridge over the Fraser River at New Westminster, B.C.

11125—July 9—Authorizing the Laval Electric Company to erect its transmission line across the wires of Mr. Archambault, near Mascouche Station, Que.

11126—July 12—Authorizing the city of Lethbridge to lay a sewer and water main under the C.P.R. on the road allowance between Sections 4 and 5, Township 9, Range 21, Alberta.

11127—July 12—Authorizing the St. Mary's Wood Specialty Company to lay a drain under the track of the C.P.R. at a certain point in St. Mary's, Ont.

11128—July 12—Authorizing the corporation of the city of Lethbridge to lay a water main and sewer under the C.P.R. tracks at Westminster Road, Lethbridge, Alta.

11129—July 7—Authorizing the C.N.Q.R. to divert the public road on Lots 1 and 3, Parish of Portneuf, Quebec.

11130—July 11—Directing that the Anglo-American Telegraph Company's tariff of telegraph tolls for the transmission of messages between its offices in the Province of Prince Edward Island, and between its offices in the Province of New Brunswick, also between its offices in Prince Edward Island, and its offices in New Brunswick, C.R.C. No. 1, be approved, and that the said tolls, together with a copy of this Order, be published in at least two consecutive weekly issues in the Canada Gazette.

11131—July 12—Approving revised location of the C.P.R. Company's Soo Branch as now constructed at Desbarats Station, and authorizing the C.P.R. to construct its railway across Huron Avenue, at Desbarats.

(Continued on page 113).

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.

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

THE UNION OF NEW BRUNSWICK MUNICIPALITIES.—President, Mayor Reilly, Moncton; Hon. Secretary-Treasurer, J. W. McCready, City Clerk, Fredericton.

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 GAS ASSOCIATION.—J. Keillor, Secretary-Treasurer, Hamilton, Ont.

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

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, Victoria Embankment, London, W.C.; Hon. Secretary-Treasurer for Canada, Lawford Grant, Power Building, Montreal, Que.

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

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 IRRIGATION ASSOCIATION.—President, A. M. Grace, Medicine Hat, Alta.; Secretary-Treasurer, John T. Hall, Brandon, Man.

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.

NEW YORK CEMENT SHOW.—December 14-20, 1910. First annual convention in Madison Square Garden, New York. Under the management of the Cement Products Exhibition Company, 115 Adams St., Chicago.

CHICAGO CEMENT SHOW.—February 15-23, 1911. Fourth annual exhibition, at the Coliseum, Chicago, Ill. Under the management of the Cement Products Exhibition Company, 115 Adams St., Chicago.

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

UNITED STATES GOOD ROADS' ASSOCIATION.—July 28-29-30-31, 1910, Niagara Falls, N.Y. President, Arthur C. Jackson.

NEW ENGLAND WATER WORKS ASSOCIATION.—September 21-23. Annual meeting, Rochester, N.Y. Willard Kent, Secretary, Narragansett Pier, R.I.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.—October 11-16. Seventeenth annual convention, Erie, Pa. Prescott Folwell, Secretary, 239 W. 39th Street, New York, N.Y.

NATIONAL MUNICIPAL LEAGUE.—November 14-18. Annual meeting, Buffalo, N.Y. Clinton Rogers Woodruff, Secretary, North American Building, Philadelphia, Pa.

UNION OF CANADIAN MUNICIPALITIES.—August 31st to September 2nd. Tenth annual convention, Toronto, Ont. Secretary, W. D. Lighthall, K.C., Westmount, Que.; Assistant Secretary, G. S. Wilson, 107 St. James Street, Montreal, Que.

INTERNATIONAL MUNICIPAL CONGRESS AND EXPOSITION.—September 18-30, 1911, at Chicago, Ill. Curt. M. Treat, Secretary, 1107-8 Great Northern Building, Chicago.

NATIONAL IRRIGATION CONGRESS.—Eighteenth Annual, September 26-30, 1910, Pueblo, Colorado. Secretary, Arthur Hooker, Spokane, Wash.

WESTERN CANADA IRRIGATION ASSOCIATION.—August 3, 4, and 5, 1910, at Kamloops, B.C.

TORONTO, CANADA, JULY 28, 1910.

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THE ENGINEERS' LIBRARY

Supplement to THE CANADIAN ENGINEER. 62 Church St., Toronto, Ont.

CONTENTS FOR JULY 28, 1910.

THE ENGINEERS' LIBRARY.

With this issue we announce the publication of a supplement to The Canadian Engineer.

This supplement will appear monthly, and will be devoted exclusively to book reviews and new publications. As the Department grows, it is expected that, in addition to reviewing of books, we will from time to time, be able to review articles that appear in the different engineering magazines.

The engineer is a busy man, and cannot take the time to himself to look over all articles published. We intend to devote considerable time to this class of work and point out to the engineer where he may secure, with the least possible trouble, the greatest amount of information on a given subject.

For this Department of the paper we would gladly accept criticisms of articles that appear in our own or other journals, and also of books published or criticisms of the reviews published.

BOOK REVIEWS.

Railway Act of Quebec, compiled and published by J. A. Lefebvre, Department of Public Works, Quebec, Que. Size 6 x 9, pp. 100, price $2.00.

This publication is a consolidation of the Acts of the Province of Quebec, relating to railways, the taxes payable by railway companies and the repayment of railway subsidies, and has in addition a table showing the subsidies of all kinds which have been guaranteed or paid on account of provincial railways.

The publication in the one volume contains the information in both French and English. Each section gives the references to the original Act or Revised Statutes of Quebec, from which it is taken.

It will be found very convenient for lawyers or engineers having to do with railways in that province.

Directory of Contractors' and Public Works Annual, 1910, size 6 x 9, pp. 500, price $4.00. Published by the Contractors' Chronicle, 48 Gray's Inn Road, W.C., London, England.

This is a reference book containing a list of contractors engaged in the various kinds of contract work in Great Britain. In addition to the list of contractors, engineers and architects, the volume contains the names and addresses of the various associations and organizations that are connected with the engineering profession and the contractor, together with a list of the officers of the principal public bodies of Great Britain.

Some sixty pages are devoted to summaries of the recent decision of the courts on matters that affect the contractor and the engineer. There is also published a list of the private bills that passed the last session of the British House, together with the applications granted by the Board of Trade.

The classification enables one to see at a glance, who it is that has the giving out of contracts and to get the names and addresses of the principal officials of the different corporations and public bodies. The aim of the compiler and the editor has been to arrange the work that will bring in close relation the municipal officers and engineers who have contracts to give out and the firms who are in a position to undertake the class of work which is being given out.

"Tests of Timber Beams" by Arthur N. Talbot, is issued as Bulletin No. 41 of the Engineering Experiment Station of the University of Illinois. The tests described in this bulletin were undertaken with the view of supplying data concerning the structural properties of full-size timber beams of the quality secured under ordinary methods of purchase. The test timbers were selected by the inspectors of two railroad companies. The material thus chosen and tested included 112 bridge stringers of longleaf pine, shortleaf pine, loblolly pine, and Douglas fir, and of several hundred smaller test pieces cut from the same timber. The beams were generally 8 x 14 in. or 8 x 16 in. in section and 14 ft. long.

The results show a preponderance of failures in horizontal shear which is so marked in every series of tests as to emphasize the importance of the shearing resistance of timber. The stringers developed horizontal shearing stresses averaging from 273 to 390 lb. per sq. in. in the several series. Blocks having the full thickness of the beam were cut from an uninjured part of the beam, and the results of shear tests made on these are much below those which have been obtained from small test pieces heretofore used. Comparatively little difference in shearing resistance was found for the different kinds and conditions of wood, large seasoning checks controlling the strength in the stronger woods. It is shown that seasoning checks should be recognized as a source of weakness and that in woods which develop checks and cracks in seasoning, care should be given in dealing with large sticks to avoid rapid and uneven seasoning. The results also show the strong influence of knots, cross grain and other defects on the strength and elastic limit of beams in which they appear. While these effects have been recognized for a long time, their importance is now emphasized by the fact that with the growing scarcity of timber, poorer grades of timber are constantly coming upon the market, making it desirable that the dangers arising from such defects be more accurately understood.

The fibre stress developed in beams not failing in horizontal shear is generally low, averaging for untreated timber tested from 3,690 lb. per sq. in. in the Old Douglas fir to 5,300 lb. per sq. in. in the longleaf pine. One longleaf pine stringer developed a fibre stress of 8,410 lb. per sq. in., while in another a value as low as 2,530 lb. per sq. in. was found. In general, the fibre stress at the elastic limit is proportionally high, the ratio to the fibre stress at failure averaging from 0.67 to 0.90 for the several series of tests.

The small beams cut from the top and bottom of the tested stringers developed from 50 per cent. to 100 per cent. higher strength than the large stringers, the results demonstrating the effect of size on strength in a striking way. The

data given in some engineers' pocket-books and other books are largely from tests of small sticks, and it is shown that values for strength of timber frequently cited are far higher than may be obtained with full-size structural timbers.

The results disclose the interesting fact that sticks having knots and cross grain are generally less stiff than clear sticks, a fact that suggests that when very strong sticks and defective sticks are placed side by side in a structure, the result is that the weaker stick takes less than its share of load and the stronger and stiffer stick takes more.

The results of the tests are accompanied by reproductions of photographs showing the appearance of the timbers and by carefully prepared descriptions. The results are analysed and discussed in a manner which makes clear their significance. The bulletin will be of interest to all users of large-size timber pieces.

International Language and Science, 90 pages, 6 x 9, cloth; translated by F. G. Donnan, professor at the University of Liverpool, published by Constable & Company, Limited, 10 Orange Street, Leicester Square, London, W.C.

Written by scientific and literary men living in five different countries, this publication is intended to explain the present state of the question of an international auxiliary language, in favor of which many able arguments are set forth. The translator says that internationalization of thought is the motto of the twentieth century, the device on the banner of progress; and that this question of the final solution by the methods of science is one of the greatest of scientific problems.

In the first chapter, the author points out that all who are occupied with the reading or writing of scientific literature must have felt the want of a common scientific language and regretted the great loss of time and trouble caused by the multiplicity of languages employed in scientific literature. After recognizing the fact that a knowledge of German, French and English is no longer sufficient, the reader is convinced that the need for a common scientific language is great.

Able discussions are contributed on the necessary linguistic principles for the construction of such a language; on the application of logic to the problem; on the relationship of the international language to science; on the question of nomenclature; and on the subjects of reading, writing and speaking.

The observations are based upon seven years of careful investigation, and the translator expresses the hope that English-speaking men of science will not judge the question before a quiet and dispassionate examination.

The volume would add to the value of any engineer's book-shelf.—W.M.

Joint Outlet Sewer Report, by Alexander Potter, C.E., New York City. Size 6x9, pages 110.

This report embodies all the matter that appeared in the edition of 1905, and contains considerable new matter. Among this new matter is a synopsis of the Joint Sewer Laws, under which the Joint Trunk Sewer was constructed and is being maintained. This was written by Mr. Adrian Riker, Counsel for the Joint Meeting since its inception. It is of interest to note that the Passaic Valley Trunk Sewer Commission, which has been commanding a great deal of attention during the last few years, has formulated its laws after the laws governing the Joint Trunk Sewer. This is interesting because agitation for the Passaic Valley Sewer was started a number of years before the Joint Trunk Sewer was even thought of, and the fact that the sewer which forms the subject of the report which I am sending you, has been in successful operation for the last five years, is a tribute to the wisdom and zeal of those public-spirited men who gave their time and attention to the consummation of this important enterprise.

Another important matter dealt with in this report is that of sewer leakage, the experience of five years of maintenance clearly indicating that in a reasonably well constructed sewer the element of leakage is a progressively diminishing factor. Continuous gaugings of the flow in the sewer at numerous points give abundant testimony as to the truth of this assertion.

Another matter dealt with in the report is a discussion in connection with odors arising from sewers where house traps have been inserted between the sewer and the house vents throughout districts where it has been necessary to close up the perforations in the manhole covers.

The report contains full information as to costs and apportionments of costs. It is also fully illustrated with details of construction and photographs showing the progress of the work, and also contains a map of the district sewered, upon which is delineated the system of main trunk sewers and the laterals connected therewith.

The plan of apportioning the cost of the sewer was suggested by the writer and was based upon the capacity which it was assumed each municipality required, and the length of sewer necessary to serve each of the municipalities; or, in other words, the apportionment of cost was based upon the assumption of each town designing its own sewer outlet to a common point and each municipality sharing the cost of such joint sewers as could be used by it in the ratio of their respective capacities in the portions utilized by them. The maintenance, on the other hand, has been apportioned equally between all users, on the basis that, being a gravity system, the town contributing the largest volume to the sewer required no greater service than the town contributing a lesser amount. The experience of the last five years indicate that the flow from the larger towns requires less attention and maintenance than the flow from the smaller towns.

There are other facts in connection with this report which might be of interest to you and your readers.

The men most active in bringing this project to a successful completion were Mr. Francis Speir, Jr.; Adrian Riker, Esq.; and the writer, and it is interesting to note that these three have retained their identity with the Joint Trunk Sewer from its inception to the present time in the respective capacities of Chairman of the Joint Meeting, Counsel and Chief Engineer.

"Hydraulic Elevators," by Wm. Baxter, Jr., published by McGraw-Hill Book Company, 6½ x 10, 320 pp., $2.50.

Attempting as he does to cover only one type of elevator, the hydraulic, the author has been able to go somewhat fully into the details of design, construction, and management of these. The book, on the whole, is intended rather as a help to the engineer in charge of the elevator already installed in a building rather than as a guide for those intending to install one, as little space is devoted to the comparison or criticism of the standard types. With the above-noted exception the author has gone very thoroughly over the ground. The diagrams of the assembled machinery are almost complete enough to be used as erection plans, and in addition to this sections are shown of each of the numerous valves and controls. Considerable space is devoted to the explanation of these diagrams, about half the book being taken up with the "kinetics" of the elevator's rather intricate mechanism. The author first deals with the most elementary principles of elevator design and traces the development of the hydraulic elevator from its primitive water-balanced "bucket in a well" type of the modern high-pressure, electrically-controlled one. The plunger type being so different in design is dealt with

separately, some ten out of the forty-two chapters being devoted to it. The principal subjects and types discussed are briefly as follows:—Advantages in speed regulation and reduction in size of machinery obtained by high pressure. Counterbalancing, direct and attached to gears, three to one, etc., low and high speeds. Horizontal cylinder machines, pushing and pulling types, advantages of pushing machine for high pressures, gears up to and above sixteen to one. Crane horizontal pushing type, controlled by lever-operated main and pilot valve, automatic stop valve, stop bolts, valve gear. Whittier pulling type, stop ball control, construction and operation of valves, hand rope. Morse & Williams pulling machines, double-decked in limited floor space; stop and main valves, construction of piston, operation of lower, main and upper valves. Overhead sheaves and bearings, lubrication and babbitting, loose and rigid shaft, supporting beams. Discharge pipe relief valves, vacuum and water hammer, air cushion, strainers and their only temporary use with high-pressure systems. Setting of valves, stop-valve, etc., of Morse & Williams machine, carrier rollers for rope sheaves, latch mechanism, valve pistons, omission of pilot valve, stand ropes. Vertical type, plunger not in elevator shaft; general arrangement of system, location of force pump. Low-pressure type, suitable up to seven storeys, two to one gear, Otis, triple method of counterbalancing, circulating pipe, drip, packing, hand rope, balls and safety connection of same, running guides, safety jaws, plank and rocking lever, speed governor, operating valve mechanism and gearing, valve piston, pressure tank, throttle valve, occasional bursting of cylinders due to hard packing. Low-pressure vertical type, lever control, hand rope not suitable for first-class service, lever indirect control through motor cylinder "pilot valve" at top of valve chamber, rotation of valve sheave by lever, toggle joint safety in iron guides, standing rope system and "kinetics" of same. Pilot valve control, advantages, stop screw, speed regulator, packings, lap of valves, hand rope control, relief valve. Safety devices, clamp type rotated drums, springs, gradual retardation, wedges, shafts, bevel gear, emergency lever in relation to clamp safety, magnetic valve control, structural advantages of obviating stretch of ropes, lack of close control and liability to derangement. Magnetic control for battery current; solenoid type, secondary pilot valves, floor switch, wiring diagrams. Double power hydraulic system, variation of lifting power with load obtained by use of both high and low pressure, inspirator effect of combination of two, non-circulating valve and its occasional use. Otis Running Rope System, rigging of ropes, pilot valve. Causes of disordered mechanism and how prevented or removed, bouncing or settling of car, valve packing, rack and pinion type. Automatic top and bottom stopping devices, stop balls, friction defects, effect of stretching of ropes, method of shortening same. Construction of travelling sheave frames, foundations and supports, weighing of piston. High-pressure hydraulic elevators, construction and operation of accumulators, cylinder, plunger and sheaves, adjustment and care of stop valves as used with accumulators. Plunger elevators, passenger type, pipe cylinder, plunger construction, pilot valve, starting valve, plunger valve, piston valve, main and pilot control, levers, high speed valve. Plunger freight elevator, hand rope control, adjustment of valve movement; rack and pinion valves, replacing shoes, disconnecting plunger. Standard plunger elevator contrasted with Otis, operation of valves, arrangement of posts, discharge tank, safety devices, practical instructions, pilot valve removal, care and management. "Safe lifters," locking devices, etc.

A. C. O.

PUBLICATIONS RECEIVED.

The Strength of the Alloys of Nickel and Copper With Electrolytic Iron, Bulletin No. 346, of the University of Wisconsin, by Charles Frederick Burgess, E.E., and James Aston, Ch. E. Size 6 x 9, pp. 40, price 25 cents.

"Tests of Timber Beams*" by Arthur N. Talbot, issued as Bulletin No. 41 of the Engineering Experiment Station of the University of Illinois, is a detailed report of the tests of a large number of full-size timber bridge stringers. The test beams included new, seasoned, and creosoted wood of several species. The report also gives the results of shear and bending tests on specimens cut from the large beams. Important conclusions concerning strength and other properties of structural timber are given.

*Copies of Bulletin No. 41 may be obtained gratis on application to W. F. M. Goss, Director of the Engineering Experiment Station, University of Illinois, Urbana, Illinois.

Report of the First Annual Meeting of the Commission of Conservation, 1910. James White, secretary, Ottawa, pp. 215, size 6 x 9.

Geology of St. Bruno Mountain, Province of Quebec, by John A. Dresser, issued by The Department of Mines, Canada, Ottawa, Ont., size 6 x 9, pp. 35.

A Reconnaissance Across the Mackenzie Mountains, by Joseph Keele, issued by the Department of Mines, Canada, Ottawa, Ont., size 6 x 9, pp. 60.

Work Wages and Profits, by H. L. Gantt, published by The Engineering Magazine, New York, N.Y., size 5 x 7, pp. 200.

Engineering Construction in Steel and Timber, by William Henry Warren, second edition, published by Longmans, Green & Company, 39 Paternoster Row, London, England, size 6 x 9, pp. 470, price $5.00.

CATALOGUES RECEIVED.

Switches—The Jenney Safety Switch Co., Niagara Falls, N.Y., have issued a catalogue showing the parts, method of construction and style of their safety switch connections. This device protects the sidings from carelessness or oversight in the operating of trains on the main line.

Wooden Pipe Covering—The Canadian Mineral Rubber Co., 1 Toronto St., Toronto, have issued a neat pamphlet describing the advantages of pioneer mineral rubber pipe coating and pioneer field paint.

Contractors' Supplies—C. W. Hunt Co., of West New Brighton, N.Y., have issued their general catalogue No. 102, describing coal handling and hoisting machinery, conveyors, industrial railways, electric locomotives, electric and steam hoists.

Friction Clutches—The Hill Clutch Co., Cleveland, Ohio, in catalogue No. 8, describe fully the uses and advantages of their friction clutches. They also give sizes and prices.

Concrete Mixers—The Canadian Agencies, 18 Toronto Street, Toronto, are circulating an interesting catalogue describing an improved cube mixer. These machines vary in size from 2½ cubic feet to 64, they also describe in the same catalogue sewer excavators and open ditching machines, together with drag line excavators.

Portable Lights—The Alexander Milburn Co., 307 West Lombard St., Baltimore, Md., have issued catalogues describing the application of acetylene for contractors and railroad construction portable light. The strong, white and steady light at a cost of 1¼ cents per 1,000 candle power per hour.

Cranes—The Royce, Limited, Trafford Park, Manchester, England, in a recent catalogue illustrate their motor cranes of various sizes and capacity and suitable for every class of work such as freight and railway yards, freight on docks, machinery and equipment in buildings and power plants.

RAILWAY EARNINGS; STOCK QUOTATIONS.

Stock quotations on Toronto, Montreal and London exchanges, and other information relative to the companies listed in the above tables, are appended. The par value of all shares is $100.

Co.	Capital. 000's Omitted.	Price July 22, 1909.	Price July 14, 1910.	Price July 21 1910.	Sales last week.
C. P. R.	$150,000	185½	189	185½-184½	1,140
Mtrl. St.	18,000	217-216½	233-232½	224¼-222	1,971
Hal. Elec.	1,400	115-113½	121½	121½-121	25
Tor. St.	8,000	.. ..	.. ..	.. ..	656
G. T. R.	226,000	1st pfd. 108½; 3rd pfd. 55½; com.			26

The following table gives the latest traffic returns it is possible to obtain at the time of going to press:--

Road	Wk. Ended	1910	Previous Week	1909
C. P. R.	July 21	$1,958,000	$1,928,000	$1,502,000
G. T. R.	July 21	660,452	921,043	715,672
C. N. R.	July 21	277,800	291,900	211,800
T. & N. O.	July 21	21,080	22,763	31,345
Mtl. St.	July 23	71,677	86,478	60,589
Halfx. Elec.	July 21	5,028	5,092	4,452

Figures showing the earnings of Canadian roads since July 1st, this year and last, are appended:

Road	Mileage	July 1st to	1910	1909
C. P. R.	10,326	July 21	$5,908,000	$ 4,734,000
G. T. R.	3,536	July 21	2,460,857	2,323,827
C. N. R.	3,180	July 21	864,500	582,300
T. & N. O.	264.74	July 21	66,986	90,607
Mtrl. St.	141.79	July 23	231,959	199,785
Halfx. Elec.	13.3	July 21	15,002	13,099

CALGARY STREET RAILWAY.

That the municipal ownership of public utilities is profitable is the experience of Calgary, with its street railway system, which has been in operation something less than a year. During the first six months it earned a net profit of 10 per cent. over all expenses, including principal and interest on sinking fund. It is expected the profits for the present six months will be considerably in excess over the first.

MONTREAL STREET RAILWAY.

The figures show the Montreal Street Railway earnings for June and for nine months, with comparisons. Good increases are shown:

June.	1910.	Inc.
Earnings	$384,564	$ 29,646
Expenses	198,848	11,528
Net earnings	$185,715	$ 18,118
Surplus	126,662	10,199
Expenses p.c. of earnings	51.71	*1.07
Nine months—		
Earnings	$3,091,799	$299,826
Expenses	1,806,291	117,688
Net earnings	$1,285,507	$182,137
Surplus	907,904	140,225
Expenses p.c. of earnings	58.42	*2.06

*Decrease.

ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

(Continued from Page 111).

11132—July 12—Approving location of the C.P.R. Company's line of railway from Sedgewick to the west boundary of Section 30, Township 44, Range 12, west 4th Meridian, mile 0 to 3.65.

11133—July 12—Authorizing the C.N.R. to construct its railway across sixteen highways in Township 2, Ranges 19 to 21, west Principal Meridian, Manitoba.

11134—July 12—Extending, until the 8th of August, 1910, the time within which the C.P.R. was required by Order No. 10524, dated May 9th, 1910, to install an electric bell at the crossing of William Street, London.

11135—July 12—Extending, until the 8th of August, 1910, the time within which the C.P.R. was required by Order No. 10523, dated May 9th, 1910, to install an electric bell at the crossing of Colborne Street, London.

11136—July 8—Relieving the C.P.R. from providing further protection at the crossing of Zorra Street, Beachville, Ont.

11137—July 12—Authorizing the Montreal Street Railway to connect its railway with the C.P.R. on Sanguinet Street, Montreal.

11138—July 8—Authorizing the Robert McNair Shingle Company to construct a crossing over the C.P.R. Company's right-of-way, one mile west of Port Moody, B.C.

11139—July 12—Authorizing the C.P.R. to construct an additional track across the road allowance between Sections 5 and 6, Township 2, Range 25, west Principal Meridian, at Waskada, Man.

11140—July 8—Authorizing the C.P.R. to construct an industrial spur for the Saskatoon Brick and Supply Company in Saskatoon.

11141—June 27—Authorizing the G.T.R. to construct two additional tracks or sidings upon and across St. Clair Avenue, Toronto, Ontario.

11142—July 6—Dismissing application of Messrs. Milligan Bros., proprietors of the Russell House, Ottawa, for an Order fixing the terms of contract for the installation of a room telephone service in the applicant's hotel.

11143—July 12—Authorizing the C.P.R. to reconstruct Bridge No. 53.0 over the Maitland River, on the Teeswater Branch.

11144—July 12—Authorizing the C.P.R. to construct two industrial spurs for the Frank Lime Company, at Hillcrest, at the Crow's Nest Section of its line of railway.

11145—July 12—Authorizing the corporation of the town of Maisonneuve, to lay a water pipe under the track of the C.N.Q.R. at Aird Avenue, Maisonneuve.

11146—July 12—Authorizing the corporation of the town of Maisonneuve to lay a gas pipe under the track of the C.N.Q.R. at Aird Street, Maisonneuve.

11147—July 12—Authorizing the C.P.R. to construct an industrial spur to the premises of the Western Dry Dock and Shipbuilding Company, in Port Arthur, Ontario.

11148—July 13—Amending Order No. 11087, dated July 6th, 1910, by striking out the words "Grand Pabos," where they occur in the recital and operative part of the Order, and substituting therefor the word "Newport."

11149—July 13—Relieving the Q. M. & S. Railway Company from providing further protection at highway crossing known as Chemin de Ligne, in Sorel, Quebec.

11150—July 13—Relieving the P.M.R. from providing further protection at the crossing of the highway at Cedar Springs.

11151—July 13—Relieving the C.P.R. from providing further protection at the crossing of the highway between Concessions 2 and 3, Township of Lobo, County Middlesex, Ont.

11152—July 5—Relieving the Dominion Atlantic Railway from providing further protection at the crossing of the 2nd highway west of the station, Middleton, N.S.

11153—July 12—Approving the tariff of telegraph tolls for the transmission of messages between the G.T.P. Telegraph Company's offices in Canada, C.R.C. No. 9, filed under the company's filing advice, No. 9, dated May 18th, 1909.

11154—July 13—Approving location of the Vancouver, Fraser Valley and Southern Railway Company's line of railway, from the eastern boundary of the city of Vancouver to False Creek.

11155—July 13—Authorizing the C.N.O.R. to construct its line of railway across Vale Street, Colborne, Ont.

11156—July 11—Authorizing the G.T.P. Branch Lines Company to connect its Yorkton Branch with the C.N.R. in the south-west ¼ of Section 36, Township 30, Range 4, west 2nd Meridian, at Canora, Sask.

11157—July 12—Directing that the C.N.R. prohibit the whistling by those or any of those in charge of any locomotive steam engine operating within the limits of the city of Winnipeg; such whistling to be allowed only where it shall be deemed necessary by those or any of those in charge to prevent an accident, and further directing that any person or persons offending against this regulation shall be liable to a penalty of $50 for each and every such offence.

11158—June 24—Authorizing the Quebec, Railway, Light and Power Company to cross the tracks of the C.P.R. at St. Valiers Street, Quebec, P.Q.

11159—July 13—Directing that all portion of the Hudson's Bay Company's Reserve in the city of Edmonton, lying west of 16th Street, and south of the right-of-way of the C.N.R. as a strip between two lines parallel with and perpendicularly distant 25 feet from the centre line of the G.T.P. Railway, and containing a total of 1.8737, more or less, be released from the operation of the plan originally filed.

11160—June 27—Directing the G.T.R. to construct a branch line of railway about five miles north of Georgetown, Ontario.

NEW INCORPORATIONS.

Montreal.—Gareau Motor Car Company, $300,000. J. Therrien, N. Girous, J. A. Therrien.

Meaford, Ont.—Meaford Transportation Co., $50,000. J. F. Lunan, H. R. Cleland, W. T. Moore.

British Columbia.—British Columbia Farm Lands Co., $50,000. British Land Company, $50,000. Canadian Doorhanger Manufacturing Co., $10,000. Canadian Lang Stove Co., $12,000. Couids, $300,000. Great West Light Co., $10,000. Kaien Island Club, $25,000. Moosejaw Electric Railway Co., $400,000. Newport Timber Co., $400,000. Portland Canal Lumber Co., $50,000. Prince Rupert Wholesale Liquor and Supply Co., $25,000. Pyramid Asphalt and Oil Co. of British Columbia, $75,000. Quain Electrical Supply Co., $50,000. Tulameen Power Co., $10,000. Vancouver-Coalinga Oil Syndicate, $200,000. Vancouver Midway Oil Co., $600,000. Western Construction Co., $25,000.

CONSTRUCTION NEWS SECTION

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

TENDERS PENDING.

In addition to those in this issue.

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

Place of Work.	Tenders Close.	Issue of.	Page.
Quebec, Que., bridge	Sept. 1.	June 30.	56
Colchester, Ont., pier extension	Aug. 9.	July 14.	54
Collingwood, Ont., paving	July 30.	July 14.	54
Winnipeg, Man., underground cable	Sept. 1.	July 21.	54
Swift Current, Sask., sewage disposal	Aug. 2.	July 21.	54
Toronto, Ont., floor tile	Aug. 2.	July 21.	85
Oriole, Ont., schoolhouse	July. 31.	July 21.	85
Humberstone, Ont., drain	July. 30	July 21.	85
Port Felix, N.S., wharf	Aug. 15.	July 21.	85
Dover, N.S., wharf	Aug. 15.	July 21.	85
Digby, N.S., timber	Aug. 6.	July 21.	85

TENDERS.

Halifax, N.S.—Tenders will be received until August 3rd for bank fittings. R. C. Desrochers, Asst. Secretary, Dept. Public Works, Ottawa.

St. John, N.B.—Tenders will shortly be called for the construction of a permanent pavement. Wm. Murdoch, City Engineer.

Aylmer, Que.—Tenders will be received until August 15th for the construction of a wharf. R. C. Desrochers, Asst. Secretary, Department of Public Works, Ottawa.

Quebec, Que.—Tenders will be received until August 4th for following delivery and installation at the Ecole Technique De Quebec:

1. Complete forced hot water system heating and ventilating.
2. Complete plumbing system.
3. Complete master clock and telephone system.
4. Electric wiring, lamps and lighting fixtures.
5. Motor generator set.
6. 55 K.W. vertical engine and 25 K.W. horizontal engine.
7. D. C. Electric generators.
8. Storage battery and booster.
9. Electric motor equipment.
10. Switchboard installations.

Antonin Galipeault, Secretary.

Berlin, Ont.—Tenders will be received until August 1st for a compound duplex pumping engine. H. Hymmen, Superintendent Berlin Waterworks.

Beaverton, Ont.—Tenders will be received until August 10th for the electric wiring of the town hall. L. J. Cameron, Chairman Building Committee.

Brantford, Ont.—Tenders will be received until August 1st for the grading of a new road. J. A. Smith, Township Clerk.

Fort William, Ont.—Tenders will be received until July 27th for the erection of two houses. Hood & Scott, 43 Murray Block, Architects.

Islington, Ont.—The tenders for the erection of a steel concrete culvert on the Burgess side road were as follows: R. J. Lowe tendered for $375, but I. M. Scott was awarded the contract at $355. R. J. Lowe's tender of $325 for a steel concrete culvert on the Albion Road was accepted, it being the only one received.

London, Ont.—Tenders will be received until July 28th for sewers. Geo. W. Wright, Deputy City Engineer.

London, Ont.—Tenders will be received until August 8th for electrical pumping equipment. H. J. Glaubitz, C.E., Consulting Engineer, Toronto. (Adv. in The Canadian Engineer.)

North Toronto, Ont.—Tenders will be received until August 1st for 40,000 square feet concrete sidewalk. W. J. Douglas, Clerk, Eglinton, Ont. (Adv. in The Canadian Engineer.)

New Liskeard, Ont.—Tenders will be received until July 29th for the supply of material and the erection of an addition to the schoolhouse in S. S. No. 4, Dymond. W. J. Emerson, Secretary.

Ottawa, Ont.—Tenders are being called for the construction of vessels for the Canadian Navy. The ships must be built according to the British admiralty plan. Preference will be given to Canadian firms.

Ottawa, Ont.—Tenders will be received until Sept. 1st for the furnishing and delivery of iron posts for use on the survey of Dominion lands. P. G. Keyes, Secretary, Dept. of the Interior. (Adv. in The Canadian Engineer.)

Peterboro', Ont.—Tenders will be received until July 30th for the erection of a brick foundry. Wm. Blackwell, Architect.

Port Arthur, Ont.—Tenders will be received for lathing, plastering, painting and galvanized work. C. J. King.

Toronto, Ont.—Tenders will be received until Aug. 9th for the construction of a concrete viaduct. G. R. Geary (Mayor), Chairman, Board of Control.

Toronto, Ont.—Tenders will be received until August 2nd for the supply of water meters for the year. G. R. Geary, (Mayor), Chairman Board of Control.

Toronto, Ont.—Tenders will be received until July 30th for the erection of a branch building for Imperial Bank of Canada. Darling & Pearson, 2 Leader Lane, Architects.

Toronto, Ont.—Tenders will be received until August 2nd for mason work, roofing, plumbing and painting in connection with the new electric substation, West Toronto. G. R Geary, (Mayor), Chairman Board of Control.

Toronto, Ont.—Tenders for the ties and rails for the proposed industrial railway track to be constructed by the city on the east side of the Don will shortly be advertised for by the City Engineer.

Toronto, Ont.—Tenders will be received until Sept. 6th for the construction of a steel viaduct. G. R. Geary, (Mayor), Chairman Board of Control.

Minnedosa, Man.—Tenders will be received until July 29th for spillway and intake structures for dam of the Minnedosa Power Co. H. F. Maulson, Secretary.

Winnipeg, Man.—Tenders will be received until Aug. 1st for the erection of a stone church and school building. J. H. G. Russell, Architect, McArthur Bldg.

Winnipeg, Man.—Tenders will be received to furnish all material and build basement 20 x 36 x 8 with bay in front. Downie Bros., 307 McGreevy Bldg.

Wawanesa, Brandon, Man.—Tenders will be received until Aug. 3rd for 700 feet cement sidewalks. W. T. Johnston, Box 26, Wawanesa.

Estevan, Sask.—Tenders will be received until August 24th for electric lighting and sewerage. Chipman & Power, Engineers, Winnipeg and Toronto.

Regina, Sask.—Tenders will be received until July 28th for the erection of an isolation hospital. A. E. Chivers, City Clerk.

Sedley, Sask.—Tenders will be received until September 1st, for the erection of a village hall and fire station. Reilly, Dawson & Reilly, architects, 108 Willoughby and Duncan Block, Regina.

Swift Current, Sask.—Tenders will be received until August 21st for sewers and sewage disposal works. J. Darlington Whitmore, Engineer, 104 Willoughby & Duncan Block, Regina.

Edmonton, Alta.—Tenders will be received until Aug. 4th for the supply and delivery of approximately 200,000 square feet wire fabric for concrete floors. John Stocks, Deputy Minister of Public Works.

Lethbridge, Alta.—Tenders will be received until July 27th for additions to the Superintendent Engineer's house. Geo. W. Robinson, Secretary-Treasurer.

Prince Rupert, B.C.—Tenders will shortly be called for grading and water system. W. M. Davis, City Engineer.

Red Deer, Alta.—Tenders will be received until Aug. 12th for furnishing, hauling, and putting on fix drop siding on Willowdale schoolhouse. G. McIntosh, Secretary, Willowdale, S.D.

Victoria, B.C.—Tenders will be received until Aug. 1st for grading Yates Street and laying down the concrete foundation on the sub-grade. W. W. Northcott, Purchasing Agent.

Britcola, B.C.—Tenders will be received for supplying and installing heating appliances for North Hastings school. C. Corder, Secretary.

Victoria, B.C.—Tenders will be received until Aug. 1st for a concrete cement mixer. W. W. Northcott, Purchasing Agent.

Victoria, B.C.—Tenders will be received until Aug. 1st for the installation of a complete system of cluster lights. W. W. Northcott, Purchasing Agent.

Washington, D.C.—Tenders will be received until Aug. 8th for railway, grading and bridges. R. A. Ballinger, Secretary, Dept. of the Interior, United States Reclamation Service.

New York, N.Y.—Tenders will be received until Aug. 3rd for electric light wiring and fixtures, State Arsenel, 7th Avenue and 35th Street. F. A. McNelly, Secretary, State Armory Commission, Capitol, Albany, N.Y.

CONTRACTS AWARDED.

Montreal, Que.—The Foundation Co., Ltd., has been awarded contract for the erection of concrete oil tanks for the Queen City Oil Co., at Toronto.

Outremont, Que.—Contracts amounting to $67,097 were let for sewer construction as follows: W. G. McDonald, sewers on Querbes Street, $6,700.95; De L. Epee, $6,396.80; Champagneur, $6,641.90; Rockland, $4,548.75; total, $24,288.40. R. T. Smith & Co., Pagnuello Avenue, $11,725.50; Maplewood, $3,192.50; Roskeld, $2,372.50; Sunset, $1,995; total, $19,285.50. M. Lapointe, Bloomfield Avenue, $11,833.50. W. Duquette, Outremont Avenue, $7,417; Wiseman Avenue, $4,273; total, $11,690.

Brockville, Ont.—The city council decided to build by day labor, the new pumphouse. The tenderers for the job were all local men, whose figures were as follows: Barclay, Fair and Fox, granite and brick, $12,996. Street and Anderson, granite and brick, $10,911. Street and Anderson, brick, $10,661. W. Patterson, concrete, $9,000. W. Patterson, brick and granite, $9,481. W. Patterson brick, $9,600. The building will be erected to conform with the pumping station and work will be started shortly on the job.

Cornwall, Ont.—The contract for the 34-foot concrete arch over River De Lisle was awarded to Merpaw and McDonald, for $2,066.25. The other tenders ran $2,196.07, $2,393.07, $2,477.25, $2,511.45, $2,527.31, and $2,535.93. The engineer's estimate was $2,480. W. H. Magwood, Cornwall, Ont., Engineer.

Chatham, Ont.—George Fielder, of Chatham, was given a contract for putting a concrete floor on the south approach to Kent Bridge, at $575. Other bids were: Wm. Graham, Kent Bridge, $825; A. S. Everett, Thamesville, $925; Geo. Coumbar, Chatham, $1,325.

Guelph, Ont.—The People's Railway has let the following contracts: Grading, Berlin to Bloomingdale, McMillan & Co.; grading, Berlin to New Hamburg, O'Brien Construction Co.; concrete work between New Hamburg and Guelph, Chas. Robbins, Galt.

Newmarket, Ont.—Contract for the High school was let to Mr. McIntosh, of Alexander, Ont., at $13,000.

Port Arthur, Ont.—S. Brown, of Winnipeg, has been given a contract to build a roundhouse at this point, for the Canadian Northern Railway.

Peterboro', Ont.—The concrete walks of the Township of North Monoghan have been awarded to James Boyer, at 9⅞ cents per sq. foot.

Toronto, Ont.—The lowest tender for the laying of the 500-foot extension of the intake pipe was $35,000. The city engineer's estimate was $20,500. The pipe is to be supplied by the Canada Foundry.

Moose Jaw, Sask.—Flanagan & Murphy, of Fort Willian, Ont., have been awarded the contract for the sewage disposal works.

Regina, Sask.—The contract has been let for the new building of the Regina foundry, to T. Spray, of this city. The work is being completed by Sept. 3rd, and will be a brick on concrete foundation 80 feet by 142 feet, with steel truss roof.

Lacombe, Alta.—Davidson and Westaway, of Calgary, secured the contract for the construction of concrete sidewalks, at 23½ cents a square foot, and curb and gutter at 68 cents per lineal foot. Other bids for walks were: 24c., 35c., and 36c.; curb and gutter, 60c., 75c., and 75 cents.

RAILWAYS—STEAM AND ELECTRIC.

Fort William, Ont.—Fort William has been instructed to install, before Sept. 1st, an interlocking plant at the James Street crossings. Interlocking plants are also to be installed at the C. N. R. crossing Fredericton Street, and at the C. P. R. crossing Yonge Street, and a derailing device to be placed on the G. T. P. spur.

Welland, Ont.—Work has started on the street railway extension and it is expected it will soon be completed, as there is little grading to be done.

Windsor, Ont.—The first train has passed through the Michigan Central tunnel under the Detroit River. It is a regular steam locomotive drawing two flat cars. It is expected the $12,000,000 tunnel will be officially opened in the autumn.

Regina, Sask.—The C. N. Ry. has made application to the city council for permission to use, jointly with the G. T. P., terminals to be established here.

Edmonton, Alta.—The Alberta and Great Waterways Co. have failed to meet the first instalment of interest on bonds. The Province of Alberta has met the obligations and do thus become possessors of the charter. It is expected that the roadway will be put through as a Government enterprise.

Red Deer, Alta.—The Alberta Central Railway has commenced construction work and it is expected the work will be pushed west to the mountains.

Kamloops, B.C.—The C. N. R. have made a survey for a line from here through the Okanagan District. Generally the line will follow the old stage road through Grand Prairie District, Campbell Creek and the Upper Sand River.

Nelson, B.C.—The C. N. R. are letting contracts along the Fraser River, W. P. Tierney, of this city, having secured a 10-mile section, and Chas. Johnson, of Seattle, a 20-mile section.

Victoria, B.C.—Jean Wolkenstein, of New York, is here to discuss with the Government the proposed line from Vancouver to Fort George. A reconnaisance survey of the Vancouver-Fort George line has recently been completed by Messrs. L. M. Rice & Company, of Seattle, and Mr. Wolkenstein anticipates no difficulty in carrying his imposing undertaking through to completion.

BY-LAWS AND FINANCE.

Camrose, Alta.—Three by-laws authorizing an expenditure of $33,500 were passed by the ratepayers. Thirty thousand dollars is for the installation of an electric light plant.

Owen Sound, Ont.—The County of Grey has sold debentures amounting to $20,000, to cover the cost of bridge construction.

Revelstoke, B.C.—This municipality sold $44,511 debentures to complete the sewerage system. A system has already been installed in the central part of the town.

North Toronto, Ont.—This town recently sold $17,000 debentures for High school construction.

Brockville, Ont.—This municipality has just sold debentures aggregating $39,058.60 for the construction of bridges, collegiate institute, fire halls and for the purchase of road-making machinery.

Montreal, Que.—The controllers have recommended borrowing $20,000 for road construction. For public works, $5,000,000 will be borrowed.

Ville St. Paul, Que.—The Catholic school commissioners will borrow $118,000 for the construction of a boys' academy and a girls' school.

New Westminster, B.C.—The following by-laws were carried: Lulu Island bridge, $30,000; street improvements, $150,000; fire apparatus, $12,000. These were defeated: Schools, $97,500; parks, $35,000.

LIGHT, HEAT AND POWER.

Kingston, Ont.—T. B. Caldwell, of Lanark, has purchased the water power at Playfair, Ont. He will transmit the power to Lanark to run his factory. Its capacity is about 500 horse power.

Niagara Falls, Ont.—The new 18-foot concrete pipe line of the Ontario Power Company, designed to carry sufficient water to develop 75,000 h.p., was completed on Tuesday last. It is 1⅛ miles long, and the cost was about $500,000.

Ottawa, Ont.—The Ottawa Electric Co. has taken out a permit for a brick transformer building, to cost $18,000.

Vancouver, B.C.—It is expected that by Sept. 1st the Western Canada Power Co., which is developing power at Slave Lake, will be able to furnish 20,000 horse power. The current will be sent from the power house under pressure of 60,000 volts.

SEWERS, SEWAGE AND WATERWORKS.

Aylmer, Que.—The town will proceed at once with the construction of a pipe line from the Bradley Creek to large reservoir near the town limits; total cost, $21,000.

PERSONAL.

Mr. Geo. Verity, of the well-known electrical firm of Verity's, Limited, of Birmingham, Eng., accompanied by E. W. Arnold, B.A., A.M.I.E.E., were visitors at Toronto office of The Canadian Engineer this past week.

J. W. Saaler, of the Bruce Peebles Co., Ltd., Manchester, England, has been transferred to Johannesburg, South Africa, where he will take up an important position for this company.

H. JOHNSTON, C.E.

J. O. McMullin has been appointed Gold Commissioner for the Portland Canal Mining District.

Mr. Herbert Johnston, the newly appointed Town Engineer of Berlin, Ont., was born at Meaford, Ont. He graduated in Civil Engineering from the Faculty of Applied Science of Toronto University in 1903. He became an Ontario Land Surveyor in 1905. In 1908, he was admitted as an Associate Member of the Canadian Society of Civil Engineers.

His first practical experience was with John Rogers, Esq., O.L.S., Mitchell, Ont., where he spent two years in drainage engineering. In 1903 he entered the employ of Wm. Mahlon Davis, C.E., Berlin, and in 1905, he formed a partnership with Mr. Davis with the firm name of Davis & Johnston. During the last five years the firm have been employed in many engineering works, the most important of which are as follows: Galt Sewerage System, Listowel, Preston, Hespeler and Wingham Water-works, Berlin Sewage Disposal Works, Waterloo Sewage Disposal Works and Guelph Water Supply.

On July 1st, Mr. Davis left Berlin to assume the duties of City Engineer of Prince Rupert, B.C., and Mr. Johnston was appointed Town Engineer of Berlin.

Archer & Cerow, who represent the Jeffrey Manufacturing Company, of Columbus, Ohio, have moved from the Dineen Building into new and more roomy quarters, at 174 King Street East, Toronto, corner of Front and George Streets.

MISCELLANEOUS.

Fredericton, N.B.—It is expected that $2,500 will be spent on improving the city wharves.

Sydney, N.S.—It was decided by the city council to go ahead with the $5,000 subway at McQuarrie's Crossing.

Cretna, Man.—The Manitoba Government Elevator Commission took over on July 22nd, the elevator recently known as Chamber's elevator, and is about to put it into shape for opening. It is understood this is the first elevator the Commission has purchased, and the sum paid for it was in the neighborhood of $3,500.

Winnipeg, Man.—The City Engineer has been instructed to prepare plans and estimate the cost for a municipal gas plant to be submitted at the next meeting of council.

Chilliwack, B.C.—Council will probably spend $10,000 for a rock crusher.

New Westminster, B.C.—The British Columbia Telephone Company will, next year, install a modern telephone switch-board.

EMPLOYERS' LIABILITY INSURANCE.*

By Miles M. Dawson.

As at present supplied in the United States, employers' liability insurance consists of an insurance company undertaking for a consideration, called a premium, to assume the liability of the employer to his employees who are injured by reason of what the law terms negligence, and to the next of kin of employees who lose their lives through his negligence. In practice it consists in the insurance company making it a business to drive as hard a bargain as it can in the settlement of claims of this nature or to resist such demands and defend against them in the courts if necessary, according as one course or the other may seem less expensive or for any other good business reason more desirable.

This system has not proved satisfactory to any of the parties in interest. It is not satisfactory to employers, because, while it appeals to them as a ready means of escaping annoyance and occasional excessive verdicts, it involves the payment of large amounts which go for agency, adjustment, home office and other expenses, and which must be paid by the employers in addition to the sums that actually reach the injured employees and the next of kin of employees who are killed. It is unsatisfactory to the companies because they find that there is constant pressure upon them to be more liberal in their settlements, since the employer is not directly affected by each settlement, and at the same time equally constant pressure upon them to furnish the insurance at

*From an address before the National Metal Trades Association, New York convention.

lower premiums. They also tire of being continually in the courts or continually resisting the payment of claims, and competition among them is resulting in several of the companies choosing to make prompt settlement in as many instances as they can, instead of standing upon their rights under their contracts and under the liability law. It is not satisfactory to the workmen and their next of kin because they are confronted with a purely business proposition at a time when there may be very great need, and when, under the old conditions, the employer might, and very likely would, as a matter of sympathy, contribute to their relief, even though not liable under the strict letter of the law. Another objection on their part is that litigation is more expensive to them, longer drawn out, more bitterly fought and the defense conducted by men of special skill in such matters. They also urge that often advantage is taken of their necessities to drive a specially hard bargain without their being made aware of their rights in the matter.

There is also a fourth party to the transaction—the public. Whatever employers or employees fail to do for the relief of the victims of industry falls upon the public in the most unfortunate form of charity or even, eventually, by reason of the impoverishment of families and the consequent failure to educate and train children, through courts and prisons.

A very prominent manufacturer of Germany, after a recent visit to the United States, made substantially this statement: "I was here once before, some fifteen years ago. At that time I felt that German manufacturers had much to learn from America, and particularly about the management of their factories. Now I do not find that there is much to learn, while I know that American manufacturers have very much to learn from us." No more than 25 years ago German workmen were not regarded as efficient, either from the standpoint of quantity or quality of product, as the workmen of several other countries, and particularly Great Britain and the United States; but precisely the contrary is now pretty generally acknowledged to be the case. It will interest my hearers, I am sure, to know that when I was abroad in 1908 to study employers' liability and employers' liability insurance, as well as other schemes for insuring workmen, I found that the superior efficiency of German workmen, on the whole, was very largely ascribed by everybody to the system of employers' liability insurance which had been introduced in Germany.

Under the system which obtained there before, and which was about the same as in this country at present, the life of the workmen in many occupations was a gamble, in which the fate of their wives and children and of others who might be dependent upon them was at stake. They saw the severest misfortunes come to families, amounting to complete demoralization, without any fault on the part of the man himself. At the present time precisely the contrary condition exists—viz., that the only way in which those dependent upon the workman can be involved in absolutely disastrous misfortune is for him to become an idler and fall out of the ranks of regularly employed wage earners. If he is a steady workman and if any misfortune comes to him, a sufficient financial support to keep him and his family from the poorhouse or from depending upon public or private charity is assured. The effect of this upon his character is said to have been nothing short of marvellous. Other results likewise are pointed to, namely: that by reason of the new conditions there is very little expensive litigation; that the cost of getting a dollar to the insured workman or the family of a workman who is killed is about 10 or 12 cents, instead of at least another dollar, as in our own country; that the burden on the manufacturers is evenly and uniformly distributed, and that excessive verdicts are not merely transferred from the shoulders of the individual manufacturer to the entire trade, but also do not exist at all.

The general impression in the United States is that Germany has a system of State insurance, where the State collects premiums from the employers, administers the funds, pays the claims, and in general manages the whole affair. The fact is precisely the contrary. The system is one under which the trades themselves are organized into mutual trade associations such as your own, to which every person or company engaged in that trade is by law required to belong and which are managed by their own members. The liability to employees is transferred from the individual employer to these trade associations, and the amount of liability is absolutely fixed by law and is likewise entirely independent of questions of negligence, so that there is no quarrel over whether the employer is liable or not. The only difference of opinion that arises is when there is partial disability, the degree of which has to be determined. While these associations are conducted at an expense of about 10 or 12 per cent., it is generally conceded that their effectiveness, both in the shrewd and careful management of their business and also in bringing about the adoption of safety devices and a reduction in the hazards of industry, far exceeds that of any system which has ever been introduced in any other country.

Under the German system the amount of liability in event of total disablement is fixed at a certain proportion of the wages and is payable like wages—that is, by weekly payments. In the event of partial disability an amount proportionate to the impairment of the earning power is paid. In the event of death a pension is paid to the widow during her widowhood—that is, until her death or remarriage—and a pension to each child until he reaches 16 years. These pensions in the aggregate must not exceed the amount that the man would have received himself had he been totally disabled. This system I personally regard as the most satisfactory one for employers' liability insurance that can be found in any country. It could be introduced here, precisely as it is in Germany, only by means of legislation. If there were such legislation, as our national Constitution now stands, it would apply only to individual States and would take effect in those states only when adopted by their respective legislatures.

The further questions remain, What can be done under our existing laws by the voluntary act of individual employers or trade associations of employers, and what method of insurance is wisest for them? Employers' liability insurance in its usual form, as a mere means of escaping liability, is perhaps as satisfactory as any other method now open to employers. Its disadvantages are obvious, as already stated.

There are but four other methods available. One of these is a workmen's collective policy, issued by an employers' liability insurance company for protection of workmen, without regard to liability, the employer contributing toward the premium and either thereby becoming entitled to be protected against his liability, or else paying a somewhat reduced premium for protection against such liability. Theoretically, this kind of insurance is much more desirable from many standpoints than employers' liability insurance alone, but in practice it has not found favor.

The most recent form of insurance of this general nature is known as "employers" compensation policy," under which the employer is authorized to compensate his employees for injuries sustained, without regard to liability, to the amount of one full year's wages for the loss of two limbs or the sight

ENGINES FOR TEMISKAMING

Specifications of Four New Locomotives for T. & N. O. Rly.

The Canadian Locomotive Company, Limited, of Kingston, Ontario, are building four new locomotives for the Temiskaming and Northern Ontario Railway. The specification follows:—

Engine.

Gauge	4 ft. 8½ in.
Type of Engine, 4-6-2	Pacific type passenger locomotive.
Fuel used	Bituminous coal.
Weight in Working Order, Drivers	135,500 lbs.
Weight in Working Order, Total	202,500 lbs,
Wheel Base of Engine, Rigid	12 ft. 7 in.
Wheel Base of Engine, Total	31 ft. 6 in.
Wheel Base of Engine and Tender	57 ft. 10 in.
Height over all, Engine and Tender	14 ft. 9¼ in.
Heating Surface, Fire Box	162 sq. feet.
Heating Surface, Tubes	2,705 sq. feet.
Heating Surface, Total	2,867 sq. feet.
Diameter of Driving Wheels	69 in.
Material of Driving Wheels Centres	Cast steel.
Diameter and Length of Driving Journals	9½ in. x 12 in.
Diameter of Cylinders	21 in.
Stroke of Cylinders	28 in.
Type of Boiler	Extended wagon top.
Working Pressure of Boiler	200 lbs. per sq. inch.
Number of Tubes	272.
Diameter of Tubes	2 in.
Length of Tubes	19 ft. 0 in.
Injectors	No. 9 locomotive type.
Safety Valves	Coale's muffled pop.
Brakes	West'house No. 6 E.T.
Kind of Packing	U.S. Multiangular Metallic.

Tender.

Weight of Tender, Loaded	123,000 lbs.
Capacity of Tank in Imp. Gallons	5,500 lbs.
Style of Tank	Hopper type.
Coal Capacity	10 tons.
Style of Truck	4 wheel equalized.
Diameter of Wheel	36 in.
Kind of Wheel	Schoen solid steel type.
Diameter and Length of Journal	5½ in. x 10 in.
Brake Beam	Simplex I beam type.

MARKET CONDITIONS.

Montreal, July 27th, 1910.

Conditions in the iron market of the United States are practically unchanged. Buyers are taking only what they cannot possibly do without, their view of the market being that further declines are not at all improbable. It seems to be the opinion that the dullness of the past few weeks may continue for some time to come, so that it is very difficult to make sales under the circumstances. The whole point is whether or not prices are likely to go lower in the meantime. About the only business done in the south during the week was for a very small quantity of pig-iron, and even this business had to be done at a reduction in price.

The situation both in the pig-iron and in the steel markets is greatly influenced by the relationship of the railways and the Interstate Commerce Commission. The railways are being prevented by the Commission from putting into effect the higher rates until at least the first of November, and it is thought that this will in all probability influence them to make few or no extensions while awaiting increased earnings. Unfortunately these suspended hostilities between the Commission and the railways are exerting their influence on the iron and steel markets.

In all branches of the iron and steel industry there is a tendency on the part of consumers to go slow. There has also been some discussion regarding the possibility of a cut in the price of sheets by the Steel Trust. Some products have not yet been marked down sufficiently, it is thought, and this naturally prevents buyers from operating. The railways are not only practically out of the market as buyers of rails, but also of other kinds of steel, and of different railway equipment. The crop situation is also exerting a great deal of influence at the present time, inasmuch as a failure of any considerable extent would undoubtedly induce the railways to cease to make further extensions which would otherwise be made.

Advices received from Great Britain show that there is practically no change in the iron and steel markets on the other side of the Atlantic. A certain amount of export is constantly in progress, but the volume is very light at the present time. Nothing new seems to have developed in the market, and prices continue at about the same level as has prevailed for some months past.

In the local market there is nothing new. Demand throughout the country is reported to be fairly satisfactory, but there is very little snap to the buying, and everything indicates that consumers are following the policy of restricting purchases until the situation develops more certainty. Prices continue practically unchanged all along the line, not only for raw material, but for finished and semi-finished products.

The market holds steady at recent prices:—

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

Bar Iron and Steel.—The market holds dull and steady. 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.

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 2½ cents extra, or 10c. per bbl. weight.

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

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

Iron.—The market is steady and prices unchanged. 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.

Nails.—Demand for nails is steady and prices are: $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.

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, $75.05; 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.

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

Railway Ties.—See lumber, etc.

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

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

Spikes.—Railway spikes are steady, at $2.45 per 100 pounds, base of 5½ x 9-16. Ship spikes are steady at $2.85 per 100 pounds, base of ⅝ x 10-inch, and ⅝ x 12-inch.

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

Telegraph Poles.—See lumber, etc.

Tar and Pitch.—Coal tar, $3.50 per barrel of 40 gallons, weighing about 500 pounds; roofing pitch, No. 1, 70c. per 100 pounds; and No. 2, 55c. per 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.
Butter.—Fresh made creamery, 23 to 23½c.
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.
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.
Dried Fruits.—Currants, Filiatras, 5¾ to 6½c.; choice, 8 to 9c.; dates, 4 to 5c.; raisins, Valentias, 5 to 6¼c.; California, seeded, 7½ to 9c.; Evaporated apples, prime, 8 to 8½c.
Eggs.—No. 1 eggs are 20 to 21c.; selects, 22 to 25c.
Flour.—Manitoba, 1st patents, $5.90 per barrel; 2nd patents, $5.40; strong bakers', $5.20.
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.
Potatoes.—Per 90 lbs., good quality, 60 to 70c.
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.
Rolled Oats.—Oatmeal, $2.20 per bag; rolled oats, $2, bags.
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.
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.
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.

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Toronto, July 28th, 1910.

Nearly every merchant conferred with speaks of the strike of trainmen on the Grand Trunk as interfering with his business. The inconvenience and loss being suffered are great, and it is noticeable that most merchants or manufacturers have small sympathy for the men in the dispute. Founders inland, in the south-west peninsula of Ontario suffer for lack of coal or pig-iron; stone and lime and brick dealers cannot get their goods into Toronto; dealers in roofing, steel, and iron goods, in fact, heavy goods generally, where they cannot command either C.P.R. or water connection, are badly handicapped. A large house whose business lies 75 per cent. in the part of the province served by the Grand Trunk, says; "I cannot get a car in or out, and have had a wearisome week, besides losing money every day."

The pork-packing houses are severe sufferers; those at Stratford and Collingwood are shut down, those at Peterboro and Ingersoll nearly so, for lack of hogs. Toronto provision dealers say they have had to withdraw their travellers from districts served by the Grand Trunk, finding it impossible to take orders from Grand Trunk Railway points. We have seen letters by the dozen, saying; "Your goods shipped 15th, not reached us yet;" or, "How much longer must we wait for that car promised?" And it would seem that a crop of law suits must result from such an intolerable situation.

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

Antimony.—Trade is quiet, price unchanged at $8.50.
Axes.—Standard makes, double bitted, $8 to $10; single bitted, per dozen, $7 to $9.
Bar Iron.—$2.05 to $2.15, base, per 100 lbs., from stock to wholesale dealer. Free movement
Bar Mild Steel.—Per 100 lbs., $2.15 to $2.25. Sleigh shoe and other take same relative advance.
Boiler Plates.—¼-inch and heavier, $2.20. Boiler heads 25c. per 100 pounds advance on plate. Tank plate, 3-16-inch, $2.40 per 100 pounds.
Boiler Tubes.—Orders continue active. Lap-welded, steel, 1¼-inch, 10c.; 1½-inch, 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.
Building Paper.—Plain, 27c. per roll; tarred, 35c. per roll. Demand is moderate.
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.

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.
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 constant.
Coal.—The price of anthracite still remains at $6.50 per ton, net, and pea coal at $5.50 per ton. In the United States there is an open market for bituminous coal and a great number of qualities exist. We quote: Youghiogheny lump coal on cars here, $3.75 to $3.80; mine run, $3.65 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.—A very large volume of business is being done, but the market is weaker at $15.25 to $13.50. Production goes on at a rapid rate.
Detonator Caps.—75c. to $1 per 100; case lots, 75c. per 100; broken quantities, $1.
Dynamite, per pound 21 to 25c., as to quantity.
Felt Roofing.—A very good volume of trade is going on at $1.80 per 100 lbs. as before.
Fire Bricks.—English and Scotch, $30 to $35; American, $25 to $35 per 1,000. Fire clay, $8 to $12 per ton.
Fuses.—Electric Blasting.—Double strength 4 feet, $4.50; 6 feet, $5; 8 feet, $5.50; 10 feet, $6. Single strength, 4 feet, $3.50; 6 feet, $4; 8 feet, $4.50; 10 feet, $5, per 100 count. Bennett's double tape fuse, $6 per 1,000 feet.
Iron Chain.—¼-inch, $5.75; 5-16-inch, $5.15; ⅜-inch, $4.15; 7-16-inch, $3.95; ½-inch, $3.75; 9-16-inch, $3.70; ⅝-inch, $3.55; ¾-inch, $3.45; ⅞-inch, $3.40; 1-inch, $3.40, per 100 lbs.
Iron Pipe.—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.
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. The market unchanged and quiet.
Lead.—A very fair demand exists, at an unchanged price of $3.75 to $3.85. A better feeling exists, however.
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, supply might be larger; the strike hampers dealers.
Lumber.—An unusually brisk demand has characterized the month, and prices are fully maintained. Pine is good value at $32 to $40 per M. for dressing, according to width required; common stock boards, $28 to $33; cull stocks, $20; cull sidings, $17.50. Southern pine dimension timber from $30 to $45, according to size and grade; finished Southern pine, according to thickness and width, $30 to $40; hemlock is in demand and held quite firmly, we quote $17.50 to $18; spruce flooring in car lots, $22 to $24; shingles, British Columbia, are steady, we quote $3.10; lath, No. 1, $4.60; white pine, 18-inch, No. 2, $3.75; for 32-inch, $1.85 is asked.
Nails.—Wire, $2.35 base; cut, $2.60; spikes, $2.85 per keg of 100 lbs.
Pitch and Tar.—Pitch, unchanged at 70c. per 100 lbs. Coal tar, $3.50 per barrel. Demand moderate.
Plaster of Paris.—Calcined, New Brunswick, hammer brand, car lots, $1.95; retail, $2.15 per barrel of 300 lbs.
Putty.—In bladders, strictly pure, per 100 lbs., $2.25; in barrel lots, $2.10. Plasterer's, $2.15 per barrel of three bushels.
Ready Roofing.—An active demand; prices are as per catalogue
Roofing Slate.—Most of the slate used in Canada comes now from Pennsylvania or Maine, the Canadian supply being slender and mostly from the Rockland quarries of the Eastern Townships in Quebec. There is a

great variety of sizes and qualities, so that it is difficult to indicate prices. But No. 1 Bangor slate 10 x 16 may be quoted at $7 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.

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

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

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 very active; price, 73 per cent. off list at factory for car-load lots; 60 per cent. off list retail.

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

Sheet Steel.—American Bessemer, 10-gauge, $2.50; 12-gauge, $2.55; 14-gauge, $2.35; 17, 18, and 20-gauge, $2.45; 22 and 24-gauge, $2.55; 26-gauge, $2.65; 28-gauge, $2.80. A very active movement is reported at unchanged prices.

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.

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

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

Tin.—Market irregular, with considerable business passing. We quote 34¼ to 35c.

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

Zinc Spelter.—The market can no longer be described as lively; a steady but limited movement goes on at $5.50 to $5.75 per 100 lbs.

CAMP SUPPLIES.

Butter.—Dairy prints, 19 to 21c.; creamery prints, 23½ to 24c.; the creamery output is now considerable.

Canned Goods.—Peas, $1.15 to $1.75; tomatoes, 3s, 85c. to 95c.; pumpkins, 3s, 90 to 95c.; 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.

Cheese.—Moderately firm; old cheese, large, 13c.; twins, 13¼c.; new, 11¾ to 12c.

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

Dried Fruits.—Raisins, generally higher, Valencia, 6½c.; seeded, 1-lb. packets, fancy, 8c.; 16-oz. packets, choice, 7½c.; Sultanas, good, 6 to 7c.; fine, 7 to 8c.; choice, 7½ to 8½c.; fancy, 8 to 9c.; Filiatras currants, cleaned, 6½ to 7c.; Vostizzas, 8½ to 9c.; uncleaned currants, 6¼ to 6¾c.

Flour.—Keeps higher; quotations at Toronto are: Manitoba flour, first patents, $6.20; second patents, $5.70; strong bakers', $5.40; Ontario flour, winter wheat patents, $4.60 to $4.70 per barrel.

Lard.—Tierces, 15c.; tubs, 15¼c.; pails, 15½c.

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

Pork.—Not much doing, short cut, $31 to $31.50 per barrel; mess, heavy, $28 to $28.50.

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

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

Smoked and Dry Salt Meats.—Long clear bacon, 14½ to 15c. per lb., tons and cases; hams, large, 17 to 17½c.; small, 18½ to 19c.; rolls, 15 to 15¼c.; breakfast bacon, 19 to 20c.; backs (plain), 19 to 20c.; backs (peameal), 20 to 21c.; shoulder hams, 14c.; green meats out of pickle, 1c. less than smoked.

Spices.—Allspice, 18 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.

Sugar.—Granulated, $5.30 per 100 lbs., in barrels; Acadia, $5.20; yellow, $4.90; bags, 5c. lower.

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

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

Vegetables.—Trade interrupted by the Grand Trunk Railway strike. Very little goods moving. The following are nominal quotations:—Potatoes—Ontario, dull and weak; new, per barrel, $2.50 to $2.60; New Brunswick Delawares, 65 to 75c. per bag; onions by the sack, Egyptian, $2.50 to $2.75; cabbage, per crate, $1 to $1.50.

AMERICAN HORSE MARKET.

Importation of high-grade horses for purposes of improving the quality of the general draft horse has begun in Oregon to a large extent. Stock-growers of eastern, central and southern portions of the state are buying heavy draft stallions of the purest blood and are paying from $2,500 to $3,500 each.

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Winnipeg, July 26th.

Good progress is being made on all the large contracts in Winnipeg, and this, despite the unprecedented demand on every branch of the trade.

Individual contractors, it is stated, have as much as $2,000,000 worth of work on at the present time, but report that prospects are good for finishing within contract time.

Supplies are keeping pace with the demand, but no more, and stocks of many of the lines are very low. Prices are down to normal, and conditions generally are good. No labor troubles of any consequence have occurred in the city this year, and on the whole the labor market is well supplied.

A large number of apartment blocks are under construction this season and will be completed in time for occupancy this fall.

The cement market continues to be active, and large shipments are coming forward to supply the western trade. Prices are unchanged.

In all other lines business could scarcely be better, and quotations on this market are as follows:—

Anvils.—Per pound, 1 to 12½c.; Buckworth anvils, 80 lbs., and up, 10¼c.; anvil and vice combined, each, $5.50

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

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

Bar Iron.—$2.50 to $2.60.

Bars.—Crow $4 per 100 pounds

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

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

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

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

Coal and Coke.—Anthracite, egg, stove or chestnut coal, $9.75 large lots to $10.50 ton lots, net; Alleghany soft coal; carload lots, basis, Winnipeg, f.o.b., cars, $6 per ton; cannel coal, $10.50 per ton; Galt coal, $2 f.o.b., carload lots, $9 single ton; coke, single ton, $7 at yard; large lots, special rates. American coke, $11 to $11.50 a ton; Crow's Nest, $10 a ton.

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

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

Chain.—Coil, proof, ¼-inch, $7; 5-16-inch, $5.50; ⅜-inch, $4.90; 7-16-inch, $4.75; ½-inch, $4.40; ⅝-inch, $4.20; ¾-inch, $4.05; logging chain, 5-16-inch, $6.50; ⅜-inch, $6; ¼-inch, $8.50; jack iron, single, per dozen yards, 15c. to 75c.; double, 25c. to $1; trace-chains, per dozen, $5.25 to $6.

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

Dynamite.—$11 to $13 per case.

Hair.—Plasterers', 80 to 90c. per bale.

Hinges.—Heavy T and strap, per 100 lbs., $6 to $7.50; light, do., 65 per cent.; screw hook and hinge, 6 to 10 inches, 5¾c. per lb.; 12 inches up, per lb., 4¾c.

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

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

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

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

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

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

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

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

Plaster.—Per barrel, $3.

Roofing Paper.—60 to 67½c. per roll.

Rope.—Cotton, ¼ to ½-in., and larger, 23c. lb.; deep sea, 16½c.; lath yarn, 9½ to 9¾c.; pure Manila, per lb., 13¼c.; British Manila, 11¼c.; sisal, 10½c.

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

Spikes.—Basis as follows:—1¼ 5 and 6, $4.75; 5-16 x 5 and 6, $4.40; ⅜ x 6, 7 and 8, $4.25; ½ x 8, 9, 10, and 12, $4.05; 25c. extra on other sizes.

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

Staples.—Fence, $3.40 per 100 lbs.

Timber.—Rough, 8 x 2 to 14 x 16 up to 32 feet, $38; 6 x 20, 8 x 20, up to 32 feet, $42.

Tool Steel.—8½ to 15c. per pound.