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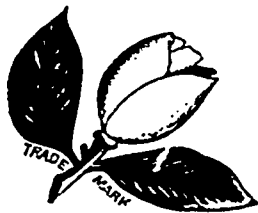
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STEAM ENGINEERING JOURNAL

OLD SERIES, VOL. XV.—No. 6.
NEW SERIES, VOL. IV.—No. 8.

AUGUST, 1894

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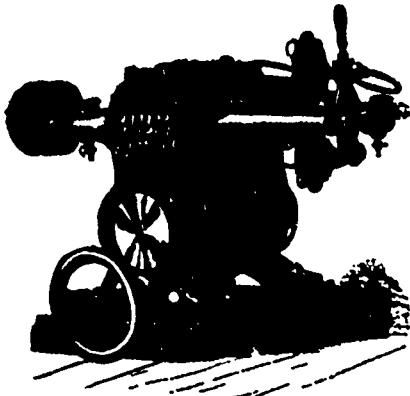
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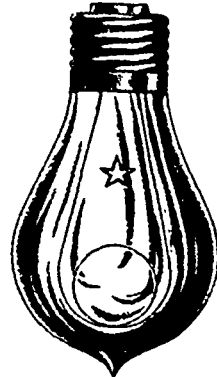
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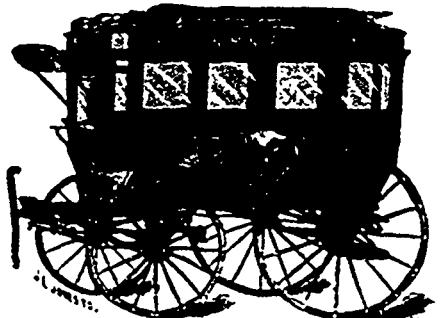
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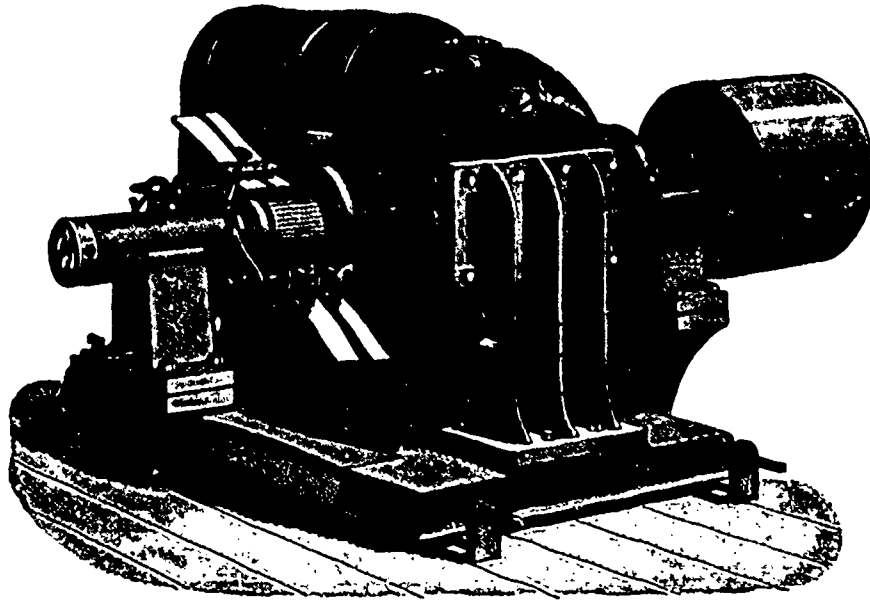
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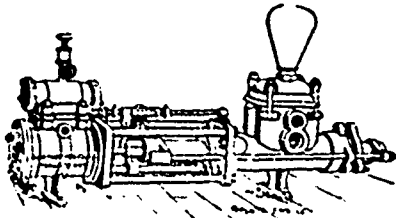
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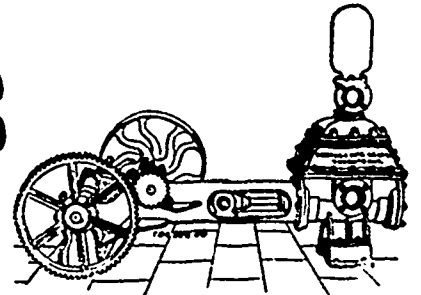
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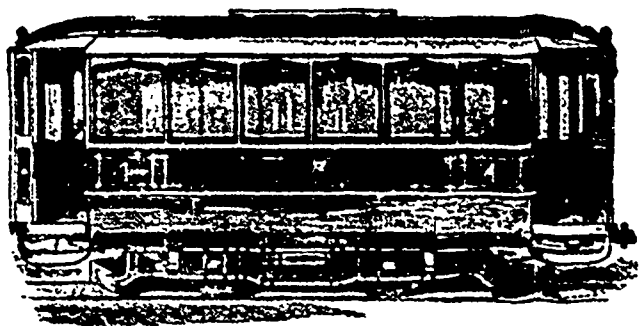
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Vol. IV.

AUGUST, 1894

No. 8.

THE ELECTRIC PLANT AT UPPER CANADA COLLEGE.

UPPER Canada College, Toronto, possesses as well equipped a modern plant as any private institution in Canada. The engine and boiler room are separate from the main building proper, and have splendid light and ventilation provided for those employed in that department.



VIEW OF ENGINE ROOM, UPPER CANADA COLLEGE, TORONTO.

The 800 lights used throughout the building and the current that is used for various purposes hereinafter described, is manufactured by two high speed engines of 40 and 80 H. P., which, by the aid of endless belts are connected direct to two Edison generators. From these machines the current is carried to a distributing cabinet and switch-board, thence to section switches, sixteen in number, from which lights can be supplied as required to a particular section of the building.

The college also possesses a storage battery plant of 24 cells, but owing to the great expense attached to its operation it is not in use.

The building is perfectly ventilated by two 6 H. P. motors, coupled direct to fans, which get a supply of fresh air from a height of over 100 ft., through a chimney or chute, and send it through conduits to all parts of the college.

The laundry is operated by a 7½ H. P. motor doing the duty required, and is supplied with an independent heater for heating water.

The gongs in the building are operated by six cells of storage battery, as also the door bells and annunciators.

The heating is under electric control, the building being equipped with the Johnson Electric Service Company's apparatus, which, as the temperature varies, regulates the valves on the radiators.

The college owns its own pumping plant and gets its supply from the city, but owing to the great height, the water has to be taken from the city main by pumps at the college, and forced 125 ft. to tanks located in the attic, which supply the different parts of the building. There are also return and feed pumps for the boilers. The boilers are three in number—two low and one high pressure. There are hot water boilers and heaters to perform their respective duties.

Two large cisterns holding 30,000 gals. of water are erected on the grounds, so that in case of fire, if the city water supply could not be had, an ample private supply would be available.

It would well repay any reader of this journal to take a trip to Deer Park and inspect the above plant. Mr. Saxby, who has been connected with the college since its erection, in the management of its plant, will give them a warm welcome and show them through the building.

CANADIAN ELECTRICAL ASSOCIATION.

A SUFFICIENT number of Western members of the Association have already intimated to the secretary their intention to be present, to warrant the belief that in point of attendance as well as in all other essential particulars, the approaching annual convention to be held in Montreal in September will prove highly enjoyable, profitable, and in every respect successful. The papers that will be brought before the convention and the discussions thereon will be of the utmost interest to all branches of the profession. They comprise:

Paper on "The Possibility of Securing Better Regulation at Central Light and Power Stations by means of Fly Wheel Accumulators of Improved Construction," by Mr. John Galt, C.E. and M.E., Toronto.

Paper on "A Method of Distribution with Equalization of Potential Difference," by Mr. D. H. Keeley, of the Government Telegraph Service, Ottawa.

Paper by Mr. E. C. Brethaupt, Berlin, Ont.

Paper on "The Application of Electricity for Medical and Kindred Purposes, from Light and Power Circuits," by W. B. Shaw, Montreal.

Paper by Mr. T. R. Rosebrugh, Lecturer in Electricity, School of Practical Science, Toronto.

Paper on "Electrolysis," by Mr. J. A. Raylis, Bell Telephone Co., Toronto.

Paper on "Telephone Cables, their Construction and Maintenance," by Mr. F. J. F. Schwartz, Bell Telephone Company, Montreal.

Paper on "Alternating Motors," by L. M. Piolet Montreal.

Paper by Mr. John Langton.

Prof. C. A. Carus-Wilson, of McGill University, has invited the Association to inspect the electrical laboratories at that institution, and to witness the operation of apparatus which has recently been completed for the measurement of alternating current power. Prof. Wilson proposes to exhibit the apparatus in conducting an actual test of a transformer.

To enable the committee to make arrangements as complete as possible, it will be necessary for them to know the probable number of members who will attend the convention. Every member is therefore desired to intimate to the secretary, at his earliest convenience, if he is likely to be present, so that the approximate number may be known and accommodation provided, and that advance copies of the papers to be brought before the convention may be forwarded.



VIEW OF DYNAMO ROOM, UPPER CANADA COLLEGE, TORONTO.

As above stated a considerable number of replies, promising attendance, have already been received. It is hoped that those members who have not as yet intimated their intention to be present at the meeting will do so as soon as possible. It is expected that the executive will shortly be in a position to announce definitely the date and details of the programme of the convention.

STREET LIGHTING BY ALTERNATING ARCS.*

By CHARLES G. ARMSTRONG.

THERE are many places, even in districts for which incandescent lighting meets the general need, were a few arc lamps can be used to good advantage, so it was to be expected that alternating plants would find some calls for arc lamps to be used on their circuits. But there has been such an amount of work done in developing alternating arc lamps—no less than fourteen having appeared on the market since last June—that there must be a larger field for these lamps than that of mere incidental adjuncts to an incandescent plant. So far, these lamps have only been used in small numbers here and there when no series arc circuits were at hand, and the common impression seems to be that there is their limit of usefulness. But I cannot agree with this. I believe that with all its faults and drawbacks the alternating arc lamp has some very good points of merit, and that when these are coupled with the advantages of alternating current distribution for long distances, the alternating arc will lend itself to the conditions of modern practice about as readily as the commonly used series arc lamp. Indeed, I believe it perfectly feasible to use alternating arcs for extended street lighting with as good results as would be expected from a series arc plant under the same local conditions.

At first thought, the planning of a street lighting system for a city, and of using multiple instead of series wiring may seem expensive; but let us look at both sides. If we plot the ideal town plant we find the lamps all arranged along a circle or loop about as shown in Fig. 1, and no doubt the series arc system with a single wire is then the simplest and cheapest. But in practice we find that the towns are not often laid out to suit such simple wiring plans, while Councilmen Smith and Jones and Brown all have their notions as to the location of the lamps, so the actual diagram is more like Fig. 2, much of the wiring being in loops so as to nearly double the length of the circuit. Of course every foot of this wire has to carry the full current (say ten amperes), whereas in multiple system, like that shown by Fig. 3, the size of the wire would diminish as we get farther from the station, both systems using the same voltage, 2,000. This difference in the cost of the wire may amount to considerable. In the case of a 60 light town plant, for which I

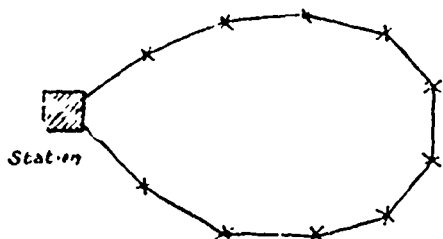


FIG. 1.—STREET LIGHTING BY ALTERNATING ARCS.

recently made the estimates, the alternating current transformer system showed a saving of ten per cent. on the wire over that which would have been needed for the same lamps on the ordinary series circuit.

As to the arc lamps themselves, there has been quite a change during the past year in the voltage adopted for them. The early forms were adapted to be run from 50 volt transformers with a resistance in series. Then this resistance was gradually reduced so as to run three lamps in series on a 100 volt circuit, thus giving better results and taking less energy. Lately the manufacturers have gone a step farther by planning their lamps to work direct from 30 volt transformers, leaving out all resistance. The lamps themselves are as economical as the series lamps, each consuming about 450 watts for a nominal 2,000 candle power. Of course there is the extra cost of the transformer, but this, together with the alternating arc lamp itself, costs no more to-day than a first-class series lamp. The loss in the transformer does not count for much, as the transformer is always worked at full load and therefore at its greatest efficiency. What is more, the transformer tends to steady the fluctuations in voltage at the lamp, so that it cannot creep up to 20 or 57 volts as it often does with series lamps. One of the advantages gained by running arc lamps in multiple is that every lamp is independent of the rest. If a lamp should get out of order, it will keep its crankiness to itself without affecting all of the others. Indeed, the most that it could do would be to short-circuit itself and blow the fuse of the transformer. The same advantage is found in case of a break on the line, as this only cuts out the lamps beyond the break, instead of crippling the whole system. Likewise, only the joints between the given lamp and the dynamo interpose their effective resistance, while in series systems any and all bad joints affect the whole number of lamps. The voltage used at the lamps is harmless, they can be trimmed with safety at any time, and it is comparatively easy to plan the feeders for safety. As to the illuminating power of the lamps, the direct current arcs have the advantage of throwing out most of the light-giving rays in a downward cone, whereas the alternating arc sends out a double cone of light. By using a reflector much of the upwardly projected light can be thrown downward, and

* Read before the Chicago Electrical Association.

in the case of street lighting a portion of the rays will be reflected from the under surface of the foliage. So I think that for the low suspension commonly used throughout the country, the alternating arc is the proper one, while for tower lighting the direct current arc would be preferable.

In comparing the energy of the two systems, the commercial efficiency of the dynamos and the cost of armature repairs will also be an important item. Good series generators show an efficiency of from 80 per cent. to 85 per cent. when built, but after a few years this falls to 70 per cent. and often as low as 50 per cent. On the other hand we can count on from 85 per cent. to 90 per cent. or even 92 per cent. when using alternators and can figure on quite a saving for armature repairs. I have seen figures from 300 arc light stations which average \$3 per year per arc lamp for armature repairs alone. This agrees with the commonly

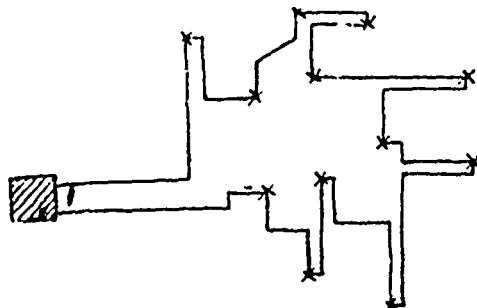


FIG. 2.—STREET LIGHTING BY ALTERNATING ARCS.

known fact that arc armatures are much more likely to be damaged than those of an alternator. I believe that under similar conditions an alternating armature will outlast from two to three arc armatures.

The matter of carbons for alternating arcs has been an important question, as a fine grade is needed for this work. The lamp manufacturers have wisely taken the expedient of using an inclosing globe, so as to make a carbon last 18 hours which otherwise would be consumed in 14 hours. Moreover, the carbon manufacturers in this country are hastening to bring out a grade of carbons suited for alternating current work, and the probability is that we can soon purchase American carbons for these lamps at prices not much in advance of that charged for hard series arc carbons.

I have already spoken of the greater efficiency which we can readily expect from the alternating generators. We can also get them in larger sizes, so that in place of from 12 to 20 series machines, each with a capacity of eighty to one hundred lights, we would have, say, three generators of 300 to 400 horse-power each, these being preferably slow-speed machines, connected direct to the engines, thus doing away with belts, ropes and shafting.

At present the common voltage for the primary circuits is about 2,000, having grown to this point from 500, at which it started, and I believe we can assume from 2,000 to 2,500 volts as our settled standard. Still, if I were to plan an ideal arc lighting plant for a large city, I would choose a still higher voltage, perhaps 4,000 volts. My station would be some three or four miles out of town, and I would run my wires in conduits to some distributing centers in the city, transforming at these points to 2,000 volts, and running thence to the alternating arcs.

Figure out such a plant for a good sized town, and note the saving in circuits alone as compared with series circuits which have only from 50 to 100 lights each. You will then see what the prospects are for the extensive use of alternating currents in connection with street lighting by arc lamps.

HIGH SPEED ENGINES.

WE are very apt to think only of our own particular branch of engineering, says the Tradesman, when discussing any problem pertaining to it and this seems particularly so in the case of the high speed stationary engine. In stationary practice we see in first class engine rooms the high speed engines guarded with particular care and the room as free from dust and dirt as it can be made, so as to give all the bearings as little grit or foreign matter as possible. And on a 12x18in. high speed engine for sample, running perhaps 300 revolutions per minute, we think it wonderful that it runs and keeps cool, think the piston speed enormous, and hardly dare breathe while near it for fear of a hot box. Yet in locomotive practice we have speeds exceeding this in many instances, and have the engine without any foundation, so to speak, the main boxes never in line (going up and down over the frog and crossings) and Jersey sand blowing around the engine until the running parts are almost white as snow, yet the engine runs, and gives comparatively little trouble. So that it seems foolish to brag so much about our high speed stationaries, when if run under the same conditions as the locomotives, they would be apt to give unending trouble.

On the other hand, it is very probable that if a locomotive was pinned down to a foundation it would do little better, as the freedom of motion to all its parts must be in a measure responsible for their running at all, the swinging and shaking absorbing jars which might be noticed materially if on a solid foundation.

CHARACTER SKETCH.

ROSS MACKENZIE

MANAGER NIAGARA FALLS PARK AND RIVER RAILWAY.

"If you choose to play, is my principle
Let a man content to the uttermost
For his life's set prize, be what it will."

THE wonderful strides that have been made in the application of electricity to present day methods of travel needs no extended demonstration in these columns. On a sea voyage, Mr. Edison, after spending hours on deck looking at the waves, said, that it made him wild when he saw so much force going to waste. "But one of these days", he continued, "we will chain all that—the Falls of Niagara as well as the winds—and that will be the millennium of electricity". The millennium of Mr. Edison has not yet come, but who will say when it may not be expected?

The development of electric transmission has found one of its chief products in the electric railway. There are in operation over 250 electric railways in the United States, embracing 2024 miles of track and utilizing 3830 motor cars, operated by 6400 motors, with an estimated capacity of 174,435 horse-power. Out of 956 street car plants existing in the United States and Canada, 589 are operated by horses, 49 by cables, 240 by electricity and 73 by steam. "Canada has been", says the Electrical Engineer, "quicker than any other part of the British Empire, excepting the Mother Country, to appreciate and adopt the electric railway". These pioneer roads are found in the familiar Metropolitan line, running out from North Toronto; at Windsor and at St. Catharines. Perhaps the most important step, however, in the direction of applying electricity to railway transmission is found in the construction of the now popular Niagara Falls Park and River Railway, running from Queenston to Chippawa, giving a view of Niagara Falls, that enhances in a wonderful degree the marvellous beauty of that picturesque spot. A description, and illustrations, of this road have already appeared in these columns, and there is no need of a further sketch here. Let us, however, turn our attention to the man, who, by his ability and energy, is doing much to popularize and make successful this electric railway.

The manager is Mr. Ross Mackenzie, who claims as his birthplace New York city, first seeing the light there in 1857. The greater part of his lifetime, however, has been spent in Canada. He received his education at the Model School and Upper Canada College, Toronto.

Waterloo was won on the play grounds at Eton, said the Duke of Wellington, because the spirit that made the boys at Eton struggle to be best in a game, and discipline themselves in cool nerve and courage to win a school match, was the same spirit that made them study on the great day when the game was fought with armies and the prize was the liberty of Europe. Ross Mackenzie is remembered by many Torontonians for his love of outdoor sports. Old lacrosse players know him as one of the "boys", who always helped them to reach goal successfully. Taking his later success in life as evidence, it is not unfitting to apply the reference of the Duke of Wellington to Mr. Mackenzie's career.

In 1873 Ross Mackenzie entered the service of the Shedden Company, and in 1875 became the agent of that company in Hamilton. In 1876 and 1877 he was in the employ of the same Company in Toronto. In 1878 the position of book keeper for the Credit Valley Railway, then under construction, was offered Mr. Mackenzie and he accepted it. In 1880 he was appointed cashier and accountant of the railway, and in 1884 when the Credit Valley was merged in the Canadian Pacific Railway he received another "move up," becoming general superintendent's accountant of the Ontario division. A year later he was removed to Montreal to the eastern division.

Those whose pleasure it has been to meet Mr. Mackenzie, have always found him genial, and indeed jovial. To apply a remark made of Walter Raleigh, "He was one who seemingly achieved great things with a certain airy ease and instinctive facility of touch". Yet it was of Raleigh, Queen Elizabeth said, "he could toil terribly". Mr. Mackenzie has always been a worker whether on the play ground or in a railway office, and the steady advances he has made indicates the importance of the thoroughly trained man in any calling.

It may be a question in the present day of many schools and much studying whether there is need for more education, but this is becoming clearer every day that there is a growing need for more education on distinctive lines. As the Outlook has recently said: "In the long run it is the trained man who succeeds, because it is the trained man who studies all the conditions of

success and meets them intelligently. Twenty years ago our rail roads were run on free and easy principles, with a happy-go-lucky assurance that good natured and industrious men could get the trains through. Now the best of the railroads are run on scientific principles, with experts in every department, and the whole management as thoroughly organized as if it were a great scientific institution; and the success of the roads in the matter of dividends and freedom from accidents depends very largely upon the thoroughness of the organization and the scientific spirit in which it is conducted."

When the Niagara Falls Park and River Railway was in running shape, Mr. W. A. Grant became manager. Later Mr. Mackenzie was removed from Montreal and succeeded Mr. Grant. The road has been a success beyond the best expectations of its promoters. Though a year of commercial depression, Mr. Mackenzie intimates that the traffic this year, so far, has been much in excess of a year ago. So assured indeed has been the success that the company felt warranted in double-tracking the road this year, a step that is certainly appreciated by the travelling public and has proven a needed and wise move by the railway. It is fair to say that this success has been attained, in a large measure, because the railway is manned by such trained and thorough-going business men as Mr. E. B. Osler, of Toronto, the president; Mr. W. Hendrie, of Hamilton, vice-president; and Mr. Ross Mackenzie, manager.

ENGINE AND BOILER FOUNDATIONS.

THE depth of engine foundations should be at least six feet, says a contributor to the Boston Journal of Commerce, unless there is a good rock bottom before reaching this depth, so that the engine anchor bolts may be anchored directly into the rock, otherwise, if there is no such rock to anchor to, and the above depth has not been made, there will not be enough weight to the foundation to hold the engine down. The writer is well aware of the fact that there are engines on the market today where great care and attention has been given thoroughly to counter-balance the engine, so that the engine will run steadily and smoothly, set upon four pins, and will not jar or shake off the pins, the engine not being bolted to the foundation. The above is all right so far as it goes, but will not answer for large engines, and especially when the engine is very heavily loaded. The length of the foundation on the shaft end of the bed, measured from the centre of the shaft to the end of the foundation, should be equal to the length of the foundation measured from the cylinder end of the bed to the centre of the shaft. The correct proportion of this foundation is about seven and one-half times the stroke of the engine. In a great many places this length of foundation on



MR. ROSS MACKENZIE.

the shaft end of bed has been very much diminished. There is no better place to throw in a brick on an engine foundation than on the shaft end; here is where the weight is required.

The above dimensions which have been given will make the ends of the foundation equally divided on each side of the centre of the shaft in the centre of the apex of the foundation. The width of the foundation at the bottom should be equal to eight strokes of the engine. In the case of an engine 12 inch stroke this would be 96 inches.

Concerning the boiler foundations, T. F. Scheffertells the American Society of Mechanical Engineers that his experience has found a depth of 3 feet below the floor line to be sufficient. A good, hard sandstone will give good results when brick is not used, which some people prefer. The width of the foundation should be 6 inches more on the floor line than the boiler side walls, which should be 24 inches for a boiler above 5 feet diameter. There has been considerable argument about the best height from the floor line to the fire-door opening, 22 to 24 inches is a satisfactory height, but 30 inches is considered a much more satisfactory and better height for the ordinary fireman, and in many instances where the fronts themselves do not permit of this height it has been obtained by raising them 6 inches or more above the floor line, and has been given good satisfaction. Another point that is debatable is the height from the bridge wall to the boiler. For 66 inch boiler 12 inches is a good height, as this gives an area between the bridge and 1 shell largely in excess of the boiler tube area. Another point of consideration is the distance of the grate from boiler, which this writer gives as 26 inches for a 66 inch boiler burning soft coal, and this height he finds has proven very satisfactory. Such a height will evaporate more water than 30 inches.

GOVERNMENT INSPECTION OF ELECTRIC LIGHT.

FOLLOWING are the provisions of the Act passed at the last session of the Dominion Parliament for inspection and regulation of electric lighting plant :-

1. This act may be cited as *The Electric Light Inspection Act*.
2. In this Act unless the context otherwise requires, -
 - (a.) The expression "contractors" means any company or person undertaking to furnish electricity to any purchaser for lighting purposes.
 - (b.) The expression "purchaser" means any person to whom electricity is furnished for lighting purposes.
 - (c.) The expression "meter" means electric light meter, and includes every kind of machine, apparatus or instrument used for measuring the quantity of electrical energy furnished to the purchaser.
 - (d.) The expression "purchaser's terminals" means the ends of the electric lines or conductors situate upon the purchaser's premises at which the supply of electricity is delivered from the service lines.
 - (e.) The expression "department" means the Department of Inland Revenue.
 - (f.) The expression "Controller" means the Controller of Inland Revenue.
3. The commercial unit of supply of electrical energy shall be one thousand watt-hours, or the equivalent thereof in ampere-hours.
4. Before commencing to give a supply of electrical energy for illuminating purposes to any purchaser, the contractors shall declare to such purchaser the constant pressure at which they propose to supply energy at his terminals.
 2. The variation of pressure at any purchaser's terminals shall not under any conditions of the supply which the purchaser is entitled to receive, nor at any time, exceed three per cent. from the declared constant pressure, whether such variation is due to the resistance of the service lines or apparatus belonging to the contractors, or to any action or effect produced by such apparatus for which the purchaser cannot be shown to be responsible, or partly to a variation of pressure in the distributing mains from which the supply is taken.
 3. The contractors shall not be liable for any variation of pressure caused by unavoidable accident to the generating plant or apparatus, or by the uncontrollable condition of the elements.
 4. The contractors shall be responsible for all electric lines, fittings and apparatus, belonging to them or under their control upon the purchaser's premises, being maintained in a safe condition and in all respects fit for supplying energy, but they shall not be responsible for any damages arising from the use of electric current in lines, fittings and approaches not belonging to them or under their control.
 5. If the contractors are reasonably satisfied, after making all proper examination by testing or otherwise, that at some part of a circuit a connection with the earth exists of such resistance as to be a source of danger, and that such connection does not exist at any part of the circuit belonging to the contractors, any officer of the contractors duly authorized by them in writing may for the purpose of discovering whether such connection with the earth exists at any part of the wire upon any purchaser's premises, at all reasonable times, after giving one hour's notice of his intention to do so, enter such premises and disconnect the purchaser's wires from the service lines, and may require the purchaser to permit him to inspect and test the wires and fittings belonging to the purchaser and forming part of the circuit.
 7. If on such testing the officer discovers that a connection exists between the purchaser's wires and the earth, and that such connection has an electrical resistance not exceeding five thousand ohms, or if the purchaser does not give all due facilities for such inspection and testing, the contractors shall forthwith discontinue the supply of energy to his premises, giving immediate notice of such discontinuance to the purchaser, and shall not recommence such supply until they are satisfied that such connection with the earth has been removed.
 8. If any purchaser is dissatisfied with the action of the contractors, either as to the mode of making the test or in discontinuing the supply of electricity to his premises, the wires and fittings of such purchaser may, on his application to the department, be tested for the existence of such connection with the earth by an electric light inspector.
 9. If the contractors make default in complying with the requirements of any of the foregoing sections as to supply, they shall be liable for every such default to a penalty not exceeding twenty dollars for every day during which such default continues.
 10. Any person who maliciously or fraudulently abstracts causes to be wasted or diverted, consumes or uses any electricity, shall be deemed guilty of theft and punishable accordingly.
 11. Any officer appointed by the contractors may, at all reasonable times, enter any premises to which electricity is or has been supplied by the contractors, in order to inspect their electric wires, meters, accumulators, fittings works and apparatus for the supply of electricity, or for the purpose of ascertaining the quantity of electricity consumed or supplied, or, where a supply of electricity is no longer required or the contractors are authorized to take away and cut off the supply of electricity from any premises, for the purpose of removing any electric lines, accumulators, fittings works and apparatus belonging to the contractors, repairing all damage caused by such entry, inspection or removal.
 12. Inspectors of weights and measures, or of gas, or other officers of inland revenue, may be appointed and may act as electric light inspectors under this Act, but no such inspector shall be a seller of electricity or electric meters, or be employed by any person or company supplying electricity or meters, and no electric inspector shall repair or adjust any meter inspected or verified by him.
 13. The amount of electrical energy supplied by contractors to any purchaser under this Act for lighting purposes, or the electrical quantity contained in such supply shall, if the purchaser so desires, be ascertained by means of a suitable meter, duly certified in accordance with regulations established under the authority of this Act.
 2. Whenever a reading of a meter is taken by the contractors for the purpose of establishing a charge upon the purchaser, the contractors shall cause a duplicate of such reading to be left with the purchaser.
 14. No electric light meter shall be fixed for use which has not been verified and stamped as hereinafter provided.
 15. No meter shall be fixed for use unless it plainly indicates by means of suitable dials the amount of current or energy passing to the purchaser's wires.
 2. Electrolytic meters at present in use may be continued; but the number of such meters shall not be added to, and all renewals of meters shall be made by the substitution of the direct-reading types.
 3. The capacity of every meter fixed for use shall be marked in a conspicuous place with the number of amperes or watts it is constructed to supply.
 16. No meter shall be stamped which is found by the inspector to register, or to be capable of being made to register, quantities varying from the legal standard unit of electricity more than three per cent. in favor of either the contractor or the purchaser.
 17. The verification of each meter shall be attested by affixing or impressing on some essential part thereof, a stamp or mark of such description and in such a manner as is directed by regulations made by the Controller.
 18. Within twelve months after the expiration of five years from such verification and stamping, every meter shall again be verified and stamped.
 19. No meter duly stamped as aforesaid shall be liable to be re-verified or re-stamped within a period of five years from the then last verification or re-verification thereof, although it is used in any other place than that at which it was originally stamped, but shall be considered a lawful meter throughout Canada, unless found incorrect under this Act, or requiring re-verification by lapse of time as aforesaid.
 20. In every case the contractor shall keep the meter in good repair, and shall be responsible for the due inspection thereof, and, except as herein otherwise provided, shall pay the fee lawfully chargeable for such inspection, and shall be liable for all penalties incurred with respect to such meter.
 21. The verification and testing of meters shall be performed in accordance with the provisions of this Act and with such further regulations, not inconsistent therewith, as are made by the Controller.
 22. The contractors shall provide electricity and wiring and all other reasonable facilities for testing, free of charge, at such places as are agreed upon between the contractors and the department.
 23. If any dispute arises between the contractor and the purchaser or between the contractor and the inspector, respecting the correctness of such meter, the inspector shall, if required by any person dissatisfied, refer such dispute to the department for final decision.
 24. The inspector shall give to either the contractor or the purchaser, or to both, on payment of the proper fee, a certificate stating the result of his inspection, and the time at which it was made, and at whose instance, and any other particulars he thinks it right to insert for the information and guidance of the persons concerned; and such certificate shall be *prima facie* evidence of the condition of the meter inspected, and shall bear an adhesive stamp or stamps representing the fee lawfully chargeable for such certificate.
 25. The contractors shall at all times keep in their office, in a book or books, the names and addresses of purchasers for the time being—which book or books shall be open to the inspector during office hours, and from which he may take such extracts as he thinks fit; and for any failure to comply with the requirements of this section, the contractors shall incur a penalty of fifty dollars.
 26. The fees for inspection of purchasers' wires and the testing of lamps and meters shall be determined from time to time by the Governor in Council and published in the Canada Gazette, and such fees shall be regulated so that they will, as nearly as may be, meet the cost of carrying this Act into effect; and all fees received under this Act shall be accounted for and paid to the Minister of Finance and Receiver General at such time and such manner as the Controller directs, and shall form part of the Consolidated Revenue Fund of Canada.
 27. The Governor in Council may from time to time direct stamps to be prepared for the purposes of this Act, bearing such device as he thinks proper, and may defray the cost thereof out of any unappropriated money forming part of the Consolidated Revenue Fund of Canada, and the device on such stamps shall express the value thereof, that is to say, the sum at which they shall be reckoned in payment of the fee hereby prescribed.
 28. Separate accounts shall be kept of all expenditures incurred and of all fees and duties collected and received under the authority of this Act; and a correct statement thereof up to the thirtieth day of June then last past, shall be yearly laid before Parliament within the first fifteen days of the then next session thereof.
 29. Every person who, except under authority of this Act, makes, causes or procures to be made, or knowingly acts or assists in making, or who forges or counterfeits, or causes or procures to be forged or counterfeited, or knowingly acts or assists in the forging or counterfeiting any stamp or mark used for the stamping or marking of any meter under this Act, shall incur a penalty not exceeding two hundred dollars and not less than fifty dollars, and every person who knowingly sells, utters or disposes of, lets, lends or exposes for sale, any meter with such forged stamp or mark thereon, shall, for every such offence, incur a penalty not exceeding two hundred dollars and not less than twenty dollars, and all meters having on them such forged or counterfeited stamps or marks shall be forfeited and destroyed.
 30. Every person who knowingly repairs or alters, or causes to be repaired or altered, or knowingly tampers with or does any other act in relation to any stamped meter, so as to cause such meter to register wrongly, or who prevents, or refuses lawful access to any meter in his possession or control, or obstructs or hinders any examination or testing authorized by this Act, shall incur a penalty not exceeding one hundred dollars and not less than fifty dollars, and shall pay the fees for removing and testing, and the expense of purchasing and fixing a new meter. Provided that the payment of any such penalty as aforesaid shall not exempt the person paying it from liability to indictment or other proceeding to which he would otherwise be liable, or deprive any other person of the right to recover damages against such person for any loss or injury sustained by such act or default.
 31. Every person who fixes for use, or causes to be fixed for use, any meter, before it has been verified and stamped as herein required, shall incur a penalty of twenty-five dollars for every such unverified or unstamped meter.
 32. Every inspector who stamps any meter without duly testing and finding it correct, or who refuses or neglects, without lawful excuse, for three days after being required under the provisions of this Act, to test any meter, or to stamp any meter found correct on being so tested, or who neglects to perform any duty imposed upon him by this Act, or by any regulations made under the authority thereof, shall incur a penalty not exceeding fifty dollars and not less than ten dollars, and shall be liable to dismissal from office.
 33. All penalties imposed by this Act, or by any regulation made under the authority thereof, shall be recoverable in a summary manner, with costs, before any justice of the peace for the district, county or place in which the offence was committed, if the penalty does not exceed twenty dollars, and before any two justices of the peace if the penalty exceeds twenty dollars, and may, if not forthwith paid, be levied by distress and sale of the goods and chattels of the offender, by warrant under the hand and seal of the Justices by whom also any imprisonment to which the offender is liable may be awarded.
 34. No action or prosecution shall be brought against any person for any fine or penalty under this Act, unless it is commenced within six months after the offence is committed.
 35. Before supplying electricity to purchasers, the contractors shall obtain

from the department, or from an officer appointed for the purpose, a certificate of registration and shall pay the officer issuing such certificate the fees prescribed by the Governor in Council.

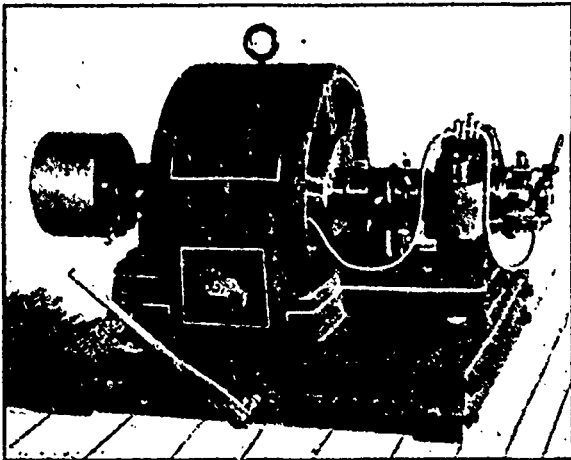
2. Such certificates shall expire on the day of in each year, and shall be renewable from year to year.

36. So soon as the standards and apparatus have been obtained and approved, the Governor in Council may issue a proclamation, fixing a day, not less than six months from the date of such proclamation, upon which the provisions of this Act respecting inspection shall go into operation.

37. The Governor in Council may establish rules and regulations
(a.) For the testing of electric light lamps for illuminating power;
(b.) For instituting tests to determine what style or make of meter shall be used to measure the quantity of electrical energy supplied; and
(c.) Such other regulations, not inconsistent with this Act, as are necessary for giving effect to its provisions, and for declaring its true intent and meaning in all cases of doubt.

NEW ALTERNATING AND DIRECT CURRENT DYNAMO.

THE new alternator represented by the accompanying illustration has no commutator, brushes, or moving wire. It is of the inductor type, but so constructed, the makers claim, that the troubles common to this class are eliminated. The revolving



ALTERNATING AND DIRECT CURRENT DYNAMO.

field is a smooth surface, having plenty of cooling surface. Surrounding this are three stationary coils, wound ring shape, and laid in their places. Both field and armatures are thoroughly laminated, and the magnetism does not reverse in any part, but merely rises and falls; while the magnetic flow through the field coil never varies, consequently there is no inductive effect on the coil. To effect this, when the field is distorted a short circuited coil of low resistance is placed inside the field coil. The space occupied by the generating coil is not of so much importance as in wire wound armatures, making it possible to use larger inductors and a heavier insulation, and as there is no mechanical strain on this wire, a burn-out is practically impossible.

The speed of this machine is said to be slower than any other of its output on the market. The boxes are large, self-oiling, self-lining and adjustable, and are provided with oil gauges.

The exciter is direct-driven, and the armature so made that it may be easily moved from main shaft. An automatic regulator is provided, which keeps the lights perfectly steady through any variation of load, and it is claimed that owing to the simplicity of the apparatus it requires very little attention.

These machines are manufactured by Messrs. F. H. Sleeper & Co., Coaticook, Que.

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.

TORONTO, JULY 29th, 1894.

Toronto No. 1 has held two successful meetings during the present month, there being two proposals for membership and four candidates initiated. Interesting discussions have taken place on safety valves and indicator diagrams. The fourth annual convention will be held in Toronto Sept. 4th to 7th inclusive. A large attendance is expected.

W. G. BLACKGROVE,
Cor.-Secretary.

THE ANNUAL CONVENTION,

Following is an outline of the programme which has been arranged for the annual convention to be held in Toronto from the 4th to the 7th of September:—

Tuesday, Sept. 4th.—Convention opens at 10 a.m.; afternoon session; evening, open meeting.

Wednesday, Sept. 5th.—Forenoon session; afternoon, drive around city, terminating at Exhibition grounds; evening, banquet.

Thursday, Sept. 6th.—Trip to Niagara Falls, American Power House and Hydraulic Canal.

Friday, Sept. 7th a.m. and p.m., session, election of officers. Papers on interesting subjects will be read at the open meeting and sessions. All engineers are invited to attend the open meeting on Tuesday evening, Sept. 4th. A. M. Wickens, Chairman Committee; H. Terry, Secretary; G. Fowler, Treasurer; W. G. Blackgrove, Cor. Secretary.

HAMILTON ASSOCIATION NO. 2.

HAMILTON, July 25th, 1894.

Editor Electrical News.

SIR, I am glad to report that Hamilton No. 2 is getting along very nicely. Our meetings of late have not been marked by many engineering discussions owing to the very warm weather, but by the way things looked at our last meeting we will soon have a good report to make every month. We find that the manufacturers are very much interested in our behalf, and that our conventions and annual suppers are looked forward to with considerable pleasure.

W. NORRIS,
Cor. Secretary.

BRANTFORD ASSOCIATION NO. 4

BRANTFORD, July, 1894.

The following officers were installed by Bro. A. Ames at our last regular meeting: C. Walker, President; J. B. Loisyth Vice President; Jos. Ogle, Secretary; L. Fordham, Treasurer; T. Pilgrim, Conductor; A. McKinnon, Doorkeeper.

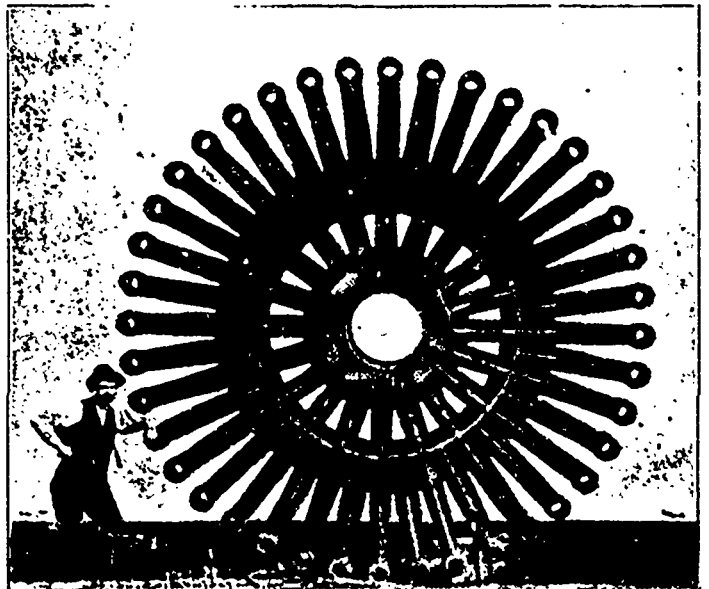
I might say that No. 5 is slowly growing in numbers and is in a very good condition, the meetings being well attended and all the members except one holding responsible positions and certificates of competency. After the installation our time was devoted to black board exercise.

JOS. OGLE, Secretary.

The coroner's jury appointed to inquire into the recent boiler explosion at the Michigan Central Railway depot at Cayuga, Ont., which resulted in the killing of John Comer, brought in the following significant verdict: "That the deceased John Comer came to his death by accident. We attach no blame to anyone, and the jury recommend that engineers professing to run boilers should stand some examination to show that they are qualified and competent for that business. We also recommend that all boilers should be officially examined every twelve months."

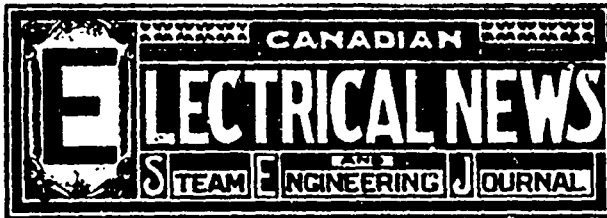
THE LARGEST ARMATURE STAR.

IN the accompanying illustration is shown one of a pair of armature stars, believed to be the largest in the world, and which are to be installed in the power station of the Toronto



Railway Co. The machines when completed will weigh about 60 tons each and have a nominal capacity of 1200 kilowatts, or 1600 electrical horse power each, under 500 volts pressure, and will be over compounded for 12 per cent drop in the lines. They are to be directly connected to a pair of horizontal cross compound condensing engines making 80 revolutions per minute. The armature stars are 13 feet in diameter and weigh over 10 tons each. The brush carriers will be about 14 feet 6 inches in diameter.

The Compagnie des Pouvoirs Hydrauliques de St. Hyacinthe, Que., has given a contract to the Canadian General Electric Co., through Mr. W. F. Dean, agent for Quebec, for two 175 K. W. three phase generators. These generators which are to be operated by water power are to transmit current at 2,500 volts for light and power to St. Hyacinthe, a distance of five miles. This plant, which is the first of the polyphase system in Canada, is to be in operation by about the 1st October.



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Advertising rates sent promptly on application. Orders for advertising should reach the office of publication not later than the 15th 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 may 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 must be at sender's 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 coming legitimately within the scope of this journal.

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

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TORONTO BRANCH No. 1. Meets 2nd and 4th Friday each month in Room D, Shaftesbury Hall, Wilson Phillips, President, Geo. H. Blackgrove, Secretary, 23 Grant Street.

HAMILTON BRANCH No. 2.—Meets 1st and 3rd Friday each month, in Macabee's Hall, Jas. Langdon, President, 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 Meiden, Secretary, Treasurer, 533 Richmond Street.

MONTREAL BRANCH No. 1.—Meets 1st and 3rd Thursday each month, in Engineers' Hall, Craig Street. President, Jos. Robertson; first vice-president, H. Nuttall; second vice-president, Jos. Badger, secretary, J. J. York, Board of Trade Building; treasurer, Thos. Ryan.

ST. LAURENT BRANCH No. 2.—Meets 1st and 3rd Tuesday each month, in Mechanics' Institute, 204 St. James St. E. Matthias Guimond, President; Alfred Latour, Secretary, 306 Delisle Street, St. Cuneonde.

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. C. Jorden, President; H. T. Flewelling, Secretary, Box No. 8.

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.

DRSIBEN 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, Chas. E. Robertson; Recording Secretary, L. Brandon; Financial Secretary, Arthur Harper.

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

WIAKTON 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.

ONTARIO ASSOCIATION OF STATIONARY ENGINEERS.

BOARD OF EXAMINERS.

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

ON July 5th fire destroyed the Administration, Mining and Electricity, Machinery and Liberal Arts Buildings at the World's Fair grounds, Chicago. Thus in one short year has passed away the spectacle whose grandeur awakened world-wide admiration.

SOME of the horse cars formerly used on the Toronto street railway are being put to a novel purpose. They have been removed to Victoria Park, the wheels taken off, and the car bodies fitted up with sleeping berths, in which condition it is said they are rented to campers at \$1.50 per week. It would be interesting to learn whether the managers of any of the other street railways have hit upon as novel and profitable a method of utilizing their discarded equipment. Locality has considerable to do with the possibilities in this direction.

AN expert who was called on by the Council of an American city to interpret a clause in a contract with a local electric lighting company, is said to have done so after the following fashion: "The arc lights are hung at the street intersections, and each one throws its light in four directions; 2,000 c. p. of lights on each of the four streets, therefore, cannot be expected. An arc light which throws 500 c. p. of light along each of four streets is a 2,000 c. p. light, as called for in the contract." This information is about on a par with some of the estimates of the cost of lighting the streets of Toronto.

THE extreme altitude maintained by the mercury during the past few weeks, whilst not favorable to business in many lines, afforded a golden opportunity for impressing people with the fact that in such weather an electric fan will make life not only bearable, but even comfortable. We may presume that the agents of the electric companies have as usual been alive to the situation, and that the education of the public in this direction has not been allowed to be neglected. Indeed the shop windows bear testimony to the fact that the electric fan is winning recognition, though possibly not as yet to the degree to which its usefulness should entitle it.

ON the 12th of July the street car traffic on the principal thoroughfares of Toronto was blocked for upwards of an hour during the passing of the Orange parade. We have been informed that a conductor who declined to stop his car on the ground that by so doing he would be disobeying orders, was viciously assaulted by one of the marshals of the procession. The street car traffic of a great city should not be allowed to be thrown into confusion by an Orange procession or any other kind of a procession, as thereby thousands of people are likely to be seriously inconvenienced. Street railway companies in cities should force this question to an issue without delay, and find out whether the right of way which they are supposed to have purchased is to be secured to them or not. The rights of the business and travelling community are likewise concerned in the settlement of the question.

A MONTREAL despatch states that at a meeting of Canadian and American capitalists held in that city recently the advisability of organizing a new line of street cars, for the propulsion of which gas instead of electricity would be employed, was considered. It is stated that further information on the subject is to be prepared and submitted for the approval of a committee. An experiment with the use of gas in the manner proposed has lately been conducted on the tramways at Croydon, Eng. The modus operandi is described thus: "The motor is placed under the tramcar together with three cylindrical gas-holders. These three reservoirs hold a sufficient supply of gas to serve for an eight-mile run. The car is about 18ft. long, and, with the machinery, weighs $5\frac{1}{2}$ tons. The motor, which is of the Otto type, and is specially constructed for tramway work, has a slow and quick speed. The ignition of the charge in the motor cylinders is effected by electricity, and the cylinders exhaust into a condenser. At the charging station an 8 H. P. Otto engine drives a compressor. By this latter the gas, which is taken from the mains, is pumped into a steel receiver at a pressure of 150 lb. per square inch. This plant is equal to the supply of five tramcars, the number which it is intended to place on the line at first. The pressure in the tramcar cylinders is about 120lb. per square inch at starting, and the cost of the gas used is stated to be 1d. per mile with a fully loaded car." The results of the experiment have not yet been made known. It is believed to be extremely doubtful whether the efficiency and economy to be realized by this method will equal those already secured by the use of electricity.

DURING a recent visit to Canada Mr. Alexander Siemens gave to the press complete figures of the estimated cost, operating expenses and probable income for the Pacific cable connecting Canada and Australasia, which formed one of the objects of the Intercolonial Conference at Ottawa. The figures given have all the weight of Mr. Siemens' great authority in cable construction and the endorsement of other cable experts, and may be accepted as correct. It is seldom that complete figures on cable work are made public, and apart from the main result shown by the balance sheet, the details, of which the bulk items are composed, reveal many interesting facts. The total length of the cable, about 8,420 statute miles, would average \$1000 per mile, of which the deep sea portion would cost \$1,500 per mile and cable for shallower water \$870 per mile. Two repairing steamers would be required costing \$500,000 each. Between New Zealand and Vancouver the cable would be landed at three islands, dividing it into four working sections, and the instruments and buildings for the staff would cost \$150,000. The staff and office expenses at these five stations vary from \$10,000 per annum at Vancouver to \$30,000 per annum at Neckar and Canton Islands, where the employees have to be boarded and lodged, and in addition receive 50% larger salaries, these islands being mere rocks in the ocean, and as Mr. Siemens mildly expresses it, "very undesirable habitations." The chief items of repairs and renewals are 200 miles of cable replaced per annum and the cost of maintaining the two repairing ships. Each vessel costs, \$3,500 a month to keep it lying in port ready for business, and an additional \$500 per day when it is actually at sea and at work, which it is estimated will be for about two months in the year. On one point no information is given, and that is during what portion of the four months cruising of the repairing steamers cable communication would be actually inter-

rupted, which would mean irremediable loss of revenue. The cruising time, no doubt, includes carrying supplies to stations, and if a fault develops gradually the cable steamer may be able to reach the spot, grapple and splice without any actual interruption, but with a sudden ground it might require more than a week to reach the spot. We regret Mr. Siemens did not touch on this topic. An interruption would be a public calamity at Neckar and Canton Islands; not lively at the best of times when work was brisk, with no occupation for the staff but to draw rations and watch the accumulation of unpendable income, they would be - well "very undesirable habitations".

INVESTIGATIONS of the distance to which water power can be transmitted by electricity and profitably sold in competition with steam power have been numerous of late. Also criticisms of these investigations, and counter-criticisms of these criticisms. Where the criticisms have been sufficiently ill judged or the counter criticisms sufficiently acrimonious the matter has been dropped, and it is probable that more than one rash "expert" is sorry he spoke. But when these are eliminated and we turn with relief to those who remain in temperate discussion of this most important question the conclusions we are led to are largely negative. We find that amongst those who have the right to speak with some authority there exists profound differences of opinion as to what it may be fairly said has been shown probably possible by experience. The Lauffen-Frankfort experiment of 1891 is really the only actual experience of transmission for over 25 or 30 miles. This transmission delivered 200 H. P. at a distance of 109 miles from the generator, with a maximum pressure of 30,000 volts between conductors, and was in operation only during the time of the Frankfort exhibition. This base is too small to give confidence in the electrical estimates that have been built upon it. There is no doubt that the 15 mile transmission from Niagara to Buffalo will be successful both electrically and commercially, but we think that the engineering profession will be greatly surprised if, even in this comparatively simple case, with only 20,000 volts, there are not many unlooked for difficulties in getting the plant into successful operation. On its commercial side the agitation has brought into useful prominence how radically the economy is affected by the size of the plant; not only, as in ordinary enterprises, by the smaller proportion of general expenses when distributed over a large business, and the generally smaller cost per H. P. of developing large water powers, but also by the marked increase in efficiency and decrease in cost per H. P. of large electrical machinery. 98% efficiency is stated for 5000 H. P. generators and 1000 H. P. motors, and prices of \$6.50 to \$7.00 per H. P. The net results are to show the impossibility of laying down any general rule as to the economical distance of power transmission applicable to all conditions, and to add to the impatience with which the electrical world awaits the completion of the Niagara plant, whose promoters know more about it and say less than any one else, and who have contracted to sell power to barges on the Erie canal at \$20 per H. P. per annum.

In the meantime both water power and steam power are threatened with a new rival in the development of the gas engine. By combustion of gas in the engine cylinder the heat energy in the coal is converted into power more efficiently than when it is carried round via a steam boiler. But the known thermal economy of gas engines has not been available commercially owing to the cost of making gas. But in the last few years several cheap modes of producing fuel gas have been devised, and thus stimulated, manufacturers have gradually increased their sizes until to-day they are not far from 1000 H. P. and giving 1 H. P. to $\frac{1}{4}$ lbs. of coal. As this is twice as good as the best performance of triple expansion condensing engines there is a large margin to work on in the cost of producing gas from the coal as compared with the cost of producing high pressure steam. A large gas producing plant at the mines, using not only coal at the pit's mouth, but the slack and shaley waste, could either transmit the gas by pipe lines, or with gas engines on the spot produce power for electrical transmission. Such a power plant would be likely to compete seriously with natural water powers, whilst in gas transmission by pipe lines electric transmission for long distances would find a rival to put it on its metal.

AMONGST those interested in electric street railways there has recently been some preliminary discussion looking to the formation of a Canadian Street Railway Association, whose objects would be similar to the street railway association in the United States. In view of the rapidly increasing magnitude and importance of the electric street railway interests in Canada some association for the discussion of common difficulties and the promotion of common interests is a natural development. Membership in the American Association will meet many of their needs, but in a different country and climate, the Canadian railways operate under many conditions in which the American roads have no share or interest. These conditions, however, are not without interest to other classes of electrical enterprise in Canada, and directly or indirectly are shared by them. The street railways have at present a very small representation in the list of members of the Canadian Electrical Association, and it seems a great pity that before segregating themselves in a street railway association they should not try whether the existing association will not fill the need they are beginning to feel. Electric street railways really occupy a central position amongst telegraph, telephone, light and power and manufacturing enterprises. Some of these have apparently very little in common with each other, but all of them come more or less into contact with the street railways. They are all well represented in the Canadian Electrical Association, which now needs only an increase in the number of its street railway members to be completely representative of all classes of electrical enterprise in Canada. All electrical interests, however dissimilar at first sight, have much in common. Like it or dislike it, they cannot help reacting upon each other, but it is in their own hands whether they endeavor to make this interdependence a help, or suffer it to become a hindrance, and it is here that the benefit comes in of beginning by a general association whose objects, as stated in the constitution of the C. E. A., are "to foster and encourage the science of electricity and promote the interests of those engaged in any electrical enterprise, and for the discussion and interchange of opinion among its members." Such an association is an endeavor to modify the natural narrowness which comes to all of us when we each know our own business and are each struggling for our own profit, and when in the obviousness of the points of difference between us and other strugglers, we are prone to lose sight of what we have in common, and regard contact as synonymous with conflict. To begin by class associations is to intensify this narrowness. To begin by a general association is to first try what profit we can derive from intercourse and such common action as is possible with those engaged in making a living in kindred occupations. Following on this the subsequent organization of special associations will come naturally as the outgrowth of healthy business development; but their membership overlapping with that of the general parent association should preserve them from the unprofitable narrowness of isolation. Whether a Street Railway Association is organized in the near future or not, we trust that the September meeting of the Canadian Electrical Association will show a large addition in the list of members interested or employed in electric street railway work.

QUESTIONS AND ANSWERS.

BELLEVILLE, ONT., June 30th, 1894.

Editor CANADIAN ELECTRICAL NEWS.

SIR, A water power is situated two miles from our pumping station, could these pumps be run by electricity generated at our water power and what would be the percentage of waste in conveying electricity that distance?

Could our pumps (Henry R. Worthington, New York) be arranged to change easily from steam, as run now, to electric motor, or vice versa? Our water power may any year fail for a month or so.

Yours truly,

M. M. THOMPSON,
Supt. Belleville Water Works Co.

[Electrical power transmission for 2 miles is perfectly feasible. Percentage loss in line depends on voltage used and initial outlay for copper. Electric power could be applied to your pumps interchangeably with steam power. Both technically and commercially the best arrangement of plant for your case including means of providing for varying pump delivery to mains under constant pressure would depend largely on a number of local conditions. It would be a matter of skill and judgment applied to a detailed knowledge of your actual conditions, and would require careful planning by some competent electrical and mechanical engineer. Ed. ELECTRICAL NEWS.]

A correspondent asks: (1.) Is there a storage battery which has proved to be of service for carriage locomotion along ordinary highways? (2.) Why, when the brushes are raised up higher on the commutator, is the current reduced?

ANSWER. (1.) Storage batteries have been frequently tried as a motive power both on highways and on surface railroads. As yet they have not proved a commercial success on railways owing to their weight and rapid deterioration much less are they suited to propelling a carriage on an ordinary highway. (2.) When the brushes of a dynamo are moved forward of the neutral point or point of commutation a smaller electromotive

force is made available owing to fewer coils of the armature being in the active field of the machine.

138 Drolet Street, MONTREAL, July 7, 1894.

Editor ELECTRICAL NEWS.

SIR,—Since you invite correspondence, and wishing to advance the value of your paper, I take the liberty of drawing your attention to an item in your July issue, which does not reflect much credit on your informant's ability.

At bottom of page 83 "W. N." Hamilton, Ont., writes—"What size storage battery would I require to run 20 inc. lamps $\frac{1}{2}$ ampere each?"

Now this can not be solved so easily as the answer given, because were only 55 cells used, the lamps would scarcely show they existed in the dark. The answer given and were it correct, and the battery short circuited through no external resistance, the result would probably be an explosion, in which the battery would be instantly consumed, through having no internal resistance. I will now endeavor to show how far the answer given is in error just by the simple fact of not allowing for the internal resistance of the battery.

Assume each cell to have E. M. F. = 2 volts.

" " " " resistance = one-tenth ohms.

then by Ohm's Law $C = \frac{E}{R}$ — or volts \div ohms = current — this equals — 20 amperes; this is the current one cell would give through no external resistance, on short circuit.

One 110 volt lamp, $\frac{1}{2}$ amp. of current has resistance of 220 ohms.

and 20 lamps in parallel = 11 ohms.

20 lamps require 10 amperes current.

Now for the number of cells in series, required to give the proper E. M. F. we have the following:

Volts required in external circuit.

Volts of 1 cell — (amperes required \times resistance of 1 cell).

or $\frac{110}{2 - (10 \times 1)} = 110$ cells in series, which is somewhat more

than the answer given. Of course the result is affected by the internal resistance of the battery.

Now for the proof:

external resistance (lamps) = 11 ohms.

110 cells one-tenth ohm each = 11 ohms.

E. M. F. of 110 cells 2 volts each = 220 volts.

$C = \frac{E}{R} = \frac{220}{22} = 10$ amperes = the current required for the lamps —

Trusting that I have made this sufficiently plain to enable any calculation to be made that may arise, I have the honor to remain.

Yours truly,

JAMES WRIGHT.

N. B. — I forgot to mention in my letter that the internal resistance of Planté's storage battery is .06 ohm. This would make the

calculation $\frac{110}{2 - (10 \times .06)} = 79$ cells (about) and very close to what would be actually required, as some energy would be lost in the necessary wiring, etc.

[The answer given "W. N." Hamilton, Ont., is correct. Mr. Wright's mistake lies in his assumption of .1 ohms per cell internal resistance. The greatest working resistance of 50 ampere-hour cell of any ordinary type would be about .01 ohms, which in case under consideration would give internal resistance $\frac{1}{5}$ of lamp resistance. It is therefore one minor factor amongst several others, and negligible for the purpose of the inquiry. The scope and function of answers to correspondents preclude discussion of all factors implied irrespective of relative importance. Answers are necessarily brief statements, and only of facts material to what we understand is the information desired. We aim at answering adequately the questions our correspondents ask, but not questions they don't ask.—Editor E.L.C. NEWS.]

PERSONAL.

Mr. J. E. Berkeley, of the Standard Electric Co., Ottawa, is at present on a visit to Europe.

Mr. James Kent, Superintendent of the C.P.R. Telegraph Co., is at present on a visit to St. John, Halifax, Cape Canso and North Sydney.

Mr. G. Osborne, Secretary of the Kingston Street Railway Co. narrowly escaped having his arm amputated, from falling from one of the company's cars a few days ago.

It is reported that Mr. J. W. Baker, who for thirty years has been in the employ of the G. N. W. Telegraph Co., will be appointed Bursar at the new asylum at Brockville, Ont.

Mr. J. J. Wright, manager of the Toronto Electric Light Co., and Mr. A. H. Smith, of the G. N. W. Telegraph Co., have just returned from a cruise on Lake Ontario, on board Mr. Wright's yacht, "The Electra."

The Babcock & Wilcox Co., with Canadian headquarters at Montreal, have just placed an order with the Dominion Coal Company, Sydney, C. B., for boilers aggregating 416 h. p. These boilers are now being manufactured in Canada.

It is announced to be the intention of the Toronto Railway Co., to immediately erect a large power house on Roncesvalle ave., near High Park, from which to supply power for the operation of the Mimco and Weston system. The site for the building is said to have been purchased, having a frontage of 250 feet on Roncesvalle ave., by a depth of 250 feet immediately north of Queen street, on the north side.

ELECTRIC RAILWAY DEPARTMENT.

THE GALT AND PRESTON ELECTRIC RAILWAY.

FOUR years ago, Mr. R. G. Cox, of St. Catharines, perceiving as he believed a promising business outlook for an electric railway which should connect the towns of Galt and Preston, set to work to arouse the interest of business men of the locality in the project. In this he so well succeeded that a company was shortly afterwards formed with the purpose of carrying out the undertaking. The management of the company was vested in the following officials: President, Thos. Todd; Vice-president, R. G. Cox; Secretary-treasurer, W. H. Lutz; Directors, Fred Clare, J. D. Moore, M.P.P., Hugh McCulloch, sr., and D. Spiers. These gentlemen have succeeded, though not without considerable difficulty, in carrying the enterprise to a successful completion. The chief difficulty encountered was the refusal of the municipality of Preston to grant the company right of way over the streets. No opposition of this nature was experienced from the three other municipalities through which the route of the railway lay. The opposition at Preston was due to belief on the part of some of the influential merchants and other business firms that the construction of the road would tend to divert trade from Preston to Galt. It took three years of persistent effort on the part of the company to dispel this belief and the opposition founded thereupon, but the task was eventually accomplished and the long-delayed franchise granted.

Early in the present year a contract was let for the construction and partial equipment of the road, to Messrs. Ahearn & Soper, of Ottawa, Canadian agents for the Westinghouse Electric Manufacturing Co., of Pittsburgh. The outside construction was done under the superintendence of Mr. Hartnett, of Toronto, while Mr. John Murphy, superintendent for Messrs. Ahearn & Soper, supervised the installation of the plant at the power station. The contract for the necessary steam plant was given to the Goldie & McCulloch Co., of Galt.

The railway company were fortunate in having the opportunity to purchase the required quantity of 56 lb. T-rails, second-hand, though in first-class condition, at a substantial reduction on the price of new material. The construction of the road began early in April, and was brought to completion about the middle of July. On Thursday, July 26th, the official opening took place, and was participated in by a number of invited guests as well as the officials of the road and prominent business men of the locality. Whatever clouds shadowed the enterprise in its earlier days, none were to be discerned on this occasion. The face of the sky as well as the faces of all who witnessed the ceremonies, seemed to smile approval.

At the Galt terminus of the line, situated close beside the G. T. R. depot, a couple of cars gaily decorated with flags, were in waiting on the arrival of the train from Toronto, to carry the officials and invited guests over the line, which is about three and a half miles in length. This distance, including stoppages, is covered in about fifteen minutes. The road, as stated, commences near the G. T. R. depot, and runs through the principal street of the town of Galt, to the C. P. R. depot, which is reached by a steep grade, and thence, following the highway, through the open country to Preston. The road is comparatively level, with the exception of three heavy grades, one of which has just been mentioned. Of the other two, one is situated in Preston and the other midway on the line. There is only one sharp curve, situated near the Galt terminus. The tracks are ballasted with gravel, and the road-bed is very solid and substantial in character. The line throughout is bonded with No. 6 wire. There are no ground plates and no return wires. No. 00 feed wires run the whole length of the line, with feeder to trolley wire every sixth pole. The span wire is of ordinary feed wire, the bell being of solid iron, not insulated.

The road is at present equipped with only two cars—one fitted up as an ordinary street car, the other with reversible cushioned seats on iron frames, after the style of a railway coach. A novel feature of this last mentioned car is the passenger baggage department, in the rear, which occupies about one-third of the interior space. The cars are vestibuled, and lighted by two clusters of incandescent lamps pendant from the ceiling. The cars were made at the works of the Ottawa Car Company.

The power station, where a halt was made to allow of an inspection of the motive power, is situated on the outskirts of Preston. It consists of a substantial stone building which, though originally built for other uses, has been remodelled and conveniently adapted for its present purpose. Attached to the boiler house in the rear there has been constructed on a stone foundation a brick chimney 80 feet in height and measuring about 9 feet square at the base. In the boiler house are two boilers, each 80 h. p. of steam. These supply steam to two compound Wheelock engines, each of 150 h. p., in the front of the building. These engines were manufactured by the Goldie & McCulloch Co., of Galt, and display excellent workmanship. They are joined by a coupling on center of shaft, and can be run singly or connected as desired. At present only one engine is required. The regulation of these engines is said to

be so close that there is a variation of only 5 to 10 volts. These engines are belted to a No. 7 Westinghouse 85 Kallowatt generator running at 175 amperes. But little more than half the capacity of this generator has thus far been brought into use. The company anticipate, however, that the road will be extended to Hespeler, three miles north of Preston, in which case it is believed the capacity of the present power plant would be found to be sufficient to meet the added requirements.

Water for condensing purposes is obtained from a creek which flows close beside the boiler house, and which is fed by never-failing springs. This water passes through a Northey jet condenser located in the basement of the building. Attached to the Northey pump is an automatic vacuum breaker, which prevents the water from rising too far. The generator is driven by 100 feet of 14 inch double ply belt supplied by the F. E. Dixon Co., of Toronto. There is now being put in a Wurtz tank lightning arrester with set of choking coils. It consists of four panels, each containing four coils of 10 turns of trolley wire. Every coil is connected with the water in the tank, the tank being grounded. The switch board, which is of oak, and rather unsubstantial looking in appearance, is fitted with a handsome set of Westinghouse recording instruments, switches, and a Wurtz non-arcing lightning arrester, separately mounted on blocks of marble. The arrester consists of two blocks of lignum vitae, carrying two brass plates, $\frac{1}{4}$ inch apart. Between these plates are fine lines burnt on the blocks, so that a path is carbonized for the discharge, which passes off without arcing. The cover is of lignum vitae, and the size of the arrester $3\frac{1}{2}$ square inches. The arrester requires no attention. The company have placed these arresters, encased in iron, at intervals along the line.

The plant is efficiently operated under the direction of Mr. W. A. Lea, formerly with the Toronto City and Suburban Electric Railway Company.

For the present the two cars running on the line are housed in one side of the power station, but the erection of a car barn adjoining the station is in contemplation. It is also intended to add to the present car equipment two trailers.

The Company are giving at present a half hour service between Galt and Preston, and by the terms of their franchise are compelled to meet all C. P. R. trains on their arrival at Galt. The gauge of the electric railway corresponds to that of the C. P. R., and a switch has been put in connecting the two roads at the C. P. R. depot, with the intention of hauling freight at night over the electric railway tracks by means of a dummy engine. It is believed that in addition to a profitable passenger traffic the road will do a large freight business.

After leaving the power station the trip was resumed. The widening of a bridge on the principal street of Preston at present stands as an obstacle to the running of cars through the town. The tracks have been laid to either side of the bridge, however, and immediately that the structure is widened to admit of carrying the railway tracks, traffic from end to end of the line will begin.

Beneath the shade of a mammoth tent pitched on the lawn of the Hotel del Monte, the company were invited to partake of a tastefully prepared luncheon, presided over by Mr. Todd, the president of the road. Following the repast there were in response to a brief toast list some excellent speeches, in which well merited praise was bestowed on the management of the company and the contractors for the energy and skill displayed in the construction of the road, and cordial wishes expressed for the prosperity of the enterprise. On behalf of the directors, Mr. Cox, the vice-president, presented to the president a life pass over the road, consisting of a card of pure silver, handsomely engraved.

There is little doubt that in the near future the Galt and Preston Electric Railway will be extended to Hespeler, which is quite an important manufacturing town, and from which a large amount of passenger and freight business would be derived.

A new fire alarm service, with twelve stations, is being put in by the corporation of Collingwood, Ont. Scott, of Oshawa, is doing the work under contract. The alarm, besides being connected to the central station, will connect at the city hall with a large bell, which rings the alarm.

The Ottawa Electric Street Railway carried during the first year of its operation 1,520,000 passengers. During the year ending May, 1894, the number of fares registered was 2,700,000. The equipment of the road consists of 65 cars, including three postal cars, which are operated by 1,700 h. p.; employment is given to 200 men.

Mr. J. N. Taylor has an article on "The Romance of the Telegraph" in Donahue's Magazine in the course of which he relates an anecdote of an old French Canadian woman who spent half a day gazing at the telegraph wires that stretched along in front of the little old house in which she lived. She was watching for a message, and a passer by, who was attracted by the old lady's attitude, asked her what she was looking at, and if she expected to see something pass on the wires, to which she replied: "Dere's long taim ah'll look does ting, me sometaime mornen, sometaime heev nin, but ah'll never see something go pass on eem. How ces dat? Wen an jook long taim, by m bye he's mek sometaime curcuse nose lak sung, deh ah spose he's hurry fas as caint see someting any more? Ah don henderstan me."

WINNIPEG STREET RAILWAY COMPANY V. WINNIPEG ELECTRIC STREET RAILWAY COMPANY AND THE CITY OF WINNIPEG.

BEFORE the Judicial Committee of the Privy Council at the beginning of July an appeal from a judgment of the Court of Queen's Bench in Manitoba in the above case was heard. The case was recently argued before a Board consisting of the Lord Chancellor, Lord Watson, Lord Macnaughten, and Sir Richard Couch, when judgment was reserved. Lord Watson, in now delivering judgment, went fully into the question at issue between the parties. The action was originally brought to secure certain rights claimed by the appellant Company under a deed of indenture executed in July 1882, between the appellants and the authorities of the city of Winnipeg for the construction and working of street railways within that city. Having very exhaustively reviewed the evidence, his Lordship said that the privileges conceded to the appellant Company were to endure for 25 years from the date of the deed of indenture executed in July, 1882, it being in the option of the city to acquire the Company's undertaking at the expiry of that period upon their giving five years' previous notice to that effect. The Company at once proceeded with their tramway enterprise, in accordance with the terms of the said deed, which gave the appellant Company powers to use and occupy such parts of the streets of the city as were necessary for the use and working of their railways. Before 1892 they had completed and were in course of working upwards of nine miles of street railways. In February, 1892, the Mayor and Council of Winnipeg passed a by-law authorizing James Ross and William M'Kenzie to construct railways upon the streets of the city. The respondent Company in April, 1892, obtained an Act of the Provincial Legislature, incorporating them for the purpose of their taking over the rights acquired by Ross and M'Kenzie, and carrying out the scheme sanctioned by the by-law of February. The respondent Company's Bill was opposed by the appellant Company, who alleged that they were entitled to a monopoly for the period of 25 years from the date of their agreement of all those streets in which their railways had already been open for traffic, and also of certain other streets in which they had intimated that they were willing and ready to construct and operate railways. This right was (the appellant contended) specially safeguarded by a clause in the Company's Act. It was (said his Lordship) unnecessary to criticise the enactments of this clause, because it was not disputed that these would be sufficient to protect any such privilege as that which was claimed by the appellant Company in the appeal. The appellants commenced the present suit by presenting to the Court of Queen's Bench a bill of complaint against the respondent Company and also against the city of Winnipeg. The appellants craved a declaration of the exclusive rights which they claimed against both respondents, and an injunction restraining the respondent Company from constructing or operating railways in any street occupied by them until an offer had been made to them of the privilege of constructing a railway upon it and had not been accepted by them within two months. In defence to the suit the respondents maintained, in the first place, that the appellant Company were not possessed of any exclusive privilege, and that the city had therefore power to sanction the construction of railways by the respondent Company, in any street of the city, whether it was already occupied by the Company or not; and, in the second place, that, if the city had in fact agreed to give the appellant Company a monopoly of the railway traffic in certain streets, the agreement was *ullius vires* and void. The original action had been decided against the appellants, as had also an appeal before a full Court. In the full Court both points were decided against the appellants. Their Lordships did not find a single expression tending to show that the Legislature either intended that no tramways other than those of the appellant Company were to occupy the streets of Winnipeg or had it in contemplation that the appellants were to obtain a monopoly from the Council of the city. If such a claim were valid, the right must be derived from the indenture of 1882; but the only authority there given was expressly limited to the construction, maintenance, and operation in each street which the Company might select for that purpose, of a railway consisting of a single or double line of rails, with needful appurtenances: "and such railway shall have the exclusive right of such portion of any street or streets as shall be occupied by the said railway, and shall be worked under such regulations as may be necessary for the protection of the citizens of said city." The appellant Company argued that the words last quoted ought to be construed as a declaration that the Company's railway was to be the only railway permitted to occupy any part of those streets into which it might be introduced by them. In their Lordships' opinion, any such construction would be contrary to the plain meaning of the words of the agreement, which in substance implied that the Company were to have no use or occupation of, and no concern with, those portions of any street which were not actually occupied by their double or single line of rails. The only clause at all bearing out the appellant's connection ran thus: "In the event of any other parties proposing to construct street railways on any of the streets not occupied by the parties to whom the privilege is now to be granted, the nature of the proposal thus made shall be communicated to them, and the option of constructing such proposed railway on similar conditions as are herein stipulated shall be

offered; but if such preference is not accepted within two months then the Corporation may grant the privilege to any other parties." Their Lordships did not think that it was going too far to say that, laying aside the terms of that stipulation, there was not a single expression in the deed of agreement which gave the least countenance to the suggestion that the Municipal Council intended to grant to the appellants an exclusive right to use and occupy any street for railway purposes. Those clauses of the deed which dealt directly with the use and occupation of the streets which were to be enjoyed by the company were not only silent upon the question of exclusive right, but were conceived in terms which it was exceedingly difficult to reconcile with the theory of an intention to create such a right. Had there been any such intention, nothing would have been easier than to indicate its existence, in the proper place, either expressly or by implication. Their Lordships were therefore of opinion that the leading clauses of the agreement which defined the Company's rights of user and occupation, could not be qualified by a subsidiary clause, such as that upon which the appellant Company relied, unless its terms were clear and coercive. They were unable to hold that the terms of the clause in question were in themselves sufficient to control the plain meaning of the previous stipulations and to constitute the right of monopoly which the appellant Company claimed. The clause could not imply an undertaking on the part of the council that in the event of a rival company obtaining statutory powers, and desiring to compete with the appellant Company in those streets in which their system had already been established, the Council should be bound, although against the interest of the community which it represented, to refuse its assent to the new scheme and to allow the Company to remain in the enjoyment of a monopoly. Their Lordships' decision, therefore, was that the judgments appealed from ought to be affirmed, and the appellant Company must pay one set of costs to the respondents.

TESTS OF SMALL ELECTRIC RAILWAY PLANTS.*

By JESSE M. SMITH.

THIS paper gives the results of a test made in October, 1893, on the power plant of the Wyandotte & Detroit River Railroad, which is a suburban road running from Detroit to Trenton, Mich., 10.5 miles long.

The plant contains two tandem compound condensing engines, rated at 150 H. P. each, and guaranteed for a maximum load of 225 H. P., made by the Phoenix Iron Works Company, Meadville, Pa. Each engine is belted direct to a Westinghouse railway generator of 150 E. H. P. The vacuum is obtained by a Conover air pump and condenser belted directly to the engine shaft. The boiler feed pump is driven from the air pump shaft. Steam is supplied by two Manning vertical boilers. One engine and dynamo only were used during the test. It will be noted at the outset that each engine and dynamo are designed to deliver an average of 150 H. P., but that during the test the average load on the engine was only 70 H. P. and the maximum 141 H. P. The best conditions of economy were therefore not realized. The test was made under commercial conditions for the owners of the plant. All the machinery had been run about three months and no adjustments by the makers had been made since it was first put in. No special care had been taken to get very close regulation either of the engine or generator. One boiler was fired with coal, and used exclusively to supply steam for the fuel atomizer of the other boiler; "straight crude oil" was used exclusively as fuel for the boiler, which supplied steam to the engine, and no steam was used from that boiler for other purposes. Indicator cards were taken at intervals of five minutes during the 17½ hours of the test. A Tabor indicator was applied directly to each end of each cylinder, and all operated by the same mechanism. Indicator cards were taken simultaneously from the four indicators by two persons on a signal given at the proper time, without regard to the load on the engine. The speed of the engine was determined by a continuous revolution counter which was directly connected to the shaft of the engine. The variation of speed was shown by a tachometer belted directly to the engine shaft, and constantly in service. It was carefully compared with the revolution counter when on constant speed, and was made to agree with the counter. The speed of the dynamo was taken at four different times by a revolution counter held in the end of the shaft for five consecutive minutes each time. Three readings gave 603 revolutions, and one reading gave 603 revolutions per minute. The speed of the air pump was taken in the same way.

The steam gauges on the boilers were connected to the boiler near the bottom, so that they show the pressure due to a head of water of about ten feet in addition to the steam pressure. The boiler gauges therefore show about five pounds more pressure than the pressure of the steam in the boiler. The standard gauge, when placed on the steam pipe of the engine just above the throttle valve, showed about five pounds less pressure than the boiler gauge, so that there was practically no loss of steam pressure between the boiler and engine.

The amperes were measured by a Weston standard ammeter connected in series with the station ammeter. The volts were measured by a Weston standard voltmeter connected to the bus bars of the switchboard. Volt and ampere readings were taken

* Abstract of a paper read before the American Society of Mechanical Engineers.

every ten seconds by a different person at each instrument, the time being given by a third person.

The water used by the boilers was taken from the overflow of the air pump, and weighed in two barrels on two scales, and was pumped from the barrels by the regular feed pump worked from the shaft of the air pump. The feedwater passed through a closed heater with brass tubes, the heater being connected with the exhaust pipe between the engine and condenser. The fuel oil was stored and fed by the Snell water pressure system. The amount of fuel oil fed to the atomizer was measured by measuring the number of gallons of water which flowed into the storage tank.

The dimensions of the plant and data, and the results, are given in the following tables :

BOILERS—Kind, Manning vertical tubular ; number, 2 ; size, known as 61 inches, rated capacity, 150 H. P., inside diameter of firebox, 6 feet ; height above grate, 3 feet 6 inches, number of tubes 184, outside diameter of tubes, 2½ inches, total length of tubes, 14 feet 10 inches, length of tubes below water line, 10 feet 7 inches ; heating surface in firebox, 89.2 square feet ; heating surface in tubes below water line, 1,272.7 square feet ; heating surface in tubes above water line, 511.1 square feet.

ENGINE—Kind, Phoenix Iron Works Company, tandem compound, condensing, diameter of high pressure cylinder, 11 1-16 inches ; diameter of low pressure cylinder, 20 1-32 inches, stroke of piston, 15 inches, piston valves on both cylinders, both controlled by shaft governor, number of fly-wheels, 2, diameter of fly-wheels, 78½ inches, face of fly-wheels, 16½ inches ; weight of rim of each fly-wheel, 2,445 lbs.

AIR PUMP—Kind, Conover belted to engine, size, No. 7, diameter of piston, 15 inches ; stroke of piston, 7 inches ; revolutions per minute, 67.

BOILER FEED PUMP—Kind, single acting plunger driven from shaft of air pump ; diameter of plunger, 3 inches ; stroke 6 inches.

DYNAMO—Kind, Westinghouse four pole railway generator ; rated capacity, 150 E. H. P., standard speed, 625 revolutions per minute, speed when tested 604 revolutions per minute.

CARS—Maker, Jones ; length, 16 feet ; weight, 14,500 pounds ; number of seats 22 ; kind of motors, Westinghouse ; number of motors, 2 ; rated power of each motor, 30 E. H. P. ; number of cars in use, 3.

ROAD—Length, 10.5 miles ; kind of rail, T ; weight of rail per yard, 52 and 56 pounds ; supported on cross ties ; ties covered with sand, and resting on sand, except from Wyandotte to Trenton, which is stone ballasted.

SPEED OF ENGINE AS CONTROLLED BY GOVERNOR.

Revolutions per minute by revolution counter, average for eight minutes with dynamo belt off.....	238 revolutions
Average revolutions per minute on regular work during 362 minutes.....	234.3 "
Per centage of variation of revolutions.....	1.58 "
Minimum revolutions per minute, dynamo producing 180 amperes, engine developing 165 I. H. P.....	227 "

DISTRIBUTION OF POWER USED.

Power consumed by friction of engine, air pump and boiler feed pump, with main belt off.....	9.22 I. H. P.
Friction of engine, air and feed pumps, and dynamo, with brushes off.....	11.34 I. H. P.
Friction of dynamo and belt.....	2.12 I. H. P.
Power consumed by engine, air and feed pumps and dynamo, with brushes on and main circuit open.....	14.34 I. H. P.
Power required to charge fields of dynamo.....	3.00 I. H. P.
Percentage of engine capacity required by friction of engine, air and feed pumps.....	6.15
Maximum power developed by engine as shown by indicator cards, during economy test.....	141.4 I. H. P.
Minimum power developed by engine as shown by indicator cards, during economy test.....	21.27 I. H. P.
Average power developed by engine, as shown by 208 sets of indicator cards, during economy test.....	70.1 I. H. P.
Average electrical horse power delivered by dynamo.....	45 E. H. P.
Average indicated horse power delivered to pulley of dynamo, estimating friction of armature shaft to be the same as friction of belt.....	59.81 H. P.
Average number of cars in use during test.....	2.89 cars
Number of passengers on cars during 17½ hours.....	1,014
Average number of passengers on car per single trip.....	15.2
Average number of passengers on cars at any one time (estimated).....	8
Weight of 10 persons at 140 lbs each.....	1,400 pounds
Weight of cars.....	14,500 "
Total weight of cars and persons.....	15,900 lbs.
Average weight in motion.....	44,950 "
Average electrical horse power per 1,000 pounds of weight moved.....	0.98 E. H. P.
Average horse power developed by engine per 1,000 lbs. of weight moved.....	1.52 I. H. P.
Average electrical horse power per car.....	15.54 E. H. P.
Average horse power developed in engine per car.....	24.25 I. H. P.
Average watts delivered by dynamo per horse power developed in engine.....	478.8 watts
Average watts delivered by dynamo per horse power delivered to belt of dynamo.....	557.3 watts
Average speed of cars per hour, including all stops, 21 miles in 1.5 hours.....	14 miles per hr
Average speed of cars between stops.....	15.38 "
Total car hours.....	50.25 hours
Time of test.....	17.33 "

ECONOMY TEST.

Duration of test.....	17½ hours
Average horse power developed in engine as shown by 208 sets of indicator cards taken at five-minute intervals.....	70.1 I. H. P.
Average horse power delivered by dynamo as shown by 6,209 sets of readings taken at ten-second intervals.....	45 E. H. P.
Net average steam pressure in boiler by 4-hour readings.....	111.8 lbs.
Average vacuum by half-hour readings.....	25.2 ins.
Steam used by engine per hour.....	1,721.1 lbs.
Steam used by engine per horse power per hour.....	24.55 "
Steam used by fuel oil jet per hour.....	291.5 "
Steam used by engine and fuel oil jet per hour.....	2,008.8 "
Per centage of steam used by fuel oil jet.....	14.5
Fuel oil used per hour for engine, 20.25 gals.....	133 lbs.

Fuel oil used per horse power per hour for engine, 29 gals.....	1.9 lbs.
Additional fuel oil which would be required to maintain oil jet for one hour, 3.43 gals.....	22.58 "
Average temperature of water flowing from air pump.....	91.8 Fah.
Average temperature of feedwater entering boiler.....	126.6 "
Rise of temperature of feedwater due to heater.....	34.8 "
Per centage of fuel saved by heater.....	3.66 "
Fuel oil required to evaporate 1,000 lbs. of water from 126.6° Fah. into steam at 112 lbs. pressure.....	11.79 gals.
Water evaporated from 126.6° Fah. into steam at 112 lbs. pressure per gallon of fuel oil.....	84.81 "
Ditto per pound of oil.....	12.9 lbs.
Area of steam outlet of atomizer.....	.07 sq. in.
Which is same as a round hole .3 in. diameter	

It will be noted that 14.5 per cent. of the total steam generated was used by the fuel oil atomizer. The atomizer was not properly proportioned for the work, and did not receive enough air. The flame was red and evidently not economical. The atomizer and furnace have since been arranged with much better results.

In this engine the piston valves which distribute the steam to both high and low pressure cylinders are controlled by the governor.

It will be noted that while this is a condensing engine the high pressure cylinder does a good share of the work even on the lightest loads, and the receiver pressure does not vary greatly either during a single revolution, or during a change of load of from 21 to 101.8 H. P. While the load changes 488 per cent., the average receiver pressure only changes 167 per cent., and even when the engine ran with the belt off and developed 9.2 H. P., there was no negative work in either end of either cylinder. These results, which I believe to be highly important, both for economy and close regulation, are due to the valves of both cylinders being controlled by the governor.

The results of a study of the indicator diagrams are given in the following table :

1. H. P. in H. P. cylinder	Set No. 1.	Set No. 2.	Set No. 3.
Crank end.....	2.4	13.8	25.3
Head end.....	2.5	14.8	26.1
1. H. P. in L. P. cylinder			
Crank end.....	8.3	16.6	25.2
Head end.....	7.8	17.6	25.2
Total 1. H. P.....	21.0	62.8	101.8
Maximum pressure in receiver.....	5.9	9.0	11.0
Minimum " ".....	4.0	6.4	7.5
Average " ".....	4.9	7.2	8.2

The variations in load in a plant of this kind are not only extreme but rapid, and were from 5 to 134 amperes. In one interval of 10 seconds the load increased 115 amperes, which equals 120 I. H. P.

During the regular operation of the plant and with these extreme variations in load, the needle of the tachometer never left the space enclosed by the 230 and 240 revolution marks.

FLY WHEELS.

For convenience of those designing or buying steam engines, we give herewith a table applicable to engines of various horse powers, at different speeds, and from which the required weight of fly-wheel rim in pounds may be got by dividing the number given by the diameter of wheel decided upon. The larger the wheel the less rim-weight it needs.

TABLE FROM WHICH TO GET WEIGHTS OF FLY WHEEL RIMS.

H. P.	REVOLUTIONS PER MINUTE,			
	60	70	80	90
	Constant	Constant	Constant	Constant
25	45126	33163	25391	20111
30	54152	39796	30469	24133
40	72202	53061	40625	32178
50	90253	66327	50781	40222
60	108303	79592	60938	48266
70	126354	92857	71094	56301
75	135379	99490	76172	60333
80	144404	106122	81250	64365
90	162455	119388	91406	72460
100	180505	132654	101563	80444
125	225631	165816	126953	100555
150	270758	198980	152343	120666
175	315884	232143	177734	140767
200	361010	265306	203135	160888
225	406136	298469	228516	180999

THE GEAR BUSINESS.

THE gear business has grown to be quite extensive, so much so that one of the firms in this line has decided to secure a patent on bevel gears with plain surfaces for the flanks of the gear teeth. It may be that this firm has a special curve of their own to run with a straight flank tooth, but if they will look into the theory of the matter they will find that there is only one form that will work properly with a straight flank, and that form is determined by the flanks themselves, without any discovery being needed from any source.—Journal of Commerce.

SPARKS.

An electric railroad from Chatham to Fort Lambton, via Dover, is talked of.

Telephonic communication was recently established between Guelph and Chicago, a distance of 600 miles.

The Winnipeg Electric Street Railway Co. have decided to issue transfers over their entire system at one fare.

It is said to be the intention of the Wellington Coal Co., of Nanaimo, B. C., to install an electric plant in their mines.

The management of the Light, Heat & Power Co., of Kingston, Ont., has recently been placed in the hands of Mr. B. W. Folger.

By the narrow majority of five, the ratepayers of Orillia have approved the expenditure of \$13,000 on an incandescence lighting system.

A by-law authorizing the purchase by the city of Vancouver, of the electric railway at that place, has been disapproved of by vote of the ratepayers.

The application for incorporation of the Niagara Falls Electric Bridge Co., which was recently before the Dominion Parliament, has been withdrawn.

The ratepayers of Weston have expressed approval of the granting of a bonus for the extension of the Toronto Suburban Railway to that village.

The agreement between the corporation of Ottawa and the Ottawa Electric Co., for the city lighting for a period of ten years, has been formally concluded.

There has recently been a change in the Montreal Electric Co., Mr. W. F. Taylor having retired. The business will be continued by Messrs. John and Wm. H. Shaw.

Messrs. F. H. Sleeper & Co., of Cotuit, Que., are endeavoring to form a company to supply electric light to the village of Ormstown and the town of Huntingdon.

Mr. George W. Kieley, formerly President of the Toronto Railway Co., died suddenly at his residence in Toronto on July 18th. Mr. Kieley very highly respected in the community.

The Hamilton papers look upon the completion of the Galt & Preston Railway as an indication that the proposed Hamilton Radial Electric Railway project will be successfully carried out.

The Electric Light and Water Supply Co., of Gananoque, Ont., are said to have under consideration the construction of an electric railway from that town to Gananoque Junction, a distance of four miles.

The engine in the Kingston Electric Railway Company's power house was damaged by lighting on the 2nd of July to such an extent that the operation of the street cars was delayed until the following day.

At the twenty-fifth annual meeting of shareholders of the Dominion Telegraph Co., held in Toronto on July the 11th, Mr. Thos. Swinburne was re-appointed President, Sir Frank Smith, Vice-President, and Mr. Fred Royer, Sec.-Treas.

The Nova Scotia Telephone Co. has recently established communication with Maitland, via Truro. The line extends through Clifton and Black Rock, and from thence to Maitland by means of a submarine cable, 3,500 feet long, crossing the river.

The offer of the Canadian General Electric Co. to light the streets of London with arc lights at 25 cents per light per night, has been accepted by the City Council. The offer of Mr. T. H. Everett, for the electric street railway franchise was not entertained.

The Dominion Parliament has granted incorporation to the Boynton Bicycle Electric Railway Co., which proposes to run from Winnipeg via Toronto, Ottawa, Montreal and St. John to Louisburg, Cape Breton county, N. S., and from Montreal to Quebec.

The Chief of Police of Montreal has been instructed by the Council to cause the arrest of any motor-man who runs his car at a faster rate than eight miles an hour. It will be interesting to learn in what way the police will determine at what rate the cars are run.

The City Council of Victoria, B. C., is considering the question of a suitable site for the electric power house which it is proposed to erect. It is suggested that arrangements should be made in connection with the erection of this station for the cremation of the city garbage.

A Keweenaw dispatch states that the Power Company of that place are talking of making the attempt to intrude electric power to Winnipeg, a distance of 100 miles. The company will do well to wait the result of the Cataract Construction Co.'s efforts on this line, before proceeding with the experiment.

Several officers of the Toronto, Montreal and Cleveland railway syndicate, with Mr. Sam Hughes, M.P. of Lindsay, have been incorporated as the Hughes Car Ventilating Co., Limited, with a capital of half a million dollars, for the purpose of placing upon the market an invention by Mr. Hughes for the ventilation of cars.

The city council of Winnipeg will be petitioned to sanction the running of street cars on Sunday.

The Standard, Chandlere & Ottawa Electric Light Companies have been formally amalgamated under the name of the Ottawa Electric Co. The officers of the new company are: President, Mr. T. Ahearn; vice president, Hon. E. H. Bronson. The capital stock of the company is \$1,000,000, with a paid-up capital of \$645,000.

Negotiations are said to be in progress for the purchase by the Toronto Railway Co. of the Metropolitan Electric Railway at North Toronto, but it is stated that no agreement has been arrived at. It is denied that an injunction has been issued by some of the shareholders of the Metropolitan Railway Co. to prevent the consummation of the deal.

The construction of a belt line electric railway, three miles in length, at Nanaimo, B. C., with a continuous line six miles in length to the neighboring town of Wellington is proposed by Messrs. J. H. Brownlee and W. C. Haywood, of Victoria. It is proposed also to light the streets of Nanaimo, Wellington and Northfield. The cost of carrying out the proposal is estimated at \$147,000. The interest on this sum the city will be asked to guarantee.

The Toronto Railway Co. have recently posted in their cars regulations forbidding passengers to attempt to alight from a car without previous notice to the conductor; to attempt to get on or off a car while it is in motion; to ride on platform or steps of cars, or lean on gates at side of cars; to cross tracks without stopping and looking for cars. The company will not entertain any claim which may arise from violation or want of regard of any of these rules and warnings.

Two electric companies have secured incorporation at St. George, N. B. One is called the St. George Electric Co., Ltd., and is composed of T. H. Estabrooks, A. P. Barnhill and Dr. Wm. Hayward, of St. John, and Hon. A. T. Dunn and F. B. Dunn, of Musquash. It has a capital stock of \$5,000 in \$100 shares, and one-half of the stock is preferred. The other is known as the St. George Electric Light and Power Co., with a capital stock of \$5,000 in \$10 shares. It is composed of St. George people—J. Sutton Clark, Timothy O'Brien, Andrew S. Baldwin, John Frawley, Dr. H. J. Taylor, James Bogue and John O'Brien.

The following gentlemen have been elected as the Board of Directors of the Hamilton and Dundas Railway Co. for the ensuing year: Messrs. B. B. Osler, Q. C., Adam Brown, Alex. Bruce, Q. C., George Rumberger, H. S. Osler, George S. Counsell, and John Garrett. At a meeting of directors held immediately afterwards, Mr. B. B. Osler, Q. C., was chosen president, Mr. Adam Brown, vice-president, and Mr. W. S. McBrayne, Secretary-treasurer. The conversion of the road to electricity was discussed, and progress was reported in the completion of the company's arrangements in this direction.

Owing to night of way troubles the Hamilton, Grimsby and Beamsville Electric Railway is not expected to be ready to go into operation before September. Several wealthy farmers at Grimsby have yet to be settled with, probably by arbitration, and the procedure of the courts is conducted with great deliberation. The worst part of the grading has been done, viz., at Red Hill, where filling was required to a depth of 3 to 19 feet for a distance of 400 feet. The iron bridge at this point is now being erected. The power station building is completed and the engines are being erected. The generators have not yet arrived. Owing to the refusal of the county to grant the right of way, the road will be constructed only as far as Grimsby village this year, but the expectation is that an agreement will be reached with the county authorities under which the line will be extended to Grimsby Park.

TENDERS WANTED

Tenders will be received by the undersigned, until WEDNESDAY, the 15th August, 1894, for the erection and furnishing of

ELECTRIC LIGHT PLANT

including poles and wire, lamps, etc., etc. And for erecting a Power House on the water power owned by the Town of Trenton, to be owned and operated by the municipality.

Also a tender for lighting the Town of Trenton, the tender to state price separately, and to furnish their own plans and specifications.

Further information can be obtained from the undersigned. The lowest or any tender not necessarily accepted.

G. L. CROWE, Chairman Fire, Market and Police Committee Trenton, 25th July, 1894.

Parliament has sanctioned the bill providing for an increase in the capital stock of the Montreal Park and Island Railway from \$500,000 to \$1,000,000. Mr. Williams, the promoter of the bonus for the road, has been granted \$125,000 worth of stock in the company, as remuneration for his services.

SITUATION WANTED

Electrician and Engineer open for engagement; thoroughly understands management and repairs to machines and lamps, wiring, etc.; strictly temperate; references.

R. H. SANBY, JR., 103 Walker Ave., Toronto, Ont.



TENDERS

FOR

ELECTRIC LIGHT PLANT

Tenders will be received by registered post only, addressed to Ald. W. T. Stewart, Chairman Committee on Fire and Light, Toronto, up to 11 o'clock a.m. of

Saturday, the 1st of September, 1894,

For the installation of a complete electric light plant for the

CITY OF TORONTO, ONT.

Separate tenders will be received for the various portions of the work, viz:

1. Engine Equipment.
2. Counter Shaft and Pulleys.
3. Belting.
4. Boilers.
5. Pumps and Steam Piping.
6. Economizers.
7. Dynamos and Station, Electrical Apparatus.
8. Arc Lamps.
9. Poles and Overhead Circuits.
10. Mast Arms and Lamp Attachments.

Plans and specifications may be seen and forms of tender obtained at the office of the City Engineer on and after Saturday, the 11th of August, 1894.

Specifications for items Nos. 2, 3, 5 and 6 may be withheld until balance of apparatus is decided upon.

A deposit in the form of a marked cheque, payable to the order of the City Treasurer, for the sum of 2 1/2 per cent. on the value of the work tendered for, must accompany each and every tender, otherwise they will not be entertained. All tenders must bear the bona fide signatures of the contractor and his sureties (see specifications) or they will be ruled out as informal.

The committee do not bind themselves to accept the lowest or any tender.

W. T. STEWART, Chairman Com. on Fire and Light.

Committee Room, Toronto, July 26, 1894.



TENDERS

For Lighting the Streets of the City of Toronto.

Tenders addressed to the undersigned will be received by registered post up to 12 o'clock noon of

SATURDAY, SEPTEMBER 1st, 1894,

For the lighting of the streets, avenues, squares, and lanes of the city of Toronto with electric light and gas for a period of five years from the 1st of January, 1896. Specifications and forms of tender can be obtained upon application at the office of the Secretary of the Fire Department, Hay Street Fire Hall, on and after Wednesday, August 1st.

Cash deposit or marked cheque, made payable to the order of the City Treasurer for the sum of \$3,000, must accompany each and every tender, together with the bona fide signatures of two responsible persons who will become sureties for the due fulfillment of the contract. The deposit accompanying the tender will be forfeited to the city in the event of the person or persons whose tender is accepted failing to execute the contract or give satisfactory sureties for the due fulfillment of the same. Deposits of unsuccessful tenderers will be returned. Lowest or any tender not necessarily accepted.

W. T. STEWART, Chairman Com. on Fire and Light.

City Clerk's Office, Toronto, July 27, 1894.

... THE ...

Canadian General Electric Company

LIMITED.

HEAD OFFICE:

65 to 71 Front Street
West.

TORONTO, ONT.

CAPITAL,

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Electric Mining Locomotives, Hoists, Pumps,
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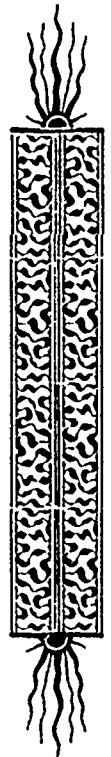
Arc Lighting Apparatus.

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Generators for Lighting or Power Circuits
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MOONLIGHT SCHEDULE FOR AUGUST.

Day of Month.	Light.		Extinguish.		No. of Hours.
	H.M.	H.M.	H.M.	H.M.	
1.....	P. M.	7.30	A. M.	4.00	8.30
2.....	"	7.30	"	4.00	8.30
3.....	"	7.30	"	4.00	8.30
4.....	"	7.30	"	4.00	8.30
5.....	"	8.40	"	4.00	7.20
6.....	"	9.10	"	4.00	6.50
7.....	"	9.40	"	4.00	6.20
8.....	"	10.20	"	4.00	5.40
9.....	"	11.00	"	4.10	5.10
10.....	"	11.20	"	4.10	4.50
11.....	"	11.50	"	4.10	4.20
12.....	"	12.50	"	4.10	3.20
13.....	A. M.	12.50	"	4.10	3.20
14.....	"	1.40	"	4.20	2.40
15.....	No light.		No light.	
16.....	No light.		No light.	
17.....	No light.		No light.	
18.....	No light.		No light.	
19.....	P. M.	7.10	P. M.	9.30	2.20
20.....	"	7.10	"	10.10	3.00
21.....	"	7.10	"	10.40	3.30
22.....	"	7.10	"	11.20	4.10
23.....	"	7.10	"	11.50	4.40
24.....	"	7.10	A. M.	12.20	5.10
25.....	"	7.10	"	1.00	5.50
26.....	"	7.10	"	1.10	6.00
27.....	"	7.00	"	2.10	7.10
28.....	"	7.00	"	3.30	8.30
29.....	"	7.00	"	4.30	9.30
30.....	"	7.00	"	4.30	9.30
31.....	"	7.00	"	4.30	9.30
Total,					159.20

The advantages of electrical transmission of power are largely those of the relation of the position of the machinery with the motive power of the establishment. Each room is entirely independent from other rooms, and any motor is always ready for service as long as the machinery from which it derives its electricity is in operation.

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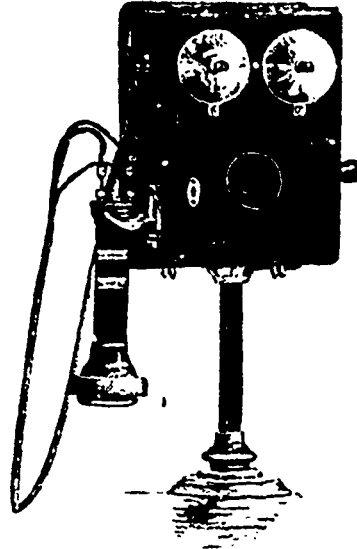
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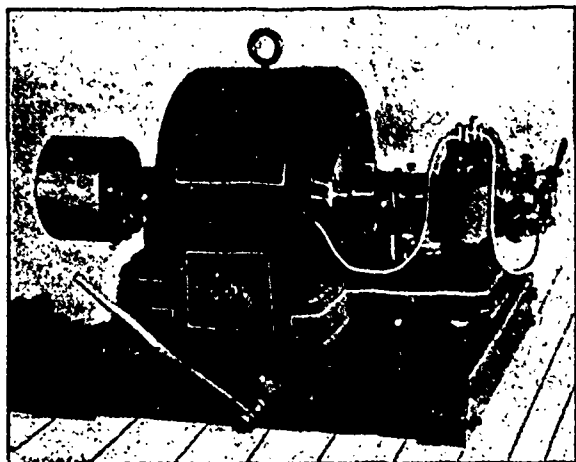
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THE EXACT ARC LAMP NON-MAGNETIC

... FOR ...
Direct-Incandescent or Alternating Circuits.

IT IS WITHOUT A COMPETITOR ON ALL CIRCUITS SINGLY OR IN SERIES

It is not affected by the flashing of machine. IT CAN BE REPAIRED BY ANY ONE.

It is much more reliable in action and would save the cost of patrolmen.

The energy expended on the electro magnets' mechanism to operate most arc lamps is utilized in THE EXACT to enhance its candle power. Its resistance is lower than any other lamp.

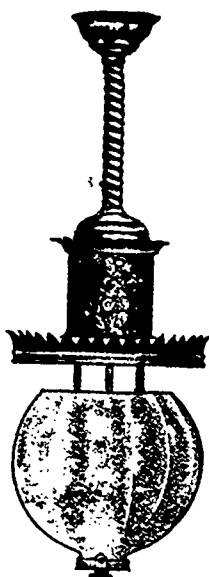
By using this lamp all the requirements of a city for power arc and incandescent lighting may be met by an alternating plant thereby saving cost of direct generators, engines, shafting line construction and maintenance of same, thus reducing the cost of installing and maintenance nearly fifty per cent.

One lamp can be burned on a 5 light transformer and from 25 volts up.

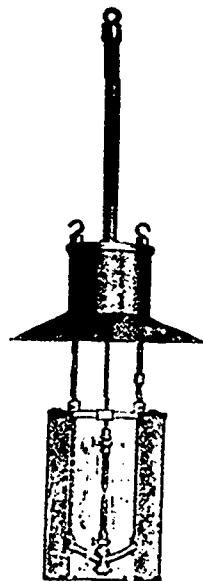
To Electric Lighting Companies— It will pay you to destroy your lamps and purchase direct from us.

The Gurney-Tilden Co., Ltd.
Sole Manufacturers
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• THE EXACT ARC LAMP CO. OF CANADA
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CORRESPONDENCE SOLICITED.



For indoor lighting.



For street lighting.

BUSINESS TROUBLES.

We regret to be compelled to announce the failure, during the last month, of two of the best known Canadian electrical manufacturing companies, viz., the Reliance Company, of Waterford, Ont., and Messrs. T. W. Ness & Co., of Montreal. We hope to learn that it will be possible for these companies to make such arrangements with their creditors as will enable them to resume business at an early date.

SPARKS.

The telephone office at Ronney, Ont., was recently destroyed by fire.

It is said to be the intention of Mr. Cone to install an electric light plant at Parry Sound.

The Toronto and Montreal railway companies have recently equipped many of their cars with fenders.

The construction of a telephone line from Eganville to Bulger, Ont., a distance of eight miles, is talked of.

The ratepayers of Kincardine have approved of a by-law for the expenditure of \$10,000 on an electric light plant.

A telephone line has recently been opened for service between Lethbridge and Corlston, Alberta, a distance of 46 miles.

The Bell Telephone Co. have recently expended upwards of \$10,000 on the improvement of its offices and plant at Kingston.

Notice is given of the intention of the Colonial Telegraph and Telephone Co., Limited, of Niagara Falls, to apply for incorporation.

The Seaforth Electric Light Co., has given a contract to the Johnston Electric Co., of Toronto, for a 1,000 light incandescent plant.

Messrs. Mills & Pettes are being complimented upon the satisfactory manner in which they are lighting the town of Knowlton, Que.

Mr. Simmonds, superintendent of the Kingston Electric Street Railway, has recently patented an invention for the electric lighting of trail cars.

Mr. W. H. McEvoy has given a contract to the Canadian General Electric Co. for a 500 light incandescent plant to be installed at Amherstburg, Ont.

Some Toronto capitalists are said to be interesting themselves in a project for the construction of an electric railway between Clinton and Bayfield, Ont.

The Brantford Electric Street Railway Co. are said to be negotiating for the purchase of a park on the outskirts of the city, with which the company's lines would be connected.

The Bell Telephone Co. are erecting a line of 40 foot poles between London and Stratford, which will complete a metallic circuit from London to Toronto, via Stratford and Guelph.

The new power house now in course of erection for the Montreal Street Railway Co., is expected to be completed early in the autumn. The building and equipment will cost about half a million dollars.

The question of the renewal of the Hamilton city lighting contract has

again been before the council, but no conclusion has yet been reached. The matter will again be discussed at the next meeting of the council.

Mr. David A. Starr, who recently resigned the position of general sales agent for the Royal Electric Co., is at present in the West Indies, acting as consulting engineer to the Trinidad Electric Light and Power Co.

The town of Carleton Place is said to have withdrawn the bonus which was proposed to be given to Messrs. T. W. Ness & Co., of Montreal, in consideration of the removal of the company's works to that place.

Mr. Henry W. Darling, well known in Toronto as the ex-president of the Canadian Bank of Commerce and the Toronto Board of Trade, has recently been elected treasurer of the General Electric Co., in the United States.

It is believed to be unlikely that the Toronto and Scarborough Electric Railway Co. will extend their line to Little York, but the line will probably be extended to Queen street and there make connection with the city line near Victoria Park.

The town council of Galt have been looking into the question of operating their own electric lighting plant, and are said to have arrived at the conclusion that the cost by this method would be greater than under the present contract system.

It has been decided to submit a by-law to the ratepayers of the village of Lanark, empowering the council to grant a bonus of \$5,000 for the construction within two years of an electric railway to connect that place with either the C.P.R. or G.T.R. line.

The motor and repair shops of the Montreal Street Railway Co. will shortly be removed from Hochelaga to the company's building at Chenille and Vitre streets, where extensive alterations are now going on, with the view of adapting the buildings to the purpose.

A 30 years' franchise has been granted to the Trenton Electric Light Co. for the construction and operation of an electric street railway from the town to the Grand Trunk depot, with a loop line running through the town. The length of the road will be two and one-half miles.

The preliminary plans of the company which is about to construct works for the utilization of the water power on the Canadian side of Niagara Falls, are said to have been approved by the Queen Victoria Park Commissioners, so that it is expected the development of the scheme will be at once commenced.

The Stanstead Electric Light Co. has been incorporated with a capital stock of \$25,000. The promoters of the company are:—Henry Lovell, Mooly B. Lovell, Charles A. Lovell and Fritz E. Lovell, manufacturers, of Costicook; Michael F. Hackett, John M. Le Moyne, Alfred N. Thompson, Henry E. Channell, of Stanstead Plain; and George F. Terrill, of Sherbrooke.

As the result of recent difficulties between the two companies, an action for \$10,000 has been taken against the Merchants' Electric & General Service Co., Limited, by the Electric Surface Co., Limited, of Canada, at Montreal. The city of Montreal has also entered an action against the Montreal Street Railway Co., to recover \$26,354, half the cost of clearing snow from the city streets during last winter.

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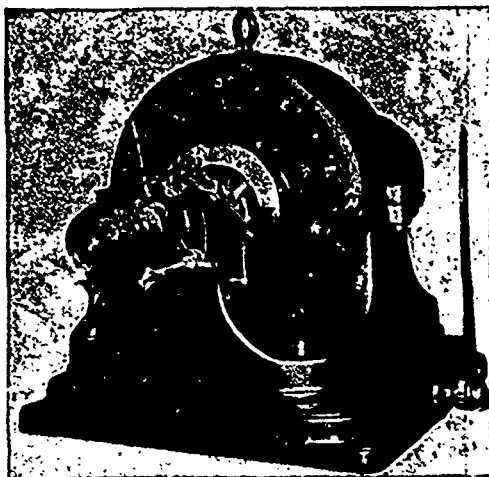
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Single and

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Slow Speed

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Electric Railway Equipments Complete. Transformers.

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NOTICE. The Westinghouse Alternator is the only Alternator of its type in which the Armature Coils are removable and may be kept in stock. Coils are lathe wound, thereby securing the highest insulation. All armatures are iron clad.

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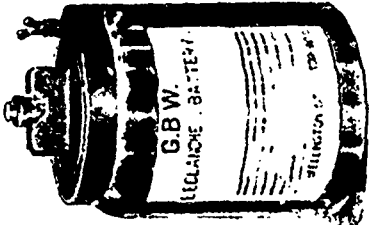
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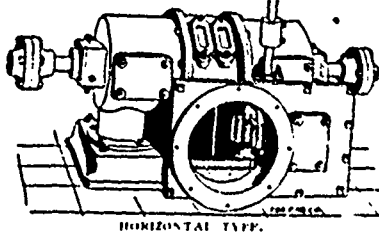
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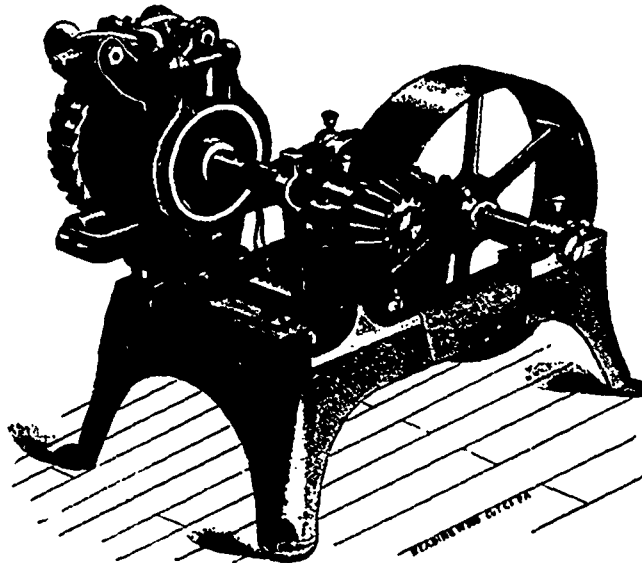
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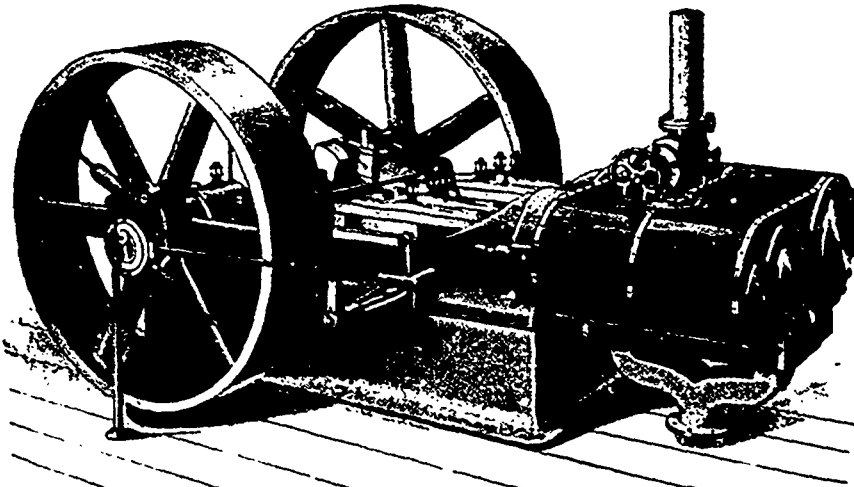
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NOTICE.

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(Signed) ARMINGTON & SIMS.



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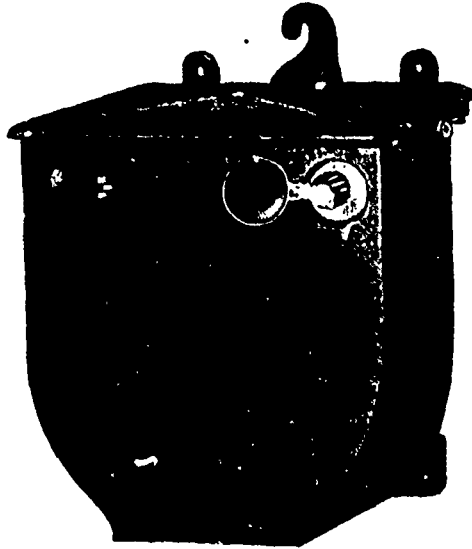
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"CYCLE" GAS ENGINE
 IMPULSE EVERY REVOLUTION without
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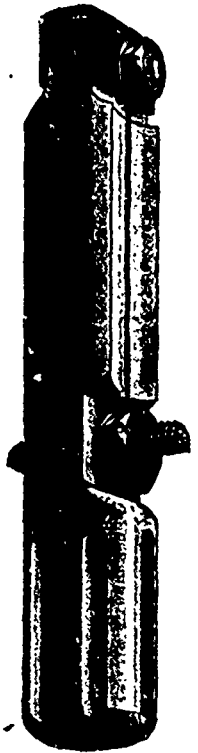
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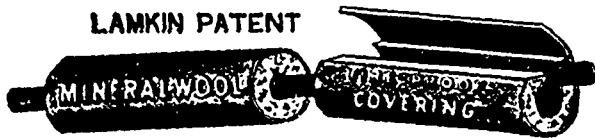
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