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The Canadian Engineer

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DISCHARGE CAPACITY OF SAFETY VALVES.

The February issue of The Journal of the American Society of Mechanical Engineers contains the results of some tests made upon Crosby safety valves by Prof. E. F. Miller, of the Massachusetts Institute of Technology.

The tests were made to determine the discharge capacities of 3-and 3½-in. locomotive pop safety valves, Fig. 1, at varying lifts under 200 lb. steam pressure and of corresponding sized inspector valves of the flat-seated and bevel-seated types, Figs. 2 and 3, under 100 and 150 lb. steam pressure. In each case the spring was released by a spindle and the valves were set a definite distance from their seats. In order to avoid unequal expansion, the metal of the valve body and that of the spindle were made the same in the case of the locomotive valves; and the difference in expansion was similarly obviated, as far as possible, in the inspector valves.

Connection was made to the boilers through a 5-in. line and all the discharge was condensed in a surface condenser and weighed.

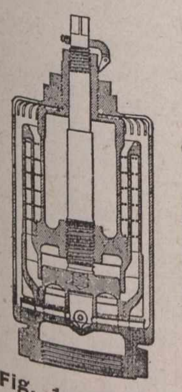


Fig. 1.—Muffled Locomotive Type.

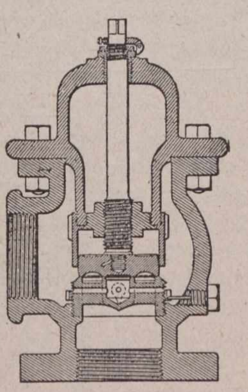


Fig. 2.—Flat-seat Inspector Type.

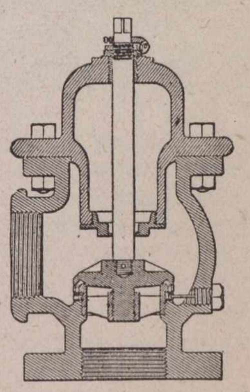


Fig. 3.—Bevel-seat Inspector Type.

The additional lift due to the yielding of the metal because of the presence of steam pressure on the under side of the valve was determined in each case by placing the valve in a testing machine and subjecting it to a load corresponding to the steam pressure, the movement of the valve with relation to its seat being measured by a micrometer caliper.

The results of the tests are plotted in Figs 4 and 5. As a result of these tests the muffled locomotive pop safety valve is now made as shown in Fig. 6.

In an addendum to Prof. Miller's paper, Mr. A. B. Carhart, of the Crosby Steam Gage & Valve Co., makes some general comments regarding pop safety valves. Quoting in part these remarks, he says:

"Pop safety valves were invented about 60 years ago and about 30 years later were perfected in this country and went into general use. Broadly, the invention consists of an addition to the disk of the valve so that when the valve is closed the addition is excluded from the action of the steam. However, when the valve opens the outflowing steam acts upon it and with the initial force causes the valve disk suddenly to rise higher and the spring to be compressed more than it would be with a force due to the steam pressure acting upon the original area only.

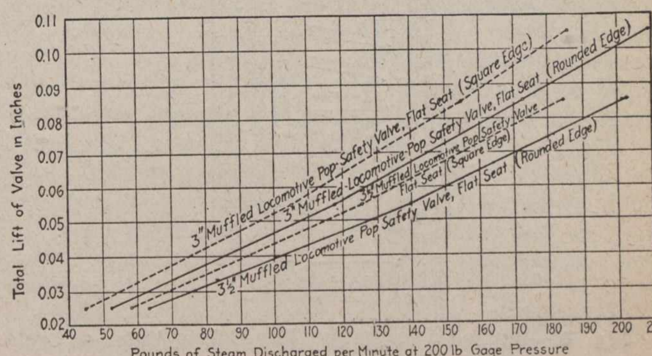


Fig. 4.—Results of Tests on Locomotive Type of Pop Safety Valve.

"The bevel-seated valves (Fig. 3) generally have this additional area at the periphery of the disk, outside of the seat, where it forms a chamber with a more or less contracted outlet at the extreme lip of the valve, through which all the steam must pass after escaping over the seat before it reaches the open air.

"As the seat is formed at an angle of 45 deg. to the vertical, the passage between the seat and the disk faces, when the valve opens, is diagonally upward, and what is called the lip of the valve is so related to this seat that the

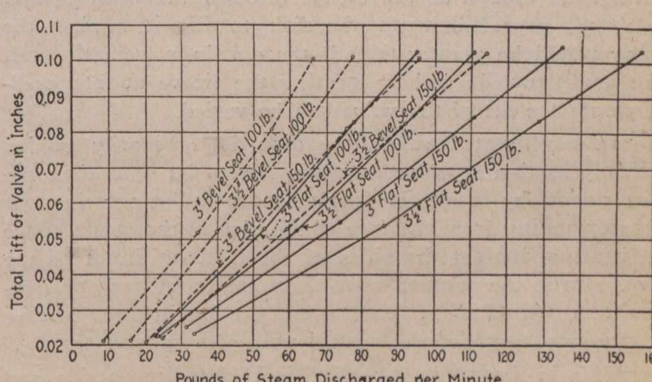


Fig. 5.—Results of Tests on Inspector Type of Pop Safety Valve.

steam is forced to impinge directly upon it before being deflected downward toward the bottom of the chamber where it reacts. The effect of the impact upon the lip of the valve is increased by the expansive force of the steam acting in the lip chamber on account of the partial and momentary confinement before it passes into the open air. Sometimes openings are made through the lip or in the floor of the chamber, through which the steam escapes and so reduces the pressure within the lip chamber that the valve disk will not lift too high.

"Annular valves have the additional area located at the centre of the disk and within the outer seat. This area is excluded from the action of the steam when the valve is closed, by means of an inner seat, but is acted upon directly by the steam when the valve opens. The disk is simply a flat cover for the valve base and has two concentric seats

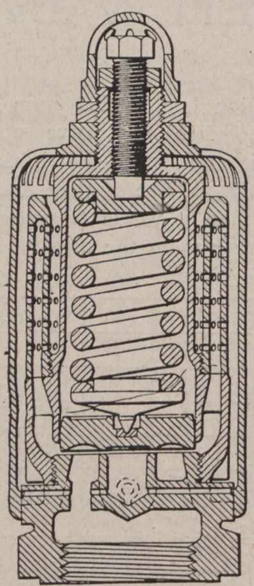


Fig. 6.—Muffled Locomotive Pop Safety Valve as Now Made.

in the same horizontal plane. The central area of the disk, which is not exposed to the steam when the valve is closed, covers a well which communicates to the outer air through four hollow arms radiating from it out through the sides of the valve body.

"When the valve opens, the steam is discharged directly across the outer flat seat, and there is also a separate additional flow over the inner seat into the central well and out through the four hollow arms. The openings through these arms are controlled by a sleeve, threaded on the valve body, so that it may be turned upward or downward as desired. If it should close the open ends of the hollow arms, preventing the escape of the steam through the central well, the reactionary effect upon the disk to lift it against the spring would be greater than if the openings from the well were unobstructed; and by locating the sleeve at intermediate points the lift of the valve can be varied.

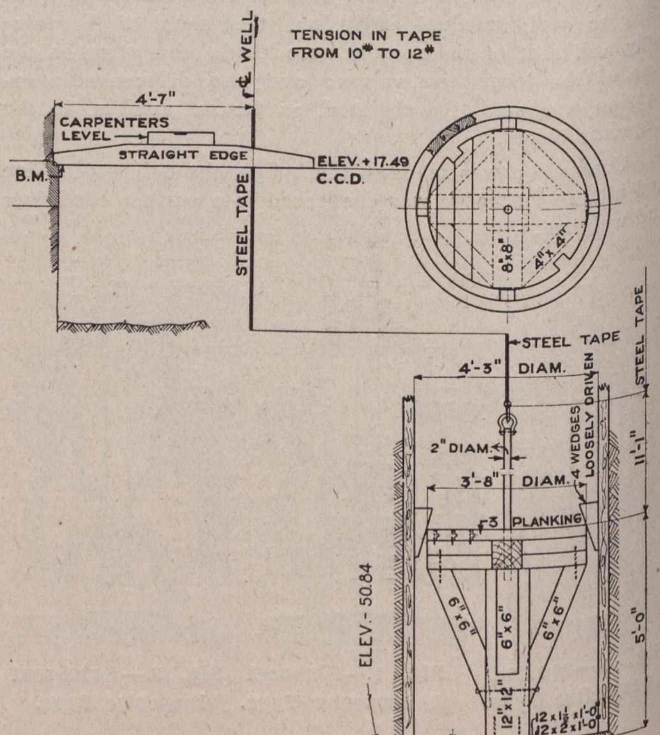
"In bevel seated valves the disk is ordinarily guided vertically so that it will return properly to its seat when the valve closes, by means of four or more radiating wings or vanes extending from the face of the disk in the steam space and bearing against the sides of the inlet or throat of the valve. But in the annular valve there are no guides or wings attached to the disk, which is simply a flat member having the truncated form of the central zone of a sphere.

"This is placed in a cylindrical chamber outside and above the steam space, and there it lifts or moves freely as acted upon by the steam against its lower face and by the opposed spring which presses upon it at its centre. The contact between the chamber and the spherical part of the disk is the least possible, which permits universal movement of the disk without possibility of cocking or sticking, and yet insures that the disk will return accurately upon its seats when the valve closes."

TESTS ON HARDPAN.

Hardpan and rock underlie the clay bed on which a large portion of the city of Chicago is located. Deep building foundations generally are carried down to one of these materials, the standard construction being wood curbed circular wells excavated down through the clay bed and filled with concrete. No tests are recorded as having been made on the bearing power of Chicago hardpan, despite its frequent use as a foundation bed, until the construction of the Cook County Hospital was undertaken. The following is an abstract of discussion before the Western Society of Engineers, by Mr. Frank A. Randall, chief engineer for Morey, Newgard & Co., who are engineers for the work.

The preliminary borings were made 6 ins. in diameter for about 30 ft. in depth and 3 ins. for the balance of the depth. These borings show below yellow clay a thick stratum of "soft sticky clay" down to about 37 ft. below ground level, with solid blue clay running into "hard clay and gravel" down to hardpan at an average of about 47 ft. below ground at the south end and 56 ft. below ground level under the main building. The main building is about 550 ft. long by 70 ft. deep, and has four pavilions, 40 ft. by 200 ft., projecting from the rear. The ground area covers



Details of Apparatus.

about 75,000 sq. ft. Rock was shown according to borings at elevations —67 and —89.5 in two cases, but the latter figure was assumed to be the more reliable. Because of the great difference in cost between caissons to hardpan and to rock and the size of the loads to be carried, it was decided to use hardpan caissons, provided the test showed a satisfactory layer of hardpan, with rock in the same relative location as in the preliminary borings. Bids were received also for pile foundations, but as the prices for these amounted to some $13,000 more than those for caissons, the latter were used. The caissons tested were carried on down after the test to determine the thickness of the hardpan stratum and the depth to rock. The hardpan was found to be from 15 to 20 ft. in depth, with hard clay and gravel beneath, and rock was found at elevation —90, below ground level.

The test was made in caisson No. 163, which was 4 ft. 3 ins. in diameter and 64.7 ft. below ground level, or at an elevation of —51.17 ft., Chicago City Datum.

The apparatus consisted of a loading platform, extra bearing plate, wedges, 12-ft. rod, steel tape, straight edge, carpenter's level, platform scale, 13 tons of pig iron and tripod with drum for raising and lowering pig iron. The apparatus as used is shown on the screen.

The timber loading platform consisted of a central post 12 x 12 ins., with two 8 x 8 pieces crosswise at the top and covered with 3-in. planking. The post was shod with a steel plate 12 x 12 square by 1½ ins. thick. The extra bearing plate was a steel plate 12 x 12 x 2 ins., and was used beneath the loading platform, resting directly on the hardpan. Four wedges were used to steady the platform, loosely placed, as shown in the sketch. (See Figure.)

The steel rod, 2 ins. in diameter and about 12 ft. long, sat in a babbitted hole, 14 ins. deep, in centre of the platform. To the upper end of this rod the steel tape was attached. The rod projected up through the pig iron and thus permitted the tape to be unfastened while pig iron was being lowered into well. The tape was an ordinary steel tape, graduated to feet and inches.

The straight edge was as shown in detail and was found perfect when tested by reversal of the carpenter's level, which latter was of more than ordinary sensitiveness and accuracy. The platform scale was obtained from the hospital and was found correct by checking same against known weights. Thirteen tons of pig iron was on hand, but only about twelve tons of this was used, this amount being considered sufficient by all concerned. The tripod was of ordinary construction, such as was used on the work for excavating and filling wells.

Water had been standing in the well for several days and this water was removed Friday morning, on Jan. 26th. It is also necessary to deepen well between 2 and 3 ft. in order to remove earth which had been softened by the standing water.

As soon as this was done a hole 4 ins. deep and about 18 ins. square was dug in the centre of the bottom of the well and the bottom carefully cleaned and leveled. The extra bearing plate was then set, leveled and centred in this hole. It had been intended to enclose the central hole in a wooden box of four sides, to be backed up with concrete and clay to keep all water out of hole, but water sprinkled in from above directly into hole, so this had to be abandoned.

At 5.30 p.m. (Friday) a start was made at lowering the platform, but due to the fact that the platform had to be rotated so that notches would clear lugs in rings of lagging, the platform was not in place until 7.25 p.m. Platform was raised and dropped several times onto bearing plate in order to force out as much as possible of the earth which had sloughed off into hole.

Loading of pig iron onto platform was begun at 8.40 p.m. Pig iron was weighed out in batches averaging about 600 lbs. as fast as lowered and placed. The pigs were of varying size and were placed in layers of stretchers and headers radiating toward centre and bonded together in addition by small pieces of wood as deemed necessary. No pig iron was placed closer than 1½ ins. of the lagging, the pile when completed being about 4 ft. in diameter and a little over 12 ft. high.

Five readings were taken at intervals, the method being as follows: A permanent bench mark was established upon water table of present hospital building, within 4 ft. 7 ins. of the centre of well. Elevation of B. M. = + 17.49 C. C. D. This was leveled across from the B. M. to the tape by means of straight edge and read tape to the nearest 1/16 in.

The readings taken were as shown in the following table:—

Time.	Load.	Reading Ft.	Ins.
Jan. 27—			
12.15 a.m.	4,079	52	4½
6.30 a.m.	10,887	52	4 15/16
9.35 a.m.	17,362	52	4 15/16
12.00 a.m.	23.189	52	4 15/16
Jan. 28—			
9.00 a.m.	24,189	52	5⅛

The well tested was a very wet one, due to the fact that two sewers, 6 and 9 ins. in diameter, were cut into in sinking. This well was the wettest one encountered. From about 12 ft. to 14 ft. of water stood in the well during test.

When the platform and bearing plate were removed it was noted that ⅛ in. of compressed earth adhered to top of loose bearing plate.

The caissons were designed for 44,000 lbs. per square foot at top of caisson and were belled twice the diameter of the shaft. Considering hardpan at 60 ft. below the surface, the unit designing load on the latter is about 13,300 lbs. per square foot, or about one-half of the test load. The test load was applied to 1 sq. ft., while the area of the well was about 16 sq. ft. It is not known how much bearing value of the hardpan is increased when the caisson is completed and the well completely filled, but it must be a very material increase. The results indicate that the hardpan stratum will carry the load designed for with safety. Doubtless a portion of the settlement was due to the compression of the loose soil which sloughed in as platform was being lowered.

The test was conducted by Morey, Newgard & Co., under the personal supervision of the author. The W. J. Newman Company, contractors for the caissons, supplied labor and material. The total cost of the test was $400.

GROUND WATERS.

Underneath the surface of the earth is a vast body of water which may be likened to an underground lake, called the ground-water. It is into the upper surface, frequently termed the water-table, of this ground-water that wells are sunk for domestic and other water supply. In "The Water Powers of Canada," issued by the Commissioner of Conservation, it has been estimated that, if all the moisture resident in the upper 100 feet of the ground were collected, the amount would be the equivalent of a lake of water some 17 feet deep; that is, the equivalent of about seven years' rainfall. During periods of plant growth this ground-water yields, chiefly by capillary action, part of its moisture to the plants; and then, during seasons of excessive rainfall, is again replenished from the rainfall. The annual fluctuation in level of the ground water-table under normal conditions is but a few inches.

The underground waters of Canada, in some places, are now being tapped and wasted. State after State, in the United States, has enacted laws designed to conserve the underground waters.

BRITISH ENGINEERS ARRIVE.

The engineering party, under the direction of Mr. Henry W. Crees, of London, Eng., arrived in Montreal on Saturday, April 27th last, by the Canadian Northern liner Royal George.

CONCRETE FENCE POSTS.*

By L. J. Hotchkiss.†

A paper on this subject should include a description of the more important types of posts so far developed and a discussion of their merits. It has not been possible, however, in the time available to get together the information for such a paper. I shall, therefore, confine myself to the one post with which we have had experience on the Burlington Railroad.

The machine was set up in 1911 and a small number of posts, about 6,000, were made. It has now been put in operation for this season's work, but has been running only a few weeks.

In going into a new proposition of this kind there are always some delays in getting the plant organized and operating smoothly. We have had the usual amount of trouble along this line and have not yet been able to determine how cheaply we can make posts.

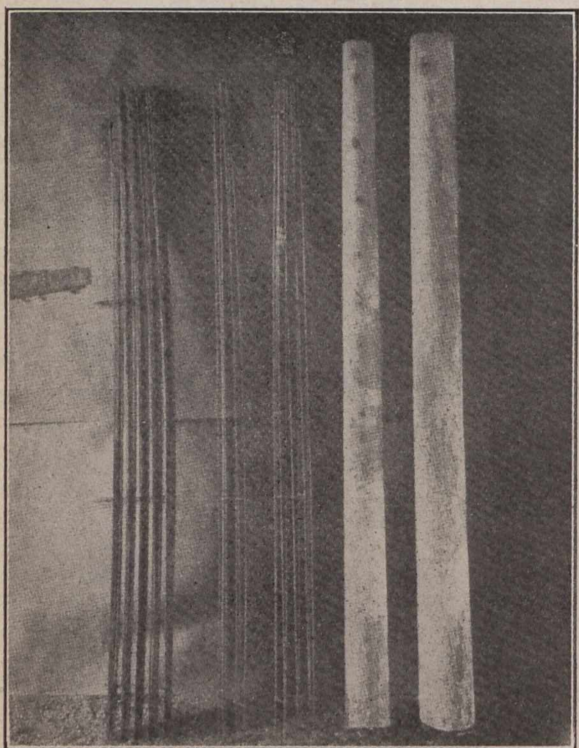


Fig. 1.

With the plant as now arranged, the machinery is all enclosed in a frame building 28 feet by 94 feet. The concrete materials are brought into the house at the rear of the post machine and storage room is provided in the house for a considerable quantity of material so that it may be warmed for use in cold weather. The drawing shows piles of stone chips and sand. The chips, or screenings, were tried experimentally because they could be obtained at practically no cost. They were not satisfactory, however, as the concrete seemed to lack strength and the posts were not smooth. A mixture of sand and screenings was tried, with somewhat better results.

A supply of small gravel containing a large proportion of sand was then obtained and this material is superior in every way to the others mentioned. It can be obtained in any desired quantity and at a moderate price, and will undoubtedly form the standard material for this work.

As the posts are taken out of the machine they are placed on a push car standing on the track shown at the upper part of the drawing. In cold weather they are stored in the house for a few days before being taken out of doors. In warm weather they are stored indoors or out, as may be most convenient. They are removed from the moulds a day or two after being made and stored against the heavy timber racks until ready for shipment or until they are strong enough to be corded up in piles. For a week after being removed from the moulds they are thoroughly wet down once a day and in summer protected from the sun by tarpaulins.

In the rear of the post machine is the measuring machine, consisting of two hoppers for gravel and cement. A small conveyor operates in the bottom of the hoppers and dumps the materials in proper proportions into a boot. Here it is picked up by a bucket elevator and taken to the mixer at the top of the machine.

The mixer is a large shallow bowl with a concave bottom. A number of paddles rotate in this bowl and mix the concrete, water being sprayed on it from a perforated pipe. In the bottom of the mixer is a hole which is closed by a form of gate valve, and through which concrete is discharged into the moulds below.

Under the mixer is a turntable arrangement which holds four moulds at a time. There is also a jolting device so arranged that as each mould is being filled it is alternately raised and dropped through a distance of perhaps an inch. This tamps the concrete effectually and insures a smooth finish.

Two forms of reinforcement are used. The one which was used last year is made from sheets of No. 24 or No. 26 black iron. The sheets are passed through a machine which cuts out half the reinforcement for a post at each pass. At the same time long slits are cut in the iron and the edges of the slits turned up. Two strips of this material are inserted in the mould to form the reinforcement for one post.

It has not been altogether satisfactory, however. If the concrete material is a bit too coarse it does not run through the slits readily and the posts are not well filled out. The reinforcement also has a tendency to get out of place during filling and is occasionally found to be near the centre of the post instead of at the outside.

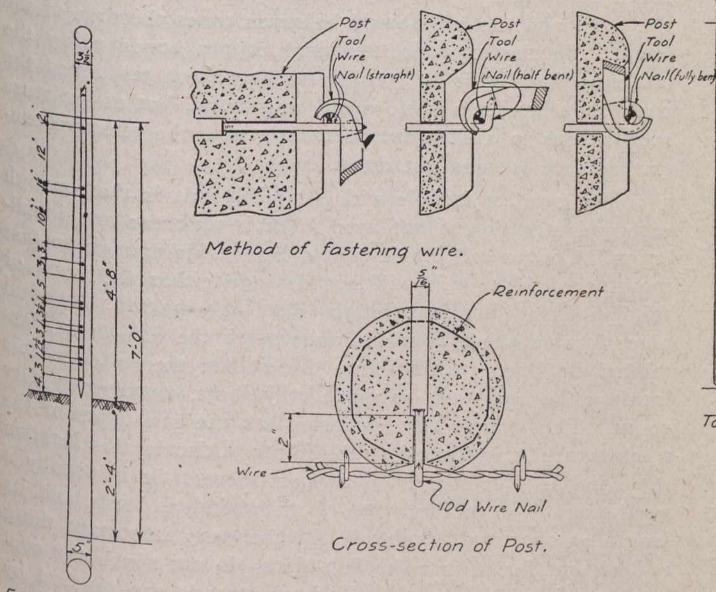
Fig. 1 shows an improved style of reinforcement now coming into use. It is made entirely of wire, each wire being crimped to insure a bond with the concrete. The material is shipped knocked down, as shown at the left of the photograph, and is quickly made up into the cages shown at the centre. The wires may be of such size as needed to give the required strength and the concrete flows around it without obstruction.

Fig. 2 illustrates the post and also the method of fastening the wires to the posts. By reference to the cross sections it will be seen that there is a groove in one side of the post and that the holes through the posts are offset, being smaller on the grooved side of the post. These holes are of such a size that a ten-penny nail can be pushed through them until the head brings up against the offset. The fence wire is then placed on top of the projecting end of the nail and the latter bent up around the wire until its point is curled back into the groove, thus holding the wire tight against the post. This work is done with a small tool which is shown in successive positions in the upper part of the drawing. This is a very cheap and effective fastening. One difficulty has developed in connection with it, however.

* A paper before the Eighth Convention of the National Association of Cement Users.

† Assistant bridge engineer, C. B. & Q. Railroad, Chicago.

The pins with which the holes through the post are made are necessarily all alike. The post is tapered. As a result the small part of the hole through which the shank of the nail passes is longer nearer the bottom of the post than at the top. Consequently the nails at the top stick out too far and when bent around the fence wire the points strike the bottom of the groove and make it difficult to pull the



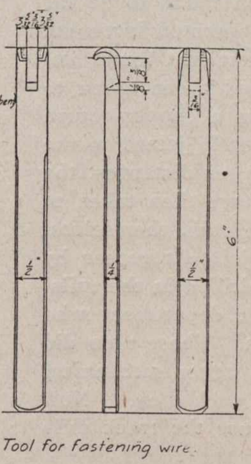


Fig. 2.

wire up close to the post. A tapered strip is now attached to the outside of the mould under the heads of the pins. It is of such a thickness that the offset in the holes is a uniform distance from the grooved side of the post and all nails project the correct distance to insure proper fastening of the wire.

Another method of fastening the wires is shown in Fig. 3. It will be seen that the hole through the post is of uniform diameter and a piece of wire with one end doubled

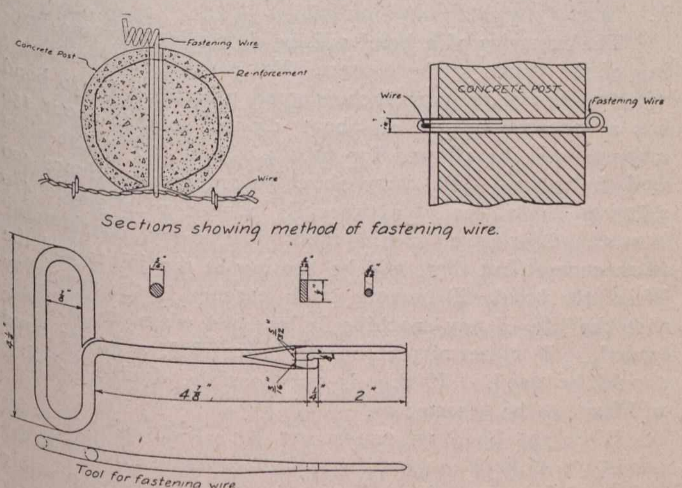


Fig. 3.

back is substituted for the nail. The other end of the wire projects at the back of the post, and by means of the tool shown this is twisted up into a corkscrew. The fastening has not yet been tried out in practice, but its use on an experimental post seems to indicate that it is simple and efficient. It was designed for use with a round post having no groove. As our moulds are all grooved, we expect to use it with this type of post.

The annual consumption of cedar posts on a large railroad runs into hundreds of thousands. Rot and grass fires eat them up, unruly steers break them off and the ever-present hobo finds them good fuel for his campfire, provided he can get them without too much labor. None of these agencies except the steer have any effect upon concrete posts and there is a large field for their use. They must be produced cheaply and in large quantities, however, and must be strong enough to stand rough handling as well as to resist the forces which come upon them in service.

The machine we are using will turn out 400 posts per ten-hour day. As previously stated, we do not yet know how low the cost can be gotten, but we are satisfied it can be made such that they will compete with cedar posts.

It must not be expected that a concrete post will stand the degree of rough handling which can be given a wooden post. It is easy enough to make them strong enough to withstand the loads which come upon them in a fence and they are in no sense fragile. But some degree of care must be used in handling them or cracked posts will result.

If they are used with the same degree of care and intelligence required in any other form of permanent construction it is very certain that most satisfactory results may be obtained.

TRACK ELEVATION AT MONTREAL.

Montreal is still awaiting an arrangement with the Grand Trunk Railway regarding the elevation of the company's tracks. It is now at least three or four years since the matter was taken up seriously, it having been in the realms of discussion for years previous to that. Some few years ago, however, the company and the city got as far forward as to discuss plans. Plans were even drawn up, and, if not actually approved of, were at least given favorable consideration. At the present time, the railway passes into the city from the west on a surface track, the crossings being very numerous, and being on a level with the street. The track coming up from the south crosses the Victoria Bridge and joins the track entering the city from the west. The work of elevating the tracks will naturally be very costly, and this may, to a considerable extent, explain the many years' delay which has taken place in carrying out the work to completion.

The whole subject was to have been taken up at the last meeting of the Railway Commission, held here a few days ago. The city had previously consented to contribute $2,000,000 towards the work, and it was generally thought that the railway regarded this as sufficient. In fact, it was generally understood to be the sum originally asked by the railway. Now, however, the Grand Trunk expresses its dissatisfaction at the amount, the work being much more costly than previously supposed. The public do not quite understand why the city should pay anything towards elevating railway tracks, but the principle seems to have been accepted by the city council. The Commission will deal with the matter at its next meeting.

INVESTIGATION AND CARE OF RETURN RAILWAY CIRCUITS.*

By E. E. Nelson.

In the early days of electric railroading it was supposed that the earth had zero resistance on account of its area being practically infinity. This was soon found to be far from the truth. As the number of cars operated increased the drop in voltage become so large that it was found impossible to move the cars, and means had to be taken to help out the earth return. In some cases a copper return was laid in between the tracks and frequently joined to the rails. But with the heavier loads and greater distances, the cost of this becamt prohibitive. Means were then taken to utilize the great carrying capacity of the rails themselves. This was done by bonding the rail joints together by means of copper wire fastened into holes drilled in the rails. This work was usually left to the track department who assigned it to the cheapest paid workmen. These men did the best they knew how, but it was a better mechanical than electrical job which was put out by such men. Now it is intended by all electric railways to use the track rails for the return of current from the cars to the power house. But on account of the rails being in close contact with the ground such railways use both the rail, ground, and material buried in the ground for their return circuits.

When a steam engine, electric generator, motor, or similar machinery breaks down, the electric railroad manager is notified in a very forcible manner, but when his rail bonds are in poor or only fairly good condition, there is no startling notification. Perhaps he notices that the power at the cars is usually weak and he notifies his power house that they are not holding up the voltage. Or he jumps to the conclusion that his feeder capacity is too small a section, and on the spur of the moment strings in additional feeders without any great benefit. Or possibly he may notice at the end of the month or year that the kilowatt-hour per car-mile on his road is much larger than that expended by his associates. To remedy this he may get after his transportation superintendent and tell him that the motormen are very wasteful with the power. All these troubles in addition to many more that might be mentioned are likely to be caused by poor track bonding.

It is realized by practically all railway managers to-day that unless extreme care is taken with the return circuits the losses in these circuits will become enormous; even enough to make the difference between a road paying and not paying dividends.

Rail steel is a very good conductor. Weight for weight it is about one-seventh as good a conductor as copper. A copper wire bar weighing 1 lb. per yard has an area of about 110,000 cir. mils, hence an iron bar weighing one pound per yard is equivalent to about 16,000 cir. mils copper. The resistance of 16,000 cir. mils copper is approximately 0.6 ohm per 1,000 feet. Therefore, the resistance of a steel rail in ohms per thousand feet is equal to 0.6 divided by the weight of the rail in pounds per yard, and the carrying capacity of the steel rail in circular mil copper equivalent is equal to 16,000 multiplied by the weight of the rail in pounds per yard. Seventy pound rail, which is the size commonly used in street railway work, therefore, has a carrying capacity equal to 1,120,000 cir. mils copper. In order to use this great copper equivalent carry capacity, it is only necessary to bond the rails themselves electrically together. This is now usually done by the following types of rail bonds: expanded terminal copper bonds; soldered, brazed or welded copper bonds; amalgam bonds; and by means of welding the rail joints themselves together by either a cast, electric or thermit weld.

A rail bond has its greatest resistance where it comes into contact with the rail. If the steel has a resistance of seven times that of copper, the area of the contact between the bond and the rail should be seven times the area of the bond. In the expanded terminal copper bonds using the ordinary T-rails, it is possible to get about ten times the contact surface of a 250,000 cir. mils bond, but as moisture soon creeps in and corrosion takes place, the effective contact surface is soon cut down.

The greatest trouble with all rail bonds is that enough care and attention is not used in their purchase and installation. Copper rail bonds should be flexible enough so that movement of the rail will not damage either the bond or the contact surface between the bond and the rail. An ideal place for installing bonds is underneath the fish-plates, fastening the bond terminal into the web of the rail. In this location the bond can be made very short, usually not over 10 in. The shorter the bond the less the resistance of the track return is increased at the joints. Also in this location the bond is protected from copper thieves. It is usually a good plan to keep the area of the bond as large and its length as short as possible. Another very important thing to look out for is that the fish-plates do not pinch the copper strands of the bond. If these strands are pinched by fish-plates, the expansion and contraction of the rail due to changes in temperature will soon cause some of the strands of the bond to break in two, and the carrying capacity of the bond is by this means considerably lessened. Some roads use two bonds on the same joints in order to insure a path of good conductivity in case of failure of a single bond. Where double bonding is not required to keep the heating of the joints down, this practice is not recommended. One of the two bonds is very likely to have imperfect contact and the road has the service of only single bonding at the expense of double bonding, so that it is better practice to install a single bond of sufficient capacity and to maintain it.

The capacity of a bond will be determined by the heating of the bonds at the contact. For contact surfaces about 100 amperes per square inch is good practice. A 4/0 bond has a contact surface of about 1.5 in., so that about 150 amperes may be allowed for each 4/0 bond. The fish-plate well bolted up will carry about 50 amperes. Hence 400 amperes is a load for two rails bonded with single 4/0 bonds. Of course, such a track will carry considerably more current but there will be heating at the joints and the life of the bond will be very much lessened in the same way that the life of any machine is lessened when it is overloaded. If more current has to be carried, a larger bond should be used. If this is not possible, double bonding will have to be resorted to.

When the bonding supervisor is called upon to order bonds for a piece of new track, he frequently finds that the rails and fish-plates have already been ordered and possibly are on the ground. The fish-plates selected have frequently no provision made for a bond placed underneath them on the web of the rail, so that he is forced in ordering bonds to use bonds of an undesirable type. Fish-plates ordered for an electric railroad should have as large a space as possible between the plates and the web of the rail. Extreme care should be used in selecting bonds to see that the strands of the bonds are not pinched by the fish-plates. For this purpose full information should be given the bond manufacturers of the size of the rail, fish-plate and bolt

* A paper read at the seventh annual convention of the Southwestern Electrical and Gas Association, Houston, Texas.

spaces. This is best furnished by means of blue-prints of the rail sections, and fish-plates used. These blue prints can easily be obtained from the rail joint manufacturers.

Too much care cannot be taken in the way in which bonds are put on. In drilling the holes in the rail, oil under no circumstances should be used, because it is impossible to wipe all of this oil out of the hole, and a thin film will be left in, which will cause a high resistance contact, which in turn will cause heating. In a short time the increase in the resistance of the bond will be so much that electrically the bond is of no use whatsoever. The writer has not found any trouble in having holes bored dry, but if some sort of a lubricant is demanded sal soda and water is recommended. After such use, however, the hole should immediately after it is drilled be very carefully wiped out with a clean rag. Without any delay the bond should be installed so that the contact will not be damaged by rust. Before installing the bonds, the bond contact terminals should be polished with emery cloth. When using a screw compressor a very small amount of flake graphite mixed with oil placed in the punch hole on the bond head will prevent the compressor plunger from cutting the bond and will enable the compressor screw to be turned up much more readily. Care should be used, however, that none of this graphite and oil is gotten on the contact surface. The writer has found that the wrenches furnished by the makers for screw bond compressors do not have enough leverage power. It is his custom when a new screw compressor is received to have the length of the wrench increased to five feet. He also instructs the compressor man by all means, if possible, to break the compressor by turning up on the wrench when compressing bonds in the rails.

Care should be used in sharpening the drill bits used for boring bond holes, as a drill bit not properly ground will drill a hole considerably larger than it is supposed to. For this reason bonds expanded by means of driving a steel pin into the centre of the bond head are, in the writer's judgment, very undesirable. These steel pins do not allow for various sizes of holes drilled with different bits. Men to work on the bonding gangs should be selected with great care. Only such men should be used as are able to realize the importance of bonding and are able to be taught how to install them. They should be conscientious enough to do the best they can whether or not the boss is watching them.

Immediately after a bond is installed and it is covered up by the fish-plate, it is impossible to tell whether or not a first-class or only a fair job has been done. Poor workmanship will show up in six months or a year's time. Bonds which extend around the outside of the fish-plates are undesirable, both on account of their great length and their danger from copper thieves. Soldered, brazed, and welded bonds have been used to a considerable extent, but it is very difficult to get them properly installed with the kind of labor usually available. The electric brazed bond, however, is desirable, but its installation necessitates expensive machinery. Amalgam bonds give good results for temporary bonding, but do not last for any great length of time. Welded joints can only be used in paved streets where the rail is buried. This prevents sudden changes in temperature, and also prevents buckling due to expansion. This type of joint is to be recommended where the full carrying capacity of the rail is required and the tracks are buried in paved streets.

Railroad crossings and all track special work should be bonded by means of copper cable extending around them, unless the crossings and special work are of the solid weld type. The carrying capacity of this cable should be the same as the rail itself, as on a bolted up crossing or special work very little dependence can be placed upon the rails themselves carrying any current. If desired, old rails, well bonded into the tracks on each side of such special work, can be used to good advantage for special bonds. On all track, attention should be paid to having the fish-plate bolts well tightened up, for, if the joints are loose mechanically, the bonds will soon be damaged so that they are of no practical use.

If there is a great deal of current leakage from the rail to the ground, it will be found that the base of the rail will wear out, due to corrosion, much faster than the ball. In fact, if this leakage is too much, the base of the rail will be damaged in a short time so that it cannot be spiked to ties. Salts will increase this corrosive effect. It has been found that ties treated by the chloride of zinc process in order to prevent the ties from decaying, will, when used under rails carrying electric current of 100 to 200 amperes, cause the base of the rail to be eaten away in three years' time, so that the rails are practically useless. This happened under the writer's observation on tracks that were both well and poorly bonded. The poorly bonded track corroded much faster than the well bonded track.

An idea of how much current sometimes leaks from an electric railway track, is given by an observation of the amount of current given up to a power house negative bus by means of a 500,000 cir. mils cable connected to telephone lead sheathed cables about 4,000 feet away from the power house. The output of the station at the time was 1,500 amperes. It was found that 350 amperes of the return was being picked up on the telephone lead sheathed cables buried in an underground conduit, and was returned through the 500,000 cir. mils ground wire, thus amounting to over 20 per cent. of the current return.

In investigating railway circuits, it is well to keep graphical records of the power house output, and also to place graphical recording meters at various places on the system between the rails and water pipes. From these records values can be gotten of the power house output and at exactly the same time the leakage from the rail to the ground can be obtained. All of these values can be placed on a map and different values of the leakage for different outputs of the station and different shiftings of the location of the load on the system can be studied. Thus a good idea of what is necessary to do in order to cut down leakage to a minimum from the track to the ground can be decided upon. At any rate, the track bonding should be kept in first-class condition. For this purpose the bonding should be carefully done in the first place and once a year all rail bonds should be tested by reliable men. All defective bonds should be repaired. It is common practice to compare the resistance of a rail joint with the resistance of a length of the same kind of rail. That is, the resistance of the joint would be said to equal two, three, or four feet of rail, as the case might be. There are various bond testers on the market which will give this reading direct. Most of them rely on the current in the rail itself, or that there is no current flowing to give any tester which will show conclusively whether or not there is any current in the rail. Sometimes it is hard to tell whether the joint in question has as good carrying capacity as the rail itself, or that there is no current flowing to give any readings. Joints on seventy pound rail bonded with 4/0 bonds which show a resistance of five feet of rail, are only fairly good. Those joints which go over ten feet are bad. A 4/0 bond in 70-lb. rail will, if it is in first-class condition, usually show a resistance of from one to two feet of rail.

Before deciding upon the supplementing of track returns by means of auxiliary return feeders, it is well to make some test of the exact resistance of the track return, and of the overhead resistances. This can be done by means of a water rheostat load placed at night upon the system, after the cars are all in. Ammeter and voltmeter readings should be taken using, perhaps, a telephone line, or, if the system is sectionalized, one of the unused sections, as a voltmeter lead back to the station. The resistance of the overhead and ground return can then be calculated by ohm's law. Assuming that the track bonding is in first-class condition, then, if any more feeder is to be run, this feeder, for the best economy, should be used as a ground return, if the return resistance is the largest; and for a trolley wire feeder if the overhead resistance is the largest. Although in general it is necessary to keep the resistance of the return considerably less than the resistance of the overhead, in order to minimize leakage and keep the return current confined to its legitimate conductors which consist of the rails and ground feeders.

To sum up, it can be stated that satisfactory return circuits are only possible with first-class track bonding. Poor bonding workmen will spoil the best bond ever made. Care should be used in the purchase of track bonds, and the greatest care should be used in their installation. Periodically, thoroughly reliable men should test and repair all bonding.

TRACK FOUNDATIONS UNDER PAVEMENTS.

The selection of the type of track foundation under city streets which will give the best service at a minimum expenditure is a problem which confronts engineers when they prepare for the reconstruction of existing lines or for new extensions. In a recent issue of the Electric Railway Journal this subject was commented upon editorially, and the remarks there made are worth attention. There appears to be a general tendency to use concrete almost exclusively for this purpose. Careful investigations made recently on the surface railways in Chicago, however, have shown that similar results may be obtained by using a compactly-rolled or tamped crushed stone or gravel. A study of the advantages and disadvantages of both types affords a comparison that is instructive.

When concrete is employed as a track foundation the accepted practice has been to make the depth 6 in. under the ties. On new work little difficulty is experienced in obtaining first-class concrete foundations; the track is laid and blocked to a proper elevation, and the concrete foundation deposited in place and allowed to set perfectly before it is necessary to turn traffic over it. In the reconstruction of old track the results are not so satisfactory unless it is possible to route traffic around the piece of newly-laid track; in fact in many cases the foundations are not permitted to set sufficiently before cars are operated.

Investigations as to the proper length of time to allow for the setting of concrete foundations have shown that it should be not less than ten days, and experience on the Chicago railways has extended it to fourteen days. In many cases the failure to allow sufficient time has resulted in crushing the green concrete, causing the track to become badly out of line and surface. It has been learned that the best results are obtained by spacing the ties, whether steel or wood, at 3-ft. centres. The general opinion has been that concrete provided additional bearing. It has been found, however, that dependence upon the concrete bearing value has led to increased tie spacing to such an extent as to break down the foundation.

The use of crushed stone or gravel instead of concrete for foundations offers little advantage from the standpoint of initial cost for new work. However, in the reconstruction of old track, the use of one of these materials may be advantageous for several reasons. Although it may be necessary to increase the depth of the foundation 1 in. or 2 in., the cost of the material in place is lower, and the setting time is eliminated. In fact, the best results are obtained if traffic is turned over the track immediately after it is raised to the finished elevation. This reveals the weak points and permits retamping before the paving is laid.

The fact that ties must be spaced at closer intervals on crushed stone than on a concrete foundation has influenced the popularity of the latter type. The result of the tests on the Chicago railways shows that spacing should be decreased to 2-ft. intervals for either wood or steel ties. The reduced cost of material and labor with crushed stone as compared with concrete, however, more than offsets the increased cost of ties. As to the relative life of the tie in crushed stone or in concrete foundations, experience has shown that there is practically no difference. A factor which does not appear to receive proper weight is the reduced maintenance cost resulting from the use of crushed stone.

While the use of concrete is absolutely necessary in some instances, particularly where the subsoil is composed of quicksand or boggy material, these cases are special. Where the subsoil has good bearing qualities, crushed stone may be used so as to secure increased flexibility and decreased maintenance cost. Another point for consideration is the result of increased rigidity where that exists in track construction. The more rigid construction is believed to increase rail corrugations, and, therefore, to decrease the life of the rail. The cost of rail-grinding is also a factor.

During the reconstruction of old track, the problem of routing cars is a serious one, especially during rush hours, on many railways. As it is essential to a good concrete foundation to keep the track affected out of service for at least ten days, the cost and inconvenience of the delays experienced in routing traffic around new work should be considered.

Since the cost of material and labor in the construction of a concrete foundation is about the same as for crushed stone and the life of both types is about the same, provided equal diligence is employed during the construction period, the matter should be considered from the standpoint of operating cost. The increased facility for making repairs and the probable reduction of rail corrugations, which affect the cost of maintaining the equipment if they are serious, are worthy of thought When the question of foundation is not governed by the bearing quality of the subgrade, it appears that crushed rock or gravel has many advantages under the conditions prevailing in Chicago.

TEST OF MARINE THERMOMETER.

The Minister of Marine will afford Prof. H. T. Barnes, of McGill University an opportunity to make a practical test of his micro-thermometer, the instrument devised by the professor to give warning of the presence of icebergs at sea. A test of the apparatus was made in the Gulf of St. Lawrence by the steamer Stanley in 1910.

The Minister's intention now is to give it a further and more extensive trial. To this end the Government ice-breaking steamer Montcalm will be commissioned to cruise during the month of June next in the waters of Belle Isle and between that point and the entrance of Hudson Straits, equipped with the micro-thermometer. Every precaution will be taken to give the instrument a thorough trial. Should it prove efficacious in indicating, at any considerable distance from the ship, the existence of ice in quantity, doubtless the micro-thermometer will be adopted as a standard adjunct to modern equipment designed to assure the safety of ships at sea.

AN EFFICIENT METHOD OF HANDLING CONCRETE FOR STREET PAVING BASES.

The illustration shows the plan view of an installation used in laying the concrete street bases in Portland, Oregon. This installation embodied several novel features, and resulted in a great saving, both in time and money, over the ordinary methods of handling concrete in this kind of work. The raw material was piled on a cross street back of the mixer, and a drag bucket was used to haul the sand, gravel, and cement to the mixer.

On the streets where there were no railway tracks, Koppel portable track was laid down the centre of the street, a Y switch leading to the mixer, as shown in the drawing. A turntable was placed at the end of the track, and from the turntable short sections of portable track were laid at right angles to the length of the street, and reached to the curb line.

The mixer unloaded directly into Koppel steel dump cars, and the cars were then run down the track to the right or left, and the concrete deposited just where it was needed, requiring very little shoveling. In this way a section of the street base was laid clear across the street, after which the turntable and cross tracks were moved six or seven feet back toward the mixer by merely removing a section of the portable track.

On the streets where there were double railway tracks two different methods were employed in carrying on the work. In both of these methods the mixer, materials and Y switch were placed as in the method just described.

On some of the streets the portable track was laid the length of the street between the two railway tracks. This method allowed the concrete to be dumped to either side of the portable track, thus filling in the space between the railway tracks. At the end of the portable track a turntable was placed, from which a section of portable track ran to one curb. This left one of the railway tracks clear, while on the other, when a car came along, the cross section of portable track was very easily lifted up and replaced after the car had passed. The turntable and portable track were blocked up just enough to permit the cross track to be laid on top of the street railway rails, so no elevated tracks were required. After the one side of the street and the section between the railway tracks was completed, the portable track was removed to the other side of the street and that part of the street completed. Another method employed on streets with double railway tracks was to lay the portable track on one side of the street and fill in that side of the street and one of the railway tracks. The portable track was then moved to the other side of the street, and that side and the other railway track filled in. This left a space between the two railway tracks to be filled in, which was done by using the turntable and a cross section of portable track which was laying either side of the street.

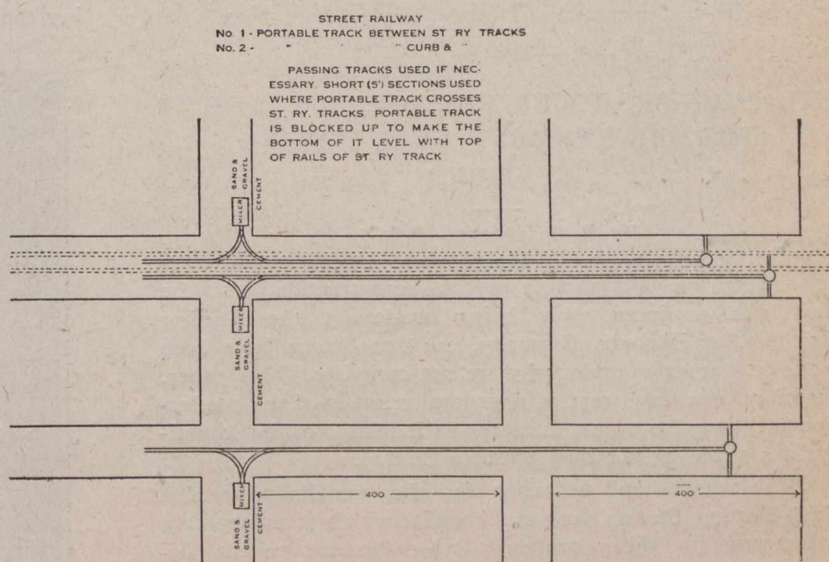
In all three methods employed, the concrete was dumped away from the portable track, and as a section of the base was laid a short section of the portable track was removed and the turntable and cross section of track moved back toward the mixer.

The great advantage of all three methods was that the concrete was placed just where it was needed, and handling the concrete reduced to a minimum.

TESTS OF SHEET PILING.

The last report of the Committee on Wooden Bridges and Trestles, of the American Railway Engineering Association gives some interesting methods for tests on sheet piling.

The procedure suggested for these experiments was that a strong concrete open-top box be made, across the middle of which a vertical plate diaphragm of tempered spring steel could be set; this diaphragm being held in place against horizontal motion at its top and bottom. On both sides of this diaphragm the box would be simultaneously filled with the material to be tested, as sand; thus representing (when the box is full) sheet piling driven in sand.



Plan of Layout for Handling Concrete.

The sand was then to be removed from one side of the diaphragm, as would occur when a trench is excavated protected by sheet piling. After the diaphragm had assumed the curve due to the pressure of the sand its curved shape was to be accurately determined and a closely fitting template made to record its curvature.

In order to determine the amount and distribution of the sand pressure, the diaphragm would then be removed from the box and placed horizontally, supported at its ends at the same points it was supported by when vertical in the box. A number of metal strips should be provided, each long enough to reach across the diaphragm, but of varying thickness to make up any required weight, and of equal width.

These would be piled at equal intervals on the diaphragm until it reaches the exact curve of flexure which was given it by the sand and recorded by the template; bearing in mind that the tops of the successive piles of metal strips must be on a curve of some uniformity (which may be called the curve of load) without such irregular outline as that of a battlement, and carried over the supports on the line indicated by the curve approaching them. The total pressure, and the centre of pressure, would thus be determined, it is thought, with considerable accuracy.

As a check, the flexure curve of the diaphragm already found could be plotted to a convenient scale, and successive differentials taken thereof up to and including the fourth. As the equation of this flexure curve is unknown, the differentiation would be done graphically, remembering that the first differentiation gives the curve of tangents to the flexure curve; the second the curve of moments; the third the curve of shear, and the fourth the curve of load, which should agree with the curve of load determined by the first method—that of weights superimposed on the horizontal plate.

Other materials than sand need testing, such as a heavy semi-fluid mud, and ballast. In each case the angle of repose would be noted of the unretained material, and its weight per cubic foot.

In order to obtain definite conclusions the concrete box and steel diaphragm should be of rather large size; and to prevent the friction of the retained material on the sides of the box from affecting the result materially, narrower steel plates could be placed on each side of the main diaphragm, observations being taken on the main plate only.

The investigation could be extended to determine the pressure on abutments, which are generally filled against gradually on one side only. It seems probable that under such mode of filling, the total pressure would be greater, and its centre lower, than in the case of sheet piling.

THE PEAT PRODUCER GAS POWER PLANT AT THE GOVERNMENT FUEL-TESTING STATION.*

By B. F. Haanel, B.Sc.†

Owing to alterations in the construction of the peat gas producer, now being made by the Körting Brothers, of Hanover, Germany, the tests which have been made and are now under way are not complete. This paper, therefore, can only treat in a general manner of the production of power from peat in so far as it relates to the investigations made at the Fuel Testing Station.

The reasons and necessity for the establishment of a Fuel Testing Station, and the benefits which it is expected will accrue to those provinces which possess no coal deposits and consequently are dependent on foreign sources for their fuel for all purposes, by demonstrating a satisfactory and comparatively cheap method for the production of power from peat, lignite and the cheaper grades of the imported coals, have been many times stated, so that it will be unnecessary to reiterate them here.

While the Fuel Testing Station was originally erected for the purpose of demonstrating a commercial and economical method of generating power by the utilization of peat in a gas producer, the plant has been enlarged sufficiently to include the investigation of lignite and coal in the producer.

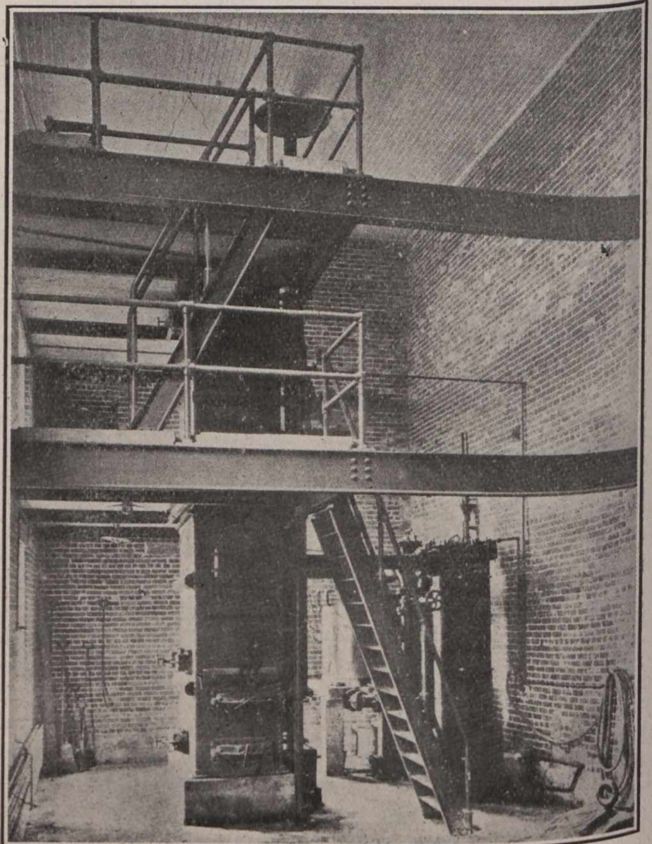
That part of the power plant in which peat is exclusively used consists of a 60 horse power Körting peat gas producer and gas engine with a direct connected 50 kw. direct current generator. The load which it is desired to carry on the engine is regulated by means of a portable resistance stand capable of absorbing the full load of the generator.

The producer gas cleaning apparatus consists of a wet coke scrubber, tar filter and a dry scrubber. The engine is started by means of compressed air, which is supplied by a compressor driven by a 3 h.p.—a.c. motor, which charges into a receiver. A suction fan driven by a 1 h.p.—a.c. motor is provided for starting the producer.

Description of Producer.—The Körting peat gas producer as originally installed, consists of a rectangular steel shell about 15 feet in height from the floor level by about 5 x 3 feet in horizontal section. Near the top, grates are provided on either side. These two entirely independent grates are separated by a space approximately 12 x 12 inches.

Below the grates are chambers into which the ashes drop, and these ash chambers and the grates above are accessible through two doors. About 3 feet above the floor level there is a second grate with two ash pits, one on either side, access to which is provided by two doors as above. Directly above the grates near the top or upper zone, a cast iron chamber is provided. This chamber is connected by means of a water jacketed pipe to a similar chamber beneath the grates near the bottom of the producer. This is called the lower zone. These two chambers are provided with doors for the purpose of cleaning. In addition to the doors just described, there are two doors situated on the back of the produced just over the lower zone grate bars through which the fire can be poked or cleaned.

On top of the producer are two hoppers for feeding fuel to the two grates of the upper zone. The doors covering the ash pits of the upper and lower zones are provided



60 Horse Power Körting Peat Gas Producer at Government Fuel Testing Station, Ottawa, Canada.

with adjustable air openings. The lower end of the water jacketed pipe mentioned above, is submerged in a water seal.

The lining of the producer, which is made of the best quality of fire brick, conforms to the general shape of the producer for a distance of about four feet above the grate bars of the lower zone. From this point, the lining is jogged or stepped on the two narrow sides until the grate bars of the upper zone are reached, leaving a space of about 12 x 12 inches.

Principle of Operation.—The green peat containing about 30 per cent. moisture and a large amount of volatile matter, is fed through the two hoppers described above, and is partially burned on the grates of the upper zone. The heat resulting from the combustion of peat is, or should be, just sufficient to drive off the moisture and volatile matter, leaving behind practically pure peat coke, which falls through the narrow opening below the upper grates into the

* From the Journal of the Canadian Peat Society.

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lower zone where the final and complete combustion takes place.

In addition to the moisture and heavy hydrocarbon vapors driven off from the peat during the process of coking, the gases passing into the lower zone contain nitrogen, a small amount of carbon monoxide, carbon dioxide, and a trace of methane and ethylene.

When the producer is in condition for operation, the space between the grates of the lower and upper zones is filled with peat coke, the lower layer of which, for a height of about eighteen inches above the lower grates, is incandescent owing to the combustion of the coke on these grates.

The gases, heavy hydrocarbon vapors and moisture evolved from the combustion of peat in the upper zone, are drawn up (by means of the suction of the fan or engine) into the gas chamber above the grates of the upper zone, previously described, into and down through the water cooled pipe into the chamber beneath the grates of the lower zone and then up through the bed of incandescent peat coke to the two off takes on either side of the producer to the cleaning system and engine.

A small quantity of the heavy hydrocarbon vapors and possibly some of the moisture is condensed on the walls of the water cooled pipe and drops into the water seal below, where the resulting tar can readily be removed.

The gases of the upper zone and the remainder of the hydrogen vapors and moisture now pass through the incandescent coke of the lower zone. Here the hydrocarbon vapors admitted into the lower zone together with the moisture (steam) and air admitted through the air openings in the ash pit doors, in passing through the hot carbon either burn, or are split up into permanent combustible gases. The moisture is reacted upon by the hot carbon. The result of this reaction is free hydrogen and either carbon monoxide or carbon dioxide. The carbon dioxide, evolved in the upper zone, is reduced to carbon monoxide. The final gas consists of a large quantity (by volume) of nitrogen, carbon monoxide and smaller quantities of carbon dioxide, hydrogen, methane and ethylene.

The Cleaning System.—As previously mentioned, the cleaning system consists of a wet coke scrubber, tar filter and dry scrubber.

The wet coke scrubber consists of a cylindrical, steel shell about 6 feet in height by 2½ feet in diameter, closed at the top by an air tight cover and at the bottom by a water seal. This shell is filled for a height of about 3 feet with coke. When in operation, this coke is continuously sprayed with cold water. The final gas leaving the producer enters the scrubber near the bottom and leaves near the top.

In passing up through the wet coke and water spray, the gas is cooled and most of the dust and a large quantity of tarry matter, which escaped decomposition in the producer, is removed.

From the wet coke scrubber, the gas passes through the tar filter. This filter consists of a cast iron box about 3 feet in height, and 3 feet by 6 inches in horizontal section. Inside this box are fixed a number of baffle plates and four perforated metal plates which are placed near the outlet. These plates can be sprayed with hot water when the suction on the system indicates that the filter is clogged. The gas enters at one end of the filter and passes in and out among the baffle plates and through the perforated metal plates and then into the dry scrubber. Most of the tarry matter carried with the gas past the coke scrubber is removed in this filter and flows off with the wash water into the seal. The dry scrubber is a cylindrical steel shell about 4 feet in diameter by about 3 feet in height, closed on the top and bottom. The top cover can be removed. This shell is packed with excelsior through which the gas must pass before entering the engine. Free moisture and some tarry matter is removed from the gas in its passage through the scrubber.

Results of Tests.—Several tests have been made with the peat manufactured at the Victoria Road peat bog, and with that manufactured at the Government peat plant at Alfred.

In these tests, peat with varying quantities of moisture were used, the lowest quantity being 15 per cent. and the highest 43 per cent. Since the producer is designed to operate with peat containing from 25 to 30 per cent. water and is, therefore, not provided with an evaporator for supplying steam (which is absolutely necessary when running on dry fuels), 15 per cent. moisture peat was found to be too low for satisfactory operation owing to the high temperature prevailing in the producer and of the final gas,—thus lowering the thermal efficiency,—and the formation of some tar.

While peat containing moisture up to about 40 per cent. can be used by operating the plant at half load, the most satisfactory moisture content was found to be about 25 to 30 per cent.

Any tar which may be formed and find its way past the cleaning system into the admission valve and cylinder of the engine can be easily removed while the engine is running, by injecting into the open end of the cylinder a mixture of oilsoap and water. Tar resulting from the distillation of peat is readily soluble in such a mixture and in this respect differs from coal tar.

Fuel Consumption.—The average fuel consumption per b.h.p.h. at full load (60 h.p.) was found from many tests to be from 2¼ to 2½ lbs.

For one bare horse power year of 3,000 (300 ten-hour days), this would amount to 3.75 tons.

For the purpose of showing the saving in fuel costs, which can be realized by generating power from peat in the peat producer gas plant, the following comparisons are given.

In estimating the following costs, the cost of one ton (2,000 lbs.) of machined peat, at the bog where the producer-gas plant is assumed to be situated, is taken at $2.00. The cost of a ton of soft coal is assumed to be $4.00 in carload lots, f.o.b. At some points this price would be less, while at others it would be considerably higher.

The consumption of peat per brake horse power hour is assumed to be 2½ lbs.; lower fuel consumptions have been obtained, but the writer desires to use a conservative figure.

The fuel consumption per brake horse power hour of the coal producer gas plant is taken at 1½ lbs., and that of the steam plant at 6 lbs. The latter figure relates only to comparatively small plants.

On this basis, the fuel costs per brake horse power year (3,000 hours) would be as follows:—

	Fuel, cost per brake horse power. Year.
Peat producer gas plant, peat at $2 per ton	$ 7.50
Coal producer gas plant, coal at $4 per ton	9.00
Steam plant, coal at $4 per ton............	36.00

When peat is manufactured on a larger scale with machines provided with mechanical excavators and other labor saving devices, the above cost (2.00) per ton will be very greatly reduced, so that a power plant situated at the bog will be able to show a much greater saving in fuel costs over that of a coal producer gas plant or steam plant.

In order to arrive at the saving, which will be effected by the utilization of either peat or coal in a producer gas power plant over that of a steam power plant, it is necessary to estimate the operating costs and fixed charges since these will remain about the same for all the plants in question. A slight saving will, however, be realized in the peat producer gas plant, over the steam and even the bituminous coal producer gas plant, in the operating costs, since the peat producer gas plant is very easily handled, the producer practically taking care of itself. Hence, one man, an engineer at moderate wages, can easily take care of a 100 h.p. plant. While this is true in a general sense, the writer has seen a 150 h.p. bituminous coal producer plant handled entirely by one man, but such cases are not common. A bituminous coal producer is more difficult to operate and requires more or less constant attention, and therefore for proper working should have the services of a stoker. A steam plant of like capacity would require a fireman in addition to the engineer. In short, a peat producer gas power plant, in its simplicity and ease of operation, is not unlike an anthracite producer gas plant, which is recognized as the simplest of all such plants.

While hydro-electric energy is in many sections of those provinces possessing water powers, the cheapest power available, and for many purposes the most suitable, it must be borne in mind that there is a limit to which electric energy can be economically transmitted, since the cost of power increases rapidly with the length of the transmission line. In addition, there are localities which cannot be served by such transmission lines and still others to which such power is not suitable—for example, those requiring a 10-hour or intermittent service. For such districts, it is manifestly cheaper and more satisfactory to develop power independently by some other means, and it is hoped that producer gas power plants erected on a few wisely chosen bogs will serve this purpose.

The demonstration plant at Alfred and the Peat Producer Gas Power Plant erected in the Fuel Testing Station at Ottawa (the former serving to demonstrate a commercial process for the manufacture of a cheap fuel from peat and the latter serving to demonstrate an entirely commercial, economical and reliable method of generating power from such fuel), will, it is hoped, prove instrumental in:—

1. The development of such of the peat bogs found in the the provinces of Ontario and Quebec, as are suitable for the manufacture of peat fuel, along sane and commercially profitable lines.

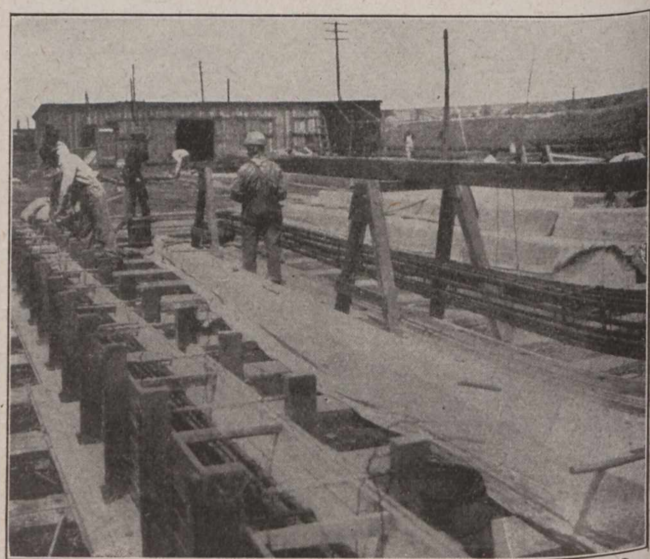
2. The establishment of power plants on the bogs, which will serve existing towns and cities with electric light and power, and attract industries to those parts of the above provinces which can be economically and satisfactorily served by such power.

CONCRETE TELEGRAPH POLES ACROSS MARSHY GROUND.*

By GEORGE GIBBS.†

Among the facilities required on the New York Terminal Division of the Pennsylvania Railroad was the Railroad Company's telephone service. The line for this purpose forms an extension of the New York-Philadelphia main line, from its point of intersection with the Terminal Division at the east side of the Passaic River near Newark, N.J., and consists of a pole line along the right of way across a continuous five-mile stretch of semi-tidal meadow swamp land known as the "Hackensack Meadows," to the tunnel portal at Bergen Hill, the Hackensack River being crossed midway of the section. The ground surface is covered with a heavy growth of reeds, and the top stratum is a peaty bog, from 8 to 15 feet deep, underlaid with varying strata of clay, fine sand, and mixed sand and clay for very considerable depths. It will be seen, therefore, that the problem was to provide a design of pole which would not only be strong in itself, but which could be set in a stable foundation in a soft and uncertain ground. It was desired to make the line entirely secure against interruption by severe storms or by fires in the swamp reeds. It appeared, under these conditions, that the ordinary type of wooden pole would not be wholly satisfactory, either as regards strength for such a heavy service or safety as regards the frequent meadow fires.

The use of reinforced concrete poles for the purpose appealed to us, but very little reliable data about either the cost or service from such design was obtainable. In Europe the author had observed the quite extensive use of concrete poles, chiefly for electric transmission purposes, but details of their construction were not at hand. These poles are frequently of structural steel covered with a protective coating of concrete, and sometimes are of wood encased in concrete, and much ingenuity has been expended in devising special forms of composite poles, but with what practical success it is difficult yet to say.



Manufacture of Concrete Telegraph Poles, Showing Skeleton Frame Suspended in Place; Frame in Form, Ready for Pouring, and Finished Pole.

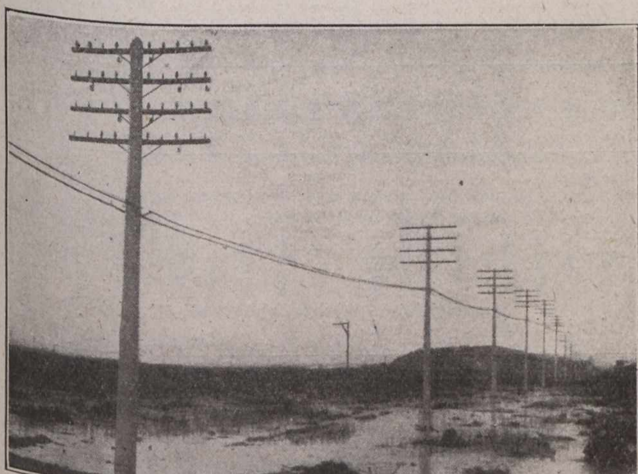
The desirability, however, of securing a strong fireproof line across this section of our road was so great that the writer undertook to design in his office a simple form of reinforced concrete pole, which could be manufactured on or near the work and at a cost which would not be prohibitive. Without previous data to go upon the design evolved is somewhat experimental, and probably the notes here given will not be of very great assistance in fixing a precedent for an ordinary telegraph pole, as our conditions called for heavier construction than usually required of such lines. The data, however, is given for what it is worth, as indicating a heavy and difficult piece of construction for a special problem.

There were 202 poles required, spaced from 70 to 135 feet apart, with an average standard spacing of 120 feet, the variations in span being due to numerous railway and highway crossings. The height of the top of poles above the ground also varies for the local conditions from 25 to 50 feet, and the total length of poles from 35 to 65 feet. The loading called for an ultimate capacity of 60 open tele-

* A paper before the Eighth Convention of the National Association of Cement Users.

† Consulting Engineer, Pennsylvania Railroad.

graph wires and two 40-pair telephone cables and one signal control cable. The open wires are of copper, Nos. 7 and 8 B. & S. gauge, and the cables Nos. 13 and 16 B. & S. gauge insulated wire, with a lead covering. The cables are carried by steel messenger wires. The weight of the wires and cables is 10½ pounds per running foot, giving a total loading for the average span of 1,268 pounds per pole, or including cross arms, insulators, brackets and fittings, 1,500 pounds per pole. In addition to this static vertical loading, emergency conditions were assumed of an extra loading of half inch of ice on the wires and a wind pressure of 8 pounds per square foot on wires and 13 pounds per square foot on poles. The stresses under these conditions not to exceed the elastic limits of the wires and of the carrying structures. These assumptions are equivalent to a vertical loading of 7,600 pounds per pole and a horizontal



Concrete Telegraph Pole Line over Hackensack Meadows, N.J.

force of 4,000 pounds exerted one foot below the pole top. The normal sag of the wires at 60 degrees Fahrenheit temperature is 4½ inches and a normal tension of 273 pounds for No. 8 wires and 130 pounds for No. 9. The maximum hot sag at 130 degrees Fahrenheit is 11 inches; the tension in the wires under maximum wind pressure with the ice loading at 20 degrees Fahrenheit is 702 pounds and 470 pounds respectively for the two sizes of wires.

The design adopted is that of a tapering, smooth surface, reinforced concrete pole, square in cross section with chamfered corners and having a taper of ½ inch in 5 feet. The concrete is of 1½:2:4 mixture, assumed to have an ultimate strength in compression of 2,000 pounds per square inch. The reinforcement is composed of mechanical bond bars tied together into a square skeleton frame, and in the complete pole this reinforcement is covered by a one-inch minimum thickness of concrete. The following table gives details of the complete construction.

In order to manufacture the poles economically a yard was established adjacent to the right of way and with side track connections for delivery of materials. The ground was leveled and set with stringer pieces, three feet apart, of old wooden car sills, so as to furnish a convenient surface upon which to erect the timber forms. This yard permitted of the simultaneous manufacture of six poles and the storing in place of 90 poles during the period of seasoning. In the process of manufacture the skeleton reinforcement is first made up, the twisted steel mechanical bond bars being tied together to form a square skeleton frame; this frame is then suspended at the proper height above the ground and the sectional wooden frames put in position around it. The concrete mixture is then poured in and carefully tamped. In this way six poles were made per day and were left in place at least sixteen days to season.

Table of Concrete Poels.

Length, feet	Equivalent pull, 1 ft. from top.	Edge distance for steel.	Area steel.	Extreme Fiber stress in concrete comprs'n.	Unit compression stress in steel.	Weight of pole.	Cubic ft. concrete.	Weight of steel, pounds.	Lin. ft. of wire wrapped around pole.
30	4066	1.75	3.38	1953	19059	5000	33.15	819	228
35	4321	1.75	3.63	2087	20480	6200	41.44	1077	273
40	4505	1.75	4.03	1917	19667	7600	50.75	1309	333
45	4647	1.75	4.40	1987	20428	9200	61.58	1493	375
50	4763	1.87	4.73	1886	19692	11000	73.24	1792	431
55	4860	1.87	5.00	1832	19155	13000	86.58	1974	490
60	4945	2.00	5.30	1812	19083	15000	101.28	2249	533
65	5020	2.00	5.48	1976	18591	17600	117.23	2575	618

After a number of experiments it was found best to set the poles in pits excavated in the marshy stratum. These pits were generally about 9 feet square and 5 feet deep, and a timber grillage was placed around the base of each pole, and about 5 feet below the top of the ground. This grillage consisted of six track cross ties bolted together and to the pole, and partly planked over by 3-inch rough lumber. The pole, which projected below the grillage and was pointed at the butt, was jetted down by compressed air into the sandy layer, so that the grillage would rest at the bottom of the pit. The pits were then back-filled with rock and clay. Poles on curves are cross-guyed, and the terminal and railway crossing poles are head-guyed with steel cables.

In order to determine the stability of the foundations, as above described, as well as the transverse strength of the pole itself, a test was made of a 55-foot pole set in a 13-foot deep foundation. The test consisted in applying a horizontal pull 39.5 feet from the ground. The breaking load was 4,360 pounds and the point of fracture 20 feet from the ground, at the top of the 32-foot reinforcement bars. The foundation itself was found to be amply secure.

The actual cost of labor and material for manufacture of these poles, reduced to a unit cost for an average length pole of 40 feet, weighing 7,600 pounds, was as follows:

Forms—labor and material	$19.00
Concrete—labor and material	26.50
Reinforcement—labor and material	32.00
Total per pole	$77.50

The above does not include cost of preparing site, engineering, etc., and is for the bare poles (without fittings or foundation timbers). To obtain the cost of the poles erected, there must be added the cost of loading, distribution, foundations and setting, cross arms and fittings, but these items were special to the particular location and would be of little use as a matter of general information. It might be stated, however, that the cost of handling and erecting these heavy poles was considerably more than would be the case for wooden poles; furthermore, care must be taken in loading and unloading them and special appliances are required for their erection.

In the special case in question it was figured that the cost of the line erected complete was not greatly in excess of that of an equally stable wooden pole line, as in order to meet such a condition it would have been necessary to employ "H" frame poles and set them in equally expensive foundation pits. In the case of this line it is interesting to note that the foundations and setting cost considerably more than the poles themselves.

To sum up, it may be said that for the particular case of this heavy line having very difficult foundation conditions, the use of a reinforced concrete pole resulted in a durable, safe and neat appearing construction at little additional cost to that of a wooden pole line inferior in all these respects.

Properties of Metals.

THE EDITOR:

Dear Sir,—I enclose herewith a table which I think should prove of interest to most of your readers as it contains information culled from a great many sources, and should prove a good labor saver in hunting up references, etc.

F. TISSINGTON, Sherbrooke, Que.

METAL	Weight in Lbs.		Cubic Measure		Specific Gravity Water=1	Ultimate Strength			Coefficient of Elasticity Direct	Melting Point		Coefficient of Linear Expansion	Specific Heat Water 32°=1	Atomic Weight	Heat Conductivity Silver =1000	Electrical Conductivity Silver @ 32° F. = 100		Contraction parts of an inch Fluid to solid state
	Cubic Ft.	Cubic In.	Ft. per ton 2,000 lbs.	Ins. per lb.		Tensile Lbs.	Com-pres'on Lbs.	Shear Lbs.		Cent.	Far.					32° F.	212° F.	
Aluminum, Cast	160	.092	12.5	10.9	2.56	13500				753	1392	F. .000013	.212	27.0	665	63.09		
" Wrought	168	.097	11.9	10.25	2.57	33000				630	1157	C. .0000206	.225	27.0	665			
Antimony	418	.242	4.78	4.15	6.72	1100				425	797	F. .0000061 C. .0000108	.051	120.0	215	3.88		
Arsenic	362	.21	5.55	4.76	5.84					412	773.5		.083	75.0				
Bismuth	617	.353	3.25	2.83	9.90	3250				270	518	F. .0000077	.031	208.5				.156
Brass	515	.298	3.88	3.35	8.2	27500			14,230,000	900	1650	F. .00001052	.094			21.0		
" Cast	524	.30	3.81	3.33	8.4	22500	10000		9,170,000	900	1650	F. .0000194	.094					.210
" Wire	533	.309	3.74	3.24	8.548	50000				900	1650	F. .00001074	.094					
Bronze	545	.315	3.67	3.18	8.78											30.0		
Cadmium	542	.314	3.68	3.19	8.74					320	608		.0567	112.0		24.579	17.596	
Chromium	376	.218	5.31	4.57	6.06								.100	52.4				
Cobalt	532	.309	3.75	3.24	8.55								.1073	59.0				
Copper	552	.3192	3.62	3.13	8.9	30000			15,000,000	1054	1929	F. .00000944	.092	63.5	845	91.517	64.919	
" Cast	527	.304	3.81	3.28	8.607	20000	58000		12,000,000	1050	1922	C. .00001718	.092	63.5				.193
Gun Metal 10 Copper 1 Tin	528	.306	3.81	3.148	8.46	36000			13,500,000			F. .00001062						
Gold	1200	.695	1.67	1.44	19.24	20000				1250	2282	F. .0000083	.032	196.5	981	64.96	48.49	
Iridium	1166	.678	1.72	1.48	18.75								.1886					
Iron, Cast	450	.26	4.45	3.8	7.23	17000	95000	10500	17,000,000	1050—1200	1922—2192	F. .000006 C. .000011094	.130		359			.125
" Wrot	480	.28	4.17	3.6	7.698	50000	50000	40000	29,000,000	1500—1600	2732—2912	F. .00000642 C. .000011204	.114	56.0	436	12.350	8.377	.137
Lead	712	.4121	2.81	2.437	11.418	2500	7000		2,000,500	330	626	F. .000016	.031	207 0	287	8.277	5.761	.319
Magnesium	109	.063	18.35	15.9	1.75					230	447		.2499	24.0				
Manganese	499	.289	4.0	3.46	8.0								.122	55.0				
Mercury	849	.491	2.36	2.04	13.596					—38.8	—40	F. .0000333	.033	200.0	677	1.738	1.575	
Nickel	516	.298	3.88	3.35	8.28					1500—1600	2732—2912	F. .0000067	.109	59.0		7.89		
Platinum	1342	.778	1.49	1.29	21.5	53000				1710	3110	F. .000005	.032	195.0	380	7.933	6.688	
Silver	653	.379	3.06	2.63	10.505	41000				1000	1832	F. .000011 C. .0000217	.056	108.0	1000	100	71.316	
Steel, Mild	490	.29	4.08	3.53	7.85	67500	67500	56000	30,000,000	1300—1400	2372—2552	F. .0000066 C. .000010788	.116		397			.133
Tin	462	.267	4.34	3.75	7.4	4700			3,500,000	235	455	F. .00001166 C. .0000217	.056	118.5	422	14.014	8.657	.278
" Cast	455	.262	4.4	3.82	7.291	4480				228	442	F. .00001210	.0548	118.5	422			
Uranium	1146	.665	1.74	1.51	18.5								.028	240.0				
Zinc	428	.248	4.66	4.02	6.86	15800			13,400,000	412	774	F. .0000163	.095	65.4	641	24.063	17.506	.329

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CONTENTS OF THIS ISSUE.

THE CITY AND SUBURBS PLANS ACT.

A step in the right direction has been made by the Ontario Legislature by the passage of the City and Suburbs Plans Act. The clauses of the Act provide that in all cities of a population of 50,000 or over, and throughout a five-mile zone surrounding such cities, the subdividing of areas into building lots, and the locating of highways through such areas must hereafter be in accordance with plans approved by the Ontario Railway and Municipal Board. A copy of this Act appears in this issue of *The Canadian Engineer*.

The growth of towns and cities in Ontario and throughout Canada has been so rapid and the method of laying out building lots in territory adjacent to these cities has been so haphazard that the results to the cities have been rather serious. No definite plan has been adhered to in these sub-divisions, and this has caused great difficulties in providing thoroughfares and transportation facilities when these new areas are annexed to the municipality. Additions to the city's territory have caused increased demand for better transportation facilities, but the lack of connecting streets and main thoroughfares in the new sections has led to endless trouble. The Act as now passed gives assurance that the streets and the general layout in areas hereafter sub-divided will be in accordance with the highways and thoroughfares of the city.

As we have noted, the Act is a step in the right direction. There is still room, however, for legislation giving some oversight or control to the city over a suburb's development. Public improvements, such as waterworks, sewerage systems, street car lines, etc., should be designed so that when they are later connected to the city system there may be a minimum of loss and a maximum of economy.

THE SALARIES OF ENGINEERS.

We have referred many times in these columns to the poor salaries paid by municipalities to their engineers, and, while conditions are improving slowly, there remain many grounds for complaint still. The city of Toronto is by no means the least offender in the matter of inadequate salaries to their engineering staff. Yet, the city, through its City Council, newspapers, and even the engineers themselves, refer to the fact that many engineers have left the city's employ to take positions in other cities at greatly increased salaries. The statement is made, and often reiterated, that Toronto is a training-ground for engineers for other cities. If this is true, and we do not doubt it, the condition of affairs is one to be ashamed of rather than one to express pride in. Heads of engineering departments in Toronto are receiving salaries lower than towns of 6,000 or 8,000 people are paying to their engineers. Assistant heads of departments, men in actual charge of the construction work, are receiving salaries less than the foremen, who are receiving orders from them. Is it any wonder these men leave when the opportunity arrives? Any citizen who makes a statement that the city's engineering department is a training-ground for better positions has little idea of the fitness of things. No worse charge could be made against the city. If the salary question at the City Hall were adjusted, more efficient work would be done and a permanent staff would be built up. When we consider that assistant heads of departments are receiving salaries of less than $100 a month, and that clerks with no special training or ability are receiving $150 to $200 a month, we can readily understand why so many changes occur in the engineering department.

The City Engineer has not been altogether lacking in blame for this condition, for recently, when the head of one of his departments was appointed to another position, the Council wished to raise his salary and keep him. The City Engineer, however, said that if this man's salary were raised sufficiently to keep him employed by the city, that a number of other increases would have to be made; therefore, he would advise that the salary remain as before. To secure a well-balanced, efficient and enthusiastic organization, each individual man must be satisfied. Therefore, any reorganization of the Works Department of the city of Toronto must include a readjustment of salaries and the payment of sufficient to assure the permanent retention of men experienced in the city's work.

RAIL SPECIFICATIONS.

The standardization of rail manufacture has progressed rapidly during the past ten years, due mainly to the joint action and co-operation of manufacturers and engineers. In a recent issue of a contemporary, Mr. W. C. Cushing draws attention to the test conditions as imposed by the various engineering associations, and it is to these test conditions that a good deal of the advance in the perfection of rail-making is due. It must be added, however, that the frequent failures of rails noted, with the attendant terrible consequences, leaves much to be accomplished still. Mr. Cushing states that specifications for steel rails have always consisted of three general parts: chemical requirements of properties, physical requirements, and the details of manufacture. Up to the time the Rail Committee of the American Railway Engineering Association recommended certain specifications in 1901, the various railways emphasized one or more of the above three parts, according to their individual preference or experience. Some almost ignored the chemical requirements, others were more or less elaborate in their physical requirements, while some barely touched upon the details of manufacture, and others treated the subject quite elaborately. Since that time, by the devotion of considerable time and much careful study to the question, the American Railway Engineering Association have progressed towards the adoption of standard specifications for rails. It has now a set of proposed specifications which embody the best knowledge of the subject, and these are being changed from time to time in the light of new experimental investigation. New methods of testing or improvements on these methods are used to determine the physical property, while practically no change has been made in the chemical requirements from the standard specifications of the rail manufacturers. The railway engineers prefer to subject the finished material to such tests as will cast aside the defective rails, and this accounts for the additional tests over those in use some years ago. A marked improvement is apparent in the rails being laid since the adoption by the manufacturers of the new specification.

EDITORIAL COMMENT.

Now that the first wave of sympathy and criticism regarding the disaster to the Atlantic liner, Titanic, has passed, we are able to form some judgment and to hear the candid opinions of men qualified to speak on the subject. There is little doubt that the sinking of the vessel will have the effect of placing some restraint on the size of future ships. When the region of extreme sizes in engineering structures is reached, experience and precedent alike are at fault. There was a good reason for the project of building the Quebec bridge, but there appears to be little reason for the construction of 50,000-ton liners. The disadvantages of such large vessels are becoming apparent, but until a general public feeling is expressed against their construction, they will continue to be built.

* * * *

The utilization of the peat resources of Canada is becoming an important matter as the cost of coal increases and the liabilities of coal strikes remain. We noted some time ago the foundation of a Canadian Peat Society. The objects of the Society, formed about two years ago, are to gather and disseminate information concerning peat and peat deposits and products, for the purpose of educating the public as to the value of these products, to encourage the drainage and development of bog and peat land for agricultural purposes, and generally to adopt such measures as may aid in the establishment and the sound basis of a peat industry in Canada. With the above objects in view, the Society are now issuing a quarterly journal, which is to be a source of accurate information and of encouragement and aid to peat men in general. This Society is deserving of the hearty support of every Canadian interested in the development of our latent resources.

* * * *

Denver, Colorado, has made a move towards lessening the smoke nuisance. A smoke abatement commission of five members to advise the mayor and the smoke inspector is provided for in a bill drawn up by the city art commission. The bill is more drastic in its conditions than previous smoke ordinances. The following clauses may be referred to: for every alteration made in the chimney of any kind a permit is required; before a heat or an electric generating plant of any kind is constructed, repaired or altered in any manner, the plans and specifications must be submitted to the smoke inspector; persons failing to take out permits to construct or repair furnaces, etc., will be fined $25 for each day of the construction or alteration; persons who cause dense smoke to rise from heating plants, locomotives, etc., are liable to a fine of from $10 to $100 for each offence. While the above conditions are rather rigid, if conditions in Denver are as bad as in some of our Canadian cities, it is quite certain that a severe regulation, strictly enforced, is required. It is time that adequate inspection and enforcement of smoke by-laws and regulations were made.

COST OF TRACK-LAYING ON THE ERIE RAILROAD.

An article by H. C. Landon, Division Engineer of the Erie R.R., in the Erie Railroad Employees' Magazine, gives some figures of cost on track laying under the old methods, which may be of use in determining whether or not the use of a track-laying machine will be economical. Mr. Landon writes as follows: In 1905 and 1906, while Engineer M. of Way of the Buffalo & Susquehanna R.R., I was in direct charge of all track laying, ballasting, etc., between Wellsville and Buffalo, and had, in fact, previous to this time, charge of all the track laying of the Buffalo & Susquehanna system from 1898, about 110 miles in all. I have not the data of cost of this work, except that with the low price of labor, the cost per mile, including rental of engines, cars, etc., and the cost of labor, it did not exceed $275 per mile. As much as 5,700 ft. of track had been laid in a single day with about 65 men, through the winding valleys of the branches of the Susquehanna River, south of Wharton, Pa., and the average kept up to very close to a mile per day, where any considerable grade was ready ahead of the track layers.

On the line between Wellsville and Buffalo there were a large number of bridges to be constructed, as the track laying advanced, the steel for the bridges being brought over the new line, so that the track layers hardly became organized for rapid work before they were stopped for a period of two or three days to two months, while the new structures were being erected. During this period the track layers were ballasting the new track, or engaged in completing unfinished track on troublesome fills. The laborers, especially the spikers and members of the iron gang, had had previous experience, and had in general become quite expert in the work.

About one-third of the men were Hungarians and the balance Italians. No natives were employed. While at first the Slavs were decidedly the better laborers, some of the Italians became expert in spiking and in handling the rail, so that spike gangs and iron gangs were made up of Italians and Hungarians, creating a rivalry which expedited the work considerably.

Two truck gangs were always employed, passing each other by using a portable turntable, or by lifting the heavy truck body from the wheels. Good camp cars were provided, and also a well-equipped blacksmith's shop. A combined gasoline engine and pump, and a tank of 10,000 gals. capacity—which could be quickly taken down and erected—formed part of the equipment, so that the track-laying engine could be kept close to the work.

The longest stretch of grade which was ready for the track and where no large bridges intervened to delay the work, was between Belvidere and Belfast and White Creek bridge. On this stretch it was demonstrated what a track-laying gang could do when the organization was well in hand. This work does not compare with feats in the west over a level country, but among the winding roads of the east, it does compare very favorably. The biggest day's work on this stretch was 5,000 ft. and the average for the 6 miles was 4,600 ft. per day.

North of White Creek bridge, 5,900 ft. was laid on July 2, 1905, including delay of several hours placing a small bridge at Transit Bridge. The average for this one gang during the time employed was about 4,400 feet per day.

Other smaller gangs were employed out of Arcade and Hamburg, working north and south to reach important large structures nearby, and while these did not accomplish as much in a single day, the average of about 50 ft. per man was accomplished.

The track-laying gang was made up about as follows:—

1 foreman, at $4	$ 4.00
2 assistant foremen, at $3	6.00
12 spikers and nippers, at $1.50	18.00
36 trackmen, at $1.50	54.00
2 tie tiers, at $1.50	3.00
2 tie spacers, at $1.50	3.00
1 spike puller, at $1.50	1.50
4 bolters, at $1.50	6.00
2 rail unloaders, at $1.50	3.00
4 tie unloaders, at $1.50	6.00
1 water boy, at $1.25	1.25
Total	$105.75

Behind the supply train, full tie-ing:

1 foreman, at $3	$ 3.00
24 laborers, at $1.50	36.00
1 timekeeper, at $2	2.00
Total	$ 41.00

At storage yard, loading rail and ties:

1 foreman, at $3	$ 3.00
24 laborers, at $1.50	36.00
Engine and crew, at $40 per day	40.00
Total	$ 79.00
Total in all	$225.75

The average amount of track laid per day was over 4,000 ft. At 4,000 ft. per day the cost per mile would be $297.97. As much material, rail, ties etc., was received while track laying was in progress, the expense of rehandling in the supply yard was avoided.

The auditor's books, when rail laying was completed between Wellsville and Buffalo, indicated the entire cost of labor for laying 98.1 miles of track to be $29,515.45, or $300.85 per mile. Of this 98.1 miles of track, 85 miles was main track and the balance sidings, "wye" tracks, and passing tracks.

The labor cost included the building of the turnouts, etc. This is the total cost of labor, including engine and train crew, fuel, supplies and rental of engine and of office force.

All rail laid was 80-lb. A. S. C. E. section.

RAILWAY PLANS PREPARED.

The Canadian Pacific Railway will expend a large amount of money at St. John this year. Mr. D. McNicoll, general manager was in the city recently and stated that plans were prepared for an additional elevator with a capacity of 2,000,000 bushels, and that as fast as the federal government constructed the sea wall, upon which work will be begun this spring, the company would fill in the shore lots at West St. John and lay additional tracks. He said that the company could handle twice as much traffic at St. John as it is doing at the present time if the terminal facilities at the port were able to take care of it. The company during the winter built extensive freight sheds on property that it acquired at the head of the harbor. Mr. McNicoll says much more must be done at that point in order to handle their local and provincial business. The company will spend considerable money during the summer on their railway lines in New Brunswick.

PROGRESS IN CANADA IN BIOLOGICAL METHODS OF SEWAGE DISPOSAL DURING THE LAST TWENTY YEARS.

By Willis Chipman, C.E.

Twenty years ago the principles underlying the biological methods of sewage treatment were attracting the attention of municipal engineers in Great Britain, experiments were being carried on, and phophecies being made, echoes of which were to be heard in Canada.

Broad irrigation was then the accepted standard in Great Britain, although the nitrification theory of purification was not so well understood as to-day. Profitable crops were too often the desideratum rather than sewage purification, but on the whole the results were satisfactory. Broad irrigation had also been adopted at Paris, France; Berlin, Germany, and many other cities. The land necessary for broad irrigation was not always available, however, and many cities and towns in Great Britain and in Germany had adopted chemical precipitation methods, but, generally speaking, its advocates were experimenting continually.

The failure to produce a marketable fertilizer from sewage sludge by chemical precipitants stimulated inventors, and many processes were invented, patented, and advertised to the public.

About 1871 filtration through charcoal was tried in England, as a result of which the conversion of the ammonia and the nitrogen or organic matter into nitric acid was recognized, and the theory of intermittent filtration first brought to the attention of engineers.

The State Board of Health of Massachusetts undertook a series of experiments in sewage filtration in 1886, as a result of which intermittent downward filtration was adopted by many towns, and by 1891 this method of sewage purification may be said to have become the standard in New England.

In the Province of Ontario the first practical attempts at sewage purification were made at the Asylum for the Insane, London. The works were designed by the late Col. George E. Waring, of New York, an engineer of international reputation, and constructed by the Provincial Department of Public Works. The sewage was intermittently applied to channels or ditches, well underdrained, but it was then called a flat-bed-irrigation system. The agency of bacteria was, however, recognized in descriptions given of the system.

These works have been in continuous operation since 1888, and the results have been eminently satisfactory, due largely to the labor available for properly operating the beds, and for cultivating the crops.

In 1890 experiments and tests were conducted at the Provincial Institute for the Deaf and Dumb at Belleville with a patented system known as the "Condor" system, but the results were not satisfactory. The chemical solution in this process was merely sulphate of iron.

In the following year the "Ferrozone 'Polarite'" process, another patented system, was experimented with at the Ontario Agricultural College, Guelph. Upon the recommendation of the late C. H. Horetzxy, of the Provincial Public Works Department, this system was subsequently adopted at the Mimico Asylum, at the Institute at Belleville, and at other Government institutions throughout the Province.

In 1892, the town of Berlin, Ontario, constructed sewage purification works, which were no doubt the first municipal works in Canada.

* Presented at Annual Meeting of Canadian Public Health Association, Montreal.

The population of the town at this time was about 7,500. Three miles of sewers on the separate system conveyed 125,000 gallons daily by gravity to a plot of land secured for disposal works. It was estimated that over fifty per cent. of the flow represented subsoil infiltration.

Of the twenty acres purchased, five acres at least were unfit for use. Eight acres were originally laid out into four flat beds, cosely underdrained, and separated by embankments.

For three or four years the results were quite satisfactory, notwithstanding as much attention appears to have been given to the raising of crops as to the treatment of the sewage. During the winter months the sewage was permitted to flow directly to the small stream with a volume of three cubic feet per second, and only one attendant was engaged in the summer to apply the sewage to the beds in rotation.

In 1896, the Provincial Board of Health investigated certain complaints of riparian owners below, and four years later a small septic tank was added, also two filter beds for experimental purposes.

In 1894, the town of Waterloo followed the example of Berlin and constructed several beds for sewage treatment.

In 1896-97 the city of Hamilton constructed chemical precipitation works at Wentworth street, and in 1898 similar works were constructed at Ferguson avenue, since which they have been in continuous operation. These works were the first municipal precipitation works in the province. The sewage is precipitated by carbonate of lime and sulphate of alumina, the sludge pressed by Johnson presses, and the resultant cake sold or given away to market gardeners, or burned, according to the supply and demand.

Deodorants and disinfectants have been experimented with in several places, but Hamilton has adhered to precipitation, and the satisfactory results are due largely to the original design of the works. The effluents may not be non-putrescible, but the grosser solids are removed.

Of the various proprietary processes experimented with in England, one of the first to receive attention here was the "Amines" process, but it does not appear to have been adopted at any place in Canada. The "Porous Carbon" system was experimented with, but the results were not considered as satisfactory in either case.

The "International System" of purification by the use of "Polarite" and "Ferrozone," having been adopted at several of the provincial institutes, was thus brought into public notice. A company soon took advantage of this and rosy pictures were painted by promoter artists at Toronto, Stratford and London. In the latter city, in 1898, the system would have been adopted for treating the sewage of the entire city if the engineers acting for the city had not pertinaciously opposed the scheme.

The parent company of the International system was organized in England, and a subsidiary company at Detroit, Michigan, from which point Canada was exploited. Several towns in the United States adopted the system to their sorrow, the most notable instance being Madison, Wisconsin.

After a few years' contributions had been paid to the parent company for supplies of Ferrozone and Polarite, the Provincial Government decided to experiment with sand, gravel, etc., and made the discovery that with selected materials the results were quite equal to those obtained with Polarite and Ferrozone. This process then passed from the Canadian stage of action, to be succeeded by the Septic Tank System, promoted by a syndicate. The claims made for this newly discovered method of sewage treatment were little short of miraculous, and immediately attracted the attention of sanitary authorities in Canada, but it does not appear that any tanks were constructed by municipal authorities in this country prior to 1901.

At Berlin a second investigation was made by the Provincial Board of Health in 1901, the evidence demonstrating that the beds were of insufficient capacity to treat the flow, which had increased to 350,000 gallons of very strong sewage per day. The beds were found to be overworked, waterlogged, full of sludge, and the authorities were at the same time endeavoring to raise crops.

In 1902 the Legislature appropriated $2,000 to carry on experimental work in the interests of the municipalities in the province, which experiments were made at Berlin. As a result the town decided to construct:—

(a) Two septic tanks.

(b) To pump the affluent of the tanks.

(c) To adopt intermittent downward filtration.

Fourteen acres of high gravelly land subdivided into sixteen beds, were selected adjoining the original "Sewage Farm," as the public persisted in calling the works.

In Dr. Amyot's report upon the Berlin experiments of 1902, the system of treating sewage by contact beds was clearly described, as well as the results of experiments with effluents from septic tanks, Stoddard trickling filters, and Intermittent sand filters.

In 1900-1901 the city of Stratford constructed Sewage Disposal Works, comprising intermittent filtration beds, which were soon overworked and outgrown. Additions were made in 1904-1905 and a septic tank constructed.

Ten years ago four municipalities in the Province of Ontario had constructed sewage disposal works:

(1) Berlin—Filtration beds, 1892. Experimental septic tanks and two small filter beds, 1901.

(2) Waterloo—Filtration beds, 1894.

(3) Hamilton—Chemical Precipitation Works, 1896-7.

(4) Stratford—Filtration beds and small septic tank, 1901.

The sewage from several provincial institutions was also being satisfactorily treated.

Two or three experimental septic tanks had been constructed, but the boom of the next decade had not commenced.

As a result of a series of experiments carried out by Mr. D. Cameron, the city surveyor of Exeter, England, a syndicate was formed and patents secured in Great Britain, the United States, Canada, and other countries throughout the civilized world for the septic tank system. By 1900 the city of Exeter had become a Mecca for engineering pilgrims, and within a few years Cameron tanks or similar tanks were being constructed not only throughout Great Britain but elsewhere, and generally without consulting the Cameron Company. This company claimed the following advantages for their system:—

1. The non-production of sludge.

2. An effluent in the best condition for irrigation or filtration.

3. Filters were recommended by the company to purify the tank effluent.

4. A process free from nuisance.

5. Automatic and absolute reliability in working.

6. The first cost was within the reach of all communities.

7. Working expenses were practically nil.

It is not surprising that the Septic Tank System especially attracted attention in Canada, where climatic conditions were more severe than in Great Britain, and the problem of sludge disposal not as well understood.

The first municipal septic tanks to be constructed in Canada were probably the small ones at Berlin and at Stratford.

A larger tank was built at Stratford in 1904, and in the same year two tanks were built by the city of Guelph. The following places constructed septic tanks between 1904 and 1911, approximately in the order given:—

Peterboro, Toronto (Woodbine area); Vancouver, B.C. (in part); Regina, Sask.; Moose Jaw, Sask.; Berlin (No. 2); North Bay, London, Woodstock, Brampton, Barrie, Vernon, B.C.; St. Thomas, Guelph (No. 2); Haileybury, New Liskeard, Orillia, Oshawa, Bridgeburg, and probably other places.

Hundreds of smaller tanks were also constructed for public institutions and private residences, of which there are no records.

In 1910 the Cameron Septic Tank Company, of Chicago, threatened suit against a number of municipalities in Canada for infringement of patents, which had been declared valid by the Superior Courts of the United States, although it would appear that in Great Britain the patentees did not press their claims for royalties.

The most important claim of the company, the non-production of sludge, was soon proven untenable. The discovery was also made that it was not essential that the tanks should be made air tight, and the light excluded, also that the utilization of the evolved gases was more than offset by the risks from explosions.

The Canadian septic tank boom of the last ten years has commenced to subside, but engineers have profited largely by the experience gained.

The removal of part of the matters in suspension renders the sewage more amenable to further treatment and prevents the clogging of beds and filters. The refuse from certain manufactories, such as sugar refineries, breweries, etc., may, however, neutralize this effect by rendering the sewage acid.

Many of the tanks constructed during the last five years have been more correctly called sedimentation tanks, sludge removers, rather than sludge digesters.

The "Imhoff" tank is at the present time prominently in the eye of the public, due largely to the characteristic energy of the promoters of a patented process or article. Dividends must be earned by royalties paid.

The irrigation beds at the London Asylum, at Berlin, Waterloo and Stratford, were practically identified with the downward intermittent filtration system of New England.

The contact bed system evolved from the above system has not had the popularity in Canada enjoyed by the filtration beds or by the septic tank system, owing largely to the expense involved in properly applying the sewage. Contact beds were constructed by the city of London in 1901, by Stratford in 1904, and by Geulph in 1910, also by the city of Toronto at Woodbine avenue, in connection with the Cameron septic tank installation.

Hydrolytic tanks do not appear to have been adopted by any municipality in Canada, but experiments were to have been made at Edmonton in 1910, the results of which should soon be made public.

Percolating and sprinkling filters are now being adopted by a number of municipalities throughout Canada, but none are as yet in operation so far as the writer is aware, excepting the percolating filter of the Stoddard type at Vernon, B.C.

At the present date the engineers favor tanks for the removal of the grosser solids by sedimentation, the treatment of the effluent upon filters, and the disinfection of the filtrate after a second sedimentation.

By the end of the decade now dawning, every inland city and town in Canada will probably have adopted some method of sewage purification. Such works must be carried out by the municipal engineer, with the assistance of the chemist and the bacteriologist, and we have much preparatory work to do, not only in educating the general public and their representative councils, but in conducting experiments with systems now in operation and in collecting data in advance of designing and constructing.

PUBLIC UTILITIES.

The problems of the valuation of public utilities have been prominently before the Canadian public, the question of the purchase of the Toronto Street Railway and the Winnipeg Street Railway having been recently discussed.

At the recent International Municipal Congress Mr. Bion J. Arnold, chairman of the supervising board of engineers of Chicago said:

"During the last twenty-five or thirty years the most of the great inventions which have made possible the public utility corporations of to-day came into existence. During the early part of this period inventors were rivaling each other, promoters were doing their best to outwit each other, financiers were doing the best they could to gain in financial profit in promoting various enterprises, or backing different enterprises in order that the financial profit might be realized; so that we might say the first ten years of this period was one of strife on the part of all people interested in the matter—and all were interested in it, inventors, promoters, financiers and the public—they were all interested in the final result.

"During this period franchises were granted to public utility corporations upon easy terms. And perhaps it is well that they were so granted, because the public was desirous of securing the advantages of the public utility corporations, and the public also was without the knowledge as to the terms such franchises should be granted upon. And it took some years of experience in the operation under those corporations and under our modern conditions before those facts could be learned..

"The result was that competitive franchises were granted in cities to lighting companies, electric railway companies, to gas companies, to water companies—seldom, however, to water companies, but sometimes—on the theory that competition was the best thing for all concerned, that the greater the competition the lower the cost of production and consequently the lower cost to the consumer. We have since learned that that meant the duplication of capital in many instances, which has since been consolidated into one large company—usually with a profit to both parties—and the result is that the public is carrying to-day a capitalization upon public utility properties that it never should have been asked to carry, and never would have been, had it not been for this competition principle which was followed at that time. We did the best we knew under the circumstances.

"During the past ten years, however, certain corporations which have been granted those privileges had misused those privileges—I do not say all of them but certain ones had—the resulting overcapitalization and the fixing of rates made the public pay higher than it should. As soon as these conditions became known to the public and the franchises of the original corporations began to lapse, then the day of settlement came. These original promoters of these companies, not having understood what depreciation meant, and furthermore, going upon the theory that when franchises lapsed they would be renewed by the municipalities, and also upon the theory that when it became necessary to rehabilitate the properties, they could issue new securities and additional securities for money to rehabilitate with—I say, going upon those two theories, no allowance was made for depreciation and in many instances not sufficient allowance was made for maintenance—maintenance as distinguished from depreciation, meaning the ordinary upkeep of wear and tear, depreciation meaning the natural wear of the property that must be kept up by maintenance or upkeep, or that wear which comes out of the property, necessitating its being renewed.

"For instance, a car may be bought to-day. You can buy new brake shoes, new wheels, new seats, new mats for the floor, etc., and keep it running. That is maintenance. But when that car becomes obsolete or completely worn out and has to be renewed with another car, then comes in renewal or depreciation. And the difference between the value of the original car and the value of the new car—we will assume that the new car was substituted at the same value as the old one—you must provide sufficient money to buy a new car with. It is that value that I call renewals or depreciation. I say, no allowance was made for this in the original promotion of these enterprises in many instances; in fact, I know of no instance in this country where that was allowed.

"Now, what is the result? We have found ourselves, when these franchises lapsed, with dilapidated properties and no money to rehabilitate them, and so highly capitalized that the companies could not stand additional securities in many instances. That is the situation that confronts numerous corporations in this country to-day. It confronted more five years ago than it does now.

"In some cities the problem has been met and solved. It has been met and solved in Chicago, in Cleveland, they are endeavoring to solve it in New York, Detroit, Pittsburgh, Seattle and San Francisco.

"There is a fair basis of settlement between the companies and the public. It has taken me about nine years to come to the conclusion as to what that fair basis is in my own mind, and having had more or less to do with these questions between the public and the corporations, first representing one side and then the other, and sometimes both sides of the same case by agreement, I have given it some thought.

"And I have come to this conclusion, that where a corporation has been honestly managed, judiciously managed from the day of its inception to date, notwithstanding the fact that it may have put in horse cars, light rails and had to renew them, so that if you go out and look at that property to-day you will find no value for those cars or rails—suppose it paid the promoters a profit, suppose it paid a discount on securities in order to raise the money to float the proposition at this time—I say, all such things as that, obsolescence, discounts on securities, reasonable promoters' profits, legal fees connected with the organization, things of that character which cannot be found to-day in the property if you go out and look at it and make a value upon it—I say, such things as that are rightfully a part of the original cost of the property and should be allowed to stay in the capitalization of the company until the parties who have put their money into the property have had a chance to earn that money out, with a fair return upon it.

"So I say if you take the records of a company from the date it was organized up to date and allowing a fair return—I would say a good, liberal rate of interest upon every dollar that went into the property up to date, deducting from what you allow the difference between what the company actually took out in dividends and what it ought to have received upon this basis, then the difference left over and above the value of the physical property that you find to-day should be allowed to stay in the capitalization until the company can earn it out.

"In other words, if the company is to be regulated now, as it often is in many instances where public service commissions are in vogue, and this public service commission, or the public, says: 'From now on you can earn a fair return upon the real value of your property, or upon some valuation'—in other words, 'You are not going to be allowed to make excessive profits any longer, we are going to regulate you from now on'—I say that under such conditions the company has a right, and has a right to demand, that it be allowed to earn a liberal return upon the real money that was put in from the date that the money went in up to date, and that even from this time on after the rate of return is agreed upon between the public body and the public corporation—call it six per cent. if you choose—that all over and above that six per cent. shall go into an amortization fund to gradually retire the difference between that real value of the property as it exists and this obsolescence, promotion fees, etc., which I have named, so that eventually the property will be paying a return simply upon the value of the physical property performing the service.

"Now if I make that clear, suppose that a company has $100,000 worth of physical property to-day. Suppose it has shown it has put in $120,000 in real money, that is, on this basis I have figured, say at eight per cent. from the time it went in. There is a difference then of $20,000 that there is nothing to represent at the present. I say, the company is entitled to earn a return upon that $20,000, in addition to the real value of $100,000, at six per cent., we will say, and to continue to earn it upon that, and all that it earns over that six per cent. shall go into a fund to gradually retire the $20,000 I have mentioned, so that finally the property is paying a return simply upon $120,000 worth of property. The best way to do that is gradually to increase the property to the amount of the $20,000 by gradually putting that money into real physical property."

IMPROVEMENT OF PUBLIC HIGHWAYS ACT.

The amendment to the Ontario Act to aid in the Improvement of Public Highways, will be of interest to engineers. The following are the changes which are of importance:—

The sum of $1,000,000 is set apart out of the consolidated revenue fund to aid in the improvement of public highways.

The said sum shall be in addition to any sum heretofore set apart for the like purpose, and shall be applied as provided by the Act to Aid in the Improvement of Public Highways, passed in the seventh year of the reign of his late Majesty King Edward VII., chapter 16, and amendments thereto, and subject to the same terms and conditions as the fund set apart by that Act.

Section 2 of the said Act is amended by adding thereto the following subsections:

(a) The council of every county in which road improvements are undertaken under this Act shall by by-law designate an engineer or some other competent person subject to approval by Minister of Public Works to act as county road superintendent under the direction of the council.

(b) No grant shall be made to any county under this Act until subsection a has been complied with.

(c) The county road superintendent shall place some competent person as foreman or inspector in charge of any work which it is impossible for him to personally oversee, and it shall be the duty of the foreman or inspector to see that the work is properly carried out.

(d) No member of the council of the county and no member of the council of any local municipality in the county shall be appointed or act under subsections a or c or be employed by the county road superintendent in any capacity, and any such member who is appointed, or who acts or is employed in contravention of this subsection shall be disqualified from sitting or voting in the council of which he was a member at the time of his appointment or employment.

The treasurer of every county shall, before the first day of March in each year, make up and transmit to the Minister of Public Works a detailed and audited statement of all expenditure upon, or in connection with, county roads or bridges for the next preceding calendar year. The statement shall be in such form as the Minister of Public Works may direct. The treasurer shall forthwith publish the statement at least once in a newspaper, published in the county town. The clerk of the county shall procure not less than one hundred copies of the statement and shall deliver or transmit by post one of such copies to each of the electors who shall first make request for the same.

Section 6 of the Act is amended by adding the following: "Or the council instead of raising money by debentures may provide the money required out of county funds, or by an annual county rate in the manner authorized by the Municipal Act, and all the provisions of this Act shall apply to any moneys heretofore or hereafter so provided as fully as if debentures had been issued, whether a by-law transferring such moneys to a special account under this Act has or has not been passed."

Section 12 of the Act is repealed and the following substituted therefor: "All highways designated and assumed by a county council in accordance with section 2 of this Act, except as in subsection 3 of section 2 otherwise provided, shall be maintained and kept in repair by the corporation of the county in which such roads are situate, and in all cases of doubt or dispute as to what constitute works of maintenance or repair, and what constitute works of construction and the purchase and maintenance and repair of road machinery, plant and equipment, properly chargeable under this Act, the decision of the Minister of Public Works shall be final; provided that after the expiration of three years from the final construction and completion of the county system of roads, which shall be so declared by the Minister of Public Works, the county council may, with the approval of the Lieutenant-Governor in Council and of two-thirds of the minor municipalities in the county expressed by by-law, declare that such system of county roads shall, on the 1st of January following, revert to the local municipalities in which the same are situate, and such roads shall thereafter be maintained in the same manner as township roads."

Where it is found by the Minister of Public Works that any highway assumed by the county council under the Act, has ceased to be, or for some other reason is not of sufficient importance to be constructed and maintained as a county road, such road or section thereof may be struck off the approved plan of county roads, by the Lieutenant-Governor in Council, and such road or section thereof shall thereupon revert to the local or township municipality in which the same is situate.

The Act is amended by inserting therein the following section:—

(1) The Minister of Public Works may arrange with the corporation of any local municipality for the construction or improvement therein of an object-lesson or experimental road, or of more than one such road.

(2) The Minister may lay out, construct, improve and complete any such road and the Public Works Act shall apply to anything done by him under this Act.

(3) The cost of material, labor, special engineering or other services, plant, machinery and equipment and the repair and maintenance of plant, machinery or equipment in or about any work undertaken by the Minister under this section or incidental thereto, shall be paid out of the fund set apart under this Act, upon the certificate of the Minister and for that purpose accountable cheques may from time be issued against such fund in favor of the Minister, upon his requisition therefor.

(4) A road shall not, by reason of its having been constructed or improved under this Act, become or be the property of the Crown, but every such road after its construction or improvement shall be under the jurisdiction of the council of the municipality in which it is situate and shall be maintained and kept in repair in the same manner as other roads in the municipality.

When any highway leading to, or adjacent to any city or town separated from the county is widened, strengthened, reconstructed or otherwise improved or requires the expenditure of a greater amount for maintenance and repair to meet the requirements of increased, heavy, constant or other extraordinary traffic to and from such city or town, beyond the requirements which, but for the existence of such city or town, would be deemed those of a standard highway for the locality, the corporation of such city or town by by-law passed with the assent of at least two-thirds of the members of the council thereof may agree with the corporation of the county to contribute such additional cost, or a proper proportion of the cost, or that the amount of the contribution of such city or town shall be determined by arbitration under the Consolidated Municipal Act, 1903, and may, without the assent of the electors, provide by by-law for the issue of debentures payable in not more than twenty years from the date of the issue thereof to raise the amount agreed upon or awarded, or may agree with the corporation of the county for the payment of such amounts in annual instalments to be raised by annual special rate upon the rateable property in the city or town.

The council of any county may assume as a county road under this Act, any main or leading road or roads through or within such county, and where such road or roads do not serve all townships equally, the county council may, with the approval of the Minister of Public Works, omit from assessment any township or townships through which such road or roads do not pass, or may assess any or each township through which such road or roads pass for a larger or smaller amount in order to equitably assess the cost; or the council of any county in which a system of roads is established may, upon the application of a township council, and with the approval of the Minister of Public Works, levy a special rate upon the township for the construction, improvement or maintenance of the county road or roads within such township.

SUMMER SCHOOL.

Announcement is made of the twelfth annual six weeks summer school of the College of Engineering of the University of Wisconsin, which opens on the twenty-fourth of June.

Courses of instruction and laboratory practice are offered in electrical, hydraulic, steam and gas engineering, mechanical drawing, applied mechanics, testing of materials, machine design, shopwork and surveying, in addition to which subjects may be taken in the College of Letters and Science.

For bulletin, address F. E. Turneaure, University of Wisconsin, Madison, Wisconsin.

RAILWAY, TELEPHONE AND OTHER POLES.

The statistics for the poles purchased during 1910 in Canada were obtained from the telephone, telegraph, electric light and power and electric and steam railways operating in Canada. Reports were secured from 559 companies, about 89 per cent. of the total number in operation, by Mr. H. R. MacMillan, of the Forestry Department, Ottawa. Electric light and power companies numbered 291, telephone companies 161, steam railway companies 62, electric railway companies 41, and telegraph companies four. Of these companies 283 operated in Ontario, 94 in Quebec, 39 in Nova Scotia, 35 in Saskatchewan, 27 in Alberta, 23 in New Brunswick, 23 in British Columbia, 17 in Manitoba, 10 in Prince Edward Island, and eight were United States Companies operating in Canada.

The total number of wooden poles purchased in Canada during 1910 was 782,841. The gain over the number reported for 1909 was 434,586, or 118 per cent., due partly to the increased building of steam railway and rural telephone lines. The total value at point of purchase was $1,043,874, which was an increase of $546,822 over the value in 1909. The average cost of poles was $1.39 in 1909 and $1.33 in 1910. The decrease of six cents was due to an increase in the use of short cedar poles by telephone and telegraph companies.

Cedar is the wood most frequently used for poles in Canada, as it is practically the only Canadian wood growing to a convenient pole size which is cheap, easily handled and durable. There were 758,209 cedar poles purchased in Canada in 1910, or 99.2 per cent. of the total. Spruce, furnishing 0.7 per cent. of the total, stands next in the list, having increased in use 175 per cent. over 1909. One-tenth of one per cent. of the total is made up of chestnut, larch and Douglas fir.

The unspecified are, on the average, more expensive because a small proportion of them belong to high length-classes and may include some treated poles. The use of larch has decreased from 14,401 poles in 1909 to 73 poles in 1910. The increased use of spruce accounts partially for this, but the difference is mostly due to the fact that a local telephone company building through a larch district in 1909 in the West used larch poles entirely, but did not build lines in 1910.

Chestnut, hitherto taken with unspecified, was this year separated. All chestnut poles are imported from the United States.

In 1909 pole users were classified under three headings: (1) Telephone and telegraph; (2) steam roads; (3) electric roads, power and light. It was found difficult to properly separate the first two, and in 1910 only two divisions are made: (1) railways, telephone and telegraph, and (2) electric roads, power and light. In 1910, as in previous years, the important class was that including the railway, telephone and telegraph companies, which purchased 744,387 poles or 95.1 per cent. of the total number reported. The use of poles by these companies was 119 per cent. greater in 1910 than in 1909, the increase being all in cedar.

This increase in the use of cedar is also seen in the consumption by electric roads, power and light companies, which used 113 per cent. more cedar in 1910 than in 1909. These companies bought 38,454 poles in 1910, or 4.9 per cent. of the total.

For the steam railway, telephone and telegraph companies the average cost of poles purchased in 1910 was $1.20 per pole; and for electric railway, power and light companies, $3.98. The difference in these average prices indicates the difference in the size or grade of the average poles suitable for the purposes of the two classes of companies.

In the shorter length-classes, as the 20-to-25-foot class, which composes 75 per cent. of the total number used, it is seen that chestnut is cheapest, then cedar, larch, spruce and Douglas fir. This in itself would explain the great popularity of cedar, for it gives for the money more service than any of the other native woods used.

The prices paid for poles range from $1.01 for chestnut poles 20 to 25 feet long to $7.39 paid for poles of unspecified species 41 feet and over. In general the value of poles advances very rapidly, though not proportionately, with increasing length. The one instance in the 31-to-35-foot class in which spruce poles were bought for 51 cents may be explained by the purchase of the poles in a locality of Nova Scotia where woods have comparatively low value.

Cedar poles appear in every length-class, and form the largest proportion. Spruce also is found in every class, but neither chestnut, larch nor Douglas fir were used over 30 feet in length.

In the thirty-foot class cedar poles are more expensive in Canada than in the United States. Above thirty feet they become cheaper. As seventy-five per cent. of the poles used in Canada are thirty feet or less in length, this means that companies using poles pay more for them, on the average, in Canada than in the United States. At present Canadian users are paying no attention to preservative methods, which in reality increases still more the relative cost. The pole-users of the United States, though paying less for their poles, treat them at a small extra expense, thus increasing the life of the pole and decreasing the yearly cost.

Spruce poles cost more in Canada than in the United States in 1909, except in the 20-to-25-foot class. In this short-length class the cost is 13 cents less per pole in Canada. In the 26-to-30-foot class they cost 35 cents more in Canada than in the United States. In lengths of 31 to 40 feet and over, spruce poles cost from 11 cents to 64 cents more per pole in Canada.

In 1910 poles were exported to the United States and other countries to the value of $74,708. Imports into Canada consisted of 138,285 cedar poles worth $139,486, making an excess of imports over exports of $64,778. These imported cedar poles cost $1.00 per pole and belonged to the 25-foot length class.

Poles, as at present used in Canada, receive no protection against decay in the parts in contact with the soil. The result is that moisture is drawn into the pole, fungus growth is supported and the pole is useless in a short term of years. This unnecessary waste may be done away with and the cost per annum of a pole line may be decreased by treating the poles with certain preservatives. According to information obtained from the Forest Service of the United States, 576,631 poles or 15.4 per cent. of the total used, received such treatment before use in 1909.

In 1908, 10.6 per cent. received such treatment. This increase within a year of nearly 50 per cent. in the use of chemical preservatives shows that the experiment is successful and that it is making poles less expensive. As has been shown, 75 per cent. of the cedar poles used in Canada are from 20 to 40 cents per pole more expensive at the point of purchase than similar sizes in the United States. Evidently it pays United States pole-users to use preservatives with cheap poles. It would, therefore, pay Canada much more to lessen the annual cost of her more expensive poles by lengthening the life of the poles.

It requires from 175 to 200 years to produce the average cedar pole, which, if left unprotected, will rot and be useless in fourteen years. This species, forming 99.2 per cent. of the total number used, grows entirely in the south-eastern part of Canada. At present the yearly consumption far exceeds the annual growth. Under the present methods of exploiting the forest, cedar will become commercially extinct in a few years. It is absolutely necessary that some method be adopted to avoid this catastrophe. The easiest means is to adopt the general use of preservative treatment to lengthen the life of cedar and to make other species, not naturally decay-resisting, available for pole use.

Untreated cedar poles, thirty feet long, cost, when the pole is in place, $7.00, and last on the average fourteen years. This is an annual cost of 71 cents per pole, allowing interest on a five per cent. basis. By the creosote brush treatment, which consists in applying the preservative to the pole by hand with a brush, the cost of each pole is raised to $7.20. These poles have a life of seventeen years, making the annual cost 64 cents per pole, or reducing the cost seven cents per pole per annum. If the open-tank treatment is used, which consists in saturating the poles in alternate hot and cold preservative baths of creosote, the cost per pole is $8.05. These poles last 22 years, which makes the annual cost 61 cents per pole, or 10 cents less per pole than with untreated poles. The use of preservatives is both a saving of expense and a saving of the forests.

Spruce, though at present forming only 0.7 per cent. of the total (5,524 poles being used in 1909) should receive attention.

It is a tree which grows to useful pole size in 60 to 100 years, is cheap, light and easily handled. The reproduction of spruce is excellent. It occurs naturally over large areas in Canada, and, under present conditions of logging, is reproducing rapidly. It is adapted to many kinds of soil and the species is quickly propagated by seed. Untreated, the wood is not durable, but if treated it will last as long as the naturally durable and more expensive species used at present.

Preservative treatments will be of no particular benefit to the lodgepole pine of the West, used chiefly for mining timbers and props. This species is of suitable pole size and occurs extensively on the mountain slopes of Alberta and British Columbia. As an untreated pole, it decays quickly in contact with the soil, lasting about five years. The tree grows tall and straight with very little taper and makes a well-shaped pole. Large quantities of this timber have been killed by fire. The dead trees are now standing thoroughly seasoned and in excellent condition for effective treatment. The sapwood is about an inch thick and is easily impregnated.

It would cost $1.40 per pole to treat by the tank method 35-foot poles of this species. Such a treatment would increase the life of the poles to 20 years, an increase of 300 per cent. over their present life.

The adoption of the preservative treatment of poles would result in a great saving to the pole-users of the prairie provinces. Cedar from Eastern Canada is now used almost exclusively for poles in the prairies, and because of the long freight haul is very expensive. Close to the pole-lines of Western Canada there are large quantities of lodgepine and spruce. Poles of these species may be treated and set for less cost than untreated cedar poles and will give greater service than untreated cedar poles. This is an opportunity for economy which should not be overlooked by companies erecting pole-lines.

Metallurgical Comment

T. R. LOUDON, B.A.Sc.

Correspondence and Discussion Invited

FURNACE ELECTRODES PRACTICALLY CONSIDERED.*

By R. Turnbull.

A number of papers have been read at the various meetings of this society during the last two or three years, and articles published in the technical papers, on electrode losses, but, so far as I am aware, the practical end of the electrode question has never been taken up by any one of our members except in a very superficial manner.

It therefore occurred to me that as electric furnace practice is only confined to a very small percentage of the members of this society, and as there must be quite a number who have never encountered electrode troubles, and who may not understand what benefit the society is getting from the above mentioned discussion on electrode losses, that for these reasons a practical paper written on the subject of electrodes by one who has been in the business for a number of years might prove of some benefit to the members as a whole.

Before going into the history of the electrode, let us first see what relation is has to the electric furnace. Putting it in its simplest form, the electrode is to the electric furnace what the steam pipe is to the steam engine. In the latter case the steam or source of energy is carried to the engine in the pipe at a certain pressure, represented by pounds per square inch and the volume of steam by the number of cubic feet. To get more power, should the volume be increased the pipe must be made larger in diameter, in order to avoid frictional losses, etc. The same result could be attained, within a certain limit, by increasing the pressure and allowing the volume to remain the same. In the case of the electrode, the pressure and volume of the steam are replaced by volts and amperes; an electrode, if large enough, will carry to the furnace a certain number of amperes with very little loss in volts, but as the amperes increase, the section of the electrode must also be increased, otherwise the loss in volts by resistance in the electrode will become serious and considerably decrease the output of the furnace. As in the case of the steam pipe, the pressure in volts might be increased in order to get more power into the furnace, but electric furnace operation is generally controlled by the voltage, and a variation from the usual number of volts would upset the good operation of the furnace.

Now let us examine what an electrode is composed of, and what constitutes a good and bad electrode.[1] The mixture used in the manufacture of the ordinary electrode is anything but a complicated one, being simply some kind of carbon mixed with certain percentages of pitch and tar. This, after being well mixed together, is moulded in some special apparatus to the desired form, and then baked in a furnace in a non-oxidizing atmosphere. This looks simple, and when one looks back on the troubles and tribulations experienced by technical men in electric furnace work over quite a number of years, due mainly to bad electrodes, it seems strange that the secret of making electrodes which would not break was not discovered long ago. But good electrodes were made from the very beginning, and it is quite possible that amongst the first batch of electrodes made some were equal in quality to the best electrodes made at the present day. This was where the great difficulty confronting the manufacturer lay, in his ability to, unintentionally, turn out a first-class electrode and a thoroughly bad one at the same time and under exactly the same conditions. Electrodes made at the same time, under the same conditions, and baked in the same furnace, have shown in actual service as many different characteristics in quality as could well be imagined, some giving excellent service whilst others simply went to pieces after being in operation for a few minutes.

As the electrode is to the electric furnace what the gasoline motor is to the aeroplane, one can well imagine what a bad electrode meant to the operator of the electric furnace; without the efficient gasoline engine the aeroplane would probably be unknown, and the same might be said would be the case of the electric furnace without good electrodes.

In the early stages of electrode manufacture petroleum coke was mostly employed, it being first of all calcined to drive off all volatile matter. This was afterwards replaced by retort carbon, a kind of coke which is deposited in the retorts in gas works, and which is nearly pure carbon. Better results were obtained by the use of retort carbon than with petroleum coke, and it was considered for a time the only material with which a reasonably good electrode could be turned out. I have not sufficient data to enable me to say when and where the first large electrodes were made, but I should not be far wrong in saying that they were first made by Dr. P. Héroult at his works in Froges, France, some fifteen years ago; at that time he made them as large as 16 inches (40 cm.) square and 6 feet (1.8 m.) long. Some of these first electrodes manufactured by him were very good, and some very bad, and little if any reliable data could be collected from his work. I should like to say here, however, Dr. Héroult has not abandoned the field, he having established works in Niagara Falls, N.Y., where excellent electrodes are now being turned out, and although the process used is different in some respects from his original one, he is still working along the same lines. His original process is still being used with good results at at Welland, Ontario, by Electro-Metals, Limited.

Now, what was the reason of so many failures to turn out a good article in the early days, and why do nearly all electrode manufacturers, even those who have been but a short time in the business, turn out to-day a fairly satisfactory article? I think I am not far wrong in saying that the main cause of failure was in the use of the wrong carbon material. Petroleum coke did not work well, and electrodes made from it crumbled to pieces in the furnaces. Retort carbon made a better electrode, but as this commodity was collected from gas works all over the world, a homogeneous article could not be counted upon, and this made its use dangerous to the manufacturer, so far as reliability was concerned. It was only when anthracite coal came into use that real progress was made, and the best kind of electrodes in use to-day are made from this material. Hardmuth, of Venisseux, France, was, if I am not mistaken, the first to use anthracite coal on a large scale, and for some time his electrodes were the best in the market. He was quickly followed by the German makers.

*Read before the American Electro-Chemical Society on April 19th 1912.

[1] There are two classes of electrodes, the amorphous carbon and the graphite; it is the former to which I wish to draw attention, as graphite is prohibitive for ordinary furnace practice, owing to its high cost.

the Plania Werke and Siemens. We are indebted to-day to the Plania Werke for the moulded screw, which enables electrodes to be joined together, thus doing away with the stub and machining of the electrode and the trouble of changing electrodes in the furnace. This screwed electrode applies mainly to furnaces for the manufacture and refining of steel. At the present time nearly all manufacturers are using anthracite coal as the carbon base, and while electrodes made by some manufacturers are superior to those made by others, this is mainly due to the different methods of moulding the electrodes and preparing the coal employed.

So much progress has been made in this industry in the last two or three years that perfectly satisfactory electrodes up to 24 inches (60 cm.) in diameter and 7 feet (2.1 m.) long are now being made, whilst only a few years ago nothing over 12 inches (30 cm.) square and five feet (1.5 m.) long was satisfactory. No doubt still larger electrodes can and will be built, as electric furnaces are still growing in size, and the time is not far distant when steel furnaces of 30 tons' capacity, and operating with electrodes three feet (0.9 m.) in diameter, will be as common as are our small 5-ton furnaces of to-day.

Before closing this paper, I would like to give a few hints as to the best manner of employing an electrode in order to ensure the best service and avoid the losses of which we have heard so much. Carbon, unlike metals, is a better conductor hot than cold, and the hotter it is, the better conductor it becomes. Carbon, however, even at a very high heat, is still a poor conductor, and it is impossible in actual practice to avoid some loss in the electrode itself. In all conductors, the longer the conductor, the greater the loss, but this loss can be lessened by increasing the size of the conductor. This same rule applies to electrodes, and in order to avoid all losses to the greatest extent possible the current should enter the electrode at a point as near as possible to the point where it will leave it. It is quite common practice to connect the metallic conductor to the head of the electrode, but this is a grave mistake, as the loss in volts in a long electrode will be from 4 to 6, depending on the current density employed, and in a furnace where the operating voltage is 50 volts, this loss would be equal to from 8 to 12 per cent. of the total energy consumed. Electrodes should be held in the same manner as one would hold a bar vertically in the hand, so that they can be taken at any point on their length, and in smelting furnaces the holder giving contact to the electrode should not be at any time more than 1 foot (30 cm.) above the charge. As the electrode wears away it is slipped through the holder, and the process goes on until it is finally taken by the head, but at no time should the part of the electrode carrying the current project more than 2 to 6 inches (5 to 15 cm.) from the holder itself. The losses, both of heat and energy, can be decreased by increasing the size of the electrode, but this can be carried too far. The writer would recommend a current density of from 30 to 35 amperes to the square inch of section (5 to 6 per sq. cm.) in order to keep the electrode as cool as possible and thereby prevent side oxidation and heat losses. With too large an electrode, quite a good percentage of the total energy supplied to the furnace would be required to keep the electrode warm.

An important point, the value of which is sometimes overlooked when considering the size of electrodes, is that it is often advisable to use electrodes of greater cross-section than electrical necessity demands, but for a totally different reason. In some processes, for instance, the electrode when working is surrounded to a certain depth by charge mixture. At the surface of such charge mixture, and therefore at some distance from the working end of the electrode, inflammable gases are given off, and these burning in air tend to attack and consume the electrode. Thus there is a tendency to reduce cross-section at this point with consequent increased current density, followed by rise of temperature, which further aggravates the condition described. It is, therefore, wise, for convenience sake, to use a larger cross-section so that the burning away does not result in eating the electrode through, letting a large piece of elecrode into the charge and disturbing conditions generally This is one of the exigencies imposed by practice.

FERRO-SILICON, FERRO-CHROME AND FERRO-PHOSPHORUS.

Ferro-silicon, ferro-chrome, ferro-phosphorus, etc., have been made in electric furnaces at Buckingham, Que., by the Electric Reduction Company, Limited. The furnaces were not in operation during 1910. Ferro-silicon has also been made in electric furnaces at Sault Ste. Marie, and at Welland, Ont. The electric furnaces operated by the Electric Metals Company were in operation during 1910. These furnaces, constructed some three years ago, consist of four furnaces of from 1,000 to 1,500 horse-power each, the daily production being from 5 to 8 tons.

The imports of ferro-silicon, manganese, etc., during 1910 were 18,900 tons valued at $464,741, or an average of $24.59 per ton. The imports during 1910 were 17,699 tons valued at $411,536, an average of $23.25 per ton.

Returns of steel production received direct from the producers showed a total production of ingots and castings for 1910 of 822,284 tons, as compared with 754,719 tons in 1909, and 588,763 tons in 1908. In 1910 the production of open-hearth ingots was reported as 580,932 tons, Bessemer ingots 222,668 tons, direct open-hearth castings 18,085 tons, and other steels 599 tons; compared with 1909 there was an increase in total production of 67,565 tons, or nearly 9 per cent.

Statistics showing the quantities of the principal materials used in steel furnaces have been obtained for the first time for the year 1910, and it may be of interest to refer to these here. The total quantity of pig iron used in steel furnaces during 1910 was 690,913 tons: of which 601,219 tons were produced by firms reporting, and 89,694 tons purchased. The quantity of ferro-alloys used was 8,143 tons purchased. Scrap, etc., was used to the extent of 211,453 tons, being 140,913 tons produced by the firms reporting, and 70,540 tons purchased. Ores used included 1,317 tons of manganese ore and 39,332 tons of iron ore, while 144,110 tons of limestone or dolomite flux were used 7,461 tons of fluorspar. In Ontario a little over 600 million cubic feet of natural gas were used, while in Nova Scotia, coke oven gas was used at Sydney, of which a record of quantity is not obtained.

Complete statistics of the production of rolled products and of manufactured steel have not been received. Returns from seven of the largest producers show a production of blooms, billets, slabs, etc., of 628,100 tons, of which 580,533 tons were used by the producer for further manufacture, and 47,567 tons sold to other rolling mills.

The production of rails was 399,762 tons, of rods 88,456 tons, of bars 125,778 tons, of other rolled products 31,516 tons. The production of steel rails in 1909 was returned as 377,642 tons, and in 1908, 300,935 tons.

CHEMISTRY IN SWEDEN.

Chemistry has played an important part in the industrial history of Sweden. No less than twenty of the known chemical elements have been discovered by Swedes.

EXPERIMENTS ON HEAT INSULATION.*

By F. A. J. FitzGerald.

At the twentieth general meeting of this society a paper[1] was presented describing an electric furnace experiment in which it was found that the heat losses were so great that the furnace was not commercially practicable. It was also observed that by placing a layer of special heat insulating bricks wherever practicable on the outer walls of the furnace the heat losses were much diminished.

The very serious consequences of not attending properly to heat insulation led to an attempt to study the subject of heat losses, and the following paper describes some of the preliminary experiments.

Energy which should be usefully employed in the electric furnace is lost in various ways: Current leakage, generation of heat in the cables and other means for conducting the current into the furnace, conduction, convection and radiation of heat by the furnace walls, etc. In many furnaces there can be little doubt that the most serious loss of energy is that due to the escape of heat through the walls.

In the study of this subject we have no data which enables us to make calculations of the heat losses which will occur with different materials and under various conditions. No doubt there have been careful and valuable investigations made on the heat conductivity of materials and some experiments on the emissivity of hot bodies. Little information is available as regards convection. When such data as we

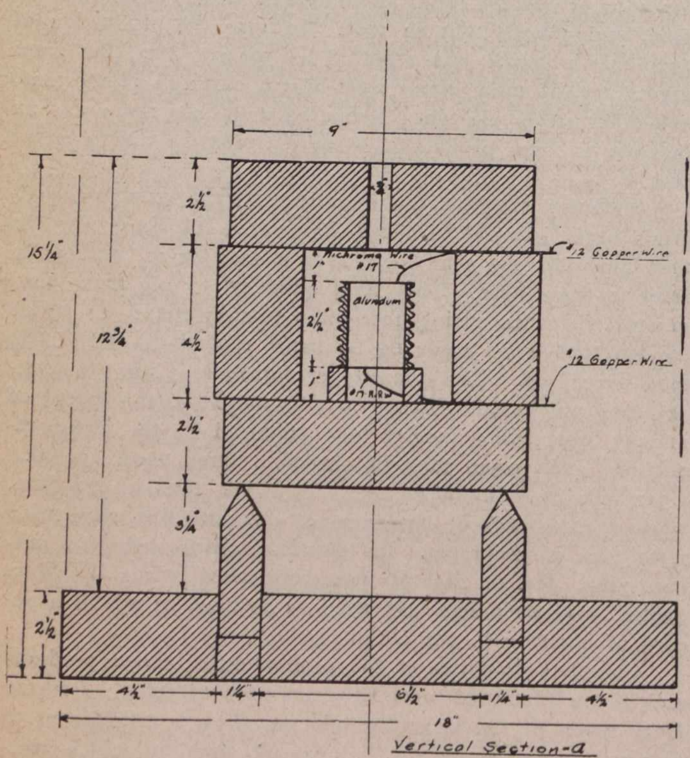

Fig 1

have on these various causes of heat loss are examined and an attempt made to calculate probable losses the results are usually most unsatisfactory. On the other hand it is still more unsatisfactory to construct electric furnaces and find that they are commercially impracticable because the heat loss through the walls is such a large percentage of the total heat generated in the furnace.

The ideal method of studying the subject would be to make the necessary experiments to determine the heat conductivity of the various materials to be used in constructing the walls of furnaces, to make measurements of the emissivity of the heated walls and so forth. But when the plans for such an investigation are made it is soon seen that much time and expense is involved. Under these circumstances

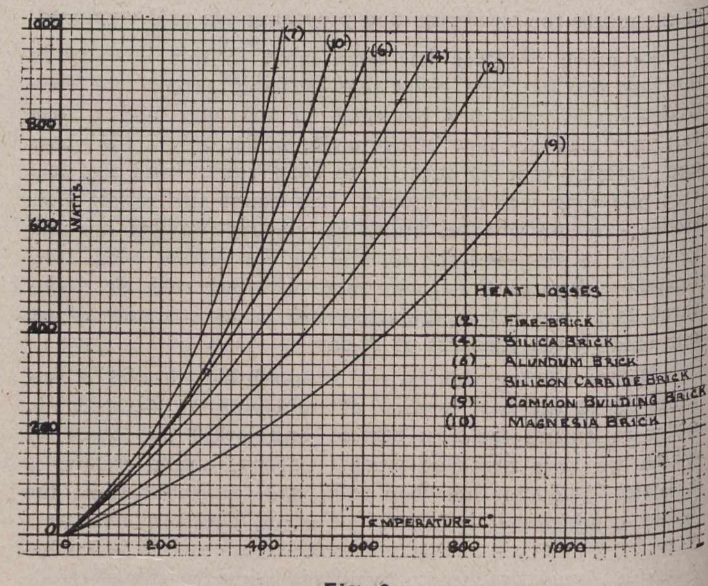

Fig. 2.

it was thought to be more immediately useful to determine by comparatively simple experiments what materials would give the minimum loss of heat. By such work a great many materials could be immediately rejected and those which gave good results would be more fully investigated.

The apparatus used in the experiments is shown in Fig. 1. The furnace is constructed of the bricks under investigation and is heated by means of a resistor of "Nichrome" wire through which the current is passed. The resistor is connected to the source of current through a rheostat so that the rate of generation of energy in the resistor can be regulated, and means are provided for accurately measuring this rate. The method of making a test is to regulate the current so that a definite temperature is reached in the furnace and then to continue heating until the temperature becomes perfectly constant. As a rule a single determination takes several hours and the temperature is not considered constant until the readings of the pyrometer show no variation for at least two hours. When the temperature is constant the rate of generation of energy in the resistor is determined and this gives the rate at which heat is escaping through the furnace walls, neglecting what escapes by conduction through the leads going to the resistor and through the wires of the pyrometer thermo-couple. In nearly all cases four determinations at temperatures ranging from 200° to 900° were made for each of the materials tested.

From the data obtained as described above, curves were plotted in which the abscissas are temperatures and the ordinates watts.

In Fig. 2 are shown the curves obtained with several different bricks.

No. 2 is a fire brick of moderately good quality, that is to say, it is not of any special make. It was the brick used in constructing the furnace referred to in the paper mentioned above.[2] The maximum temperature reached in the brick testing furnace was 800°.

* Read before the Am. Electro-Chem. Soc., April 18, 1912.

[1] "Note on an Unsuccessful Furnace Experiment," F. A. J. FitzGerald. Transactions 20, 89 (1911).

[2] Ibid.

No. 4 is the curve for a silica brick. It is interesting to note that in the paper already referred to it was said:

"It was recognized that silica brick are better heat insulators than fire brick, as may be seen from Wologdine's determinations[3] which show that the heat conductivity of silica is 0.0020 and of fire brick 0.0042."[4]

It appears, however, that in spite of its low heat conductivity this particular silica brick is not a satisfactory insulator. The maximum temperature reached with the silica brick was 670°. The heat loss here was 36 per cent. greater than with the fire brick. It is not very safe to theorize as to the cause of this phenomenon, but it looks as though the radiation from the surface of the silica brick is very much greater than from the ordinary fire brick. The vast differences due to the nature of the radiating surface is not so surprising if a familiar household phenomenon is considered, viz., the great difference in the rate of cooling of the common black iron kettle and the polished silver tea pot.

No. 6 was obtained from an alundum brick, one of the highly refractory ones made by the Norton Company. The transmission of heat was so rapid with this brick that the maximum temperature obtained in the furnace was only 570°. This illustrates well the value of such alundum refractories as crucibles, muffles, etc., where it is desirable to have as efficient transmission of heat as possible.

No. 7 is the curve for a brick made of silicon carbide. The brick is pure silicon carbide, that is, no bond is used in making it. The transmission of heat is extremely good with this brick so that the maximum temperature reached in the furnace was only 420°. Comparing this brick with the fire brick (2) when the temperature in the furnace was the same (420°) it is seen that the rate of escape of energy is 920 watts and 300 watts respectively, or more than three times as great in the case of the silicon carbide brick.

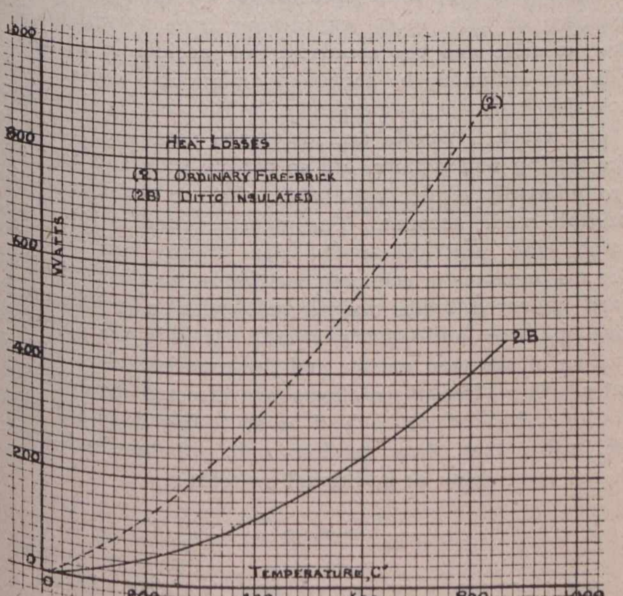

Fig. 3.

Curve No. 9 is that for an ordinary red building brick of the cheapest kind. It is seen to be the best insulator of any of this lot, the heat losses being as much as 34 per cent. less than those for the fire brick (2) at a furnace temperature of 800°.

Curve No. 10 shows the results obtained with a magnesia brick. This was of a standard kind made of brown magnesia and not the Grecian magnesia variety.

[3] Electrochemical & Metallurgical Industry, Vol. VI. (1909), page 383.

[4] These Transactions, Vol. 20, 89 (1911).

In Fig. 3 are shown the results obtained, first with the ordinary fire brick (2) and then after covering the whole furnace built of this brick with a 25 mm. (1 inch) thickness of a special heat insulating material kindly supplied by a well-known manufacturer. It will be observed that this material reduced the heat losses by more than 50 per cent.

In Fig. 4 is a comparison of the heat losses obtained with the ordinary fire brick (2) and a brick specially constructed for heat insulation. Here it will be observed that in the case of the special insulating brick the heat losses are reduced 68 per cent.

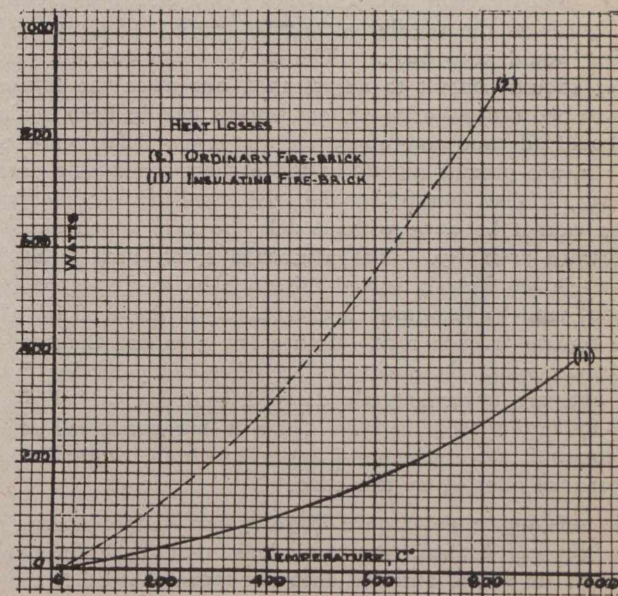

Fig. 4.

The first object of this work is to make a study in the quickest way possible of the heat insulating properties of various kinds of brick used in building furnaces and get some notion of the amount of heat lost with such materials. The ultimate object in view is the production of a heat insulating article, the cost of which will be less than that of the watt-hours uselessly dissipated through furnace walls.

TERMINAL BRAKE TESTING.*

By F. B. Farmer.

As we seek efficient train brakes and as the standard set by law is based on the train, it is obvious that terminal brake tests of trains must be made. Stated differently, the requirements can not be met by confining inspecting, testing and repairing to shops and repair tracks. Consideration of overtime and the sixteen-hour law, as well as expeditious train movement demand the minimum lapse of time between that for which the crew is called and the time the train departs. Hence, a train prepared for departure should require no more brake work after the engine is coupled than, at the most, stopping a few leaks in hose couplings and making the formal test. But often there are greater delays due to making other repairs, or the train proceeds with less efficient brakes than it should have. To avoid this, the repairs required must be determined with arriving trains. The incoming engineer should add to the reduction required for stopping enough to fully apply the brakes, and the brake-

* Abstract of a paper read at the December meeting of the Western Railway Club, Chicago.

man should await his advice that this has been done before cutting off the engine. Car inspectors should be present to make an immediate examination and to bad order all defective brakes. Such repairs as ordinary brake pipe leaks, defective hose and wrong piston travel, which require little time, should be made, but cars requiring heavy brake repairs should be marked for the repair tracks.

Here is where judgment must be exercised, as perishable or other very important loads, as well as empties needed at once for such lading, must not be delayed. Neither should other less important cars be held in numbers far greater than the local force can repair in a day if such force is as great as the regular amount of work, including such repairs, would keep busy. The car foreman and the yard master should consult to adjust this, but when the former removes bad order marks without repairs having been made, he should fill out and apply an air brake defect card to better insure prompt repairs at the earliest practicable date. However, it does not follow that the repairing of defective brakes cannot be done without delay to cars which should go forward promptly. The Minneapolis, St. Paul & Sault Ste. Marie has largely solved this problem at an important terminal yard by assigning a short track in the yard for air brake repairs to such cars. With a few men and the necessary repair materials, such cars are often ready for the first train out, are never actually delayed, and few are allowed to go forward without repairs. This is but one detail of a very comprehensive scheme of improvement in freight brake maintenance effected by this road.

As one repair point on a large system cannot maintain all freight car brakes, it is obvious that each terminal should do its share, but this does not mean that other than the outgoing test should be made on through trains at the points with small facilities. A brake well repaired will go for a long period without becoming defective, but the too common failure to do so is due to inadequate repairs. To reduce the cost of brake cleaning by leaving cylinders and auxiliary reservoirs loose on the car is to insure leaky pipes. The same result follows if the brake pipe and retaining valve pipe are not well secured. That most serious fault, brake cylinder leakage, will develop sooner than it should, sometimes immediately after the cleaning, unless a suitable lubricant is employed and packing leathers are replaced when a good inspection and a careful test would show that they should be. The practice often followed of cleaning and testing triple valves on the car cannot insure good work. Neither is it common practice to test hose with soap suds while under maximum pressure and remove those found porous, or to examine the retaining valve weight and clean the case and small vent port. Until these and other details are given better attention in shops and on repair tracks, it will not be possible to effect the economy in time and money in terminal brake testing and the consequent repairs that will otherwise follow.

The M. C. B. requirement that cars in interchange must have retaining valves should imply the maintenance of this part and its pipe by the owning road. It is not sufficient to say that the mountain road may make needed repairs at the owners' expense, as this means undue delay to traffic. However, inspections show that the average efficiency of brakes is otherwise much lower on the cars of level grade roads, a condition for which there is no warrant as that for the average mountain grade road is enough below 100 per cent. efficiency to justify making it the minimum.

That the regular terminal test of freight train brakes misses many of the defects which nullify the object sought in attaching air brakes, is conclusively demonstrated by the following: Within a few months competent parties made a test on several freight trains at the summit of a mountain grade, following a similar test by regular inspectors at the preceding division terminal, and out of which trains bound down this grade were supposed to leave with 100 per cent. efficient brakes, based on such test. The tests consisted of charging to 70 lbs., making a service reduction of 15 lbs.

Per Cent Good Brakes by Test. Standing.	Per Cent Good Brakes by Test. Thermal.	Tons per Good Brake by Test. Standing.	Tons per Good Brake by Test. Thermal.	Cars per Train.
97.7	68.8	42.6	59.5	61
91.0	75.0	45.0	54.6	56
100.0	60.0	40.7	67.6	58
98.1	53.7	42.5	77.6	54
98.1	52.8	43.8	81.5	53
96.4	53.5	41.7	75.0	56
88.9	67.2	46.2	61.2	55

and rapidly examining for any brakes failing to apply or leaking off and incorrect piston travel. To show conclusively the oversights of the ordinary terminal brake test the infallible thermal brake test was made on each train at the foot of the grade. The customary plan was there followed of considering three cars with "warm" wheels equal to one with "normal" wheels; that is with a good brake. In addition to showing the results in percentage, they are given in "tons per good brake," derived by dividing the train tonnage by the number of good brakes.

The first train was a test train and had 2,501 tons. The other six were regular trains and ran from 2,252 to 2,367 tons, averaging 2,286 tons. Each train had a considerable percentage of foreign cars. No tests of or repairs to retaining valves were made.

The big returns from good brakes are mainly concealed, consisting of the more expeditious train movement they make possible and the avoidance of accidents, neither of which can ordinarily be shown in dollars and cents. Their observable expenses, consisting of initial cost, maintenance, flat and cracked wheels and delays to cars and trains for brake testing and repairs, are so readily seen and tabulated as to generally render even more obscure their great but intangible credit account. The pressing need is for a more accurate and practical appreciation of the fact that good brake maintenance is economy and for better directed efforts toward improved brake maintenance with a minimum increase in time and money spent. In this the active cooperation of the yard master and the superintendent will aid greatly. Too often their efforts are directed toward showing why trains cannot be held or switching done for brake work, rather than how to accomplish the desired results with the least delay or additional switching.

THE CITY AND SUBURBS PLANS ACT.

The following is the text of the new Act respecting Surveys and Plans of Land in Certain Cities and Their Suburbs, passed by the Legislature of Ontario:

Where any person is desirous of surveying and subdividing into lots with a view to the registration of a plan of the survey and subdivision, any tract of land lying within or within five miles of a city, having a population of not less than 50,000, he shall submit a plan of the proposed survey and subdivision to the Ontario Railway and Municipal Board for its approval.

The Board shall have authority before approving of the proposed plan to require such changes to be made in it as the Board may deem proper as to:—

(a) The number and width of the roads or streets;

(b) The direction in which the roads and streets are to run and their location; and

(c) The size and form of the lots.

Nothing in clause (a) shall authorize the laying out of any road or street, less than 66 feet in width.

In determining as to the suitability of the proposed plan, or as to the desirability of any change in it, the Board where the land lies within the city shall have regard to making the subdivision and roads and streets and their location and width, and the direction in which they are to run, conform as far as practicable with any general plan which has been adopted or approved by the council of the city in accordance with which it is contemplated that the city and suburbs shall be laid out or the re-arrangement of the streets and thoroughfares shall be effected, and where the land is situate without the limits of the city, the Board shall have regard to

(a) The proximity of the land to the city;

(b) The probability of the limits of the city being extended so as to include it;

(c) The securing of driveways and adequate thoroughfares connecting the city and the outlying districts;

(d) Making the subdivision and the roads and streets and their location, and width, and the direction in which they are to run, conform as far as practicable with any plan so adopted or approved or if no such plan has been adopted or approved with the plan on which that part of the city which lies nearest to the land is laid out.

No plan of any such land shall be registered unless it has been approved by the Board and a certificate of its approval, signed by the chairman or a member of the Board or the secretary is endorsed on the plan, and no lot laid down on a plan, not so approved shall be sold or conveyed by a description containing any reference to the lot as so laid down or to such plan.

Notice of an application to the Board for its approval of a plan, shall be given to the corporation of the municipality in which the land is situate and to the corporation of the city, and all parties interested shall be entitled to be heard, and maybe represented by counsel at the hearing of the application.

A copy of the plan shall accompany such notice.

Objections to the plan shall be stated in writing and be filed with the secretary of the Board within 21 days after delivery of the notice and plan.

If no objection is made within that period the applicant shall be entitled to have the plan certified as approved, unless the Board of its own motion shall have otherwise directed.

Sittings of the Board shall, if required by the council or municipality objecting to the plan, take place at such time and place in the city nearest to the land, as the Board, by notice to the applicant and to the clerk of the municipality requesting the same, appoints.

ENGINEERING NOTES.

Province of Ontario.—Under the provision of the Public Health Act, the Provincial Government will organize seven health districts. Two of these will be in New Ontario, two in the sparsely settled districts stretching across from Georgian Bay to the Ottawa River, and the remainder so arranged as to produce the best results, having regard to population and natural conditions. This will mean in all fourteen salaried appointments—seven district health officers and seven inspectors, the former to receive a salary of $2,500 per year, the latter $1,000. These districts will be so arranged as not to conflict with the work of the municipal health bodies now working in towns and cities that are not part of counties, and the organization will be made effective as soon as the present officials serve out their terms of office.

Mr. J. B. Shelton, car foreman of the Grand Trunk Pacific shops at Transcona, Man., is building a new truck and sleeping-car for the use of employees when called to wrecks. The car will be a model of its kind, and will materially add to the comfort of the men.

PERSONAL.

Mr. F. B. Connery has resigned from his position as superintendent of overhead construction work with the Toronto Hydro-Electric Commission and has accepted a similar position with the Toronto Power Company.

Mr. Jackson Clark, of Wellington, Ont., has received the appointment of assistant district provincial surveyor and will be located at North Battleford, Saskatchewan. Mr. Clark graduated from the School of Practical Science this year.

Mr. Alan Mair Jackson, who has just passed his final O.L.S. examination, has been appointed county engineer for Haldimand county, with headquarters at Dunnville, Ont. Mr. Jackson is an associate member of the Institute of Mining and Metallurgy.

OBITUARY.

Charles Robert Boucher, one of the most widely known railroad engineers in Canada, died at Sault Ste. Marie, Ont., on April 26th last. Up to the time of his illness he had been engaged in building bridges along the line of the Algoma Central Railway. He was also prominent in the construction of the Temiskaming and Northern Ontario, and had been from coast to coast on both sides of the border in railroad construction. He was buried in New York. He leaves a widow and one son. He was 64 years of age.

BOARD OF GOVERNORS OF THE UNIVERSITY OF TORONTO.

Mr. T. A. Russell and Lieut.-Col. Albert E. Gooderham were appointed by the Provincial Government on April 25th to places on the Board of Governors of the University of Toronto. These gentlemen are to take the places formerly occupied by Hon. W. T. White and Hon. T. W. Crothers. The appointments take effect at once.

NEW PRESIDENT OF AMERICAN ELECTRO-CHEMICAL SOCIETY.

Mr. William Lash Miller, professor of chemistry at the University of Toronto, has been elected president of the American Electro-chemical Society.

To a Canadian this is a signal honor, in view of the fact that he will represent the American Electro-chemical Society at the Congress of Applied Chemistry, which meets in Washington next September on the invitation of the President and Government of the United States.

At the meeting of the Congress, which is held every five years, will be industrial chemists from all over the world. This will be the first time the society has met in America. The last meeting was in Rome.

ANNUAL MEETING SOCIETY OF CHEMICAL INDUSTRY.

The Society of Chemical Industry elected the following officers at the annual meeting held April 25th, Toronto: Chairman, Wallace P. Cohoe; vice-chairman, R. F. Ruttan, W. L. Goodwin and Prof. J. Watson Bain; Executive Committee, H. P. Mills, O. H. Wurster, R. T. Mohan of Hamilton, A. Neighorn, Milton L. Hersey, C. F. Heebner, J. A. De Cew, Prof. W. Lash Miller, G. F. Guttman, N. N. Evans, T. H. Wardleworth, E. G. R. Ardagh.

Mr. O. H. Wurster read a paper on the manufacture of glycerine as a by-product of soap. He showed the various methods used commercially, and which may be used in the future for the refining of the crude glycerine so produced in order that the glycerine may be used in the manufacture of dynamite, and also to produce a chemically pure glycerine for other purposes.

Mr. Anthony McGill, LL.D., of the Inland Revenue Department, Ottawa, presided.

COMING MEETINGS.

CANADIAN INSTITUTE.—198 College Street, Toronto. May 4th—Annual Meeting and Election of Officers. President, J. B. Tyrrell; Secretaay, Mr. J. Patterson.

AMERICAN RAILWAY ASSOCIATION.—May 15th, Semi-Annual meetlng at New York City. Sec'y, W. F. Allen, 75 Church St., New York.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—May 22nd-25th. Annual Convention at Chicago, Ill. Secy., D. B. Sebastian, La Salle St. station, Chicago.

FOURTH NATIONAL CONFERENCE ON CITY PLANNING.—May 27th-29th. Meeting, Public Library, Boston, Mass. Sec'y, Flavel Shurtleff, 19 Congress Street, Boston, Mass.

AMERICAN WATER WORKS ASSOCIATION.—June 3rd-8th. Annual Convention at Louisville, Ky. Secy., J. M. Diven, 271 River St., Troy, N.Y.

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

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

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

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

ENGINEERING SOCIETIES.

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

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

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

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

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

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

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

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

MUNICIPAL ASSOCIATIONS

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

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

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

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

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

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

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

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

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

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

CANADIAN TECHNICAL SOCIETIES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

CANADIAN STREET RAILWAY ASSOCIATION.—President, D. McDonald, Manager, Montreal Street Railway; Secretary, Acton Burrows, 70 Bond Street, Toronto.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

CONSTRUCTION NEWS SECTION

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

PLANS AND SPECIFICATIONS ON FILE.

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

Bids close			Noted in issue of
4-30	Tunnel sewer, Edmonton, Alta.	(S.)	4-4
4-30	Trunk sewer, Edmonton, Alta.	(S.)	4-11
4-30	Subway, Moose Jaw, Sask.	(P. & S.)	4-18
5-10	One diesel oil engine, Vernon, B.C.	(S.)	4-25
5-15	Reinforced arch bridge, Guelph, Ont.	(P. & S.)	5-2
5-29	Water works, sewerage and electric light systems, Melfort, Sask.	(P. & S.)	5-2

(Saskatoon plans and specifications are on file at The Canadian Engineer Office, 820 Union Bank Building, Winnipeg).

(Melfort plans and specifications are also on file at The Canadian Engineer Offices, 820 Union Bank Building, Winnipeg, and B33, Board of Trade Building, Montreal).

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.
Arborg, Man., school house	May 1.	Apr. 11.	59
Berlin, Ont., sewer pipe	May 1.	Apr. 25.	61
Calgary, Alta., timber structures	May 15.	Apr. 18.	76
Calgary, Alta., concrete structures	May 1.	Mar. 28.	70
Calgary, Alta., designs for aqueduct	May 1.	Feb. 22.	70
Exeter, Ont., water pipes, etc.	May 6.	Apr. 25.	72
Exeter, Ont., sewer pipe	May 10.	Apr. 25.	72
Fort William, Ont., garbage incinerator	May 15.	Apr. 18.	74
Fredericton, N.B., school building, St. Mary's Reserve	May 2.	Apr. 18.	60
Guelph, Ont., laying tracks	May 3.	Apr. 25.	72
Hillsborough, N.B., post office fittings	May 6.	Apr. 25.	62
Lebret, Sask., school house	May 31.	Apr. 25.	61
Little Pines, Sask., school house, etc.	May. 6.	Apr. 4.	60
Moose Jaw, Sask., paving	May 15.	Apr. 25.	72
Muncey, Ont., alterations to Industrial School	May. 1.	Apr. 4.	60
Orangeville, Ont., bridge	May 6.	Apr. 25.	61
Ottawa, Ont., pumping machinery	May 14.	Apr. 25.	70
Ottawa, Ont., dredging	May 6.	Apr. 25.	62
Ottawa, Ont., road machinery	May 6.	Apr. 25.	62
Ottawa, Ont., dredging	May 13.	Apr. 25.	62
Ottawa, Ont., steel tug	Apr. 22.	Apr. 11.	60
Ottawa Ont., designs for monument	Oct. 1.	Apr. 18.	60
Ottawa, Ont., fishing protection vessel	June 17.	Apr. 18.	74
Port of Quebec, Que., proposals for drydock	July 2.	Apr. 18.	60
Point Grey, B.C., plans for university	July 31.	Feb. 7.	60
Regina, Sask., electric supplies, Sec. 6 to 9	May 15.	Apr. 11.	72
Saskatoon, Sask., superstructure 23rd Street subway	May 17.	Apr. 18.	76
Sault Ste. Marie, Ont., widening lower entrance channelway	May 10.	Apr. 18.	60
Selkirk, Man., bridge, Gunn's Creek	May 7.	Apr. 18.	60
Stratford, Ont., bank building	May 6.	Apr. 25.	62
Toronto, Ont., Dundas Street	May 7.	Apr. 25.	72
Vancouver, B.C., pumping engine, hose wagon, etc.	May 2.	Apr. 11.	60
Vancouver, B.C., water pipe and gate valves	May 15.	Apr. 25.	62
Varna, Ont., drainage work	May 15.	Apr. 25.	62
Vernon, B.C., diesel oil engine	May 10.	Apr. 25.	72

TENDERS.

Arkona, Ont.—Tenders for the erection of the Arkona Baptist Church, plans and specifications of which may be seen by applying to W. J. George, Arkona, will be received by the Secretary, R. Crawford, up to May 10th, 1912.

Cobourg, Ont.—Tenders will be received till the 14th day of May, 1912, for the construction of sewage disposal works for the House of Refuge, Cobourg. Specifications, etc., at the office of the Engineer, T. Aird Murray, 303 Lumsden Building, Toronto, or at the Town Hall, Cobourg. (See advt. in Canadian Engineer).

Guelph, Ont.—Whole or separate tenders addressed to Prof. W. H. Day, O. A. College, will be received up to noon of May 8th, 1912, for the several trades in connection with the erection of a Masonic Temple, Guelph. Plans and specifications may be seen at the office of W. A. Mahoney, Architect, 20 Douglas St.

Grandview, Man.—Tenders for the construction during 1912 of about 30,000 feet of granolithic sidewalk in the town of Grandview, Man., will be received by Wm. Dickie, Secretary-Treasurer, Grandview.

Guelph, Ont.—Tenders for the construction of a reinforced arch bridge and viaduct for foot traffic on Heffernan Street, over the C.P. Railway and the River Speed, having a total length of about 520 feet. J. Hutcheon, city engineer. (See advt. in Canadian Engineer.)

Hamilton, Ont.—Tenders will be received up to Thursday, May 30th, 1912, for supplying the corporation of the city of Hamilton with flanged special castings for Beach Pumping Station, 3 Venturi meters, 2 travelling cranes, and water tower. Specifications at the office of the City Engineer. S. H. Kent, City Clerk. (See advt. in Canadian Engineer).

Hamilton, Ont.—Tenders will be received by Geo. H. Lees, Mayor, up to May 9th, 1912, for the several works required in the erection of a public comfort station under Hughson Street roadway. Plans, etc., at the office of the architect, A. W. Peene, No. 2 King Street West, 2nd floor, Hamilton. S. H. Kent, City Clerk, Hamilton.

Kamloops, B.C.—Tenders are invited for the supply of all materials and labor required for the completion of a new High School at Kamloops, B.C. Plans and specifications may be seen at the office of John Parlett, architect, Freemont Block, Victoria Street, Kamloops.

London, Ont.—Tenders for fifteen bridges to be erected in London Township will be received by Mary Grant, clerk, 110 Dundas Street, London, until noon of May 4th, 1912. Plans and specifications at the County Engineer's office, County Buildings, city.

Melfort, Sask.—Tenders will be received until May 29th, 1912, for water works, sewerage and electric light systems for the town of Melfort. J. E. Durin, secretary-treasurer, Melfort, Sask. Messrs. McArthur, Murphy and Underwood, engineers, Bottomley Block, Saskatoon, Sask. (See advt. in Canadian Engineer.)

Province of New Brunswick.—The Department of Public Works, Fredericton, will receive tenders for the rebuilding of Lane's Creek arch bridge culvert at Upper Woodstock, Carleton County. The tenders are to be in by May 20th next.

North Battleford, Sask.—Tenders will be received by the Secretary-Treasurer until 8 p.m., on the dates specified against the respective works, for the following, viz.:—

Contract H, furnishing and erecting boiler, May 15th.

Contract J, furnishing and erecting 750 horse-power steam engine and accessories, May 15th.

Contract K, furnishing and erecting 500 k.w. generator and equipment, May 15th.

Plans and specifications may be seen at the office of the engineers, Toronto and Winnipeg, and at the town hall, North Battleford. J. Griese, Esq., Mayor. H. W. Dixon, Secretary-Treasurer. Chipman & Power, Engineers.

Ottawa, Ont.—Tenders for the construction of a Public Building at Wallaceburg, Ont., will be received at the Department of Public Works, Ottawa, up to 4 p.m., on Wednesday, May 13th, 1912. Plans, etc., at the Post Office, London, Ont.; Post Office, Wallaceburg, Ont., and at the office of R. C. Desrochers, Secretary, Department of Public Works, Ottawa.

Ottawa, Ont.—The Department of Trade & Commerce has been advised that the Commonwealth of Australia is inviting tenders for 135,633 tons of steel rails and 9,644 tons of fish plates required for the government railway system. Tenders close on May 29th. Canadian manufacturers will forward offers by mail which leaves San Francisco on May 1st. Rails and fish plates are to be of open hearth steel, and are to be delivered at Fremantle and Port Augusta. The rails are to be 80 pounds to the yard mostly, but a small portion is to be 60 pound rails.

Ottawa, Ont.—Tenders will be received by the secretary, R. C. Desrochers, Dept. of Public Works, until May 13th, 1912, for dredging required at the following places in the province of Ontario: Goderich, Napanee, Picton, Telegraph and Nigger Islands.

Ottawa, Ont.—Tenders will be received by the secretary, R. C. Desrochers, Dept. of Public Works, Ottawa, up to May 15th, 1912, for dredging required at the following places in the province of Ontario: Lanoraie, Woodland, Vercheres, Varennes and Lavaltrie. Specifications, etc., at the office of the Dept. of Public Works, Ottawa.

Owen Sound, Ont.—Tenders for a concrete dam at Inglis Falls will be received up to noon, Monday, May 13th, 1912, at the office of the Wm. Kennedy & Sons, Ltd., Owen Sound, at which place plans and specifications are to be seen.

Owen Sound, Ont.—Tenders will be received up to noon of May 9th, 1912, for all trades required in the erection of a Public Library Building at Owen Sound. Drawings, etc., may be obtained at the Architects, Forster & Clark's office. J. H. Packham, Chairman of the Board.

Regina, Sask. — Tenders will be received by the City Commissioners up to noon of May 5th, 1912, for the construction of two filter beds, one stand-by tank, pipe lines connecting with the various parts of the works. Copies of plans and specifications may be had from J. M. MacKay, chief engineer, trunk sewer works, Regina.

Saskatoon, Sask.—Tenders will be received by the City Commissioners up to noon of Tuesday, June 25th, 1912, for the complete installation (including all buildings) of a 70 ton per 24 hours incinerator plant, and the operation of the same for a period of three months after completion. (See advt. elsewhere in Canadian Engineer.)

Toronto, Ont.—Tenders will be received up to noon, Monday, May 6th, for the dredging of the crib berths at the new Ashbridge's Bay docks. Plans of location, etc., may be obtained at the office of the Toronto Harbor Commissioners, 76 Adelaide Street West. F. S. Spence, Acting Chairman.

Weyburn, Sask.—The Secretary, Weyburn High School, will receive tenders up to Friday, May 10th, for the erection of a Collegiate Institute building. Copies of plans and specifications may be seen at the office of Geo. J. G. Jarrett, architect, Weyburn, and at the Builders' Exchange in Regina and Winnipeg.

Winnipeg, Man.—Tenders, separate, will be received by the Chairman, Board of Control, up to noon of May 15th, 1912, for the manufacture and delivery at the city gravel pit, Bird's Holl, Man., of one electric locomotive with accessories complete, and one electrically-operated shovel with accessories complete. Specifications, etc., may be obtained at the office of the City Light and Power Department, 54 King Street. M. Peterson, Secretary, Board of Control Office, Winnipeg.

CONTRACTS AWARDED.

Battleford, Sask.—The Western Pavers, Limited, Saskatoon, have the contract for laying approximately 150,000 sq. ft. of cement sidewalk, with crossings and curbing.

Brandon, Man.—The work of construction on the two wings of the new asylum will be carried out by Mr. John Clark, who also has the contract for the main building, which will soon be completed. The addition will be the same height as the rest of the new building, and will cost over $100,000.

Fredericton, N.B.—The Fredericton & Grand Lake Coal & Railway Company have signed a contract with Messrs. A. E. Trites & Son for the construction of the Gibson and Minto Railway. The contract calls for the construction of the road between Gibson and Minto, a distance of 31 miles, and also for the construction of the masonry structures of the several bridges on the line. The Dominion Bridge Company of Montreal will have the contract for the superstructures of the bridges. The cost of the railway, including bridges, will be $650,000.

Kenora, Ont.—The contract for the installation of the new electrical unit in the power-house has been awarded to Messrs. Allis-Chalmers-Bullock Company of Montreal. The contract amounts to $25,000.

Lake Quinze, Maple Rapids, Que.—Dam and sluiceways, contractors, Messrs. Morrow and Beatty, of Peterborough, Ontario.

Little Lameque, N.B.—Wharf: Contractor, H. G. Beresford, of St. John, N.B.

Moose Jaw, Sask.—The contract for laying about 96,000 lineal feet of 18-inch steel water pipe has been awarded, one-half to Maurice S. Holmes, Souris, Man., at 90c. per lineal foot complete, and the other half to the Moose Jaw Construction Company, Limited, at 94c. per lineal foot complete. Walter J. Francis and Company, Consulting Engineers.

Moose Jaw, Sask.—The Moose Jaw Construction Company, Limited, have received contract for supplying and erecting a reinforced concrete reservoir of 2,000,000 gallons capacity at a cost of $34,352. Walter J. Francis and Company, Consulting Engineers.

Moose Jaw, Sask.—The contract for supplying and erecting four centrifugal pumps, two motors, wiring, switchboard and accessories, has been awarded to The Canadian Boving Company, Limited, 164 Bay Street, Toronto. Price, $4,075. Walter J. Francis and Company, Consulting Engineers.

Moose Jaw, Sask.—Contracts for supplying and erecting two prime mover equipments, transmission equipment and accessories for headworks pumping station at Caron, have been awarded to the Canadian Fairbanks-Morse Co., Ltd., of Montreal, their price being $8,755.

Moose Jaw, Sask.—Supply of various valves and fittings for waterworks installation; Contractors, Messrs. Drummond, McColl & Co., Montreal, Que., unit prices total amounts to about $8,000.

Moose Jaw, Sask.—The contract for supplying and erecting one elevated water tank of 75,000 gallons' capacity, has been awarded to George T. Horton, Washington Heights Station, Chicago, Ill., at a cost of $6,400.

Moose Jaw, Sask.—The following tenders were received for the extensions that are to be made to the King Edward Schools: The Western Building Company, $30,972; Gowan & Potts, $32,950; and Navin Bros., $31,500. The Western Building Company received the contract, which includes heating and all other necessaries.

Moose Jaw, Sask.—Contract for the supply and delivery of sewer pipe and specials f.o.b. cars, Moose Jaw, has been awarded to the Dominion Sewer Pipe Co., Swansea; price, $5,117.85. Other bidders were: The Ontario Sewer Pipe Co., Mimico, $5,500; Messrs. Whitlock & Marlatt, Moose Jaw, $5,555; Saskatchewan Glass & Supply Co., city, $5,659.75; Astrid S. Paving Co., Chicago, $5,677.50; Toronto Pottery Co., $5,865.50.

North Battleford, Sask.—Messrs. Kilbride, Kilbride & Sutherland, of North Battleford and Calgary, have received the contract for 180,000 sq. ft. of concrete sidewalk. Price, 10-ft. walk, 18c.; 6-ft., 5-ft., and 4-ft. walk, 15c.

Port Arthur, Ont.—The Northern Electric & Manufacturing Co. have been awarded the contract for the installation of a fire alarm system at a cost of $10,343.

Prince Albert, Sask.—The Ambursen Hydraulic Construction Co. of Montreal, has been awarded the contract for the construction work on the proposed Lacolle Falls power scheme. The estimated cost of the whole undertaking totals up to $945,000.

Regina, Sask.—Contracts for trunk sewer pipe have been awarded by the city council as follows:—

1.—Seventh Avenue Trunk Sewer, the Canadian Lock Joint Pipe Company, $41,133.70.

2.—Wascana Valley Trunk Sewer Contract No. 1, the American Sewer Pipe Company, $29,631.04.

3.—Wascana Trunk Sewer Contract No. 2, Messrs. Broley & Dicken, of Fernie, B.C., $20,585.20.

Toronto, Ont.—Dredging of Approach Channel to Ferry Wharves at Hanlan's Point, in Toronto Bay: Contractors, the General Construction & Dredging Co., Ltd., of Toronto.

Upper Salmon River, N.B.—Pier: Contractors, Warren Downey and Oscar Downey, of Curryville, N.B.

Victoria, B.C.—The British-American Construction Company have been awarded contracts for the construction of the piers, landing stage, building platform and launching ways in connection with the construction of the G.T.P. drydock at Prince Rupert.

Victoria, B.C.—The contract for the work on the new High School on the site at Fernwood Road, has been awarded to Messrs. Dinsdale & Malcolm. The building is to cost about $329,000.

Winnipeg, Man.—The Burridge-Cooper Company, Limited, of Winnipeg, have the contract for supplying a 50-h.p. gasoline traction engine, delivered f.o.b. city yards at $3,350.

Winnipeg, Man.—Supply of ten double end asphalt wagons, to be delivered f.o.b. cars, city yards; contractors, Messrs. Burridge-Cooper Co., Ltd., Winnipeg; cost, $3,440.

Winnipeg, Man.—Engineer of Construction, J. W. Astley, Winnipeg, has the contract for the erection of a machine shop at city yards, Ross Avenue and Tecumseh Street, at a cost of $16,568.

Winnipeg, Man.—The firm of Barrett & McQueen, contractors, were awarded the contract by the C.P.R. for the erection of a million-bushel transfer elevator in the company's new yards in North Transcona.

RAILWAYS—STEAM AND ELECTRIC.

Calgary, Alta.—A report states that within a month or two work will be started on the building of a railway to the property of the Alberta and Canada Iron Syndicates, 25 miles west of the town of Okotoks, and when the railway is completed, a great smelter and a 400 ton stamp mill will be erected and iron will be mined. The whole project will involve the expenditure of around $5,000,000. P. Burns is behind the venture.

Province of British Columbia.—Messrs. Mackenzie and Mann have purchased the Butte Inlet Railway Charter in this province. It is reported that they will construct about twenty miles of the line during the coming season.

Eastern Ontario.—The Canadian Pacific Railway have recently installed a new block signal system on their lines between Hull and Ottawa. According to the system a train cannot leave Hull or Ottawa before the conductor has obtained a staff which is locked and unlocked by electrical means. Only by deliberately ignoring the system could a collision of two trains occur between Hull and Ottawa.

Province of New Brunswick.—Contracts are being closed for the construction of Gibson and Minto Railway during the season now opening.

Sir Thomas Tait, as president of the Fredericton and Grand Lake Coal and Railway Company, is signing the contract with the Provincial Government, and the work has been offered to Messrs. A. E. Trites & Son, and will be, it is expected, accepted by them.

Northern Ontario.—The T. & N. O. Commissioners have placed an order for a gas-electric car according to a recent report.

Welland, Ont.—A deputation of farmers, fruit-growers and business men from Pelham and Font Hill were promised consideration of their request for line extension from the management of Niagara, St. Catharines and Toronto Electric Railway.

Western Canada.—Revision of existing grades and surveys for double tracking the Canadian Pacific main line between Vancouver and Calgary, a distance of over 600 miles, are now under way. The work is in charge of F. F. Busteed, former general superintendent of the British Columbia division, who has established headquarters at Kamloops, B.C.

LIGHT, HEAT AND POWER.

Prince Albert, Sask.—Mr. J. R. Heckle, representing the Ambursen Hydraulic Construction Company, has made a proposition to the municipal council of this city regarding the construction of a dam and headworks for the Lacolle Falls power scheme.

Province of Quebec.—A notice has been sent out from the department dealing with the provincial water powers to the effect that the proposed auction of water powers in this province arranged to be held on May 14th next has been postponed until June 26th by order of the Minister of Lands and Forests.

Winnipeg, Man.—Considerable activity will soon be witnessed in the matter of line construction in and around this city owing to the department having charge of the civic light and power calling tenders for 2,000 wooden poles.

GARBAGE, SEWAGE AND WATER.

Cartierville, P.Q.—A sterilization system depending on hypochlorite of calcium has been installed in this municipality under the supervision of Engineer Meadows, of the Provincial Board of Health. The system has given satisfactory service so far.

Toronto, Ont.—The cost of constructing the filtration plant at the Island has amounted to $40,000 above the original estimates. The additional expense is made up as follows:—Changes in the electrical equipment at the pumping station and the installation of the Island pumping plant at the station, $9,000; extra fill for the clear water reservoir, $3,500; additional motors, $2,000, and the balance in miscellaneous work.

Winnipeg, Man.—Owing to an accident at the pumping plant at the main city well the city was recently on the verge of a water famine, as a supply of 5,000,000 gallons of the 7,500,000 gallons is expected from this source.

BUILDINGS AND INDUSTRIAL WORKS.

Calgary, Alta.—Negotiations that have been under way for some time have been concluded and as a result the Winona Pioneer Tractor Company will erect a large plant in this city.

Edmonton, Alta.—Work will commence on a new Grand Trunk Pacific hotel at Edmonton, Alberta, which will be a third link in the chain of hotels which this company intends to build throughout Western Canada. For some time Messrs. Ross & McFarlane, architects, of Montreal and Winnipeg, have been engaged in the preparation of plans, and within a few weeks the actual construction work will begin.

Edmonton, Alta.—The directors of the Alberts College have purchased 240 acres and are about to erect a modern educational institution for boys and young men.

Fort William, Ont.—The Edwardsburg Starch Company, propose the erection of a starch and syrup factory to cost $350,000.

Hamilton, Ont.—Mr. M. S. Glassco and G. B. Jacobs are looking for a suitable site on which to erect a jam factory. The capital of the new concern is given as $100,000.

Medicine Hat, Alta.—Messrs. Bennett and Lockwood are about to erect a new hotel on Montreal Street, and W. R.

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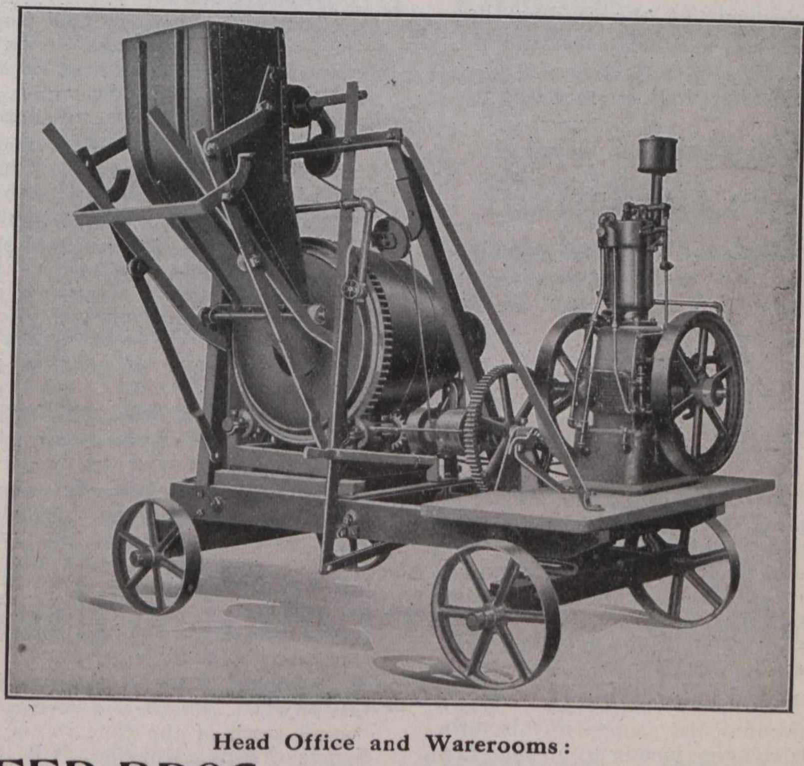

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Penland has commenced construction work on a new hotel on Ottawa Street. Both are three storey structures.

Nelson, B.C.—The Provincial Government will give the sum of $50,000 toward the erection of a new hospital to cost about $100,000.

North Winnipeg, Man.—The members of the Board of North Winnipeg Hospital are planning to erect a $100,000 structure that will form the nucleus of a modern hospital equipment.

Ottawa, Ont.—The management of the Capital Brewing Company are preparing to erect a new building on Wellington Street. Mr. Kuntz is manager of this company.

Port Arthur, Ont.—Preliminary arrangements are being made for the erection of an I.O.O.F. Hall on the corner of Park and Court St. Estimated cost $40,000.

Regina, Sask.—The management of the Ontario and Manitoba Milling Company have reached a satisfactory agreement with the Board of Trade whereby the company will erect a large milling plant in this city. The company have agreed to erect a mill with an output of 2,000 barrels per day, to erect a linseed flax mill and an oatmeal mill, and to erect their own power plant.

Regina, Sask.—The names of Peter Henry Van Gorp, Iowa, U.S.A., and Anson Barker, of this city, appear on the list of directors of a recently formed agricultural implement manufacturing concern. The company has a capital of $100,000, and it is expected that a building will be erected here at an early date.

Saskatoon, Sask.—The congregation of Grace Church are collecting funds for the erection of their new church. The estimated cost of this work is given at $75,000. Mr. A. C. McEwan is chairman of the committee in charge of the matter.

Toronto, Ont.—Messrs. McGregor & McIntyre are preparing to construct a steel plant on Shaw Street. This work is to cost about $40,000.

Vancouver, B.C.—Plans are under preparation for a $600,000 opera house. The building will be of steel frame construction and have accommodation for 1,550 patrons.

Vancouver, B.C.—The directors of the Vancouver General Hospital have made arrangements for the construction of a laundry addition to the buildings. The cost of this will be about $52,000.

West Toronto, Ont.—Work on a large locomotive roundhouse has been started for the Canadian Pacific Railway. When completed it will accommodate 150 engines.

Yorkton, Sask.—The management of the Hudson Bay Company at Winnipeg will erect a $50,000 store in this town.

Yorkton, Sask.—Mr. W. D. Dunlop will erect a $50,000 store in this city. It is to be red brick and cut stone 60 x 70.

BRIDGES, ROADS AND PAVEMENTS.

County of Chateauguay, P.Q.—The councilmen of this county are preparing to start an extensive programme of road improvement. About $350,000 is to be spent in this work.

Fort William, Ont.—The Island side of the new Canadian Pacific Railway bridge across the Kaministiquia River was badly damaged from the effects of a severe wind storm that swept that vicinity recently. Three approach spans were wrecked and considerable steel work torn from the concrete anchorage.

Hamilton, Ont.—Certain interests in this city are interested in a proposition calling for the paving of the highway between Toronto and Hamilton. They have estimated the cost to be $15,000 per mile, and point out that the many advantages arising from the work would be ample to offset the original outlay.

Lindsay, Ont.—It is reported that a new bridge will have to be constructed over the Pigeon River in the immediate future, as the old one was damaged by ice.

Montreal East, P.Q.—The municipal council of this town are arranging for considerable concrete paving to be done this year.

Peterborough, Ont.—The ratepayers will vote and decide the question of erecting a bridge across the Otanabee River.

Saskatoon, Sask.—The municipal engineering department are about to commence sand stone paving on the steep portions of the city around the Nutana Hills. This work will cost about $15,000.

Vancouver, B.C.—The municipal council have passed an order calling for $500,000 worth of street pavements to be laid during the next few months.

Victoria, B.C.—A delegation has been appointed to present a list of benefits arising out of the construction of a bridge across Seymour Narrows to the Federal Government at Ottawa.

Winnipeg, Man.—Plans are under preparation for the construction of a new steel bridge leading into Elm Park. The plans show a structure 521 feet long with an elevation of 25 feet above the average summer water level. As soon as the plans are ratified at Ottawa tenders will be called. The designer of the bridge is Prof. Brydon Jack, engineer of the Elm Park Company.

FIRES.

Winnipeg, Man.—The Macpherson Fruit Company's plant and storehouse was recently damaged by fire.

Winnipeg, Man.—Fire damaged the plant and premises of Messrs. Brown and Rutherford, lumber merchants. The loss will be about $25,000.

CURRENT NEWS.

Amherst, N.S.—An order for 60,000 tons of car building material has been placed with the mills of the United States Steel Corporation by the Canadian Car and Foundry Co.

This will be used in the construction of a large number of cars recently ordered from the Canadian company by the Canadian Pacific, the Grand Trunk, the Intercolonial and the Canadian Northern.

The Canadian roads are still figuring on further large equipment purchases.

Mr. George J. Bury, vice-president and general manager of the C.P.R. western division, has announced that the company has decided to increase the rolling stock to the extent of $22,000,000 to keep up with the tremendous growth of the system.

Eastern Ontario.—The Dominion Government will probably deepen the Murray Canal from Trenton to Cobourg. It is now nine feet deep and covers a length of eight miles. Survey parties are being sent out, and on their report will depend the extent of the deepening. The canal will be lighted for night navigation this summer.

Fort William, Ont.—The management of the Rhodes-Curry Company of Amherst, N.S., and the management of Edwardsburg Starch Works have been in this city looking for suitable sites on which to establish plants.

Fort William, Ont.—Should the ratepayers vote in favor of granting certain privileges to the management of the Canada Car and Foundry Company, of Amherst, N.S., the company have pledged themselves to erect a plant to cost $1,000,000, to complete the work within 20 months of the start of building operations and employ 1,000 men for the first five years.

Fort William, Ont.—The harbor tug Sarnia is now in dry dock and will have a new set of boilers installed as the old ones were condemned by the Government inspector.

Medicine Hat, Alta.—In order that the Ogilvie Milling Company's plant may be constructed with all possible speed the councilmen have had lists prepared and will request all voters to attach their names and their method of voting. In this way the delay caused by the preparation of the voters list will be overcome and should the majority pledge their support for the by-law the company will commence building operations at once.

Moncton, N.B.—A company has been recently formed in this province to work and develop the tungsten deposits. The capital stock of the concern is given as $99,000, and Mr. Samuel Freeze, Moncton, N.B., has been elected vice-president and manager. The purposes of the company are to explore the tungsten and tin ores discovered at Burnt Hill Brook on the Miramichi River, which in a measure was opened up

last summer and which was favorably reported upon by Dr. R. W. Brock, director of the geological survey of Canada.

Montreal, P.Q.—The Board of Control have at their disposal $800,000 and will use the same for improvements that are to be included in the supplementary estimates. The major portion of this amount has come in as revenue from tax arrears and according to the civic constitution may be spent on works other than those of a permanent nature.

Port Arthur, Ont.—The Board of Education has accepted the plans of Hood and Scott, Architects, for a 12-roomed school building in Coatsworth Park. Estimated cost $50,000.

Quebec, P.Q.—The management of the Dorchester Electric Company has purchased a large lot of land known as the Taschereau property. It is said that the company intends immediately erecting their workshops on the site.

Regina, Sask.—Builders resident in this city recently held a meeting for the purpose of forming a Builders' Exchange for the province of Saskatchewan, and later to become affiliated with the Dominion Exchange.

Sarnia, Ont.—The municipal council have negotiations on with the management of a large steel manufactory. They have offered one acre of land free.

Stratford, Ont.—The ratepayers voted in favor of constructing a new market shelter at a cost of about $10,000. Other by-laws carried call for the granting of a free site to the Macdonald Thresher Company, the guaranteeing of an $8,000 loan to Mr. B. M. Williams, and to grant a loan of $5,500 to Mr. G. L. Griffith, who proposes the establishment of a sadlery and harness plant in this city. Mr. Williams requires his money for assistance in the organization of a woolen plant.

St. Lawrence River.—The Federal Government has secured by contract for another year the George Davie wrecking plant for use on the St. Lawrence River, it is also reported that in addition to this the shipping interests are taking steps to provide a thoroughly up-to-date plant, installed with wireless telegraphy and other modern equipment.

TRADE ENQUIRIES.

The following were among the inquiries relating to Canadian trade received at the office of the High Commissioner for Canada, 17 Victoria Street, London, S.W., during the week ending April 15th, 1912:—

A Glasgow firm who sell all grades, crude and manufactured, of asbestos, are prepared to act as selling agents for Canadian mine owners not already represented in Great Britain.

A Liverpool firm make inquiry for the names of Canadian manufacturers of linseed cake.

A South of England engineering firm wish to appoint Canadian agents for the sale of their centrifugal and turbine pumps.

A London firm desires to secure agencies for Canadian importers and exporters.

From the branch for city trade inquiries, 73 Basinghall Street, E.C.:—

A London firm manufacturing a new patented tobacco pipe, and also a special pipe cleaner, seeks suitable Canadian resident agents.

PATENTS.

The following is a list of patents recently granted to inventors in Canada; the list is furnished by Messrs. Fetherstonhaugh & Company, Royal Bank Building, King Street East, Toronto.

J. H. McKittrick and G. S. Ransom, cremators; P. L. Robertson, screw machines; J. M. Farrow, spike machines; T. Allatt, apparatus for making spacers for antifrugal separators; A. G. Ham and A. A. Homm, hair spring tester; M. E. Colhoun and W. Colhoun, ladies' hat fasteners; E. Carlson, harrows; T. C. Fleming, window refrigerators; E. A. Gerth, Jr., an advertising device; H. A. Gorrell, whipholders; H. C. Hogarth, filters for wells; W. H. Landon, devices for tapping trees; F. A. Leslie, water coolers and heaters; J. McLaren, cocks; W. W. Ormsbee, Jr., containers; R. Roebuck, snow plows; C. E. Smith, tile draining machines; A. E. Williams, skirt elevators.

LESSON OF THE TITANIC DISASTER.

The Editor:

Sir,—We who build on land have learned some things from the naval architects and it is barely possible that they could learn a twist or two from us. The salvation of our buildings—from fire—lies in fire-resisting construction and small units of space where fire may originate; the salvation of a ship lies in making it fire and waterproof and cutting it up into as many water-tight compartments as possible.

Collision bulkheads, false keels and midship compartments are well enough, but not sufficient. The coal-bunkers, the trunk-hold, the supply compartments, any space about a ship that can be made water-tight should be so and have only emergency openings thereto and that can be closed from the bridge or automatically. But it seems to me, and I have had something to do with ships and am not altogether without experience, and I have advocated it for years (though mariners and naval constructors have steadfastly averred I was wrong) that the decks themselves be made buoyant. Not necessarily detachable decks that would float off in a wreck, a species of raft, as has been advocated, but just buoyant decks. Steel plates top and bottom of deep deck beams, very thin plates on the bottoms to save weight, but amply effective. There would be nothing to close off, no dependence in emergency upon man or machinery, but simply unsinkable construction. Between every two deck beams would be an air compartment. Suppose the ship be rammed by another, or rip its bottom open on ice, or have its bulkheads otherwise put out of commission, it would fill with water to the first deck. There would be encountered a species of "ship-preserver," not sufficient buoyancy to sustain the entire load, but enough to slacken the load. The water would rise to another deck, more buoyancy and so on up, perhaps submerging all but the top decks, but the vessel would float. You couldn't sink it in any storm or crash Let the accident rip parts of the decks off, still, as long as any beams held together, there would be buoyancy enough to sustain the wreck. Few ships have higher than eight feet decks. Make the deck beams light of section but deep, at least a foot, and then you have, whatever may happen to the vertical water-tight compartments, at least one-eighth of the bulk of the ship in horizontal, absolutely air-tight and water-tight ship-preserving space. Supposing, to get abundant thickness of decks, you have to build ships of one deck less in maximum height, surely that "loss" is as nothing compared to the advantages of having an absolutely unsinkable ship, something our naval architects have not yet given us.

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A NEW DEVICE FOR THE DETECTION OF WATER IN HOLDS OF SHIPS.

An electric alarm to signal the presence of water in the hold of a vessel is the invention of Leon Ducharme, 160 Montcalm Street, Montreal, P.Q. It consists of an ordinary electric bell attached by wires to a cylinder with a float inside. As the water rises the float rises and closes the electric circuit, sounding the bell. The cylinder can be set to ring the alarm at any depth of water from inches to feet. The alarm can also be attached to the usual discindicator.

The invention claims that on a large ship with one of these cylinders in each compartment of the ship, all attached to a bell alarm and a discindicator in the chart room, the captain of the ship would know the very second that water entered his ship and be able to act immediately.

A REINFORCED CONCRETE PAVEMENT.

During the summer of 1910 a reinforced concrete pavement was laid in Plymouth, Wisconsin. The base was laid 5 in. thick and the surface coat 1½ in. thick, according to standard concrete specifications. Three unusual features of construction were used in the building of this pavement. "Pecky" cypress was used for expansion joints in place of the usual asphaltum, or tar. The 1-in. by 8-in. boards were used along each gutter and every 4 feet across the street, and at the end of the ties of the street car tracks. These boards were used as forms for the outside of the cement gutters and as a template for the crown of the street. A considerable saving of lumber as well as time in placing and removing the same was thus effected.

The reinforcement used was Triangle Mesh, Style 7 woven wire. This was placed directly on the concrete base so as to lie between the surface and the base.

The surface-finished coat consisted of granite chips from ¼ in. to ¾ in. in diameter, granite screenings from ¼ in. down to dust and Portland cement in proportion to give the densest mixture. After this mortar was spread over the concrete base and the mesh, it was troweled smooth, and while still soft the larger granite chips were cast by hand over the surface of the pavement, giving the entire area a roughened appearance. Some of the stones disappeared entirely into the soft cement mortar, leaving depressions in the pavement, while the others sank in only part way. The result was a surface which, while level enough to cause no annoyance in riding over it, was still rough enough to overcome any slipperiness of surface.

This pavement, in monolithic squares of 40 feet, is now nearly two years old, has passed through two winters, and there is not the sign of a crack or a flaw in it. It is not slippery and does not wear perceptibly. The expansion joints have worn off some, but not enough to show any abrasion of the concrete along the edges of the boards. The contract price for this pavement, including grading, was $1.23 ½ cent per square yard. The pavement was designed and constructed under the supervision of Mr. W. G. Kirchoffer, of Madison, Wisconsin.

MINING CLUB IN VANCOUVER, B.C.

The Vancouver Mining Club was recently organized by a large number of the city's well known mining men.

Mayor Findlay outlined the objects of the association, and stated that it could and would, no doubt, take a very prominent place in the mining affairs of the province. The The public had lost faith in mining schemes for they had been victimized by the wild-catter and it was the duty of the club to put before the public the real facts of the different mining activities that from time to time excite the pubilc.

Mr. R. Hedley spoke of the work of other mining clubs. The Spokane Mining Club, he said, had aided the mining interests of that part of the country to a considerable extent. The club in Slocan had also done good work in making some mining promoters retract their prospects for getting rich quick. The association, in his opinion, would make Vancouver the headquarters of all mining activities for the province and would also be a place where reliable information could be obtained relative to the mineral resources of the province.

ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

Each week on this page may be found summaries of orders passed by the Board of Railway Commissioners, to date. This will facilitate ready reference and easy filing. Copies of these orders may be secured from The Canadian Engineer for small fee.

16347—April 17—Directing G.T.R. to construct within 30 days from date of this Order spur from main line into property of Clifton Sand, Gravel & Construction Co., in Twp. of Stamford, County of Welland, Ontario.

16348-49—April 20—Authorizing C.P.R. to reconstruct 8 bridges on its Crow's Nest, Lethbridge, Havelock, Red Deer, Mountain and Farnham Subdivisions; and construct bridge at mileage 38.7, Kootenay Central Subdivision.

16350—April 20—Approving location of Kettle Valley Ry. Co. between mileage 53.92 and 65 west of Midway, B.C.

16351—April 20—Approving location of James Bay & Eastern (C.N.R.) station grounds at St. Felicien, Que.

16352—April 20—Authorizing G.T.R. to reconstruct 5 bridges on its 12th District Northern Division.

16353—April 20—Approving location of G.T.P. B.L. Co. stations on its Tofield-Calgary Branch (11 stations).

16354—April 20—Approving location of C.N.O. Ry. through unsurveyed territory, Dist. of Thunder Bay, mileage 363 to 383 from Sudbury Jct.

16355—April 19—Authorizing C.P.R. to construct its Bassano to Irricano Branch across 13 highways and diversions in Alberta.

16356—April 22—Authorizing G.T.P. B.L. Co. to cross and divert highway in N.E. ¼ of Sec. 23, Twp. 53, R. 8, west 5th. Mileage 67.9, Alberta.

16357—April 23—Directing Bell Telephone Co. to extend its telephone lines into Township of York, to provide a telephone service to said W. E. Duncan, Wm. E. Riley, and J. B. Riley, work to be completed within 30 days.

16358—April 23—Dismissing application of city of Valleyfield, Que., re G.T.R. crossing at Edmond Street.

16359—April 23—Directing city of Montreal to commence work of constructing subway authorized by Order 10455 of April 28th, 1910, not later than 15th May, 1912, same to be completed within 6 months from 15th May, 1912.

16360—April 22—Approving revised plan of C.N.R. Standard Pile and Frame Trestle, for Eastern Lines.

16361—April 22—Approving location of Algoma Eastern Rly. Station at Nairn Centre, Ontario.

16362—April 23—Authorizing G.T.P. Ry. Co. to construct spur for Fitshugh Lime and Stone Co., Ltd., near Edmonton, Alta.

16363—April 13—Authorizing G.T.P. B.L. Co. to erect stations at 18 points on its Regina-Boundary Branch, Saskatchewan.

16364—April 23—Authorizing C.P.R. to construct its Kipp to Aldersyde Branch across road allowance at mileage 83.66.

16365—April 22—16366—April 18—Authorizing C.P.R. to construct three spurs for Tyndall Quarry Co., Ltd., near Winnipeg, Man., and spur for J. Wilson, near village of Como, Que.

16367—April 24—Authorizing C.P.R. to use and operate bridge No. 87.0, Swift Current Subdivision.

16368—April 23—Authorizing London, Lake Erie Ry. and T. Co. to cross with spur line into their gravel pit London and Port Stanley Gravel Road, at Lambeth, County of Middlesex, Ontario.

16369—April 26—16370—April 25—Authorizing G.T.R. to construct siding into premises of New Burford Canning Co., Ltd., Twp. of Burford, County of Brant, Ontario, and for Ford Motor Co., Ltd., in the Twp. of Sandwich East, County of Essex, Ont. (Windsor.)

16371—April 24—Amending Order 16150, March 20, 1912, by making Lot "1" read Lot "2" in recital and operative parts of Order.

16372—April 24—Authorizing G.T.R. to construct 7 bridges on its Holmedale Branch, Brantford, Ontario.

16373—April 24—Authorizing T.H. & B. Ry. to construct spur into premises of Fretz, Limited, Hamilton, Ontario.

16374—April 25—Approving locations of G.T.P. B.L. Co.'s stations on its Moose Jaw North-West Branch, (7 station sites).

16375—April 26—Authorizing C.N.Q. Ry. to construct spur on Prince Albert Street, Tetraultville, now Montreal, Que., for delivery of carload freight to residents.

16376—April 23—Approving revised location of C.N.O. Ry. station grounds at mileage 174.5, Twp. of Storrington, Ontario.

16377—April 24—Authorizing C.N.O.R. to cross seven highways in the County of Pontiac, Quebec.

16378—April 24—Authorizing C.N.O. Ry. (Montreal-Port Arthur Line) to cross public road between Lots 3 and 4, in Twp. of Bristol, County of Pontiac, Que.

16379—April 22—Authorizing C.N.O. Ry. to cross seven highways in the Twps. of March and Torbolton, and Fitzroy, Ontario.

16380—April 24—Authorizing C.N.O. Ry. to construct spur track to proposed local freight terminals in city of Regina, Sask.

16381—April 24—Authorizing C.N. Alberta Ry. to cross with lines and tracks of its main line under lines and tracks of G.T.P. Ry. main line in N.W. ¼ Sec. 3, Twp. 53, R. 18, W. 5 M.

16382—April 25—Approving by-law No. 1 of Pere Marquette R.R. authorizing Geo. C. Conn, E.T.M., and Wm. E. Wolfenden, G.P.A., to prepare and issue tariffs of passenger tolls.

16383—April 24—Approving location of Lumber Conveyor of T. S. Sims & Co., Ltd., Fairville, N.B., across C.P.R.

16384—April 27—Authorizing C.P.R. to reconstruct 5 bridges on its MacLeod, and Cartier Subdivisions, Alta. & Lake Superior Divisions.

16385—April 25—16386—April 24—16387-88—April 25—16389—April 26—16390—April 25—16391—April 22—Authorizing C.P.R. to construct spur for Redcliffe Clay Products Co., Ltd., Redcliffe, Alta. For Whiteworth Brothers at Pilot Butte, Sask. For Sovereign Lime Works, near Angus Station, Que. For Messrs. F. W. Baird & Son, Parish of St. Jeanne de Neuville, County of Portneuf, Que. For C.P.R. on Lot 95, Parish of St. Paul, Manitoba. For C.P.R. on Lot DGS, 25, St. John, city of Winnipeg, Manitoba. For James McLaren Co., Ltd., in Twp. of Campbell, County of Labelle, Que.

16392—April 29—Authorizing C.P.R. to expropriate for purposes of taking care of traffic, lands in the Parish of Kildonan, and part of N.W. ¼ of Sec. 17, Twp. 11, R. 4, E.P.M., to establish East Yard near Winnipeg, Manitoba.