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ESTABLISHED 1893.

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The Canadian Engineer

ESTABLISHED 1893.

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THE ADVANCE IN SEWAGE DISPOSAL METHODS.

Ontario is the most densely populated Province of Canada. Its manufacturing centres have great quantities of trade waste. Until the present, the general method of sewage disposal has been to carry the sewage into bodies of fresh water, which in most cases are either directly used for water supplies or led into water supply basins.

Something over a year ago The Canadian Engineer took up with considerable vigor the matter of stream pollution. Since that time editorial after editorial has gone out on this subject and has been widely quoted by the press from one end of Canada to the other, and we feel that The Canadian Engineer has been no small factor in influencing legislation in Alberta and Saskatchewan, and encouraging the Senate Committee of Ottawa to further inquiry in the matter of sewage disposal.

We also notice with considerable satisfaction that at the recent sitting of the Ontario Provincial Board of Health several plans of sewage disposal were disallowed. In those cases where the plans were disallowed the mode of disposal was the primitive one of allowing the raw sewage to flow into public waters.

The Board of Health were not as stringent in these matters as they might have been, but the steps they have taken are a distinct gain and an indication to consulting sanitary engineers and to city engineers that in the future sewage disposal schemes must include some method of sewage purification.

From this out, the beautiful streams and lakes of Ontario are not to be cesspools or catch-basins for the filth from our municipal and industrial centres.

It is to be expected that the Board of Health will cause a report to be prepared which will describe the method of disposal now adopted by Ontario municipalities, and that in the near future legislation and regulations will be adopted making it compulsory for every town and incorporated village to have adequate sewerage system and modern sewage disposal plans.

NATIONAL GOOD ROADS ASSOCIATION.

One of the most important gatherings that will be held during 1910 in connection with good roads in America will be the third National Good Roads Congress, which is meeting at Niagara Falls, N.Y., on July 28th, 29th and 30th, 1910.

Although the society is largely under the control and sustained by residents of the United States, yet their road problems and their transportation problems are so similar to those of Canada that their deliberations will be of value to Canadians, and it is expected a great many will avail themselves of the opportunity of listening to some splendid addresses by Americans who have accomplished something in the way of road improvement.

The saving from good roads in the matter of postal delivery, parcel delivery and produce transportation is of great importance. The advantages of good roads are hard to over-estimate. They enhance the value of farm lands; add wealth to the producer and consumer; they save wear and tear and worry and waste; they beautify the country and bring it in touch with the city; they give to scattered people social, religious and educational advantages; they are the avenues of trade, the highways of commerce; they bind the country together in thrift and industry and intelligence; they promote a social intercourse and prevent intellectual stagnation.

To-day, one of the live economical problems is the high price of food and the increased cost of living. Good roads, by reducing the cost of transportation, will reduce cost to the consumer and the cost of living. What has been waste will be marketable and useful.

More money is wasted annually on highways in America than would pay for the upkeep of our transcontinental railways. It is only in recent years that people have come to realize the waste, and such discussions as are likely to take place at the Good Roads Association meeting in Niagara Falls will be a strong factor in eliminating wasteful methods in highway work.

THE PROGRESS OF AERONAUTICS.

The year 1910 will go down through history as an epoch-marking year in aeronautics. In Europe and in America the flights made during the last few months have demonstrated that man has been able to perfect the heavier-than-air machines, and that aviation is now something more than a dream.

The English Channel has been crossed and recrossed. Long flights have been made in England, France, Germany and the United States, and in Canada, Montreal and Toronto have seen ascensions of two and three thousand feet.

Dirigible balloons for many years have been used to navigate the air, but more recently the perfecting of monoplanes and biplanes has drawn attention to the heavier-than-air machines in such a way as would indicate that these machines are no longer simply a scientific plaything, but a commercial and marketable undertaking.

It has been estimated that over two hundred men have mastered the art of flying. In England alone some eight hundred aeroplanes have been completed or are under construction. Prize money has been freely offered, and much of it has been attached by the aviators.

Firms manufacturing flying machines are engaging aviators to ride their specially constructed machines, thus reviving the old-time rivalry between firms that existed in the earlier days of cycle and motor racing.

The perfecting of the gasoline motor for use in the automobile has developed the strong, reliable machinery which the aviator requires for his flying machine. In still air these monster birds, which measure forty feet from tip to tip, soar and circle with apparently as much poise and confidence as a condor.

The perfecting of the telephone, the wireless telegraphy, the development of great speed in ocean travel and railroad transportation has made more complex our social problems. The perfecting of the aeroplane. What will it bring?

STANDARD REGULATIONS OF THE DOMINION RAILWAY BOARD AFFECTING HIGHWAY CROSSINGS, AS AMENDED MAY 4th, 1910.

Unless otherwise ordered by the Board, the Regulations regarding the future construction of highway crossings are and shall be as follows:—

1. With each application, the railway company shall send to the Secretary of the Board three sets of plans and profiles of the crossing or crossings in question:

Scale:

Plan		400 ft. to an inch.
Profile of railway	Horizontal..	400 "
	Vertical	20 "
Profile of highway	Horizontal..	100 "
	Vertical	20 "

1st set, for approved by and filing with the Board.

2nd and 3rd sets, to be furnished to the respective parties concerned, with a certified copy of the Order approving of the same.

2. The plan and profile shall show at least one-half mile of the railway each way and 300 feet of the highway on each side of the crossing.

3. The plan shall show all obstructions to the view from any point on the highway within 100 feet of the crossing to any point on the railway within one-half mile of the said crossing.

4. The Company shall give the Municipality in which the proposed crossing lies, 10 days' notice of the application and copies of the plan, and furnish the Board with proof of service.

5. The road surface of level or elevated approaches, and of cuts made for approaches, to rural railway crossings over highways shall be 20 feet wide.

(a) A strong, substantial fence, or railing, four feet six inches high, with a good post-cap (four inches by four inches), a middle piece of timber (one and one-half inches by six inches), and a ten-inch board firmly nailed to the bottom of the posts to prevent snow from blowing off the elevated roadway, shall be constructed on each side of every approach to a rural railway-crossing over a highway where the height is five feet or more above the level of the adjacent ground—leaving always a clear road-surface of 20 feet in width.

6. Unless otherwise ordered by the Board, the planking, or paving blocks, or broken stone topped with crushed-rock screenings, on rural railway-crossings over highways (between the rails and for a width of at least eight inches on the outer sides thereof) shall be 16 feet wide.

7. In cities, towns, and villages, the width of all kinds of approaches to a railway-crossing over a highway (street or avenue) and of the planking between the rails and on the outer sides thereof, must be regulated by the position of the street and the traffic or the anticipated traffic thereon, but shall not be less than 20 feet wide.

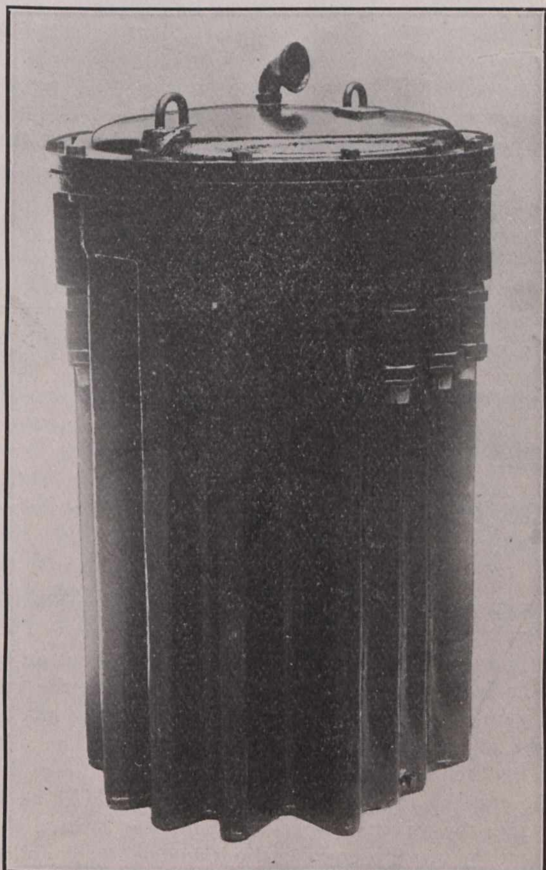
8. Cuts and Fillings on Highway Crossings.—Wherever a cut on the line of railway exceeds 9 feet or a filling thereon exceeds 7 feet at a highway or street crossing, the railway company, before proceeding with the work of construction, shall refer the matter to the Board, with a full statement of the facts and circumstances, that the Board may decide as to the advisability of ordering a separation of grades at the said crossing.

9. In special cases, it may, upon application, be ordered that any existing highway crossing be constructed so as to conform to the foregoing standards and requirements.

SEVERE SERVICE CONDITIONS REQUIRE IMPROVED MANHOLE TRANSFORMER.

There is a growing demand for distributing transformers to be installed in underground vaults, called manhole or subway openings, that furnish access to underground systems of distribution. This demand comes from the larger companies who are operating in the big cities, and is for an absolutely first-class unit, with regard to both operating efficiency and adaptability to the service conditions.

As these transformers are installed in subway manholes which are liable to flooding from heavy rains or overflow water, one of the main requirements of service is that the manhole transformers shall be water and air-tight; that is, the joints between the case and cover and where the leads issue from the case must be water and moisture-proof. Hence, it is necessary to enclose the transformer in a hermetically sealed case, and design it for an exceedingly low temperature rise. This demands careful design as well as the highest grade workmanship. At the same time, the transformer must not only be so constructed that it is possible to make it water-tight, but such that the unit can be installed quickly and easily. Also, it is necessary that the design permit the transformer to be connected to or disconnected from the line without removing the cover or otherwise opening the case.



Any expansion of the oil under a rising temperature, of course, compresses the air in the upper portion of the transformer case and causes a rise in pressure. Under abnormal operating conditions, such as a short circuit, a considerable rise in this pressure may occur, which will make the transformer case liable to serious injury. In order to avoid any danger from such occurrences, a safety or relief valve for any excess pressure should be provided. The completed transformers should be tested at the factory at a sufficient air pressure to insure their being air-tight and moisture-proof.

The Westinghouse type "S" manhole transformer fulfils the foregoing conditions of service and exactions of design and is rapidly increasing its popularity. The magnetic circuits and coils of this transformer are the same as those of the well-known Westinghouse type "S" transformer, but they are mounted in a case of special design that adapts them to manhole service.

The accompanying illustration shows the transformer supplied by the Westinghouse Electric and Manufacturing Company to the Kentucky Electric Company, Louisville, Ky., one of the largest electrical companies in the country employing underground distribution. The many advantages of this type of construction have led to its adoption for the entire line of transformers designed for manhole service.

STANDARD SPECIFICATIONS FOR REINFORCING BARS.

The Association of American Steel Manufacturers has just announced the formal adoption by letter-ballot of a standard specification governing the chemical and physical properties of concrete reinforcement bars. This announcement is an important one, since it is the first specification to appear which could be called authoritative; it also differs from the many specifications under which steel for reinforcement has been manufactured up to this time in the fact that hard steel as well as the usual medium grade is included, in both plain and deformed sections; also in providing standards for the manufacture of cold-twisted bars. The Association of American Steel Manufacturers is a technical body composed of the principal steel manufacturers of the United States.

Standard Specifications for Concrete Reinforcement Bars.

1. Steel may be made by either the open-hearth or Bessemer process. Bars shall be rolled from billets.

2. The chemical and physical properties shall conform to the following limits:

3. In order to determine if the material conforms to the chemical limitations prescribed in paragraph 2 herein, analysis shall be made by the manufacturer from a test ingot taken at the time of the pouring of each melt or blow of steel, and a correct copy of such analysis shall be furnished to the engineer or his inspector.

4. For the purposes of these specifications, the yield point shall be determined by careful observation of the drop of the beam of the testing machine, or by other equally accurate method.

5. (a) Tensile and bending test specimens may be cut from the bars as rolled, but tensile and bending test specimens of deformed bars may be planed or turned for a length of at least 9 inches if deemed necessary by the manufacturer in order to obtain uniform cross-section.

(b) Tensile and bending test specimens of cold-twisted bars shall be cut from the bars after twisting, and shall be tested in full size without further treatment, unless otherwise specified as in (c), in which case the conditions therein stipulated shall govern.

(c) If it is desired that the testing and acceptance for cold-twisted bars be made upon the hot rolled bars before being twisted, the hot rolled bars shall meet the requirements of the structural steel grade for plain bars shown in this specification.

6. At least one tensile and one bending test shall be made from each melt of open-hearth steel rolled, and from

each blow or lot of ten tons of Bessemer steel rolled. In case bars differing ⅜ inch and more in diameter or thickness are rolled from one melt or blow, a test shall be made from the thickest and thinnest material rolled. Should either of these test specimens develop flaws, or should the tensile test specimen break outside of the middle third of its gauged length, it may be discarded and another test specimen substituted therefor. In case a tensile test specimen does not meet the specifications, an additional test may be made.

(d) The bending test may be made by pressure or by light blows.

7. For bars less than 7-16 inch and more than ¾ inch nominal diameter or thickness, the following modifications shall be made in the requirements for elongation:

(e) For each increase of ⅛ inch in diameter or thickness above ¾ inch, a deduction of 1 shall be made from the specified percentage of elongation.

(f) For each decrease of 1-16 inch in diameter or thickness below 7-16 inch, a deduction of 1 shall be made from the specified percentage of elongation.

(g) The above modifications in elongation shall not apply to cold-twisted bars.

8. Cold-twisted bars shall be twisted cold with one complete twist in a length equal to not more than 12 times the thickness of the bar.

9. Material must be free from injurious seams, flaws or cracks, and have a workmanlike finish.

10. Bars for reinforcement are subject to rejection if the actual weight of any lot varies more than 5 per cent. over or under the theoretical weight of that lot.

Properties Considered.	Structural Steel Grade. Plain Bars.	Structural Steel Grade. Deformed Bars.	Hard Grade. Plain Bars.	Hard Grade. Deformed Bars.	Cold-Twisted Bars.
Phosphorus, maximum—					
Bessemer	.10	.10	.10	.10	.10
Open hearth	.06	.06	.06	.06	.06
Ultimate tensile strength, pounds per sq. in.	55/70,000	55/70,000	80,000 min.	80,000 min.	Recorded only
Yield point, minimum, pounds per sq. in.	33,000	33,000	50,000	50,000	55,000
Elongation, per cent. in 8″, minimum	1,400,000 T.S.	1,250,000 T.S.	1,200,000 T.S.	1,000,000 T.S.	5%
Cold bend without fracture—					
Bars under ¾″ in diameter or thickness	180°d.=1t.	180°d.=1t.	180°d.=3t.	180°d.=4t.	180°d.=2t.
Bars ¾″ in diameter or thickness and over	180°d.=1t.	180°d.=2t.	90°d.=3t.	90°d.=4t.	180°d.=3t.

The Hard Grade Will Be Usea Only When Specified.

A CONCRETE CONSTRUCTION PLANT ON A SHORT-TIME JOB.

When the contract for the concrete foundations of the new Boston & Maine R. R. locomotive shops was placed with the Aberthaw Construction Company of Boston, Mass., last November, the stipulation was made that the work should be completed in the very shortest possible time. The contractors therefore decided to erect a complete concrete mixing and handling plant although the entire job contained less than 2,000 yards of concrete.

The resulting costs as well as the speed obtained fully justified the erection of the construction plant although it was in operation only about five weeks. These costs per yard were:—

Labor, mixing and placing	79c.
Rental of plant	39c.
Handling and erecting of plant	18c.
Total	$1.36

It is probably fair to say that it would have been difficult to mix this material for less.

The arrangement of the construction plant was as follows: A single spur track from the railroad was run to the site approaching it at right angles to the buildings and about the middle of same. Some two hundred feet from the building site and on the right hand side of the spur track approaching the work, the mixing platform, mixer, and elevator were placed. The railroad siding was paralleled by an industrial track on the same side as the mixer. The mixer platform and the industrial track were built about on the level with the body of a freight car. Turnouts on the industrial track were provided on either side of the mixed platform for passage of cars and storage for idle ones. The aggregate could be unloaded to the mixer platform direct from the freight cars or into industrial cars which could be dumped direct into the mixer. The cement shed was located about 100 feet from the mixer alongside the industrial track and railroad siding. Cement was unloaded from the freight cars into the cement shed and transferred to the mining platform by wheel barrows or industrial cars.

As the tops of the foundations were several feet above ground level, the track for delivering the concrete was raised so that it could be dumped from the industrial cars direct into the forms. The raising of the industrial track brought the dump cars too high for the mixer to discharge into them so a short elevator tower with an automatic trip bucket was erected. The mixer discharged into this bucket which was hoisted and dumped into the cars. A portable locomotive engine supplied power for the mixer and for a hoist to operate the elevator.

The reinforcing steel and lumber for forms were unloaded on the opposite side of the railroad track from the mixer and nearer the site of the building. The steel was bent and the lumber cut for the forms and carried into place by hand.

THE

Sanitary Review

SEWERAGE, SEWAGE DISPOSAL, WATER SUPPLY AND WATER PURIFICATION

THE SASKATCHEWAN UNIVERSITY AND SEWAGE DISPOSAL.

The new Provincial University in the course of erection at Saskatoon is about to adopt an ideal system of sewerage accompanied by an up-to-date method of sewage disposal.

One reason for this is that the University will, in the future, have a Sanitary Engineering course attached to its curriculum, and the disposal works will be made a source of interesting study and experiment for the students, in addition to providing useful data relative to frost conditions in this severe climate.

The system is designed by Mr. Darlington Whitmore, C.E., in conjunction with Mr. T. Aird Murray, C.E., consulting engineer to the Bureau of Health.

Twenty-five thousand dollars have been set aside by the University Governors for purposes of sewage disposal.

The sewerage will be on the "separate" system, viz., only sewage and waste water will be dealt with, while the road and surface water will be discharged by separate pipes direct into the Saskatchewan River.

Provision will be made for 2,000 persons and 430 head of cattle, there being a farm connected with the University, the amount of sewage being calculated at ·13 cubic feet per second.

The sedimentation tanks will be on the continuous flow system and septic action will be avoided. The tanks will be divided into three separate compartments, providing varying velocities of flow of .0001, .0005, .0007 feet per second. Each compartment will be further separately controlled, so that seven varying rates of flow as distinct from velocity can be obtained.

The liquid from the tanks will be distributed over biological filters protected from the frost. The filters will be on the percolating or trickling system, and will be in sections, providing varied sizes and character of filtering material. Different rates of filtration will be experimented with, the aim being to provide a non-putrescible effluent at all times of the year.

The oxidized or non-putrescible effluent will be further disinfected or sterilized, probably with calcium hypochlorite. This plant, together with its results, will prove of great value to the Province, and will, no doubt, furnish interesting and useful data to the Bureau of Public Health.

The method of distributing the sewage over the filters will be by that of the well-known "Stoddart" system, by which even distribution is obtained without any moving parts.

SWIFT CURRENT, SASK.

The system of sewage disposal about to be adopted for Swift Current is that of biological filtration by means of trickling filters preceded by continuous-flow sedimentation tanks. The non-putrescible effluent will be disinfected by calcium hypochlorite before being discharged into the stream, the humus from the filters being first settled out.

The water supply will be on the air-tank pressure system as at Yorkton, Sask., and recently described in these columns.

Three years ago Swift Current was represented by a few frame buildings. Swift Current is now among the list of the most prosperous towns in Saskatchewan, and in a few months' time will be provided with up-to-date sanitary and water supply requirements.

RESERVOIR OUTLETS TO EARTHEN EMBANKMENTS.

By George N. Yourdi, M.Inst.C.E.*

Embankment-making in Great Britain is, practically speaking, a matter of yesterday, and perhaps it would not be wide of the mark to say that the failure of the Dale Dyke Embankment in 1864 earmarks the date when the attention of engineers was turned to the study of reservoir construction, and a revolution was made in the mode of providing proper, safe, and durable outlet arrangements to regulate and control the stored waters. One failure teaches more than many successes, and that at Dale Dyke has taught a most important lesson, so that engineers should no longer be led to practise false economy by neglecting the proper principles that should govern their designs.

Practically up to the time of the failure of the Dale Dyke Embankment the general practice was either to lay a line of naked pipes surrounded with puddle, or to construct a mosonry culvert through or under the embankment. The outlet arrangements of the Dale Dyke Reservoir consisted of two lines of 18 in. diameter spigot and socket cast-iron pipes laid in a trench and surrounded with puddle, each pipe line being controlled by a valve at the outer end. The trench in which the pipes were laid was under and through the embankment. The cause of the failure at Dale Dyke has never been satisfactorily explained on account of the divergence of opinion expressed by the experts who were called in, and, like a good many other similar problems, has been left unsolved.

Naked Pipes Under Embankment.—Nothing can very well be worse than naked pipes laid through or under the made embankment, resting on and surrounded by a mass of plastic clay puddle, subjected, as this would be, to the unequal pressure due to the weight of the embankment. The pipes can

(Continued on page 72).

* Read before the British Association of Water Engineers at York.

BRITISH METHODS OF OPERATING SINGLE TRACKS.

(By a British Signal Engineer)

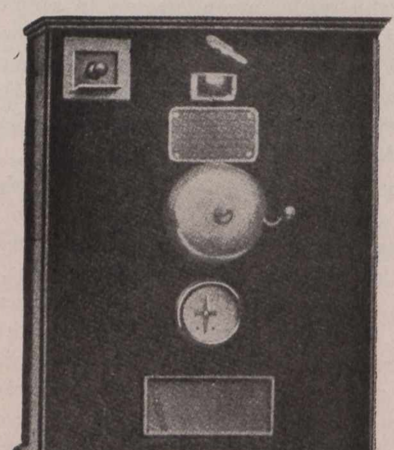
The working a single tracks is one of the vital problems in railway operation. Not only must trains be got over the line safely, but expeditiously and these are by no means synonymous terms. As the traffic of the country grows, train movements must be accelerated and their number increased. This is comparatively easy where the tracks are doubled but on single lines each train that is added generally means two additional trains over the roads as the return trip has to be provided for and each train on a single line is an unusual source of danger. Trouble may come from the front as well as from behind.

Unfortunately, in Canada and in the United States, most of the roads are only single-tracked and as the expense of doubling the road is prohibitive, so single-tracked they will have to remain for some considerable time.

In England most of the railways are doubled. From the latest returns—those for the year ending December, 1908—it appears that of 15,999 route miles in England, only 5,320 are single. In Scotland 2,267 miles out of 3,843 and in Ireland 2,692 miles out of 3,363 are single.

But while the trouble in the United Kingdom has not been so great owing to there being less single track and the lengths being exceedingly short compared with those on this side of the Atlantic, yet the traffic has been heavier or, at least, more frequent. A study, therefore, of British methods may not be devoid of instruction and cannot fail but be of interest.

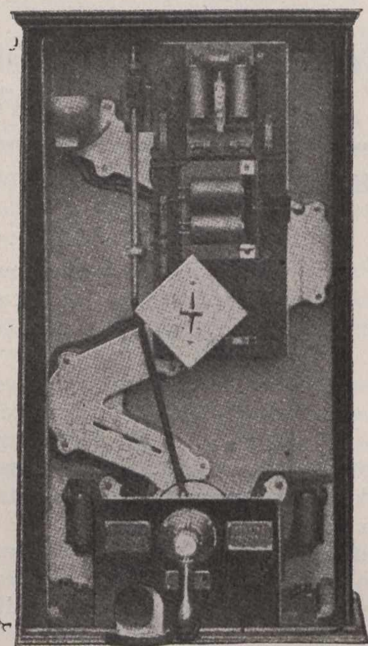
Before the introduction of the telegraph and block systems all trains on single lines were operated by schedule that could not be departed from without instructions which had, of course, to be written and sent by train. In the meantime, often a train had to wait indefinitely and dare not move. But with the telegraph came easier methods as



changes could be made, after the issue and exchange of the requisite orders. These were issued solely by the superintendent of the division.

A time table, modified as required by crossing orders, remained the standard method of operating single tracks in England for many years, but greater safety was provided after the introduction of the old train staff.

The staff was a symbol to an engineer that he was in possession of the single-line section. There was only one staff for a section and no train being allowed in the section



unless the engineer had the staff with him it followed that its possession was an indication to the man that he was also in possession of the section.

The introduction of the staff in regular single track working was brought about in a simple manner. A double-line tunnel in Yorkshire was undergoing repair and all trains were operated over a single track. To guard against two trains meeting in the tunnel it occurred to some one that if a train was not allowed to pass unless the engineer was in possession of a "billy" or stick, a collision could not happen.

Its use under these conditions was found so efficient and provided some of those safeguards that are necessary on single lines that it was tried on a branch of the London & North Western Railway near Leamington as an accessory to the use of the fixed schedule and crossing orders.

Trouble, however, came from every train having to be in possession of the symbol. When there was only a schedule, orders could be laid down for two subsequent movements to be made in one direction, but this was not practicable after the train staff was introduced as the staff had to be brought back from the other end, after being used by the first train, before the second could go.

This led to the introduction of "tickets" which authorized an engineer to proceed through the section, provided he saw that the train staff was being left behind him. This guarded against a train coming from the opposite direction. Such an opposing train could not come with a ticket as the tickets were kept in a box, the key of which was the staff itself.

It is easy to imagine conditions under which there was the possibility of a collision under this method of working, but it should be recorded that an accident was a very rare occurrence. This may be, in part, accounted for by the fact that the block-system was in use in addition. As soon as it was found that the block system could be relied upon, the Board of Trade compelled the railways to put it in and every new line opened after 1871 was compelled to have the block-system.

It should further be placed upon record that the only serious accidents of the last 40 years on single tracks occurred on lines where neither the train-staff nor the block-system was in use—only crossing-orders. One of these was in September, 1874, and the other in August, 1876.

Traffic about this time began to grow and while the addition of the train staff tickets had helped in getting following trains over the line there was still the trouble that if a train arrived at one end of the section when the staff was at the other there was delay and often when no train was due to take the staff it had to be sent by hand. There was also an uneasy feeling that the ticket system was not as safe as could be desired.

Considerable relief—in more ways than one—was experienced, when in 1878 an electrically-controlled token system was introduced and no train was allowed to enter a section unless the engineer was in possession of a token. Each section had a dozen or more of these tokens that were kept in a case, there being a case at each end of the section. These were electrically controlled and access to the case could only be obtained by the combined action of the operators at each end. Only one case of the pair could be opened at the same time, and when opened, only one token could be withdrawn.

The withdrawal of one token at once locked up access to both instruments so that a second token could not be obtained until the first had been disposed of and it therefore follows that a second train could not enter a section until the first had left.

Absolute safety, was, as a consequence, obtained not only against opposing trains but against rear-end collisions between following trains. Provision, too, was made to allow for a token that had been obtained but was not required to be returned to the instrument.

So successful is this method of operation that practically all the single tracks in Great Britain are controlled thereby and this meets with the approval of the Board of Trade, who specify that single tracks are to be equipped with token instruments and this satisfies the law of the land that all passenger lines must be equipped with the block-system. The same method prevails in many British colonies and dependencies.

In India one of the systems employed is the Neale's Patent Token Instruments which are illustrated herewith. The photographs show the instrument with and without the front of the case. The token is a ball which is small, light and can be readily exchanged at speed.

A standard code of bell signals is used wherewith the operators can communicate with each other. This is done by pressing in the white plunger that forms part of the handle in the base of the instrument. The bell is in the centre. The tokens are contained in the zigzag channel seen in the left illustration and when released they are obtained from the aperture to the left of the handle in the base. In the top left hand corner is a small drawer by which the token, when taken from an arriving train, is inserted in the instrument. The tokens for adjoining sections are differently shaped and that for one section will not fit the drawer of an adjoining section. In the centre is a galvanometer to indicate when the sending or receiving current is in action and below it is a glazed aperture provided to enable the operator to see if any tokens are in the case.

The handle in the base can be turned to either the right or to the left. Normally it and the handle in the companion instrument at the other end of the section, is vertical. If a man, say at A, wants to obtain a token, he sends the prescribed bell signals to B and if those received in reply are satisfactory he again presses in the bell plunger which again rings the bell at B, the sending current also being indicated on the galvanometer of the instrument at A and the receiving current being indicated on the other instrument at B. This attracts a double relay in the upper part of the instrument at B, bringing into use a local battery and so attracting a magnet, whereby the handle of the instrument at B is freed and it can be turned to the left; when so turned the aperture is closed and no token can be withdrawn from that end. A circuit is at the same time completed to the instrument at A and now, when the plunger of the instrument at B is pushed in, a current is sent that releases the handle at A, and allows it to be turned to the right. On each side of the handle are indicators to remind the operator whether the intended movement is for him to send a train or to receive one.

When the handle at A is turned to the right the opening at the bottom of the zigzag channel is widened so that one ball is freed and it rolls out at the aperture in the base. This same movement holds back the next ball with the result that only one token can be out at a time. The energizing current is also cut out and the handles of both instruments are locked—the one to the left and the other to the right—and here they remain until the token is taken to the instrument at B or it may if withdrawn in error, be restored to the instrument at A.

When the token is placed in the drawer in the upper left-hand of the instrument at either place and the drawer is pushed in, the token falls down the zigzag channel and in its course strikes a vertical sliding shutter which at its upper end joins up the double relay, causing an electrical lock to be taken out of the handle allowing the latter to be turned to the normal vertical position. When in this position, and the plunger is pressed in, a current is sent to the distant instrument unlocking of the handle there so that it may be again put to vertical. All is now in order for a second train to be signalled which may be from either end.

We have some recent evidence on very high authority as to the worth of the Neale's Token Instrument. On December 14th last, a paper on Railway Signalling in India was read at the Institution of Civil Engineers in London, by the late director of railway construction in India. Speaking of this instrument he said that the cost was low and that "it has been widely adopted on the East Indian and the Great Indian Peninsular Railways, being found thoroughly satisfactory."

The makers and sole licencees are the well-known firm of Saxby and Farmer, Limited, whose Canadian office is in Montreal, 611 Canadian Express Building.

NEW INCORPORATIONS.

Elk City, Ont.—Royal Westmount Mines, $2,000,000; G. M. Webster, Montreal; H. Sykes, J. Baillie, Westmount.

Edmonton, Alta.—Arrow Lake Land Co. Western Prospecting and Mining Co. British Empire Insurance Co. Pembina Coal Co.

Montreal, Que.—Montreal Reform Club, $20,000; F. S. Mackay, J. C. Macdiarmid, L. Garneau. Mott Company, $100,000; G. W. MacDougall, L. Macfarlane, E. J. Waterston. Walter Baker & Co. of Canada, $50,000; J. S. Lovell, W. Bain, R. Gowans, Toronto.

Toronto, Ont.—Canada Machinery Corporation, $3,000,000; H. Riley, J. E. Riley, E. G. McMillan. Sterling Realty Corporation, $100,000; F. Watts, W. Poulton, J. L. Galloway, J. Cowan, Jr. Chillas, Black, $40,000; H. R. Chillas, S. W. Black, W. J. McWhinney. Toronto Motor and Garage Co., $50,000; J. B. Sutherland, D. Fletcher, H. C. Macdonald. C. Goode & Sons, $100,000; A. R. Goode, H. H. Goode, Miss E. R. Goode.

RESERVOIR OUTLETS TO EARTHEN EMBANKMENTS.

(Continued from page 69).

never remain as originally laid, but sooner or later some of the joints must get drawn or a pipe or pipes become fractured, with the result that the water will have full play, and must very quickly effect the destruction of the works. It may, therefore, be taken as an axiom that durable work cannot possibly be obtained with an arrangement of this kind.

Culvert Through and Under Embankments with Central Pillar.—The obvious danger of the practice of laying naked pipes prepared the way for the arrangement which may be described as a masonry culvert built in a trench under the made embankment. At the point where the culvert crosses the puddle trench a masonry or concrete pillar is brought up from the bottom of the puddle trench with a view of giving it support and preventing it from yielding to the pressure brought to bear on it. The effect of this was, unfortunately, the breaking of the back of the culvert owing to the unequal pressure and weight of the embankment on either side of the pillar acting on the ground supporting the culvert.

"Slip Joint."—To get over the difficulty, the method was introduced of building the culvert in a series of lengths, each length being independent of the one against which it abuts as regards vertical bonding. In this way the rigid culvert was made articulated, and capable of responding to any tendency to settlement. On paper this mode of allowing the culvert to accommodate itself to any tendency it may have to settlement should work satisfactorily; indeed, it has been successfully carried out in a number of cases. There are, however, instances where it has proved a dire failure. The weakness of the "slip joint" method lies in the fact that the settlement must be uniform and the range of vertical movement small, otherwise jamming will take place with crushing of the abutting faces, which will probably be accompanied by fracture. It is not, therefore, an arrangement that can be recommended.

Tunnel Outlet.—The doubtful practice of providing an outlet for the stored waters by means of a culvert of any kind through or under the embankment, and the many failures that have occurred with these methods have induced many engineers to adopt an outlet arrangement consisting of a tunnel driven through and in the solid rock, passing round one end, and entirely disconnected from the embankment.

The tunnel can either be made of a size to deal with flood water during construction and after, in which case there would be no need for a waste water course, or of a size just sufficient to permit of accessibility to the permanent draw-off pipes as well as for periodic examination of the work.

The tunnel can be lined with cast-iron plates backed either with concrete or with a thin backing of cement grout injected pneumatically in the ordinary way, or it may be constructed of brick or ashlar, in all cases having projecting divide walls provided at suitable points along its length to prevent the water from creeping on the outside.

It is extremely difficult to lay down any rules in regard to outlets, as they are the most difficult part of the work that an engineer has to deal with. It might, however, be laid down as an axiom that for high embankments a tunnel outlet is the only safe and reliable means of providing for the stored waters. For medium high embankments (say not exceeding 40 ft.), and provided solid rock that will not yield when subjected to the unequal pressure due to the weight of the embankment can be found at a reasonable depth, a culvert under it might safely be adopted. The trench must not, however, be at a great depth, and the rock must be not only homogeneous but massive, and not interbedded with shale or other soft strata, and, above all, must be continuous from one end to the other. For low embankments, when the depth does not exceed, say, 25 or 30 ft., a syphon carried over the top of the embankment or round one of the flanks may be adopted with advantage.

Draw-offs.

The outlet, whether tunnel or culvert, should be commanded by a tower, in which the valves or other arrangements for regulating the discharge of the stored waters should be fixed. The best position for this is at the mouth of the outlet, the valves being so arranged that they are accessible for repairs, and the tower capable of coping with any and every eventuality. A watertight bulkhead or stopping is fixed at the base, which acts as a water-lock, and effectually safeguards against the flooding of the culvert should any accident occur to either the tower or the valves, and the supply, even if the tower were carried away, could be maintained without interruption. The tower permits of proper inspection and the carrying out of repairs to the valves and fittings at all times, as by its means all are accessible. Should a pipe at any time become fractured in the tunnel the supply can be cut off and the necessary repairs carried out.

Valve Pit.—A method for regulating the discharge of the stored waters by means of a valve pit built in the middle of the inner slope or close to the puddle wall is one that has been followed in the past, but, in the author's opinion, it should be avoided for the following reasons:

(a) A considerable length of culvert on the upstream side is inaccessible when there is water in the reservoir.

(b) The liability of the pit to be thrown out of the vertical on account of the earth pressure of the embankment, and more particularly when the pit occupies a position close to the puddle wall.

(c) As the pit is connected at its base with the culvert, its inability to resist the earth pressure will produce fracture, accompanied with crushing on both sides of its junction with the culvert, and in this way water will penetrate into the very heart of the made embankment and seriously endanger the work.

Central Stopping.—Another and a still more reprehensible method of controlling the discharge in culverts through embankments is the introduction of a masonry, concrete, steel, or iron bulkhead in or about the centre of the culvert. The discharge pipes lead off from this central stopping, and are governed by a valve or valves in the downstream side of the culvert. Here, again, the upstream end of the culvert is inaccessible, and in case of a burst pipe it would mean sending divers down to attempt to plug the inlet end of the pipe. Should they fail in this there would be no other course left but to empty the reservoir. Nothing can be worse than this mode of controlling the discharge, and the folly of such a design is too self-evident for further critical analysis.

OTTAWA'S WATER CONSUMPTION.

Ottawa, Ont., has a population of 80,284. During 1908 the average daily consumption per capita was 179 Imperial gallons. This is 13 gallons less per day per capita than during 1907.

The highest consumption during the year was in July and August, these two months being about 5-4/10% above the average. November was the lowest, being about 8½% below the average. The total variation was only about 14%.

INFORMATION IN REGARD TO FABRICATED WIRE FENCES AND HINTS TO PURCHASERS.*

By Allerton S. Cushman,

Assistant Director Office of Public Roads, in Charge of Chemical and Physical Investigations.

Introduction.

For a number of years the Office of Public Roads has been making a study of the various problems presented by the corrosion and rusting of iron and steel, particularly in relation to road culverts and wire fencing. So many inquiries for information in regard to what constitutes the best type of fabricated wire fence reach the Office that it has been thought best to prepare this paper for the benefit of farmers and agriculturists generally.

The Deterioration of Wire Fences.

To begin with, we may accept the following statements as facts supported by the testimony of a large number of consumers as well as by the results of scientific investigation and observation.

(a) A very large proportion of the wire fencing manufactured and sold in the United States rusts much more quickly than it should. In many instances fencing which might reasonably be expected to last for ten or fifteen years will begin to rust and decay rapidly in less than two or three. Near the seashore and also in the neighborhood of large cities and manufacturing plants which pollute the atmosphere with sulphurous gases, wire fences will naturally rust much more quickly than under average rural conditions. Even under strictly rural conditions there has been noted a great difference in the life of wire, owing to prevailing climatic conditions, such as the general strength and direction of the wind and the amount of abrasive dust which is carried. After making all due allowances for these variations, it is none the less true that under perfectly normal rural surroundings there is still sufficient reason for complaint in many cases on account of rapid disintegration of wire fences.

(b) It is often claimed that the old wire manufactured twenty to thirty years ago was more resistant to corrosion than that which is now produced. While this has been shown to be true in many specific cases, the observation has no bearing on the modern fence problem, because trade conditions, metallurgical practice, and the demand of the consumer have brought about conditions entirely different from those which prevailed years ago. No puddled-iron wire is now made in the United States or in any other country for the manufacture of woven or fabricated wire fences. As under the circumstances it would be impracticable and impossible to return to iron wire as distinguished from steel, it is useless to waste time in the discussion of this phase of the subject.

The rapidity with which a given wire fence will rust under normal conditions depends upon a number of factors, among which the following should be noted:

(1) The character and quality of the steel from which the fence is constructed.

(2) The character and quality of zinc, or spelter, used in the galvanizing process.

(3) The integrity or evenness of distribution of the zinc coating.

(4) The weight of zinc carried by the wire.

(5) The weight or gauge of the wire used in the fencing.

* From the Department of Agriculture U.S.A. Year Book.

The Manufacturer's Problems.

The first three of these factors furnish problems for the manufacturer alone. The tendency now among the leading manufacturers is to pay more and more attention to the control of the impurities in their steels and a decided improvement has been made in this respect within the last few years. There is still room for further improvement and, on account of the fact that the manufacturers are now alive to the necessity of turning out a better product, there is every reason to believe that a better quality of steel will be used hereafter in the manufacture of fencing. The problem involving the character and quality of the zinc, or spelter, used in the galvanizing processes is not yet solved, although some improvements have been brought about. In regard to the integrity or evenness of the distribution of the zinc coating, great progress has been made within the last few years and it is now possible with care to produce a more even and heavier coating than has previously been used.

Problems of the Middleman and the Consumer.

Over the last two factors named above, the consumer and the middleman exercise as much influence as the manufacturer, if not more, and therefore can not evade their share of responsibility for the rapid rusting of wire fencing. It appears to be a technical impossibility for the manufacturer to make a light-gauge wire carry as much of the protective zinc coating as a wire of heavier gauge, and yet the demand of the consumer for cheap light-weight fencing has caused a growing tendency to supply lighter and lighter gauges. It is to the interest of the manufacturer, as well as the middleman, to supply the demand which will insure the highest percentage of sales. The consuming public, in demanding lightness and apparent cheapness, is thus responsible for two principal factors which lead to the rapid rusting and consequent destruction of fencing.

The leading manufacturers catalogue and advertise wire fencing of many different weights and designs and as a rule advocate the use of heavier wire where durability is desired. The middleman, with limited warehousing facilities, can not carry in stock all the different types provided by the manufacturer with whom he deals, and so he usually carries only that kind and weight which his opinion and experience tell him is the best seller in his neighborhood. Thus it is often to the interest of the middleman to lead and influence the demand in a locality. A purchaser who goes into a store to buy wire makes his selection, in nine cases out of ten, from the stock on hand, regardless of the possibility that none of it is well adapted for his especial needs or conditions. For this reason the middleman must accept his share of the responsibility for the increased tendency to corrosion of modern fence wire.

The writer believes that a wire fence should never contain wires of lighter gauge than No. 9 or No. 10, except in the fine-meshed poultry and rabbit fencing, which will later on be spoken of separately,

Careful observation of a large number of fences in different parts of the country shows that the vertical or stay wires in a fabricated fence almost always begin to rust before the line or bar wires. This is due in part to the fact that the tie wires are usually of light gauge and consequently carry a lighter zinc coating, and in part to the fact that the rainwater running down the vertical wires makes a stronger attack on the zinc Therefore, if the object is to purchase a fence which will last the longest, instead of one whose first cost is the lowest, it is important to select a type in which the stays are as large and as heavy as the line wires.

How to Practise Real Economy.

Many consumers will be willing to pay almost twice as much for a good fence if they can feel assured that it will last three or four times as long without rusting. On the other hand, many consumers will object, because they think the first cost is an item of such importance that they can not afford to take their choice. This is in most cases a mistaken idea. The kind or type of fence that is selected should depend upon the use to which it is to be put. A hog-tight fence needs a certain number of strong wires near the ground, while a cattle fence calls for a different design and must be horse high. In many cases a design of all 9-gauge wires can be selected which will answer every purpose, and cost no more, or even less, than the lighter-gauge fences ordinarily used. A general-purpose farm fence, hog tight and horse high, 58 inches high, and containing 12 wires, should cost about 40 cents per rod if made up principally of 11-gauge bars and 12-gauge stays. The same fence, made of all 9-gauge wires, should cost about 60 cents per rod. It is probable that the heavier type would outlast the lighter by many years, but the initial cost is high. Now, in many such cases the consumer could select a fence that would answer every purpose—say one with 8 wires, 45 inches high, made up of all 9-gauge wires—costing about 40 cents per rod. If a fence of this type is not high enough for heavy stock, a single strand of barbed or smooth wire run along the posts about 6 to 10 inches above the top will add to its efficiency with a small addition to the cost. In other cases where it is not necessary to fence hog tight, the fabricated wire can be set on the posts with a clearance at the ground, thus increasing its height. A systematic inspection in various parts of the country has shown numberless cases of fences made of 12 and 14 gauge wire, which in less than three years were rusting badly, to the great disgust of the owners. In many cases these were 12-wire fences, 58 inches high, or 10-wire fences, 52 inches high, although they were performing service for which a 6-wire fence, 35 inches high, with perhaps a single additional wire, would have answered.

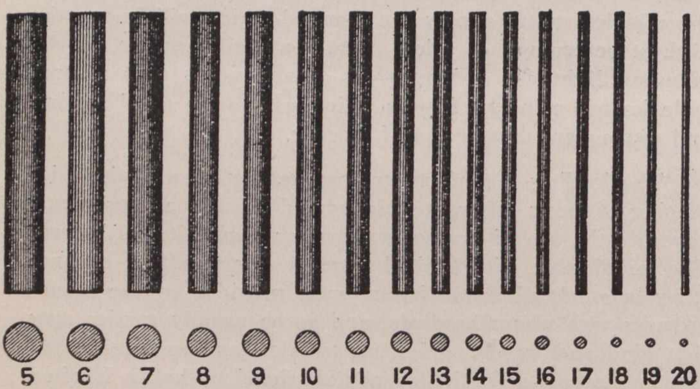


FIG. 1.—Sizes of plain wire.

Badly selected, broken-down, and rusty fences give a shabby appearance to any country and too often represent a mistaken idea of economy. If it is necessary for a purchaser to economize on first cost, it should be done by cutting out unnecessary bars and stays and not by reducing the gauge of the wires.

Sizes of Wire and Character of Steel.

The approximate diameters of the different gauges are shown in figure 1, and the number of feet to the pound of various sizes of wire to which reference has been made are given below:

Sizes and weights of plain wire.

Gauge	Diameter. Inches.	Weight of wire per mile. Pounds.	Length of wire per pound. Feet.
1		1,128	4.68
2		970	5.44
3		836	6.31
4		715	7.38
5		603	8.75
6		519	10.17
7	3-16	441	11.97
8		369	14.29
9	5-32	309	17.05
10	9-64	256	20.57

Gauge	Diameter. Inches.	Weight of wire per mile. Pounds.	Length of wire per pound. Feet.
11	1-8	204	25.82
12	3-32	156	33.69
13		117	44.78
14	5-64	90	58.58
15		73	72.32
16	1-16	55	95.98
17		41	128.6
18		31.77	166.2
19		23.67	223
20		17	309.6

There is, of course, a practical limit to the increase of size in the wires and, except for certain special purposes, the use of heavier wires than No. 9 gauge is not recommended. Larger sizes increase the weight unnecessarily and the wires are so stiff that it is difficult for the user to handle and stretch the fabric. No. 9 gauge wire is strong enough for every practical purpose and can be made of low-carbon or so-called "mild" steel, which is much easier for a farmer to handle and fasten than high-carbon or spring steel. High-carbon steel is used for strength in lighter gauge wires and an impression is prevalent that high-carbon steel is more resistant to corrosion than mild steel. This is not true, and in the opinion of the writer low-carbon stock is a better all-round material for fence wire than high-carbon or spring steel.

A Bad Combination.

In some cases where hard steel has been assembled in the same structure with mild steel the latter has been seen to corrode more rapidly than the former. The detailed scientific explanation and proofs of this statement can not be entered into here, but it is a fact that the contact of two different types of steel in a fabric or structure will result in the protection of one at the expense of the other. In other words, one of the two types of metal will rust much faster than it would have done if assembled in a structure by itself. This is due to the difference of electric potential that is set up at the junctures of metals of different type, a condition which inevitably leads to rapid corrosion and which should be carefully avoided. As soon as all the manufacturers appreciate the truth of this statement one of the many factors which tend to promote accelerated rusting will be removed.

Advantages of Using Heavier Wire.

The general use of Nos. 9 and 10 gauge wire will be found to be of mutual advantage to both the producer and the consumer of fencing. The use of the heavier wire enables the manufacturer to work up a larger tonnage of metal without material increase in labor and other cost charges, and he may also expect to earn a better reputation for his products than he has hitherto enjoyed. The consumer will be repaid by the longer life of his fences and a higher efficiency in the objects for which the structure is designed. It is a mistaken idea to suppose that because the use of heavier wire operates to the advantage of the manufacturer, the selection of light wire must necessarily operate to the advantage of the consumer. A light fence which must soon be renewed might possibly be considered an advantage to the manufacturer, if there was only one kind of fence available or if he entirely controlled the market. But a consumer is not likely to repeat a failure with a particular brand of fence, and as the competition in the manufacture of wire is especially keen in this country, it is at once apparent that fences which rust rapidly work against the interest of all concerned.

Many wire fences are injured by trespassers and by people climbing the wire. A wire fence was not designed to be climbed, but it is evident that the heavier wire will not suffer from this cause to the same extent as the lighter gauges. A single strand of four-point barbed wire set about 6 to 8 inches above the top of the fabricated fence and on the opposite side of the post will usually obviate the difficulty.

Improvements in Galvanizing.

Within the last few years the leading manufacturers have so improved the methods of galvanizing fence wire that it is now possible to put on a heavier coating of zinc. One objection to heavy zinc coatings is that they have a tendency to crack or lift a little at the joints and bends in the fabric. This has been considered a bad feature by both producer and consumer and has resulted in a tendency to wipe the zinc coating very smooth in the galvanizing process in order to overcome the difficulty. In some cases this wiping is so successfully accomplished that almost no zinc is left. In fact, this point raises an interesting question as to whether a slight roughening at bends is not to some extent a guarantee of a heavy zinc coating. By means of standard tests a chemist can tell how much zinc is carried by galvanized wire and, if the consumer desires to go to the expense, he can have sample wires from different brands of fencing examined and reported on before he makes his purchase. If this method is resorted to, however, conclusions should not be drawn from the result obtained on a single sample of the wires under examination. At least seven wires from each fabric should be tested before drawing conclusions. The samples should represent different strands and should be cut about 1 foot in length.

Painting the Fence.

The life of wire fencing may be prolonged by painting, as has been shown by tests carried on for many years at a number of zoological gardens in different parts of the world. It has been estimated that the ordinary farm type of fence can be painted at an expense of about 1 cent per rod. The main difficulty encountered in painting wire is in the kind of the paint. Paints which may have given good results on house or barn are not necessarily suitable for putting on wire. The writer has seen successful results obtained with the use of a basic chrome green paint. In general the advice of some person familiar with paint technology should be taken before selecting a paint suitable for galvanized wire.

Poultry Netting.

Some information may now be added on the subject of poultry netting. This form of wire construction naturally calls for a much lighter gauge wire than ordinary farm fencing. Poultry and rabbit fencing is furnished in a number of different designs by the manufacturers, but the kind most generally used is known as hexagon poultry netting. This is usually made in two different grades by the manufacturers. One grade is galvanized after fabricating or weaving the mesh; the other grade is made from about 20-gauge wire previously galvanized. It is safe to say that the second grade is not fit to use, and should never be purchased by anyone who desires to build a lasting structure. If first cost is a great consideration it would be wiser to make the poultry runs smaller and select the better grades of wire. It is easy to distinguish between these two grades of poultry netting, as that which is woven of wire previously galvanized will readily untwist, while in the other grade the twist will be found to be stuck together by the zinc coating.

Use of Wire Fencing in Sheep Raising.

In concluding this brief paper it may be pointed out that the proper fencing of land is one of the most important problems of American agriculture. This is particularly true of the sheep and hog raising industries. There are probably from 50 to 60 million sheep in the United States at the present time, of which a very large proportion are range-fed and herded. There is, however, a growing tendency to undertake the raising of pastured sheep. In Australia, where the old system of herding has been given up entirely, it is estimated that the owners obtain an increase of 10 per cent. in lamb crop due to the pasturage system. Under the conditions which prevail in this country at the present time it is probable that the successful pasturage of sheep must depend principally upon efficient wire fencing. Properly designed fencing not only protects the animals from the attacks of predatory enemies, but also enables them to be transferred at frequent intervals to new land, which appears to be an absolute necessity for successful sheep raising.

The Department of Agriculture receives a large number of letters asking for information in regard to the best brands and types of fence to buy. It is evident that the Department can not give specific answers to questions of this kind, for such information would amount to an advertisement for any special brand or style recommended

Summary of Recommendations.

(1) Buy the best grade of wire you can afford. If you must economize, do so in the design of your fence and not in the gauge or weight of the individual wires.

(2) If your dealer does not carry in stock the design or type of fence you think is needed, ask him to supply you with the manufacturers' catalogue. If he can not do this, write to the sales agents of the manufacturers.

(3) Insist on getting what you want; if the dealer will not or can not supply you, order elsewhere. Railroad companies and other corporations make reasonable specifications for the wire fence they require and insist on having them filled. You can do the same thing.

(4) Remember that the farm fence made of light-gauge wire, while cheaper in first cost, is often the most expensive in the end, and that the first cost can be lowered by intelligent selection of the type and design best adapted to your special needs.

(5) Remember that the manufacturers are anxious to sell fencing and will always be glad to furnish you with information.

(6) Some of the manufacturers are now ready to supply fences made out of extra heavily galvanized wire. These fences, of course, cost more than the stock types and are difficult to manufacture. For further information, you should write the manufacturers.

(7) The public demand for better fence wire, together with the co-operation between the Department of Agriculture

and leading manufacturers, is gradually bringing about great improvements in the quality of wire fences. You can aid this movement by insistent demand for what you want, but you can not expect the maximum quality and rust resistance for the minimum cost.

(8) The names of the leading manufacturers of steel wire and fencing can be obtained from advertisements in trade papers or from agricultural journals; they can not under any circumstances be furnished by this Department.

SOME PRACTICAL CONSIDERATIONS CONCERNING CONTRACTS FOR LIGHTING AND POWER SERVICE.*

W. N. Ryerson.

In treating this subject the writer intends from the outset, so far as is possible, to eliminate the legal aspect and to confine himself to the statement of such technical subjects as should be covered by any contracts of importance, but in this connection emphasizes the absolute necessity of submitting any contract form or special contract to the best legal authority before it is executed.

Naturally, the amount of money involved will largely determine the care which should be devoted to drawing up any contract, but in general it seems preferable to have contracts of this nature as brief and clear in their terms as possible, as, while we as engineers may understand perfectly what is intended to be expressed, it is advisable to have the wording such as will make it easier to explain the various points to non-technical men, particularly in contracts for retail lighting where negotiations are largely conducted with individuals. The larger manufacturing companies, in making contracts for considerable amounts of power, are usually able to afford, and if they are wisely managed, do engage a competent engineer to advise them before closing contracts.

The following points have been considered of importance in such documents, but in setting forth the list no attempt has been made to group them in the order of their relative importance, as so many of them are absolutely necessary in any properly drawn up contract.

1. Term of Contract.—If the contract is for a large amount of power or involves payments of considerable amounts of money it will, of course, be advantageous in the majority of cases for both parties to agree upon a fairly long term. Affecting this phase of the subject care should be exercised by the generating company not to enter into contracts for longer terms than their existing franchises or other legal limitations may determine.

A very ordinary form is to make the contract for a definite term with privileges on both sides of renewal from term to term, the contract being cancelled by either party on a certain definite notice.

Other contracts provide for a certain definite number of renewals with or without provisions for revising the rates at the beginning of each period.

2. Price or Consideration.—This point is of obvious importance and care should be taken to express the methods of charging in the simplest possible language, and if practicable illustrations should be given showing a sample bill under certain assumptions if the methods of charging used are other than the straight kilowatt hour or flat rate systems. For instance, the readiness to serve charge or some of the newer methods involving this charge, a customer's charge and a power charge.

The importance of clarity in setting forth the methods of charge cannot be over-estimated and while it is probably not possible to state these in words of one syllable, they should be as near this goal as possible.

3. Uses to Which Current is to be Put.—It is usual in contracts for power to state the particular use or uses and in some cases to restrict the consumer to these only, while others simply specify whether the current is to be used for lighting or for power purposes, or both.

4. Point Delivery.—This is of importance in all contracts whether for small or large amounts and should be very clearly and definitely stated so as to avoid misunderstandings as to where the generating company's responsibility ends and the customer's begins.

5. Meters.—It is well to define the type or style of meter (whether integrating, curve drawing or maximum demand or any combination of these) and who is to furnish and maintain them, which, of course, includes the checking and calibration.

It is also advisable to insert a stipulation that if the generating company supplies the meters a proper and sufficient space in the customer's premises must be furnished for their installation, as well as that of any transformers or other apparatus used in connection with the meters.

6. Access to Customer's Property.—A clause stipulating that at all legitimate hours the employees of the generating company may freely enter the customer's premises for inspection or other necessary work is advisable but not absolutely necessary except in the larger contracts.

7. Balancing of Phases.—This, of course, applies only to systems supplying polyphase alternating current, or three-wire direct current systems.

Some contracts provide a penalty for unbalancing in the way of increasing the charge if the unbalancing exceeds a stated amount. This clause is usually of little or no importance except in the case of large users of single-phase current, such as electrolytic furnace work and other processes of this nature.

8. Power Factor.—Some companies make it a practice to stipulate that a certain power factor must be maintained and to provide a penalty for power factors below this amount. This, of course, applies only to contracts for the supply of alternating current.

The writer's feelings in regard to this, as well as the foregoing subject of unbalancing of phases, is that they might be construed as providing other methods of charging for the current than those set forth in the portion of the contract covering this subject, and for that reason be objectionable to some customers.

There has been considerable controversy as to the advisability of having such clauses in the contracts, but there is no doubt that low power factor and unbalancing of phases sometimes works great hardships on the generating company, especially where the customer is located at the extreme end of a long transmission or distributing line which also supplies current to other users, in the way of making the regulation on this line worse than it otherwise would have been.

If the customer's installation is properly taken care of in the first place and care used in selecting apparatus and properly applying it to the work to be done. it would seem that little or no trouble should result to the generating company from these two points, but, on the other hand, unless such care is used there have arisen cases in the writer's exper-

* Being the President's address before the Canadian Electrical Association, July, 1910.

ience where considerable harm and expense have resulted to the generating company.

Salesmen for the manufacturers of electrical apparatus are often zealous in disposing of as many dollars' worth of machinery as possible whether this machinery is adapted to the work or not, and this has resulted in the installation of induction motors larger than were required. By taking advantage of the well-known overload characteristics of electric motors will be found that in the great majority of cases these can be so proportioned as to run at exceedingly good power factors, during a greater portion of the time, and in some instances where this is not possible and the motors are operating at a small fraction of their rated capacity, some means for correcting the power factor can be used, such as the use of synchronous motors as condensers, either running light or serving some useful purpose in the installation.

The expense of these synchronous motors is sometimes hard to justify to customers unless the contract contains some provision as is outlined above, especially when taken in conjunction with the better class of labor required to operate this type of motor and the time necessary to start synchronous apparatus in the event of a failure in the power supply as against induction motors.

9. Penalty for Non-Payment of Bills.—It is usual with all generating companies to state that accounts must be paid on or before a certain day of the month succeeding that on which the bill was rendered. Some companies prefer to accelerate payment by giving discounts, while others choose that the penalty shall take the form of a certain percentage to be added to the amount otherwise due, for failure to pay before the date mentioned.

The writer is of the opinion that the latter method is the better of the two, as, especially in cases of retail lighting companies, their normal rates, which they expect to receive, in a great majority of cases then become known, whereas, in the case of discounts allowed for payment, the high rate without discount is very often associated in the popular mind as the price at which electric current can be purchased, this fact having in some cases a bad effect on the generating company.

Some penalty is usually exacted for failure to pay within a specified time from date of bill in the way of shutting off current, cancelling the contracts, etc. These are undoubtedly of benefit to the generating company and should be incorporated in any contract whether large or small.

10. Penalty for Interruption to Service.—There has probably been as great a diversity of opinion in regard to this question as any other in the making of contracts, but the writer's experience leads him to think that it is becoming more difficult to contract for the supply of power to public utilities without such a penalty clause. Whether this shall apply to retail contracts is another matter and will depend largely upon the necessity on the part of the consumer for absolutely continuous service.

The point of continuity is one to which every public service corporation manager should give the greatest attention, and the importance of this is well known, as evidenced by the amounts of money invested in duplicate apparatus, transmission lines, etc.

It is advisable in large distributing systems to provide in the contract that interruptions during certain specified hours may be had for the purpose of doing work on the lines of the generating company, especially in cases where the distribution voltage is too high to admit of this work being done with potential on the lines. Such interruptions should, of course, be made without penalty to the generating company.

It is very usual to provide that no penalty shall ensue for failure to deliver under certain stated conditions, such as catastrophes and other causes beyond the control of the generating company after the exercise of due care and diligence, but this should always be coupled with a like provision absolving the consumer from payment of readiness to serve, or other fixed charges, in the event of like happenings to his plant or equipment.

11. Excess Power.—In power contracts, particularly, it is well to insert a proviso that power in excess of that originally contracted for, should the consumer enlarge his plant, must be taken from the generating company, with the reservation that such power is to be supplied if at the time application is made the generating company is in a position to supply the excess needed, but if this is not the case the consumer should undoubtedly be given the right to purchase or generate the excess in any way feasible.

12. Arbitration.—A general arbitration clause should be in all contracts involving long terms and for considerable amounts of current. This clause should define the manner in which the arbitration proceedings shall be conducted and particularly the manner of determining on the arbitrators.

Such clauses are very common and are familiar to most of us.

13. Supervision of Consumer's Apparatus.—This subject has been touched upon in one of the preceding paragraphs, but the writer would beg to call further attention to the matter in relation to the general layout of the consumer's plant. Some companies require the consumer to submit detailed plans of his installation, so far as it relates to the connections between the generating company's lines and his own equipment, usually including the step-down transformers, where such are used, lightning arresters, fuses, oil circuit breakers, switches, etc., where these are of the same voltage as the generating company's incoming line.

This, in the writer's estimation is a mistake, as it imposes the responsibility on the generating company practically for the engineering of the consumer's plant, but it is undoubtedly of value that some means be adopted to allow the generating company to pass on certain essential features, merely as a protection to itself and its other customers.

With some users of current first cost is of the greatest moment and the temptation is always to utilize cheaper apparatus, particularly where the siren songs of electric apparatus salesmen are listened to. It is the writer's firm opinion that the type of oil circuit breaker, fuses or other automatic protective device, as well as lightning arresters, where such are used, should be passed on by the generating company, and in some instances the type of transformer or large motors should also receive their attention.

The larger manufacturing companies usually have too much at stake in the way of reputation to risk putting out inferior apparatus, but there are growing up all over the country numerous small concerns professing to manufacture high voltage apparatus and motors who have no reason for existence, due to their lack of facilities, knowledge and general in experience. This subject can usually be taken care of properly if the relations between generating company and consumer are friendly, and the mere fact of pointing out to the prospective consumer the importance to himself as well as the other customers of the generating company of continuous service and the results which may ensue from the use of cheap or inadequate apparatus should be sufficient.

In case of contracts for retail lighting it is, of course, advisable to state in the contract or application that the installation shall be made in accordance with either the local wiring rules or the regulations of the fire underwriters. Some companies cover this by making the installation subject to the approval of the company's inspection department where such exists. To such installations the writer's foregoing remarks would not apply.

14. Definition of Delivery.—This is necessary in the majority of contracts and is usually expressed by stating that the maintenance at the point of delivery of the agreed upon voltage and frequency (of alternating current) shall constitute delivery whether consumer actually uses current or not.

15. Voltage of Supply.—In retail lighting distribution systems it is generally sufficient to specify the voltage which will be delivered to the consumer, and it is possible with any properly designed and operated system to maintain this voltage within very close limits, but in the case of large power distributing systems voltage conditions throughout the circuits and especially at the ends of long lines, will be found to change from time to time as the number of customers connected, and consequently the load demands, vary.

In these cases it is advisable to state that the delivered voltage will be between two limits and to see that the consumer purchases his transformers with suitable taps on the primary or secondary winding to enable him to obtain the required secondary voltage with changes in that delivered.

16. Frequency.—This, of course, applies only to alternating current circuits and is of importance. The normal frequency should be stated and it is well to make a general statement that this frequency, as well as the voltage covered in the preceding paragraph, will not vary to such an extent as will prevent the commercial operation of the consumer's apparatus when this apparatus is properly designed and installed so as to receive power from a miscellaneous system supplying varying loads.

If possible, it is well not to tie one's company down to any definite figures on this point or to provide any penalty for failure to maintain the regulation stated, for obvious reasons.

17. Mutual Liability.—The writer has found it advisable to insert in contracts calling for delivery of power at high voltage a paragraph worded similar to the following:

> "Consumer shall save the company harmless from any and all loss or damage sustained, and any and all liability, to any person whomsoever, incurred by the company by reason of any negligence on the part of the consumer, his officers, agents, or employees in constructing, maintaining and operating his plant, or any machinery, appliances, or apparatus used in connection therewith."

> "The company shall save the consumer harmless from any and all loss or damage sustained, and any and all liability to any person whomsoever, incurred by the consumer by reason of any negligence on the part of the company, its officers, agents, or employees in constructing, maintaining, and operating its transmission system or any machinery, appliances, or apparatus used in connection therewith."

This paragraph, unless made mutual, is of little or no benefit to either party, as it does not apply equally to both sides.

18. Definition of Terms.—It is well, especially in large contracts, to clearly define any terms of a technical nature used therein, devoting a separate paragraph to this purpose—such terms as "day," "kilowatt hour," "horse-power hour," etc.

19. Assumption of Liability to Successors and Assigns.—This is usual in all corporate instruments and should be in any contract except the very smallest retail lighting documents.

20.—Sole Use of Generating Company's Power.—It is usual in some contracts to stipulate that the consumer shall use only such power as is supplied to him by the generating company, but this, of course, will not apply to installations where the generating company agrees beforehand to supply excess or peak power in connection with some existing power supply, and in this connection a proviso is sometimes inserted entitling the consumer to power in excess of that contracted for in the event of emergencies to his other source of supply. This is in the nature of a breakdown service, with which we are all more or less familiar.

21. Delay in Delivery or Use.—In contracts of magnitude a clause should be inserted absolving both parties to the contract for liability in the delivery or use of power for reasons beyond its control, but it is well, if possible, to limit this to a certain specified period if such can be done.

A point in connection with the above which should be taken care of is the prevention of the delivery or use by injunction or other court proceedings.

22. Deposit or other Guarantee.—It is sometimes customary, when contracting with small users of current, to require a bond or deposit, to be returned when the contract expires or is cancelled for other causes not the fault of the consumer. This will very seldom apply in the case of contracts involving large amounts of power, as it will be presumed that the executive of any generating company will assure himself of the financial stability of any concern with whom he proposes to do business before the contract has been executed, but this, of course, is not possible in retailing current for lighting purposes on account of the time and labor involved.

23. Lamp Renewals.—It should be clearly stated whether the generating company furnishes lamp renewals and, if so, on what basis, whether the lamps are delivered to the consumer and what type of lamp is furnished free of charge, if any.

In general, the writer feels that for retail supply a very informal (if such a term may be used) form of contract is all that is required, this very often taking the form of an application signed by the consumer and accepted by the generating company, but that for large amounts of power a more formal document is better for the reason that it impresses the consumer with the responsibilities upon which he is entering and the larger amounts involved will usually warrant the more formal document with its greater expense for printing, binding, etc., and further, that such larger contracts are usually made with concerns or individuals able to employ disinterested advisers in regard to the technical points involved.

The writer is very strongly of the opinion that, in order to retain the confidence of the public, who are the final arbiters of our success, our rates for current should be explicitly stated and printed in the contract before this is submitted for signature by the consumer. This procedure will assure our customers that we are not endeavoring to make a "trade" with them and will indicate that our rates are alike to all and are open to the inspection of anyone.

This is especially important in view of the certainty of all public service corporations sooner or later coming under the supervision of public service commissions, both in Canada as well as the United States. Our position with these commissions will be immeasurably stronger if our rates can be shown not only to be just, but to be fixed, and that whether our methods of charging be simple, as has been the case generally in the past, or very complex, as seems likely in the near future, they must be uniform.

What has been said above does not, of course, preclude the making of special contracts, which every company is likely to do at some time or another, for the supply of so-called "second class" or "limited use" power, whether this use be daily or yearly. This form of contract can, if carefully drawn up and equitably charged for, be easily justified to any fair-minded body of men.

POLES AND POLE LINES.*

F. L. Rhodes, Engineer American Telephone and Telegraph Company.

Much work has been done in adapting the design of pole lines to the condition to be met, and this has required a study of the stresses on the poles, cross-arms, pins and wires under wind and sleet loads, and of the strength and durability of many different kinds of timber.

In recent years the problem of prolonging the life of wooden poles and of obtaining some practical commercial substitute, such as poles of reinforced concrete, has received much attention.

Of the timbers used for poles, the white or eastern cedar, Idaho cedar, chestnut and the yellow pines are of the first importance; red cedar, juniper, cypress, catalpa, redwood and several varieties of oak are used locally to a limited extent.

Most Economical Pole in Each Section.

The most economical pole for use in each section of the country is that pole which will withstand the required load at the minimum annual cost. The load carried by a pole depends upon (a) the number and size of the wires, (b) the length of span, (c) climatic conditions as to wind velocity and the occurrence of sleet, (d) the natural shelter of the line by hills or forests.

The annual cost depends upon the first cost and the length of life. Into the first cost of the pole in place, enter the price at the woods as regulated by market conditions, the freight rate depending upon the weight of the timber and the distance from the point of supply, and the cost of teaming and erecting, which is also influenced by the weight. The length of life depends upon a variety of factors, the principal of which are the character of the timber and the local climatic conditions.

Throughout the New England and Middle Atlantic States chestnut is the principal pole timber, with, however, considerable use of cedar, particularly in Northern New England. In the South, yellow pine is the principal timber, with some use of chestnut, juniper and cypress. The yellow pine has to be creosoted. If this is not done, owing to the severe climatic conditions, not only the part near the ground line, but the whole length of the untreated pole will decay with great rapidity.

On the Pacific coast and in the Rocky Mountain States, Idaho cedar, Douglas fir and Redwood poles are used. The Redwood trees grow to great diameter, so that poles of this timber have to be sawed.

In the Central West, the Mississippi Valley and Prairie States, eastern cedar, Idaho cedar and yellow pine are the principal species in use. The selection is governed chiefly by railroad connections with the timber regions and by freight rates.

In the long distance lines, out of all the poles in use, 62 per cent. are cedar, 31 per cent. chestnut, 5 per cent. juniper and 2 per cent. creosoted yellow pine.

The comparative strengths of the principal pole timbers are as follows, the figures representing fair average values for the fibre stress in pounds per square inch: Cedar, 3,600 pounds; chestnut, 5,000 pounds; yellow pine, 6,000 pounds.

From these figures it will be seen that, size for size, a chestnut pole is nearly 50 per cent. stronger than a cedar pole, and that yellow pine is a trifle stronger than chestnut.

There is considerable difference in the weights of the different pole timbers. This has a direct bearing on the cost of transportation and distribution, and to some extent affects the cost of erecting. Chestnut and creosoted yellow pine poles weigh about twice as much as cedar poles of the same size. In the case of yellow pine, the treating process adds about a third more to the weight of the pole.

Different kinds of poles taper more or less rapidly, the average diameter taper being about one inch in six feet of length for cedar, one inch in seven feet of length for chestnut, one inch in ten feet of length for Idaho cedar, one inch in ten feet of length for yellow pine.

Leaving out of account the compression load due to the weight of the wires, and considering only the horizontal load due to wind pressure on the poles and wires, a pole may be considered as a beam fixed at one end and loaded at a point at the centre of the cross-arm system.

A large amount of mathematical work has been done in applying the theory of beams to poles. I will only touch very briefly upon a few of the results. Owing to the taper, a pole is a beam of non-uniform breaking strength. The section where the breaking strength is theoretically less than at any other section is at the point where the diameter is one and one-half times the diameter at the centre of the applied load.

Except in poles more than about 35 feet in height this section is at the ground line, and even in the case of very tall poles, the weakest section rapidly falls to the ground line on account of decay at that point. For poles of a given length and kind of timber, the breaking strength varies with the cube of the diameter at the breaking section. This fact serves to show why it is that stout poles are so very much stronger than slim poles.

Rates of Increase in Strength.

Taking the strength of a pole 10 inches in diameter as 1,000, the rate of increase in strength for each additional inch of diameter up to 15 inches is shown by the following table:—

Diameter, inches.	Relative strength.
10	1,000
11	1,330
12	1,730
13	2,200
14	2,740
15	3,380

This relation of the cube of the diameter also explains why it is that in cedar poles the effect of a limited diameter of hollow heart on the strength is but trifling.

Chestnut rots considerably faster than cedar. The results of measurements on more than a thousand poles indicate that the average annual decrease in diameter of sound wood is about 0.1 of an inch in cedar and about 0.15 of an inch in chestnut.

The greatest decay with chestnut poles is usually found from four to six inches below the ground line. With cedar poles the greatest decay usually occurs closely at the ground line.

In formulating specifications it has been found convenient to divide poles into seven classes. These classes are designated by the letters of the alphabet from A to G inclusive. Classes A, B and C are respectively 8, 7 and 6 inches minimum diameter at the tops. In addition to this requirement of top diameter, classes A, B and C have minimum requirements specified for the size at a point 6 feet from the butt, this being approximately the ground line when the pole is set.

* Read before the New England Telephone Society.

A lot of unselected poles (which is termed the "wood's run"), all meeting a certain specified top diameter, are found to vary considerably in size at a point of 6 feet from the butt. For example, out of 180 6-inch top, 25-foot cedar poles measured at random, the diameter at the 6-foot mark ranged from 7.6 inches to 12.4 inches. Ninety-five per cent. of these poles, however, only ranged between 8.6 inches and 10.5 inches, or about 1 inch above and below the average. Ont of a lot of 320 6-inch top, 25 and 30-foot poles, almost exactly one-half were found to be below the class C requirement for size at the ground line.

It will thus be seen that classes A, B and C poles are selected poles, being approximately the stouter half of the "wood's run." The specifications for these higher class poles are purposely so drawn in order that the poles of superior strength will be used in the heavier and more important lines. In general, class A poles are used for 5, 6, 7 and 8-arm lines. Such heavy lines are occasionally made necessary where two toll routes join to enter cities where the difficulties of obtaining or holding rights-of-way make such heavy construction imperative. Class B poles are used for 6-arm lines, and class C poles for 2-arm lines.

Below class C the diameter at the base of the pole is not specified, the poles being purchased on top diameter alone, and the "wood's run" taken. Class D poles are 6 and 7-inch for the taller poles. These class D poles are the portion of the "wood's run" which remains after the class B and class C poles have been picked out to meet the required size at the base. Classes E, F and G comprise 6, 5 and 4-inch top poles that are used for lines of less than 20-wire ultimate capacity, running down to the 4-inch top class G poles used for a single subscriber's bracket line.

Specification cedar poles, new, will carry about the following loads applied horizontally at the centre of the cross-arm system: Class A poles, 3,100 pounds; class B poles, 2,300 pounds; class C poles, 1,500 pounds.

In exposed locations added strength is gained by using stouter poles, by replacing them at shorter periods, by setting more poles to the mile, by guying and bracing, and in some exceptional cases by using so-called A or H fixtures, constructed on two poles with cross-bracing.

Long Time for Cedar to Grow.

Under normal forest conditions, the average cedar pole requires from one hundred to two hundred years to grow. The average 30-feet cedar pole is about one hundred and forty years old when cut.

As these poles have an average life in the neighborhood of fifteen years, it is evident that for every cedar pole in use there should be not less than ten poles growing, if the supply is not to be impaired. Chestnut grows more rapidly, an average pole requiring from forty to sixty years to grow.

Pole timber has been and is being cut with little if any regard to maintaining the supply on a permanent basis. Looking back over a period of twenty years, we find that pole prices have been steadily advancing. Roughly speaking, the prices of cedar poles doubled in the ten-year period from 1895 to 1905.

It is the increasing scarcity of timber which has brought the question of prolonging its life prominently to the front in this country. In Europe timber conditions forced the consideration of preservative methods long before the matter was taken up actively in this country. In the early days many schemes for preserving the butts of poles by charring, by coating with tar or asphalt or by setting in concrete were proposed and tried.

Experience has demonstrated that these expedients are entirely ineffectual and useless. It is now generally accepted that an effective timber preservative must be of an antiseptic nature, that it should penetrate the wood to a considerable depth below the surface, and that it must not easily wash out of the timber.

Wood is composed of a multitude of minute elongated cells, pointed at both ends, which lie up together to form the wood structure. The surfaces of the cells are in contact with each other, and are firmly joined together by a cement-like coating. When timber is fractured there is a tearing away of these cemented surfaces.

The decay of timber is caused by the activity of low forms of plant life, principally in the form of fungus threads, which produce ferments that exert a soluble action on the walls of these wood cells. These small organisms can grow either in light or in total darkness, but all of them require certain amounts of air, food, moisture and heat.

It is near the ground line, where the earth holds the moisture and keeps the wood damp for long periods in the presence of air, that decay is most rapid. Preservatives act antiseptically to kill the fungus growths that produce decay, and also to some extent by plugging up the pores of the wood, thus preventing the entrance of the moisture.

The dead oil of coal tar or coal tar creosote, which, according to the German statistics has by far the best record, is the preservative which has long been used in this country.

The usual method of applying this treatment requires a somewhat elaborate plant, the principal feature being the treating cylinder, of which there are several at each of the principal plants. The treating cylinder is sometimes 130 feet long and about 7 feet in diameter. It is constructed like a steam boiler shell, with both ends hinged so that they can be opened.

The timber to be treated is piled on small cars, which run on rails directly into the cylinder at one end. The cylinder is then tightly sealed and filled with steam. The timber is steamed for several hours, length of time and temperature being regulated by the specifications. The steaming softens and opens the wood cells and liquifies the sappy constituents of the timber. After the steaming is discontinued a vacuum pump is applied to the cylinder. This draws the liquids out of the timber to a large extent. When the flow of liquid from the condenser during the application of the vacuum has ceased, the pumping is stopped, and the cylinder filled from a large measuring tank with dead oil of coal tar.

Preservatives near the Ground Line.

When the cylinder is completely filled, pressure is applied to force the specified amount of oil into the timber. After the oil pressure is released, the oil is pumped back into the measuring tank and the difference in the initial and final readings on a gauge attached to the measuring tank shows the amount of oil that has been absorbed by the timber.

As the portion of the pole at the ground line is the part which decays most rapidly, much attention has recently been given to methods for applying preservatives to the section of the pole extending from about a foot above the ground line to about two feet below the ground. The simplest way of doing this is to apply the preservatives like paint, with a brush.

This method was used to a considerable extent in some parts of this country from 1900 to 1905. The results did not in all cases prove beneficial. When the preservative was applied to poles that were seasoned, it appeared to postpone decay, whereas, when green poles were treated, no benefit resulted, and in some cases decay appeared to be hastened.

A line of experimentation which has been carried out in co-operation with the forest service has been the treatment of pole butts with dead oil of coal tar by the open tank process.

With this method the butts of the poles are placed in tanks and covered with dead oil to a point about one foot above the ground line. The oil is then heated above the boiling point of water, either by means of steam pipes within the tank or by a fire built beneath it. This converts the water in the wood cells into steam, most of which escapes by bubbling through the oil.

The air in the wood cells is also expanded and expelled. After the pole has been thoroughly heated in this manner, the oil is either allowed to cool or the poles are transferred to another tank containing cold oil. In either case the effect is to form a partial vacuum in the wood cells, allowing the oil to be forced into the timber by atmospheric pressure. A considerable number of poles have been treated by this method. These poles are now under observation, and it is hoped before many years to have conclusive evidence as to the value of the treatment.

Creosoted Poles Examined.

Dead oil of coal tar contains various volatile constituents which tend to escape from treated timber after protracted exposure to the elements. Creosoted poles that have been in a line for nearly ten years, have been removed and the oil extracted from them and analyzed with great care. As the original composition of this oil had been very carefully determined by analysis ten years ago, it was possible to discover any chances that had taken place in it.

It has been shown that although the lighter distilling constituents of the oil tend slowly to escape from the portion of the pole above the ground, the composition of the oil in the portion of the pole at the ground line and below is practically unchanged after ten years.

It is also a fact that creosoted wood poles are practically free from attack by woodpeckers. In some sections of the country, notably in the Eastern Central States, Texas, Arizona, and California the destruction of poles by woodpeckers is a serious matter. Some of the woodpecker holes are three of four inches in diameter and four or five inches deep. In some cases, they destroy the poles in only a few months, so weakening the pole that it may be dangerous for a lineman to climb it.

The economy of treating pole butts with preservatives is closely connected with another question, namely, that of extending the life of the poles which have become rotted at the ground by some form of reinforcement. These have consisted in general of setting a stub of new timber close alongside the old pole and binding the pole and the stub together by means of twisted wire wrappings.

As a result of various tests three styles of stub reinforcement, differing from each other in the method of attaching the stub to the pole, have been adopted. The simplest form used for the lighter and less important lines makes use of the old plan of wire wrappings alone, although some improvements have been made in the method of applying the wrappings. For the more important lines, the wire wrappings are supplemented by two bolts extending through both pole and stub. Special tightening bolts are provided for the wire wrappings.

In some portions of the country creosoted yellow pine stubs promise the best economy. In other places there are found local timbers which, although not growing in the proper size for poles, may yet possess good strength and long life.

The great advances in the use of reinforced concrete which have been made in recent years have set many people at work designing and building concrete poles. The results thus far obtained show that the poles are remarkably uniform in strength, and that their actual breaking loads are close to the computed values.

The poles are square in section and are hollow. They taper from twelve inches at the butt to six inches at the top. The walls are about two inches thick. Different amounts and kinds of steel reinforcements have been used. As a fair average of all the poles it can be said that the weight is about 2,000 pounds, of which about 300 pounds is steel and 1,700 pounds concrete. Cedar and chestnut poles of equal height and strength weigh about 500 and 1,000 pounds respectively. The poles will probably cost about $10 as against $5 for cedar poles. These figures do not take into account the costs of transportation and erection.

A considerable number of these poles will be made and erected, in order that experience may be had as to the effect upon them of stresses, vibrations, frost, lightning, and other actions of the elements. If, as there is every reason to expect, the prices of wooden poles continue to increase, a stronger case can be made out in the future for concrete poles than at the present time. So far as can now be seen, for a number of years to come, their use will be restricted to especially important lines and to permanently located poles in exchange work, such as poles for interior block distribution.

At one time Norway pine was used almost exclusively for cross-arms. The cutting off of the Norway pine forests has, however, made the price of this timber so high that it is no longer used to any considerable extent for cross-arms.

About ten years ago, yellow pine was introduced as a cross-arm material. This wood in its natural state does not have the necessary life, and cross-arms of yellow pine are therefore treated with dead oil of coal tar.

Douglas Fir For Cross-arms.

At the present day these creosoted yellow pine cross-arms form a large portion of the total supply. With the opening up of the Western forests, Douglas fir has entered into the field as a cross-arm material, and a large number of these arms are now being used. Other timbers are from time to time being investigated for use for cross-arms, and experimental installations of cross-arms of cypress and gum timber are now under observation. The strength of 10-pin creosoted pine standard cross-arms is such that they will sustain a downward load of about 250 to 300 pounds at each pin.

Locust is pre-eminently the best wood for insulator pins. It is not only of high strength, but also of long life, and possesses the valuable property of high resistance to decay even when in contact with decayed wood.

Top Pins.

Locust suitable for pins does not grow in forests. Scattered specimens are encountered here and there, frequently in almost inaccessible places. Locust timber, therefore, is not cut by organized gangs, but by the farmers who have a few scattered trees on their land and who oftentimes cut the timber into billets which are accepted at the country stores in trade. In other cases, the farmers send their billets directly to the pin manufacturers. In either case the farmer cuts and delivers his billets only when he has nothing else to do.

These hand-to-mouth methods of supply, over which there has been found no method of control, became during the year 1905 a source of considerable embarrassment to consumers. In that year so much construction work was being done that locust pins could not be obtained fast enough to meet the demands of the business. As a stop-gap rock-elm pins were employed. This wood is sometimes called "Kalkeen."

Although steel insulator pins have been largely used in telegraph work, they have not commended themselves for use in telephone construction. Locust pins have an average breaking strength of about 1,200 pounds. The usual form of steel pin bends under a load of about 700 pounds. Moreover, steel pins cost from two to three times as much as wooden pins, are more expensive to place in the arms, and have a shorter length of life.

Line Wire.

Iron wire is used in many sections of the country for exchange lines, centre checking lines, and for short and comparatively unimportant toll lines. In the Central and Rocky Mountain States iron wire has usually a life of from ten to twenty years, and there are some exceptionally dry sections where still longer life is obtainable. Iron wire of the grade that is usually employed has a tensile strength of about 55,000 pounds to the square inch and elongates about 12 per cent. to 15 per cent. of its length before breaking.

The hard-drawn copper wire, which constitutes the bulk of the wire plant, has a tensile strength of from 62,000 to 65,000 pounds per square inch, and will elongate about 1 per cent. of its length before breaking.

On account of the fact that wires expand at high temperature and contract at low temperatures, the temperature has to be taken into account in stringing wires. If wires strung in the summer are stretched too tightly, they are liable to break in winter as the result of contraction. Aside from the temperature effects. the actions which occur in a span of wire under load are very complicated. For a span of given length the stress in the wire diminishes as the sag increases. Owing to the elasticity of the wire, when it is subjected to load, as by sleet, it stretches. The increase in length due to this stretch allows it to sag more than before. This increase in the sag tends to relieve the load. A condition of equilibrium is therefore reached where all the stresses are balanced.

The behavior of the wire under any given conditions can be very accurately computed. For the ordinary span of 130 feet the specified sag at 60 degrees Fahrenheit is 7 inches. Due to contraction this decreases to about 4 inches at zero Fahrenheit. The stretch of 1 per cent. is sufficient to allow the sag to increase to 6 or 7 feet before the wire breaks. The specified sags are such that the wires under the loads due to wind pressure and sleet have about the same factor of safety as the pole lines.

ELEMENTARY ELECTRICAL ENGINEERING.

L. W. Gill, M.Sc.

CHAPTER IV.

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

Power and its Measurement.—By definition, power is the rate of doing work, and, in the case of work being done by a mechanical force, it is measured by the product of the force and the distance per second over which the force acts. In the case of a waterfall, the power is measured by the product of the fall (difference of level) and the current or quantity passing per second. If electricity flows between two points not at the same potential, **the power is represented by the product of the difference of potential or voltage between the points and the current.** (It may be here noted that this is not always true in the case of alternating current, as will be seen later.) The unit of electric power is known as the "watt," and is the power expended when a difference of potential of one volt causes a flow of one ampere. From this it follows that the product of volts and amperes represents watts. In dealing with large quantities of power the unit generally used is the kilowatt, which is equal to 1,000 watts.

The relation between electrical and mechanical power is such that 1 watt is equivalent to 10^7 ergs per second, and, since 10^7 ergs is equal to .737 foot pound, it follows that 1 watt is equivalent to .737 foot pound per second, 746 watts are equivalent to 550 foot pounds, and 1 kilowatt is equivalent to 4/3 horse-power, very nearly.

Since the electric power delivered or received by a circuit is equal to the product of the voltage and current, it is obvious that these two factors must always be taken into account in the measurement of power. The voltage and current may be measured separately by means of a "voltmeter" and an "ammeter," or the product of the two may be measured directly by means of a "wattmeter." When the first method is used to measure the power delivered or received by a circuit the voltmeter must be connected to the terminals of the circuit **a** and **b**, as shown in Fig. 41; i.e., the terminals of the voltmeter must be connected to the two points between which it is required to find the difference of potential. The ammeter must be connected in series with the circuit in the same way as a water meter is connected in a water pipe. The connections are shown in Fig. 41. When the current to be measured is large, it is common practice to pass only a small fraction of the current through the meter, the main portion being "shunted" outside the meter by means of a low resistance, which is placed in parallel with the meter as shown in Fig. 42. The advantage of this method is that several "shunts" may be used with the same meter, the resistance of the different shunts

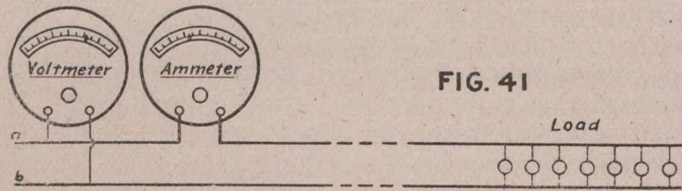


FIG. 41

being adjusted so that when the meter is used with any particular one the current is found by multiplying the readings of the meter by a simple number. Suppose, for example, that a meter is graduated to read directly in amperes when used with a given shunt, and that its range is 100 amperes. If this meter is used with a second shunt, of which the resistance is approximately one-half that of the first one, it is obvious that double the proportion of current will be shunted, and it will consequently require double the flow of current to deflect the meter the maximum amount. In this case the current would be obtained by multiplying the readings of the meter by two. A single meter with a series of shunts may thus be used to measure currents of any value.

When power is measured by means of a wattmeter, its two factors (voltage and current) are taken into account in the same way as when a voltmeter and an ammeter are used, the only difference being that the wattmeter gives the product of the two directly. The wattmeter is in effect a combined voltmeter and ammeter, and consequently has a potential coil corresponding to the voltmeter and a current coil corresponding to the ammeter. The two circuits formed by these coils have separate terminals, and in the measurement of power are connected up in exactly the same way as if they represented separate meters. The connections will thus be as shown in Fig. 43.

If the voltage measured between any two points on a simple conductor is E and the current is I, the resistance, according to Ohm's law must be E/I. The power absorbed by the conductor between the two points is $W = EI = E^2/R = I^2R$. This power is lost in the form of heat, and from the above expression it is noted that it varies as the square of the current, and directly as the resistance. This was referred to in Chapter I. as the "heat effect" of an electric current. If a battery or an electric motor is placed in the circuit between the two points considered above, so that the current has to flow against an opposing e.m.f. of E_1 volts, the effective voltage between the two points would be $E - E_1$ volts, the current would be $I = (E - E_1)/R$, and the power would be $W = EI = (IR + E_1) = I^2R + E_1I$. The first term of this last expression represents the heat loss, and the second term represents the power expended on the battery or motor; i.e., in forcing the current I against the e.m.f. E_1.

Efficiency of Direct Current Generators and Motors.—The commercial efficiency of an electric generator is the ratio of the net useful output to the total intake. In the case of self-excited generators the intake is equal to the mechanical power supplied by the prime mover or engine, and in the separately excited machine the intake is equal to the mechanical power supplied plus the electrical power used for excitation. The net output in every case is equal to the product of the current passing to the external circuit and the voltage between the generator terminals.

The losses may be divided into (a) mechanical or friction losses, (b) electrical or copper losses, and (c) magnetic or iron losses. The mechanical losses consist of bearing friction, brush friction, and windage or fan action of armature. The iron losses consist of hysteresis effect due to the continuous change in the direction of the flux in the iron of the armature caused by the rotation and the heat effect produced by the eddy currents which are set up in the rotating parts which "cut" lines of force. The copper losses include the heat effect in the armature winding and the exciting coils (shunt and series), including the regulating rheostat.

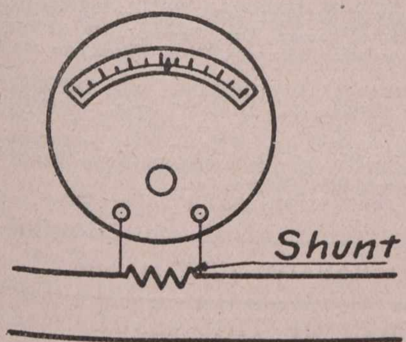


FIG. 42

Modern electric generators, almost without exception, run at constant speed, and the mechanical losses, which depend only on the speed and frictional constants, are constant and independent of the load. In any particular case these losses are represented by the power required to drive the machine at its normal speed and with no excitation. The iron losses, which depend on speed and magnetic flux, is represented by the additional power required to drive the same machine when excited, but not loaded, over that required to drive it when not excited. When measuring the iron losses in this way, the exciting current should be obtained from some independent source. If the machine provides its own exciting current the additional power will represent copper loss in the shunt coils in addition to the iron losses. In any case the excitation should be such as to give that value of flux which is necessary to generate the e.m.f. which is required when the machine is loaded. This e.m.f. is equal to the terminal voltage when loaded plus the loss of potential in the armature. (See equation 15.) The copper losses are determined by calculation. If Ia represents the armature current and Ra the armature resistance, the armature copper loss is Ia^2Ra; and if Ie represents the shunt exciting current and E the terminal voltage the loss in the shunt exciting circuit (including rheostat) is EIe. The loss in the series exciting coils is Is^2Rs, where Is represents the current and Rs the resistance of these coils.

The friction and iron losses are usually measured either by driving the generator unloaded by means of a motor and measuring the intake of the motor, or by running it as a motor, unloaded. If Io represents the current taken by the armature in the latter case, the power taken by the armature is EIo, and, excepting a small amount of copper loss, which may be neglected, this represents the iron and friction losses combined.

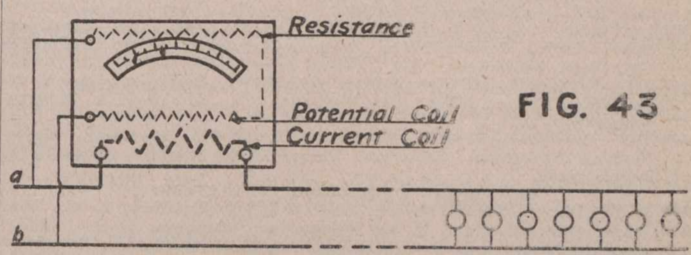


FIG. 43

Let I	represent	current in the external circuit.
Ie	"	current in the shunt circuit.
Ia	"	current in the shunt armature.
Ea	"	generated e.m.f.
E	"	terminal voltage.
Ra	"	resistance of armature.
Rs	"	resistance of series coils.
Wf	"	friction losses.
Wi	"	iron losses.
Wc	"	copper losses.

If the shunt circuit is connected directly to the brushes, Is = I, and if connected to the generator terminals, Is = Ia. In all cases Ia = I + Ie. The total copper loss is

$$Wc = Ia^2Ra + EIe + Is^2Rs \qquad (18)$$

The efficiency of the generator is

$$F = \frac{\text{Output}}{\text{Intake}} = \frac{\text{Output}}{\text{Output} + \text{Loss s}} = \frac{EI}{E + Wf + Wi + Wc} \qquad (19)$$

In the case of the motor, the losses are of the same character as those of the generator. If the current passing through the armature of a motor when running light (no load) is represented by Io, and the voltage impressed on the brushes by Eb, the power absorbed by the armature is EbIo. This represents the friction and iron losses, which are independent of the load except for a small decrease on account of the slight decrease of speed with increase of load. Unless a high degree of accuracy is required these losses may be assumed to be constant. In the case of the shunt motor the brush voltage is equal to the line voltage.

ENGINEERING SOCIETIES.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

AMERICAN TECHNICAL SOCIETIES.

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

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

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

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

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

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

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

COMING MEETINGS.

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

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

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

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

THE AMERICAN PEAT SOCIETY will meet at Ottawa, Ont., July 25-26-27, 1910. Secretary and Treasurer, Julius Boodollo, Kingsbridge, New York City.

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

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

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

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

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

AMERICAN PEAT SOCIETY.—July 25, 26, 27, 1910, at Ottawa, Can. Secretary Julius Bardollo, Kingsbridge, New York City, New York; Assistant Secretary, A. J. Forward, B.A., Ottawa, Can.

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

TORONTO, CANADA, JULY 21, 1910.

CONTENTS OF THIS ISSUE.

CONSTRUCTION NEWS SECTION

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

TENDERS PENDING.

In addition to those in this issue.

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

Place of Work.	Tenders Close.	Issue of.	Page.
Quebec, Que., bridge	Sept. 1.	June 30.	56
Toronto, Ont., sewer	July 26.	June 30.	53
Brockville, Ont., bridge	July 25.	July 7.	53
Saskatoon, Sask., boiler	July 25.	July 7.	53
Sault Ste. Marie, Ont., railway	July 23.	July 7.	53
Ottawa, Ont., steam fitting, railway shops	July 26.	July 7.	22
Colchester, Ont., pier extension	Aug. 9.	July 14.	54
Winnipeg, Man., bridge substructure	July 25.	July 14.	53
London, Ont., pumps and motors	July 29.	July 14.	53
Collingwood, Ont., paving	July 30.	July 14.	54
Winnipeg, Man., sewer	July 26.	July 14.	54

TENDERS.

Digby, N.S.—Tenders will be received until Aug. 6th for the delivery on the Government pier of about 30,000 ft. b.m. of square creosoted timber. C. E. W. Dodwell, resident engineer, P.W.D., Dept. Public Works, Halifax, N.S.

Dover, N.S.—Tenders will be received until Aug. 15th for the construction of a wharf. R. C. Desrochers, Asst. Secretary, Dept. of Public Works, Ottawa.

Port Felix, N.S.—Tenders will be received until Aug. 15th for the construction of a wharf. R. C. Desrochers, Asst. Secretary, Dept. of Public Works, Ottawa.

Coaticook, Que.—Tenders will be received until July 23rd for the construction of a reinforced concrete arch bridge. Fred. C. Davis, Consulting Engineer, Sherbrooke, Que.

Magog, Que.—Tenders will be received until July 25th for armory fittings. R. C. Desrochers, Assistant Secretary, Department of Public Works, Ottawa.

Sherbrooke, Que.—Tenders will be received until July 19th for waterworks and sewers in municipality of Asbestos. J. O. C. Mignault, Engineer.

Belleville, Ont.—Tenders will be received until July 20th for two turbine pumps, direct connected to proper motors, with lighting preventive apparatus and starting apparatus; two triplex pumps, also direct connected to similar motors and apparatus. James G. Lindsay, City Engineer.

Blyth, Ont.—Tenders will be received until July 27th for the erection of a municipal telephone system for the Blyth Telephone Co. A. Elder Secretary.

Brantford, Ont.—Tenders will be received until July 23rd for cement walks required on the grounds of the Institution of the Blind. H. F. McNaughten, Secretary, Public Works Department, Toronto.

Brantford, Ont.—Tenders will be received until July 21st for heating and ventilating required in King Edward and Ryerson Schools. Geo. W. Hall, Architect.

Grand Valley, Ont.—Tenders will be received until July 23rd for all trades in connection with additions and alterations to a school. M. G. Varcoe, Chairman, P. S. Board.

Harriston, Ont.—Tenders will be received until July 27th for the construction of a drain. W. D. McLellan, Clerk of Minto Township.

Humberstone, Ont.—Tenders will be received until July 30th for Lyons' Creek drain. George Ross, C.E.

Kingston, Ont.—Tenders will be received until July 22nd for the erection of a synagogue. Power & Son, Architects.

Oriole, Ont.—Tenders will be received until July 31st for the erection of a schoolhouse for Section No. 11, East York. J. R. Whittaker.

Peterboro', Ont.—Tenders will be received until July 23rd for the construction of concrete sidewalks. G. W. Bennett, Township Clerk.

Peterboro', Ont.—Tenders will shortly be invited for the construction of a sewerage system in the south end of this city. Messrs. Chipman & Power, consulting engineers of Toronto, have been commissioned to prepare plans by August 15th, and tenders will be required for sewers, pumping station, machinery and drains T. A. S. Hay is the city engineer.

St. Thomas, Ont.—Tenders will be received until July 27th for the contract of the clear water concrete reservoir at the waterworks. Jas. A. Bell, city engineer.

Toronto, Ont.—Tenders will be received until August 2nd for a supply of floor tile for the filtration plant. G. R. Geary (Mayor), Chairman Board of Control.

Toronto, Ont.—Tenders will be received until July 26th for the construction of sheet piling on the west bank of the River Don a distance of 283 feet. G. R. Geary (Mayor), Chairman, Board of Control.

Toronto, Ont.—Tenders will be received until July 27th for the construction of a steel superstructure 55 feet clear span, and concrete abutments for a bridge over the Black River. Barber & Young, engineers. (Adv. in The Canadian Engineer).

Toronto, Ont.—Tenders will be received until July 25th for masonry work in connection with the enlargement of Earlscourt school. W. C. Wilkinson, Sec.-Treas. Board of Education.

St. Boniface, Man.—Tenders will be received until July 22nd for the construction of a trunk sewer. H. P. Blair, Town Engineer.

Virden, Man.—Tenders will be received until July 25th for the erection of a collegiate institute. A. W. H. Smith, Secretary-treasurer, Virden S.D.

Winnipeg, Man.—Tenders will be received at 279 Garry Street, Winnipeg, Man., up to July 23rd for the following materials: 25 to 35 horse-power stationary gasoline engines, 6-ton dump scale, 100-bushel hopper scale, 26 gauge Manitoba galvanized siding, V crimp roofing, 4 ply belting, 6 in. to 18 in., standard cement per barrel. Engineering Department, Manitoba Elevator Commission.

Winnipeg, Man.—Tenders will be received until July 20th for the erection of a thirty-suite block. T. Lewiston, 903 Main Street.

Winnipeg, Man.—Tenders will be received until Sept. 1st for electrical distribution system. M. Peterson, Secretary Board of Control Office. (Adv. in The Canadian Engineer.)

Winnipeg, Man.—Tenders will be received until July 26th for wiring system, switch board and transformers required in connection with the locomotive shops of the National Transcontinental Ry. P. E. Ryan, Secretary.

Winnipeg, Man.—Tenders will be received up to Thursday, September 1st, for the manufacture, delivery and installation, 46,000 feet of thirteen thousand volt, three-core cable.

Specifications may be obtained at the Power Engineer's Office, Carnegie Library Building, Winnipeg, and may also be examined at the offices of Smith, Kerry & Chace, Confederation Life Building, Toronto. M. Peterson, Secretary, Board of Control.

Swift Current, Sask.—Tenders will be received until August 2nd for constructing sewers and sewage disposal works. A. W. Snider, Mayor.

Bladworth, Sask.—Tenders will be received until July 20th for the erection of a brick veneer school. E. J. Dobson, Secretary-treasurer, Bladworth S.D.

Regina, Sask.—Tenders will be received until July 25th for the erection of a warehouse building for the National Drug and Chemical Co. Storey & Van Egmond, Architects, Regina and Saskatoon.

Saskatoon, Sask.—Tenders will be received until July 27th for the erection of the College barns and three houses on the University grounds in Saskatoon. Plans and specifications may be seen at the office of the University, or at the Department of Public Works, Regina, or at the office of the architects, David R. Brown and Hugh Vallance, Canada Life Building, Montreal, Que., and at the rooms of the Builders' Exchange, Winnipeg. Walter C. Murray, President.

Cloverdale, B.C.—Tenders will be received until July 29th for the erection of a 4-roomed schoolhouse. C. H. Clow, architect, Murchie Block, New Westminster.

Victoria, B.C.—Tenders are invited for the supply of poles for the extension of the Government telephone line from Louis Creek to Little Fort. F. C. Gamble, Public Works Engineer.

Victoria, B.C.—Tenders will be received until July 21st for the installing of heating system in the office annex building, situated in the grounds of the Parliament buildings. F. C. Gamble, Public Works Engineer, Public Works Department.

Victoria, B.C.—Tenders are called for cluster light standards and lights and underground conduits to carry wires. Angus Smith, City Engineer.

CONTRACTS AWARDED.

Sydney, N.S.—Wm. Cooke, of North Sydney, was awarded the contract for sewer extensions here at $22,661.50. Other bids were:—

Sutherland & Redding, North Sydney	$25,552.90
J. H. Treen, Sydney	24,436.70
McDonald & McLeod, St. John	27,055.50

Fredericton, N.B.—The contract for the erection of a new brick bank building for the Nova Scotia branch here has been awarded to Joseph McVey & Sons, of St. Marys.

St. John, N.B.—For the paving of Germain Street, the lowest tender, that R. A. C. Clarke, has been recommended for acceptance. The bids were as follows:—

Carritte Paterson Manufacturing Company	$12,676
McDonald & McLeod	12,920
Westminster Paving Company, Limited	13.032
A. R. C. Clarke	14,250

Mr. Clarke submitted an alternative tender for opposite paving, amounting to $11,380, and this was recommended.

Quebec, Que.—The Department of Public Works at Ottawa has awarded to Horace Dussault a contract for the construction of a wharf at Levis, to cost approximately $283,-064.50.

Quebec, Que.—M. Lonnergau was awarded the contract for waterworks extensions in St. Malo.

Brampton, Ont.—John Conn, of Windsor, was given a contract by this town for the construction of 7,200 square yards of macadam roadway at 88 cents a sq. yard, and grading at 39c. a sq. yard; also for 5,000 feet of concrete curb and gutter at 46 cents a lineal foot. The roadway was to be 26 ft. wide, curb to curb, and to consist of a foundation course 6 in. deep of 3-in. stone, and a top course of 1½-in. stone, 4 in. deep (after rolling), with filling material between courses. The curb was 6 in. wide and 12 in. deep, and the gutter was 6 in. deep and 15 in. wide. A 4-in. tile covered with cinders was to be placed under gutter.

Brockville, Ont.—Alex. Tait of Collins Bay was given a contract crushing and spreading stone at $3.15 a cord, by the town of Westport. E. R. Blackwell, C.E., superintendent of good roads.

Cornwall, Ont.—For the construction of a concrete arch of 32-ft. span and 18-ft. roadway, the United Counties of Stormont, Dundas and Glengarry awarded a contract to Mernaw & McDonald, of St. Andrew's West, Ont., at $2,066.25. The following tenders were received:—

Mernaw & McDonald, St. Andrew's West, Ont.	$2,066.25
McDonald & McDonald, Alexandria, Ont.	2,393.07
Chisholm & Quinn, St. Andrew's West, Ont.	2,511.45
G. R. Phillips, Cornwall, Ont.	2,477.25
Helmer & Winstanley, Russell, Ont.	2,527.31
Duncan G. McMillan, Finch, Ont.	2,535.93
Alex. Cameron, Alexandria, Ont.	2,196.07

Hamilton, Ont.—J. J. Armstrong was awarded a contract for sewer construction as follows: Barton Street, Bay to Park Street, 47 cents a foot; Simcoe Street, James to Hughson Streets, 44 cents a foot, and Fife Street, 60 cents a foot.

London, Ont.—The Barber Asphalt Company have been awarded a contract for resurfacing Dundas Street from Ridout to Wellington, at $12,716.

London, Ont.—The London Foundry Company were given the contract for 76 ornamental electric light poles at $20 each, and the contract for line hardware, amounting to $1,700, was awarded to the Northern Electric Company.

New Liskeard, Ont.—Hill & Clark, a local firm, were given the contract for the construction of the sewage outfall works.

Stratford, Ont.—The heat and light commissioners decided to purchase from the John Forman Company, of Montreal, 800 75-watt Tungsten lamps for street lighting.

Toronto, Ont.—L. K. Comstock & Company of New York, were awarded a contract by the University of Toronto, for the construction of the power house, the tunnels, and the supply of some machinery in connection with the new central lighting and heating plant. The contract for boilers was given to Babcock and Wilcox, of Montreal, while W. J. McGuire, Limited, of Toronto, got the award for the heating mains. Darling & Pearson, of Toronto, are the architects, and the contracts here referred to aggregate about $250,000.

Toronto, Ont.—Contract for the supply and installation of a fire alarm telegraph central office equipment for the city was given to the Northern Electric and Manufacturing Company, Limited. Parke & Leith, of Toronto, were given the contract for aluminum wire at 22 cents a pound.

Brown & Love will do the masonry work in connection with the sub-station of the hydro-electric system on Macpherson Avenue, for $25,005.

Toronto, Ont.—John Maguire got the contract for an asphalt block pavement on College Street, between Manning Avenue and Dovercourt Road, at $42,486.

Toronto, Ont.—The new fire hall of East Toronto will cost $25,288. The masonry contract went to Page & Company at $14,195.

Woodstock, Ont.—E. S. Coppins, a local man, secured the contract for installing a Pease heating system in the Princess Street school, at $4,755.

Brandon, Man.—William Bell was given a contract for the erection of a $25,000 warehouse for the Cockshutt Plow Company.

Brandon, Man.—The Brandon Light Company have awarded contract to A. E. Bullock for laying mains necessary in connection with a new heating system that will supply the business section of the city.

Foam Lake, Sask.—For the construction of 13,000 square feet of concrete sidewalk, C. H. Conery and C. Mattaini, of Guelph, Ont., were awarded a contract by this municipality at 16 cents a square foot for walks, and 63 cents a lineal foot for curb.

Calgary, Alta.—Concrete walk contracts have been awarded as follows: Batchelor, Marshall & Skarin, south of C.P.R. track, 10 cents a square foot; McKibbon Bros., north of track, 9¾ cents.

Edmonton, Alta.—Tenders for the Athabasca Avenue bridge were as follows: Algoma Steel Company, f.o.b., Edmonton, $22,800, for erecting, including four-inch plank on sidewalk, and painting, but not including cement pedestals or abutments, $8,020. The Dirkson Bridge Works Company, of Campbellford, Ont., submitted alternative plans, the prices being with 40-foot roadway, and 5-foot sidewalks f.o.b., Edmonton, erected complete, $29,960, concrete floor $7,428 extra. The other tender of this company was for 20-foot roadway and two 6-foot sidewalks, $27,000, erected complete, $32,000. Walker and Barnes' tender in behalf of the Canadian Bridge Company, was: Steel delivered at site, $24,588, erected ready for planking and paving, $30,000. Gorman, Clancey and Grindley tendered for the Dominion Bridge Company, f.o.b. site, $24,650; erected, $29,240.

Taber, Alta.—Tenders for the erection of a new school were received as follows:

Hotson and Leader, Lethbridge	$59,980
J. E. Lussier Construction Co., Lethbridge	55,000
R. A. VanOrman, B. A. Stringum, Taber	52,075
E. R. Wildman, Taber	52,975

The contract was awarded to Mr. Wildman.

Nanaimo, B.C.—Contract for seven miles of concrete sidewalk given to contractor Wardsworth, of Victoria.

New Westminster, B.C.—The contract for the laying of the new Coquitlam pipe line has been let to the Municipal Construction Company for $108,557.57.

Prince Rupert, B.C.—The Westholme Lumber Company got the contract for a million feet of lumber for sidewalks at $15,000.

Vancouver, B.C.—The Vancouver Rubber Co. got a contract for six hose carts at $105 each.

Vancouver, B.C.—McDonald & Wilson were awarded a contract for building the telephone exchange at North Vancouver.

Vancouver, B.C.—The board of works awarded contracts for pavements on Broadway and Dunlevy Avenue and for a sewer on Tenth Avenue. T. R. Nickson was awarded the contract for two sections of the Broadway paving, getting that from Prince Edward Street to Scott Street for $44,000 and that from Ontario Street to Prince Edward Street for $49,000. Palmer Bros. & Henning got the paving contract for Dunlevy Avenue at $22,614.33. The Tenth Avenue sewer went to James C. Kennedy, whose bid of $32,000 was far below the tenders of his competitors.

The tenders considered were: Pavement, wood block, Broadway from Prince Edward to Scott, Palmer Bros. & Henning, $46,522; M. P. Cotton, $48,453; Christian, Hartney & Christian, $51,790; T. R. Nickson, $44,000; from Ontario Street to Prince Edward, Palmer Bros. & Henning, $53,-612.08; M. P. Cotton, $57,580; T. R. Nickson, $49,000; Dunlevy Avenue, Harris to Hastings, Palmer Bros. & Henning, $22,614.33; M. P. Cotton, $24.335.

Tenth Avenue Sewer—M. P. Cotton, $64,000; James C. Kennedy, $32,000; Hugh McDonald, $53,232; Palmer Bros. & Henning, $59,475; W. D. Grant, $66,578.

Third Avenue approach to Granville Street bridge, G. Webster, $3,993; T. R. Nickson, $4,500; W. D. Grant, $3,285.

Salsbury drive slip, Peterson & Parr, $3,790.03.

Victoria. B.C.—The Puget Sound Navigation Company have given a contract for a steel steamship to the Moran Co., at $125,000.

RAILWAYS—STEAM AND ELECTRIC.

Toronto, Ont.—The Canadian Northern Railway Company has secured control of more than two hundred miles of standard-gauge railway, which are expected to be excellent feeders for the line now in course of construction from Toronto to Montreal and Ottawa.

These roads are located in the eastern end of this province, and have been known respectively as the Irondale, Bancroft & Ottawa Railway, Marmora Railway & Mining Company, Central Ontario Railway, and the Brockville, Westport & Northwestern Railway Company. The Central Ontario Railway will give the C.N.R. connection with Trenton to Picton on the south, and north as far as Maynooth, while construction is underway to join the northerly line of the Grand Trunk at Whitby. The Brockville & Westport will give the company access to Brockville and the St. Lawrence traffic. The other roads are of small mileage, although construction work is already in progress on the Irondale & Bancroft to establish a through connection from the old Victoria branch of the Grand Trunk eastward to the Central Ontario, where a junction will be effected at Bird Creek. These small railways will come into the Canadian Northern System by way of absorption into the Ottawa & Ontario Railway, a Mackenzie-Mann line for which a charter was secured in Ottawa in March of this year. Building powers were given this road from a point at or near the authorized line of the Canadian Northern at Lake Couchiching, generally eastward to Hull and Ottawa.

The only construction work so far attempted on the Ontario & Ottawa line has been as an extension of the old Irondale and Bancroft.

Application is now being made to the Board of Railway Commissioners for Canada for the sanction of this agreement with the other little roads, the purchase having been already accomplished. It is understood the C.N.R. intends the placing of standard equipment on these roads at once, bringing them up to the standard of the other sections of the system. A meeting of directors of the Brockville-Westport Company was held in Brockville recently, and Mr. D. B. Hanna, 3rd vice-president of the C.N.R., elected general manager. Other appointments will follow shortly.

Welland, Ont.—Construction work has been commenced on a street railway here.

Welland, Ont.—The M.C.R. have begun the construction of their new bridge crossing the Welland canal. It will leave 150 feet clear channel being built of steel. The length is 350 feet, cost $300,000, and it will be operated by electricity. The piers on which the bridge is swung will be 55 feet deep, which will allow the canal to be deepened to 35 feet.

Brandon, Man.—The plans for the C.N.R. hotel and depot have been completed and tenders for the execution of the work will be invited next week. The estimated cost of the hotel and depot and yard improvements is something like $450,000. The design of the hotel is imposing and the equipment throughout thoroughly modern. The hotel will be seven storeys high with basement, and will be of brick and stone in classic style.

Moose Jaw, Sask.—John McRae, consulting engineer of Ottawa, and Hector A. Dion, assistant engineer, left on Thursday evening for Moose Jaw, where they will supervise the construction of the new electric street railway now being built. It is understood that the franchise for the new road was secured by a number of Ottawa men headed by A. A. Dion, of the Ottawa Electric Company and Newton J. Ker, city engineer, and that it extends for twenty years.

LIGHT, HEAT AND POWER.

Brandon, Man.—A. E. Bullock has secured the contract for laying the mains of the central heating plant which will be established here to supply the entire business portion of the city with steam heating. The trenches will be deep, and, in some cases, the mains will be 36 inches in diameter. Brandon will be the first Canadian municipality to adopt this plan of heating.

Edmonton, Alta.—An agreement has practically been reached, whereby the Edmonton Heat and Power Company, Limited, will supply this city with 10,000 h.p. of electricity at $20 per h.p. per annum. The plans for the new hydro-electric plant at Rocky Rapids, 125 miles up the Saskatchewan, are now all ready and work will be started at once. The direct transmission lines for the power will be about 60 miles long. The drop of water which has been secured at a bend in the river where there are falls, will be about 35 feet and will give a 90,000 second foot flow of water. The capacity of the plant will be about 36,000 horse power.

BY-LAWS AND FINANCE.

The municipality of South Vancouver has sold debentures amounting to $400,000, and the city of Regina an issue of $586,500.

Chicoutimi, Que.—The ratepayers rejected the by-law to authorize council to negotiate a loan of $70,000 for the purpose of making a payment to the Saguenay Hydraulic Co. upon a portion of its property desired for a municipal electric lighting system.

Ottawa, Ont.—The Carleton County council decided to issue $20,000 debentures for roads construction.

Owen Sound, Ont.—The ratepayers will vote some time in August on the proposal to aid to the extent of $50,000 bonus and $50,000 investment in stock the million-dollar drydock, shipbuilding and repair plant which English engineers want to establish here.

Sarnia, Ont.—The county council have passed a number of money by-laws which include a grant of $2,300 to assist the township of Sarnia to build a bridge over Cull Drain.

Seaforth, Ont.—On August 8th the following by-laws will go to the ratepayers for approval: (1) to authorize an agreement with the Hydro-electric Commission for a supply of 400 h.p. of electricity; (2) to raise $25,000 for the installation of an electrical distribution system; (3) to grant a $50,000 bonus to the Bell Engine & Threshing Company for extensions.

Welland, Ont.—Another by-law for waterworks extensions will probably be submitted at an early date.

Brandon, Man.—Ratepayers passed the fire hall by-law, but defeated the city hall by-law.

Humboldt, Sask.—The $2,000 street improvements by-law was carried; the $25,000 town hall and fire hall by-law was defeated.

Outlook, Sask.—Ratepayers passed a $25,000 by-law for the construction of a waterworks system.

Moose Jaw, Sask.—The following money by-laws were passed by the ratepayers: $375,000 for sewer and waterworks extensions; $20,000 for road improvements; $12,000 for concrete sidewalks, and $5,000 for plank sidewalks.

Lethbridge, Alta.—Ratepayers have sanctioned seven money by-laws aggregating $316,000, as follows: $148,000, for waterworks and sewers; $35,000, for streets; $50,000, for overhead bridges; $12,000 for steam shovels and other equipment, etc.

Medicine Hat, Alta.—The following by-laws will be submitted on August 15th: Waterworks extensions, $45,000; hospital grant, $10,000; power plant installation, $15,000.

New Westminster, B.C.—The ratepayers will vote on money by-laws amounting to $324,500, for fire hall, roads, cement sidewalks and schools.

SEWERS, SEWAGE AND WATERWORKS.

Peterboro', Ont.—Chipman & Power, consulting engineers of Toronto, have been retained by this city to prepare plans for sewerage in the south end. It is expected that that city will be in a position by August 15th to call for tenders to include sewer construction, pumping station, machinery, etc.

Toronto, Ont.—The Provincial Board of Health approved of plans for sewerage disposal at Alma, Oshawa, Tillsonburg and Trenton. The scheme outlined for a suburb of Owen Sound, formerly known as the village of Brook, was rejected because the plans did not provide for treatment of the sewage before dumping it into the bay. The plans submitted by the municipality of Steelton were not passed for the same reason. The city of Peterboro' complained that residents of Stoney Lake summer resorts were polluting their water supply.

Outlook, Sask.—The $25,000 by-law for the construction of waterworks was carried by the ratepayers.

Prince Albert, Sask.—At a recent meeting of the city council, City Engineer Creighton submitted plans for a trunk sewer estimated to cost $94,994. The plans will be forwarded to the Provincial Health Department for approval, and the work of construction will be proceeded with immediately.

Swift Current, Sask.—By-laws for sewerage, sewage disposal and water supply were passed by public vote on Saturday, 16th inst. Only two votes were registered against. J. Darlington Whitmore of Regina is consulting engineer for the schemes.

Vancouver, B.C.—City Engineer W. A. Clement has completed his report on the new sewerage scheme question, and the plans outlined have been partially adopted by the board of works.

Victoria, B.C.—H. M. Burwell, consulting engineer of Vancouver, has submitted his report on the Sooke Lake water supply proposition, which is being considered by the city council.

PERSONAL.

Mr. George Wright has been appointed city engineer of London, Ontario, succeeding Mr. A. O. Graydon, who recently resigned after occupying the office for twenty years. The city council decided to retain Mr. Graydon as consulting engineer.

Mr. F. J. Coulthard has been appointed purchasing agent for the Northern Construction Company, which has the contract for the first sixty miles of the C.N.R. in British Columbia.

Mr. T. D. McKenzie, M.A., C.E., of River John, N.S., has been appointed manager of the North Atlantic Collieries Company. Mr. McKenzie has been assistant manager at Wabana for the N. S. & Coal Company for the past four years, previous to which he was in the employ of the Dominion Coal Company at Glace Bay. Mr. McKenzie is a graduate of Dalhousie University.

MISCELLANEOUS.

Montreal, Que.—Plans of the Dominion Express Company's proposed building to cost $600,000 have been approved.

London, Ont.—The International Harvester Co. of America are planning a $75,000 addition to their buildings here.

Regina, Sask.—The library board has decided to call for plans for the new Carnegie library building, which is to be of fire-proof construction and to cost $40,000.

Regina, Sask.—The Sawyer-Massey Company have decided to establish their Saskatchewan headquarters in Regina.

Vancouver, B.C.—The Vancouver Trust Company contemplate the erection of a $30,000 office building.

CURRENT NEWS.

Ottawa, Ont.—The American Peat Society, of Ottawa, will hold a series of meetings from July 25th to July 27th at Ottawa.

Victoria, B.C.—City Engineer Angus Smith has just presented to the streets committee of the city council, an interesting report on dust prevention.

ROCK DRILLING IN CANADA.

On July 1st, a rock-drilling contest, held in Gowganda, was won by McQuilty and McCambly, who drilled 19½ inches in fifteen minutes, in a very hard quartz rock.

In this connection, a contest held last August at Cobalt, when the Canadian record was established, is of interest. The rock in which the drilling was done was a granite much similar to the Gunnison County granite. The winners were James Picken and Louis Page—known as the Page Bros., of Butte, Mont. They have been living at the Temiskaming mine for some time. In fifteen minutes they drilled 43⅜ inches. Malcolm McPhail and Hector McDonald of the Gifford came next with 30⅝ inches. The Nipissing team, two Finlanders, came third with 28½ inches.

Other teams were from the Verner mine, 26⅜ inches, City of Cobalt, 24⅝ inches, Hudson's Bay, 25⅞ inches, McGuire and McMillan, 25⅝ inches, and the Otisse-Currie, 23⅜ inches.

RAILWAY EARNINGS; STOCK QUOTATIONS.

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

Road	Wk. Ended	1910	Previous Week	1909
C. P. R.	July 14	$1,928,000	$2,022,000	$1,621,000
G. T. R.	July 14	921,043	879,362	789,746
C. N. R.	July 14	291,900	294,800	191,300
T. & N. D.	July 14	22,763	23,143	30,190
Mtal. St	July 16	86,478	73,804	75,666
Halfx. Elec.	July 14	5,092	4,882	4,380

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

Road	Mileage	July 1st to	1910	1909
C. P. R.	10.326	July 14	$3,950,000	$3,232,000
G. T. R.	3.536	July 14	1,800,405	1,558,155
C. N. R.	3.180	July 14	586,700	370,500
T. & N. D.	264.74	July 14	45,906	59,262
Mtal. St.	141.79	July 16	160,282	139,196
Halfx. Elec	13.3	July 14	9,974	8,647

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

Co.	Capital. 000's Omitted.	Price July 14, 1909.	Price July 7, 1910.	Price July 14, 1910.	Sales last week.
C. P. R.	$150,000	186-184½	187¾-187½	189-	458
Mtl. St.	18,000	216-215¾	236-235	233-232½	350
Hal. El.	1,400	115-113½	122-9	121½-	2
Tor. St.	8,000	-125	-114½-7	....	189
G. T. R.	226,000	1st pfd. 109; 3rd pfd. 57⅝; com, 26⅞			

MARKET CONDITIONS.

Montreal, July 20th.

A review of the pig-iron and steel markets of the United States shows that conditions over there are, on the whole, fairly encouraging. The production of pig-iron in 1909 was close to sixty million tons. Of this the United States produced close to twenty-six million tons, or about 42.9 per cent. of the world's output, compared with 33.2 per cent. in 1908 and 42.7 per cent. in 1907. During the early part of the present year the United States was producing pig-iron at the rate of more than thirty-one million tons a year. This is equal to about one-half the entire output of the world during 1909.

Attention is drawn to the fact that the United States is turning out as much pig-iron as Germany, Great Britain, and France combined, whereas not very many years ago the United States was turning out less than Great Britain. Assuming that the world's output of pig-iron for the remainder of the present year will be at the rate of the first half of the year, the total output will be in the vicinity of sixty-two million tons. This compares with a record of slightly over sixty millions in 1907, and about sixty millions in 1909.

Attention is being drawn in the United States to the difference between the conduct of the steel and copper industries during the past few years. The steel industry has been enjoying prosperity while the copper industry has been going backward, so far as profits and prices are concerned. This is considered to be due to the fact that the steel producing concerns have been working in harmony to keep the industry on a solid foundation, as instanced in the fact that although the consumption of steel has fallen off about 20 per cent. during the past three or four months, there has been no demoralization. In the copper industry the opposite conditions prevail, the operations of the various producers showing an absence of harmony.

It is considered that orders for steel will begin to show a gain about the middle of August, providing conditions are favorable. In the United States, there would not seem to be any very grave danger, so far as crop prospects are concerned, although some of the crops are not any too satisfactory.

Prices of pig-iron and steel are holding about the same as previously and there is no likelihood of any advance in the immediate future.

Advices from Great Britain are exceedingly uninteresting. Nothing new of importance has developed within the past week, and production and consumption are going on at about the same rate as previously. Prices show but slight fluctuations, and the situation is generally easy.

A report of the Lake Superior Corporation indicates prosperity in this concern. The directors state that the company has orders on its books sufficient to keep it employed for several months to come, the C.P.R. being a particularly liberal purchaser. Reports of the Dominion Iron & Steel Company are to the effect that the output of the concern, in all its branches, is to be greatly increased. During the past week also an improvement has taken place in the conditions surrounding the Nova Scotia Steel & Coal Company, the fight which has been in progress for some time between leading interests having been settled. The president has purchased from an antagonistic interest twenty thousand shares of the stock, this being the best evidence of his confidence in the immediate future of the concern.

Trade in pig-iron and steel, and the various finished and unfinished products, has been steady during the week, and no change of price is noticed.

The market holds steady at recent prices:—

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

Bar Iron and Steel.—The market holds dull and steady. Bar iron, $1.90 per 100 pounds; best refined horseshoe, $2.15; forged iron, $2.05; mild steel, $1.90; sleigh shoe steel, $1.90 for 1 x ⅜-base; tire steel, $2.00 for 1 x ⅜-base; toe calk steel, $2.40; machine steel, iron finish, $1.95; imported, $2.20.

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

Cement.—Canadian cement is quotable, as follows, in car lots, f.o.b., Montreal:—$1.30 to $1.40 per 350-lb. bbl., in 4 cotton bags, adding 10c. for each bag. Good bags re-purchased at 10c. each. Paper bags cost 2½ cents extra, or 10c. per bbl. weight.

Chain.—The market is unchanged, being now per 100 lbs., as follows:—¼-in., $5.30; 5-16-in., $4.70; ⅜-in., $3.90; 7-16-in., $3.65; ½-in., $3.55; 9-16-in., $3.45; ⅝-in., $3.40; ¾-in., $3.35; ⅞-in., $3.35; 1-in., $3.35.

Coal and Coke.—Anthracite, egg, stove or chestnut coal, $6.75 per ton, net; furnace coal, $6.50, net. Bituminous or soft coal: Run of mine, Nova Scotia coal, carload lots, basis, Montreal, $3.85 to $4 per ton; cannel coal, $9 per ton; coke, single ton, $5; large lots, special rates, approximately $4 f.o.b., cars, Montreal

Copper.—Prices are strong at 13¾ to 14c.

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

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

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

Iron.—The market is steady and prices unchanged. Following are the prices, on cars, ex-wharf, Montreal:—No. 1 Summerlee, $20.50 to $20.75 per ton; selected Summerlee, $20 to $20.25; soft Summerlee, $19.50 to $19.75; Carron, special, $20 to $20.50; soft, $19.50 to $20; Clarence, $17.25 to $17.50; Cleveland, $17.25 to $17.50 per ton.

Laths.—See Lumber, etc.

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

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

Lumber, Etc.—Prices on lumber are for car lots, to contractors, at mill points, carrying a freight of $1.50. Red pine, mill culls out, $18 to $22 per 1,000 feet; white pine, mill culls, $16 to $17. Spruce, 1-in. by 4-in. and up, $15 to $17 per 1,000 ft.; mill culls, $12 to $14. Hemlock, log run, culls out, $13 to $15. Railway Ties; Standard Railway Ties, hemlock or cedar, 35 to 45c. each, on a 5c. rate to Montreal. Telegraph Poles: Seven-inch top, cedar poles, 25-ft. poles, $1.35 to $1.50 each; 30-ft., $1.75 to $2; 35-ft., $2.75 to $3.25 each, at manufacturers' points, with 5c. freight rate to Montreal. Laths: Quotations per 1,000 laths, at points carring $1.50 freight rate to Montreal, $2 to $3. Shingles: Cedar shingles, same conditions as laths, X. $1.50; XX, 2.50; XXX, $3.

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

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

Pipe, Cast Iron.—The market shows a steady tone although demand is on the dull side. Prices are firm, and approximately as follows:—$32 for 6 and 8-inch pipe and larger; $33 for 3-inch and 4-inch at the foundry. Pipe, specials, $3 per 100 pounds. Gas pipe is quoted at about $1 more than the above.

Pipe.—Wrought and Galvanized.—Demand is about the same, and the tone is firm, though prices are steady, moderate-sized lots being: ¼-inch, $5.50, with 63 per cent. off for black, and 48 per cent. off for galvanized; ⅜-inch, $5.50, with 59 per cent. off for black, and 44 per cent. off for galvanized; ½-inch, $8.50, with 69 per cent. off for black, and 59 per cent. off for galvanized. The discount on the following is 71½ per cent. off for black, and 61½ per cent. off for galvanized; ¾-inch, $11.50; 1-inch, $16.50; 1¼-inch, $22.50; 1½-inch, $27; 2-inch, $36; 2½-inch, $57.50; 3-inch, $75.05; 3½-inch, $95; 4-inch, $108.

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

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

Railway Ties.—See lumber, etc.

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

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

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

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

Telegraph Poles.—See lumber, etc.

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

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

Zinc.—The tone is easy, at 5¾ to 6c.

CAMP SUPPLIES.

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

Butter.—Fresh made creamery, 23 to 23½c.

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

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

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

Dried Fruits.—Currants, Filiatras, 5¾ to 6¼c.; choice, 8 to 9c.; dates, 4 to 5c.; raisins, Valentias, 5 to 6¾c.; California, seeded, 7½ to 9c.; Evaporated apples, prime, 8 to 8½c.

Eggs.—No. 1 eggs are 20 to 21c.; selects, 22 to 25c.

Flour.—Manitoba, 1st patents, $5.90 per barrel; 2nd patents, $5.40; strong bakers', $5.20.

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

Potatoes.—Per 90 lbs., good quality, 60 to 70c.

Rice and Tapioca.—Rice, grade B., in 100-lb. bags, $2.75 to $2.80; C.C., $2.65. Tapioca, medium pearl, 5¾ to 6c.

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

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

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

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

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

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Toronto, July 21st, 1910.

The Grand Trunk Railway strike has already begun to affect business. Many trades are feeling its inconvenience in being unable to move product either in our out. There is an active demand for lumber, of various sorts, while structural steel is temporarily quiet; steel sheets active. The ingot metals are quiet, as is usual at this time of year.

In camp supplies, smoked meats show an upward tendency, while butter and new cheese are higher. Dried fruits tend upward, raisins are distinctly higher. Vegetables are not easy to obtain, they are affected by the train-hands' strike on the Grand Trunk.

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

Antimony.—Trade is quiet, price unchanged at $8.50.

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

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

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

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

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

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

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

Broken Stone.—Lime stone, good hard, for roadways or concrete, f.o.b., Schaw station, C.P.R., 75c. until further notice, per ton of 2,000 lbs., 1-inch, 2-inch, or larger, price all the same. Rubble stone, 55c. per ton, Schaw station, and a good deal moving. Broken granite is selling at $3 per ton for good Oshawa.

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

Coal.—The price of anthracite still remains at $6.50 per ton, net, and pea coal at $5.50 per ton. In the United States there is an open market for bituminous coal and a great number of qualities exist. We quote: Youghiogheny lump coal on cars here, $3.75 to $3.80; mine run, $3.65 to $3.70; slack, $2.75 to $2.85; lump coal from other districts, $3.55 to $3.70; mine run 10c. less; slack, $2.60 to $2.70; cannel coal plentiful at $7.50 per ton; cook, Solvey foundry, which is largely used here, quotes at from $5.75 to $6.00; Reynoldsville, $4.90 to $5.10; Connellsville, 72-hour coke, $5.25.

Copper Ingot.—A very large volume of business is being done, but the market is weaker at $15.25 to $13.50. Production goes on at a rapid rate.

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

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

Felt Roofing.—A very good volume of trade is going on at $1.80 per 100 lbs. as before.

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

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

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

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

Pig Iron.—We quote Clarence at $20.50, for No. 3; Cleveland, $20.50; Summerlee, $22; Hamilton quotes a little irregular, between $10 and $20. The market unchanged and quiet.

Lead.—A very fair demand exists, at an unchanged price of $3.75 to $3.85. A better feeling exists, however.

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

Lumber.—An unusually brisk demand has characterized the month, and prices are fully maintained. Pine is good value at $32 to $40 per M. for dressing, according to width required: common stock boards, $28 to $33; cull stocks, $20; cull sidings, $17.50. Southern pine dimension timber from $30 to $45, according to size and grade; finished Southern pine, according to thickness and width, $30 to $40; hemlock is in demand and held quite firmly, we quote $17.50 to $18; spruce flooring in car lots, $22 to $24; shingles, British Columbia, are steady, we quote $3.10; lath, No. 1, $4.60; white pine, 48-inch, No. 2, $3.75; for 32-inch, $1.85 is asked.

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

Pitch and Tar.—Pitch, unchanged at 70c. per 100 lbs. Coal tar, $3.50 per barrel. Demand moderate.

Plaster of Paris.—Calcined, New Brunswick, hammer brand, car lots, $1.95; retail, $2.15 per barrel of 300 lbs.

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

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

Roofing Slate.—Most of the slate used in Canada comes now from Pennsylvania or Maine, the Canadian supply being slender and mostly from the Rockland quarries of the Eastern Townships in Quebec. There is a great variety of sizes and qualities, so that it is difficult to indicate prices But No. 1 Bangor slate 10 x 16 may be quoted at $7 per square of 100 square feet, f.o.b., cars, Toronto; seconds, 50c. less. Mottled, $7.25; green, $7, with a prospect of advance. Dealers are fairly busy.

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

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

Sewer Pipe.—

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

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

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

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

Sheets Galvanized.—Apollo Brand.—Sheets 6 or 8 feet long, 30 or 36 inches wide; 10-gauge, $3.00; 12-14-gauge, $3.00; 16, 18, 20, $3.20; 22-24, $3.35; 26, $3.50; 28, $3.95; 29, $4.25; 10¾, $4.25 per 100 lbs. Fleur de Lis—28-gauge, $4.10; 26, $3.80 per 100 lbs.

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

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

Tin.—Market irregular, with considerable business passing. We quote 34½ to 35c.

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

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

CAMP SUPPLIES.

Butter.—Dairy prints, 19 to 21c.; creamery prints, 23 to 24c.; the creamery output is now increasing.

Canned Goods.—Peas, $1.15 to $1.75; tomatoes, 3s, 85c. to 95c.; pumpkins, 3s, 90 to 95c.; corn, 80 to 85c.; peaches, 2s, white, $1.50 to $1.60; yellow, $1.90 to $1.95; strawberries, 2s, heavy syrup, $1.50 to $1.85; raspberries, 2s, $1.50 to $1.95

Cheese.—Moderately firm; old cheese, large, 13c.; twins, 13¾c.; new, 11¾ to 12c.

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

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

Flour.—Again higher; quotations at Toronto are: Manitoba flour, first patents, $6.20; second patents, $5.70; strong bakers', $5.40; Ontario flour, winter wheat patents, $4.40 to $4.50 per barrel.

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

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

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

Rice.—B grade, 3¼c. per lb.; Patna, 5 to 5½c.; Japan, 5 to 6c.

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

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

Spices.—Allspice, 18 to 19c.; nutmegs, 30 to 75c.; cream tartar, 22 to 25c.; compound, 15 to 20c.; pepper, black, pure Singapore, 14 to 17c.; pepper, white, 20 to 30c.

Sugar.—Granulated, $5.30 per 100 lbs., in barrels; Acadia, $5.20; yellow, $4.00; bags, 5c. lower.

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

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

Vegetables.—Little or nothing doing, the Grand Trunk Railway strike demoralizes the market. The following are nominal quotations:—Potatoes—Ontario, dull and weak; new, per barrel, $2.50 to $2.60; New Brunswick Delawares, 65 to 75c. per bag; onions by the sack, Egyptian, $2.50 to $2.75; cabbage, per crate, $1 to $1.50.

AMERICAN HORSE MARKET.

A quiet trade is expected in the Chicago horse market all summer. Demand is not active and holders show little disposition to sell.

Desirable drafters, 1,700 lbs. and up, are $250 to $400; chunks, 1,350 to 1,500 lbs., are $175 to $230, and farm workers, $125 to $175.

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Winnipeg, July 19th, 1910.

The demand for all building material keeps steady. There is a strong market for all kinds of sewer pipe on account of a good many western towns installing sewerage systems. The same applies to all lines of cast-iron pipe for water-works—installations of which there is considerable amount being done. Cement and brick are also active, and prices at present are holding firm. Lumber is moving fairly well, dimension stuff especially, and high prices are maintained. Considerable anxiety is felt throughout the West at the partial, and in some cases total, crop failures in different parts of the country, more particularly in the southern portions of the three prairie provinces. In the central and northern sections, however, crops will be good, and the West will produce as much, if not more, wheat than last year. Rain is badly needed. The crops of the West materially affect the business conditions of Canada, and if rain comes, even at this late date, a bumper crop will be reaped. Winnipeg prices are unchanged and quotations are as follows:—

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

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

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

Bar Iron.—$2.50 to $2.60.

Bars.—Crow $4 per 100 pounds

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

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

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

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

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

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

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

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

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

Dynamite.—$11 to $13 per case.

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

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

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

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

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

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

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

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

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

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

Plaster.—Per barrel, $3.

Roofing Paper.—60 to 67½c. per roll.

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

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

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

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

Staples.—Fence, $3.40 per 190 lbs.

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

Tool Steel.—8½ to 15c. per pound.