Canadian Engineer

(Including THE CANADIAN C… …RETE REVIEW)

A WEEKLY JO… …L

For CIVIL, MECHANICAL, ELECTRICAL and RAILROAD ENGINEERS and CONTRACTORS

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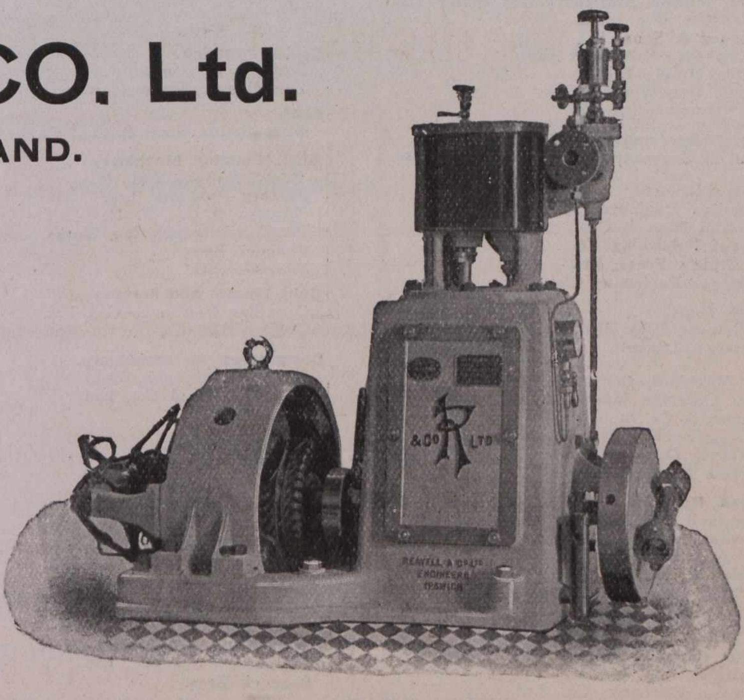

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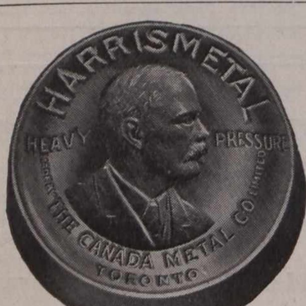

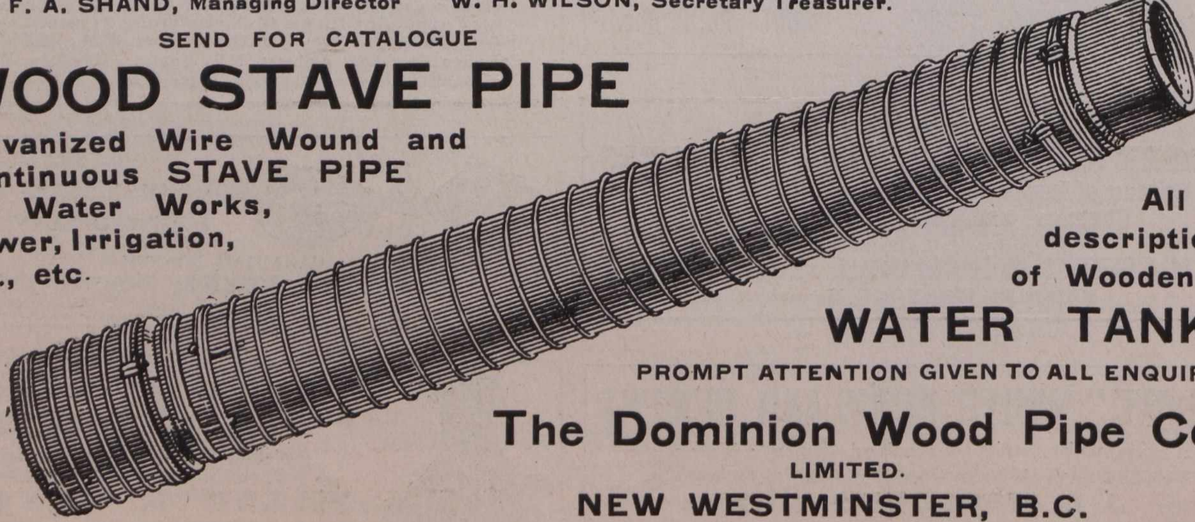

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THE CANADIAN ENGINEER

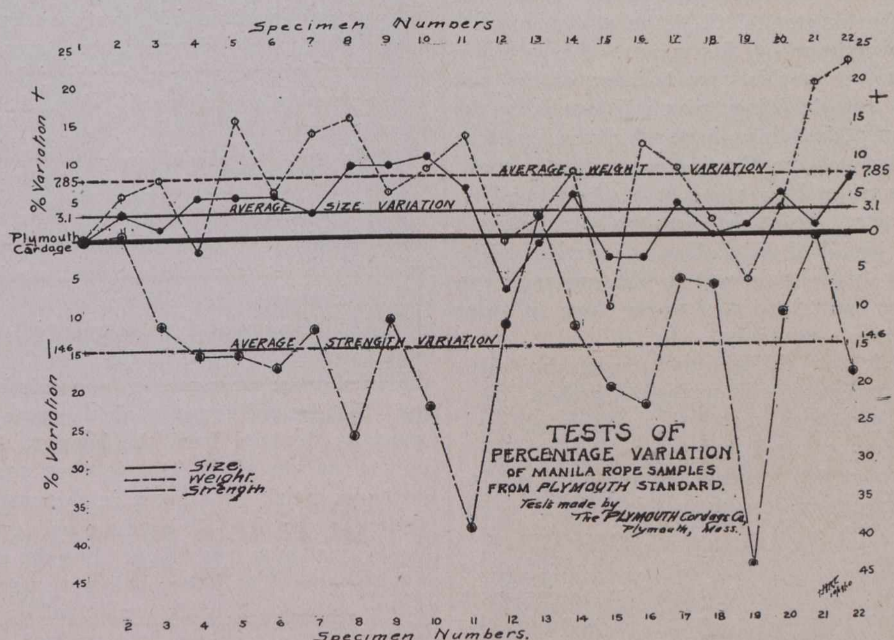
An Engineering Weekly.

HOW MANILA ROPE VARIES IN QUALITY.

In order to determine the extent to which manila rope samples such as might be bought in the open market might be expected to vary in quality, the Plymouth Cordage Company, of North Plymouth, Mass., has recently conducted an interesting series of tests on various brands of rope. To arrive at a reasonably accurate conclusion as to what might be expected from an average piece of rope as regards size compared to the nominal size, weight per unit of length, and tensile strength, twenty-two samples of rope nominally three inches in circumference, and the product of various manufacturers, were put through a careful series of tests at the works of this company. The results obtained were plotted as shown in the accompanying diagram on the percentage basis, this being found to be the most satisfactory method of showing graphically variations found.

extremes, and it, therefore, seems evident that it would be extremely difficult to judge the amount of load that an ordinary piece of manila rope of this size would bear even with the results of these tests at hand. The miximum failed under a load of 9,010 lbs., while the minimum was only able to stand 4,946 lbs., and between these figures it would be difficult indeed to say where any sample would fall.

While the strength variations were much wider than the size or weight, the two latter show sufficient discrepancies to give cause for serious thought as to the advisability of promulgating some sets of standards to which rope will measure up. It will be seen that in several cases where the size curve showed a decided rise, the weight curve dips. It would naturally be supposed that where the size was considerably greater than standard, the weight would increase correspond-



An average Plymouth Cordage sample was used as a standard and from this the variations, plus or minus as the case might be, in size, weight and strength were plotted as percentages of the standard taken. It would naturally be supposed that in an investigation of this character, considerable deviation would be found in such a large set of samples; but the actual results show variations so wide as to be actually startling. Not only are these variations large but a glance at the chart will make clear the apparent lack of consistency among the variations of the same samples. Furthermore, the averages give but little idea of what may be expected from single samples, for instance, it will be noted that the strength variations average is 14.6 per cent. below the standard, yet one sample is nearly 45 per cent. below and another one nearly 40, while two samples are higher than the standard assumed, and therefore, are credited with the plus variation. The remaining specimens are scattered promiscuously all over the territory represented between these two

ingly, but this seems not to be the case, and must indicate that some brands are much more loosely twisted than are others. Certainly it is surprising to find the weights varying between minus 9.61 and plus 22.6. That three-inch rope is by no means three inches in circumference is obvious from a perusal of the figures obtained in this investigation as to size variations. The maximum was plus 10.3 per cent. greater than the standard, while the minimum fell 7.3 per cent. below it.

The actual size, weights and tensile strengths matter but little in comparison with the variation figures which these curves show. If all the different samples fell within a few per cent. of the average it would really mtater but little what figure this average represented, for then ot would be possible to predict from the kind of rope under consideration within reasonable limits what its physical characteristics would be. The facts thus brought out should warrant serious consideration from the cordage manufacturers.

SMOKELESS FIRING IN A CITY BOILER PLANT.

It has been well understood for some time by combustion egineers that the most effective way to solve the problem of smoke production with soft coal is by means of underfeeding and providing sufficient combustion space in the furnace. The recent movement for the prevention of smoke in cities has lead many people to an investigation of how best to accomplish this result who would otherwise not have understood the proposed methods upon which effective smokelessness are based.

The fallacy of attempting to provide smoke catchers or other devices intending to change smoke after it has formed into something else or to deposit it in various ways so that the escaping gas should be clean has been demonstrated many times. Smoke once formed cannot be suppressed and therefore those interested are rapidly arriving at the unanimous opinion that the place to attack the smoke problem is in the furnace. This narrows the field of investigation down to a straight combustion problem and the combustion egineers have proved conclusively that underfeeding of the coal, combined with proper air regulation and sufficient volume for the burning of volatile hydro-carbons are the necessary requirements for success.

The experience of the superintendent of the State War & Navy Building in Washington, D.C., is an added instance of successful smoke prevention by this means. The problem was unusually aggravated in this case because of the size of the boiler plant in this building, which is probably the largest of the government buildings in Washington, and the fact that the smoke laws of the City are exceedingly rigid The power plant consists of four 185 h.p. B. & W. boilers, two turbo-generator sets, hydraulic elevator service, and a combination steam and hot water heating system. The boilers were originally hand-fired and it has always been considered necessary to burn hard coal under them in order to conform to the smoke ordinance. In order to work economy in operation it was decided to attempt the burning of soft coal by installing a trial underfeed stoker.

After this stoker had been installed a series of comparative tests on the stoker fired boiler and on the hand fired were run in order to get accurate figures on which to base a request for an appropriation from Congress to equip the remaining boilers with stokers. The results were conclusive. Not only did the stoker, which is of the Taylor Gravity Underfeed type, burn the soft coal smokelessly at all loads, but it evaporated the same amount of water as the hand-fired boilers on 60 per cent. as much coal, while the efficiency was nearly 15 per cent. higher. The stoker furthermore demonstrated its ability to carry very heavy overloads continuously, and it was decided to attempt to carry the entire load of the building on the one stoker fired boiler. Accordingly the fires were pulled under the hand-fired boilers and the stoker-fired boiler has been carrying the load continuously ever since.

A careful comparison of coal burned showed that another stoker could be bought and would pay for itself without it being necessary to obtain any further appropriation. The coal being used on this stoker installation is New River Run of Mine, analyzing about 14,700 B.T.U. per pound, and with this coal a combined efficiency of approximately 80 per cent. is obtained.

In this case, the underfeed stoker which was installed primarily to solve the smoke problem has gone much further, and changed the entire operating method of the station. This, of course, is possible because of the remarkable overload capacity of stokers of this type. The correlation of air and coal supply makes the stoker's capacity limited only by the capacity of the fan engine which not only furnishes the forced draught but also operates the stoker mechanism. By means of the mechanical underfeeding, the coal is forced to pass up underneath the fire bed, becoming gradually heated as it advances and distilling off the volatile matter before the fixed carbon reaches the temperature of combustion. The distilled gases then pass up through the incandescent fuel bed and are burned completely, thus obviating any chance of smoke being formed.

ONTARIO POWER COMPANY'S CONDUIT AT NIAGARA.

An illustrated paper of interest from the standpoint of engineering with reinforced concrete was given by Mr. Charles H. Mitchell before the Engineers' Club of Toronto on February 16th. Mr. Mitchell covered the ground in detail, and showed many interesting views of the construction in progress.

This conduit, said Mr. Mitchell, was installed by the Ontario Power Company themselves, as by this method they felt that they could obtain fuller satisfaction than if the work was let out to other firms to do for them. The tube is 1¾ miles long, 16½ feet high and 19 feet 3 inches wide. The reinforced concrete walls are 18 inches thick. The work was accomplished in but five months, and it was in every detail thoroughly done. There was throughout a large amount of labor employed on this job, as many as 1,700 men being sometimes employed, while the average number was about 1,000.

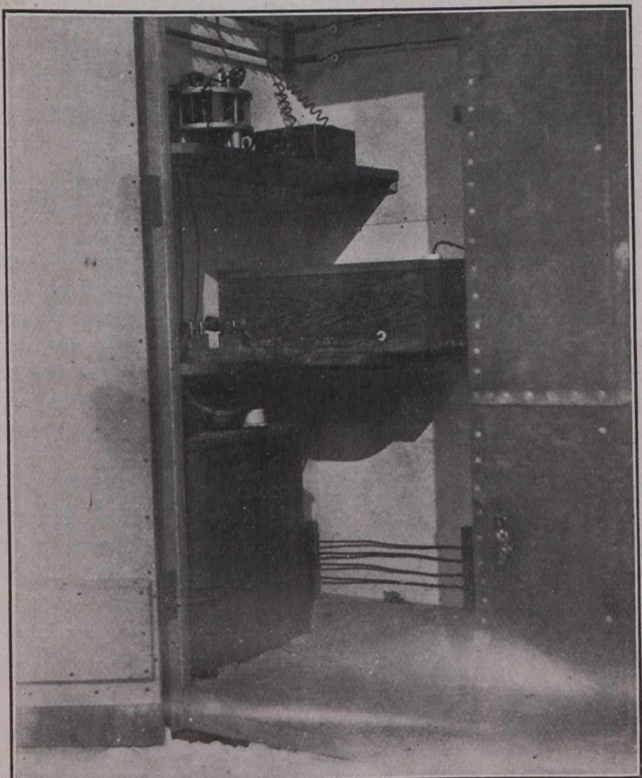
The pipe is built in a trench 32 feet wide and an average depth of 20 feet. The work may be considered as being constructed in three parts: the saddle with the invert, and the shell or upper part of the pipe. In the saddle, or foundation, a 1:4:7 mixture was used, and the saddle was laid on firm material, and rolled to shape required for the pipe. There were four men upon inspection and measuring work to about every 2,000 feet. In the invert and shell there was used what amounted to approximately a 1:1¾:2¾ mixture. The gravel for this mixture was of the best, and was especially dredged from the Niagara River. The maximum limit to the size of the broken stone used was about 1⅛ inch. Particular pains were taken in the construction of the invert portion to see that all bonding and every necessary precaution against flaw was taken. For the shell large steel forms of the shape of half the shell were used, with wings hinged at the bottom. A track was laid on the foundation, and these forms were carried into position partly by the use of a car worked along these tracks. Crude oil was used on these plates. Although there were sufficient forms on hand to complete 600 feet of the pipe, several times during the operations the supply of forms was not sufficient to carry on the work in the most desirable manner. Wooden forms were sometimes constructed in position, and some were made and then placed in position, but these were found to be far too cumbersome.

The pipe was built in sections, so that each section could be completed in a day of from ten to eighteen hours. At first twenty feet a day were constructed, but toward the last of the work it was nearer fifty. Careful inspection of every detail in this work in the bonding and joining of the reinforcement rods was followed throughout. The surface interior was finished off with a cement wash and gone over with a carborundum buffer, and the smoothest possible skin surface was obtained, as this, from the friction standpoint, was a matter of some importance. By the careful selection of aggregate a very dense concrete was obtained, and when the pipe was tested it was found that throughout it was practically watertight.

PRENTICE WIRELESS TRAIN CONTROL.*

An invention which has recently been tried out with considerable success upon the Canadian Pacific Railway and which is being watched with interest by those to whom the matter of more adequate train control is one of vital importance, is the invention of Mr. Frank W. Prentice, of Toronto.

About twenty years ago, Prof. Hall discovered that the steel rails by being bonded, could be made, to carry a low voltage of electric current without grounding, and as a result there was started a campaign of railway signalling. Taylor, Westinghouse, and hundreds of others have been working strenuously along this line. To-day it is possible to erect every three thousand feet a semaphore post that will give an indication to an oncoming train as to whether the next three thousand feet are safe. About fifteen per cent. of the 300,000 miles of track on the North American Continent are equipped with what we term visual signals.



Interior Generation Box, Showing Transformer and Oscillators.

Sadly, but truly, it has been proven that these visual signals are still dependent upon man to obey their behest in order to stop the train. It is estimated that 80 per cent. of the collisions have been curtailed by visual signals, but our railway managers, and behind them the people who place their lives in their hands, demand that the other 20 per cent. be eliminated. To accomplish this, dependence upon human agency in the control of trains when danger exists must be done away with.

Mr. Prentice believes that by his invention he has succeeded in eliminating the necessity for dependence upon the human element in train control. In this invention a wireless wave from the roadway to the moving locomotive is made the means of the stopping of the moving train.

To the average observer the distance from the air brake of a moving train to the roadway beneath is but a matter of feet and inches. To experimenters in the field of automatic train control, however, it is a formidable interval of space that cannot be measured in ordinary units of magnitude. Many are the inventors who have witnessed the inches in which they themselves first estimated this extent of space grow into miles, when they tried to span it with some form of energy, or sought to hurl across it some impulse which could be amplified and supplemented until there was power to stop a train. And, as one by one, their successive improvements on the almost inevitable first step, the mechanical trip, proved impracticable, and each new device in which they had embodied all the lessons and advantages of previous experience, succumbed to some unforeseen action, of inertia, impact, or momentum, the miles stretched into infinity, and their hopes vanished.

The results of this have been that knowledge of the conditions and requirements under which automatic control systems must operate is much more general than when interest in the subject was first aroused, and a more wholesome respect is entertained for the gap between the train pipe and rail.

The scientific basis is the discovery by Hertz that electric oscillation produced in a circuit which possesses capacity and inductance creates in the surrounding ether a disturbance which is styled an "electric wave." This wave causes the metallic filing tube, commonly called a coherer, to become a conductor of current when it is brought into the radius of influence of the wave. In the illustration, Fig. 1, three blocks of double track are shown as equipped in the approved manner with the apparatus. The system is an adaptation of the main principles to certain conditions. There are two parts to this system; first, that part which is on the track; and second, that part which is on the train.

The essential features of the track portion are the track circuit and the generator of the wave. The manner of controlling the wave by the track circuit relays will be evident from an inspection of the diagram. The generators, as a whole, include the transformer, T, the condenser, C, and the discharge points, PP, commonly known as oscillators. One of these generators is placed at the end of each block, and a wave wire is extended for a block length in the rear. This wave wire that is used is No. 12 Aluminum, and is run in a trunking in the centre of the track, midway between the rails. The generator is controlled by the track circuits of the block in advance. As long as the flow of current through the track circuits is not broken or short circuited, the A. C. relay R, keeps the generator connected with the A.C. feed

Pick-up and Main Wave Wire.

wires, stepping the 110 volts up in the ratio of 200 to 1, causing a static discharge to continuously take place between the oscillators, PP. Connected to the oscillators will be noted the wave wire, W, and pick-up wire, U, extending along the track in the relative positions shown. All the track blocks are provided with the ordinary form of vane type relays and A. C. track circuits. It will be noticed that the wires, W and U, are charged with the wave producing current only when the block in advance is clear. This is in accordance with the closed circuit principle upon which the whole system is built, as will be more fully shown hereafter. The wave wire, W, is insulated from the track, and its preferred position with reference to the track is along the middle of the ties as shown. On single track the wave wire is placed near the end of the ties. The maximum length of the wire which can be charged with one oscillator is measured by miles, so it is plain that the length of the blocks are governed, in actual operation, only by the requirements of the traffic. The maximum distance for A. C. track circuits is 16,000 ft., while that of D.C. track circuits is 3,000 ft. The installation on the C.P.R. is the first to use A.C. for track circuits on steam roads, its use heretofore being confined to electric lines. The distance in which the heaviest train going at the highest speed can stop is probably a safe minimum length for a block, 1,500 feet. The system thus is elastic enough for practically all conditions of present practice.

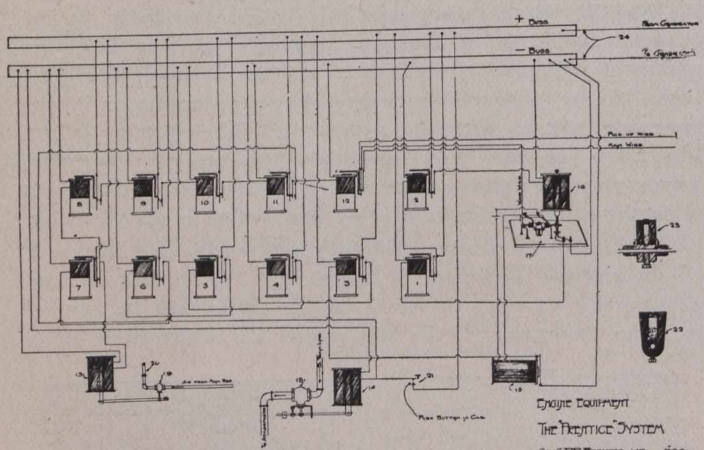


Fig. 2.—Diagram of Engine Equipment.

It will be understood that these oscillatory wave wires and generators may be applied to any forms of track circuits which are in general use, and moreover that they do not interfere with present forms of block signals. The system has no fixed signals on the ground. It may, however, be employed in conjunction with existing block and other signals.

The track installation on the C.P.R. consists of eight blocks, from 2,000 ft. to 4,500 ft. each, four blocks on the west-bound and four on the east-bound track, beginning at Queen street subway and ending at Royce avenue, a distance of two miles; generators being located at Noble street, Lansdowne, Golden, Wallace, and Royce avenues. These have been in constant service since March 25th, 1910, without interruption. The expense for current for this period has been 2 cts. per day per block—about 90 per cent. less expensive than visual signal systems. There being no batteries in the track installation, the cost of maintenance is cut 50 per cent.

Having a wire which extends throughout a block and is charged with a wave producing current, which makes the wire the centre of a series of outwardly extending concentric impulses, having a constant radius of influence at any point along the wire, it remains only to run a train carried antenna, with its coherer, into the block, and at the instant this antenna enters the zone of the wave it causes the coherer to become a conductor of electricity. This is the secret of the "wireless system."

The gap is bridged by Hertzian waves. Intangible though the wave may be, it is nevertheless a fact that it furnishes an actual and positive connection between train and track. More than this, its field of influence can be definitely confined; the radius of the zone can be limited to one or two or five feet if desired, as easily as to a mile. This, of course, is accomplished in the generating apparatus. It is necessary to prevent the receiving by a train on one track of a wave intended for a train on the other track, and to make it imposible for a train going in one direction to be interfered with by a wave intended for a train going in another direction.

The part of the system which is carried upon the engine comprises first of all the main antenna, 19 ft. long, suspended from the boiler braces by three hangers, the antenna consisting of aluminum plate four inches wide, and hanging directly over the wave wire, 2 inches above the level of the pilot or 7 inches from the indurated trunking. Second: A pick-up antenna suspended in a like manner on the right hand side, suspended beneath the cylinder cocks, 13 inches outside of the rail and directly over the pick-up wave wire at the end of each block. Third: A Pyle turbine generator giving 6 volts and 20 amperes of current for supplying the working force of the wave responsive apparatus. Fourth: The train control mechanism, the salient feature of which is the coherer, consisting of a wood fibre receptacle having a hole in the centre, and two lugs inserted in its bottom ¼ of an **inch apart.**

Placed in the coherer are the wave responsive filings, sufficient to fill in the aperture between the lugs. The coherer is rotated upon an axle through 90 degrees of space by a solenoid rack and pinion, being held in th upright position two seconds by means of two hold relays, the filings during that time resting between the lugs. Normally these filings are a non-conductor of current, but when the Hertzian wave is emanated in their zone the resistance on their outer surface is broken down and a current flows through them, closing the master relay, 15. Once these filings are cohered they will retain such cohesion until they are jarred to restore their non-resisting qualities, hence the rotating coherer to drop them out by gravity to perform this function. The coherer is in operation constantly as long as an engine is in service. The master relay opens and closes every three seconds when the wave is being received. Connected to the master relay is a series of 10 hold relays, 3 to 12 inclusive, Fig. 2. These relays will hold their magnetism one second each after the current is broken, and being in parallel series, relay 12 releases its contact 10 seconds after the master relay ceases to be operated by the wave controlling influence.

Relay No. 7 through its contact energizes solenoid 13, whose plunger holds closed through a fulcrumed lever valve 19, which stops the air from the main reservoir blowing whilste, 20.

Relay 11 through its contacts energizes solenoid 14, which through its fulcrumed solenoid holds closed balanced valve, 18, preventing the escape of air from train line through a one inch port.

Relay 12 has a front and back contact and a common connecting with coherer 17. When relay 12 is closed its common is in connection with the main wave wire antenna under the engine, and when disengaged is in connection with the pick-up antenna located under the steam chest.

Solenoid 14 is also subject to control by a push button, 21, located in the cab of engine, by the engineer.

Engine No. 798, leaving John street roundhouse on its trip to West Toronto, has its solenoid coherer, 16 and 17, is operation. There being no wave between Simcoe street and Parkdale, master relay, 15, hold relays 3 to 12, solenoids 13 and 14, are de-energized, whistle 20 is blowing, train line valve is held closed by push button 21, to keep brakes released. Entering wave zone just west of Queen street subway, if the block is unoccupied, pick-up wave wire is unengaged and the wave jumps to the pick-up antenna, the wave reaching the coherer through its contact on relay 12, closing master relay 15, which closes relays 3 to 12. The coherer thus being automatically connected with main antenna under the engine, solenoid 13 stops the whistle from blowing, solenoid 14 closes valve 18, and the engineer can then remove his finger from push button 21. The engine is now under control of the wave, and as long as the wave the track. The engine is brought to a stop unless the engineer when the whistle starts to blow closes push button 21, holding solenoid 14 closed, thus preventing the application of the brakes. If the engineer is incapacitated or dead it is obvious that the train will be brought to a stop. Suppose that before 798 reaches Golden avenue the train in Block A has cleared, when 798 gets over pick-up wire at Golden avenue the engine is again placed under control of the wave.

However, suppose that block A is still occupied, the pick-up wire at Golden avenue is not energized and engine 798 enters the block with its coherer still connected with the outside antenna, and as the waves from the main wave will not jump over 12 inches, the apparatus on engine 798 is irresponsive, and the train runs in and through block A under the whistle signal of caution.

The hold relays are immersed in oil in a metal box and the oil will stand 50 degrees below zero.

Engine 147 has covered 5,000 miles with the apparatus intact; 104 hours continuous run of the equipment has been made on engine 798 without stopping. Engine 798 is in service from 6 a.m. Monday until 8 p.m. Sunday, handling from 20 to 60 cars per trip. Stops are made daily with wide open throttle.

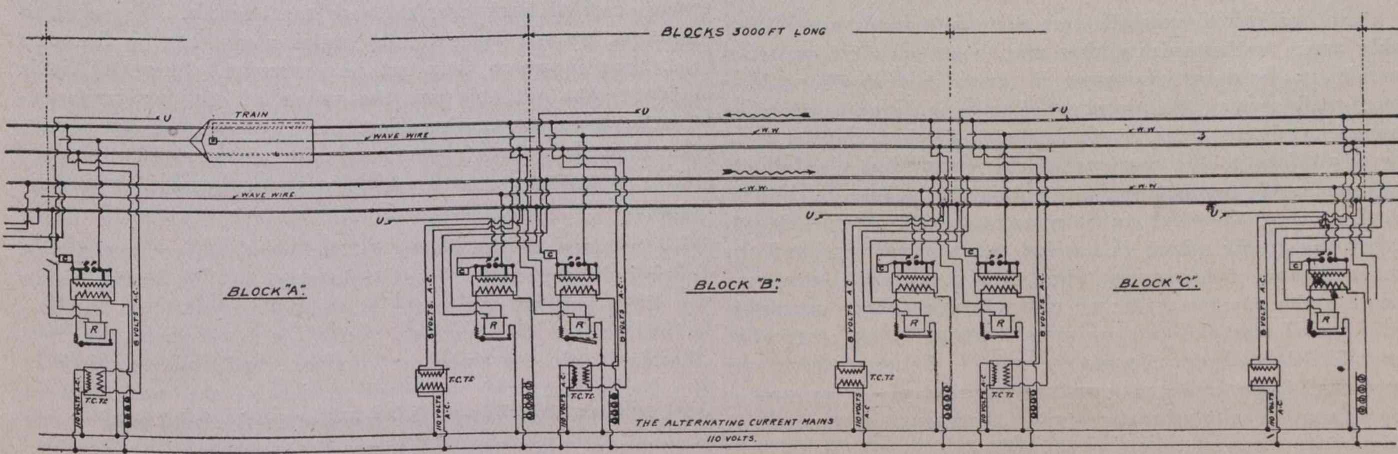


Fig. 1.—Wiring Diagram Showing Position of Generators.

is being received, master relay 15 will be opened and closed every three seconds; 2½ seconds closed and ½ second open, consequently relay 3 and its trailing relays, 4 to 12, will remain closed. The wave is being received from the generator at Lansdowne avenue, the generator in turn being controlled by the A.C. track circuits being fed from Golden avenue block station.

Suppose there is a train standing in the block between Wallace avenue and Golden avenue. The wheels of the train shut off the current from A.C. relay at Golden avenue, stopping the wave between Golden avenue and Lansdowne avenue, the coherer fails to receive the wave, the master relay remains open, in one second relay 3 opens and relays 4, 5, 6 and 7 open successively, each one second later, and in five seconds after entering the block at Lansdowne solenoid 13 drops its valve, 19, and the whistle, 20, starts blowing; 4 seconds later relay 11 opens, de-energizing solenoid 14, and the train line valve is opened, and 10 seconds after entering Lansdowne avenue block the brakes are being applied to engine 798, which will be brought to a stop without closing the throttle, as the power of the air brake is three times greater than the steam.

Relay 12 has opened and the coherer is now connected with the pick-up antenna under the steam chest, which is three ft. 5 inches from the main wave wire in the centre of

The train line valve is set for 25 lbs. reduction, and it requires this reduction to make stop with light engine. With 12 cars at 50 miles per hour a reduction of 17 lbs. is made in the train line. With 30 cars the valve only makes 13 lbs. reduction; with 40 cars 8 to 10 lbs.; and with 60 cars 5 lbs., the valve simply mechanically making the amount of reduction necessary to make the stop—no more, no less.

The basic features of the invention are set forth as follows: First among them is the fact that all track devices and all train devices are on the closed circuit principle. It is evident that the train pipe is kept closed by a balanced valve, and the moment the wave ceases it drops open by gravity. It is not pulled open, and the only chance of its failure is when the apple fails to fall from the tree to the ground, and when that occurs we will none of us have any occasion for train control.

The coherer always working is the watchman of the apparatus. It delivers a report that all is well every two seconds to the master relay. It ceases reporting when all is not well. The coherer is perpetually being up-drawn to keep it in prime condition for the wave influence, which is received by the engine carried antenna. The whistle valve and the train line valve are being forcibly retained in the presence of the wave, and opened and dropped by the gravity principle in case of its cessation exactly in the predetermined order. A failure anywhere means a stop, except the engineer is in possession of his senses and faculties and uses the push button to keep the train line closed.

Under any condition in case of the cessation of the wave the air whistle is a constant reminder of the necessity for caution and of danger ahead. A train entering a block when the next block is occupied is brought to a stop unless the engineer intervenes. After this the train may proceed under a caution signal. The caution signal forces attention either until a clear block is reached, or until the mechanism on the engine has renewed operations because of the wave on the unlock wire.

ROADS AND PAVEMENTS

GOOD ROADS.*

By A. McGillivray, Highway Commissioner.

The amount of attention that is being given in nearly every civilized country to the question of roads, not only by those who are directly responsible for their upkeep, but also by men of almost every profession and calling, makes it very evident that the importance of an up-to-date system of highways cannot be over-estimated in the development of a country and in the progress and social life of a people living therein.

No one can dispute the fact that good roads are a valuable asset to the country that may boast of their existence within its borders. Railways in more modern times have been well serving the purpose of tapping large sections of undeveloped countries, and facilitating the movement of their produce to the markets of the world, but the full development of any country must wait the advent of a well-devised, up-to-date system of common roads. They not only carry the traffic which is carried by the railways and by other means of locomotion, but they carry their own very large and exclusive traffic as well. Besides every passenger who travels on the railway or steamboat being compelled to use the road for a greater or less distance, there are millions of journeys taken without the use of the railway or steamboat at all; therefore, road travelling is much more important than all others combined.

The difference between a good road and a bad one may be represented by a vehicle requiring one or two horses to pull the same load. On a good road with easy gradients one horse should be able to haul one ton for a distance of twenty miles in a day. If the roads are in bad condition, cut deep in mud, with uneven surface and steep hills, the tractive effort is naturally far greater, and two horses at once become necessary to pull the same load, or even a lighter one. Or again, if on a good road a farmer is able to haul his farm produce to the market, a distance of five or six miles, and make two trips in a day, when on a bad road one trip is all that can be accomplished, it is obvious that the cost of marketing such produce is immensely increased, and that a great deal of time is thereby spent off the farm, in many instances at the sacrifice of urgent duties that should be performed thereon. This waste of time must certainly represent an equivalent loss of money, because no farmer who realizes his opportunities can afford to spend an unnecessary amount of time off his farm, for it is there and not on the roads that his presence is required if his work is to be conducted in a successful and businesslike manner. If this unnecessary time spent on the roads was given its equivalent value in cash, together with the amount of expenses due to the wear and tear on vehicles, harness and horses, occasioned by the poor and unserviceable conditions of the roads, there is no doubt but that in a short time the money so lost in the province would build it a first-class system of highways.

As the prosperity of towns and villages is to a great extent dependent upon the development and prosperity of the surrounding country, they, too, must reap the benefit of good roads, and a city or town can have no greater asset than a system of first-class highways radiating from it into the country, that the products of the country may be carried with reasonable cost to its markets, to be traded thereon or shipped by other means of transportation to the larger markets of the world and the merchandise of the cities and towns carried back over them to the country. Distances to markets are not measured by miles alone, but by the ease and time in which they can be overcome. Therefore, it is evident that not only are the values of outlying lands enhanced by bringing them into closer touch with the towns, but there is a great benefit derived by the towns that are made attractive by such facilities as good roads from their centres into the country.

In many of the States to the south railway companies have indicated not only a willingness but an active desire on their part to co-operate to the fullest extent in the improvement of the common roads. It is evidently to their interest to do so, since the common roads serve as feeders for their lines, and the more serviceable the roads leading to their shipping points the more attractive will these points become as marketing places for the produce of the country. There is no doubt but that the railway companies are affected by any movement that affects the general output of any country, and when this is increased their freight receipts and profits are proportionately increased, and, as roads are such a potent factor in the developing of a country's resources there must surely be immense benefits to be derived by them from time to time as these roads are improved and their efficiency increased.

The higher the standard of efficiency of the roads in a country, the more attractive does the land become for human habitation, and the more energy and labor properly directed on the land the greater will be its productiveness in consequence thereof. In fact, it might be said that as the population of a country increases the improvements to the roads will naturally increase. Likewise it is equally true that if the roads are improved it will result in population being brought to the country. It does, therefore appear that there is a cash value to be derived from the existence of good roads, by all who use them, whether they be from the country or from the city, or whether horse or mechanical traction is used. But good roads as compared with bad roads have a much wider and more important effect upon a community than mere dollars and cents. They encourage intercommunication, the free movement of the population and of the products of industry. They relieve the rural life of much of its isolation and inconvenience, bringing it into closer touch with that of the cities and towns. They permit the people of the cities and towns to take advantage of trips

*Read before the Union of Manitoba Municipalities.

into the country, that its beauty and fresh air may be enjoyed with comfort and pleasure.

The best argument that can be put forth in favor of good roads is—a good road. The practical experience of riding or hauling a load over a well-improved road, in good condition in all seasons of the year, is worth a thousand reasons that may be put forth for road improvement. A stranger's impression of a country depends largely upon the ease with which he can travel from place to place in the transaction of business or in the pursuit of pleasure, and he is pleased or displeased exactly in proportion to the smoothness of his journey or the ruggedness of his way. Pretentious dwelling houses, massive stables and barns, acres of beautifully cultivated lands, possess no attraction for one who is compelled to pick a way for his feet, to keep his eyes on the ground lest he stumble and fall in the mud, or to grip with both hands the seat of his vehicle to avoid being thrown therefrom. To man and beast alike the roadway that offers a few or no obstacles to easy travel is a delight that shortens the journey by mitigating the pangs of fatigue.

The question of cost is the one which generally interests the taxpayer, and is, no doubt, the greatest obstacle in the way of attaining good roads, because the expenditure of large sums of money is necessary to this attainment. A good road should cost more to construct than a poor one, over the same ground, but even when the initial cost of a good road is more expensive, it will be easier and cheaper to maintain, will last longer, and will easily compensate those who use it daily for the extra expense they have been put to in building it by the comfort and pleasure they will have in using it, the saving in wear and tear on vehicles, harness and horses, and by the great saving in time which is now spent on the roads, caused by their unserviceable condition. One dollar properly expended is many times more effective than half that amount injudiciously spent in doing something which may appear to serve the purpose for a time, no matter how soon it will have to be done over again. In no other line of work is this more evident than in the construction of roads, and it must be admitted that a great amount of this false economy has been practised in the past in this particular line of work in this province.

In earlier days in the history of Manitoba, when the population of the different municipalities was scattered, and the distances to railway centres were much greater than they are now, it could hardly be expected that permanent work could be obtained with the limited amount of money at the disposal of the municipal councils. A means of access to the existing makets had to be provided for outlying settlers over long stretches of impassable country. The energy and money had to be distributed to all quarters to relieve in some measure the exigent necessities of almost isolated settlements. Great credit is due to the men who have had to endure the hardships of those times in driving for miles in circuitous routes to avoid impassable stretches of swamp and in hauling their produce through mud and mire, and also to the men who undertook the responsibility of relieving to the best of their ability such a situation. But those times have passed—never to return. The population of the country has increased, and a network of railways has been constructed throughout a large portion of the province, along which marketing places have sprung up every few miles, putting the farms within comparatively close distances of shipping points, so far as miles are concerned, and removing to a great extent the hardships and difficulties of pioneer days to the producer. There is yet, however, a great deal to be desired in further eliminating so much unnecessary expense, inconvenience and loss of energy.

In order that every dollar spent on the construction and improvement of the roads may be expended judiciously and made to return some appreciable value, and that, in the near future, the roads may be brought up to a certain standard of efficiency, every municipality should have before it some definite policy in carrying on this work. A certain plan of improvement should be laid down and adhered to as closely as possible. This plan should provide that every mile or portion of a mile improved be done with the idea of making it a component part of some system later on. It is impossible to improve all the roads in this province in one year. It is an undertaking that will have to be carried on for a number of years, and as such it should be undertaken in a systematic and businesslike way and not dealt with in any haphazard, happy-go-lucky, go-as-you-please method. If railway companies undertook to construct and maintain their lines, or farmers to carry on the busness of their farms after the method prevalent in many municipalities of dealing with the road problem in this province, they would most probably find themselves insolvent in a very short time. It is only by a very careful study of the situation and by the adoption of hard-headed business tactics that this, like all other important work, can be successfully and ecenomically performed and permanent and far-reaching results obtained.

Every municipal council is familiar with the roads of most importance in its own municipality, or where such roads should be located, to accommodate satisfactorily the greatest number of its residents as a means of communication within their own boundaries or with adjoining municipalities. There is no doubt that roads so situated will require and should receive more attention and should be constructed and maintained to a higher standard of efficiency than side roads having less traffic over them and of less importance to the residents of the district as a whole. A plan of improvement should, therefore, be outlined and followed in such a manner that the main highways or roads that will be of the widest benefit to the whole municipality would receive special attention and be brought up to as high a state of serviceableness as quickly as the means of a municipality will permit.

A great amount of money is necessarily wasted in trying to construct roads without first having secured sufficient information with regard to drainage. The method of going ahead and constructing pieces of roads here and there, regardless of what is going to be done with the water, which must necessarily accumulate in the ditches, very often means in time the reconstruction of long stretches of highways which have proved unsatisfactory, owing to the lack of drainage. Oftentimes this is the case after large sums of money have been spent on the roads. Now, if certain lines of improvement were laid down and the roads to be improved were specified, with the help of an engineer a municipality could at once get all the required information in regard to the levels and topography of the surrounding country, and would thus know definitely and for all time just what provisions would have to be made for drainage purposes, enabling the work to be undertaken systematically and from points of best advantage.

In laying out a system of roads in any part of the country, the first important step should be to acquire a system of drainage to adequately handle the water. Securing the information and levels necessary to determine such a system is no small or easy task. It is the work of an engineer, and should not be entrusted to anyone who has not the requisite knowledge to properly undertake and perform it. It is information that should be in the possession of

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WATER ANALYSIS AND THE PUBLIC HEALTH.*

By D. G. Revell, B.A.M.B., Provincial Bacteriologist for Alberta.

It is with much pleasure that I accept the invitation to present a paper before the Union of Alberta Municipalities. In union there is strength and with the opportnuities for action in this rapidly growing country the Union of Alberta Municipalities is assuredly potential for much good. I am therefore glad to bring before you a subject of prime importance to everybody, but especially to those whom you represent, viz., those living in municipalities. As the population of a community becomes denser, so-called "public utilities" become increasingly more vital to the well-being of the citizens, and I believe that among these utilities I may safely give the water-supply first place in importance. No other one thing is so great a factor in public health.

Among the great resources of the Province of Alberta the health c+ her people must be reckoned as first. The conservation o˘ this basic resource of her people is fundamental to the full development and realization of all her other resources. In this work of conservation the Union of Alberta Municipalities can, and undoubtedly will, play a large part.

At the outset of what I have to say it may be well to define the two chief terms in the title of this paper. By "water-analysis" is here meant the examination of water by laboratory tests to ascertain certain data which aid in forming an opinion as to the sanitary quality of the water, that is, its fitness for domestic purposes.

"Public health" is perhaps most easily defined as the object of public hygiene, which in turn cannot be better defined than in the words of Sedgwick."†

Public hygiene is the science and the art of the conservation and promotion of the Public Health. It has for its function the prevention of premature death and the promotion of normal life, health and happiness is communities, chiefly by the elimination or amelioration of unfavorable environmental conditions common to many persons or communities either at one time or at different times. It includes especially hygienic problems common to groups or communities such as camps, villages, towns and cities, e.g., water supplies, drainage, milk supplies, ice supplies, the control of infectious diseases, heating, lighting, ventilation, school sanitation, municipal sanitation and the like."

The laboratory tests above referred to comprise physical, chemical, microscopical and bacterial examinations. In addition to these the thorough study of a water includes the medical question of its biological effects and such engineering questions as the available quantity, head, feasibility for use as compared with other possible supplies, etc. This comprehensive study of water-supplies may be termed "water-investigation," and is most effectively carried on by the co-operation of bacteriologist, chemist, physician and engineer.

A mention of some other kinds of analysis of water will serve to make clearer by contrast what sanitary analysis is. Thus there is mineralogical analysis of water to determine exactly the mineral substances which are dissolved in it, and which may have medicinal or commercial value; also boiler-analysis to decide as to the suitability of a water for boiler use; commercial analysis of water intended for industrial purposes such as dyeing, brewing, etc. It is a serious but common mistake to look upon sanitary water-analysis as similar to these others, or like the assay of an ore, and to expect it to be carried out under the same conditions as are appropriate for these.

*Read at last U. A. M. Convention, Wetaskiwin, Alta.

†"Principles of Sanitary Science and the Public Health," by W. T. Sedgwick, McMillan Company, New York.

Says a well-known authority *on water analysis:

"A great deal of popular misconception exists upon the subject of the analysis of potable water, and it is commonly supposed that such an examination may be looked upon from practically the same point of view as the analysis of an iron ore. That this belief is founded on fallacy may, however, be readily shown. When an iron ore is submitted for analysis the chemist determines and reports upon the percentages of iron, phosphorus, sulphur, etc., found therein; and at that point his duties cease, inasmuch as the ironmaster is ordinarily capable of interpreting the analysis for himself. Even should the analyst be called upon for an poinion as to the quality of the ore, the well-known properties of the constituents make such a task an easy one, and assuming the sample to have been fairly selected, the opinion may be written without any inquiry as to the nature of the local surroundings of the spot whence the ore was taken.

"A water-analysis, on the other hand, is really not an analysis at all, properly so called, but is a series of experiments undertaken with a view to assist the judgment in determining the potability of the supply."

The popular tests by which the quality of a water is judged are its odor, taste and "appearance" (or color and clearness). These tests are utterly unable to distinguish between a safe and an unsafe water and may condemn a perfectly safe water and accept a very dangerous one. Thus, odors commonly attributed to sewage pollution may be due to either living or decaying algae and diatoms (two classes of water-plants) or to infusoriae (so-called "animalculae," minute forms of animal life) and as these are usually harmless an ill-smelling water may therefore be quite safe to drink.

All natural waters are pure water plus chemical substances and living organisms, dissolved or suspended in the water. Ordinarily the chief chemical substances in water are:—

1. Gases occurring in nature, such as oxygen, nitrogen, carbon dioxide and ammonia;

2. Liquids, as for example, organic acids;

3. Solids, such as lime, magnesia, iron, as salts or compounds, and various organic substances.

The living organisms are:—

1. Bacteria and other small and simple forms of plant life, such as algae and diatoms:

2. Low forms of animal life, so-called animalculae or infusoriae. These and the algae and diatoms are examined for by the use of the microscope.

3. Higher forms of animal life (crustaceans, insects, worms, fish, etc.), are also found in water but are not ordinarily taken account of in analytical work.

Of these various contents of water those of most interest here are:—

(a) Chemical substances not in themselves harmful in the minute amount usually present but whose presence is indicative of the possible dangerous bacterial contamination of the water; the occurrence and amount of these substances are determined by chemical analysis;

(b) Certain kinds of bacteria, either themselves dangerous to health, or probably accompanied by such and

*W. P. Mason, page 1, "Examination of Water."

hence indicative of contamination; these are determined by bacterial analysis.

As it is the numbers as well as the kinds of bacteria present that guide in judging the character of a water, and as both these features (numbers and kinds) change soon after a sample is bottled, in a thorough study of a water-supply it is necessary to begin the bacterial examination in the field (i.e., in the locality where the water-supply is.) A bacteriologist must visit the source, take the samples and "plate" (or plant, make cultures of), them there. The cultures can then be transported to the laboratory for careful examination and study.

The bacteria in water may be put in three classes:—

1. Normal water bacteria, which are always present and are harmless. Their number varies with the temperature, season, amount of suitable food for them in the water, etc., and differs greatly in the various kinds of sources of the water, and even for the same source of water, especially as the season changes.

2. Harmless aliens, not present in "pure" waters but derived from the soil and while not harmful themselves are to be regarded with suspicion owing to the bad company they are apt to keep.

3. Harmful aliens from sewage or bad soil, i.e., really of animal origin and hence condemning the water absolutely. The alien bacteria do not thrive in water, especially in keen competition with the normal water bacteria and tend as a rule to disappear sooner or later from water by so-called "self-purification" of the latter. Harmful mineral constituents when present in noteworthy amount usually render themselves self-evident by the taste of the water or by their effect on the users of it. If a water disagrees, no amount of analysis will reconcile the users of it to its special effects. It is astonishing how often people ask the analyst to tell them what they already know most unmistakably ,namely, that a certain water is good to drink or is not. Analysis is ordinarily necessary and justifiable to ascertain the presence only of concealed dangers, or the character of objectionable constituents known to be present. In the great majority of cases the dangerous character of a water is readily evident to the eye. As President Drown, of Lehigh University said, "It does not require a chemical examination to decide whether a stream has been polluted by sewage when one can see the sewage flowing into it."

For sanitary analysis a true sample is absolutely necessary, that is, a sample which exactly represents the water as it exists in its source or as consumed. "Chemical analysis" is an extremely delicate process, estimating constituents in parts per million and expressing these to one or two places of decimals, that is, in tenths or hundredths of one part in a million. It therefore shows as minute amounts as one part in 100,000,000. Hence it is absolutely necessary that water samples be properly taken in the first place, in suitable and perfectly clean containers and properly cared for until brought under examination. Some of the substances tested for readily become altered after bottling the water, but these changes can be minimized by adding a small quantity of chloroform to the sample and by keeping it cool. The bacterial content of a water is even more susceptible to alteration than the chemical. A bacterial sample can not be treated with a preservative but must be kept cool by packing in ice. There are always numerous bacteria of several kinds in even small quantities of the best and purest natural waters. The number is usually estimated and stated for one cubic centimeter amount (about 1/16 of a cubic inch). A water is free from living bacteria only after being sufficiently heated or when it contains germicides (or substances which destroy bacteria). The numbers and kinds of bacteria in a water sample are ascertained by culturing, a process analogous to the determination of the numbers and kinds of minute seeds present in a quantity of soil by germinating and growing the seeds into plants.

The requirements, purpose and limitations of a water-analysis must be kept clearly in view by those making use of it. The analytical findings apply strictly only to the sample; indirectly they apply to its source, but only in so far as the sample at analysis is truly representative of the latter.

The findings from an analysis of a sample do not apply to the past or future state of the source of the sample; and herein is one of the most common popular mistakes in regard to the possibilities in water analysis, viz., it is commonly thought that an analysis is an easy and certain means of determining whether a given water has been the cause of typhoid fever. That this beleif is erroneous, however, readily appears when it is known that typhoid infection of water is usually temporary and the disease does not appear generally for two or four weeks (the so-called "incubation period") after the person takes the germs into his mouth by drinking water or otherwise. A week or two more then elapses after the "onset" or appearance af symptoms, before the disease can be definitely recognized and diagnosed. Then some future time passes before a sample is taken for examination. Thus a period of seven or eight weeks usually intervenes between the drinking of typhoid infected water and the subjecting of the water to analysis. Meanwhile all trace of the contamination may have disappeared, leaving the water apparently quite innocent. Moreover, if the examination could be made at the right time even the most careful examination. may fail to detect typhoid bacilli that are actually. present. In the routine bacterial examination of water we try to ascertain the number of colon bacilli present. These are the most abundant kind of bacteria in the colon (or large intestine) of animals, hence they abound in animal excreta and being hardy and rather easy of detection they are utilized as a test for excretal contamination. Typhoid bacilli are not nearly as hardy as colon bacilli, and are also extremely difficult to isolate and identify. Hence we examine water usually only for colon bacilli. From their number the possibility and probability of typhoid germs being present is deduced. Even then we must remember that water may be infected by urine alone and colon bacilli then may be absent or present only in such small numbers as to afford no indication of the true state of the water. The urine of a person who has had typhoid may contain as many as 500,000,000 typhoid bacilli in each cubic centimetre! These may persist for years and be continually given off by the individual although his health may be perfectly good all the while.

Practically all water used for domestic purposes is derived by distillation from the ocean and other large bodies of water. This is carried on continuously on an enormous scale by nature. From all natural water surfaces—in fact from all natural surfaces of every kind exposed to the air, such as those of the soil, trees, vegetation of all kinds, as well as bodies of water—evaporation is always going on thus providing a continuous stream of pure water passing into the atmosphere in the invisible form of water vapor, a gas. By winds this is widely distributed over the earth and, owing to temperature changes, much reappears as clouds or mist and is precipitated from time to time as rain, snow and hail. A part comes out of the air quietly by condensation on cold surfaces as dew or "frost" deposits. All these as formed in or from the air are pure water—chemically pure. Almost at once on its visible separation from the air the water begins to acquire other constituents: A—From the air: Gases and "dust": (Air "dust" is fine particles of lifeless mineral and organic matter plus living bacteria and other kinds of minute vegetables and and animals). B—From the soil: Soluble solid or liquid substances; finely divided undissolved substances suspended in the water, making it more or less turbid; abundant bacteria and other living things. C—From other water with which it mixes.

According to the source, natural waters may be divided into the following kinds:

1. Aerial; Rain-Water and Snow; Hail, Dew and "Frost."

2. Surface; (a) Streams and rivers; (b). Ponds and lakes; (c). Ice for domestic use may be included also here, although in its bacterial character and to a less extent also in its chemical, it is more akin to aerial waters.

3. Subterranean; (a). Shallow wells; (b). Deep wells and springs.

The numbers and kinds of bacteria and the kinds and quantities of chemical substances normal to these various classes of water are different for each sort and even within one class the constituents may vary within considerable limits without actual contamination being present. In order, therefore, to interpret a water-analysis (that is to understand its significance) it is absolutely necessary to have certain data, viz., such a description of the source and environment of the water as will show the significance of the amount of each constituent determined in the analysis.

*To quote from one of the highest authorities of the present day on water-examination.

"For a proper interpretation of the results of chemical and bacterial analysis, a knowledge of the source of a water is imperative. It has been supposed sometimes that an analyst might be biased in his estimate of the character of a water by his knowledge of its origin, and in accord with this notion persons submitting a sample of water for analysis sometimes think it necessary to conceal the source. The reason for this mistaken conception is that in the popular mind the analyst is believed to test for definite harmful impurities in water. This, however, is not the case; the opinion of the analyst is based on inferences drawn from the relative abundance of various substances or elements that are not in themselves harmful, but which indicate with more or less precision the probable presence of actually harmful constituents. . . . Since, as will appear, the value of a sanitary water examination depends solely upon the interpretation and not upon the absolute quantitative results, knowledge of the source of a water is of paramount importance. . . . Any attempt to maintain fixed standards of chemical purity in sanitary water analysis or to condemn in a mechanical fashion waters that contain certain constituents in apparent excess is based on a fundamental misapprehension. Beef tea or egg nog may contain amounts of albuminoid ammonia and chlorin far above the amount that would be thought admissible in a potable water, and are none the less wholesome. Interpretation of the results of chemical analysis can only be warranted by a careful study of all the data obtainable, and as has been pointed out, a correct interpretation is often impossible in the absence of information concerning the source and surroundings of the water sample. So important, in fact, has this environmental examination become, that in recent years investigators often lay little stress upon either chemical or bacterial examination in cases in which data can not be obtained regarding the collection, transportation and source of a given sample. The chemical examination, in particular, is considered to-day as a substantial aid in supporting a judgment as to the character of a water rather than as the sole basis on which an opinion can be formulated."

If a doctor were asked what is the matter with a person who weighs 250 lbs. he would, before answering, wish to know the person's height, age, sex, weight in the past, etc. The person might be perfectly healthy.

The general purpose of sanitary water-investigation is to safeguard the public health as dependent on purity of water-supply. The specific purposes of the analyses made in this Province are:—

1. To ascertain the suitability for domestic use of given public water-supplies, or;

2. To ascertain if the water is concerned in carrying or causing disease, or;

3. To obtain "comparates" for Alberta waters ("Comparates" are analytical findings in water from various sources known to be uncontaminated). Just as when we attempt to determine the sanitary quality of water it is necessary to have other analyses with which to compare the analytical figures obtained from the sample in hand, so we must know what is usual for unpolluted waters of that locality at that season of the year. This is determinable only by numerous examinations, giving what are known as "comparates."

A reliable opinion as to the sanitary status of a water-supply can be rightly formed only upon the following data:—

1. The history of the use of the water, especially its effect on health.

2. The data from intelligent, exact and thorough sanitary and topographical inspection of the environment of the water.

3. Comparates for the locality and season in question.

4. The analysis of proper samples of the water.

Of these four requirements the first two are more necessary than the last two, and are generally more easily and quickly obtainable.

The effect of the use of a given water on health is a biological test and is one of the most crucial tests to which the water can be subjected. It is moreover a test which has already been made usually before any other test is asked for. In one instance I was asked to examine the well-water of a family in which there were then six cases of typhoid. For months previous to the onset of these cases the well-water was also used by a lot of other persons, none of whom developed typhoid. This was a biological test that exonerated the well quite clearly and much more certainly than all the chemical and bacteriological tests could have. Indeed these would have condemned the well, for it was just beside the barnyard and the stand or well-cover had openings (for the rods of the double force-pump) through which the manure brought there by the farmer's boots was being washed every time water was pumped. It was winter and one could see the manure right there and see it washed into the well whenever water was pumped. Seeing is believing, and it required no analysis to prove that that well certainly was both chemically contaminated and also contained plenty of colon bacilli (from barnyard manure). Yet the well played no part in the typhoid outbreak for which it had been blamed. A brief study of the cases revealed a "walking case" as the originator of the outbreak, by contact.

Water-analysis is unfortunately the subject of the grossest misconceptions not only as to the why and the how of undertaking it and as to the application of its findings, but even as to what supplies are proper objects of such attention. Briefly these latter are:—

1. Supplies proposed for public use, or extension of public use, and,

*E. O. Jordan, in the Journal of the American Medical Association, Vol. XLVIII, May, 1907.

2. Supplies in use and justly under suspicion of causing disease. A water is justly brought under suspicion by what may be compared to the general examination which a doctor makes of a patient before he ventures any diagnosis. This general study often either gives the water a "clean bill of health" or unmistakably condemns it without recourse to laboratory tests which are frequently uncertain in their significance and should follow, not precede, the general study mentioned.

Laboratory examination of public supplies proposed for new use or for extended use has regard to color, odor, taste, turbidity, hardness, alkalinity, total dissolved solids, chlorine and iron; also free ammonia, albuminoid ammonia, nitrites and nitrates; exceptionally we may also determine dissolved oxygen and putrescibility of highly polluted waters. In addition to the quality of the water as indicated by the analysis there should also be ascertained: ,a). The quantity available, whether sufficient for present and future purposes; (b). The environment of the water, both the present actual and the probable future conditions to which the water supply will be exposed; (c). The cost to install, maintain and operate the necessary works to handle the water. A careful inspection or topographical survey of the source of the water should put contamination out of the question as a possibility, or at least as a probability, before the water supply is adopted, unless no other is available and means to purify it are incorporated into the waterworks system.

There is a great deal of popular error as to the possibilities in water-analysis. I think the chief reasons for the mistake are:—

1. In many instances of typhoid epidemics in large cities sensational results have been got by thorough investigations of the water-supplies at fault—the public have regarded these investigations as consisting merely in analysis of the water, although the analysis of the water may in many such instances have quite failed to prove the water at fault In other words, the general public, and even many medical men, have confounded water-analysis and water-investigation. The latter includes the former and much more.

2. Water-analysis proper has been confused by the laity with other analyses which are absolute in their findings and do not require interpretation.

3. Water-contamination is usually temporary, but the uninformed think analysis of a sample shows all the past history of its source.

Two somewhat common and very serious mistakes are, first, to regard water as always to blame for typhoid and, second, to rely solely on water-analysis to discover the part played by water in typhoid outbreaks. Typhoid infection always comes to its victim more or less directly from another human being. The germs are carried by various agencies of which the most common are water, milk, flies and fingers. But water can not originate the germs of typhoid, neither can milk, nor even the much-blamed but usually innocent "unsanitary conditions," broken sewers, etc. Perhaps the most common way in which typhoid is communicated in Alberta is by contact, i.e., close association with a person sick with typhoid fever or still harboring the germs after an attack. It has been discovered in recent years that of every hundred persons who recover from typhoid some four continue to give off typhoid germs in their excreta for years afterwards. These are termed "typhoid-carriers," and they often cause mysterious outbreaks of typhoid by infecting water, milk or food. Again, the infection may be carried by flies from exposed contents of privies used by such persons. The lesson from this is to regard all human excreta—both urine and faeces—as dangerous. In every community there is almost certain to be one or more typhoid-carriers, hence as early as possible every municipality should establish a public waterworks system and a sewerage system and enforce their use by all householders, thus abolishing the death-dealing privy and private family well.

As regards the mistake of relying too much on water-analysis to discover the cause of typhoid I shall merely point out that in the investigation of typhoid outbreaks the question to be answered is not merely "Is the water to blame?" but "What are the sources and channels of the typhoid infection in this instance?" This question can be answered only by a competent investigation by a trained and experienced man, an epidemiologist, (that is, one who studies epidemics). In the course of such investigation it may be found advisable to have water-analysis but this should neither begin nor end the enquiry. As an epidemic of any infectious disease is in reality a bacterial phenomenon it can be properly and successfully studied only by a bacteriologist, hence an epidemiologist is essentially a bacteriologist.

Water analyses are often asked for in connection with suspected conveyance of disease by drinking the water. In these instances if there is any reason for suspecting the water, the result of analyses should, of course, not be waited for before taking measures to render the water safe. Not to analyze but to sterilize, that is the first requisite in dealing with suspected water. This may now be easily done by means of the so-called "hypochlorite" sterilization which is simple, cheap and effective. The investigation as to the status of the water may then be proceeded with, and the satistion had of knowing that the possibilities of further trouble for the time being from water have been eliminated. People are often advised "to boil the water," a very useful precaution, but not so good as the all-including sterilization by hypochlorite treatment.

To sum up briefly the points I wish to emphasize:—

1. Pure (i.e., safe) water supplies are a first requisite for the public health.

2. In the selection and protection of public water-supplies, comprehensive water-investigations are necessary.

3. Water-analysis is an essential part of water-investigation.

4. To have any real value water-analysis must be carried out with exactness and rigid care. Proper samples are absolutely necessary.

5. The results of every analysis must be "interpreted" before they are understood or are any practical value.

6. The interpretation can be made only when we have comparates and full data regarding the source of the sample.

7. Such comparates and data are obtainable only by systematic work, carefully planned and carried on over a long period.

8. Uniformity and economy in such work can not be secured if it is left to haphazard local events. It can be successfully carried on only by a State organization with the necessary machinery and authority for such investigative work.

This brief discussion of this question would be far from complete if I did not carry these deductions a step further to their logical conclusion.

The broad policy upon which our Provincial University has been launched, constituting it a university and provincial (or state) in the true and proper sense of these terms, makes the investigation of these resources of the Province not merely a privilege but a duty of the University.

Investigation of the water-resources of the Province as a definite undertaking by the University could redound only to the mutual and lasting benefit of both, giving the university material and opportunity with much valuable and necessary information which would continually find application in the administrative work of the Provincial Board of Health. Certainly this is a need which must be adequately met if the health of our people is to be properly safeguarded. We cannot in this utilize results obtained in other Provinces and States. We have to deal and to do with Alberta waters and conditions, and must study these ourselves. Such an undertaking is extensive and requires an appropriately large organization to carry it on successfully.

GOOD ROADS.

(Continued from Page 337.)

every municipality, and, once correctly obtained, would be most valuable for present requirements and as a reference for future extensions in road construction.

In securing proper drainage for all parts of a municipality it very often is found necessary to extend through adjoining municipalities to obtain outlets for drains. Municipalities so situated might facilitate matters a great deal by co-operating and working harmoniously together in adopting the best methods possible for drainage for the roads in each. It often occurs that improvements along this line are retarded by a lack of co-operation on the part of the municipal councils interested. Again, it is only natural to expect that proper drainage for the roads cannot always be secured by constructing drains along the surveyed lines of the boundaries of the different sections, along which lie the allowance set apart for highway purposes. These section lines were surveyed north and south, east and west, regardless of the topography of the country, and the engineering difficulties met with in attempting to follow them with lines of continuous drains to adequate outlets are consequently numerous and very frequently insurmountable.

It is sometimes possible to get good drainage for large sections of the country by following these lines until they are intersected by large natural waterways, but when this becomes impracticable there should be no hesitation in deviating from these courses and establishing others across country until sufficiently large runways are encountered to control the water imposed upon them. Very often there is a great antipathy among municipal councillors to spend money appropriated for road purposes anywhere but on the roads proper. Road money cannot be spent to better advantage than in just such ways as these if they are needed to secure good drainage. Better wait for another year or so to build a road grade than to bury money in the mud by trying to construct one without first providing an escape for the water that may flow down upon it. Sometimes land owners are averse to having these drains constructed across their lands. There are no doubt cases where such a drain would be the cause of a little inconvenience in carrying on the work of the land by having to cross and re-cross it in getting from one field to another, while, on the other hand, a direct benefit would very often ensue in the reclamation of acres of low-lying land along its course, which would incidentally be drained by such a proceeding. But the fact to be borne in mind is this—that good drainage is as essential to the attainment of good roads as the latter are to the achievement of the full development of a country's resources, and no question of sentiment or lack of co-operation between parties interested should be permitted to stand in the way of accomplishing this result when once it is undertaken; and, whether or not it will be found necessary to construct outlet drains through adjoining municipalities or across private property in order to obtain this, the work should be prosecuted, regardless of the small inconvenience that may be caused to a few in an earnest endeavor to better the conditions of a great many. In reality the pursuance of such a course in obtaining satisfactory drainage means only the improvement of the natural runways of the water to the larger creeks and rivers. and will certainly be attended with more security from damage by erosion or by the flooding of adjacent lands.

It might be pertinent here to say that this course will of necessity be adopted before the desired results in the matter of good roads in this province shall be attained. The pressing need of a large percentage of the bad roads in Manitoba to-day is drainage, and drainage of an effective character, and not, as might be supposed by some, covering of gravel or broken stone. While this is a stage in their improvement which should be looked forward to with every expectation of its being attained in the not too distant future, especially in regard to more important and leading highways, yet any erroneous idea of the arrival at this stage being attended with any permanent or far-reaching results should not be entertained if it has been accomplished at the sacrifice or neglect of adequate drainage. When once a proper drainage system has been effected a tremendous step will have been taken towards the creation of good roads.

In all large undertakings that involve the expenditure of big sums of money, the first important step, after plans defining the nature and extent of the work are settled upon, is the furnishing of a capable and reliable head to direct the execution of its several details. In no other enterprise is such a step more necessary than in one where the final cost or the ultimate success is influenced by the direction or administration of labor. In this category is road construction to be found. The cost of gravel in pits or of stone in quarries is a small item compared with the expense in labor attached to loading it into wagons, hauling it with teams to where it is to be used and spreading it on the roads. The building of drains and the erecting of road grades are purely matters of labor. Therefore, the outlay of money required for such, and the lasting effects produced therefrom are almost wholly dependent upon the skilful management of the labor employed.

This renders all the more emphatic the desirability and necessity of municipal councils placing their road work under the control of a competent superintendent in order that the most beneficial and economical results may be obtained. In most of the counties of the Province of Ontario, and also in many of the States of the Union to the south, this important step has been taken within the last few years, and no doubt a great deal of the excellent progress now being made in developing systems of up-to-date highways in these counties and States may be attributed to its adoption, while the unsatisfactory condition of the highways in this province, after the large expenditure of money upon them, may be assigned in no small degree to the neglect of having such a plan. Experience gained in actual discharge of duties is most valuable, although its acquisition may sometimes be very costly, and it is certainly an unwise plan for municipalities to be continuously attempting to educate men in the art of road-building as they are now doing by delegating it to their councillors as part of their official duties, when the personality of a council board is changing from time to time. It appears that the better plan would be to select some competent person to fill this position, and the more experience he has already gained the more acceptable will he be, and the more the municipality will profit by the additional experience he will be acquiring as time goes on and results are being accomplished.

The qualifications of a person suitable for such a position, if he is not an engineer, should be ability to follow the plans prescribed by one, and to organize and manage well a system for carrying on the works in hand. He should be expected to act in the capacity of manager for the council, and be directly responsible to them, while he should have full control of all men, machinery and teams engaged under him. He would also act as inspector for the municipality on any contract work being performed for it on roads or bridges, and in general be always on the alert to detect and correct any discrepancies that may happen to occur in the prosecution of these works.

The maintenance of a road is the work of keeping it as nearly as possible in its original shape and condition, while the repairing is the work of bringing it up to its original condition, rendered necessary by the neglect to maintain it. This maintenance of the public highways is just as important as the actual construction of the roads themselves, for no matter how well they are built they will deteriorate if they do not receive a sufficient amount of care and attention.

For years past road-makers have been endeavoring to put down something in the form of a road that would stay "put" under the ravaging influences of weather and traffic. They realize that the necessity of constantly and frequently doing over again something that had been done before was not only irksome, but it was far from economical. Just to what extent they have been successful may be determined in individual cases by the ensuing reduction in the burdensome task of maintenance. Economy in maintenance will be a large factor in determining the style of road used in the country. When the upkeep of an earth road in a serviceable state becomes too expensive, by increased traffic conditions thereon, it will have to give way to a more substantial and durable type. But the usefulness of this first-mentioned class may be extensively prolonged by judicious care and attention being given it when once it is properly constructed. Its susceptibility to the destroying action of water when exposed to heavy traffic makes constant inspection imperative to retain a satisfactory condition. It is a very poor policy to expend large sums of money in building roads and then to allow them to go to wreck and ruin for the want of a little work to keep them together and assist them to withstand the wear and tear of weather and traffic. When the farmers of this country recognize to a sufficient degree the real value of good roads in general, and the importance of maintenance as a means to their attainment, to induce them to co-operte with and assist the municipal authorities in establishing a system whereby the roads will receive ample care and attention after they have once been properly constructed, then, and probably then only, will the waste of energy and money that is now going on in parts of this province be arrested, and the efforts put forth towards securing the desired results in the improvement of road conditions become appreciably noticeable.

The split-log drag is an implement of great value in maintaining the surface of the roads, especially the earth roads. Its cheapness, simplicity of construction, and ease of operation make it suitable to existing conditions in this country at the present time. As pamphlets have already been sent out from the Department of Public Works to the councils of the different municipalities illustrating its construction and operation, little need be mentioned here about it in respect of those points. In order to obtain the best results at a minimum outlay from the working of this drag, its application must be systematically undertaken and the road surface never permitted to remain in a broken state for any length of time. In the spring season and after continued rain storms these naturally become rutted by the wheels of vehicles, and if left in this condition these ruts from receptacles for the water for the next succeeding storm, and render them more susceptible to the cutting action of even the lightest vehicle, and so on until the radius of the highest wheel becomes the measure of their depth or the road becomes a regular mire. Now, if these ruts were filled in after the frost has left the ground in the spring and after rains, this difficulty would be obviated and the roads kept in a constantly passable condition, without the expense of costly repairs which must certainly follow its neglect.

In order to successfully perform its work the drag should be applied when the soil is wet but not too sticky. Hence a large mileage of roads will obviously require treatment about the same time, and to work every mile to the best advantage a large number of drags must be employed. It seems, then, that the most practicable solution of the difficulty would be for a number of farmers resident along the different highways to undertake this work, and for each to devote an hour or two with a man and team on a day after continuous rains, when it could be most advantageously performed on the portions of the roads most conveniently situated, and to receive a reasonable remuneration for their time and labor. An hour's work on one drag should accomplish the desired result on a mile and a half or two miles of road, if worked at the proper time.

No farmer who has the welfare of the roads at heart, and who realizes that good roads go hand in hand with profitable farming and the pleasures and comforts of a rural home, should hesitate to give a few hours each season to such work, and until such time as his help and co-operation can be obtained the task of maintenance of the country roads will be a difficult one for municipal councils and road superintendents of the province.

There is no doubt that it is only by both the independent and joint efforts of the municipal corporations, applied with business principles and acumen in constructing their highways, and by both the individual and collective assistance of the resident population in maintaining them, that the development of this country's resources will go on uninterrupted in so far as this progress is influenced by the creation of good roads.

THE LONDON, ONT., WATERWORKS SYSTEM.

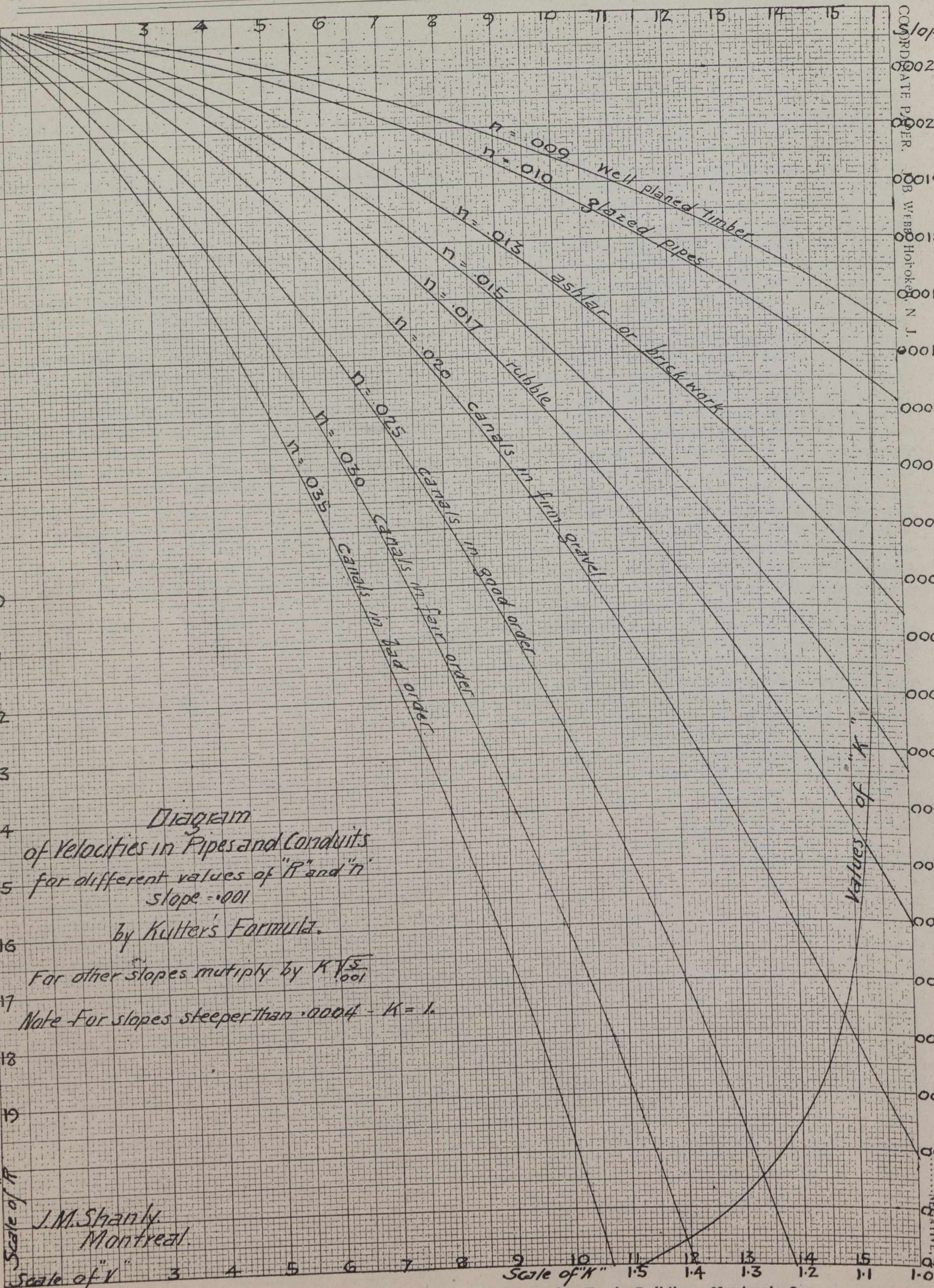
The 32nd annual report of the Water Commissioners for London, Ont., contains some interesting information. Frank D. Ark is general manager for the Commission. The population of London is 50,000, and the operation of the system is vested in a Board of Water Commissioners. The water is supplied from springs and is pumped to a reservoir which is some 200 feet above the city. The area of the reservoir is 78,400 sq. ft., and has a capacity of 5,000,000,000 imperial gallons.

The number of gallons pumped per pound coal at the Springbank station was 322. This pumpage was against an average static and dynamic head of 240 ft., or a duty of 74,469,469 ft. lbs. The cost of pumping per million gallons $7.74, or per million gallons raised one foot, 3 1/5c. The coal used was Pittsburg Youghiogheny Steam Lump Coal.

The ordinary service is half-inch and the average length of service is 60 ft. with an average cost of service for the year of $14.48.

Of the complete service 7.42 is metered.

The average consumption of water per capita per day used is about 97 imperial gallons.



Prepared by J. M. Shanly, Consulting Engineer, Board of Trade Building, Montreal, Que.

The Canadian Engineer

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Everything affecting the editorial department should be directed to the Editor.

The Canadian Engineer absorbed The Canadian Cement and Concrete Review in 1910.

NOTICE TO ADVERTISERS.

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CONTENTS OF THIS ISSUE.

THE EXPLOSIVE INDUSTRY IN CANADA.

During the last year or eighteen months several large explosions, which have resulted in the death of many people, impress the Dominion Government with the necessity of a thorough investigation into the methods adopted in Canada in connection with the manufacturing and storing of high explosives.

The Dominion Government secured the loan of a British inspector of explosives in the person of Capt. Arthur Desborough, and his report, recently presented to the Dominion Government, is a sweeping criticism of the methods of manufacture and storage and transportation of high explosives.

Capt. Desborough makes ten important recommendations, including the inspection of factories, control of importation, the inspection and sampling and establishing of testing stations, and the appointment of a staff, consisting of a chief inspector, assistant inspectors and a chemist.

Regarding the authorization of explosives, it is recommended that the manufacture or importation for sale be prohibited until chemical advisers of the department have had an opportunity to report. In this regard the report says:—

> It will undoubtedly improve the quality of the explosives manufactured in the Dominion, and should thereby have a tendency to diminish accidents in use; it must not be expected, however, that fool-proof explosives will ever be produced. It will also prevent the user being placed at the mercy of the enthusiastic inventor who persuades him to try a new explosive which has probably been invented many years previously and then discarded on account of its danger or unsuitability.
>
> Factories should be licensed on the principle of limiting the amount of explosive allowed to be present in a building, types of construction of buildings adopted, limitations of number of work persons allowed to be present, and the nature of operations allowed to be carried on in the various buildings.

The manufacture of nitro-glycerine as carried on in this country is considered unnecessarily dangerous. The large quantities stored in one building and the carrying on of cartridge packing so close to the stores is considered by the inspector most unwise.

Insufficient details of manufacture, such as the allowing of dust to gather on the floors, the presence of unnecessary movable articles, grit getting into the explosives, and improper electric light wiring are all weaknesses which the inspector refers to.

It is not expected that fool-proof explosives will ever be produced, but the report clearly shows that considerable can be done in the way of improving present conditions so as to increase the safety, both of the man working in the factory and the user of the product.

CHANGE IN THE VALUE OF THE INTERNATIONAL VOLT.

On January 1st, 1911, the Bureau of Standards, United States, adopted a new value for the Electromotive force of the Weston normal cell, namely:—

$$E = 1.01830 \text{ international volts at } 20° \text{ C.}$$

This is equivalent to an increase of about 0.08 of 1 per cent. in the value of the volt. This change will be of some considerable interest to those having to do with the electric current, as this change will be adopted not only in the United States, but Canada, Great Britain, France, Germany, Italy, Austria, Switzerland, Sweden and Mexico, as these countries each were represented at the International Electrical Congress which met first in Chicago in 1893, and has since had meetings in Europe.

The definitions laid down by the Chicago Congress were used in forming the Government Regulations and Statutes in these matters in the various countries represented at the Congress, and the London Conference gave value to the electrical units.

The following values for the Weston normal cell have been in use up to the present time in the various countries:—

In the United States	1.0189	international volts at	25°
equivalent to	1.019126	" "	20°
In Germany	1.0186	" "	20°
In Great Britain....	1.0184	" "	20°

As a consequence of the different values used for the Weston cell, both the volt and the ampere as used in the various countries have been slightly different, for precise measurements of electric current have nearly always been by means of standard resistances and standard cells. The watt has differed twice as much as the volt or ampere. Under the new arrangement these units will be precisely the same in the different countries.

It is fortunate that international values for the electrical units are likely to become the standards in various countries, otherwise the loss and inconvenience to electrical workers would be great.

STREAM POLLUTION IN CANADA.

The action of the Canadian and United States Governments in directing the International Waterways Commission to take up the question of stream pollution is sure to improve the sanitary conditions surrounding many of our lake and river towns, and will do much to insure abundance of good drinking water for the cities bordering the Great Lakes.

The action of the International Waterways Commission will necessitate most of the municipalities on the Great Lakes and navigable rivers to take up the question of sewage disposal, purification and sterilization. It is true the present order has to do only with international waterways, but that question will immediately broaden to the pollution of streams dividing these international waterways, so that Canadian municipalites must consider the discontinuation of the short-sighted practice which has been adopted too frequently of simply dumping, without purification, the sewage into the lakes.

CEMENT CONVENTION.

The Canadian Concrete and Cement Association are holding their third annual convention and exhibition in Toronto from March the 6th to 12th. Elsewhere in this issue will be found a list of the members and exhibitors, but the list is not by any means complete, nor is the programme, of which an outline is given, as yet complete.

The great interest being taken in cement and the extended uses of concrete as a material of construction widens the interest in the meetings of this organization and in its exhibition.

Mr. Wm. Snaith, of 57 Adelaide Street East, Toronto, is the manager of the Convention and Exhibition, and will be pleased to furnish fuller information to those wishing to attend or to exhibit.

THE ONTARIO GOOD ROADS ASSOCIATION.

The ninth annual meeting of the Ontario Good Roads Association will be held in the Municipal Building, Adelaide Street East, Toronto, on March 1st, 2nd and 3rd.

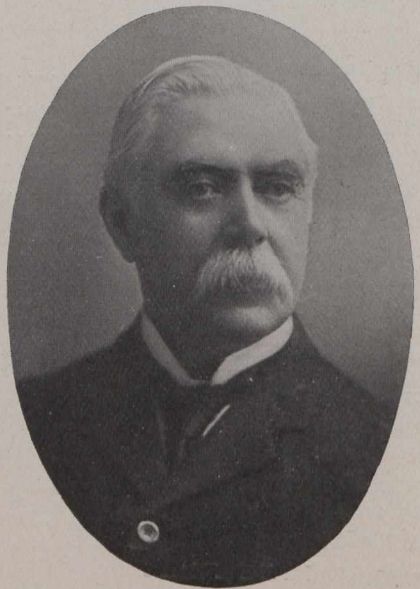
The value of good roads to cities, towns and villages, as well as to rural municipalities, insures a large interest in the proceedings of this Association, and because of the good work this volunteer organization is undertaking, is hoped the support will be generous.

EDITORIAL NOTE.

The definite announcement as to the date and meeting of the International Municipal Congress Exhibition, which is to be held in Chicago, has been made. The Exhibition will open in the Coliseum on September 18th, and will continue until the last of the month. It is believed that through this exposition, making possible comparisons, one community with another, of their systems of government, their notable accomplishments of the past and their plans for the future, a spirit of rivalry and civic pride will be developed that will do much for the advancement of municipal betterment. C. M. Treat, 1107 Great Northern Building, Chicago, is secretary of the organizations which are uniting in this undertaking, which for some two years the Chicago Association of Commerce has been planning.

ENGINEERS' CLUB OF TORONTO.

The first annual meeting of the Engineers' Club of Toronto was held at the Rossin House on May 5th, 1899. In spite of doubts expressed by several engineers as to the continued success of such a club, only three annual meetings



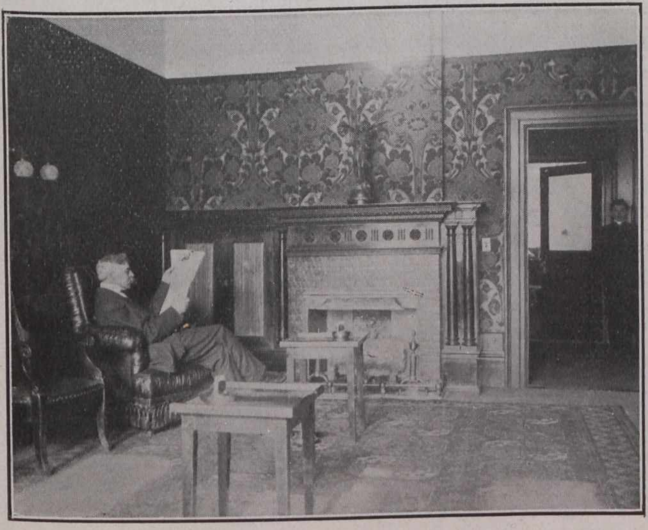
Capt. Killaly Gamble, President Engineers' Club.

were held at the Rossin House, viz., on the 5th May, 1899; the 13th February, 1900, and on January 8th, 1901.

On November 16th, 1901, the club entered upon a lease with Mr. Horn for rooms located at 96 King Street West. Up to the beginning of the present year these rooms have served the purposes of the club. They comprise an entrance hall, cloak-room, assembly hall, seating over one hundred, two reading-rooms and lavatory, all electric lighted and steam-heated. These rooms, partly refurnished, continue to form part of the new extensive club premises.

Assembly Room, Looking East, Old Portion.

For some considerable time back there has existed a decided feeling amongst the club members that the sphere of the club's interests should be extended socially. The only difficulty was accommodation. This difficulty has been met by leasing the premises of the old Clarendon Hotel, which adjoins the old club premises.



Smoking Room, New Portion.

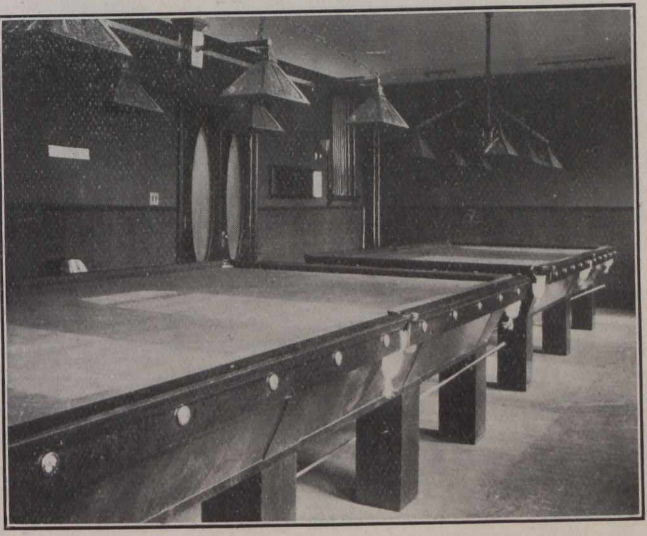
It may be truly said that the Engineers' Club of Toronto has suddenly evolved from what was in reality a merely technical society into a fully established social club, which at the same time retains all its old technical and valuable features.

The additional accommodation allows of a spacious dining-room, with most efficient kitchen arrangements; permanent office and administration quarters, writing-rooms and several card-rooms, and well-lighted billiard-room with two full-sized English tables. A permanent technical library has also been added in connection with the assembly-room, while the old reading-room has been greatly improved in its facilities in current literature.

The expenses of maintaining a fully equipped and organized club such as the new Toronto Engineers' Club must necessarily be great. It is as yet too early to talk of its measure of success. On the other hand, results up to the present fully justify the desire of the members for

Part of the Reading Room, Old Portion.

extension. The new membership already almost touches the 400 figure, while 800 is the number limit. The membership will consist of 500 regular members, 200 non-resident members, 25 life members and 75 associates. An entrance fee of $50 is charged against those joining other than the chartered members of the club before reorganization. The



Billiard Room, New Portion.

annual fee for full membership is $30, less $5 in fees, being paid before the 1st of February, while non-resident members pay $25, less $10. Associate members are those who wish only to participate in the technical interests of the club, with an annual fee of $5.

Membership is not confined to engineers only, but also includes all those who in any way are interested, technically or commercially, with engineering work.

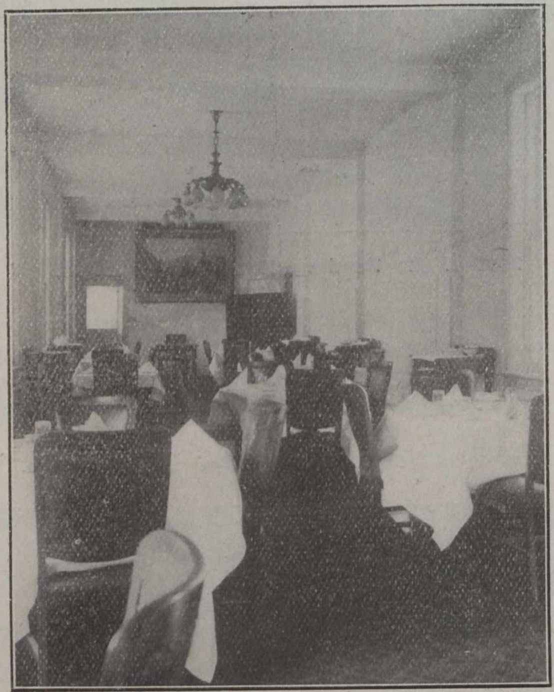
The permanent secretary-treasurer is Mr. R. B. Wolsey, who has successfully acted as secretary to the club in the past.

HEATING SYSTEM OF THE UNION LEAGUE ADDITION, PHILADELPHIA.

The new addition to the well-known club house of the Union League, Philadelphia, consists of basement and sub-basement below the street level, and six stories and a loft above. The latter is below the stop story on which are located sleeping rooms.

Two systems of indirect heating are in use as well as a Webster vacuum system connected to direct radiators. Three distinct exhaust systems extract the vitiated air from the building and insure steady air circulation.

The main air supply is obtained from a vertical duct leading down to the sub-basement from a sidewalk grating. A right angle turn brings the fresh air to a tempering coil containing 1,650 sq. ft. of heating surface. Beyond this coil is located a Webster air washer of 4,500 cubic feet per minute capacity, in which the in-coming air is cleansed of dirt and gases by the combination rain and spray device peculiar to this washer. Circulation of the spray water is obtained by means of a Worthington 2½-in. centrifugal pump direct connected to a 7½-H.P. General Electric motor. An eliminator consisting of a double row of inclined horizontal V-shaped baffies extracts the entrained moisture and then the air passes through the reheater to twin fans. The latter are No. 9 Sirocco motor-driven units which discharge the air upward through a short vertical shaft to three main horizontal ducts under the ground-floor ceiling. The largest of these, which is 15-ft. by 15-in. in cross section runs under the ground-floor corridor with branches leading up through the floor on either side to supply warm air to this story. At the end of this duct two branches lead to the sides of the building where branches are taken off to flat vertical ducts leading to the first and second floors. Indirect heating units are installed in these branches under the ground-floor as secondary heaters for the upper floors. Two similar ducts lead from the vertical warm air shaft from the fans and supply the remaining area of the first and second floors in the same manner.



One of the Wings of Dining Room, Looking South, New Portion, Engineers' Club.

(See Article on Page 347.)

A No. 7 Sirocco fan located in the sub-basement alongside of the air washer supplies untempered air for ventilating the engine and boiler rooms. Two main horizontal ducts on the sub-basement ceiling distribute this cool air to various parts of the power plant.

The ground floor, where are located the bowling alleys, barber shop, lockers, etc., is vented through a main duct running along the corridor ceiling and discharging through a vertical air shaft. A 60-in. disc fan on the roof insures positive movement of this air. Ventilation for the first floor is accomplished by means of vertical ducts discharging into parallel horizontal ducts on the ceiling of the second floor. These also serve the second floor, and convey the air to a second vertical shaft surmounted by a 72-in. disc fan on the roof.

The air supply for the third and fourth floors is obtained by means of a blower in the loft which discharges through an indirect heater to ducts supplying both floors. A cloth filter covers the inlet to this ventilating system. The exhaust system for the third and fourth floors consists of a series of vertical ducts leading to two main horizontal exhaust ducts in the loft. The latter discharges through a 36-in. disc fan into the space above the main stair skylight.

By this system of indirect ventilation, fresh clean air at the proper temperature is obtained throughout all parts of the building and foul air is extracted as soon as formed. The system of individual inlet and discharge ventilating ducts for each locker is particularly noteworthy, insuring as it does, rapid drying of clothes and entire absence of the odors often noticed in the vicinity of lockers. The temperature regulation is automatic throughout, both direct and indirect heating systems being equipped with thermostatic control.

All direct radiators are operated on the Webster vacuum system, designed by and installed under the direction of Warren Webster & Co., of Camden, N.J., who also manufactured the air washer installed in this building. The main 12-in. exhaust line from the engines, supplemented by a 10-in. line from the pumps, runs to the feed water heater where an 8-in. branch pipe is taken off to the heating system. This connects with an 8-in. main supply riser running to the loft. A branch header connects with this riser just below the ground-floor level to supply the direct units in the basement, the ground-floor and the first and second floor, the three latter stories being served by up-feed risers and the basement by down-feed risers. All direct radiators are equipped on the return end with Webster water seal motors which discharge air and water to the returns, but prevent the passage of any uncondensed steam. Down-feed supply lines are dripped to the returns through water seal motors.

A ring header in the loft serves the direct radiators on the third, fourth and fifth floors, the latter by up-feed risers, and the third and fourth floors by means of down-feed supply pipes. The returns from the fifth floor are piped to a ring header in the loft and thence by way of a vertical riser to the basement return main, while the lower floor returns flow through separate risers to the main return header in the sub-basement. This main terminates at the two Warren 8-in. x 12-in. x 12-in. vacuum pumps, to either or both of which it may be connected. The discharge from these pumps passes to an air separating tank on the sub-basement ceiling and thence to the feed water heater. Webster suction strainers are provided on the suctions of the vacuum pumps. Separate supply and return lines serve the indirect heaters, the returns connecting with the main return header.

Steam for all purposes is supplied by three 300 H.P. Edgemoor water tube boilers through two main steam headers. One of these supplies the generator engines, with a branch to the refrigerating plant, and the other furnishes steam for all the other pumps. By means of cross connections it is possible to supply live steam through reducing valves if necessary, to the heating system.

The operation of the heating and ventilating system of this building has justified the elaborate layout. Flexibility is one of its most noticeable points and the detailed thoroughness of the architect's plan as carried out by the engineers, Messrs. Francis Brothers & Jellett, Inc., has resulted in a most satisfactory system. With the Webster vacuum system, positive circulation of steam is insured, and such annoyances as water hammer, leaky air valves, and the like, are entirely obviated. The Webster air washer has thoroughly demonstrated its ability to rid the ventilating air of dust and dirt, and to provide a healthful air supply for breathing. Horace Trumbauer was the architect of the building. The contractors for the work were Charles Monday & Company.

THE WORK OF A FOREST ENGINEER.*

By A. H. D. Ross, M.A., M.E.

During the present century our population is sure to reach the eighty million mark. Meantime, enormous quantities of wood will be required for the construction of the railways needed to open up the country in advance of settlement and to build homes for the people. The myth that we possess inexhaustible supplies of timber is now pretty well exploded. The fact of the matter is that we have far less timber in Canada than many of us are willing to admit, and much of it is of an inferior quality. The growing scarcity of timber has led to a steady rise in prices during the last thirteen years, and the end is not yet. In Eastern Canada the wholesale prices of pine and spruce lumber have advanced between 50 and 60 per cent. This is partly due to the growing scarcity of timber and the increased cost of logging, partly to the enormous quantities of timber exported to other countries, but mainly to a knowledge of the limited quantity still available.

The growing scarcity of timber in other countries than our own and the constantly improving transportation between the different countries of the whole civilized world warrant us in predicting the establishment of world prices for timber.

Thus, if our people are to avert the evils which have overtaken other lands where the forest resources have been allowed to diminish or approach the vanishing point, they must adopt a general and far-reaching policy for the management of their timber lands. Such a policy must be based upon adequate, scientific and practical grasp of the whole situation. Hence, there has arisen the necessity for a class of men with both a training of a highly technical nature and a clear conception of things which at first sight do not seem to be related, even in the remotest degree. These men must clearly understand the relationships that exist between the different parts of their work. Otherwise, they will make many serious blunders and bring their profession into disrepute.

A forester is not a mere botanist let loose to air his theories at the expense of others; neither is he a mere "lumber jack," fire ranger, sportsman, entomologist, pathologist, dendrologist, silviculturalist, or any other kind of an ist. He should be all of these rolled into one and must clearly understand all these phases of the general problem of preserving his property and increasing its productive capacity. The profession of forestry touches life at many points, and cannot safely be entrusted to half-educated men. It has constantly to deal with questions of tremendous magnitude and importance, and its devotees are engaged in a profession of which they may well be proud.

The professional forester does not aim to oppose Nature, but to assist her—to make use of the naturally favorable conditions existing in any given locality and to hold in check the unfavorable ones. He exercises, and modifies their growth so as to produce the most valuable timber in the shortest space of time. All this must be done without diminishing the value of the soil for the prdouction of future crops.

Just as the agriculturist is engaged in the production of food crops, so the forester is engaged in the production of wood crops. Each carries on his business for the practical purpose of producing a revenue. Each must protect his crop from insect ravages, fungous diseases, fire, trespass, etc. Each of them should guard against the impoverishment of the soil, and constantly aim to increase its value. In each case the land is the principal capital, and any part of it either wholly non-productive or turned to a less profitable use than it might be represents so much wasted capital.

Twenty years ago, the science of forestry was regarded as an abstract and debatable theory, and all knowledge of it was confined to a few experts and enthusiasts whose views were regarded as of doubtful value. To-day the most intelligent and public-spirited members of the community regard the treatment of our forest resources according to well established forestry principles as a vital and urgent economic problem. From what has already been said, it is surely evident that the professional forester should be thoroughly trained in all the branches of his work if he is to be of the highest service to the State.

The recognition of this fact has led to the establishment of a number of forestry schools at leading educational centres on this continent. In Canada alone, we now have three such schools, and the chances are good for two more within the next five years. About 3½ years ago the Faculty of Forestry in the University of Toronto, was established with two instructors in forestry and eight students. The number of students is now 47, and the teaching staff in forestry subjects has been increased to four. In the University of New Brunswick, a Department of Forestry was established 2½ years ago with one instructor and ten students.

At Laval University, Quebec, a Department of Forestry has just been established with two instructors and 15 students.

The report of the British Columbia Royal Commission of Inquiry of Timber and Forestry, just issued, foreshadows the establishment of a thoroughly equipped Faculty of Forestry in the Provincial University to be opened shortly.

In "Sunny Alberta" there is an agitation to secure provincial control of all the lands within her borders. If this agitation leads to ultimate success, the province will be immediately faced with the tremendous problem of administering the very large forest reserve recently created on the eastern slope of the Rockies. This will doubtless mean the establishment of another forest school in connection with the Universiy of Alberta.

The creation of the Conservative Commission is a decided step forward in the matter of preventing the waste of our natural resources. Its recommendations will have great weight, and I, for one, feel confident that there is a future for the practice of our profession in Canada.

*From an address delivered before the Engineers' Club, Toronto.

The preliminary training for this profession consists of a four years undergraduate course, supplemented with considerable practical experience in the field. A brief outline of the course at Toronto University may be of interest. The first two years' work are mainly along the line of an Arts course with Science options—the last two years being almost entirely devoted to technical forestry subjects. There is also a six year combination course, whereby a man gets both his Arts and his Forestry degree. Already there are four students in this course, and it is expected that the proportion of men taking it will increase as time goes on.

In what may be described as the technical part of the regular four year undergraduate and the six year combination courses, our students get a thorough drill in Elementary Panerogamic and Cryptogamic Botany, Vegetable Physiology, Physics, Chemistry, Mineralogy, Geology and Soil Physics. More specialized courses are given in Forest Botany, Biological Dendrology, Economic Forest Entomology, and the Fungous Diseases of Trees. The Synoptical Course takes a general survey of the whole field of Forestry Science; after which Forest Geography and the History of Forestry are dealt with for the express purpose of letting the men know what is going on in different parts of the forestry world and enlarging their outlook.

Then comes a very complete course in Silviculture, or the art of growing wood crops to the best advantage, followed by briefer courses in Forest Protection, Forest Surveying, Forest Mensuration, Forest Valuation, Forest Utilization, Timber Physics and Wood Technology, Forest Regulation, Forest Finance, Forest Management and the Preparation of Working Plans.

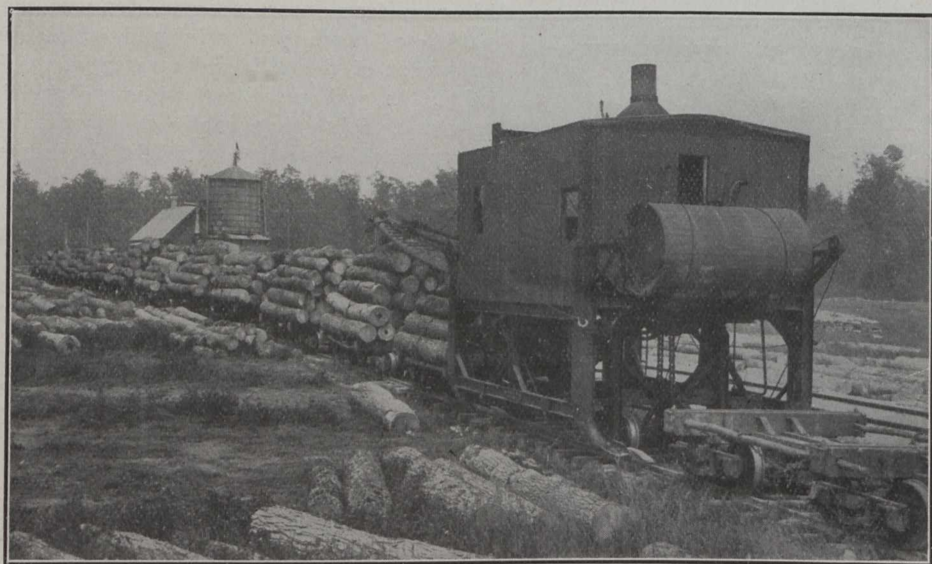
Some of the Special Lecture Courses are on Prairie Planting and Farm Forestry, The Administration of Canadian Timber Limits, Business Methods of the Lumber Trade, Forest Law, Wood Preservation, Fish, Culture and Game Preservation.

From this outline of his academic training, I think it will be clear to almost everyone that the young men who complete their course will have a pretty clear view of the whole field of forestry science. As regards their field training, there is only one way to acquire it, namely, by experience in the woods. No amount of reading or theorizing will give them this experience. It must be learned at first hand, but there can be scarcely any doubt that the men who go into the woods with the broad, general outlook that a thorough academic training gives them, will acquire this kind of knowledge very quickly, and what is of more importance, know how to apply it in cases where men without similar training would utterly fail, and thus prove themselves thoroughly unpractical.

Before being granted the degree of forest engineer, candidates must give at least three years satisfactory service in the field and present a thesis upon some selected topic.

It will, therefore, be in order for use to examine some of the problems that constantly present themselves to the men in the field, and how they grapple with them.

In a young and undeveloped country like ours, a considerable portion of the foresters time is taken up with surveying and mapping. At times a rough reconnaisance survey is all that is needed. At others it is necessary to make a topographic map of the region, showing by what routes the timber can be most easily removed. If the property is to be placed under permanent management, it will be necessary to make a complete forest survey of it. This will include: 1, a more or less accurate plane and topographic survey; 2, an estimate of the amount of timber; 3, a determination of the rate of growth of the timber; 4, a study of the conditions of light, moisture, soil, and other factors influencing the present and future condition of the forest crop; 5, the location of permanent roads, dams, bridges, and other structures needed for the removal of the timber.



Decker Log Loader.

In a rough way, every logger is his own topographer, and has acquired his knowledge by cruising, but unfortunately it is often very inaccurate, is easily forgotten, and cannot be transferred to his successor, who has to acquire his knowledge of the locality all over again. With a good topographic and timber map of the tract, all this information can be kept in the head office, where it is of very great value. Contours can be put in with sufficient accuracy with an aneroid. A glance at the map will show the probable location of roads needed, and thus save time in the field. On the timber map will be shown the location and extent of the fellings and the progress of the work as the tract is brought under management. In short, it represents in miniature the lay of the land and the woods operations being carried on from one year to another.

The Building of Roads.

When it is pointed out that about 70 per cent. of the cost of producing lumber is spent in the woods, it will at once be seen that the first duty of the forester is to provide cheap and efficient means for the removal of his crop. This crop is both bulky and heavy and gives him ample scope for the exercise of his ingenuity in adapting means to ends. Very frequently he cannot secure the services of civil or mechanical engineers and has to work out his own problems on the spot. His ability to do so at once makes him a valuable man to his employers.

The object of any road is to provide a means of transportation from one point to another with the least expenditure of power and money. The main principles governing the location and construction of the road are 1. To secure as easy grades as possible. 2. Have direct routes. 3. Avoid all unnecessary ascents and descents. 4. Place the centre line so the cost of construction will be a minimum. 5. Cross obstacles like ravines, etc., as nearly at right angles as possible. 6. Cross ridges through the lowest pass to be found.

When good maps can be had of the district, the task of locating the road is a comparatively simple one. Usually, however,no map at all is to be had, in which case the forester must make a reconnaisance survey of the whole belt of country between the controlling points, to discover the best route. Mountainous country often appears much worse than it really is for the building of a road, and rolling country often appears better than it afterwards proves to be. The main thing is to have "an eye for country" and not waste time over an unnecessary degree of accuracy on the preliminary work. Usually the general location of a large part of a route is self-evident, or may be determined after a very brief examination. In most cases direction is determined with sufficient accuracy by means of a small magnetic compass, distance by pacing, and differences in elevation by means of an aneroid barometer. A good pair of field glasses will save much unnecessary travel. The difficulty of location and the amount of care demanded, will depend altogether upon the character of the country and the grades required. If in the same valley, or along the bank of a river or lake too large to be bridged, the location is self-evident. If the river is smaller, has sharp bends and variable banks and is easily bridged both banks should be carefully examined to determine the best location and crossing points. The proper choice of bridge sites is an important matter. Where possible, the bridge should be placed at right angles to the current, be as short as possible, have good foundations, avoid bends in the stream and be placed between stable banks so as to secure a permanent concentration of the waters in the same bed. Frequently this means the subordination of the line of the road to the most suitable crossing point. When the controlling points lie in different valleys the location of the line is often a very difficult matter, especially when there are two or more possible routes. Usually, however, the location will include the lowest summits and highest low points, such as river crossings, etc. Hence the elevations of summits and sags, and the distances between them, together with the constructive character of the country must be determined. Low ruling grades are always desirable, whether the road is to be for sleighs, wagons, traction engines or locomotives. Where there is a prospect of the road being sold later on as a link in a railway system, it is well to spend considerable time and money in securing the best possible location. A few hundred dollars spent on preliminary surveys will in such cases be repaid an hundredfold. For such work as this it will, of course, be necessary to use transit, level and stadia rod.

The first steam logging railroad was built in Michigan, in 1876, by Mr. W. S. Gerrish, who was called a hare-brained enthusiast for proposing such a scheme. It proved such a success that a few years later there were 720 miles of such roads in the State. Now, the mileage of logging railroads in North America is computed at over 25,000 miles. Their general use has led to the designing of locomotives and cars most suitable for that class of work. To secure cheap construction, cuts and fills are avoided as much as possible and the engines must be able to climb heavy grades and round sharp curves. This has led to the construction of shay-geared and other types.

Right here I wish to call attention to the splendid

A White Pine Forest Grown From Natural Seeding. This Land Had Been Cut Over and Then a Fire Had Disposed of the Debris. From the Remaining Trees the Present Growth has Sprung.

chance there is for some forester or mechanial engineer to invent an efficient type of spark arrester which will not interfere with the draught. Hall's patent seems to be the best attempt so far, but has not been taken up by any of the big railway systems. The general adoption of an efficient spark arrester would annually save millions of dollars worth of the nation's wealth.

In regions where the commercial timbers are good floaters, horse lumbering and the driving of streams in flood time will be largely employed. Here, again, the forester will have ample scope for his engineering skill in the laying out of iced roads, the building of dams, slides, tugs, alligators, etc., for the movement of the timber. I have in mind the case of one of our students whose advice has already saved his employers the tidy sum of $38,000, and of another who recommends the construction of a short canal between two lakes to avoid the vexatious delays due to contrary winds.

In European countries portable tramways and wire ropeways are much employed for the movement of wood crops. The portable railways are built in sections which can be hooked together, and are sometimes employed in connection with permanent roads. The newest type has been invented by a forester.

In the large timber of the Pacific coast and the cypress swamps of the south the long logs are hauled in to the railway or other landing place by Bull Donkey engines. A light line pulls out the heavy cable to be attached to the log, or string of logs, which are then drawn in by winding in of the heavy cable. Often each log is capped by a steel cone so it will come more easily around obstructions and through soft mud. In the case of cypress the logs are generally snaked out to canals along which they are then rafted; the Bull Donkey being mounted on a scow which is anchored or snubbed at convenient points along the canal. Where a Cableway Skidder is used, the Head Spar is the mast of the scow and the Tail Tree off in the swamp a convenient distance.

Rudder Beam, Thompson River, B.C. Notice How the Fins or Rudders Set Beam Diagonally Across Stream.

One of the first graduates of the Cornell School of Forestry is now in the employ of the Lidgerwood people, and is their expert in the installation of logging machinery. Each problem in logging is apt to be different from almost every other, and such a man can be of very great service to the lumbermen and to his employers. In fact, there are scores of chances for foresters with a little engineering skill to "make good."

In the more mountainous districts, the cableway skidder is an exceedingly useful device for the bringing in of logs, pulpwood, tan bark, etc., to the railway or other road at a minimum cost. In many cases it is the only practical method of yarding the timber at all; as for example, where it is in "pot holes," across deep ravines, or up slopes where the construction or cost of roads or slides would be prohibitive. Even in the country where it is easy to construct railways, the cableway skidder is coming largely into use. The principal objection to it, from the forester's standpoint, is the damage done to the young trees by the swaying and dragging of the logs as they are being hauled in; but it is an open question whether the extra growing space due to the non-construction of roads and the saving in cost of building and maintaining them do not balance the injury done to the young crop.

To sum it all up, the character of the machinery best suited for logging on a large scale will depend upon the general topography of the region, the cost of the building logging roads, the stumpage per acre, and the size and character of the timber. For example, in the case of hardwoods, driving would be out of the question and transportation by wagon, sled or rail would be necessary to reach the mill or market.

For the loading of logs on cars, several devices are in use. The Barnhart loader moves on a pivot in all directions and will load from 600 to 800 logs a day, provided they are within 100 feet of the track. As each car is loaded the machine pulls itself along rails laid on the cars, and loads the next one. In the Decker Loader, the empty cars are pulled forward beneath the loader. In other cases a turn of cable round the log on a raised platform rolls it onto the car as the cable is tightened up by means of a drum or "spool."

From what has been said, it will be seen that every forester should be a first-class logger and be constantly on the alert to utilize the engineering skill which has been developed in the logging business. Not only this, but he should be on the lookout for new methods, which usually means the adaptation of old ones to new problems.

Besides removing the timber in as cheap a manner as possible, the forester must also consider the future condition of the property. The ordinary logger is a mere exploiter who has no concern whatever for the future, and is generally frank enough to tell you so. The forester, on the other hand, is very much concerned with the problem of leaving the tract in the best possible condition for the growth of the timber left standing and for its removal when mature. This generally means the laying out of a permanent system of roads, the disposal of the debris incident to lumbering and the suppression of undesirable trees. In other words, he must practise silviculture, if he is to increase the amount and quality of the timber grown. Herein lies the most important part of his work—work calling for a full knowledge of his subject and the exercise of rare judgment and skill.

Another phase of the forest engineer's work is to be met with in the management of protection forests, which do so much to equalize the stream flow. With the transformation of water power into electric energy all over this continent it will at once be recognized that the maintenance of as even a flow as possible is a matter of very great importance.

In Alberta there is also a field for the forester with some knowledge of irrigation engineering problems. One of our recent graduates, now in the service of the Dominion Forestry Branch, is likely to have quite as much to do with irrigation problems in Alberta as with forestry problems. In my opinion, every forester should know how to gauge a stream quite as well as the ordinary civil engineer. This knowledge would enable him to bring in accurate information long before it would be obtained in the ordinary course of events.

Another field for the exercise of skill and ingenuity is to be found in the felling of timber. So far it is done by means of the saw and axe. Steam and electric devices have not been successful. For the cutting up of long logs in the water steam saws are in use in some localities, and in a few instances, compressed air is used for a similar purpose.

Still another line of work followed up by foresters is that of testing the strength of woods used in various structures. The United States Forest Service has quite a staff of men in different parts of the country making all sorts of tests of the strengths of wood under varying conditions. Another line of work is that of preservative treatment, in which several foresters are making investigations.

Still another line of work calling for engineering skill is that of fixing sand dunes. This usually consists in bringing the moving sand to a standstill by means of brush or fences, planting grasses and other deep-rooting plants to bind the surface and establishing tree growth.

On denuded slopes the movement of the soil and water must be arrested before tree growth can be established. One of the best examples of this is to be met with in the south of France, where shortly after the French Revolution, the destruction of the forest on the mountain slopes resulted in the rendering of eight millions of acres of fertile land unfit for agriculture. To stop the erosion and prevent further damage, it has been necessary to build fascines, revetments and retaining walls to arrest the flow of the water and break it into gentle falls. The silting up of the pockets behind these obstructions formed a series of terraces which were sodded or sown with grass, whilst steeper places were planted with willows or other quick-growing trees to retain the soil in place and prevent washing. Already the French Government has spent forty million dollars on this work, and it is estimated that at least one hundred million more will have to be spent before the restoration is complete.

These then are a few of the phases of the work of a forester, and I think you will agree with me in stoutly maintaining that he may well be proud of his profession, and that in the practice of it he will find abundant opportunities for the exercise of all the engineering skill he is possessed of.

THE DEPRECIATION PROBLEM.

By William B. Jackson.

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In considering "The Depreciation Problem" it is essential to clearly understand what the word depreciation actually represents. There is no universally accepted definition of the term, so far as the writer knows, though the importance of depreciation as a factor in the operating costs of electric railroads has been recognized by most writers on the subject of railroad finance and by the commissions having to do with railroad questions. In its most important features, in consequence, there has come to be a generally accepted consensus of opinion as to what depreciation means.

Every part of a properly constructed and well-equipped electric railway can be maintained in good operative condition by current repairs for a period of years; but the time comes with every building and unit of equipment when it, like a suit of clothes, can no longer be kept serviceable by repairs or current maintenance, and when it must consequently be replaced substantially in its entirety. It will thus be seen that two elements enter into the maintenance cost of the unit. One, the current maintenance or repair expense required to maintain it in condition suitable for service, and the other the cost of replacing or renewing it at the end of its useful life. The latter entails the necessity of accumulating, during the life of the unit, sufficient funds to replace it when it must go out of service. Expenditures for current maintenance are naturally distributed more or less uniformly throughout the life of the part, in accordance with the needs for repairs, while expenditure made necessary by depreciation must all be met at the end of the useful life of the unit, and is, therefore, often designated as deferred maintenance. Depreciation results from this quality, found in most parts of electric railway plants, which limits their useful lives and makes their ultimate replacement, as a whole, necessary, notwithstanding that current repairs may have been well attended to.

The length of useful life of a unit is determined by one, or both, of two factors. First, the inherent quality of most physical property to deteriorate, on account of the effects of use and of the elements, to a point where it cannot be longer economically maintained in satisfactory operative condition by ordinary repairs—that is, a unit ultimately reaches a point of "decrepitude" when it is either impossible to keep it in satisfactory operative condition by current repairs, or the cost for such repairs becomes so great that it is more economical to replace the old unit by a new one. Second, the effects of changes in the art whereby the character of the service required is so changed, or the efficiency of apparatus for providing corresponding service is so improved, that plant still physically capable of doing the work for which it was designed is no longer able to economically provide the service required, and it is, therefore, obsolete. This second factor is well designated "obsolescence."

A third division called "inadequacy" is sometimes considered in estimating depreciation. This is intended to cover the effect upon the useful life of apparatus or plant of expansion in business whereby otherwise serviceable apparatus is outgrown and must be replaced by larger apparatus. The writer does no consider such a division necessary, for any effect caused by inadequacy which can be estimated may properly be considered under "'obsolescence."

These principles apply simply and perfectly in practice. Let us take, for example, a new electric railway and consider for a moment the rails and their fastenings. Current maintenance will keep these in good operative condition for, say, an average of seventeen years on the straight track, and for an average of five years on the curves. This will be accomplished by the usual track gangs, which will keep the track in alignment, raise low joints when they occur, replace a defective rail as occasion requires, etc. But after a period of years the track gang can no longer keep the rails so that they are safe or suitable for service, and then large sections of track must be replaced as units, for which relatively large expenditures must be made. Such expenditures cannot be provided for in the same manner as expenditures for current repairs. The latter are distributed with reasonable uniformity year by year, and may be cared for from current earnings, but the former are of only periodic occurrence, and require relatively large expenditures of accumulated funds.

These renewals cannot appropriately be paid for from funds charged to capital account, for that would have the ultimate effect of piling up unending capital with only one set of rails to show for it, nor can they appropriately be paid for by the company's notes to be liquidated during the life of the new rails (except under emergency conditions or in case the company had accumulated assets for the specific purpose of carrying such notes), for this would keep the company loaded with floating indebtedness which, when paid, would only have to be renewed when another set of rails was required. The company should accumulate funds during the life of the rails for the express purpose of providing for their replacement at the end of their useful life. The only way to be reasonably assured of having such funds when required is to estimate, when the rails go into use, the average years of service to be expected from them and the net cost of their renewal, and then distribute the charge for their replacement over the estimated useful life. And thereby the annual depreciation of the rails is obtained.

By the same process the requirements for depreciation of each kind of plant in a property may be estimated and the average amount per annum that must be appropriated to care for depreciation or replacements for each kind of plant may be determined. With possession of this information, it is merely a matter of taking the aggregate of these amounts to obtain the annual appropriation to the depreciation account required for the entire property. A knowledge of this amount places the management of an electric railway company in position to have the books of their company so organized that the accounts will show, month by month, and year by year, the amount of appropriation required for depreciation and the amounts of the appropriations actually made for the purpose, together with the amount of the fund that should be in the depreciation reserve and the sum actually accumulated. They are then in a position to know, at all times, the depreciation requirements of their company and its accomplishments in providing for deferred maintenance and depreciation reserve. In the case of many electric railroads the average costs for deferred maintenance are as large, and in some cases are larger than for current maintenance, and their importance should be fully taken into account in a system of accounting that is to show the true operating costs of any property.

To estimate the correct amount of annual depreciation that should be expected in an electric railroad, the factors of "decrepitude" and "obsolescence" must each be given due weight. The effect of "decrepitude" is likely to be physically apparent in a piece of apparatus during a larger portion of its useful life than is that of "obsolescence," but the ultimate effect of either is to terminate the useful life of the apparatus. With buildings, power plant apparatus and electrical equipment the factors of "decrepitude" and "obsolescence" are usually both active in determining the rate of depreciation. "Obsolescence" alone determines the rate of depreciation in roadbed since there is no physical deterioration that cannot be made good by current repairs, and road bed is only superseded because of abandonment of old locations, owing to requirements for better alignments, lower grades, etc. Depreciation in steel rails may usually be considered as occasioned by "decrepitude" since their replacement is generally made necessary by wear alone; unless the requirements of heavier rolling stock call for the laying of heavier steel, in which case the additional cost of heavier rails may be chargeable to capital.

There is some division of opinion as to whether railroad ties may be considered as coming within the classes of property for which deferred maintenance appropriations should be made. The propriety of making such appropriations on account of ties will be most readily appreciated if considered from the viewpoint of a new property. During the earlier years of a railroad's existence there is no expense on account of ties, further than the renewal of a defective tie from time to time, but after from five to seven years tie replacements become necessary in large quantities, and excessive expenditures for deferred maintenance occur. Thus, during the earlier years a misleading cost for tie maintenance will be shown unless appropriate consideration has been given deferred maintenance in the depreciation account.

The same considerations apply to almost all parts of an electric railway property. In the case of ballast the dividing line between current maintenance and deferred maintenance is likely to be less marked than with ties, but the propriety of building up a fund to extinguish the cost of ballast on roadbed which may be abandoned owing to improved alignment and gradients following the demands of business, is clearly apparent.

An intelligent estimate of depreciation in a property must depend upon a thorough knowledge of the nature of the service demanded by the different kinds of plant, a wide acquaintance with the general experience respecting like kinds of plant, a broad survey of the probable effect of local conditions upon the useful life of the plant, and a wide knowledge of the past and present progress of the art, in order that an intelligent forecast may be made of the influences of "decrepitude" and "obsolescence" upon the rate of depreciation of the plant and the salvage values to be expected; and the estimates should be periodically revised, as time brings forth new developments to influence past conclusions.

The difficulty of arriving at a satisfactory basis for the calculation of depreciation is unfortunately not properly appreciated by the average layman, and by many students of the street railway problem. They are inclined to believe that the depreciation charge upon a large city system is the same as that upon a suburban or interurban railroad. They even overlook the fact that the constant changes in the art of electric traction necessitate continual revisions of the tentative standards adopted for any given property.

If they keep these matters in mind, however, the true significance of the problem and its importance both to the railways and the public should be understood.[1]

Rates of Depreciation.[2]

Estimated Per Cent. of Value to be Annually Provided for.

Item.	Adopted by Chicago Union Traction Co.	Adopted by Third Avenue Railroad Co. New York.[3]	Adopted for adjusted accounts of Milwaukee Electric Railway and Light Co.
Track and roadway:			
Track, ties, bonding, etc.	7.75	8 to 9	7.5
Special work and installation	7.75	.....	8.0
Rolling stock:			
Bodies and trucks...	5.00	5	5.0
Electrical equipment..	6.66 to 8.50	.....	7.5
Fenders, registers, lights, clocks, etc..	....	.....	10.0
Overhead system:			
Poles	[4]5.00	.....	5.0
Wiring, fittings, etc..	10.00 to 14.00	.....	10.0
Underground System:			
Conduits	....	3	2.0
Feeders, cables, etc..	....	3	4.0

[1]For the purpose of illustrating the nature and importance of the charges which should be made to the depreciation account, the allowances made upon three important systems, as reported in the special census bulletin on electric railways for 1907, are here reproduced.

[2]From table submitted in the case involving the rates of fare in the city of Milwaukee, Electrict Railway Journal, April 10, 1909.

[3]Rates quoted in the franchise-tax case.

[4]Iron poles.

Power-plant equipment:			
Engines	6.66	4	5.0
Boilers	6.66	.....	7.5
Heaters, economisers, pumps, etc.	6.66	.....	7.5
Piping	6.66	.....	5.0
Traveling cranes	6.66	.....	5.0
Bolting, shafting, ropes, etc.	6.66	.....	5.0
Coal and ash conveyors and hoist wagons	6.66	.....	5.0
Dynamos	6.66	.....	5.0
Generating apparatus.	6.66	.....	5.0
Storage battery	6.66	.....	10.0
Switchboard and cables	6.66	.....	5.0
Shop tools and machinery	5.00	.....	7.5
Building and improvements	2.00	2	2.0

With a few exceptions, each percentage in the above table refers to a group of two or more parts or kinds of plant and represents the percentage obtained from the aggregate of the depreciations for each part calculated separately. The percentages, therefore, may not be applicable to any other particular road without modifications. This will be appreciated by referring to the items of track, ties, bonding etc., which are all shown in one group, though they do not individually have the same rate of normal depreciation, and all engines are in one group without regard to their types or quality.

Depreciation requires most thoughtful consideration on account of the insiduous nature of its growth. When a well designed and constructed property is new it will operate for some years without any expenditures on account of depreciation, but after a limited period apparatus becomes worn out or obsolete, and its renewal or replacement becomes necessary. Ties, which for the first few years require only the attention of the regular track gangs, become unfit for further use and must be replaced in large numbers; pole lines must be renewed in their entirety; trestles reach a condition when they must be replaced entirely or substantially so; buildings and power plant apparatus become worn out or obsolete; cars and equipment must be replaced; old grades and alignments become inadequate, and old roadbed must be abandoned for new. In fact, depreciation must be provided against every part of the physical property except land. But the growth of depreciation or deferred maintenance expense does not necessarily become apparent in the operations of the property until the necessity of relatively large expenditures for replacements is at hand, and there is the possibility of such time arriving without those in charge of the plant realizing its approach. When such replacements become necessary they necessitate expenditures in large amounts which cannot be taken care of by the usual appropriations for current maintenance, and their cost may not be cared for by funds on capital account, for the replacements add nothing to the capital value of the plant except in so far as the replacements may be of a more costly character than the original, in which case the difference in cost may appropriately be charged to capital account.

Where, either through want of foresight or lack of earning capacity of the property, those having in charge the well-being of an electric railroad have not seen to it that appropriate assets have been accumulated to care for the depreciation of the plant, it means that one of three conditions will arise when the time finally arrives when the replacements, on account of depreciation, must be made. Money must be borrowed, on the strength of the future earning capacity of the road to cover the cost of the replacements (such borrowings being gradually liquidated from the earnings of the road), while at the same time a keen eye is kept on the care of depreciation for the future; or the property may be forced into the hands of a receiver, or it may be possible to do what is indefensible under the conditions, float additional stock or bonds to take care of expenditure for renewals of plant that is already represented in capital.

Failure to appreciate the inexorable law that apparatus must come to the end of its useful life, has resulted in the financing of economically unsound electrical railroad enterprises, and in the embarrassment of good enterprises through the distribution of the stockholders of funds that should have been held in reserve for deferred maintenance. Difficulties arising from lack of funds with which to provide replacements are often responsible for poor service—sometimes even for unsafe surface—upon roads from which good service should be expected. On the other hand, failure to anticipate all the expenditures that must be expected when the effects of depreciations have become apparent has, in some cases, led to the establishment of rates less than sufficient to provide for all the expenses of the properties and give a fair return on the investment.

The importance of "The Depreciation Problem," as related to electric railway properties, has not been fully recognized in the past. This is probably not surprising considering the peculiar nature of depreciation, the limited degree to which its importance has been understood, the conditions under which many railway projects have been financed in the past, and the great magnitude of many of the railroads of the country.

In the financing of early electric railroads the depreciation expenses were frequently ignored either on account of lack of understanding of the necessity for considering such expenses or because of a desire to make a creditable paper showing of projects which, if fairly presented, would be seen to be without merit; and the policy of ignoring depreciation expenses has sometimes continued after such projects were financed, owing to deficiency in funds to care for such expenses. But probably the most fruitful reason for ignoring depreciation expenses in connection with electric railways has been the influence of the example of the large and well established steam railroads. With these it has been the usual practice not to consider depreciation expenses separately from current maintenance expenses. Such procedure has been supported on the grounds that when a railroad becomes large and well established the depreciation expenses become equalized and may be distributed with much the same uniformity as those for current maintenance. The situation is different for electric railways. These are relatively new and comparatively small, and few of them have arrived at the time when the annual expenditure required for replacements has reached its maximum. In most cases, moreover, when expenditures on account of depreciation must be made, they are irregularly periodic and relatively large, and cannot easily be distributed so as to be met from day to day by the current earnings. Accumulated earnings are required for their payment.

In the past it has been a not uncomon practice to finance renewals and replacements of plant by issues of stock or bonds. This procedure was frequently sanctioned without thought of impropriety. Such a procedure, however, means the ultimate destruction of any reasonable relation between the expenditures for construction charged to capital account and the actual physical property represented by plant in service. If proper attention has been given to current maintenance and deferred maintenance, any electric railroad should be capable of giving substantially as good service after years of operation as if it were a road newly constructed for the same service. The construction cost appropriately chargeable to capital account should not differ materially in the two cases except as it might be influenced by changes in costs of material and labor between earlier and later dates.

Since funds should be in hand to replace the parts of an electric railroad at the ends of their useful lives, it is evident that such funds should be accumulated gradually during the lives of the parts. The ideal plan would be to make this accumulation by uniform yearly increments. Such a procedure is frequently not practicable, owing to the variations, from year to year, in the balance of gross earnings over current operating expenses, and also from the fact that for the earlier years of operation, during the upbuilding of the business, there is likely to be little or no margin of earnings which may be devoted to such purposes, although the project may have a perfectly sound basis.

Electric railroads must expect lean years when it is difficult to meet all obligations, and prosperous years when the short comings of the lean years must be met. The prosperous years should provide surplus for the future if a reasonable operation of the property will permit. The building up of a depreciation reserve is likely to be affected by this condition. From this fact, coupled with the fact that expenditures for renewals are irregular in their occurrence and large in amount, it is clearly seen that this important factor in the necessary expenditures of any electric railroad can only be given suitable consideration if the books of the company show how the annual appropriations made to the depreciation fund agree with the estimated amounts that should have been appropriated, and also how the fund accumulated in the depreciation reserve agrees with the surplus that should be in hand.

It should be recognized that so long as a property is in condition to give as much and as good services as when it was new, its value, as represented by the amount of legitimate earnings to which it is entitled, cannot become reduced owing to depreciation in its plant. But any depreciation that may have occurred should be offset, when practicable, by a reserve carried for that purpose, or, if the property has been unable to make full appropriations to the depreciation account, complete knowledge of the situation should be possessed by the management, and the building up of the reserve in the future should be a most important financial consideration. Since the renewals do not occur at the same time for all parts of a property, an electric railway after beginning operation is never equipped throughout with a new plant. Therefore, there is a difference between the first cost of the depreciable plant and a depreciated value estimated for the same plant on the physical condition after years of use. The depreciation reserve need not equal the full amount of this difference.

One of the simplest ways in which the books of a company may be arranged to show the facts in relation to depreciation appropriations and reserves, is to have accounts showing the amount by which the physical property of the company is depreciating month by month, as determined by estimate made in the manner heretofore explained; showing the actual appropriations made to the depreciation fund, and showing the amounts expended for replacements on account of depreciation. Any income derived from the investment of depreciation reserve may be utilized as accretions to the reserve.

An appropriate combination of such accounts will show at all times the relation between the total amount that the property has depreciated and the amount of reserve held to care for this depreciation, as well as the relation of the actual amounts appropriated to care for deferred maintenance to the amounts expended for this purpose.

Since electric railways, and other public service companies, have in many states come under the regulative control of state commissions and municipal authorities, there has been much discussion as to whether, in the case of properties which have paid generous dividends to the security holders, the depreciation account meanwhile being permitted to languish, the security holders should be expected to build up the depreciation reserve to correct proportions from earnings that might otherwise appropriately go into their own pockets. Some findings of the United States' courts and rulings of state commissions indicate a tendency toward an affirmative answer, but a difficult phase of the matter is the determination of what may be considered undue dividends for an electric railway company, especially during past years, considering the newness of the art of electric railroading and the relatively unstable state of the business during the past and in the present. Such questions as these do not affect the obligation on the part of the electric railroad managements to have their accounts arranged so that they will be kept informed whether they are protecting the interests of their properties in the matter of depreciation appropriations and reserves; and, if they are not, that they may have the information to enable them to intelligently handle the problem of correcting the situation.

Even if a property is not in a position to care for depreciation as outlined in the foregoing, owing to relatively small earnings, this does not justify ignoring the facts relating to depreciation since any readjustments of rates that may be found necessary should be undertaken with full knowledge of all matters affecting the real cost of service. Commissions and others, who have given attention to the question of railroad capitalization and rates, agree that deferred maintenance costs should be not as an operating cost and not as a capital charge. Under these conditions it is essential that electric railway companies should accumulate funds from earnings which will place them in position to care for the renewals required by the effects of depreciation.

It should be borne in mind that "The Depreciation Problem" does not represent the only purpose for which funds must be accumulated during the present to care for liabilities maturing in the future. Every company must expect to meet expenditures occasioned by extraordinary occurrences which cannot well be covered by ordinary insurance, such as the effects of unusual storms and conflagrations, the results of strikes, extraordinary accidents, and the like; and every company occupying public ways is confronted with the certainty that they will be compelled to make costly changes of plant, owing to changes made in state or municipal regulations. It is proper that a company should make annual appropriations to provide funds to meet obligations arising from such causes.

Where franchises are limited there is the necessity for accumulating sufficient reserve funds to protect the security holders from loss of their capital under the most unfavorable conditions that are likely to arise at the termination of the franchise. Where companies abandon valuable plants, as when they give up their own power plants to buy power from outside sources, the net value of such abandoned property should be gradually extinguished from the capital account by accumulation from earnings. Again, plans for financing electric railroad properties frequently call for accumulations of earnings according to a definite contract, and other legitimate needs for reserve or surplus funds arise.

In the foregoing consideration of "The Depreciation Problem," I have followed principles having general application to all electric railways. The question of rates charged by public service companies is far from being settled. An extensive readjustment is now taking place, and it seems inevitable that rates will be periodically revised in the future. It seems manifest, therefore, that a full understanding of all the elements which make up the cost of railroad service is necessary. An important one of these elements, and one which has heretofore failed of adequate attention, is that of depreciation renewals. The renewal expenses required by depreciation should be squarely faced, and not passed on in multiplied ratio to future generations.

TREATED TIE TIMBERS.*

The enormous rate of consumption of timber for railroad ties is giving serious consideration to all railroads at the present day.

The all-important question which it behooves us to consider now, is what method, if any, can be adopted to lengthen the life of timber, until such time as metal or other manufactured ties can be used to the same advantage as ties now are commonly used. Until within a few years ago all the ties used were white oak, chestnut and long leaf pine, which could be purchased at a small cost. At the present time this timber is so scarce that the price is getting beyond reach for railroad ties, as a result the railroads must turn to the inferior timber for their tie supply. It has been proven that this inferior or short-lived timber can be chemically treated so that the life will be prolonged several years, making it last longer than the best white oak, untreated.

Before ties are treated all bark should be removed and thoroughly seasoned ,and natural seasoning is preferable to artificial. There are nearly four hundred patents granted on methods or material for the preservation of timber, all of which, with the exception of a possible few, have proven failures; however, chemical treatment of timber is no longer an experiment, as it has been clearly shown that properly treated timber will not decay, consequently there should be no hesitation in adopting the use of treated timber on all railroads.

By treating timber a great many more ties can be cut from the same number of trees. They were usually cut from the best part of the tree, getting but one tie from every eight or eight feet six inches as far as heart timber could be cut, but by treating it, very often four sawed ties can be had from the first, second and third cuts, using all the sap wood that it is possible to cut.

The road I was connected with in 1890 and 1891 used several thousand treated ties, long leaf pine, loblolly, hemlock and a few red oak. The treatment consisted of creosote and three others, which are not worth mentioning, as they shortened instead of prolonged the life of the tie. They were all treated by the present system, the short leaf or loblolly pine absorbing about forty-five pounds of creosote to the tie, while the long leaf pine and red oak did not absorb quite so much. The life of long leaf pine and red oak treated ties double that of the same class untreated. This year I looked over the tracks where the treated ties were placed and found a great number of the creosoted short leaf pine ties in the track after a period of twenty years. The life of ties in this climate is as follows:

	Untreated. Years.	Treated. Years.
White oak	8 to 10	
Loblolly	4 to 6	12 to 14
Red oak	3 to 5	6 to 10
Long leaf pine	6 to 8	12 to 14
Chestnut	8 to 10	
Hemlock	2 to 4	4 to 6

I have had no experience with treated chestnut or white oak. Judging from my experience all preservatives must contain more or less creosote, as it assists penetration and also prevents the leaking of other chemicals used in the treatment. It is estimated that during the yast year over one hundred million ties were used for renewals in this country alone. It can be readily seen that if all ties can be cared for in such a way as to double the life of them, in a few years but half the amount will be required.

It should be borne in mind that the treatment of timber is a protective measure merely against decay, and not against the mechanical abrasion and abuse the tie receives after being placed in the track, such as the cutting and grind of the rail, respiking and poor drainage. There are many devices for securing this protection, the most simple are tie plates and tie plugs, for millions of ties are ruined by frequent respiking. When a spike is removed for any cause the hole should be plugged and the spike driven in the same place. In the so-called soft wood, dowel pins should be used, which can be put in the tie before treatment at the treating plant for a very small cost.

The chisel point spike should be abandoned and a diamond point used, such as a point of a wire nail, which will not destroy the fibre of the timber. By the use of dowel pins, tie plates and diamond point spikes, rail will be as secure on soft wood ties as it would be on an oak tie with screw spikes, and the liability of spread track would not be as great in winter, and rough track in summer. On gravel or other fine ballast the wave motion of the rail lifts the tie with it and allows the ballast to work under it. When the ties are frozen to the roadbed the wave motion of the rail breaks the head from the screw spikes.

*From paper by J. L. Single, read before the Roadmasters and Maintenance of Way Association, Sept., 1910.

ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

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

12902—February 6—Authorizing Niagara, St. Catharines & Toronto Railway to open its line from Welland to Port Colborne for traffic.

12903—February 7—Approving revised location of C.P.R. Weyburn to Lethbridge Branch from a point in Section 17, Township 8, Range 18, west 2nd Meridian, at mileage 26.2 to a point in Section 22, Township 7, Range 22, west 2nd Meridian, at mileage 52.2, Saskatchewan.

12904—February 7—Approving location of Kootenay & Alberta Railway Co.'s line from Pincher to Beaver Creek Alta., mileage 0.0 to 13.09.

12905—February 6—Authorizing G.T.R. to operate its trains over crossing of Niagara, St. Catharines & Toronto Railway a short distance south of Welland, Ont., authorized by Order 9552, of February 3rd, 1910.

12906—February 7—Directing that Bell Telephone file tariffs of tolls under penalty of $100 per day not later than February 20th, 1911, in accordance with terms of Order No. 12625, of December 14th, 1910.

12907—February 6—Authorizing G.T.R. to cross crossing of Niagara, St. Catharines & Toronto Railway, authorized by Order No. 9552, of February 3rd, 1910, without being brought to a stop, speed limited to 15 miles an hour.

12908—February 6—Authorizing Seymour Power & Electric Co., Ltd., to cross with its wires wires of G.N.W. Tel. Co., in Lot 3 ,Concession 2, Township of Murray, County of Northumberland, Ont.

12909—February 7—Authorizing Water Commissioners of Berlin, Ont., to lay water main under G.T.R. at Strange Street, Berlin.

12910—February 7—Relieving C.P.R. from further protection at crossing at mileage 22.92, Lot No. 4, Parish of St. Jerome, County of Terrebonne, Que.

12911-12-13—February 7—Authorizing C.P.R. to construct spurs to premises of Canadian Western Lumber Co., Ltd., District of Millside, near New Westminster, B.C. An extension to industrial spur for James Smart Co., Brockville, Ont An industrial spur for city of Winnipeg, in Block "B," St. John, Winnipeg.

12914—February 7—Directing that C.N.R. maintain an agent and place and maintain an outside closet at Devlin, Ont., not later than 7th March, 1911, under penalty of $25 per day.

12915—February 7—General Order in matter of specifications for installation of electric bell signals at highway crossings.

12916—January 25—Directing that the G.T.R. and Boston and Maine provide a connection between their trains, Nos. 2 and 70, at Sherbrooke, Que., not later than 15th May, 1911.

12917—January 25—Directing that G.T.R. provide a watchman at east end of Windsor Mills, Station, Que., from 7 a.m. to 7 p.m., wages to be borne as follows:—½ by G.T.R., ⅙ by town of Windsor Mills, and ⅙ each by Canada Paper Co., and Brompton Bridge Co.

12918—January 25—Directing that C.N.Q.R. open and maintain a water course across right-of-way for a drainage scheme to drain Lac a' l' Ours, in discharge of Lac aux Sables, put in head gates, etc., by 1st June, 1911, application of Mayor of Lac aux Sables, Province of Quebec.

12919—February 8—Extending Order No. 12072 dated October 22nd, 1910, C.N.R., until 15th May, 1911.

12920—February 8—Approving location of G. T. P. B. L. Co. new station on its Calgary Branch, at Camrose, Alta.

12921 to 12931 Inc.—January 23 and 24—Approving Standard Tariff of Maximum Sleeping and Parlor Car Tolls to apply on and after February 15th, 1911, on following railways;—C.N.O.R., C.P.R., G.T.P., T. H. & B., Rutland Railroad Co., Wabash Railroad Co., Boston & Maine Railroad Co., Michigan Central Railroad Co., G.T.P., C.N.R., N.Y.C., and H.R.R. Co. (Note:—In case of C.P.R. and G.T.P. said approval shall not in any way prejudice the right parties interested in the application of the Vancouver Board of Trade charging that railway rates generally in the West are discriminatory against Vancouver, said parties to be at liberty to present any evidence they may desire against the charges hereby approved for sleepers and parlor cars west of Calgary & Macleod. All Tariffs of Tolls to be published for two consecutive weekly issues of The Canada Gazette).

12932—February 7—General Order for all railways under jurisdiction of Board to file within 60 days copies of regulations in force for inspection, testing, and washing of locomotive boilers.

12933—February 8—Extending time until June 1st, 1911, for completion of work provided to be performed by Order 11875, October 5th, 1910.

12934—February 9—Authorizing C.P.R. to construct bridge over Talbot River for Georgian Bay & Seaboard Railway Co.

12935—February 9—Authorizing C.P.R. to cross with double track highway at mileage 45.9, Brandon Subdivision, Manitoba.

12936—February 7—Authorizing C.N.O.R. to cross public road between Lots 16 and 17, Jct. Gore, Township of Gloucester, Carleton County, Ont.

12937—February 7—Recommending to the Governor-in-Council for sanction agreement between Quebec, Railway, Light & Power Co. and Quebec County Railway Co.

12938—February 7—Refusing application of C.N.R. to cross track of C.P.R. Didsbury-Kinivie Branch with its Vegreville-Calgary Branch in north-west ¼ Section 21, Township 25, Range 24, west 4th Meridian.

12939—February 8—Authorizing Vancouver, Victoria & Eastern Ry. to construct branch line from a point on main line near McLean Drive to Park Lane, city of Vancouver, B.C.

12940-41—February 10—Authorizing Niagara, St. Catharines & Toronto Railway to operate trains over crossings of air line of G.T.R., a short distance south of Welland, and at crossing of G.T.R., in Port Colborne, in accordance with Order 9552, of February 3rd, 1910.

12942 to 12948 Inc.—February 10—Authorizing C.P.R. to construct additional track (double track) across highway at mileage 43.1, 46.5, 59.95, 48.8, 48.0, 47.7, 8.05, Brandon Subdivision.

12949—February 10—Authorizing N. St. C. & T. Ry., M.C.R.R., T. H. & B., pending completion of interlocker Order by Order 9552 to operate all trains over crossing of Canada Southern & T. H. & B., authorized by Order No. 10639, March 22nd, 1910, trains to come to full stop, and to be flagged by watchman employed by M.C.R.R., and paid for by N. St. C. & T. Ry. Co.

ENGINEERING SOCIETIES.

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

QUEBEC BRANCH—
Chairman, A. E. Doucet; Secretary, P. E. Parent. Meetings held twice a month at Room 40, City Hall.

TORONTO BRANCH—
96 King Street West, Toronto. Chairman, H. E. T. Haultain; Secretary, A. C. D. Blanchard, Engineering Building, Toronto University, Toronto. Meets last Thursday of the month.

MANITOBA BRANCH—
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, A. A. Dion, Ottawa; Secretary, H. Victor Brayley, N. T. Ry., Cory Bldg.

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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.

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

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

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

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

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ENGINEER'S CLUB OF TORONTO.—96 King Street West. President, Killaly Gamble; 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.

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

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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.

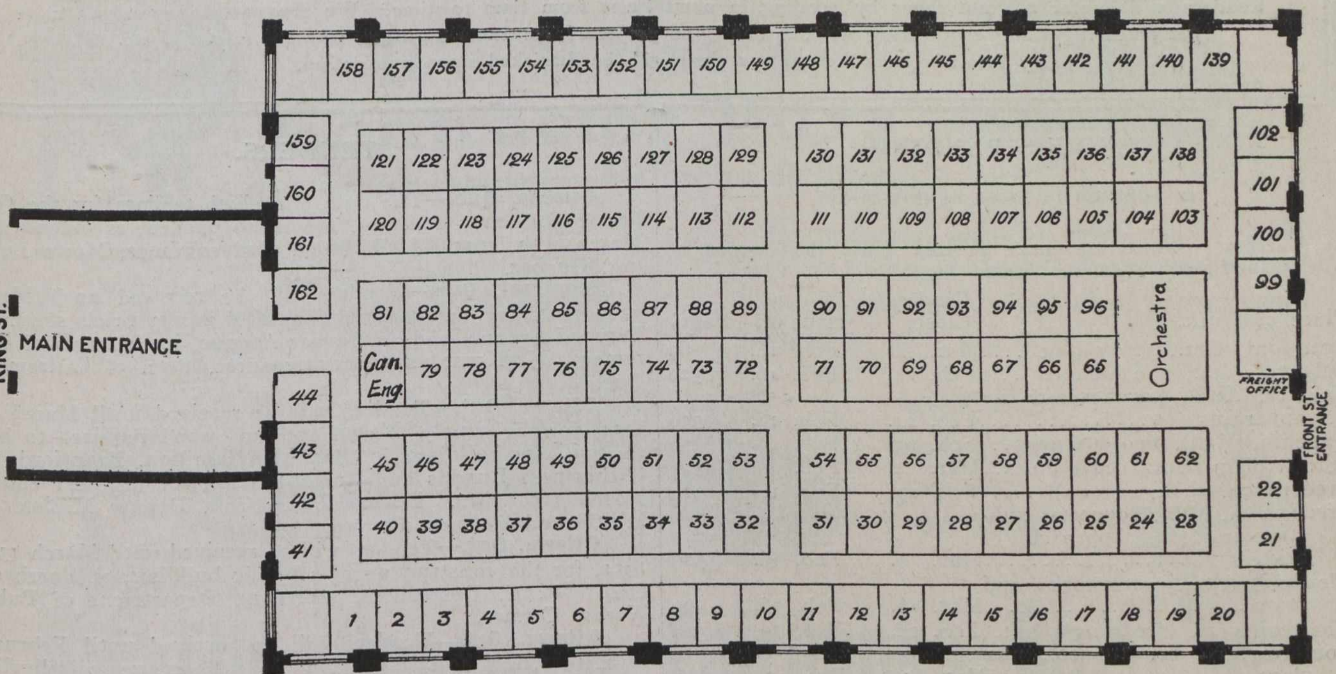
UNDERGRADUATE SOCIETY OF APPLIED SCIENCE, McGILL UNIVERSITY.—President, H. P. Ray; Secretary, J. P. McRae.

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

WESTERN CANADA RAILWAY CLUB.—President, Grant Hall; Secretary, W H Rosevear, 100 Chestnut Street, Winnipeg, Man. Second Monday, except June, July and August, at Winnipeg.

CANADIAN CEMENT AND CONCRETE ASSOCIATION.

The arrangements for the Third Annual Convention and Exhibition by Canadian Cement Workers are nearing Completion. A Partial List of Exhibitors, together with the Arena Plan, is given herewith.



112, 113, 128, 129—Canada Foundry, Toronto.
130—C. S. Wert, Kendallville, Ohio.
72, 73, 74, 87, 88, 89—Wettlaufer Bros., Toronto.
32, 33, 34, 51, 52, 53—Steel & Radiation, Limited, Toronto.
8, 9, 10—Kent Mill Co., 170 Broadway, New York City.
71, 90, 110, 111—Trussed Steel Co., Walkerville, Ont.
91, 92—Eadie Douglas Co., Toronto.
69, 70—Cement Products, Toronto.
30, 31, 54, 55—Ideal Concrete Machinery, London, Ont.
43—National Roofing Co., Tonawanda, N.Y.
68—Benj. Moore & Company, Toronto.
80—Canadian Engineer, Toronto.
57—Contract Record, Toronto.
67—Construction, Toronto.
65—Builder & Contractor, Toronto.
12, 13—Alf. Rogers, Toronto.
139—Standard Paint Co., Montreal, P.Q.
66, 67—Canadian Art Stone Co., Toronto.
50—Canadian Manufacturing Publishing Co., Toronto.
114—American Saw Mill Machinery Co., Hackettstown, N.J.
107—Roman Stone, Toronto.
58—Alderson Hammond & Ritchey Co., Toronto.
45—Canadian Inspection Co., Toronto.
21, 22, 22a—W. D. Beath & Son, Toronto.
75, 76, 77, 84, 85, 86—Canada Cement Co., Montreal, P.Q.
103—Cement Era, Chicago, Ill.
40—Hercules Cement Co., Buffalo, N.Y.

CURRENT NEWS.

Montreal, Que.—A Montreal firm is preparing to erect five hundred all-cement houses this spring. These will be modelled on lines laid down by Edison. The houses will be entirely of concrete. This form of building construction, it is claimed, has many advantages over all others. It is absolutely fireproof, requires no renovating, and is absolutely permanent. Another leading factor is the comparative cheapness. Under ordinary circumstances such a house is ready for occupancy within three weeks of digging the foundation.

Ottawa, Ont.—Mr. N. Cauchon is preparing plans for a sedimentation basin for Ottawa's water supply from Lake Deschine, which will be laid before the board of trade at its next meeting. The plan is that since the water will be raised very much when the Georgian Bay Canal is put through and great areas along the Ontario shore will be flooded a basin for sedimentation could be made there. He would run a wall along the present shore line from the Nepean Bay up to Skead's mills and form a lake of all the flooded land southwest of this wall. Here the water would remain still for 20 days at the present rate of consumption, by the city, which would give a chance for all the impurities to settle. The wall would not have to be a strong one, because there would be no pressure against it. It would simply be there to prevent the water in the basin from mixing with the water of the river to the north. Of course it would be necessary to carry out the scheme to build the dam proposed for the Georgian Bay Canal at the Chaudiere at once.

Ottawa, Ont.—Mr. W. F. Tye, the railway engineer from Toronto, is expected in Ottawa some time this week to work with City Engineer Ker in preparing a report on the best method for railway entrances into the city. They will not only deal with the proposed tunnel scheme of the C.P.R., but will map out a broad plan to provide for future railways.

Ottawa, Ont.—The promoters of a structural steel plant for the Capital, who have been some time looking over the ground, have now definitely decided to go ahead. At a meeting of the publicity department recently, the announcement was made that the promoters of the new industry had purchased six acres of land in the Bayswater district and would commence the erection of at their plant early in the spring. They will employ in the neighborhood of 200 hands at the beginning of operations, and it is expected that this number will be increased from time to time.

Kingston, Ont.—The directors of the Ontario Exploration Syndicate were here recently to sign the agreement which the City Council passed. The syndicate pays the city $4,000 for making a wider span in Cataraqui Bridge, and deposits $10,000 as a guarantee of good faith. There is a movement for the city to purchase the bridge for $14,850 and be in a position to eventually deal with the Dominion Government. At present the city holds $20,000 stock in the bridge, the value of which is placed at $49,700. There is an annual grant of $1,400 from the Dominion Government. If a new bridge is not erected for some years the tolls collected would more than keep the bridge in repair.

CONSTRUCTION NEWS SECTION

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

TENDERS PENDING.

In addition to those in this issue.

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

Place of Work.	Tenders Close.	Issue of.	Page.
Brantford, Ont., sewer pipe	Mar. 2.	Feb. 16.	69
Calgary, Alta., pile hammer	Feb. 24.	Feb. 16.	329
Calgary, Alta., purchase of fire apparatus	Feb. 24.	Feb. 16.	330
Dauphin, Man., two bridges	Feb. 25.	Feb. 9.	54
Fort William, Ont., cedar poles	Mar. 2.	Feb. 9.	300
Fredericton, N.B., sea wall	Feb. 27.	Feb. 16.	329
Fredericton, N.B., concrete substructure and approach of bridges	Mar. 6.	Feb. 16.	329
Gleichen, Alta., waterworks and sewers	Mar. 16.	Feb. 16.	69
Montreal, Que., dredging plant	Feb. 22.	Feb. 9.	300
Monterrey, N. L., Mexico., gas plant	**Mar. 1.**	**Feb. 2.**	**66**
Ottawa, Ont., departmental bldg	Feb. 28.	Jan. 5.	131
Ottawa, Ont., schooner	Mar. 1.	Feb. 9.	300
Ottawa, Ont., motor trucks	Mar. 17.	Feb. 9.	300
Ottawa, Ont., public building at Listowel	Feb. 27.	Feb. 9.	300
Ottawa, Ont., public building at Tillsonburg	Feb. 28.	Feb. 9.	300
Ottawa, Ont., supply of cement	Feb. 24.	Feb. 16.	66
Ottawa, Ont., public building at Mitchell	Mar. 1.	Feb. 16.	329
Ottawa, Ont., wharf	Mar. 8.	Feb. 16.	329
Quebec, Que., railway	Mar. 2.	Feb. 9.	70
South Middleton, Ont., schoolhouse	Mar. 15.	Jan. 12.	163
Strathcona, Alta., engine, boilers and generator	**Mar. 1.**	**Jan. 26.**	**65**
Swan River, Man., steel bridge	Apr. 15.	Feb. 16.	66
St. Catharines, Ont., pipe and specials	Feb. 28.	Feb. 9.	70
Toronto, Ont., right to cut pulpwood	Apr. 10.	Jan. 19.	203
Toronto, Ont., cast iron pipe	Feb. 28.	Feb. 16.	70
Toronto, Ont., freight shed		Feb. 16.	329
Victoria, B.C., supply of valves and pig-lead	**Mar. 3.**	**Feb. 2.**	**269**
Victoria, B.C., construction of pavements	Mar. 3.	Feb. 16.	330
Welland, Ont., Robertson Machinery Company	Feb. 21.	Feb. 9.	300
Winnipeg, Man., supply of asphalt	**Mar. 1.**	**Jan. 26.**	**235**
Winnipeg, Man., conduit system	Feb. 22.	Feb. 9.	70
Winnipeg, Man., motor car	Mar. 3.	Feb. 9.	54
Winnipeg, Man., conduit	Feb. 22.	Feb. 16.	69
Winnipeg, Man., superstructure Sub-Station No. 1	Feb. 20.	Feb. 16.	70
Winnipeg, Man., public bath house	Feb. 23.	Feb. 16.	329

Copies of the Canadian Engineer of the issues of January 5th and 12th, are wanted. By forwarding the same to the main office your subscription will extend over an additional month.

TENDERS.

Quebec, Que.—The date, on which tenders for the Quebec & Saguenay Railway, are to be opened, is extended to March 10th, 1911. J. F. Quay, civil engineer, Morin Building, Quebec.

Montreal, Que.—Tenders will be received until March 2nd, 1911, for the construction of a 2 x 3 brick sewer on Bernard Avenue, and on Davaar Avenue, in the town of Out remont. J. Kruse, secretary-treasurer, town of Outremont, Que.

Ottawa, Ont.—Tenders will be received until March 12, 1911, for the supply of coal and fuel wood required to heat the military buildings at Toronto, Hamilton, Brantford, St. Catharines, Dundas and Burford, Ont., for the year ending March 31st, 1912. Eugene Fiset, Col., Deputy Minister of Militia and Defence, Ottawa.

Ottawa, Ont.—Tenders will be received until March 13th, 1911, for the construction of a public building, at Harriston, Ont. R. C. Desrochers, secretary, Department of Public Works, Ottawa.

Ottawa, Ont.—Tenders will be received until February 24th, 1911, for the construction of a rifle range at Belleville, Ont. Eugene Fiset, Col., Deputy Minister of Militia and Defence, Ottawa.

Ottawa, Ont.—Tenders will be received until February 27th, 1911, for the addition to Military Stores Building, London, Ont. Plans and specifications to be seen on application to Mr. H. J. Lamb, district engineer, London, Ont., and R. C. Desrochers, secretary, Department of Public Works, Ottawa.

Ottawa, Ont.—Sealed tenders will be received until February 22nd, 1911, for the supply of ironwork for three 260 cubic yard dump scows for Vancouver, B.C. R. C. Desrochers, secretary, Department of Public Works, Ottawa.

Ottawa, Ont.—Tenders will be received until March 15th, 1911, for the construction of an extension to the north breakwater at Richibucto, Kent County, N.B. Plans and specifications can be seen at the offices of E. T. P. Shewen, Esq., Dist. Engineer, St. John, N.B.; Geoffrey Stead, Dist. Eng., Chatham, N.B.; and on application to the postmaster at Richibucto, N.B. R. S. Desrochers, Secretary Department of Public Works, Ottawa.

Oshawa, Ont.—Tenders will be received until the 18th day of March, 1911, for the construction of asphalt block pavements on King Street and Simcoe Street. Plans may be seen at the town engineer's office, Town Hall, Oshawa. W. E. N. Sinclair, B.A., LL.B., mayor. Frank Chappell, town engineer. (Advertisement in the Canadian Engineer.)

Eglinton, Ont.—Tenders yill be received until March 2nd, 1911, for the supply of crushed granite and lime stone for macadam roadways during 1911. W. C. Norman, Town Clerk.

Toronto, Ont.—Sealed tenders will be received until March 1st, 1911, for the purchase, as a going concern, of the assets of the Belding Lumber Company, Limited, Toronto. Further particulars may be obtained on application to the assignee, G. T. Clarkson, 33 Scott Street, Toronto.

Toronto, Ont.—Sealed tenders will be received addressed to the Trusts & Guarantee Company, Limited, 45 King Street West, Toronto, up to the first day of March, 1911, for the purchase of all the assets and undertakings of the Silver Bar Mining Company, Limited. Further particulars can be had upon application to the liquidator, the Trusts & Guarantee Company, Limited, 45 King Street West, Toronto, or to its solicitor, Charles W. Kerr, Sterling Bank Chambers, 48 King Street West, Toronto.

Toronto, Ont.—Tenders will be received until February 28th, 1911, for the erection and completion of the Women's Building, on the Exhibition Grounds, Toronto. G. R. Geary, (Mayor), chairman, Board of Control, City Hall, Toronto.

Toronto, Ont.—The following contracts have been awarded by the Board of Control. For cast iron pen stocks for low-level sewer, to Adams Hydraulics, Limited (No. 3), price $323.87, on their own design. The lowest submitted upon the design prepared by the city's department, was by Drummon, McCaul Company, $646.50.

For the construction of the foregoing sewers as follows, the lowest tender in each case being accepted:

Edgewood Crescent, Summerhill Avenue to north end—To the National Contracting Co., price $708.

Pleasant Boulevard, Avoca Avenue to west end—To the Excelsior Contracting and Paving Co., price $814.

Astley Avenue, Douglas Drive to north City limit—To the National Contracting Co., price $1,388.

Avoca Avenue, Rosehill Avenue to St. Clair Avenue—To the Excelsior Contracting and Paving Co., price $952.

For the following, the lowest tender in each case being accepted:

Lighting fixtures—To the Fred. Armstrong Co., price $149.

Concrete paving—To A. Gardner & Co., price $1,164.

Metal weather strips—To James Everett, price $106.

Hardware—To Rice Lewis & Son, Limited, price $208.90.

Kingston, Ont.—A contract has been awarded by the city for rubble stone, required by the corporation, during year 1911, to Edward J. McFadden, Kingston. This was the only tender the price being $3.00 per toise (8 cubic yards) delivered to any part of the city.

Pembroke, Ont.—The council of Pembroke, Ont., has awarded tenders for laying the intake and force pipes. The contract for laying force main was awarded to Emile Michel at $4,300, while Geo. Crowe & Son, of Trenton, were awarded the contract for laying intake pipes at $9,812.

Hamilton, Ont.—The following contracts have been awarded by the city council:

GRAVEL—To Griffin & Simons—For delivery gravel to any point between west line of Sherman Avenue and east side of Trolley Street, $2.35 per load of 2 cubic yards. Delivery gravel to any point between the east side of Trolley Street and eastern city limits, $2.15 per load of 2 cubic yards.

To Armstrong Supply Co., Limited—For delivery of gravel—

District 1. At gravel pit, 75c. per load of 2 cubic yards.
" 2. West of east side of Bay Street and south of G.T.R., $1.75 per load.
" 3. East of Bay Street and west of east side of Emerald Street, $1.90 per load.
" 4. Between Emerald Street and Sherman Avenue south of the G.T.R., $2.20 per load.
" 5. North of main line G.T.R., $2.25 per load.

Delivery on top of mountain, including incline fare, $2.75 per load.

PORTLAND CEMENT—To Canada Cement Co., Limited, for "Canada Brand" Portland Cement, at $1.48 per barrel of 350 pounds, F.O.B., Hamilton, in cloth sacks, to be charged at 10c. extra, and credited at 10c. each when returned to mill, freight prepaid.

PIG LEAD—To Tallman Brass and Metal Co., for 10 ton pig lead at $3.45 per 100 lbs.

LEAD PIPE—To Tallman Brass and Metal Co., for 60 ton ½-inch lead pipe, 5 ton ¾-inch lead pipe, 7½ ton 1-inch lead pipe, at $4.10 per 100 lbs.

CREOSOTED WOOD PAVING BLOCKS.—To United States Wood Preserving Co., for long leaf yellow pine wood paving blocks, 3 inch, at $1.79 per sq. yard.

STOP VALVES.—To Kerr Engine Company, for 10 12-inch J.B.B.M. gate valves, hub end, with Hamilton city square nuts on stems, at $36.00 each.

115 6-inch J.B.B.M. gate valves, hub end, Hamilton city square nuts on stems, at $9.00 each.

10 cents per 100 lbs. allowed for car load shipments.

REINFORCED CONCRETE PIPE—To the Reinforced Concrete Pipe Co., Jackson Mich., for 78-inch reinforced concrete pipe, at $7.22 per lineal foot.,

ORDINARY CASTINGS—To Hamilton Foundry Company, for ordinary castings $1.95 per 100 pounds.

HYDRANTS AND LEATHER VALVES—To Kerr Engine Co., for 108 or more Hamilton pattern, at $43.00 each. 25 leather valves, 7 inch x 1⅝ inch, at $1.50 each. 10 leather valves, 6 inch x 1⅝ inch, at $1.30 each.

EXTENSION BOXES—For Forwell Foundry Co., for 1,200 small size extension boxes, $1.28 each. 200 large size extension boxes, $1.38 each

SEWER BRICK—To Ollman Bros., for delivery west of Bay Street, $7.75 per 1,000.

For delivery east of Bay Street, west of Wentworth Street, and south of Grand Trunk Railway, $8.00 per 1,000.

For delivery east of Wentworth Street and west of Sherman Avenue, $8.25 per 1,000.

For delivery east of Sherman Avenue to city limit, north of Grand Trunk Railway, $9.00 per 1,000.

CAST IRON PIPE—To Gartshore, Thomson Pipe and Foundry Co., for

(a) Cast iron pipe, $32.00 per ton.
(b) Special castings, $2.75 per 100 lbs.
Note—These prices were slightly in excess of tender of U. S. Cast Iron Co. The city firm delivers pipe at the various city works, the other tender being F.O.B., Hamilton.
(c) Cast iron man hole covers, at $2.00 per 100 lbs.

BRASS WORK FOR HOUSE SERVICES, ETC.—To Chadwick Bros., for

100	1-inch compression cocks, min. weight 7 lbs...	$185.00
100	1-inch stop cocks, min. weight 8 lbs. 3 oz....	186.50
100	1-inch corpor'n cocks, min. weight 3 lbs. 3 oz.	126.50
100	¾-inch compress. cocks, min. weight 5 lbs. 8 oz.	150.00
225	¾-inch stop cocks, min. weight 7 lbs. 5½ oz..	380.25
200	¾-inch corpor. cocks, min. weight 2 lbs. 2½ oz.	150.00
1,200	½-inch compress. cocks, min. weight 3 lbs. 8 oz.	954.00
200	½-inch couplings, min. weight 1 lb. 10 oz.....	69.00
1,200	½-inch stop cocks, min. weight 3 lbs. 2 oz....	1,020.00
1,200	½-inch corpor. cocks, min. weight 1 lb. 5 oz.	554.00
50	hydrant drop valves	12.50
		$3,787.75

Regina, Sask.—The Regina Street Railway have awarded contract for street cars to the Canadian Ford Company of Montreal, Que., who represent the Brush Company, Loughborough, Eng.

Saskatoon, Sask.—Messrs. Smith Bros. & Wilson, of Saskatoon, have been awarded the contract for the building of the first portion of the Emmanuel College in the University grounds, the amount of contract being $50,600.

RAILWAYS—STEAM AND ELECTRIC.

Montreal, Que.—The Canadian Pacific Railway has under consideration at present the continuation of the double tracking of the line westward from Medicine Hat to Calgary.

St. Catharines, Ont.—The Port Colborne division of the Niagara, St. Catharines and Toronto Railway, has opened for traffic with a two-hour service until midnight. The road is now in operation from Port Dalhousie to Welland. The new section, 8½ miles in length, gives a trolley service the entire length of the Welland Canal.

Toronto, Ont.—It is now rumored that the Canadian Northern Ontario Railway's line from Niagara to Ottawa will pass through Toronto north of the C.P.R. line. The survey, it is said, leaves the right of way of the Niagara power line, west of the power house on Avenue road, extends eastward between the C.P.R. line and McPherson avenue, and swings northwesterly across the later towards Cottingham street to a station, which it is said will be built on the south of that thoroughfare and a short distance west of Yonge street. It is stated that the C.N.R. through the Scarboro Securities Co. have bought all the land south of McPherson avenue, west of Avenue road and south of Cotting ham stret, east of Avenue road.

La Riviere, Man.—The Canadian Pacific locomotive foreman's office, together with the oil house and contents, has been destroyed by fire. The waterworks and pumping station have been put in commission and are working very satisfactorily. Owing to the large amount of snow here the railway has about 40 men shoveling out the yards.

Red Deer, Alta.—The Canadian Northern surveyors have been at work again the past few days running survey lines and taking levels through the eastern part of the town.

Merritt, B.C.—Eleven miles of steel has been laid on the Kettle Valley Railway out of Merritt. Track laying will be temporarily suspended until warmer weather sets in, but the grading operations will continue with a force of several hundred men. The contractors announce that the first thirty-mile section will be completed by the end of May. The laying of steel will be completed before that time, but several weeks will be necessary for ballasting. With the completion of a short link, Nicola Valley would now have a

short line to the boundary, the V. V. & E. Railway being finished to a point only a few miles distant from the Kettle Valley in the vicinity of the summit.

Vancouver, B.C.—It is stated that the new tramline connecting Vancouver and New Westminster by the route passing through Burnaby will be opened by March 1st, this date being the time mentioned in the tram agreement with the Burnaby council. Work is now being rushed in Burnaby, tracklaying, ballasting and overhead wiring being in progress all along the line. Some difficult work has been encountered where the line crosses Hastings, but it is hoped to have this section, as well as the portion of the line within the city limits, completed by March 1st.

LIGHT, HEAT AND POWER.

Kingston, Ont.—The municipal light plant made a net profit of $18,000 in 1910, the largest surplus in years. Electricity was produced at 1.61 cents per kilowatt hour, a reduction of a quarter of a cent over 1909. Gas was produced at 42 cents per 1,000 cubic feet. In 1909 it cost 47 cents.

Winnipeg, Man.—City officials have submitted a report showing that the voltage of current supplied by the Winnipeg Electric Railway to private houses varied from 134 to 118 in evenings, from 126 to 128 meter in night and ran as low as 100 during the day. This is claimed to be a direct violation of the Dominion Act, which makes allowance for four points in either direction for fluctuation from the standard of 110 established in the company's charter.

SEWAGE AND WATER.

Melville, Sask.—The G.T.P. secured aboundant water here recently. Pumps with a capacity of 500 gallons per minute cannot reduce the flow, which is 20 yards from the roundhouse. One million gallons per day is procurable.

CURRENT NEWS.

Victoria, B.C.—Mr. Dennis R. Harris has been appointed by Water Commissioner Drury and the civic authorities to make a survey of the watershed at the north end of Sooke Lake.

Victoria, B.C.—One of the most interesting plans in the lode mining in Canada is that proposed by the Greenwood-Phoenic Company. The defined object of the company's present activities is to excavate a tunnel through and under the mountain lying east of the city of Greenwood from a point on the Nelson mineral claim, which claim adjoins the eastern boundary of Greenwood, to a point at or near the Victoria mineral claim, under the city of Phoenix, and to run exploring and branch, working tunnels from the main tunnel, to carry on a general mining and reducing business, and to create, use and dispose of electric and other power. It is also its purpose to acquire and take over the business of the Greenwood-Phoenix Tramway Co., Limited, which corporation first undertook the construction of the tunnel from Greenwood to Phoenix, and which has already driven the tunnel for some 1,200 feet.

SOCIETY NOTES.

ONTARIO GOOD ROADS ASSOCIATION.

The Ontario Good Roads' Association have prepared a lengthy and instructive programme for their convention, which is to be held in the York County Municipal Building, March 1 to 3. The inital session is to be addressed by Mayor Geary and R. T. Bull, warden of York, whilst the speakers at the various other sessions will include Hon. J. Morrissy, Minister of Public Works, New Brunswick; W. A. McLean, C.E., provincial engineer of highways; Geo. C. Diehl, engineer of Erie County, Buffalo, N.Y.; Hon. Dr. Reaume, Minister of Public Works; A. McGillivray, highway commissioner for Ontario; Geo. H. Gooderham, M.L.A., and many other well-known experts and public men. The subjects upon which addresses will be delivered are of interest to the public as well as being of special interest to engineers. A big attendance is expected at the various sessions, all of which are open to the public.

At the annual meeting of the Electrical Association of the Province of Quebec, the officers were elected as follows: President, N. Simoneau; 1st vice-president, C. Thomson; 2nd vice-president, L. Rousseau; treasurer, W. B. Shaw; secretary, J. E. McDougal. Executive committee: F. J. Parsons, J. A. Hicks, C. E. McGregor, H. J. Vickerson, R. Moncel, H. Crouch, J. A. Valois, and W. Smith.

PERSONAL.

Mr. C. R. C. Conway, M. Inst. C.E., M. Can. Soc. C.E., recently chief engineer of the Monterrey Subway Light & Power Company and the Monterrey Waterworks & Sewer Company, Mexico, has been appointed chief engineer of the British Columbia Electric Railway Company and its subsidiary companies, Vancouver, B.C.

Mr. L. P. Sherwood, principal assistant engineer of the Trent Canal, Peterboro, has obtained the position of principal assistant engineer of subdivision A of the First Division in the Department of Railways and Canals.

Mr. C. H. Mitchell, C.E., Toronto, Ont., was invited last week to give a lecture before the Enginers' Club of Cleveland, Ohio. Mr. Mitchell gave his lecture before a large audience of American engineers who were interested in the description of the works being completed by Canadian engineers.

Mr. R. C. Saunders, formerly of the City Engineer's staff, Toronto, Ont., has been appointed Assistant City Engineer of Moose Jaw, Sask.

Mr. Frank Koester, previously with the Interborough Rapid Transit (Subway) Construction Company, the J. G. While & Company, the Guggenheim Exploration Company, and the American Smelting & Refining Company, all of New York, recently opened an office at 115 Broadway, New York as consulting engineer. Mr. Koester is author of "Steam Eleceric Power Plants" and "Hydro-Electric Developments and Engineering."

Mr. F. L. Fellowes, city engineer for Westmount, has been appointed by the Vancouver council to the newly-created post of supervising engineer of Vancouver, the agreement to cover a term of five years from May 1, 1911, with a guarantee of certain conditions. During the ten years that he has been city engineer of Westmount a great deal of beautifying and permanent work has been accomplished there, especially the paving on Sherbrooke and the Westmount belt. Mr. Fellowes went to Westmount from Toronto thirteen years ago. As supervising engineer in Vancouver he will have full control of the works department, with power to engage or dismiss all members of his staff, and all complaints concerning his men will be heard by Mr. Fellowes personally. He is to be the sole judge as to carrying out contracts and improvements according to specifications, his decision being final.

Mr. J. Race has been appointed by Engineer Rust of Toronto, to take charge of the laboratory work at the Island filtration plant.

Prof. E. A. Stone, Dean of the Engineering University of New Brunswick, has recently been elected a member of the Institute of Civil Engineers of Great Britain.

Messrs. Spencer and Campbell have been placed in charge of the Montreal office of Kilmer, Pullen & Burnham, which has been opened on 11 St. Sacrament Street, Montreal.

Bruce & Sweatman, Ltd., engineers and contractors, and Frank Sweatman, British Columbia, land surveyor, have removed from Dominion Trust Building to Suite 16, Tunstall Block, corner of Granville St. and Dunsmuir St., Vancouver

MARKET CONDITIONS.

Halifax, N.S., February 21st, 1911.

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

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

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

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

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

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

Coil Chain.—The jobbing prices of English proof chain in Halifax are as follows: 3-16 x 4, $7.15; 3-16 x 3, $6.25; ¼, $5.35; 5-16, $4.30; ⅜,

$3.90; 7-16, $3.85; ½, $3.60; ⅝, $3.60; ¾, $3.50; ⅞, $3.50; 1, $3.50; 1⅛, $3.50.

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

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

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

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

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

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

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

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

Pipe.—Wrought iron, 1-in., $5.25.

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

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

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

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

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

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

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

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

Montreal, February 22nd, 1911.

The market for pig-iron has advanced in Pittsburg, and more buyers are coming into the market. More blast furnaces are going into operation each week, and the Carnegie Steel Company furnaces are now running about 70 per cent. of capacity, and are gaining considerably. The old Clinton furnace which went out of blast last December resumed operations last week, and is running to capacity. The National Tube Company has added to its furnace capacity in the Pittsburg district, and will have all its furnaces running in the Wheeling distrct together with its mills in Pittsburg.

Mills have withdrawn prices on sheet bars and have issued a new list calling for $1 per ton more. The advance is expected to be followed in other districts shortly. The advance is attributed to the high price of scrap.

New rail inquiries in the market aggregate a total of nearly 75,000 tons, made up mostly of small tonnages. This does not include the St. Paul order for 60,000 tons.

Improvement in the heavier classes of steel is shown in the fact that the Lakawanna Steel Company is now operating between 75 per cent. and 80 per cent. of finished steel capacity, compared with only 55 per cent. to 60 per cent. on the first of the year. Lakawanna's products are principally different classes of heavy material.

Within the past few days some large orders of pig-iron have been sold aggregating a total of 500,000 tons, composed of Northern and Southern iron. In the southern district a better demand is reported over the last few days, and many producers have been able to rid themselves of a large tonnage of surplus stocks. One large producer makes the statement that iron now stacked in his yard does not aggregate more than 15,000 tons. This is due to the policy which he has pursued of disposing of as much iron as possible at market prices rather than to permit it to pile up.

While the price of pig-iron has not advanced to speak of as yet, and purchases may still be made at low figures, the outlook is good for higher prices. The Bessemer Association is making every effort to create a better market for iron, and it is said will hold conference in Pittsburg for this purpose, although it is also said that the conference is for another object altogether.

The cast-iron pipe trade is one of the strongest branches of the iron and steel industry, just now, and iron pipe foundries all over the country are gradually increasing their operations.

Advices from the other side of the Atlantic are not of great interest. Great Britain is keeping her eye on the situation in the United States, and the better tone in the latter market is reflected in the former. The situation in Great Brintain has been much better all along than in the United States, and any recovery which may take place will not be so noticeable. On the whole, prices are fractionally stronger.

In Canada, producers are almost more interested in the United States market than in their own, the reason being that it is the competition offered by the Buffalo producers which is holding prices down in Toronto and other Ontario points. If it were not for this, Canadian producers would be able to sell iron at considerably higher prices than they can at present. The general belief is that prices are now about bottom, and that any further change which takes place will be in an upward direction. Meantime, a large number of consumers have made their contracts for a considerable portion of the present year, and in some cases for the entire year. The local market shows practically no changes.

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

Antimony.—The market is steady at 8¼c.

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

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

Chain.—The market is unchanged, being now per 100 lbs., as follows:—¼-in., $5.30; 5-16-in., $4.70; ⅜-in., $3.90; 7-16-in., $3.65; ½-in., $3.55; 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, $7 per ton, net; furnace coal, $6.75, net. Bituminous or soft coal: Run of mine, Nova Scotia coal, carload lots, basis, Montreal, $3.85 to $4 per ton; cannel coal, $9 per ton; coke, single ton, $5; large lots, special rates, approximately $4 f.o.b., cars, Montreal

Copper.—Prices are easy at 13¾c.

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

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

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

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

Laths.—See Lumber, etc.

Lead.—Prices are firm at $3.65.

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

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

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

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

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

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

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

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

Railway Ties.—See lumber, etc.

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

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

Spikes.—Railway spikes are steady, at $2.45 per 100 pounds, base of 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, $4 per barrel of 40 gallons, weighing about 500 pounds; roofing pitch, No. 1, 75c. per 100 pounds; No. 2, 55c. per 100 pounds; pine tar, $9.50 per barrel of 40 gallons; refined coal tar, $4.50 per barrel, pine pitch, 3c. per lb.; rosin, 3¼c. (See building paper, also roofing).

Tin.—Prices are firm at $44.

Zinc.—The tone is easy, at 6¼c.

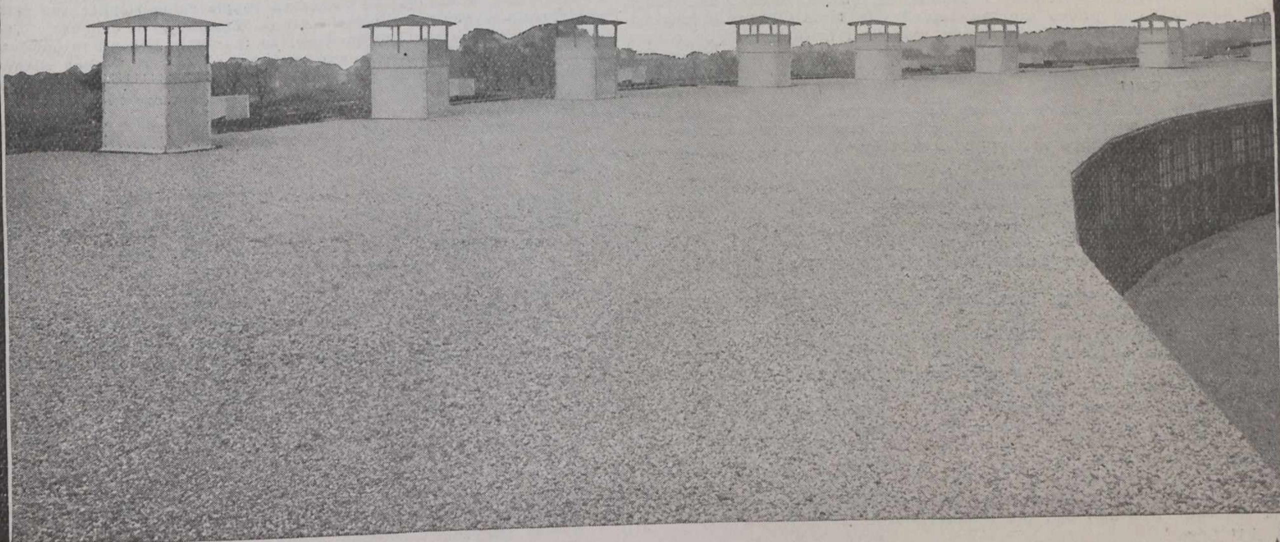
CAMP SUPPLIES.

Beans.—Prime beans, $1.85 to $1.90.

Butter.—Fresh made creamery, 24 to 26c.

Canned Goods.—Per Dozen.—Corn, $1.00; peas, $1.20 to $2.00; beans, $1.00; tomatoes, $1.45; peaches, 2s, $1.90; and 3s, $2.90; pears, 2s, $1.80;

Barrett Specification Roofs



Longest Wear for Lowest Cost

THE cost *per year of service* is the only true test of a roofing.

It discloses the absolute superiority of Barrett Specification Roofs. That is why on large manufacturing plants where costs are carefully computed, such roofs are almost invariably used.

Barrett Specification Roofs are inexpensive, costing much less than tin for instance, and little more than the best grade of ready roofings.

And their cost of maintenance is nothing, for they require no painting; they can't rust, and they will give satisfactory protection for 20 years or more.

Insurance underwriters classify these roofs as "slow burning" construction acceptable on "fire-proof" buildings.

Barrett Specification Roofs are immune from damage by acid fumes.

They are used extensively on railroad round houses. On cotton mills with their humid interiors, these roofs give perfect satisfaction for dampness does not affect them from below.

The Barrett Specification Roof illustrated above is 50,000 square feet in area, and covers the round house of the Vandalia Lines.

We will be glad to supply a copy of The Barrett Specification on request to anyone interested in the subject. Address nearest office.

The Paterson Manufacturing Co., Ltd.

Montreal Toronto Winnipeg Vancouver St. John, N.B. Halifax, N.S.

and 3s, $2.40; salmon best brands, 1-lb. talls, $2.07, and flats, $2.25; other grades, $1.40 to $2.10.

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

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

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

Eggs.—New laid eggs, 30 to 35c.; No. 1 candled, 17 to 18c.

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

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

Potatoes.—Per 90 lbs., good quality, $1.10 to $1.20.

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

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

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

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

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

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

Toronto, February 23rd, 1911.

A fair consumptive movement continues in lumber, bricks, and other building material, and prices are maintained. In metals there is a good deal of activity, copper especially moves well, and is higher. The corner in tin continues, and prices are again higher. Iron and steel goods appear generally steady; pig-iron steady to firm. Building paper and roofing are very quiet.

Among camp supplies, dairy produce has weakened, while lard, pork, and dry salt meats are all lower; on the other hand, canned vegetables are advanced; especially tomatoes and corn. Vegetables are in fair supply, and their price is as a rule maintained.

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

Antimony.—The demand is less active, and the price remains 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 to $9; 2¼-inch, $10; 2½-inch, $10.50; 3-inch, $12.10; 3½-inch, $15; 4-inch, $19.

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

Bricks.—In active movement, with very firm tone. Price at some yards $9.50, at others, $10.00 to $10.50 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., 70c. 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, or Quebec Province. In October and November competition forced prices of limestone up to 90c., the city and the province competing for several thousand tons. But the reservoir and the hydro-electric being both supplied, normal prices have been resumed One quarry (Maloney's) will run all winter to supply stone for the Island.

Cement.—Car lots, $1.65 per barrel, without bags. In 1,000 barrel lots, $1.55. In smaller parcels $1.90 is asked by city dealers. Bags, 40c. extra.

Coal.—Anthracite egg and stove, $7.25 per ton; chestnut, scarce, $7.50; pea coal $6.00 per ton. In the United States there is an open market for bituminous coal and a great number of qualities exist. We quote: Youghiogheny lump coal on cars here, $3.75 to $3.80; mine run, $3.65 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; coke, Solvey foundry, which is largely used here, quotes at from $5.75 to $6.00; Reynoldsville, $4.90 to $5.10; Connelsville, 72-hour coke, $5.00 to $5.25. Shipments falling off on account of season drawing to a close. Dealers are buying only such quantities as are actually required so as to facilitate stock taking on April 1st. Nut coal still continues scarce, being held at a premium by miners. The soft coal market is practically unchanged and prices continue stiff as shipments are somewhat blocked by storms.

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

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

Dynamite, per pound, 21 to 25c., as to quantity

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

Fire Bricks.—English and Scotch, $30 to $35; American, $25 to $35 per 1,000. Fire clay, $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, $16.39; 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. Any change must be upward.

Lead.—A fair business is doing at prices unaltered from $3.75 to $4.

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.

Lumber.—Demand less brisk, because of the late season of the year, but prices are not materially altered. Pine is good value at $32 to $40 per M. for dressing, according to width required; common stock boards, $28 to $33; cull stocks, $20; cull sidings, $17.50. Southern pine dimension timber from $30 to $45, according to size and grade; finished Southern pine, according to thickness and width, $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, 48-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. Season is over.

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., $2.60; in barrel lots, $2.10. Plasterer's, $2.15 per barrel of three bushels.

Ready Roofing.—Prices are as per catalogue.

Roofing Slate.—Most of the slate used in Canada comes now from Pennsylvania or Maine, the Canadian supply being slender and mostly from the Rockland quarries of the Eastern Townships in Quebec. There is a great variety of sizes and qualities, so that it is difficult to indicate prices But No. 1 Bangor slate 10 x 16 may be quoted at $7 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, $1.05 per ton f.o.b., cars, Toronto siding.

Sewer Pipe.—

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

Above is the October list, as changed. The retail price is less 65 per cent. off these figures on all sizes 9 inches and under, or less 60 per cent. off these figures on anything over 9 inches. For car-load lots 73 per cent. off list at factory. Demand normal.

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. Active and firm at these prices.

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

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

Tin.—Control of the market is still evident, and the upward trend continues. We now quote 47c. and 48c.

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

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

CAMP SUPPLIES.

Beef.—By carcases, $8.50 to $9.50.

Butter.—Butter is firmly held since last issue, dairy prints are to 22c., creamery prints, 27 to 28c. per lb.

Canned Goods.—Peas, $1.35 to $1.75; tomatoes, 3s, $1.45 to $1.50; pumpkins, 3s, 97½c.; corn, 95c. to $1.00; peaches, 2s, $1.87½; yellow, $1.82½ to $1.87½; strawberries, 2s, heavy syrup, $1.80; raspberries 2s, $1.80 to $1.07½.

Cheese.—Moderately firm, large, 13 to 13¼c.; twins, 13¼ to 13½c.

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

Dried Fruits.—Raisins, new, Valencia, 8 to 8½c.; seeded, 1-lb. packets, fancy, 8c.; 16-oz. packets, choice, 7½c.; Sultanas, good, 8½c.; fine, 9½c.; choice, 10 to 11c.; fancy, 12c.; Filiatras currants, cleaned, 7½ to 8c.; Vostizzas, 9 to 10c.; uncleaned currants, 7 to 7¼c.

Eggs.—Strictly new-laid, 23 to 24c.; storage, 15 to 17c.

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

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

Lard.—Tierces, we quote 11½c. here; tubs, 11¾c.; pails, 12c.

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

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

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

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

Smoked and Dry Salt Meats.—Long clear bacon, 11 to 11½c. per lb., tons and cases; hams, large, 12 to 13c.; small, 15 to 16c.; rolls, 12 to 13c.; breakfast bacon, 17 to 18c.; backs (plain), 19 to 20c.; backs (peameal), 19 to 20c.; shoulder hams, 13c.; green meats out of pickle, 1c. less than smoked.

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

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

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

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

Vegetables.—Potatoes—Ontario, $1 per bag, on railway track, Toronto; Ontario Delawares bring $1, and New Brunswick Delawares $1.10; onions by crate, Spanish, $3; Canadian, $1.85; cabbages bring from $1.25 to $1.50 per barrel; carrots, 60c. per bag; beets, 75c. per bag; turnips, 40c. per bag. Fall apples sell at $4 per barrel, for ordinary, but first-class scarce at $5.

Winnipeg, February 20th, 1911.

Conditions in Winnipeg and throughout the West, in so far as building is concerned, is becoming more active every day. Preparation is also being made for a large amount of public work. The railroads are planning for an extremely busy year, and the general outlook is good.

The opening of the building season this year looks as if it would be earlier than usual, calling for a great supply of lumber and building material. This is due to the fact that never before in the history of the West has such a prodigious amount of proposed buildings been absolutely sure so early in the season.

Advices from British Columbia are to the effect that the stocks of lumber are fairly large, but the demand will undoubtedly be very heavy. To preach early buying is looked upon as a joke if it comes from an interested source. But the fact that a very large number of lumbermen are not pushing sales and have withdrawn travellers show that they are looking forward to a brisk season.

Shingles are reported higher in price. B. C. triplex X. are now quoted at $2.90 on a fifty cent rate, and some wholesalers say are likely to go to $3 or over by March 1st. Other quotations remain fairly steady and are as follows:—

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

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

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

Bar Iron.—$2.50 to $2.60.

Bars.—Crow, $4 per 100 pounds.

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

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

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

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

Coal and Coke.—Anthracite, egg, stove or chestnut coal, $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.—Coppered market wire, No. 7, $4 per 100 lbs.; No. 6, $4; No. 10, $4.06; No. 12, $4.20; No. 14, $4.40; No. 16, $4.70.

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

Chain.—Coil, proof, ¼-inch, $7; 5-16-inch, $5.50; ⅜-inch, $4.90; 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', 90c. to $1.15 per bale.

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

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

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

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

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

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

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

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

Plaster.—Per barrel, $3.25.

Roofing Paper.—60 to 67½cc. per roll.

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

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

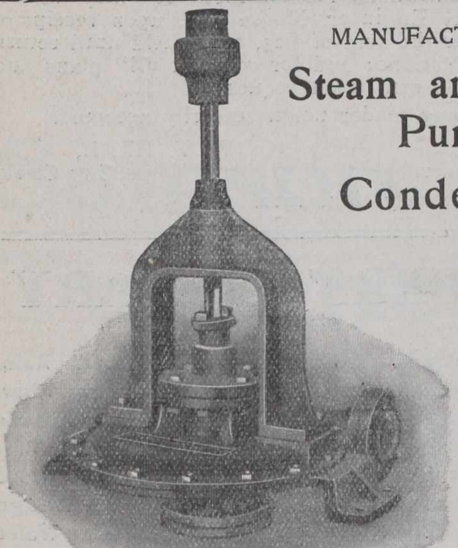
Spikes.—Basis as follows:—1¼, 5 and 6, $4.75; 5-15 x 5 and 6, $4.40; ⅜ x 6, 7 and 8, $4.25; ½ x 8, 9, 10, and 12, $4.05; 25c. extra on other sides.

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

Staples.—Fence, $3.40 per 190 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.



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MONTREAL

Tenders Called For

(Continued on pages 69 and 70.)

SUPPLY OF REINFORCED CONCRETE PIPE.

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon of Tuesday, March 14th, 1911, for the following:—

3,400 linear feet of 60-inch Reinforced Concrete Pipe.
9,728 linear feet of 66-inch Reinforced Concrete Pipe.

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

Tenderers shall submit with their tender the names of two personal sureties, approved by the City Treasurer, or in lieu of said personal sureties the bond of a Guarantee Company, approved as aforesaid.

Plans and specifications may be seen and forms of tender obtained from the Main Drainage Department, at the office of the City Engineer, Toronto.

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

The lowest or any tender not necessarily accepted.

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

City Hall, Toronto, February 20th, 1911.

MUNICIPALITY OF POINT GREY, WATER SUPPLY, DISTRIBUTING MAINS.

Contracts Nos. 6, 7, and 8.

The Corporation of the Municipality of Point Grey invite sealed tenders (1) for the work of taking delivery of steel pipes, valves, hydrants and special castings; (2) for hauling the same to the different sites in the Municipality; (3) for excavating and refilling trenches and laying and jointing about 38 miles of pipes, ranging in diameter from 25 to 4 inches.

Specification, Schedule of Quantities and Forms of Tender may be obtained at the office of the Engineers, Messrs. Cleveland & Cameron, 506 Winch Building, Vancouver, on payment of $20 which will be refunded on receipt of a **bona fide** tender and return of the documents.

Tenders made out on the Schedule of Quantities and forms supplied only will be received.

Tenders endorsed on outside of envelope, "Pipe Laying," and addressed to the undersigned and accompanied by a certified cheque for a sum equivalent to 5 per cent. of the amount of Tender, to be delivered at the Municipal Hall, Kerrisdale, not later than 5 p.m., on Monday, 6th March, prox.

The Council will not be bound to accept the lowest or any tender.

H. FLOYD, C. M. C.

Kerrisdale, B.C., February 15th, 1911.

CITY OF MOOSE JAW, SASKATCHEWAN.

Main Drainage Works.

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

Contract "A."

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

Contract "B."

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

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

The lowest or any tender not necessarily accepted.

J. M. WILSON,
City Engineer.

W. F. HEAL,
City Clerk.

Moose Jaw, February 18th, 1911.

POSITIONS WANTED

TECHNICALLY educated electrical engineer, long and representative American and Canadian experience, desires association with firm consulting engineers or operating company. Experience covers construction, operation, power market studies, maintenance costs, investigations, specifications, examinations, reports upon public utilities for financing. Best testimonials. Box 154, Canadian Engineer.

A PRACTICAL Portland cement maker, 30 years' experience, able to superintend erection of works; rotary process, and supply plans, etc.; also patentee, wishes to associate with capitalists to erect new works, or will take management of existing mills. Highest references and testimonials Address "Cement," care of Canadian Engineer, Toronto.

POSITION WANTED—Graduate Civil Engineer; ten years' experience, desires position with bridge or inspection company, as checker, designer, or inspector. Permanent position desired. Address Box 160, Canadian Engineer.

WANTED—Electrical Superintendent to take care of municipal distributing system and substation in a small city near Toronto. Applicant must have full knowledge of practical electrical construction, indoors and outdoors, and must be able to make repairs; shall also be able to sell power and do other commercial work. State full particulars and salary required. Address Hydro-Electric Power Commission, Continental Life Building, Toronto.

POSITIONS VACANT

WANTED for a town in British Columbia a road-way foreman or inspector. In applying, state fully experience, I. D., Box 408, Canadian Engineer.

APPLICATIONS will be received by undersigned for the position of Commissioner of Works for Town of North Bay. Applicants will state salary, experience and references. M. W. Flannery, Town Clerk, North Bay.

WANTED—Two foremen for structural steel erection work to commence March 1st. Reply I. D., Box 409, Canadian Engineer.

CANADIAN AGENT wanted for an old established European firm, manufacturing a special line of Electrical Apparatus. Apply "Electrician," Canadian Engineer.

MUNICIPAL COMMISSIONER WANTED.

CITY OF SASKATOON, SASKATCHEWAN.

Applications will be received by the undersigned City Clerk up to and including March the 17th, 1911, at the hour of 5 o'clock p.m., for the position of Municipal Commissioner.

Applications must be marked "Municipal Commissioner."

Further information may be had on application to the City Clerk.

JAMES CLINKSKILL, Mayor.
A. LESLIE, City Clerk.

Saskatoon, Sask., February 16th, 1911.

Index to Advertisements

TENDERS CALLED FOR

CITY OF BRANTFORD.

Tenders for Sewer Pipe.

Sealed tenders addressed to Ald. Chas. Hartman, Chairman of the Board of Works, in care of the City Clerk, Brantford, Ont., will be received till 12 o'clock noon, on

THURSDAY, MARCH 2nd, 1911,

for the supply of Sewer Pipe, required by the City of Brantford during 1911.

Specifications may be seen and instructions to bidders and forms of tender obtained on application to the City Engineer.

Each tender must be accompanied by a marked cheque, payable to the order of the City Treasurer for the amount called for in the form of tender.

The lowest or any tender not necessarily accepted.

City Hall, Brantford, February 14th, 1911.

T. HARRY JONES, City Engineer.

TENDERS WANTED.

THE QUEBEC & SAGUENAY RAILWAY.

Tenders will be received up to March 2nd, 1911, at 5 o'clock p.m. by the undersigned, for the construction of about 56 miles of the above railway, from Cap Tourmente to Murray Bay Wharf, divided up into sections of ten miles.

A certified check amounting to $20,000, for each ten mile section tendered for must accompany each tender.

Forms of tender may be obtained and specifications and plans examined at the office of J. F. Guay, Civil Engineer, Morin Building, Quebec; also at office of The Canadian Engineer, 62 Church Street, Toronto.

The right is reserved by the company to reject any or all tenders.

(Sgd.) J. F. GUAY.

CITY OF STRATHCONA, ALBERTA.

Tenders for Engine, Boilers and Generator.

Tenders addressed to David Ewing, Chief Engineer, Power House, Strathcona, Alberta, for above machinery, will be received until noon, Wednesday, March 1st, 1911. Specifications may be obtained upon application to the undersigned.

A. J. McLEAN, City Engineer.

TENDERS FOR A STEEL BRIDGE.

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

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

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

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

TOWN OF SOURIS, MAN.

Sealed Tenders will be received by the undersigned until six (6.00) o'clock p.m., on March 20th, 1911, for the following work to be done during the season of 1911:

Excavation, laying and back filling for approximately 31,500 feet of Standard Vitrified Sewer Pipe (8 in. to 20 in.) and all necessary Tees, Wyes, etc., etc.

Excavation, laying and back filling for approximately 31,500 feet of Standard Cast Iron Water Pipe (4 in. to 12 in.) and all necessary Tees, Reducers, etc., etc., also setting Gate Valves and Valve Boxes.

Excavation, setting and back filling for seventy (70) Standard Fire Hydrants.

Construction of approximately seventy-five (75) Manholes, and setting covers and frames of same.

The construction of a Brick Building 60 ft. x 40 ft. x 14 ft., on Concrete Foundation, together with all necessary machinery, consisting of Compression Tanks, Gasoline Engines and Pumps, etc., etc.

Interested parties desiring to tender on any or all of the above work can obtain further information and forms for tender by applying to the Town Engineer or Secretary-Treasurer. Plans, profiles and specifications may be seen at the office of the Town Engineer, Souris, Manitoba.

V. H. WILLIAMS, Town Engineer.

J. W. BREAKEY, Secretary-Treasurer.

Souris, Man., February 14th, 1911.

TOWN OF OSHAWA.

ASPHALT BLOCK PAVEMENT.

Sealed tenders will be received up to and including the 18th day of March, 1911, for the construction of an Asphalt Block Pavement, on a concrete base, together with cement concrete curb, gutter and widening of sidewalk where necessary, upon the following streets:

King Street, 1,750 lineal feet of width varying from 30 to 40 feet.

Simcoe Street, 1,650 lineal feet of width, varying from 30 to 40 feet.

The part to be paved will include that portion of the road occupied by the track of the Oshawa Street Railway Company.

Plans may be seen and specifications obtained from the Town Engineer's Office, Town Hall, Oshawa.

The lowest or any tender not necessarily accepted.

W. E. N. SINCLAIR, B.A., LL.B., Mayor.

FRANK CHAPPELL, Town Engineer.

Oshawa.

THE CITY OF CALGARY.

Tenders will be received by the City Commissioners up to 12 o'clock noon on the 22nd day of March, 1911, for the following machinery and plant:

One 1,500 K.W. Turbo Generator set with condenser, etc.

One 100 K.W. Exciter and Switchboards, complete.

Three 1,000 K.V.A. single-phase Transformers, 12,000 to 2,300 volts, with switching gear, etc.

An accepted cheque for 2 per cent. of the tender must accompany all bids. Cheques will be returned after the contract has been signed.

The successful tenderer will be obliged to enter into a bond with the City for the fulfilment of his contract on a date to be agreed upon by the City and Contractor.

The City reserves the right to accept any or reject the whole of the tenders submitted, or to depart from the specification as may be deemed advisable by the City.

W. D. SPENCE, City Clerk.

Dated at Calgary, Feb. 9th, 1911.

Tenders Called For

THE CITY OF HAMILTON.

Sealed tenders, addressed to Geo. H. Lees (Mayor), Chairman of the Board of Control, and sent by registered letter, and plainly marked on the outside "Tender for Sewers," will be received by the undersigned up to 10 o'clock a.m., of Thursday, March 9th, 1911, for the construction of the following sewers:

Main Street, from Albert Street to Trolley Street.
Maple Avenue, from Springer Street to Trolley Street.
King Street, from Garfield Avenue to Spadina Avenue.
Barnesdale Avenue, from Dunsmure Avenue to King St.
Highland Avenue, from Trolley Street to end of street.
Cannon Street, from Trolley Street to Ottawa Street.
Fairview Avenue, from King Street to Highland Avenue.
Barton Street, from Lottridge Street to Trolley Street.
Belview Avenue, from King Street to Cannon Street.
Mars Avenue, from Wentworth Street to Douglas Street.
Prospect Street, from Main Street to Cumberland Avenue.
Lorne Avenue, from Maple Avenue to Central Avenue.
Fairview Avenue, from Highland to Cannon Street.

Plans and specifications and other information can be obtained at the office of the City Engineer.

The lowest or any tender not necessarily accepted.

S. H. KENT,
City Clerk.

Hamilton, February 16th, 1911.

THE CITY OF HAMILTON.

Sealed tenders addressed to Geo. H. Lees (Mayor), Chairman Board of Control, and sent by registered letter, plainly marked on the outside "Tender for Sewer," will be received by the undersigned up to 10 o'clock a.m., of Thursday, March 9th, 1911, for the construction of the following sewers:

Belview Ave., from Cannon St. to Primrose Ave.
Carrick Ave., from King to Main Sts.
Dunsmure Ave., from Fairholt Road to Carrick Ave.
Kensington Ave., fom Barton to Cannon Sts.
King St., from Lottridge St. to Garfield Ave.
Rosslyn Ave., from Barton to Cannon Sts.
Central Ave., from Norway Ave. to Prospect St.
Lorne Ave., from Central to Cumberland Aves.
Glendale Ave., from Barton St. to end of Glendale Ave.
Blake St., from Maple to Cumberland Aves.
Maple Ave., from Springer Ave. to Blake St.
Boylestone Ave., from Barton St. to end of Boylestone Ave.
Balmoral Ave., from Cannon to Barton Sts.
Grosvenor St., from Cannon to Barton Sts.
Barton St., from Trolley St. to Robins Ave.

Plans and specifications and other information can be obtained at the office of the City Engineer.

The lowest or any tender not necessarily accepted.

S. H. KENT,
City Clerk.

Hamilton, February 17th, 1911.

TENDERS FOR A STEEL BRIDGE.

The Municipal Council of THE RURAL MUNICIPALITY OF MINNITONAS invite TENDERS for the supply and erection of a Steel Warren Truss Bridge, and Two Concrete Piers. Bridge to be 60 feet centre to centre of end bearings with Steel Stringers and Three-inch Plank Floor in accordance with Plan (No. F 10), and specifications on file at this Office, and also at the Office of the Chief Engineer, Department of Public Works, Parliament Buildings, Winnipeg, Manitoba.

Tenders under Seal to be delivered to the undersigned on or before the 15th Day of April, A.D. 1911.

The lowest or any Tender not necessarily accepted.

E. WIDMEYER,
Secretary-Treasurer, Municipal Council,
Minnitonas, P.O., Manitoba.

INDUSTRY INTELLIGENCE INTEGRITY

NOTICE TO CONTRACTORS.

FOR CAST IRON PIPE.

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, up to noon on.

Tuesday, February 28th, 1911,

for the supply of 20-inch CAST IRON PIPE.

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

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

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

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

The lowest or any tender not necessarily accepted.

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

City Hall, Toronto,
February 9th, 1911.

CATALOGUE INDEX

Some of the most valuable information on engineering and contracting subjects is to be found in the trade literature of the large supply houses.

The Canadian Engineer maintains a card index upon which is kept an up-to-date list of manufacturers of contractors supplies and engineering equipment. If you want the catalogues of any of these firms all you need do is to send us a postal giving your address and the list numbers (as printed below) of the catalogues you wish sent. This will save you time and labor and insure prompt service. This department can put you in direct communication with the principal manufacturers of and dealers in engineering equipment of all kinds.

1 Air compressors.
2 Air lift pumping machinery.
3 Alloys.
4 Aluminum.
5 Angles (see structural steel).
6 Architects' supplies.
7 Asbestos and Asbestos Products.
8 Asphalt.
9 Asphalt plants and tools.
10 Bars (steel)
11 Bearing Metals.
12 Bearings, ball and roller.
13 Belt dressing.
14 Belt tighteners.
15 Belting, chain, link, canvas, etc.
16 Benders (rail).
17 Blacksmiths' tools.
18 Blast furnaces and fittings.
19 Blasting powder.
20 Blocks and tackle.
21 Blowers.
22 Boiler fittings, mountings and tubes.
23 Boiler tubes.
24 Boilers (tubular).
25 Boilers (water-tube).
26 Bolts.
27 Bolts (machine).
27A Bonding for Concrete.
28 Bonds (Contractors').
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31 Brackets and cross-arms
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34 Bridge builders
35 Bridge engineers.
36 Bridges (concrete).
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39 Buckets (concrete).
40 Buckets (dredging and excavating).
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45 Carbolineum.
46 Cars (ballast).
47 Cars (concrete).
48 Cars (dumping).
40 Cars (industrial).
50 Cars (inspection).
51 Carts and wagons (ash and dump).
52 Carts (concrete).
53 Castings (malleable iron).
54 Castings (steel).
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56 Cement block and brick machines.
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69 Concrete reinforcement.
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82 Cranes (travelling).
83 Crusher castings (rock).
84 Crushing rolls.
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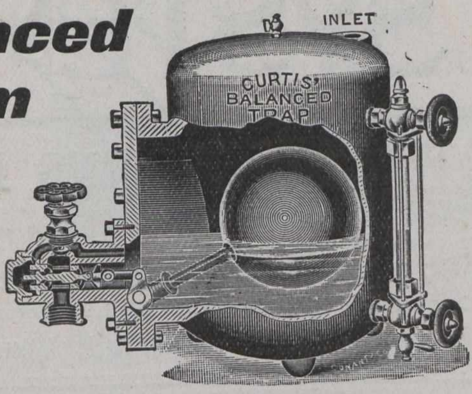
86 Curb (steel).
87 Dams (concrete).
88 Derails.
89 Derricks (pile driving).
90 Derricks (steam).
91 Drafting Instruments and supplies (see engineers' and surveyors' instruments and supplies).
92 Dredging machinery.
93 Drills (pneumatic).
94 Drills (rock).
95 Drums (hoisting).
96 Dryers (cement, asphalt and sand).
97 Dynamite.
98 Elevators (bucket).
99 Engineers and contractors.
100 Engineers' and surveyors' instruments and supplies.
101 Engines (compressed air).
102 Engines (gas, gasoline, oil).
103 Engines (high duty—pumping).
104 Engines (hoisting).
105 Engines (oil).
106 Engines (steam).
107 Engines (traction).
108 Excavating machinery
109 Explosives.
110 Fans.
111 Fence, railing and posts
112 Filters (feed water).
113 Filters (water).
114 Fire brick and fire clay.
115 Forgings (steel).
116 Foundations.
117 Foundry equipment and supplies.
118 Frogs and switches (ry.).
119 Garbage crematories.
120 Gas producers.
121 Gates and valves.
122 Gauges (steam), (see steam specialties).
123 Generators (electric).
124 Governors (water-wheel).
125 Grain elevators and storage tanks.
126 Grinding & Mixing Machinery.
127 Hand cars.
128 Heating and ventilating machinery.
129 Hoists (chain and rope).
130 Hoists (pneumatic).
131 Hoists (steam).
132 Hydrants.
133 Ice and refrigerating machinery.
134 Incline cableway engines.
135 Inspection of materials.
136 Irrigation supplies.
137 Jacks (screw and lever)
138 Jacks (hydraulic).
139 Jacks (pneumatic)
140 Jacks (track).
141 Kilns (cement).
142 Lamp posts.
143 Levels.
143A Lights (Contractors' & Municipal).
144 Locomotives (industrial and light).
145 Locomotives (steam)
146 Locomotives (traction).
147 Manganese steel.
148 Manhole covers.
149 Meters (water, oil and gas).
150 Mixers (asphalt).
151 Oakum.
152 Paints and metal coatings.
153 Paving joint filter.
154 Penstocks.
155 Pile driving machinery.
156 Pile protection.
157 Piling (interlocking steel).
158 Pipe (galvanized iron).
159 Pipe (reinforced concrete).
160 Pipe (riveted steel).
161 Pipe (wood).
162 Portland cement.
163 Pulverizers.
164 Pumps (pneumatic).
165 Pumps (centrifugal).
166 Pumps (diaphragm).
167 Pumps (waterworks).
108 Rail joints, fastenings and specialties.
169 Railroad track supplies.
170 Rails and track.
171 Rails, second-hand.
172 Railways, industrial and narrow gauge.
173 Reinforcement steel for concrete structures.
174 Riveting hammers.
175 Riveting machines.
176 Road machinery.
177 Road oils.
178 Road rollers.
179 Roofing.
180 Rope (wire).
181 Rubber boots.
182 Sand-blast machines.
183 Scarifiers.
184 Schools and colleges.
185 Scrapers, road.
186 Second-hand machinery and supplies.
187 Sewage disposal.
188 Sewer braces.
189 Sewer buckets.
190 Sewer flushers (automatic)
191 Sewer pipe.
192 Shovels (steam).
193 Shovels and picks (hand).
194 Sluice gates.
195 Steam specialties.
106 Steel substructures for tanks.
107 Street-cleaning implements, machinery and snow plows
108 Street sprinklers.
199 Structural materi
200 Structural steel.
201 Testing laboratories (chemists, etc.).
202 Ties (steel and wood).
203 Tile.
204 Track tools.
205 Traction ditching machines.
206 Transits.
207 Trench excavating machi
208 Turbine pumps.
209 Turntables (overhead).
210 Valves (sluice).
211 Wagons (contracto
212 Wagons (garbage).
Wagons (oil).
214 Well-drilling machin
215 Wheelbarrows.
216 Winches.

CURTIS ENGINEERING SPECIALTIES

Balanced Steam Trap



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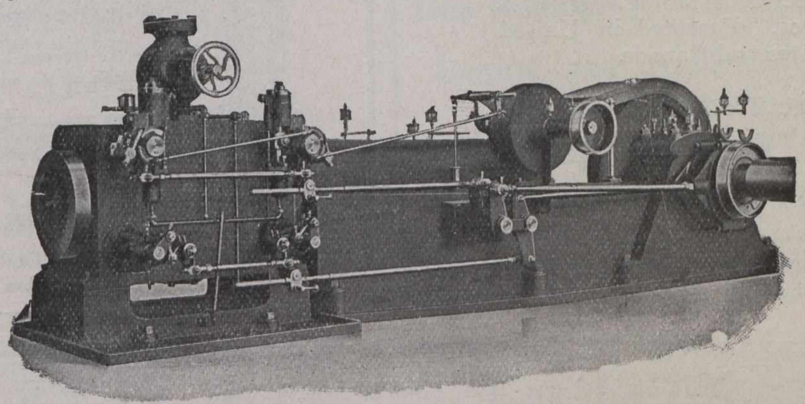

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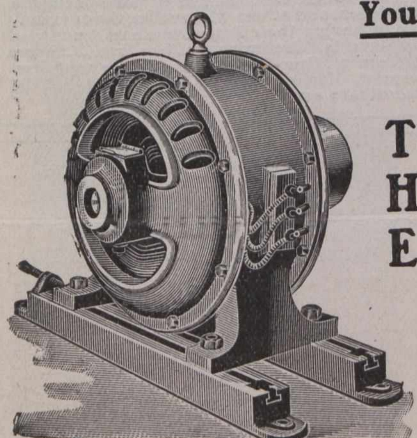

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PATENT ATTORNEYS

The Catalogue Index

on page 76 will save you much time.

AMONG THE MANUFACTURERS

A department for the benefit of all readers to contain news from the manufacturer and inventor to the profession.

LAP WELDED PIPE.

Lap welded pipe may now be obtained in sizes larger than 30-in. The American Spiral Pipe Works, of Chicago, are now making lap welded pipe from open hearth flange steel from 55,000 to 65,000 pounds tensile strength, in sizes from 12-in. to 72-in. in diameter. After their pipe is welded it is again heated in a large annealing furnace and thoroughly annealed, thus removing any strains that may have occurred during the process of making.

Test bars cut from the welded seam show the weld possesses remarkable strength, and in many tests the strength was in excess of 60,000 pounds per square inch. In a test bar cut from the welded portion of 20-in. pipe ¼-in. in thickness, the metal broke under a strain of 62,520 pounds per square inch at a short distance outside of the weld, while a bar cut from the same pipe away from which the welded seam stood 60,370 pounds per square inch. However, the American Spiral Pipe Works do not claim the welded seam to be stronger than the material from which the pipe is made, but do claim to be making a weld which will average close to the maximum strength of the plate from which the pipe is made, and a weld which enables them to use the best grade of flange steel of 60,000 pounds tensile strength.

A length of 24-in. I. D. pipe ¼-in. thickness was tested for fatigue of the metal to see if the weld would weaken under repeated strains. The pressure was brought up to between 900 and 1,100 pounds nine different times, the pipe showing no signs of fracture although it had bulged out 1¼-in. in diameter, stretching the metal about 4 inches. Finally on the tenth test a small fracture occurred near the weld. As the internal diameter of this pipe was then 25¼-in. the strain on the metal was in excess of 55,000 pounds per square inch.

A length of 20-in. inside diameter pipe ¼-in. in thickness was crushed in a hydraulic press for the purpose of testing the welded seam. Although the seam was badly folded together it remained perfectly tight under water pressure. It may be of interest to note that the total end pressure required to crush this pipe was 565,000 pounds.

The pipe is used for high pressure hydraulic lines, condenser piping, compressed air and in places where severe duty is required.

REPORT OF PHYSICAL TEST OF PIPE WELDS A/C ORDER 31806, SUBMITTED BY AMERICAN SPIRAL PIPE WORKS, CHICAGO, JANUARY 12TH, 1910.

Specimen Nos.	1	2	3	4	5
Marks	A Welded.	B Welded.	C Welded.	D Welded.	E-1 Unwelded.
Original Dimensions	1.490 x .255	1.497 x .245	1.504 x .252	1.510 x .242	1.503 x .249
Dimensions after Fracture	1.150 x .145	1.380 x .182	1.152 x .145	1.180 x .145	1.130 x .152
Original Area, sq. in.	.3800	.3668	.3790	.3654	.3742
Fracture Area, sq. in.	.1667	.2512	.1670	.1711	.1718
Elast. Lt. lbs., actual	17,610	17,000	20,110	15,530	16,810
Max. Load lbs., actual	23,760	22,400	24,150	20,500	22,590
Elongation in 8-in.	1.03	.44	.68	.92	1.18
Elast. Lt. per sq. in.	46,340	46,350	55,060	42,500	44,920
Tens. Str. per sq. in.	62,520	61,070	63,720	56,100	60,370
Pct. Elong. in 8-in.	12.88	5.50	11.00	11.50	14.75
Pct. Red. of area	56.13	27.66	55.93	53.18	54.09
Character of Fracture.	Outside Weld.	Across Weld.	Outside Weld.	Outside Weld.	S. Ang.

NEW INCORPORATIONS.

Battleford, Sask.—White Land Company, $200,000.

Wadena, Sask.—Western Real Estate Co., $100,000.

Wetaskiwin, Alta.—Wetaskiwin Tent & Mattress Co., $50,000.

Regina, Sask.—Plainview Farming Co., $100,000. Builders' Supplies, $100,000.

Exeter, Ont.—Connor Machines Co., $40,000. W. Connor, G. P. Connor, L. J. Penhale.

Sault Ste. Marie, Ont.—Superior Construction Co., $100,000. P. T. Rowland, W. Calder, A. MacQuarrie.

Matheson, Ont.—Detroit New Ontario Mines, $1,000,000. C. E. Duffy, F. E. Dorenns, G. C. Wattles, Detroit.

Port Burwell, Ont.—Canadian Waterways Improvement Co., $50,000. F. W. Fay. D. F. Williams, L. Lewis.

Saskatoon, Sask.—Westhaver Hardware Co., $50,000.

Hamilton, Ont.—Climax Good Roads Machinery Co., $40,000. J. Robinson, H. Robinson, W. J. Robinson.

Ottawa, Ont.—Victoria Navigation Co., $50,000. E. A. Hall, L'Original; J .H. Hall, R. T. Holcomb, Ottawa.

Kerr Robert, Sask.—Kerr Robert Implement Co., $10,000.

Edmonton, Alta.—Edmonton County Club, $50,000. McCoppen & Lambert, $5,000. Chappelle-Milledge Co., $25,000.

North Bay, Ont.—Dominion Refineries, $50,000. G. F. Duckworth, J. F. Hickling, North Bay; R. J. Gallagher, Collingwood.

Napanee, Ont.—Missanoga Silver Mining & Development Co., $100,000. E. W. Scott, Toronto; S. E. Scott, M. Jones, Napanee.