CANADIAN ELECTRICAL NEWS AND STEAM ENGINEERING JOURNAL

OLD SERIES, VOL. XV.—No. 6.
NEW SERIES, VOL. V.—No. 7.

JULY, 1895

PRICE 10 CENTS
$1.00 PER YEAR.

CANADIAN

ELECTRICAL NEWS

AND

STEAM ENGINEERING JOURNAL.

VOL. V. JULY, 1895 No. 7.

IMPROVED WATER WHEEL.

THE accompanying illustrations show a water wheel of improved pattern which is being manufactured by Mr. Robert Graham, of Ottawa. The manufacturer lays great stress on the fact that this wheel is one solid casting, and that the buckets are so shaped that 84 per cent. of power can and is guaranteed, being, it is claimed, the highest efficiency yet reached. The wheel being solid, the annoyance and expense of buckets getting loose and falling out is avoided. The gate is as easily worked as a steam valve; one-half turn of hand wheel turns the water full on or off, so that any ordinary governor will secure a perfectly steady power, no matter how fluctuating the machinery driven may be.

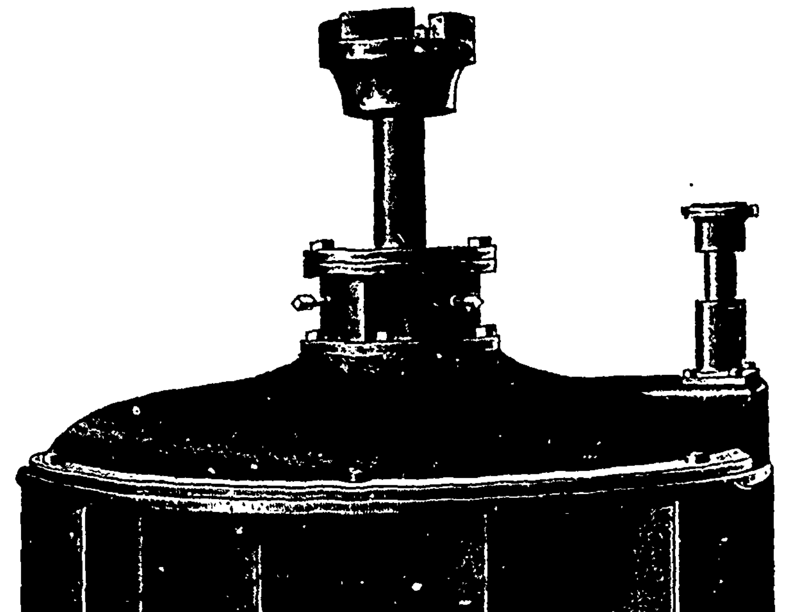
The manufacturer claims for this wheel superiority in the following points:

(1) The ease with which the gate of largest size wheel can be closed under any head of water, as the pressure of water does not in the least affect the working of the gate.

(2) The mode of applying and shutting off the water is so scientific that one half turn of the hand wheel does the whole work, making it just as easy to start, stop and govern as any steam engine.

(3) The construction is such as to almost entirely overcome delay and breakage of machinery by sticks getting into the wheel.

(4) The absence of complicated attachments. Five pieces include the whole of wheel case, either with cylinder or register gate.



IMPROVED WATER WHEEL, IN CASE, MANUFACTURED BY ROBT. GRAHAM, OTTAWA.

The wheel and case, as well as the mode of producing the same, are covered by patents.

Further information may be obtained by addressing the manufacturer.

ELECTRIC LINES AND RAILROADS.

THOSE who keep track of the companies formed, or projected, as they appear in the official gazettes, says the Financial Chronicle, of Montreal, must have been struck by the number of enterprizes organized, or proposed, for providing the towns westward of this city, with communication by an electric car service. If this continues much longer, we shall be able to reach the western boundary of Ontario without travelling by either of the existing railways, as we could go on from one point to another by the local electric cars. Although this class of service has advantages, and pleasures, we are inclined to think it is in danger of being overdone. It will entail drawbacks, which may develop into more serious proportions than the promoters of these lines seem to forsee. They are reckoning upon the diversion of the great bulk of the passenger traffic between the two towns they are severally proposing to connect by an electric service, away from the railway which is now available. Were this done, the railway so injured would certainly make reprisals, they would cut off a number of trains from stopping at such points and reduce freight handling facilities where local competition for passengers had reduced their earnings; almost certainly also, they would enhance freight rates to and from such points. Considering how all the towns from here to the Detroit River have been built up or developed by railway connections, and how necessary they are for business facilities, it seems somewhat ungrateful, as it must be also unwise, to antagonize the railway which has done such invaluable service to the country. One such enterprise that was devised to cut off local traffic from a railway has collapsed, and the people who encourage it, have been made to pay for their wat on the railway, by increased fares and shortened accommodation. We do not think the municipal authorities who assist such new lines are well advised, unless the points proposed to be connected are not served by a railway. The mere running to and fro of the people of two towns is of very trifling benefit; it is a pleasant luxury, not a business necessity or a help to trade. Investors who are tempted to put money into these companies, would do well to think twice before risking it in an enterprise that may prove to have been based more on fancy than certainty. One thing is dead certain, in the case of two towns of unequal size being so jointed, the weaker one will go to the wall, as "shopping" is sure to be drawn to the larger place.

CURRENTS OF ELECTRICITY.

WHEN a difference of potential exists in two places connected by a conductor, or a series of conducting bodies, the electricity will seek to equalize the field and a current will flow between the two points. The difference of potential may be due to several causes, but whatever the cause the current will flow. The two places may be a few inches apart, as in a wire from a primary battery, or miles apart, as in a transmission system, or in the currents of the earth or air. They may be connected by a small copper wire, the pipes of the waterworks or gas company, the rails of a street railway, or by a combination of a large number of conducting bodies. This conductor may be of large capacity, of low resistance, or may be a poor conducting medium.

To designate the character of a current, and also a current with reference to its origin, various terms are used. Battery current, dynamo current, earth current, etc., are terms used to designate the current from a battery, a dynamo, currents flowing through the earth on account of a difference of potential at different points, etc. In the production of electricity for lighting and power, two kinds of current are generated, distinguished by the direction in which they flow. The continuous or direct current, which flows continuously in one direction, and the alternating or reversed current, which alternates the direction of its flow, are the currents used, and these two kinds include a number of classes. Both currents are further designated by the voltage; thus we have a 500 volt direct current, 110 volt alternating current, or any other volt direct or alternating current.

The alternating current may alternate the direction in which it flows ten thousand times a second, or twenty-five times a second; this is called the frequency of its alternations. The alternating currents are also distinguished by the number of phases in a given period. When alternating currents are generated by transmission considerable distances, so that a current of higher voltage is used on the transmission lines than can be used for lighting and other purposes, the transformer is used for securing a current of higher or lower voltage. The current flowing in the primary wire of the transformer is called the primary current, and that in the secondary wire the secondary current.

A constant current is an unvarying current. Although the voltage may vary, the amount of current does not change. In series arc lighting systems the current is universally constant. A constant potential current is a current whose voltage is constant, as found in the multiple incandescent lighting system.

One of the great discoveries made by Faraday was that of induction or induced currents. While experimenting with electricity and magnetism he found that if he took a wire, joined the ends and moved it rapidly in front of a magnet, a current would be induced in the wire. This action of the magnet is called electro-magnetic induction. The current is called the induction or induced current and it is upon the principle discovered by Faraday that all dynamo electric machinery is based. If we take a coil of wire and a bar magnet and pass the magnet rapidly through the coil, a current will be induced in the coil, or if we move the magnet into the coil and then withdraw it we will have a current flowing first in one direction, and as we withdraw it, in the other. The more rapid the motion the stronger the current.

This discovery was soon followed by another of equal importance—that a current of electricity whose strength is changing in one conductor could induce a current in another conductor forming a closed circuit, and that a current brought near a conductor and then removed would induce a current in the second conductor. Suppose we have two coils of wire, the terminals of one connected to the terminals of a primary battery and the terminals of the second connected to a galvanometer. If these coils are placed near together with a battery current flowing through the first there will be no current detected in the second. If, however, we place a switch in the circuit of the first and open and close it rapidly, the galvanometer will show a current in the second coil. If we close the switch and make the coil approach and recede from the second coil, the second coil will have an induced current. Upon this principle are based the alternating current transformer and similar devices.—Electrical Industries.

IMPROVED WATER-WHEEL, REMOVED FROM CASE.

TESTING MOISTURE IN STEAM.

A METHOD of testing the amount of moisture in steam has been discussed by the Institution of Engineers and Shipbuilders, Scotland. The principle in this case, more particularly applicable to marine engines, consists in comparing the saltness of the steam with that of the water in the boiler. The test, as explained, is carried out by means of nitrate of silver, and the reaction is so delicate that, with only 1 per cent. of salt in the boiler, 1 per cent. of priming water can be accurately determined to the second decimal. To one part of salt boiler water there is added 100 parts of pure condensed water, and into this is poured a small quantity of concentrated solution of yellow chromate of potash; then a nitrate of silver solution containing about 1.10 per cent. of this salt is slowly added. With each drop the salt water turns locally orange red, but this color disappears at first; later on, when all the salt has been acted on, the whole fluid changes color from pale yellow to orange. The quantity of nitrate solution is noted, and then the experiment is repeated on the condensed steam from the engine, undiluted with distilled water. The ratio of the quantities of nitrate of silver solution used in the two tests expresses the amount in per cent.

MR. Theophile Viau, the chief promoter of the electric railway scheme between Hull and Aylmer, states that the construction of the road will certainly be commenced this summer, probably within the next month.

UTILIZATION OF NIAGARA FALLS POWER ON THE CANADIAN SIDE.

We reproduce herewith from a recent issue of the New York Electrical Engineer, a diagram showing the method to be adopted for the utilization of the power of the Niagara Falls on the Canadian side of the river. This plan is said to have been approved by the Ontario Government. The work will be carried on by a company which is in close affiliation with the Niagara Falls Power Co., on the American side.

By reference to the plan, it will be seen that it is proposed to erect two power houses, each having a capacity of 125,000 horse power, and fed by a separate canal. The water discharged by the turbines will be carried through tunnels 300 to 800 feet in length respectively to the outlet

The construction of the works on the Canadian side of the river will be very much less expensive than those on the American side, where an enormous amount of money has been expended.

WHY LIGHTNING ARRESTERS SOMETIMES FAIL.

The failure of lightning arresters is too often due to careless installation. It may be instructive, says Alexander J. Wurtz in an article in Practical Science, to note several examples:

(1.) One plant is reported as having, for better protection, connected two arresters in series. This was probably done with the idea that if a little was good more would be better.

(2.) A large bank of station arresters was grounded to an iron bolt, about two feet long, driven into dry sand.

(3.) Line arresters were grounded by pushing the ground wires into the earth.

(4.) Line arresters were grounded on iron poles, which were themselves set in Portland cement.

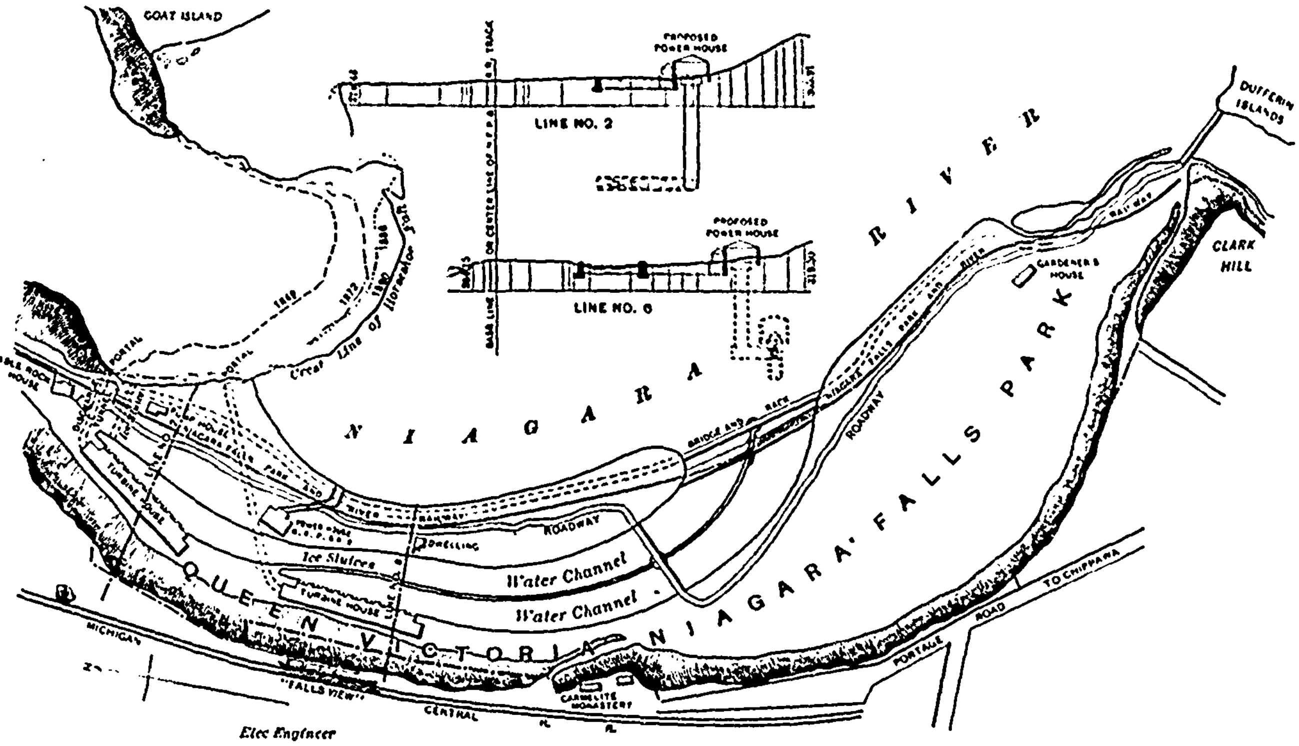
(5.) An annual inspection of automatic lightning arresters developed the fact that the arresters were nearly all burned out—in other words that the line was left unprotected.

(6.) The ground plate of a bank of arresters was thrown into a neighboring stream, which subsequently changed its course, leaving the ground plate high and dry.

(7.) The ground plate of a bank of station arresters was laid on the rock bottom of a neighboring stream.

(8.) In a large number of cases a portion of the ground wire is wound into a fancy coil (choke coil).

And so on, the list might be indefinitely extended, each such case forming a source of complaint that the arresters "fail to protect." But, when these curious mistakes are located and properly remedied, the complaints cease.



Plan Adopted for Two Power Houses and Two Canals.

THE TORONTO RAILWAY COMPANY'S ELECTRICIAN.

Editor Electrical News.

Sir, – In your last issue you make some remarks on the care of apparatus at the power house of the Toronto Street Railway Co., which in my opinion are somewhat unfair to the men in charge of the machinery. I do not think you would do any man an intentional injustice, and therefore ask you to look more closely into the matter, and if you find that injustice has been done, to make amends in as public a manner as the original reflection was made.

You state by inference that since Mr. Davis was removed, that there has been no expert electrician in charge of the company's business. This may be so, depending of course on your idea of what an "expert electrician" is. I understand that the same man is in charge of the dynamos who has been in charge since the establishment of the railway plant, and if Mr. Davis had been nominally in charge, as he was previously, it would not have prevented some fool "electrician" putting a knife into the dynamo.

As the dynamo in question was still in the hands of the contractors, and it was one of their own men who did the damage, it looks a little as though the contractors wanted to unload the failure of their machine upon innocent shoulders (a most common occurrence with some manufacturers, I am sorry to say), and take advantage of the removal of the nominal head to find an excuse for their own shortcomings. I do not know that I should interfere in a matter not immediately concerning myself, but the natural instinct of British fair play which, by the way, should pervade the columns of a Canadian journal, moves me to say a word on behalf of Mr. McCullough, the skilful and painstaking electrician of the Toronto Railway Co., to whose ability is due the satisfactory service that has been given to the street railway patrons of this city.

Yours, &c.,

J. J. Wright.

Toronto, June 12, 1895.

The Street Railway Co. of Brantford, Ont., has been granted permission to lay down 1,200 feet of additional track on Colborne street, provided the company agree to place fenders on all cars.

The Toronto Railway Co have recently placed an order with the Canadian General Electric Co. for twenty motors of their new C. G. E 1,200 type. These motors, as their name indicates, have a draw bar pull of 50 ' in excess of the G. E. 800 motor, and are intended for high speed and heavy service. They are to be in operation in time for the Industrial Exhibition, and will no doubt prove of considerable assistance in handling the large crowd which have to be provided for on that occasion

SOME THOUGHTS UPON THE ECONOMICAL PRODUCTION OF STEAM WITH SPECIAL REFERENCE TO THE USE OF CHEAP FUEL.

The following is an abstract of a lengthy paper on the above subject, by the late Eckley B. Cox, ex-President of the American Society of Mechanical Engineers, and reprinted from Power.

Mr. Eckley B. Cox, the author, is a prominent Pennsylvania coal miner and merchant, as well as a mechanical engineer, and has given special attention to the utilization of the smaller and cheaper grades of fuel. His paper, which covers nearly eighty printed pages, is a very thorough and original consideration of the use of fuel, but its appreciation involves careful persual and study. The conception derived from the author's abstract presentation unfortunately was not sufficient to draw out the discussion that the paper deserved, but its value is sure to be appreciated on more intimate acquaintance.

When the temperature of the furnace reaches a point sufficiently high to melt the ash or earthy matter contained in the coal, clinker is formed and this clinker will absorb some of the carbon, so that the percentage of "ash" taken from the ash-pit will be frequently much higher than the legitimate ash shown by an analysis of the coal. Our author says. "While too much stress cannot be laid upon the importance of reducing the carbon in the ash to a proper minimum, yet this must not be pushed too far, because a low percentage of ash may be obtained by firing very slowly and gently, thus reducing very greatly the efficiency of the boiler, or by allowing such excess of air to enter the furnace that the loss due to the increase of free oxygen, nitrogen and steam in the stack, may far outweigh the advantages obtained by the low percentage of ash. I have had a number of specimens of ash analyzed, and find that they contain between nine and sixty per cent. of carbon, although it is not impossible to find ash with a greater or less per cent. of carbon than these." The importance of this loss is dependent upon the percentage of ash in the fuel, as well as the percentage of carbon in the ash, and a table is given showing percentage of the fixed carbon of the fuel lost when the carbon in ash produced is from 1 to 75 per cent., and ash in fuel from 9 to 18 per cent., varying from 11 per cent. with the lowest to 71.05 per cent. with the highest of both values. "In many boiler tests sufficient attention is not paid to this subject. The experimenter simply deducts what he takes out of the ash-pit from the fuel fired, calls the difference 'combustible' and uses the figures in calculating the amount of water evaporated per pound of combustible. Now what we want to know really is how much water is evaporated per pound of combustible in the fuel actually put into the furnace. It is of no advantage to obtain a high evaporation per pound of combustible by throwing away a good deal of good fuel with the ashes."

In order to show specifically the effect of the different losses Mr. Cox presents tables, one showing the effect of burning a hundred pounds of anthracite coal of average analysis with exactly the theoretical amount of air, and the other assuming that double the amount of air theoretically required was used, both with variable conditions of stack temperature. In the first case the per cent. of total heat of fuel lost (except that due to radiation, varies from 11.098 with the stack gases at 400 to 19.108 at 800, while with twice the theoretical quantity these values for corresponding temperatures are 17.521 and 32.612. These losses are reduced to money value in other tables, using buckwheat coal costing 50 cents at the mines and $2.50 at the furnace, and pea coal costing $1.50 at the mines and $3 50 at the furnace.

From these tables it can be seen, first, how the economy in using cheap fuel decreases as the distance from the mine increases, in other words how important a factor the cost of transportation is in the choosing of a fuel. Second, how much more important it is, the more valuable fuel you use and the further you are from its point of production, that you pay attention to avoidable causes of loss. Thus when using buckwheat coal, with double the quantity of air, and at a stack temperature of 800 degrees, instead of the theoretical quantity of air, and a stack temperature of 400 degrees, the loss is $0.5379 per ton, while with pea coal the loss is $0.7530. So that if you were burning $10,000 tons of pea coal in a year, you could afford to spend to bring about the better result, a sum of money on which $7,530 would give a fair interest and profit, while if you were burning buckwheat coal, you could only afford to spend an amount from which $5,379 would do so. At the mines, buckwheat coal with double the quantity of air, and at a stack temperature of 800 degrees, instead of the theoretical quantity of air, with stack at 400 degrees, the loss per ton would be $0.1075, while with pea coal the loss would be $0.2825, so that at the mines you could only afford to spend in improving your plant, the sum on which $1,075 and $2,825 would give a fair interest and profit. The same remarks will apply to carbon in the ash, etc.

Thus far we have assumed that the combustion in the furnace was complete, that is to say that all the hydrogen was burned to water, and that all the carbon was burned to carbonic acid gas. This, however, is generally not the case, with the more modern methods of burning coal by forced draft, particularly if a steam jet is used. In the latter case, it is not uncommon to find 6 to 14 per cent. of carbonic oxide and from 2 to 6 per cent. of hydrogen in the stack gases. Of course all the heat units of the hydrogen that go up the stack are lost, and 69.62 per cent. of all the heat units of the carbon which is burned to carbonic oxide are lost. *Carbonic oxide is almost always formed unless the bed of coal* in the furnace is thin. The air on reaching the lower part of the bed of incandescent fuel converts the carbon into carbonic acid, part of which in passing through the incandescent carbon is converted into carbonic oxide, the latter to a greater or less extent burns in the furnace, uniting with the free oxygen in the gases that have traversed the bed of fuel. Carbonic oxide will not unite with the oxygen unless the temperature is pretty high, variously estimated from 1,150 degrees to 1,500 degrees F., so that if the gases are carried to the furnace too rapidly and reach the cooler parts of the boiler before all the carbonic oxide has been burned, it will pass out of the stack unconsumed.

There is a velocity below which there is loss in the efficiency of the boiler, that is, in the amount of water evaporated per square foot of heating surface, and there is a velocity above which the percentage of unconsumed carbonic oxide and possibly hydrogen becomes so great as to diminish very much the amount of water evaporated per pound of fuel. They had found that in some cases where the passage of the gas through the boiler was very much obstructed and interfered with, it was necessary, to get the best results, to produce a suction in the stack; while in other cases they found that by closing the damper they could burn less coal, reduce their blast and evaporate more water per pound of coal and per hour. The reason was that a part of the carbonic oxide which would otherwise have been burnt, passed up the stack unconsumed because it was carried so rapidly to the cooler part of the boiler that it could not unite with the free oxygen in the gases and burn.

The analysis of the coal, of the gas, and of the ash, where proper arrangements have been made, or where there is a laboratory at the works, is a comparatively inexpensive operation compared with the great value of the results obtained. The indications given by the analysis of the coal he considers of greater value than that of the calorimeter, although where analyses are made from time to time the calorimeter would be a very valuable adjunct. The calorimeter, under the most favorable circumstances, can only give the ash and the heat units developed by a given weight of coal. While two coals might give the same number of thermal units, one might be much more economical than the other on account of different percentages of water present. In the calorimeter test all the heat that goes to make steam is returned by the condensation of steam formed, whereas if the water is evaporated in the furnace it goes up the chimney and is lost. Where the same character of coal is treated, or where the tests are checked up from time to time by chemical analysis, data can be obtained which obviate the necessity of frequent chemical analyses.

In regard to the methods of obtaining the furnace draft, he said, there are three in general use—the chimney, the fan, and the steam jet. The advantage of the chimney is, first, that it allows the deleterious gases to escape at a point considerably above the surface, and therefore, where they are the least likely to cause trouble. Secondly, when once properly built it can be maintained at little or no expense, and if sufficiently large and high, the variations of temperature, etc., can be compensated for by regulating the damper. On the other hand, it is a very uneconomical heat engine where the heat used can be saved, but where there are no means of utilizing it, it is of little consequence how economical or uneconomical it is. The steam jet has the advantage of costing very little to put in and keep in repair. Its disadvantages are, first, it requires a very large amount of steam to run it, and, secondly, it introduces a large amount of water, or steam, into the fire, all of which has to be heated and carried up the chimney, and so far as it condenses in the ash pit has to be reconverted into steam. A still greater disadvantage is the fact that unless very carefully managed there is a large development of carbonic oxide, hydrogen, and marsh gas, due to dissociation of the water, which has a tendency to carry off a great deal of heat in the stack.

The fan is more expensive to install and may cost more to keep in order, but where the arrangements can be made to utilize the heat in the stack gases, it is more economical so far as heat units used are concerned. It has one great advantage—it is possible to at all times obtain the exact blast necessary to produce the best results in the furnaces, which is very important.

He was of the opinion, though advancing it with some reservation, that particularly for the finer anthracites the best results will be obtained by blowing the air by means of a fan through the coal, and, either by a suction fan or chimney, drawing the furnace gases through the boiler, etc., in such a way that there is practically no plenum or vacuum in the furnace or under boiler—or rather a very slight plenum, sufficient to prevent the inflow of any air where it is not wanted.

"In what precedes I have not discussed the question of testing the boiler by means of weighing coal, weighing the ash, and weighing the water, as tests are ordinarily made. While nobody appreciates more highly than I do the advantage of such tests, for in our investigations we often make them, I wish to call attention to the fact that the analysis of the coal, the ash, and stack gases, and the determination of the stack and ash temperatures, give us a means of quickly and cheaply determining practically how much water we are evaporating per pound of coal, when you have once thoroughly tested your apparatus and checked up the results obtained by analysis with the results obtained by the ordinary test. There are several advantages in this manner of testing. We in this way keep track of the coal we are buying, and every large purchaser of coal ought, from time to time, to analyze it. The analysis of the test is not only important for the test, but is very valuable from another point of view. Every manufacturer using large quantities of coal should know how much money he is throwing away in his ash-heap. Stack temperatures, if they are below 800 (and they always should be), can easily be determined by the mercurial pyrometer, which can be done in a few minutes by a person of ordinary intelligence, who knows enough to read a thermometer. But the great advantage of this system of keeping track of what you are doing with your plant is, it can be and should be done when the boilers are being fired in the ordinary way and by the ordinary men. The taking of the samples of the coal and ash does not in any way interfere with the operation of the plant, nor does the taking of the samples of the gases and the temperature of the stack; it can be done at any time and as often as you please. If your man is firing badly, or better at one time than another, the composition of the gases will show it; if your boiler tubes are coated, either inside or outside, your stack temperatures will give you a very good indication that you ought to clean them, provided that you systematically watch what is going on.

"It seems to me, coal should be kept as dry as possible; not exposed to the air, if it can conveniently be avoided. Where coal has been exposed to the air and wet it is advisable to get it in the boiler house and allow it to dry as much as possible before using it. It should be handled carefully so as to avoid breakage. The boiler plant should be well covered in, so as to prevent water, snow, or ice from getting upon it. The boiler house should be kept as warm as it can be and comfortable, not, of course, by heating the building with steam or fuel, but by so constructing it that there will be a minimum loss by radiation from it, and should be as free from currents of air as possible. No water, moisture, or steam should be allowed to get into the coal, even under a patent, if it can be avoided.

"While it is a self-evident proposition that the lower the temperature at which the stack gases are discharged into the atmosphere, under the same circumstances, the greater must be the amount of water evaporated per pound of fuel, yet it is not so certain that we understand the best method of reducing these temperatures. The heated gases from the furnace come first in contact with the boiler, and are generally discharged into the stack after leaving the boiler. Under these circumstances their temperatures must be above that necessary to generate steam at the pressure maintained in the boiler—the higher the pressure of steam the higher must be the temperature at which the stack gases leave the boiler. If, however, an effort is made to reduce their temperature to a minimum, a large portion of the heating surface of the boiler nearest the stack will evaporate very little water, the difference in the temperature between the gases on one side of the iron plates and the water on the other being so slight. In the more modern plants the gases, after passing through the boiler, are used to heat the feed water, which, entering the feed-water heater or economizer at a very much lower temperature than the steam, is able to absorb heat from the gases, which the boiler is not.

"A still further economy is ideally possible by utilizing a portion of the remaining heat of the gases to warm the air which is taken into the ash-pit. While I am not really an expert in this matter, yet I venture to make a few suggestions as to what appears to be the line in which efforts for further economy should be made. I would try to have the highest possible temperature of combustion in the furnace, protecting the boiler and furnace from the direct radiation of the fire as well as I could, and would allow the gases to escape from the boiler at the highest temperature consistent with the heat contained in them, above the temperature which would be of use for this purpose, all the rest being absorbed by the feed-water; that is to say, if I were feeding 100 pounds of water per minute, I would try to increase the temperature of the gases, leaving the boiler until the thermal units in them were about what could be utilized in heating the feed-water to the temperature at which it could be placed in the boiler, without allowing the temperature of the gases escaping from the feed-water heater or economizer to be above that at which they could do useful work. My reason for this is the following: The higher the temperature at which the gases pass from the boiler, the greater will be the evaporation per square foot of heating surface, and also the higher the temperature of the feed-water pumped into the boiler will be. Consequently the greater the evaporation of water per dollar invested in the boiler. To obtain the best results, the feed-water heater should be arranged so that the water passes through the heater in the opposite direction to the gases, that is, the hottest gases should come in contact with the hottest water, and as they are cool they should come in contact with the cooler water. If the gases leaving the feed-water heater were allowed to pass either around the outside or through a series of metal pipes of sufficient length, and the air supplied to the furnace was carried through these pipes or around them, much of the heat still contained in these gases above the temperature of the atmosphere might be abstracted and returned to the furnace, and the loss of heat from the stack gases be largely diminished. There are two objections to this, the cost of the apparatus, and its maintenance, and as there would be no heat available for chimney draft, it would be necessary to have a suction fan to draw the gases out, or to have a strong forcing fan. While it is probable that in most cases it would not pay to utilize the heat of the escaping gases in this way, yet where coal is expensive it is possible that satisfactory results might be obtained."

HAMILTON, GRIMSBY AND BEAMSVILLE ELECTRIC RAILWAY.

The management of this road are making eleven round trips per day, and business both in passengers and freight is steadily increasing. In January, the number of passengers carried was 12,000; this number has now increased to 15,000 per month. The freight traffic amounts to upwards of 200 tons per month.

The company issue single, return or commutation tickets, working men's and school children's tickets, and a 1,000 mile ticket for $10.00. They are arranging for the establishing of a fruit market in Hamilton where fruit will be sold to dealers and consumers, and connection has been made with the steamboat lines by which freight from Toronto and Montreal is received and discharged over the line.

Mr. A. J. Nelles, the manager, has shown himself to be well qualified to develop the business of the road to the greatest possible extent, having devised a number of original schemes for this purpose. The experience which he gained as freight clerk on the G. T. R. railway is proving serviceable to him in his present position.

CANADIAN ELECTRICAL NEWS AND STEAM ENGINEERING JOURNAL

PUBLISHED ON THE FIFTH OF EVERY MONTH BY

CHAS. H. MORTIMER,

OFFICE: CONFEDERATION LIFE BUILDING,
Corner Yonge and Richmond Streets,

TORONTO, - - CANADA.
Telephone 2362.

NEW YORK LIFE INSURANCE BUILDING, MONTREAL.
Bell Telephone 2299.

ADVERTISEMENTS.

Advertising rates sent promptly on application. Orders for advertising should reach the office of publication not later than the 25th day of the month immediately preceding date of issue. Changes in advertisements will be made whenever desired, without cost to the advertiser, but to insure proper compliance with the instructions of the advertiser, requests for change should reach the office as early as the 22nd day of the month.

SUBSCRIPTIONS.

The ELECTRICAL NEWS will be mailed to subscribers in the Dominion, or the United States, post free, for $1.00 per annum, 50 cents for six months. The price of subscription should be remitted by currency, in registered letter, or by postal order payable to C. H. Mortimer. Please do not send cheques on local banks unless 25 cents is added for cost of discount. Money sent in unregistered letters will be at senders' risk. Subscriptions from foreign countries embraced in the General Postal Union, $1.50 per annum. Subscriptions are payable in advance. The paper will be discontinued at expiration of term paid for if so stipulated by the subscriber, but where no such understanding exists, will be continued until instructions to discontinue are received and all arrearages paid.

Subscribers may have the mailing address changed as often as desired. *When ordering change, always give the old as well as the new address.*

The Publisher should be notified of the failure of subscribers to receive their papers promptly and regularly.

EDITOR'S ANNOUNCEMENTS.

Correspondence is invited upon all topics legitimately coming within the scope of this journal.

THE "CANADIAN ELECTRICAL NEWS" HAS BEEN APPOINTED THE OFFICIAL PAPER OF THE CANADIAN ELECTRICAL ASSOCIATION.

CANADIAN ELECTRICAL ASSOCIATION.

OFFICERS:

PRESIDENT:
K. J. DUNSTAN, Local Manager Bell Telephone Company, Toronto.

1ST VICE-PRESIDENT:
A. B. SMITH, Inspector Canadian Board Fire Underwriters, Toronto.

2ND VICE-PRESIDENT:
C. BERKELEY POWELL, Manager Ottawa Electric Light Co., Ottawa.

SECRETARY-TREASURER:
C. H. MORTIMER, Publisher ELECTRICAL NEWS, Toronto.

EXECUTIVE COMMITTEE:
L. B. McFARLANE, Bell Telephone Company, Montreal.
GEO. BLACK, G. N. W. Telegraph Co., Hamilton.
T. R. ROSEBRUGH, Lecturer in Electricity, School of Practical Science, Toronto.
E. C. BREITHAUPT, Berlin, Ont.
JOHN YULE, Manager Guelph Gas and Electric Light Company, Guelph, Ont.
D. A. STARR, Electrical Engineer, Montreal.
J. J. WRIGHT, Manager Toronto Electric Light Company.
J. A. KAMMERER, Royal Electric Co., Toronto.
J. W. TAYLOR, Manager Peterboro' Carbon Co., Peterboro'.
O. HIGMAN, Inland Revenue Department, Ottawa.

MONTREAL ELECTRIC CLUB.

OFFICERS

President, W. B. SHAW,	Montreal Electric Co.
Vice-President, H. O. EDWARDS,	
Sec'y-Treas., CECIL DOUTRE,	81A St. Famille St.

Committee of Management, T. F. PICKETT, W. GRAHAM, J. A. DUGLASS.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

EXECUTIVE BOARD:

President, J. J. YORK,	Board of Trade Bldg. Montreal.
Vice-President, W. G. BLACKGROVE,	Toronto, Ont.
Secretary, JAMES DEVLIN,	Kingston, Ont.
Treasurer, DUNCAN ROBERTSON,	Hamilton, Ont.
Conductor E. J. Philip,	Toronto, Ont.
Door Keeper, J. F. CODY,	Wiarton, Ont.

TORONTO BRANCH No. 1.—Meets 2nd and 4th Friday each month in Room D, Shaftesbury Hall. Mr. Lewis, President; S. Thompson, Vice-President; T. Eversfield, Recording Secretary, University Crescent.

HAMILTON BRANCH No. 2.—Meets 1st and 3rd Friday each month, in Maccabee's Hall. E. C. Johnson, President; W. R. Cornish, Vice-Pres.; Wm. Norris, Corresponding Secretary, 211 Wellington Street North.

STRATFORD BRANCH No. 3.—John Hoy, President; Samuel H. Weir, Secretary.

BRANTFORD BRANCH No. 4.—Meets 2nd and 4th Friday each month. C. Walker, President; Joseph Ogle, Secretary, Brantford Cordage Co.

LONDON BRANCH No. 5.—Meets in Sherwood Hall first Thursday and last Friday in each month. F. Mitchell, President; William Meaden, Secretary Treasurer, 533 Richmond Street.

MONTREAL BRANCH No. 1.—Meets 1st and 3rd Thursday each month, in Engineers' Hall, Craig street. President, John J. York, Board of Trade Building; first vice-president, J. Murphy, second vice-president, W. Ware; secretary, B. A. York; treasurer, Thos. Ryan.

ST. LAURENT BRANCH No. 2.—Meets every Monday evening at 43 Bonsecours street, Montreal. R. Drouin, President; Alfred Latour, Secretary, 306 Delisle street, St. Cunegonde.

BRANDON, MAN., BRANCH No. 1.—Meets 1st and 3rd Friday each month, in City Hall. A. R. Crawford, President; Arthur Fleming, Secretary.

GUELPH BRANCH No. 6.—Meets 1st and 3rd Wednesday each month at 7.30 p.m. J. Fordyce, President; J. Tuck, Vice-President; H. T. Flewelling, Rec. Secretary; J. Gerry, Fin.-Secretary; Treasurer, C. J. Jorden.

OTTAWA BRANCH, No. 7.—Meets 2nd and 4th Tuesday, each month, corner Bank and Sparks streets; Frank Robert, President; F. Merrill, Secretary, 352 Wellington Street.

DRESDEN BRANCH No. 8.—Meets every 2nd week in each month; Thos. Merrill, Secretary.

BERLIN BRANCH No. 9.—Meets 2nd and 4th Saturday each month at 8 p.m. W. J. Rhodes, President; G. Steinmetz, Secretary, Berlin Ont.

KINGSTON BRANCH No. 10.—Meets 1st and 3rd Tuesday in each month in Fraser Hall, King Street, at 8 p.m. J. Devlin, President; A. Strong, Secretary.

WINNIPEG BRANCH No. 11.—President, G. M. Hazlett; Recording Secretary, W. J. Edwards; Financial Secretary, Thos. Gray.

KINCARDINE BRANCH No. 12.—Meets every Tuesday at 8 o'clock, in the Engineer's Hall, Waterworks. President, Jos. Walker; Secretary, A. Scott.

WIARTON BRANCH No. 13.—President, Wm. Craddock; Rec. Secretary, Ed. Dunham.

PETERBOROUGH BRANCH No. 14.—Meets 2nd and 4th Wednesday in each month. S. Potter, President; C. Robison, Vice-President; W. Sharp, engineer steam laundry, Charlotte Street, Secretary.

BROCKVILLE BRANCH No. 15.—W. F. Chapman, President; James Aitkens, Secretary.

CARLETON PLACE BRANCH No. 16.—W. H. Routh, President; A. M. Schofield, Secretary.

ONTARIO ASSOCIATION OF STATIONARY ENGINEERS.

BOARD OF EXAMINERS.

President, A. AMES,	Brantford, Ont.
Vice-President, F. G. MITCHELL,	London, Ont.
Registrar, A. E. EDKINS,	139 Borden st., Toronto.
Treasurer, R. MACKIE,	28 Napier st., Hamilton.
Solicitor, J. A. MCANDREWS,	Toronto.

TORONTO—A. E. Edkins, A. M. Wickens, E. J. Phillips, F. Donaldson.
HAMILTON—P. Stott, R. Mackie, T. Elliott.
BRANTFORD—A. Ames, care Patterson & Sons.
OTTAWA—Thomas Wesley.
KINGSTON—J. Devlin (Chief Engineer Penetentiary), J. Campbell.
LONDON—F. Mitchell.
NIAGARA FALLS—W. Phillips.

Information regarding examinations will be furnished on application to any member of the Board.

AMERICAN electrical journals are protesting against the manner in which electrical goods are being slaughtered in price, and particularly incandescent lamps, which one dealer at least offers to sell at "two for a quarter." The cost of manufacturing a medium grade lamp in Germany, where labor and material at least are much cheaper than in America, has been shown to be 11¼ cents. It is estimated that in America the cost of production, exclusive of marketing, will exceed 12 cents. It is therefore certain that lamps cannot be sold at a profit under 20 cents at least. In Canada the price has come near this limit. It is not improbable that the rise in price of materials will add to the expense of manufacture in case of electrical supplies generally, to such an extent as to necessitate a stiffening of prices of the manufactured products. The wisdom of the policy of selling at prices so little above the actual cost of production is open to question.

WE had occasion some months ago to question the soundness of the statements contained in an article in the Belleville, Ont., Sun, concerning the conduit electric railway which it was proposed to construct in that city. The article was full of glowing generalities concerning the system, but nothing came in answer to our request for something definite in the way of particulars of the method of construction and operation. It is not surprising to learn, therefore, that Messrs. Lazier & Sons, who are the principal promoters of the road, have fallen back upon the trolley system. Contracts for equipment have been awarded, and construction is being proceeded with. We hear of others who are experimenting with systems designed to dispense with the use of overhead wires, but their success or failure remains to be proven. It is quite probable that the trolley system may eventually be superseded by one which will be equally efficient, less expensive and more sightly, but the experiments in this direction have thus far not reached the point where railway projectors and municipal authorities would be warranted in undertaking to construct electric roads on other than the prevailing method.

THE railroad committee of the New York Legislature has recommended the adoption of a Bill requiring every person or corporation operating a street surface railroad within the State, to equip every car with a guard fender or sweep, on or before the 1st of September next, and fixing a penalty of $25.00 a day for each car used without such device, the fines thus incurred to be applied to the improvement of the streets of the city in which the railroad company operates.

IN another column will be found a communication from Mr. J. J. Wright, manager of the Toronto Electric Light Co., in which exception is taken to some of the statements appearing in the article in the ELECTRICAL NEWS for June touching the recent accident at the Toronto Railway Company's power station. It should be said in answer to Mr. Wright's objections that the statements published were based on information procured by a representative of this journal at the power station from what was believed to be reliable and impartial sources, and he is loth to believe that either the officials of the railway company or the representative of the Siemens-Halske Company were guilty of wilful misrepresentation. The fact that Mr. Davis was the railway company's electrician in name only, while the actual duties of the position were being discharged by Mr. McCullough, is one with which we, in common with other outsiders, could not be supposed to be familiar. We are pleased to learn from Mr. Wright that the machinery of the Company's power-house is under such competent supervision, and to give proper credit to Mr. McCullough for his ability. In fact, we fail to see why, if he satisfactorily discharges the duties of a position which calls for the highest skill of the trained electrician, the company should have allowed another person to wear the honors.

A PERUSAL of the following extract from an article in the Western Electrician regarding the result of the municipal lighting experiment in Chicago, confirms the wisdom of the decision recently given by the taxpayers of Toronto on this question: "Depending upon the published statements of interested or irresponsible persons, taxpayers have come to believe that the city was pursuing an economical policy in establishing a plant for electric street lighting. It is not at all difficult to understand how this impression was gained, although it is quite remarkable that the public should so long remain in ignorance of the true condition of affairs. It can only be explained by the fact that there was implicit confidence in the ability of Supt. Barrett to fulfil the promises he made which induced the city to adopt the policy of lighting its streets, and that he has thus far evaded making a complete statement of the result of this experiment. Such a statement would show that instead of fulfilling the promises made for it, and thereby effecting an actual saving for the taxpayers, the present municipal lighting system of Chicago has been a very expensive and unsatisfactory experiment. Sup. Barrett has been given ample opportunity to carry out his agreement to provide an economical lighting system for the city streets, but he has failed to show any advantage gained for the taxpayers. He has been urged repeatedly to present data in support of his claims that he was furnishing light at a price named by himself as the actual cost of production, but he has never been able to prove his case. In fact the whole subject of the cost of this project to the city has been shrouded in mystery, and thus far it has been utterly impossible to secure from the city electrical department any detailed statement that would be at all reliable. But while it is true that Sup. Barrett has positively refused to enlighten the electrical fraternity upon the cost to the taxpayers of his favorite scheme, and has encouraged the belief that the project was a profitable one for the city, electrical experts of established reputation have made it their business to investigate the subject thoroughly, and they have proved conclusively that Sup. Barrett's statements are based upon figures that are not complete, and that they are therefore neither fair nor honest, but misleading and injurious to the electrical business. Sup. Barrett cannot plead ignorance of these facts, for he has been confronted with them, and he has been urged to disprove the charges of bad faith made against him or to admit the error of his statements. He has done neither, but he has repeatedly promised, or rather threatened, to publish figures that would convince the world of the truthfulness and the justice of his claims and cover his critics with confusion. For six years the farternity has waited, occasionally reminding him of these promises, but he has ignored all demands."

THE necessity for better comprehension of electrical principles by those placed in charge of electrical machinery, and for the employment of a better class of men, properly qualified, in power houses, was never more emphatically shown than recently in a small town where the dynamo was run in connection with a saw mill, and by the same "engineer." The owner was heard to remark that there was "no money in electric lighting," and that all the profits were more than eaten up by the constant repairs to machinery. Enquiry elicited the facts that the saw mill engine was used to run the dynamo; the "electrician" of the plant was also the engineer, and that they "used up" an armature every three months or so,—the idea being that the armature is consumed in the production of electricity as a tallow candle is consumed in its own special way. The engineer was "all right.' Of course, the engineer always is all right; it is always the electrical machinery that is no good. A suggestion that perhaps a saw mill engine is not the best adapted to electric lighting service was met with a polite sneer. The owner (a lawyer, by the way) knew better than that, and the suggestion was regarded as rising out of the hope of selling a new engine. He also considered that the "engineer," having run a saw mill, and "been around machinery" all his life, should know all about machinery, and was, *ipso facto*, a competent electrician. This state of affairs is fortunately not very common. The combination of a bigoted owner, an ignorant engineer, and an engine not adapted to electric service, is enough to bring discredit to any electrical enterprise, but, fortunately, luck seems to have so far befriended small plants. At the same time, plants should be run with judgment, and some experienced person employed as dynamo tender, or electrician, instead of the mechanic usually engaged. It is certainly true that, as Lord Kelvin said, an electrical engineer must be nine-tenths a mechanical engineer; but it by no means follows that an ordinary mechanic, who has merely picked up what he knows by having shoved coal under a boiler, and cleaned an old engine, is in any smallest detail qualified to call himself "electrician." And that is the mistake that is made in a very large number of lighting plants. It is perfectly true that it does not take a very high intelligence to carbon a lamp, or clean a dynamo, but because a man can do these he is not therefore an "electrician," and it takes something more than this before a man can properly manage a power house. In the States and in Europe it is recognized that to properly acquire a thorough knowledge of electricity, some years of special technical education following the ordinary education of the schools, is necessary; and that the curriculum must include special courses in mechanics, mathematics, and general physics. Then again, in these old-fashioned countries, a qualification for the manager of a lighting or power house embraces not only a very thorough training in practical electricity, but also a very intimate knowledge of mechanics, of steam, of book-keeping, even of elementary chemistry; in fact a candidate must be very comprehensively educated, and remarkably capable. Here in Canada, however, we have left behind us these antiquated ideas; our youth are so naturally gifted that technical education is not necessary for them; they are so versatile that they are equally competent as farm hands, engineers, carpenters, lawyers and so on, and any man who can look after a 60 H.P. brewery plant and keep it going, is just as qualified to design and operate an entire electric power plant as a School of Practical Science graduate. It is all these impractical ideas that cause a state of affairs described quite recently to the writer by a prominent American electrical engineer, in the words "Canada is a regular graveyard of old out-of date apparatus." He might equally truthfully have said that the methods of operating are as inefficient as the machinery used.

THE numerous different makes of steam and electrical machinery, the variety of somewhat similar apparatus for attaining the same end, and the absolutely incompatible claims of manufacturing companies and their agents, all depreciating each other's makes, and fearlessly asserting their own to be without an equal, imposes a most embarrassing responsibility on the purposing investor in electrical apparatus. At this date, a company going into the electric lighting business can choose between at least a dozen different makes of electrical machinery, most of which are manufactured in Canada, at least nine different steam engines, some high, some low speed, with all their varieties of simple, cross and tandem compound, triple expansion; while the choice offered in switches, lamps, sockets, motors, brushes, wires, etc., is large. The details of design or construction on which the rival makes base their claims for absolute superiority, are, of course, just as numerous as the rival makes themselves. One well-known and excellent maker says that every other known make is simply and perfectly wrong in mechanical and electrical design combined, while his own, by a peculiar arrangement of armature and field magnets, attains that measure of perfection that is permitted to mere mortals. Another over-compounds his fields, and "begs to draw your earnest attention to the fact" that thereby the regulation of voltage is rendered automatic and perfect; a third says that instead of compounding his *alternator* fields, he takes a rectified portion of the alternating current, and therewith compounds his *exciter*, attaining the same regulation with a great deal less wire; while a fourth asks you scornfully what you want with "automatic" regulation anyway? Give him a smart, live dynamo tender, who will mind his business, and that's a great deal better and more reliable than any automatic regulation; so he doesn't compound at all, and sneers at those who do. And then a new-comer laughs at them all, because they revolve their armature through a stationary field, whereas he has struck out a line for himself, and does the opposite, claiming as an advantage the ease of replacing armature coils, and the fact that he has no moving wire. It is impossible to more than enumerate such varieties, as surface wound versus ironclad armatures; disk versus drum versus gramme ring windings; cast iron versus wrought iron versus steel, for pole-pieces; carbon versus copper for brushes, etc., *ad infinitum*. And similarly with steam engines and boilers. Everyone of these rival makes wants a purchaser's order, and will go great lengths to get it. The first object, of course, is to impress him with the clear value of one particular machine, and to run down all others; so the agent talks about magnetic circuits, and freedom from hysteresis and wasteful eddy currents; will touch lightly on the mechanical design, and fill the unfortunate purchaser full of technical phrases; and will, discreetly, appeal to him as judge on these matters, as to whether it is not so! How many of the non-professional public are able to say whether it really is, or is not so? The public, as a rule, has enough to do to keep itself posted on matters connected with its own business, and if it could once be brought to see that an electrical machine is not a mere question of iron, and copper, and day labor, it would probably begin to think that electricity is best managed by electricians, and that a business man, shrewd and intelligent though he be, is not and cannot be final judge of the comparative merits of machines, that must not only conform to mechanical principles, which after all are fairly obvious, but also to magnetic and electrical principles, which certainly cannot be considered obvious. The distinct points in an electrical machine, wherein it differs from those of all other makes, are of course claimed as improvements, and the object of all improvements is to save money. Take, for example, two rival methods of compounding—that one that puts a rectified series current round the alternator fields, and that one that takes the same rectified series current, but puts it round the exciter field instead. (The writer has no intention of comparing the two methods, but takes them only as an illustration.) Each one claims superiority. One would require probably more copper than the other, while the other would take a heavier exciter than the one. The point of the respective costs of the two machines is soon settled, and will be obvious to anyone; but is any non-professional person capable of saying whether the methods are equally efficient? and if they are not, which is the better of the two? The maker who compounds his fields will, naturally, say that the other is no good; the other will return the compliment, and the business man who knows nothing whatever about the matter is left to judge between them. Or again, one manufacturer uses Swedish iron in his castings; another uses American. The first claims superiority on account of the better magnetic qualities of his material. How does the purchaser know whether that is a valid claim? He has only got the manufacturer's word for it, and a manufacturer can hardly be considered a disinterested person, where he has a sale to make. Once again, a manufacturer makes a sale on a guarantee of such and such efficiency. How does the purchaser know whether this guarantee is made good? The manufacturer makes a test himself, and says it is all right. Of course he says so. But ought that to be sufficient for the man who has to pay the money? It seems hard to improve on the plan followed by waterworks companies, or railway companies, and other parties requiring machinery. These engage the services of a competent engineer, to whom are referred all practical questions, his duty being to act as the technical adviser of those unacquainted with engineering matters, and the results are what might be expected. Waterworks are as a rule much better arranged and operated than electric light and power plants, for the simple reason that professional knowledge and experience is admitted to be necessary for a hydraulic engineer; whereas, apparently, any farm hand or master carpenter is sufficiently equipped by nature to tackle the most difficult electrical problems.

LOOKS LIKE AN ELECTRIC RAILWAY COMBINE.

THE bill to incorporate the International Radial Railway Co., now before parliament, will bear careful scrutiny and watching by everyone desirous of seeing a healthful development in electric railways. Some very estimable citizens, principally from Hamilton, appear as charter members of the Company. These are Messrs. Alexander Burns, Alexander McKay, M. P., John Hoodless, James Edmund O'Reilly, Thomas Miller, F. A. Carpenter, M. P., Peter D. Crerar, Thomas Ramsay, William N. Myles, R. H. McKay, Arthur H. McKeown and James Frank Smith, of Hamilton; Thomas Bain, M. P., of Dundas; William Andrews, of Guelph, and E. J. Powell, of London.

An array of good names, it so happens, is not always a guarantee of the character and real purpose of a project. The names of not a few good business men are identified with the International Radial Railway Co. There are several members of parliament, and there is not wanting a lawyer or two. But let no one be carried off in any project of the kind simply by the names of those high in church courts, business circles, or the bar.

The business men of Canada know something of the power of railway corporations, and especially after the smaller roads had been brought under the control of one or other of the two large railways of this country. With competition crowded out they know how difficult it is to secure freight rates or other concessions that would be helpful to their business, and to the general business, very often, of the whole country. The railway pool, and the joint circular that is an important document in the offices of the Canadian Pacific and Grand Trunk Railways, can hardly be forgotten by business men, and must cause them to think twice when any movement is made to tie up their interests by a possible combine.

Let us look at some of the terms of the proposed bill. It does not limit the motive power to electricity, but it is very plain, as one studies the measure, that it owes its suggestion to the rapid development of electric power for railway propulsion, and especially of recent years in the opening of short electric lines in different parts of the country, proving of inestimable value to the public.

The lines of the International Radial Railway Co. will have their start in Hamilton. It is proposed to construct a line to Waterloo, passing through Galt, Preston and Berlin, with a branch to Guelph. Another line will connect Hamilton and Fort Erie, passing through Wentworth, Lincoln and Welland, with a branch through Dunnville to Lake Erie, terminating at or near the mouth of the Grand River. A third line will connect Hamilton and St. Mary's, passing through Brantford and Woodstock, with a branch to Fort Burwell. Expropriation powers exceeding those provided by the railway act are applied for. The bill empowers the company to bond the road to the extent of $20,000 per mile of single line, and $6,000 per mile additional for double track. Authority is also asked to lease the railway to the Canadian Pacific, the Canada Southern or the New York Central Railway Co., and to acquire the franchise and properties of the Hamilton and Dundas Street Railway, the Galt, Preston and Hespeler Street Railway Co., and the Berlin & Waterloo Street Railway Co. It is proposed that the company shall be given power to enter upon public highways with the consent of the municipal authorities, for the purpose of constructing a telegraph and telephone system.

The scheme is a big one, and calls for a large outlay of capital. That the projectors are likely to use their own means to carry through the undertaking was seriously questioned by Mr. Sutherland when the bill was before the railway committee of the House. He said: "They appear to be procuring the charter simply to secure the territory covered by it." Were it carried out in its entirety it would mean that every electric railway of importance in Western Ontario would pass into the hands of the proposed company. Not one of these would continue to be an independent corporation. New lines would be constructed tending to serve as useful extensions; and this much done the directors would then have power to hand this most valuable franchise over to the Canadian Pacific, the Canada Southern, or the New York Central Railway.

Have the people of this country, and especially Ontario, forgotten the efforts put forth some years ago to secure local railway accommodation for their different towns and municipalities? Some will have a lively recollection of the days of bonusing and the flattering speeches of the bonus-hunter, as he travelled from school-house to school-house and grew eloquent over the benefits that were to accrue to the country by the construction of these local and short-line railways. Where are these railways to-day? What is the position of the towns that were to become important railway centres, with workshops and many other privileges granted to them? Every one of these short-line railways has been gobbled up either by the Grand Trunk or the Canadian Pacific, and individuals and municipalities are groaning under the heavy interest and taxes contracted for at the time.

The building of short-line electric railways is one of the hopeful omens of the present day, furnishing a medium of communication where railway accommodation is unknown or very imperfect. To what extent these undertakings should be pushed and on what lines, has been discussed in this journal before, and we have not hesitated to speak words of caution where these seemed to be required. But anything we have said will not alter the fact that if there is to be a development in electric railway building it must come through independent effort. No doubt the steam railways see the competition that will meet them from the electric railways of the future. Be it so. How disastrous would be the result if parliament should sanction any measure that would tend to placing the present electric railways and the many possible, and in some cases, planned roads of the future, in the hands of any one large corporation.

Everyone interested in electrical enterprises and desirous of seeing this new force attain the high commercial purpose and place that it is designed to do, will see at a glance how anything in the shape of a combine would thwart this end. We write as among those vitally interested in the progress of the electrical industry. We can write with equal force as citizens anxious for the best interests of the country, profiting by the experience of the past and the conditions of the present, when entering a vigorous protest against any scheme such as that indicated in the bill of the International Radial Railway Co.

From whatever standpoint the scheme is viewed, the nerve of the promoters is remarkable. It is not shown that the public will be in any way benefited by the extraordinary privileges asked for in this bill. On the contrary every clause points in an opposite direction. And then, having secured about all the rights that it would seem possible to conceive of by the most wide-a-wake railway promoter, the company have the gall to ask that they be permitted to "convey or lease" to the Canadian Pacific, or other company, in whole or in part, any or all rights acquired under the act. Or failing to convey or lease that they may amalgamate with any such company. What was the Railway Committee doing when they allowed this bill to pass safely through their hands? It is now plainly the duty of parliament to see that the measure is not further advanced, and allowed to become law.

The Dundas Telephone Co., have completed their lines from Kemptville to Chesterville. The company has also 100 miles of poles ready for wiring connecting the villages of Morrisburg, South Indian, South Finch, Avomore, Monklands, Metcalf, Moorewood, Vernon, Duncanville, and Kenmore.

THE ONLOOKER.

AFTER the very successful experiment made in Boston on the Nantasket branch of the New York, New Haven and Hartford Railway on the 21st June, where an electric locomotive reached a speed of 80 miles an hour, the question is being asked with renewed force, are steam roads doomed? An electric locomotive built to haul Baltimore and Ohio trains through the tunnel in Baltimore, made its first run on the 30th ult., and the trial there proved so complete a success, that it is anticipated the locomotive is likely to go into permanent service from that day on. The Boston experiment was critically watched by the officials and attachees of the road. The work of changing the motive power of the road from steam to electricity was done under the direction of Col. H. Helt, formerly president of the Bridgeport Traction Co., but who recently was engaged by the consolidated road to superintend their electric work. The engines are of the Green-Corlis build, and especially designed for the work they are given to do. The shaft is 18 inches and the fly wheel, which weighs 64,000 pounds, is 18 feet in diameter. The condensers are so piped that the engines can work with or without them. They are arranged to regulate from no load to a maximum of 1,420 horse power. They can also be stopped by simply pressing one of several buttons. The two generators especially built for the line, run at a speed of 110 revolutions a minute and are guaranteed to develop 1,500 horse power each. The armatures, instead of being built up of wire, are made of copper disks, each insulated from the other The generators are 10 feet high and the armatures 8 feet in diameter. The switchboard is arranged with two main generator panels. The voltage is 700 volts. Save for a single feature, it is said, there is not the slightest resemblance to the steam locomotive. That feature is the cowcatcher at both ends of the locomotive cars. It is situated underneath the platforms instead of projecting beyond the body of the locomotive as with the steam locomotive. The wheels are about the size of the largest wheels used on steam cars. But the axles are considerably heavier to withstand the strain of the electric gearing. The Nantasket Beach Branch was chosen for the experiment for the reason that within its limits are concentrated most of the difficult problems which will have to be met. The curves are many and sharp, and the grade steep. Mr. John Patterson, of Hamilton, who is one of the projectors of the Niagara, Hamilton and Pacific Railway Co., who have within the past ten days secured a bill of incorporation from the House of Commons, has been to the States investigating the experiment spoken of, with the view of applying electric power to anticipated extensions of this road. To the Onlooker he said, as far as one can judge, the Boston experiment has been a complete success, and certainly if time proved the lasting character of the experiment it must go a long way to cause electricity to supplant steam for railway purposes.

CONCERNING FIRES.

IT is very generally argued, that when a boiler is being heavily worked, a thick fire is absolutely necessary, but from some experiments lately made, the opinion appears to be an erroneous one. As to the economy of the two, some maintain that heavy fires give the most economical results; but this, also, is questionable. Valuable information on the subject has recently been brought out by the results of two evaporative tests, says the Mechanical World. They were made on a 72-inch return tubular boiler, having 1,000 3½-inch tubes, 17 feet in length. The heating surface amounted to 1,642 square feet, and the grate surface to 36 square feet, the ratio of the two being 45.6 to 1. On the thick fire test, the depth of the coal on the grate varied from eight to twenty inches, being heaviest at the rear end, and lightest at the front end. On the thin fire test, the depth was maintained uniformly at about six inches. The difference in the results, as appears from the figures given, indicates an increased evaporation, due to thin fires amounting to 15.6 per cent.

The annual meeting of the Canadian Electric Light Co. was held in Montreal recently, at which the following directors were re-elected: Messrs. R. McLennan, Toronto, Adolphe Davis, Henry Hogan, Robert Bickerdike, John D. McLennan, Cleveland, O.; C. C. Claggett and F. S. McLennan. At a subsequent meeting of the directors, Mr. R. McLennan was elected president, Mr. Davis, vice-president, and Mr. F. S. McLennan, secretary-treasurer.

THE TIME SYSTEM OF THE TORONTO ELECTRIC LIGHT CO.

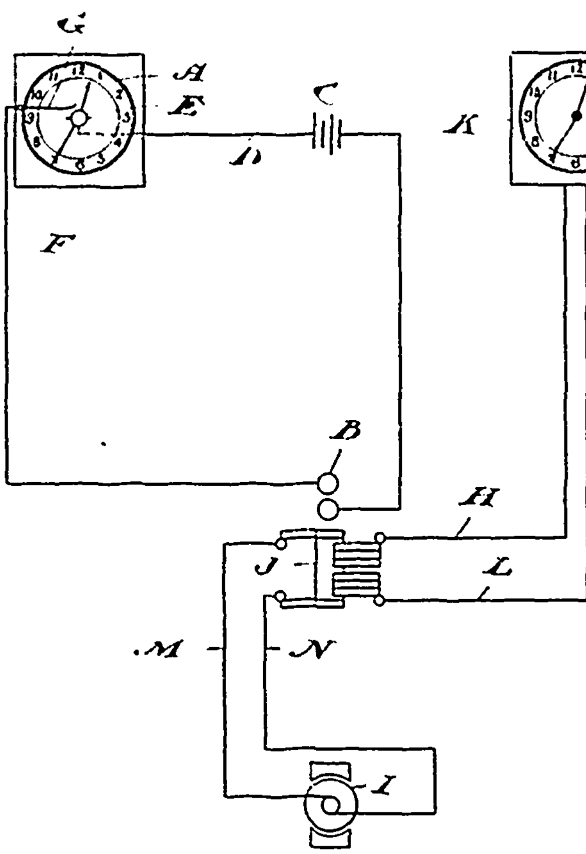
THE accompanying illustrations and particulars will serve to explain the above system, of which brief mention was made in the ELECTRICAL NEWS for June:

The object of the invention is to devise an electric time indicator which will accurately indicate time at one or more distant stations synchronously with a master clock at the central station, and it consists essentially of a distant station clock mechanism responsive only to currents of alternately changed polarity; a transmitter in circuit with the distant station clock and adapted when set in motion to change regularly the direction of the currents received from a dynamo or other source of current; a master clock in circuit with a device controlling the transmitter and adapted to make and break the circuit at regular pre-determined intervals, and thus start and stop the transmitter, the current in the master clock circuit being generated by a battery or source of current of low potential substantially, as hereinafter more particularly described.

Figure 1 is a skeleton view, showing the general arrangement of the apparatus. Figure 2 is a perspective detail of the transmitter.

In Figure 1, A is the master clock arranged in circuit with transmitter controlling electro-magnet, B, and the battery, C. One wire, D, of the circuit is always in contact with the revolving disk, E, connected to the main arbor of the master clock, A. The other wire, F, of the circuit is connected to one end of the platinum spring, G, the other end of which lies in the path of the two projections shown on the disk, E. As this disk revolves once a minute, the circuit is made and broken regularly every half minute.

In the main circuit are arranged the dynamo or other source of current, I, the transmitter, J, and the distant clock, K. In this main circuit, H and L are wires of the line circuit, and M and N the wires of the dynamo circuit. The mechanism of the distant clock, K, is only responsive to currents of alternately changed polarity, and the transmitter is so arranged that each time it is set in operation by the master clock, the polarity of the current flowing to the distant clock is reversed, and the mechanism of the clock thus put in operation.



TIME SYSTEM, TORONTO ELECTRIC LIGHT CO.—FIG. 1.

In Fig. 2, the construction of the transmitter, J, and the transmitter controlling electro-magnet, B, is shown in detail. O is a commutator suitably journalled and P a drum, around which is wound the cord or wire, Q, which is fastened thereto and also connected to a clock weight, *not shown in the drawings*. The commutator and the drum are connected by the gearing, R-R-R, as shown, so that a rotary motion will be given to the commutator when it is set free by the master clock. S is a fly, connected to a shaft, geared to the other end of the commutator, as shown in the drawing. Suitable provisions for winding the drum are also made, but as this is an ordinary clock-work train, further detailed description is unnecessary. T-T are arms connected to the near end of the spindle of the commutator, O, and which engage alternately with the end of the armature, U, of the electro-magnet, B. This armature is pivoted at V, and is provided with a weighted tail, X, as shown, to normally retain its point in a position to engage with one of the arms, T. An adjustable stop, W, is connected to the frame of the transmitter, T, so as to limit the upward motion of the armature. Thus the transmission of a current through the wires, D and F, of the master clock circuit will draw down the armature and leave the commutator, O, free to revolve, till the other arm, T, comes in contact with the armature, U, *which has been returned to its normal* position on the ussation of the current by the weighted tail, X.

The commutator, O, is constructed of non-conducting material and is provided at each end with metal rings, a-b. c and d are metal sections, connected respectively with the rings, a-b, but insulated from one another. e and f are metal sections, arranged diametrically opposite to the sections c and d, insulated from one another, but connected respectively by the wires, g and h, to the sections, b and a. Bearing on the rings, a and b, are the brushes, i and j, provided with weighted tails and pivoted in the usual manner on the brush standards, k and l, to which are connected respectively the wires, M and N, from the dynamo. M are a series of brushes pivoted on the brush standard, n. The ends of these brushes are *in position to make contact* with the sections, c and e, when the commutator revolves. o are a series of brushes pivoted on the brush standard, p. The ends of these brushes are in position to make contact with the sections, d and f, when the commutator revolves. These brush standards are connected respectively with the line wires, H and L, of the line circuit. When the commutator is in the position shown *in Fig. 2*, no current will flow through the line circuit, but when the commutator is released by the energizing of the electro-magnet, B, the sections, e and f, of the commutator will come in contact with the brushes, m and o, and a current will then flow through the wire, M, standard, l, brush, j, ring, b, wire, h, commutator section, e, brushes, m, standard, n, *line wire*, L, *distant clock*, K, line wire, H, standard, P, brushes, o, commutator section, f, wire, g, ring, a, brush, i, standard, k, and wire, n.

When the sections, e and f, have passed from underneath the brushes, m and o, the other arm, T, on the end of the commutator spindle has come in contact with the end of the armature, U, and the commutator becomes stationary. The next time the electro-magnet, B, is energised and the commutator released, commutator sections, c and d, come into contact with the brushes, m and o, and the course of the current is then through the wire, M, standard, l, brush j, ring, b, commutator section, d, brushes, o, standard, P, wire, H, distant clock, K, line wire, L, standard, n, brushes, m, commutator section, c, ring, a, brush, i, standard, k, and wire, N. The commutator is again stopped as before, when the commutator sections, c and d, have passed *from underneath the brushes, m and o. It will thus be seen* that the revolution of the commutator sends currents of alternating polarity to the distant clock, K, which is made to respond only when receiving such currents.

The construction of the mechanism of this clock will be readily understood. q is a polarized steel armature connected to a spindle, r, journalled on the frame, s, in a vertical position, in a manner similar to the balance wheel of a common clock. t is a worm formed on the spindle, r, which engages with the worm wheel, u, on the arbor, v, journalled as illustrated. w and x are the hands of the clock which are driven from this arbor in a similar manner to that in every-day use in ordinary watches and clocks, and which will be readily understood by one conversant with such matters.

From this construction it follows that the revolution of the armature, q, will impart the proper motion to the hands, w and

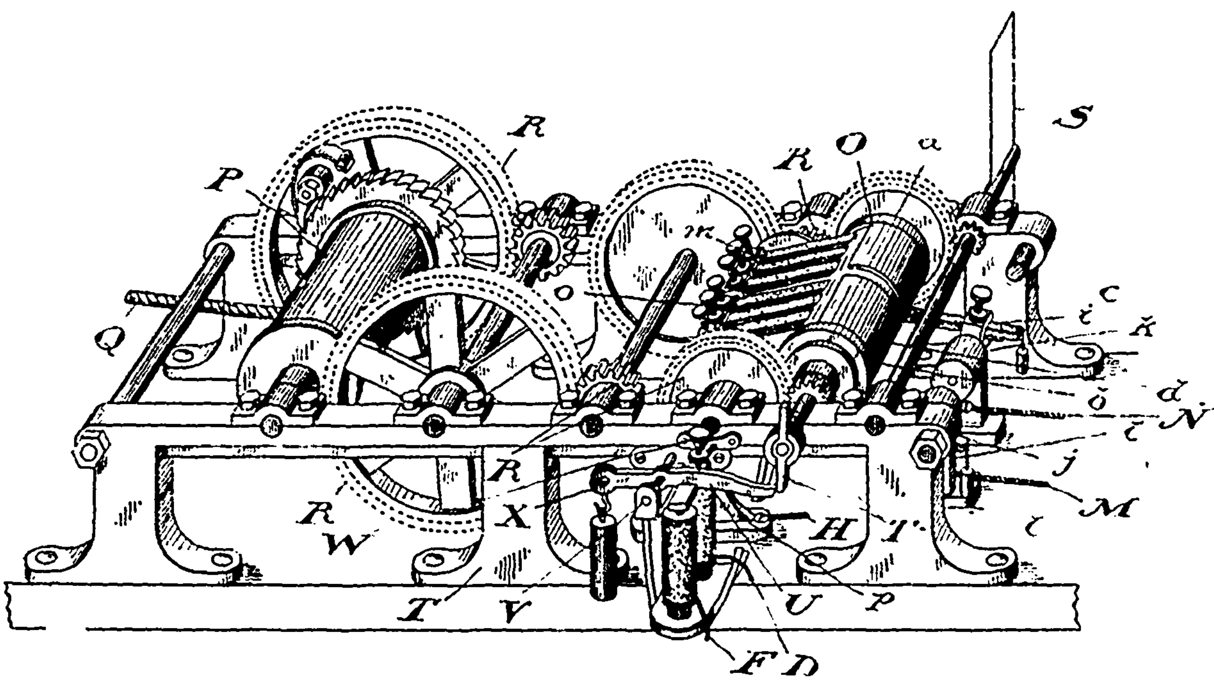
x. a' is an electro-magnet suitably supported on the frame, s, with its poles, b', in close proximity to the circular armature, q. The wires, H and L, of the line circuit are connected to this electro-magnet, as shown, so that when a current passes through them, the electro-magnet is energized and its poles attract the poles of the armature, q, having an opposite polarization. It is evident that as long as the current flows through the electro-magnet, a, in the same direction, no further motion of the armature, q, is possible, but when a current is sent through it in a reverse direction, the polarization of the electro-magnet is changed and, as before, opposite poles of the armature, q, are attracted, and another half revolution of the armature takes place. c' is a spring connected, as shown, to the frame, s, with its lower end lying in the path of the cross-bar of the armature, q, so as to permit of its motion in one direction only.

The features which the inventor considers particularly important are—First, placing the master clock in an auxiliary circuit so that its office is merely to set in operation a transmitter controlling the flow of current in the main circuit. This enables the use of a current of very low potential in the auxiliary circuit, so that no trouble can occur through the carbonizing of the contacts on the master clock, and as these contacts may be made very light, no disturbance of the time-keeping qualities of the clock can occur, such as might happen with the stronger and heavier contacts required, if the high potential current in the line circuit also passed through the master clock.

If, by the collection of dust on the contact points or by vibration of the contact spring, a double contact takes place in the master clock, no trouble is caused, as the first contact has energized the transmitter controlling electro-magnet, and released commutator, and the second contact produces only a vibration of the armature of the electro-magnet, which will not in the slightest affect the transmitter.

The second point is the alternate reversal of the currents in the main circuit. If two contacts are made on the same sections of the commutator through dust or in any other way, the first contact alone will operate the distant clock, the second contact producing a current in the same direction, which, as already described, is not competent to produce any effect, as the current must be reversed before a further revolution of the armature in the distant clock can take place.

In practice, the wires, H and L, leading from the transmitter would be connected to a switch-board, suitably arranged so that the current from the transmitter can be distributed to any desired number of circuits of preferably about fifty clocks to the circuit. A single wire might in many cases be sufficient for the distant clock station, as suitable ground connections might be substituted for the return wire.



TIME SYSTEM, TORONTO ELECTRIC LIGHT CO.—FIG. 2.

THE WORKING SURFACE OF A PULLEY.

IT has taken considerable time to settle the question in regard to belts made of leather, as to which side should run next to the shaft wheels, if, indeed, it has been settled, for even now it is rehashed occasionally by saw mill men, etc., says an exchange. It is always a pleasure to see the best side of a belt stand out whenever a new belt is to be set in motion, and good looks go a long way on all such occasions.

In spite of all tests that have been made on leather belting, nothing has ever been said of the extra cling that the flesh gets by being easily squeezed into every depression on the face of the pulley, which the grain side has a tendency to bridge over. This seems to follow the law of friction where the particles of one material interlock themselves with those of another. Pulleys covered with leather and wheels made of hardwood of all kinds have given much greater driving power from the same grasp of belt than the handsomely polished metal pulleys have done, though this latter class of wheels has all the advantages that are to be derived from atmospherical influences.

But the fine imperfections on the true surface, which are the real gear teeth of friction, are not there in the abundance found in the material that is more closely allied with the belting itself. Everything would seem to indicate that a driving wheel is finished in the wrong direction when a covering of leather adds so much to its driving capacity.

The teeth of gear wheels are not cut lengthwise, and this gives all the hold that its strength will allow to the turn of a pulley, with the finishing cut taken crosswise and ground on a polishing wheel, herringbone fashion. This may not be appreciated in the machine shop, but the object to be obtained is the very one that a draw file is used for, namely, to pitch the minute grooves found on every surface in the right direction.

The corporation of Collingwood have closed a contract for a 1,000 light alternator and a 140 h.p. slow speed engine, the electrical part of the work going to the Canadian General Electric Co., Ltd., and the steam plant to the John Abel Co., of Toronto.

An establishment has for some time been in operation at Pribram, Austria, where tests of fuel are carried out on a sufficiently large scale to enable the heating efficiency of any kind of fuel to be practically determined. In carrying out this process ten tons of the fuel to be tested are divided into two lots of five tons each, a separate and distinct trial being made of each lot, the results obtained being checked one against the other. The tests, which are carried on day and night continuously, are made on a mild steel boiler; the grate is of the stepped type, with a total surface of 23.6 square feet, the heating surface of the boiler is 624 square feet, and that of the feed water heaters 356 square feet; the chimney stack is 106 feet high, the inside diameter at the bottom being 3.6 ft., and that at the top 2 ft. 6 in., there being good draught for the boiler. Special care is requisite that the boilers and accessories be thoroughly cleaned out after each test.

INSPECTION OF ELECTRIC LIGHT IN CANADA.

As most of our readers are no doubt aware, an Act has been passed by the Dominion Parliament providing for the inspection of electric light, and provision is now made for the inspection of electric light and current the same as for gas. The organization has recently been completed by Mr. O. Higman, of the Inland Revenue Department, Ottawa, who is said to have framed it on the lines of the greatest possible economy in connection with the gas inspection department. Below is given a list of the staff, together with the inland revenue divisions over which each inspector has charge:

John Williams, London—Inland Revenue Divisions of London, Windsor and Stratford.

D. McPhie, Hamilton—Inland Revenue Divisions of Hamilton, Brantford and St. Catharines.

J. K. Johnstone, Toronto—Inland Revenue Divisions of Toronto, Guelph and Owen Sound.

Wm. Johnson, Belleville—Inland Revenue Divisions of Belleville, Kingston, Prescott, Cornwall and Peterborough.

H. G. Roche, Ottawa—Inland Revenue Divisions of Ottawa and Perth.

A. Aubin, Montreal—Inland Revenue Divisions of Montreal, Three Rivers, Terrebonne and Joliette.

M. Levasseur, Quebec—Inland Revenue Division of Quebec.

A. F. Simpson, Sherbrooke—Inland Revenue Divisions of Sherbrooke, St. Hyacinthe, St. Johns and Sorel.

A. Rowan, St. John, N. B.—Inland Revenue Divisions of St. John and Chatham.

A. Miller, Halifax, N. S.—Inland Revenue Divisions of Halifax, Yarmouth, Pictou, Cape Breton, Charlottetown, Prince Edward Island.

The act provides for the testing of incandescent lamps for candle-power, and a sample of each style of lamp furnished to customers must be passed by the inspector. For the testing of meters a scale of prices varying from 75 cents to $3.50 for each test has been arranged, the test to be made once every five years, the cost to be paid by the company; but should the company or consumer desire a test oftener than provided by the act, the fee must be paid by the party at fault.

QUESTIONS AND ANSWERS

"Fireman" writes: In handling an automatic cut-off Wheelock condensing engine, should the throttle valve be partly closed or open, according as there is full load or only part load on? Is it in the interest of economy or otherwise to run an automatic cut-off engine with partly closed throttle? The engine in question has a fair load to carry.

ANSWER.—With an automatic engine the throttle valve should always be left full open, no matter how small the actual load at the moment may be. It is not in the interest of economy or anything else to try and control the engine by the throttle valve, as the object of the automatic valve is to make this unnecessary, as the very name "Automatic" indicates.

PERSONAL.

Mr. Wm. McKenzie, President of the Toronto Street Railway Co., is at present on a visit to England.

Mr. R. O. King, son of Mr. R. W. King, of Georgetown, Ont., a student in electricity at McGill University, was recently awarded the gold medal and a two years' scholarship.

Mr John Starr, one of the leading men in the trade in Canada, was in New York last week. Mr. Starr sold the first T.-H. apparatus in France, and is now a general dealer in supplies at Halifax.—Electricity, N. Y.

At St. Gregory's church, Montreal, Miss Gertrude Sise, second daughter of Mr. C. S. Sise, Vice-President of the Bell Telephone Co., was recently married to Mr. Ernest Nash, son of the late Captain Nash, of Ottawa.

The marriage is announced of Mr. Stephen L. Coles, associate editor of the Electrical Review, and Miss Sallie E. Field, of New York City. The happy couple enjoyed a fortnight's trip to the Thousand Islands and Montreal. Our congratulations are extended to Mr. and Mrs. Coles.

PUBLICATIONS.

The initial number of the Electrical Journal, to be published monthly by Geo. P. Lowe, at San Francisco, has reached our table. It bears evidence of careful and efficient editing and management, and will we trust meet the expectations of the publishers.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

NOTE.—Secretaries of the various Associations are requested to forward to us matter for publication in this Department not later than the 20th of each month.

TORONTO ASSOCIATION NO. 1.

THE above Association at its last regular meeting elected the following officers:—Pres., Bro. Lewis; Vice-Pres., Bro. S. Thompson; Rec.-Secretary, Bro. T. Eversfield (by acclamation); Fin.-Secretary, Bro. Butler; Treasurer, Bro. A. M. Wickens; Conductor, Bro. Mose; Doorkeeper, Bro. Slute; Co Secretary, Bro. Huggett; Trustees, Bros. Fowler, Phillip and Huggett.

MONTREAL ASSOCIATION NO. 1.

Montreal, No. 1 has recently elected the following officers: President, John J. York, (re-elected); First Vice-President, J. Murphy; Second Vice-President, W. Ware; Secretary, B. A. York; Treasurer, Thomas Ryan, (re-elected); Financial Secretary, H. Nuttal, (re-elected); Corresponding Secretary, H. Thompson; Conductor, P. J. Mooney, (re-elected); Doorkeeper, W. McHalpin; Trustees, John H. Garth, George Hunt and J. G. Robertson.

HAMILTON ASSOCIATION NO. 2.

At the regular meeting of the above Association held on the 21st June, the following officers were elected for the ensuing term: President, E. C. Johnson; Vice-President, W. R. Cornish; Corresponding Secretary, Wm. Norris, (acclamation); Financial Secretary, A. Nash, (acclamation); Treasurer, W. Nash, (acclamation); Conductor, Wm. Jones; Doorkeeper, A. Vollick, (acclamation); Trustees, P. Statt, R. Mackie, R. C. Pettigrue.

The Corresponding Secretary reports the Association to be in a flourishing condition, and much interest is taken in the meetings by the members.

J. F. Philbir, of Rat Portage, was recently killed by coming in contact with an electric wire.

Mr. Wm. Johnson, of Belleville, has been appointed divisional inspector of the district for electric light.

A brick-maker named Harry Dent, of Bracondale, was recently killed on the Toronto and Suburban Electric Railway.

A movement is on foot for the construction of a telegraph line from the 150 mile house to the Forks of Quesnelle, B. C.

Forty men employed on the Springbank section of the London Electric Railway recently struck for an advance in wages.

Five directors of the Bell Telephone Co. have recently been engaged in a tour of inspection of the lines in the eastern townships of Quebec.

Mr. P. R. Randall has applied to the Township Council of Hope for permission to construct an electric railway on a portion of Rice Lake gravel road.

The Toronto Mineral Wool Manufacturing Co. has been incorporated, with a capital stock of $24,000, to manufacture mineral wool and boiler coverings.

Canadian patents have recently been granted to Mr. F. S. Smead, of Montreal, for a gas engine, and to Mr. W. J. Still, of Toronto, for an electric motor.

Work has been commenced on the extension of the Outremont branch of the Montreal Park & Island Railway. The extension will be double tracked and will be three miles in length, extending from the present terminus at Cote des Neiges to Westmount.

Mr. John A. Seely, of the firm of Beldon & Seely, New York, was recently in Montreal and accompanied Mr. Corraveau over the Montreal Park & Island Railway. Mr. Seely considers there is a splendid future for electric railways on the Island of Montreal.

The contract for supplying the ties and trolley poles for the electric railway at London, Ont., has been awarded to Messrs. Kernahan, Webster & Ferguson, of that city. About 40,000 cedar ties and 1,500 trolley poles be required. The trolley poles must be not less than 30 feet in length.

The first transmission of electrical power generated by the monster dynamo of the Niagara Falls power house took place on June 28th, when power was transmitted to the Pittsburg Reduction Co. The test was eminently successful. It is understood the amount of power transmitted exceeded 2000 horse power.

Letters patent have been issued incorporating the Dominion Electric & Manufacturing Co., with a capital of $50,000, and headquarters at Montreal. The applicants are: Messrs. C. F. Sise, Robert McKay, Hugh Paton, J. R. Thibaudeau, Robert Archer, C. P. Sclater and L. B. McFarlane, all of Montreal.

Mr. F. S. Pearson, of the Dominion Coal Co., who is also interested in the Halifax electric street railway, states that all the material for the road has been contracted for with the exception of the cars. Active work on the construction will commence this month, and part of the road will be in operation in August. The electric power station will be equipped with the latest improved machinery.

SPARKS.

Mr. John Childerhose is installing an electric light plant at Eganville, Ont.

The Kingston & Gananoque Electric Railway Co. has obtained incorporation.

The new electric cars for the Kingston electric railway will seat sixty people.

The Brantford Electric and Power Co. are offering for sale 80 bonds of $500 each.

The Canada Paper Co. are installing an electric light plant at Windsor Mills, Que.

The large lumber mill now being erected at Whitney, Ont., will be lighted by 300 electric lights.

The prospect is said to be favorable for the construction of an electric street railway at Barrie, Ont.

The owners of the Jeffery mine, Danville, Que., are seeking a franchise to run electric cars from the mine to the depot.

The village of Aylmer, Que., is considering a proposition from Mr. Conroy to light the streets of the town by electricity.

A survey has been made of the site for the power house of the Consolidated Light & Tramway Co., New Westminster, B. C.

The City Council of Quebec have accepted Mr. Beemer's proposition to construct an electric railway along the streets of that city.

The Canadian General Electric Co., of Peterboro', have just completed the second car for the Galt and Preston Street Railway.

The Selkerk Electric Co., Ltd., Selkerk, Man., has applied for letters patent to increase the capital stock from $10,000 to $25,000.

The earnings of the Toronto Street Railway for the month of June last are said to be $2,400 below that of the same month last year.

The Montreal Street Railway Co. will run a night service of refrigerator cars between the cattle market, the abattoirs and the meat market.

Work has been commenced on the extention of the Mimico Street Railway to Long Branch. Grading and tie laying are being proceeded with.

The town of Berlin, Ont., has granted the Bell Telephone Co. a five years' franchise in return for a free fire alarm system and three telephones.

The bill empowering the Thousand Island Railway Co. to construct electric lines from Gananoque to Kingston and Brockville is said to have been dropped.

Mr. George C. Robb, chief engineer of the Boiler Inspection and Insurance Co., has recently made a favorable report on the boilers in the City Hall, Hamilton.

The electric light contract between the town of St. Marys, Ont., and Mr. L. H. Reesor expires this fall, and a special meeting of the council is announced to discuss the making of a new contract.

The long-distance telephone line between Toronto and Montreal is expected to be completed about the end of September. The length of the line will be about 400 miles, which will be the longest in Canada.

General Riley, Consul General at Ottawa, has obtained a charter on behalf of an American syndicate to build an electric road about twenty miles in length, in the province of Quebec, from St. Rami to Napierville.

The ratepayers of the village of Huntingdon, Que., have granted a franchise to the Stadacona Water, Light & Power Co. for the construction of an electric light system. The work is to be completed by November 1st next.

At a recent meeting of the directors of the Bell Telephone Co. of Canada, Mr. Robert Mackay was elected vice-president and Mr. Charles Cassels a director, to fill the vacancy on the Board caused by the death of Mr. Geo. W. Moss.

Mr. Forsyth, projector of the Hamilton Radial Electric Railway, is said to have been successful in financing his scheme, and surveys of the line from St. Catharines to Schaw station, on the C. P. R., and to Toronto, have been completed.

The Executive Committee of the Toronto City Council has recommended that the tender of the Toronto Electric Light Co. be accepted for lighting the streets for five years, from January 1st, 1896, at 20½ cts. per light per night, or $78.81¼ cts. per light per annum.

Herbert Cottrell, Newark, N.J., has received a United States patent and a Canadian patent on a telephone without electrodes, which operates on the principle of an electrical shunt, having a path of high resistance and of low resistance, whereby the necessary variations in the current may be produced.

An electric crossing alarm, invented by Mr. John Phillips, has been used by the Grand Trunk Railway at Brockville, and is said to have given satisfaction. Mr. Phillsps is engaged in making improvements on it, which will cause a bell to ring automatically from the time the train comes within 40 rods of the crossing until it has passed.

The incorporation is announced of the Niagara Falls Electric Street Railway Co., the capital stock being placed at $125,000. The company is composed of Messrs. Alex. Manning, Hume Blake, Z. A. Lash, and P. A. Manning, of Toronto, and Mr. Chas. Black, of Welland. It is proposed to operate an electric street railway within the limits of Niagara Falls, and to build works for the production and distribution of electricity for light, heat and power.

Several changes have recently been made in the staff of the St. John Street Railway. Mr. C. D. Jones, superintendent, and Mr. A. R. Bliss, electrician, have retired from the service of the company, and Mr. H. Brown, electrician of the old Gas and Electric Light Co., becomes electrician of the railway. The office of superintendent has been abolished.

Mr. G. H. Campbell, manager of the electric street railway at Winnipeg, has recently let contracts for extensive improvements to the railway system. Some of the machinery has already arrived, and is being installed by a staff of experts. The power house is to be extended by a large addition, which will have brick walls and iron roof, absolutely fire proof. A large chimney 150 feet high will also be erected. These improvements will cost upwards of $60,000.

Mr. W. M. Kyle, of Toronto, is said to be interested in a scheme for the construction of an international electric railway belt line at Niagara Falls, Ont. The trolley line will start from the foot of Bridge street, and extend to the old horse car line in Drummondville. It will then run along Lundy's Lane to Falls View, back over the route of the old line to the Michigan Central Railway station, thence down the hill to the Canadian end of the Suspension Bridge. Mr. Kyle states that the r[illegible] of way for the Canadian portion of the road has been secured.

Col. Lazier and his associates of the Belleville Traction Co., have commenced active operations in the construction of the road. The Canadian General Electric Co. have been awarded the contract for the cars and the entire electrical apparatus. The generating plant will consist initially of a 100 Kilowatt generator, and the total road will start up with three motor cars equipped with C. G. E. 800 motors and type K controllers. The overhead construction will be of the usual type, the Belleville people seeming to have for the present at any rate, abandoned the idea of utilizing the E. M. system, regarding which they were somewhat enthusiastic about a year ago.

TRADE NOTES.

The J. C. McLaren Belting Co., of Montreal, have been granted incorporation.

The Bennett & Wright Co., of Toronto, have been incorporated, to manufacture boilers, furnaces, etc. The capital stock is placed at $98,000.

The Amherst Boot & Shoe Mfg. Co. are building a power house and will put in a 40 horse power Robb-Armstrong engine and Monarch Economic boiler.

Messrs. Ahearn & Soper, of Ottawa, representing the Westinghouse Company, have been given the contract for the overhead construction of wires, etc., for the Belleville electric railway.

The Victoria Granite Co., of St. George, N. B., has ordered a Robb-Armstrong automatic engine and a Monarch economic boiler from the Robb Engineering Co., of Amherst, N. S.

The Golden Lode Mining Co., of South Uniacke, N. S., has recently put in a duplex compound condensing pump of the Northey pattern. This pump will deliver water from a vertical depth of 400 feet.

The Canadian General Electric Co. have been awarded the contract for the entire electrical equipment of the re-organized Halifax Street Railway system. The motors will be of the usual C. G. E. 800 type with type K controllers.

The dissolution is announced of Messrs. Roe & Graham, manufacturers of water wheels, mill machinery, etc., Ottawa, Ont. Mr. Roe retires and the business will be continued by Mr. Robert Graham, whose announcement appears in our advertising pages.

Mr. R. Anderson, of Ottawa, recently placed the following motors, viz: One 5 h.p. motor for the Ottawa Electric Plating Works; one 1 h.p. motor for the Carling Brewing Co.; one ½ h.p. motor for O. Robert; one 1 h.p. motor for Batterton Bros.; one 1 h.p. motor for Frotheringham and Popham, stationers.

Allgemeine Elektricitats-Gesellschaft (The General Electric Co.), Berlin, Germany, has recently issued a handsomely illustrated catalogue, having reference to the overhead trolley system for street railways, and containing descriptions of important roads equipped by this system. The agents for this firm in Canada are Munderloh & Co., of Montreal.

In commemoration of the 4th of July, the American Electrical Works, of Providence, R. I., of which the Eugene F. Phillips Electrical Works, Montreal, is the Canadian branch, sends out to its friends a miniature skyrocket, in which is inclosed a small American flag accompanied by this sentiment: "Our best wishes that the day may be an enjoyable one to you. There is but one American flag and but one American Electrical Works."

Last week our representative called at Mr. David Starr's comfortable offices in the Board of Trade Building, Montreal, and was pleased to find him doing a very good business as consulting engineer and general electrical contractor. Mr. Starr has a number of good things on hand, and has been quietly, for the past year, working up a very good business. His long connection as general agent of the Royal Electric Co., has made him conversant with the trade all over Canada as well as the United States. He has a number of clients, in the way of central stations, etc., that he buys for exclusively, and who pay him a brokerage. A visit was also paid to Mr. Starr's repair shop, where he is employing a number of expert armature winders, and has a lot of work on hand, consisting of repairs to generators of different systems. His factory is specially fitted up for re-winding the Thomson-Houston arc dynamos.

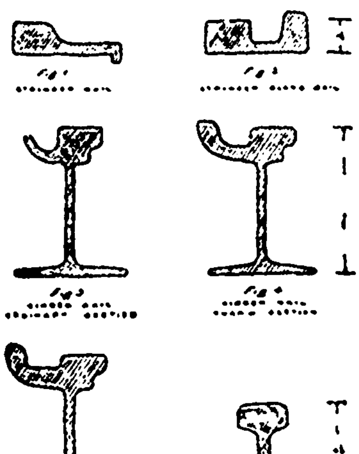
ELECTRIC RAILWAY DEPARTMENT.

SPECIAL TRACK WORK FOR ELECTRIC STREET RAILWAYS, ESPECIALLY REFERRING TO THE MONTREAL AND TORONTO SYSTEMS.*

By E. A. Stone, Ma.E., A.M. Can. Soc. C.E.

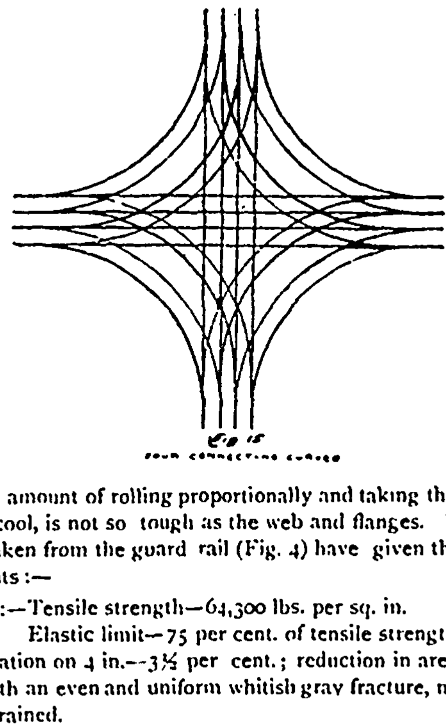
Special track work should be good substantial construction, with the greatest care paid to the designing of the parts which wear most rapidly. It is most important that track, especially in the central parts of a city, should require renewal as seldom as possible, for such renewals are very expensive, apart from the actual cost of the new track work, as traffic is interrupted, causing great inconvenience and sometimes loss of business to the public, and generally demoralising a whole route of cars, and sometimes the greater part of the entire system. Special work should be made in such a manner as to cause the least possible obstruction to vehicles, no part rising above the level of the paving more than is avoidable; the necessary recesses, grooves, etc., should be as narrow and shallow as possible, to prevent wheels of vehicles from catching. Flat surfaces should have a rough top, to prevent horses from slipping upon them. All pieces should be finished so as to facilitate the paving, no long, unnecessary projections being left on bolts, etc. The curves should be of as great a radius as the width of the streets will allow. The sharper the curve the greater is the wear on the track and wheels of cars, the slower the rate of motion, the more power required to drive the cars, the more uneven the motion and the greater liability to derailment.

The track may be made on longitudinal stringers, on cross ties, or directly on concrete with tie bars connecting the rails. The old tracks of strap rail were laid on stringers, and the rail generally called stringer rail. (Figs. 1 and 2.) The greater part of the new construction is laid on ties, and in many respects is similar to steam track work. A combination of these two methods, consisting of planks laid longitudinally on cross ties, in order to give a more even surface, has been tried, but the results do not seem to have been so satisfactory as were expected. In several streets in Montreal where permanent paving has been laid, the rails have been laid directly on concrete, and bound



together by flat tie bars with threaded ends and double nuts. This, with the concrete between the ties, and paving, makes a very solid bed; however, it does not seem to have so much elasticity as track laid on ties in macadam.

The rails used in Toronto and Montreal are "Girder" rails. Those first laid had have a height of 6½ in. with a flange of 4½ in., while those laid later are 6⅝ in. high with a flange of 5 inches; the web of the rail is not directly below the centre of the head as in the "Tee" rail, but nearer the gauge line, while a flangeway 1¼ in. wide at the top is provided for by a projecting lip. These rails average 75 lbs. per yard. This type of rail (Fig. 3) is used on all straight pieces and outside rails on curves in the special work; the inside rails are made of a section very similar to this, the principal difference being that the lip is much heavier, being one inch in width at the top and rising 5-16ths in. above the level of the head of the rail; this provides an efficient guard for the cars in running round a curve; the groove is ⅛ in. wider than in the ordinary girder rail. This rail weighs 84 lbs. per yard. (Fig 4.) Another section (Fig. 5) is, however, coming into use, and will no doubt largely replace these sections for special work; it is the same as the guard rail section, except that the groove is filled up with solid metal to within 9-16ths in. of the top of the head, thus providing a double bearing for the wheels, as both flanges and treads of wheels rest on the metal, so that the cars pass over all points without jolting, and the wear on the least durable parts of special work, viz., points, is greatly diminished. This section gives a rail of 89 lbs. to the yard. (Figs. 1 to 6.) The peculiar sections of these rails, with their thin flanges and webs, and much thicker heads, cause a variable amount of toughness in the section; the head having received



the least amount of rolling proportionally and taking the longest time to cool, is not so tough as the web and flanges. Tests on pieces taken from the guard rail (Fig. 4) have given the following results:—

Head:—Tensile strength—64,300 lbs. per sq. in.
Elastic limit—75 per cent. of tensile strength.

Elongation on 4 in.—3½ per cent.; reduction in area—2 per cent., with an even and uniform whitish gray fracture, moderately fine grained.

Web:—Tensile strength—91,250 lbs. per sq. in.
Elastic limit—75 per cent. of tensile strength.

Elongation of 4 in.—27 per cent.; reduction in area—20 per cent., with a fine grained light gray fracture.

The necessity for the increase in the weight of the new rails over the old is made apparent when it is considered that the weight of a motor car averages about 6 tons, while the weight of the old horse cars averaged only about two tons, and whereas horse cars run at the rate of about 6 miles per hour, electric cars frequently have a speed of 15 miles per hour. Tee rail (56 lbs.) is also used lately for this work, but its use is generally confined to macadamised roads in the suburbs, as its height is not suitable for paving purposes (unless raised on chairs), although otherwise quite as efficient. (Fig. 6.) The girder rail being so high admits of block paving, and by the lip on the inside provides a good edge for the pavers to work to, whilst the narrow groove offers a very slight hindrance to vehicles.

In tee rail special work, the inside rail on curves is generally guarded by a second rail being bolted to it, the two rails being held apart by cast iron filling pieces; the space between these rails is afterwards filled with cement to within an inch from the top, so as to cause as little obstruction to traffic as possible; the guard rail is slightly elevated above the running rail. Frequently rails are used in paved streets of insufficient height to admit of a paving block between the ties and the head of the rail; when this is the case, the difference in height has to be made

* Abstract of paper presented before the Canadian Society of Civil Engineers.

up by the use of chairs; this leads to rather complicated joints, and requires a longer time to lay than the method of direct spiking to the ties.

MAIN DIVISIONS OF SPECIAL WORK.

Special work may be divided into four classes considered with respect to its use and position when in place, viz.: Intersections, passing sidings, crossovers and turnouts, and miscellaneous combinations.

1. INTERSECTIONS.—By the term intersection is meant the special work placed at the intersection of two or more streets, and may assume an almost endless variety of forms as regards number and direction of curves and the alignment of the main tracks. The work must be so constructed as to guide the cars in whatever direction required, without any other external assistance than the moving of the tongues in the switches by the motor men; the cars must ride as smoothly as possible, i. e., there should be no jolting; in places where a groove is to be crossed that would cause the car to run unevenly, the floor should be raised so as to give a bearing on which the flanges may run. On double track lines the distance between tracks is usually from four to five feet, but in order that cars may pass one another on the curves, and not be obliged to wait at the ends, this distance is increased to about seven or eight feet to provide ample clearance; this extra width is obtained by striking the curves from different centres, i. e., the curves are not concentric. The practice in Montreal and Toronto has generally been to make the inner and outer curves of the same radius when the apex angle has been nearly 90°, but when the angle varies greatly from a right angle, the outer curve has generally been made sharper than the inner when running round the obtuse angle. When the centre line of street changes direction, or has a "jog" at the intersection, necessitating a plain or reverse curve on the through tracks, the complications increase very rapidly.

2. PASSING SIDINGS.—These are used on single track lines when cars run in both directions; they may be divided into two classes, viz., diamond and thrown-over sidings.

In the diamond siding (Fig. 16) the track diverges like a Y at either end, so that the centre line between the tracks in the sidings is on line with the centre line of the single track; this is the form usually adopted on single tracks running through narrow streets. If it is desired that cars should run either to the right or left at these points, the switches of the sidings must be provided with movable tongues; but if the cars always run in the same direction, they may be guided in the direction required by a movable tongue held to the proper side by a spring, so that a car facing a switch is always guided to the same side, and a car trailing it compresses the spring, and passes on, the tongue of the switch falling back to its proper position. (See plate Fig. B.) This guiding of the car in one direction, however, may be provided for much more simply by means of a switch without any movable part, commonly called a blind switch. One side of the switch is straight and the other curved; the front of the switch coincides approximately with the end of the curve of the switch, whilst the curve to the opposite side begins near the back of the switch, as shown in Fig. 18. If the cars always run to the right (as in Montreal and Toronto) the switch is made left hand, i. e., the p. c. of the curve turning to to the left is in front of the p. c. of the curve turning to the right by the length of the switch (approximately); thus a car approaching the siding travels straight along on the tangent past the point of the switch, and is then curved out of its path to the side by the curve in the rail behind, and when leaving the siding runs over the curve of the switch; this is the best arrangement for such sidings, as it is the simplest, most durable, and causes least delay to the cars.

In the thrown-over siding (Fig. 17) one track is continued straight through, whilst the other is thrown over to one side of it; this is suitable for single track lines on a side street, or in places where the track is on one side of the street. If cars are to be run to either side, switches with movable tongues are necessary; but if the cars always keep to the same side, the tongues must be provided with springs, or blind switches used. With the latter the problem is not so simple as in the diamond siding, and in order to solve it the main track has a slight reverse curve placed in it extending from the first of the switch to a short distance inside the curve cross; by introducing this, the general arrangement for the diamond siding holds good. (See Fig. 19). The radius for the curves of passing sidings in Montreal and Toronto is 300 feet to inside gauge line.

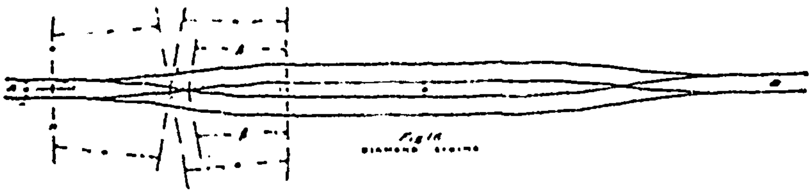


Fig. 16
DIAMOND SIDING

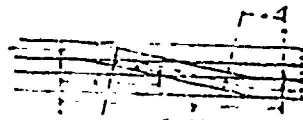


Fig. 20

Fig. 22
RIGHT HAND TURNOUT

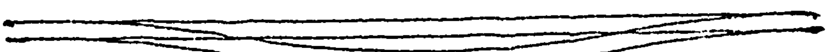


Fig. 17
THROWN OVER SIDING

3. CROSSOVERS AND TURNOUTS.—Crossovers (Fig. 20), sometimes called connecting tracks, are used on double track lines for the purpose of transferring cars from one track to the other, and consequently are placed at the terminations of regular routes and at points which are made temporary terminii to accommodate special traffic.

Turnouts (Fig. 22) are used when a double track runs into a single track, the centre line of the single track being on line with the centre line of one of the tracks of the double track line.

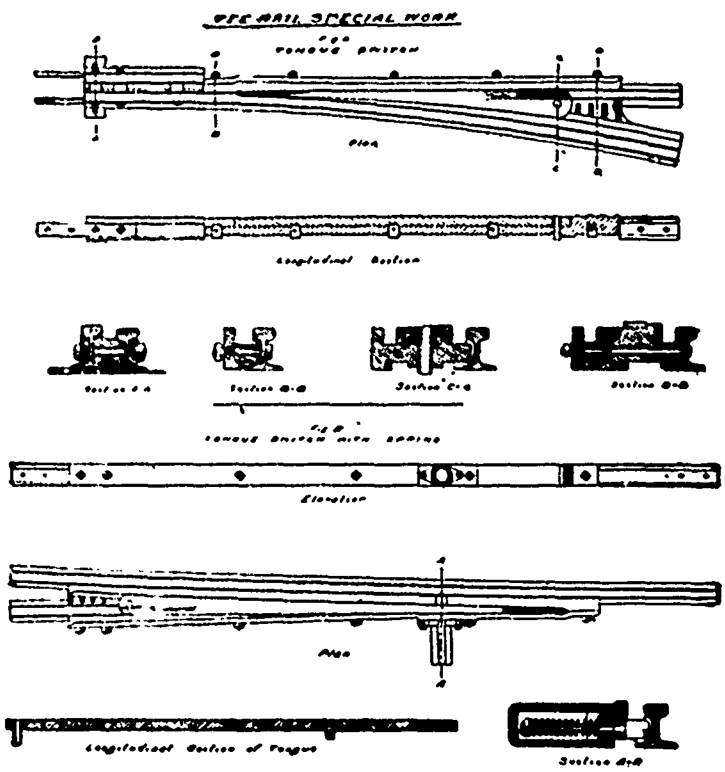
These crossovers and turnouts, as well as all special work, should change the direction of the car's motion from one line into another with the least amount of resistance possible consistent with the date given; those in Montreal and Toronto have 75 feet radius curve and about 25 feet of tangent, the latter varying with the distance between tracks; this gives a crossover of about 60 feet between extreme ends of switches. Crossovers and turnouts are said to be either left or right hand, according to the direction in which they curve from the track, as seen from the switch when looking towards the cross. Fig. 20 shows a right hand crossover. If a crossover of either hand is suitable at a certain point of the line, one of the same hand as the side to which the cars run should be chosen, i. e., right hand crossovers are preferable for systems on which the cars run to the right and left hand, or those in which the cars keep to the left; this is on account of the fact that cars running always to the right will trail all switches of right hand crossovers and face those of left, so that they cannot possibly take the wrong track in the first case, while they may be suddenly thrown out of their course in the second, and accidents result.

Fig. 18

Fig. 19
THROWN-OVER SIDING WITH BLIND SWITCHES

In addition to permanent crossovers it is always necessary to have temporary ones during construction, which are laid directly on top of the paving wherever required. These are so constructed as to be easily and quickly laid in place and readily moved from one part of the line to another by a small gang of men.

4. MISCELLANEOUS COMBINATION.—Besides the work already mentioned, there are several kinds of diamonds made to fill various requirements. There are also special combinations for car houses, etc. The simplest kinds of diamonds are those used when electric lines cross electric lines, and only require the running rails. When an electric road crosses a steam road, the steam road track requires guard rails for greater safety, and the electric line should also be guarded either by an additional rail or plate.



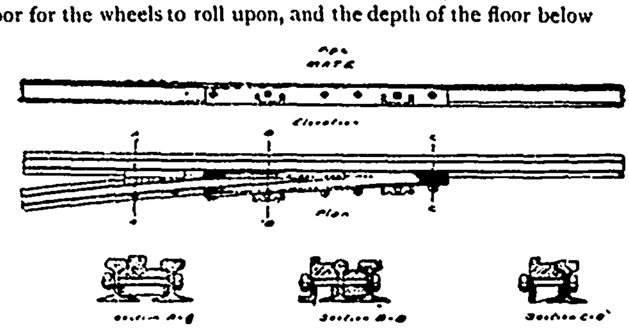
SUB-DIVISIONS.

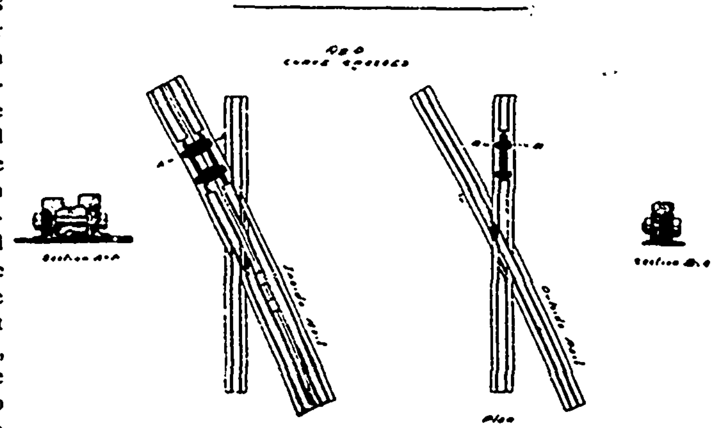
Intersections, cross-overs, etc., are composed of several pieces, which may be divided into the following sub-divisions, viz.:—Tongue switches (single and double curve), blind switches, mates (single curve, double curve and combination), curve crosses (single curve, double curve and combination), diamonds (for electric and steam crossings), split switches, stub switches and lengths of rail (curved and straight). (See accompanying illustrations).

1. TONGUE SWITCHES.—The tongue switch is perhaps the most important piece in any combination of special work, as it is subjected to greater and more frequent shocks than any other piece, its duty being to change the direction of the car's motion from one line to another. When made of girder rail, it is constructed of the guard rail section to ensure the perfect guidance of the wheels. When made of tee rail, a guard is formed either by bolting on another piece of rail, or by carrying up the casting on the side to form the required guard. The switch generally consists of four main parts, viz.:—the tongue, a casting and two pieces of rail. The tongue is made of steel, and should be of a substantial size, having a cross section near the point, proportioned to resist violent shocks; at the same time the point must be rather sharp to ensure the car "taking" it exactly; if blunt, the car may mount the tongue, and drop again, causing a severe jolt. If the top of the tongue rises above the level of the head of the rail, it is sloped at both ends so as to allow the rise and fall of the car to be imperceptible. The pin must be so placed as to make it impossible for a wheel to touch the tongue behind the pin, and so throw the switch before the back wheels have reached the point. If the tongue were made so long that the distance from the centre of the pin to the tongue point were greater than the wheel base of the cars (about 7 feet), this would be impossible; this method, however, would necessitate a too expensive switch, and the difficulty is easily overcome by rounding the back of the tongue and placing the pin sufficiently far back. The pin should also be placed so that the wheels do not run over it, and so cause it to become loose, and should be so fastened to the casting that the tongue may easily be removed at any time. The top of the casting on which the tongue slides and the bottom of the tongue should be truly even, as if not, dirt will collect between the two, and after a short time the tongue will tilt when a car runs over it, and may cause the tongue to throw to the opposite side, or the back wheel may strike the point, either of which may be sufficient to throw the car off the track. Single curved switches are those curved only on one side; double curved switches are curved on both sides.

2. BLIND SWITCHES.—The blind switch is used in place of the tongue switch when cars always run off the curve at that point and never enter it. It closely resembles the mate in general construction. In order that the guidance of the car facing the switch may not altogether depend on the fact that the car will naturally take the straight track in the direction in which it is moving, rather than turn into the curve, a ridge is left along the floor on the straight track which acts as a gauge line, to make it practically impossible for the car to enter the curve.

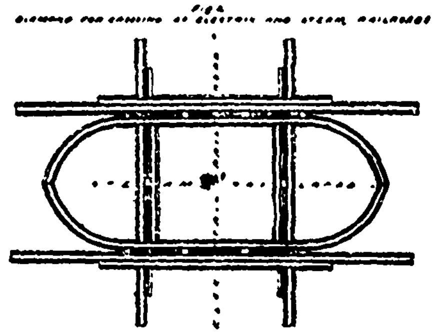
3. MATES.—The mate is the piece opposite the switch, on which the wheels of one side of the car run while the wheels on the other side are being pulled around by the switch; its sole use is to provide a surface for the wheels to run upon, and has nothing to do with the change in direction of the car's motion. It is made of two pieces of rail, and sometimes there is a casting. One piece of rail extends over the whole length, and is straight if for a single curve mate, and curved if for a double curved mate; the other piece is shorter and always curved, the head terminating in a point; this point should be so designed that the gauge at the point is quite slack, so that a wheel facing the mate may not strike upon it. The width of the point should not be less than ½ inch, as if made sharper it will wear to this. In girder rail the solid floor section makes the best mate, as it provides a wide floor for the wheels to roll upon, and the depth of the floor below





the head of the rail being less than the depth of the flange of the wheel, it quickly wears so as to provide a double bearing for the wheels, so that the point is passed without the wheels dropping heavily upon it. If the mate is not made of the floor section, but of the ordinary girder rail as used on the straight track, or if of tee rail construction, a steel casting is necessary to carry the wheels over the point from the long rail on to the short one; this casting is more efficient if carried up on the inside to provide a guard; for in case of the gauge being too slack, the tongue may have a tendency to jerk the car off the track. This casting must project considerably inside the gauge line of the short rail, the path of the rear wheels on a truck not coinciding with that of the front ones, but lying about ½ inch inside, as may be clearly seen on any worn mate.

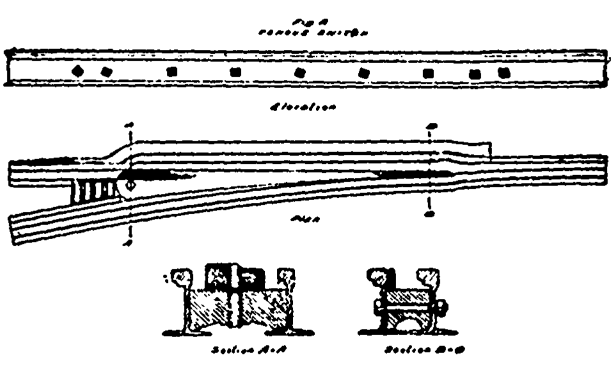
4. CURVE CROSSES.—Curve cross is the name given in this work to the piece corresponding to the frog in steam railroad work; it differs considerably from the frog, however: one, at least, of

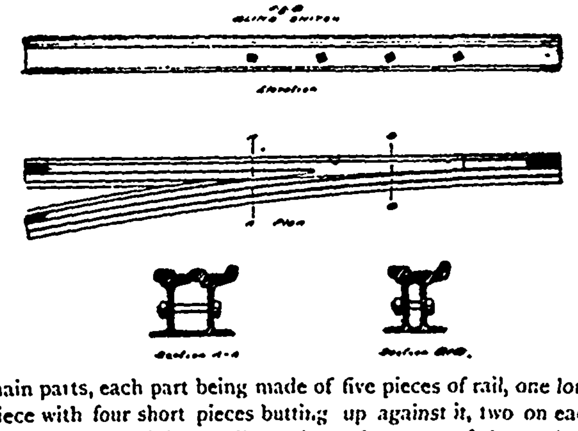


the rails in a curve cross is generally curved to a very sharp curve, whilst the frog is straight on either track; the frog has wing rails, and a wheel crossing a frog runs from one piece of rail across the channel on to another rail, whilst in the curve cross a wheel generally runs the entire length of the cross on one piece of rail, the channel for the flanges being shaped out of the head of the rail. According as one or both rails are curved, the cross is said to be a single or double curve cross.

5. DIAMONDS.—Diamonds are made in various ways, according to the requirements they are to serve. A simple single track diamond for the crossing of two electric lines consists of two

GIRDER RAIL SPECIAL WORK



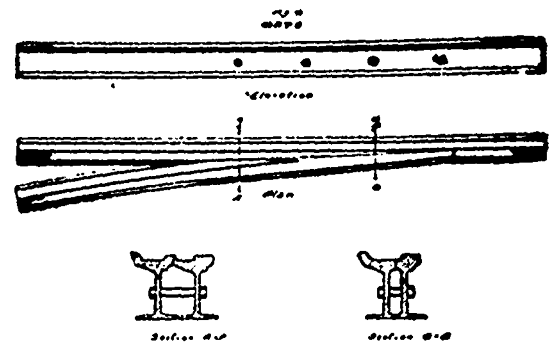


main parts, each part being made of five pieces of rail, one long piece with four short pieces butting up against it, two on each side; the long rail is usually made to form part of the track on the street having the greater amount of traffic. When an electric road crosses a steam road, the diamond is usually all made of tee rail, of the same section as the rail of the steam road. If the rails of the steam road are not to be cut, the diamond is made of three parts (Fig. E), two outside and one inside the steam track, the whole being so constructed as to lift the street car before reaching the rails of the steam track on to the flanges of the wheels, and running across on them to the other side, and then dropping gradually to the ordinary level again, so that the only place where any jolt can occur to a car while crossing such a diamond is when it crosses the channel of the steam track rails, notwithstanding the fact that the rails of the steam track are not cut to the smallest extent to provide a passage for the flanges of the street-car wheels.

6. SPLIT SWITCHES.—Split switches are used to a comparatively small extent on this class of work. They are more especially adapted to suburban traffic when tee rail is used, rather than crowded thoroughfares of cities. They are especially suitable when cars always run to the same side, when the switch may be made to work automatically by means of a spring, and in this way have been found very satisfactory.

7. STUB SWITCHES.—Stub switches are suitable for yard purposes and sidings only occasionally used; they are cheap, which is always a point in their favor. The use of a stand prohibits their use in city thoroughfares.

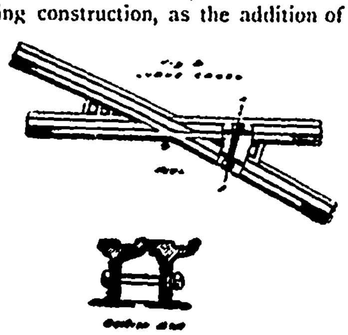
8. LENGTHS OF RAIL.—Rails for all special work should be ac-



curately cut to the required lengths, and carefully bent to the proper template if for use on a curve, or accurately straightened if required for straight track. If part of a rail is to be straight and the remainder curved, the rail must not only agree with straight edge and template for the required lengths, but it must be tested, to determine whether the straight part is tangent to the curve, for if not, the piece will not fit correctly when placed in the work of which it forms part.

THE DETERMINATION OF NECESSARY SPECIAL WORK.

Having laid down the routes of any street railway system necessary for the accommodation of the present traffic and that of the near future, the special work required becomes apparent. It is most important that curves likely to be required in a few years, but not necessary at the present, should be laid, if at all possible, during construction, as the addition of a single curve



19

to an intersection in some cases necessitates the reconstruction of the greater part of the whole intersection.

SURVEYS.

A careful survey must be made of the intersection of streets requiring special work, and all measurements of lines and angles taken which are necessary to plot with the greatest accuracy the centre lines of the proposed tracks together with the street and curb lines.

These measurements are plotted to a suitable scale (say 10 feet to 1 inch), and the most suitable radii for the required curves determined, which are usually from 40 to 75 feet radius (45 and 50 ft. are most common in Montreal and Toronto.)

The attempt is sometimes made to ease these curves as on steam railroad work; but when it is remembered that the length of most of the curves is about 80 ft., it will be seen how limited the space is in which to attempt anything of the kind; however, an improvement may be introduced by making the switches at the ends of curves of a longer radius than the main part of the curves, such as using 75 ft. radius switches on 45 ft. radius curves; this eases the curves for 10 ft. at each end and meets all practical requirements; any further steps in this direction would seem to lean towards "hair splitting."

It might here be mentioned that although these curves would appear very sharp to engineers accustomed to steam railroad work, yet there is a case on record of a 50 ft. radius curve on a trestle being used on a steam railway, and operated successfully, the speed on it being from 8 to 10 miles per hour. (U.S. Military Railway, Petersburg, Va.; see Trans. Am. Soc. C. E. 1878.) The Manhattan Elevated Railway in New York city has curves of 90 ft. radius.

There should be, if possible, sufficient space between the inside rail of the curve and the curb stone for a vehicle to pass a car easily; this, however, requires very wide streets; if this can not be done, the rail should be at about two feet from the curb stone at the corner, for if at say four feet, there would not be sufficient room for a car and vehicle to pass, but the attempt might be made and an accident ensue. The radii of the curves should also be determined with a view to sufficient room for the switches; if this is not looked to, special short switches may be required, which is not desirable. The interesting points of the gauge lines should also be carefully observed, as by the slight alteration of a radius, combination pieces of complicated construction and of an unendurable character may often be avoided. The radii having been fixed, the gauge lines alone may be laid down to a large scale (say 4 feet to 1 inch), and the calculations proceeded with.

WORKING DRAWINGS.

Having completed the calculations for an intersection, the detail drawings for each piece are made, and sent to the shop, together with a print showing the whole intersection with the distinguishing marks of all pieces and lengths of the connecting rails. A drawing is also made for assembling the work in the street, showing all necessary measurements for laying out the work, together with the position and marks of the various pieces.

SHOP WORK.

A bill of the rails required and the necessary new prints and references to old ones having been obtained from the drawing office, the manufacture of the work may be proceeded with. The bill of rails required (made out so as to give a minimum amount of scrap) is given into the hands of the man in charge of the rail saw, who proceeds to cut up the rails into the required lengths, marking the length of each and whether required straight or curved upon the web. The rails next, with few exceptions, go to the rail bender, to be either curved to the required radius, or straightened; they next proceed to the "marker off," who carefully marks the necessary lines for all machine work required to be done upon them; he also stamps the rails on the end with their distinguishing marks; the rails afterwards pass on to the machines (milling machines, slotters, shapers, planers, etc.) suited to the work required; they then go to the fitting shop to be assembled according to the drawings.

In a tongue switch the long rail has to be properly curved, and slotted or bent for the tongue to fall into place. The tongue is made of hammered steel, and the turned pin is shrunk in; this is dropped into place, and all measurements checked before being considered ready for the track.

In the blind switch and mate, one rail is planed so as to leave a long notch on one side, while the other rail is planed to a point which fits into the notch; the two are strongly bolted or riveted together and sometimes finished on a planer.

The curve crosses have usually two pieces of rail, one of which has the upper part so shaped at the crossing point as to allow the second one to drop down on the first, and fit accurately into the place allowed for it; while the second has the lower part shaped so as to allow the first rail to pass through, the two rails jointing neatly into one another. Great care is necessary in the fitting to have the angles of the intersection exactly as required; in order to obtain the correct angle, the drawing shows the spread at a fixed distance, together with the deflections of the curves at that point; so that this distance is measured along the rails from the intersection point and the deflections marked from the gauge line; the spread is then measured between the points so marked.

CHECKING.

When an intersection has been made, it is sometimes advisable to have it assembled as a final check before shipping; for this purpose a large piece of ground, as level as possible, is required, and much more than is actually occupied by the work when in place should be available; the tangents of the intersection should be laid out, and a sufficient number of points fixed to actually check the end of each curve. Having laid out the ground, the pieces are assembled, and any errors observed may be corrected; this last step ensures the work being absolutely correct, and is the best check on the work that can be adopted.

ASSEMBLING IN THE TRACK.

In laying an intersection, it makes a great deal of difference whether the whole space required is graded at once and all traffic stopped, or if only part of the intersection is graded, leaving part undisturbed so as not to interrupt traffic. When the work has to be performed in the latter way, great care is necessary in placing the work, so that the remaining part when laid may fit up to and line accurately with the first part. If it is necessary to lay out a curve, it is generally most easily performed by tangent and chord deflections or by ordinates from a chord. In grading a corner, when an important intersection is to be laid, care should be exercised in excavating to the correct depth and having the grading done evenly, for if the track has to be lifted, say six inches, after being laid, it means very much more than the same lift on ordinary track, as the weight of rail is sometimes enormous as compared with the extent of ground it covers; also, if the work has been carelessly done, and presents a very uneven bed, much more time is necessary to couple up the joints than would have been required had the grading been properly performed. The spacing of the ties for this work should receive more attention than is sometimes given to it, as it is a very important matter. The ties should be the very best available, and spaced more closely than those on the straight track.

The centre lines of tracks for both streets are accurately fixed, and if there is no diamond, the ends of the curves must be found; otherwise this is not essential. If there is a diamond in the intersection, this is laid first, bolted up and lined accurately. The other pieces having been scattered about in their approximate positions, are next drawn to place and bolted together. The rails are then securely spiked to gauge, and lifted (if necessary) to grade, when the intersection may be paved and so completed. If there is no diamond to lay, an end of a curve may be taken as the starting point. To lay the intersection so as to have the through straight tracks in perfect alignment, requires great care, as the joints are usually very close together.

An idea of the amount of rail that may be used in a single intersection, and the consequent amount of labour required to make one, may be formed from the following figures, for one laid at the intersection of St. Lawrence, Main and St. Catherine streets, Montreal (same as Fig. 15). It is built of 75 lbs. and 84 lbs. girder rail (Figs. 3 and 4). It contains 2,150 feet of rail, and has a total weight of about 26 tons. There are 86 built up pieces (switches, mates and curve crosses), and 78 lengths of connecting rails, making a total of 164 pieces in the complete intersection. The extreme length between ends and opposite switches is about 110 feet. The radius of the inside gauge lines of all the curves is 45 feet, and the distance between tracks varies from 4 ft. to 8 ft. 6 in. This intersection, as well as all others in Montreal and Toronto, was made by the Canada Switch Manufacturing Co., Lim., of Montreal.

Such work, when properly constructed and laid, represents a large amount of capital, and deserves much more attention and care than the old cast iron work; but, unfortunately, it seems sometimes to be treated no better. The curves at intersections are necessarily very sharp, and in order to diminish the amount of power required and the wear on the rails (as well as on tires) they require oiling at least once a day for heavy traffic, while the rate at which cars run over special work should be strictly regulated to a low speed. The groove of the rail and the tongue switches require to be constantly cleared of the dirt which inevitably collects, and if not removed causes great inconvenience. The life of such work may be appreciably prolonged by such attention, and when one considers the cost of renewal and the consequent interference to traffic while doing so, it will be readily seen that it pays in the end.

SPARKS.

The Crossan Car Mnfg. Co., of Cobourg, are shipping two first-class passenger, two baggage and express cars to the Toronto, Hamilton and Buffalo Railway.

The Port Dalhousie, St. Catharines and Thorold Street Railway Co. have purchased additional equipments of the C. G. E. 800 type from the Canadian General Electric Co.

The Lundy's Lane Electric Street Railway Company has been incorporated, with capital stock of $50,000 in $100 shares, the promoters being H. C. Symmes, J. A. Lowell, J. G. Cadham, G. R. Symmes, all of Niagara Falls, and H. D. Symmes, of St. Catharines.

At the present time there are over 850 electric railways in the United States, operating over 9000 miles of track and 23,000 cars, representing a capital investment of over $400,000,000. In 1877 the number of such roads amounted to only thirteen, with scarcely 100 cars.

At a recent meeting of the stockholders of the St. John Railway Co., of St. John, N. B., the following directors were elected: James Ross, J. M. Robinson, R. B. Emerson, James Manchester, J. J. Tucker, H. P. Timmerman, C. W. Weldon, H. H. McLean and William Barnhill. At a subsequent meeting the directors elected James Ross, of Montreal, president; J. M. Robinson, vice-president, and James Warren, secretary and treasurer. Messrs. Ross, Robinson and McLean were named as the executive of the company.

After a series of delays caused by the inability of the City Council to come to a satisfactory basis of agreement with the London Street Railway Co. for the renewal and extension of their franchise, a satisfactory arrangement has at last been reached, and the electrical equipment of the road is being rapidly proceeded with. The contract for the entire electrical equipment has been awarded to the Canadian General Electric Co. The motor cars, 25 in number, will be constructed in the same manner as those running on the Wilson Avenue line in Cleveland, with cross benches and side aisle, with doors at the centre and rear end of the car, a footboard being provided running the entire length of the car. This latter feature has proved itself of considerable value in handling heavy crowds. The motor equipments for each car will consist of two C. G. E. 800 motors with type K-2 controllers. The entire system is intended to be in operation in time for the Western Fair in September.

MOONLIGHT SCHEDULE FOR JULY.

Day of Month.	Light.	Extinguish.	No. of Hours.
	H.M.	H.M.	H.M.
1......	P.M. 11.20	A.M. 3.30	4.10
2......	" 11.50	....	} 3.40
3......	....	" 3.30	
4......	A.M. 12.30	" 3.30	3.00
5......	" 1.30	" 3.30	2.00
6......	No light.	No light.	....
7......	No light.	No light.	....
8......	No light.	No light.	...
9......	P.M. 8.00	P.M. 10.30	2.30
10......	" 8.00	" 10.50	2.50
11......	" 8.00	" 11.10	3.10
12......	" 8.00	" 11.30	3.30
13......	" 8.00	" 11.50	3.50
14......	" 8.00	A.M. 12.10	4.10
15......	" 8.00	" 1.00	5.00
16......	" 8.00	" 1.00	5.00
17......	" 8.00	" 1.40	5.40
18......	" 8.00	" 2.30	6.30
19......	" 8.00	" 3.30	7.30
20......	" 8.00	" 4.00	8.00
21......	" 8.00	" 4.00	8.00
22......	" 7.50	" 4.00	8.10
23......	" 7.50	" 4.00	8.10
24......	" 7.50	" 4.00	8.10
25......	" 8.30	" 4.00	. 30
26......	" 9.00	" 4.00	7.00
27......	" 9.20	" 4.00	6.40
28......	" 9.50	" 4.00	6.10
29......	" 10.20	" 4.00	5.40
30......	" 11.00	" 4.00	5.00
31......	" 11.00	" 4.00	5.00
		Total,	146.00

Please mention the CANADIAN ELECTRICAL NEWS when corresponding with advertisers ...

CANADIAN GENERAL ELECTRIC CO.

(LIMITED)

Authorized Capital, $2,000,000.00.
Paid up Capital, $1,500,000.00.

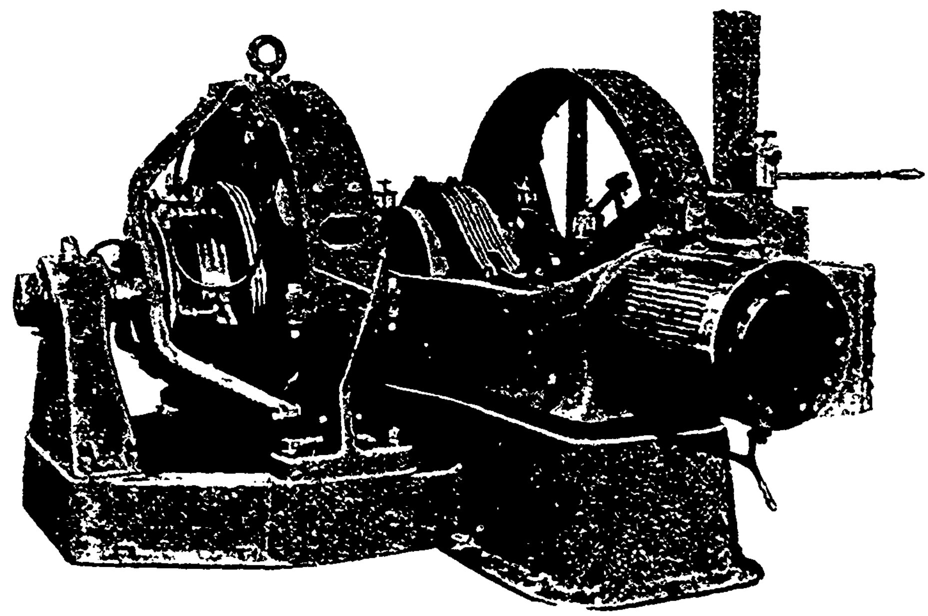
HEAD OFFICE:

65 FRONT STREET WEST, - - TORONTO, ONT.

BRANCH OFFICES:

1802 Notre Dame St. -	MONTREAL.	Main Street - -	WINNIPEG.
138 Hollis Street -	HALIFAX.	Granville Street - -	VANCOUVER.

Factories: Peterborough, Ont.



50 KILOWATT SET.

DIRECT CONNECTED GENERATORS

For Railway and Lighting Service

—MEAN—

Economy in Space
Economy in Power
Economy in Repairs

Sizes from 2½ to 1500 Kilowatt capacity.

SPARKS.

The electric light system at Windsor, Ont., is to be enlarged.

Mr. R. Anderson, electrical engineer, of Ottawa, is installing a plant of 600 incandescent lights at Vankleek Hill, Ont., for Col. Wm. Higginson. Mr. Anderson is also installing a 100 light electric plant for the Geo Matthews Co., Ltd., for their pork packing establishment at Hull, Que.

Mr. Geo. Gillies, of Gananoque, is said to run the only electric welder in Ontario. Power is supplied by the Gananoque Electric Light and Power Co. The articles to be welded are placed end to end in grooves suitable to their shape; two clamps come down fitting on the articles to be welded, which form the connecting link between the clamps and the copper plates underneath A lever turns on the current and at the same time presses the articles together, and the welding is done almost simultaneously. Articles to the weight of eight pounds can be welded on this machine.

The Ottawa Electric Co., of Ottawa, Ont., are putting in an additional 240 k. w. alternator in their steam power station, where they already have two others of the same power, supplied by Ahearn & Soper. They are also putting in a 200 k. w. D. C. 500 volt generator for stationary motor service, and are engaged in remodelling their motor circuits so as to obtain better distribution. Their workshop is busy in the construction of a large switchboard, which will be 57 feet long, entirely fireproof, and constructed on modern principles. It will be placed in power house No. 1, late of the Standard Co., which will remain the distributing station. The generators in the other stations will be connected to this switchboard, and will be run at the accustomed voltage, the regulation being done at the central station. This company is at present installing a private fire alarm system connecting their stations, work shop and offices with the fire stations in their districts. The above changes were all designed by Mr. A. A. Dion, general superintendent and electrical engineer for the company, and are being carried out under his supervision by Messrs. J. Murphy, superintendent of power stations, W. G. Bradley, superintendent of construction, and W. H. Baldwin, hydraulic engineer. The company are sparing no pains or expense in making improvements so as to maintain a high standard of efficiency throughout the service. Eighty motors aggregating 350 h. p are supplied with power by this firm, and 450 arc lights and 48,800 incandescent lamps are supplied with light.