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CANADIAN
ELECTRICAL NEWS
AND
STEAM ENGINEERING JOURNAL

OLD SERIES, VOL. XV. No. 6
NEW SERIES, VOL. IV. No. 12.

DECEMBER, 1894

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CANADIAN

ELECTRICAL NEWS

AND

STEAM ENGINEERING JOURNAL.

VOL. IV. DECEMBER, 1894 NO. 12.

MR. GRANVILLE C. CUNNINGHAM.

It affords us pleasure to reproduce from a recent number of the New York Electrical Review, the accompanying portrait and sketch of Mr. Granville C. Cunningham, manager of the Montreal Street Railway:

Mr Granville C. Cunningham, of Montreal, P.Q., who was elected a member of the Executive Committee of the American Street Railway Association, at the recent Atlanta convention, learned the profession of civil engineering in Edinburgh, Scotland. After having been engaged in various railway works and other enterprises in the old country, he left his native land in 1870 and went to Honduras in Central America, where he had charge of part of the surveys of a transcontinental railway that was then projected. The outbreak of war between Honduras and San Salvador brought this enterprise to an untimely end, and in 1871 Mr. Cunningham came to Canada. Since then his work has connected him with many of the chief railway schemes of that country. Subsequently he turned his attention to railway law, with the purpose of giving up the engineering profession, and for two years lived at St. Thomas, Ont., as the resident solicitor of the Canada Southern Railway. In 1882, however, he was appointed chief engineer of that line, which position he held until its amalgamation with the Michigan Central. He then took up contracting and built the double track branch of the Michigan Central, from Welland to Niagara Falls, in connection with the great cantilever bridge across the Niagara gorge, which work was finished in the end of 1883. In 1884 and 1885, two years were spent on the Rocky Mountain division of the C. P. R. as assistant to the manager of construction, including the winter spent at the summit of the Selkirks for the purpose of observing the snow slides and designing snow sheds an occupation of no small danger. After this he was again a contractor, and in 1887 and 1889 carried out contracts for the construction for part of the Temiscouata line near Riviere du Loup, and of the C. P. R. short line near Sherbrooke. In 1889 Mr. Cunningham was appointed assistant city engineer and afterwards city engineer of Toronto. Here his attention was directed to electric street railway matters, and it was on the report made by him to the City Council of Toronto that the system now in operation there was adopted. In 1892 he was appointed chief engineer of the Montreal street railway, and the work of converting this from a horse to an electric system has been carried out under his direction. He was appointed manager and chief engineer of the Montreal street railway. In 1878 Mr. Cunningham was elected a member of the Institute of Civil Engineers of London, and has contributed papers to the tranactions of that society, notably one describing the construction work on the C. P. R. in the Rocky Mountains, which was separately published by the society, with cognate papers in pamphlet form. He was also among the first members of the Canadian Society of Civil Engineers and was recently elected a fellow of the Royal Colonial Society of England.

MR. GRANVILLE C. CUNNINGHAM.

VALUE OF A VALVE RE-SEATING MACHINE.

One of the little things which is bound to pay its way in a steam plant of any magnitude, says Power, is a valve reseating machine. In the first place it makes a great reduction in the loss by leakage, a loss which becomes very considerable when in addition to the heat units discharged by the escaping fluid is added the destruction of pipe coverings, corrosion, and deterioration of the surrounding work which is apt to result from a neglected leak. If the valve can be repaired in situ, it will be attended to promptly. If it must be taken out, an opportunity must be awaited when the engineer has time for an extended and perhaps difficult job and the system can be shut off long enough to permit of its being done. Again, there is the saving of the time of the engineer or pipe fitter, usually overtime at an increased rate of payment; and finally there is the saving in valves, fittings and coverings, for usually some of these will be sacrificed in taking down the piping necessary to get a valve out, a new valve will be put in to save time, and the leaky one will find its way to the scrap heap.

CONCERNING DASH POTS.

The dash pots used in connection with the valve gear of many engines do not receive the care and attention they require in order that they shall perform their function in a proper manner. Indicator diagrams taken from such engines as have been in use a few months without the indicator being used upon them, show almost invariably that the dash pots have become leaky or at least do not produce the quick closing of the valves for which they are intended. On many dash pots, says an exchange, petcocks have been attached which, by being partly open or otherwise adjusted, reduce the clicking noise made each time they operate. The way these are ordinarily adjusted makes it questionable as to their utility, and it would be much more advantageous to the engine and economical of fuel, if the noise was retained and, at the same time, the valves would close with the intended rapidity. The slow closing of an ordinary slide valve is one of the detrimental features inseparable from this device and the utility of the releasing gear on higher class engines is often greatly reduced for this reason. The care of the dash pots employed in connection with the releasing gear requires fully as close attention as does the piston packing of the engine, or material used for the same purpose in a pump. A good vacuum is necessary in the dash pots to produce quick closure of the valves, and unless the packing is kept in good order the leakage which follows excessive wear, or any looseness, will reduce the quick action on which the success of that valve gear depends.

In observing a number of engines employing this device, a great difference in the rapidity of their action will be observed, for in some it will be noticed that the action is more rapid than the eye can follow, while in others a logy motion is observed that speaks ill for the utility of the device, and is a sure indication that considerable less than the best results are obtained from the use of the steam. Engineers in charge of engines having dash pots as a part of the valve gear should make themselves as familiar with the details of construction and operation of the device as they are accustomed to with other parts of the engine, with that of pumps or other apparatus employed in the steam plant and, it is needless to say, that best results can be obtained only when each detail of the plant is in the best possible condition.

When fitting up an engine shaft or other large shaft, in fact, jack shafts or similar work, it is a good plan to allow a little end play in the shaft as it distributes the oil and makes the bearing much smoother and better, says an exchange. This will often cure a shaft that has been heating and giving trouble, and in a new shaft particularly it is best to do this.

A new belt fastener recently patented in England consists of a metal plate adapted to extend across the meeting edges, the plate having one straight side and at the other side a series of spurs arranged in pairs longitudinally opposite, the spurs of each pair being at equidistant points from the transverse center of the plate and arranged in advance of the preceding pair in both directions, so that each pair will penetrate the belt at different points.

CENTRAL STATION TYPES.

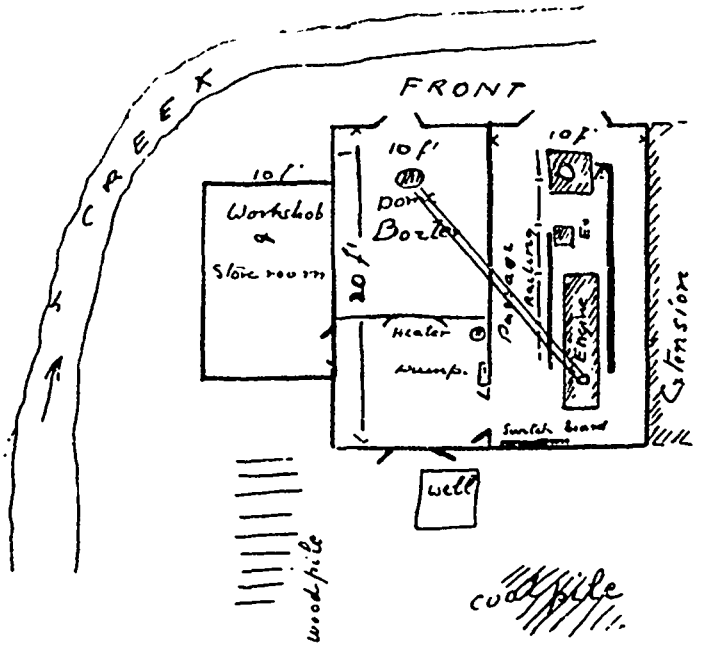
By Geo. White Fraser

NO. 1 SMALL PRIVATE LIGHTING PLANT

It has been suggested to the writer that a series of articles on the progress of electric lighting and railways in Western Canada would be of great general interest, and that if certain typical stations, selected carefully as possessing features of special value, were fully described, professional men throughout Canada, and more especially managers of small plants, might be able to benefit greatly by seeing what is done by other managers endeavoring to approximate towards perfection of service and economy, and so by calling attention to the special features in the various types whereby some particular advantage is gained, the general efficiency of management throughout the country may be raised, to the benefit of the electric lighting and railway interests generally.

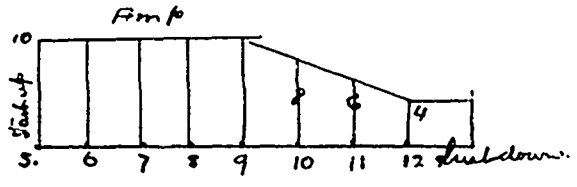
It might be supposed that a careful description, in detail, of one of the large central stations Montreal, Toronto, or Hamilton—would cover the entire field, and that small stations might profitably base their practice on that obtaining among their more wealthy brethren; and so indeed they can, but a little consideration will show that their conditions are greatly different, and in some respects their problems more difficult of satisfactory solution. The business of a large station is sufficient to allow of high salaries being paid to really scientific engineers, and the services of thoroughly skilled men are engaged throughout; intricate tests being continually made, requiring delicate instruments, and generally a refinement of efficiency and consequent economy is aimed at, quite beyond the reach of the manager of a station in a town of perhaps 3,000 inhabitants. The first principles, however, of design, construction and operation, are common to small and great, and the more carefully these are attended to and carried into effect, the better will be the prospects of future satisfactory results. The more generally it is understood that an electric lighting or railway enterprise is a thing to be seriously considered, and every successive step carefully taken, and every side issue cautiously weighed, the better for the entire electrical industry. Electricity is too often thought to be a subject that every ordinarily intelligent person can handle, and hence we find electrical enterprises placed under the charge of quite inexperienced men, the inevitably disastrous results being chalked up to the debit of electricity itself. It is the purpose of the writer to select various central stations, as types of a class. 1. The small plant in a town of 2,000 inhabitants, under private ownership. 2. The same with municipal ownership in connection with other municipal works. 3 Same in large town of 20,000, private ownership. 4. Small railway plant, with or without lighting business, and to conclude with careful description of a large city plant, railway and lighting. It is hooed that this may lead to an interchange of ideas on central station management that will be of great benefit.

Before proceeding with Type No. 1, the writer will briefly refer to one small plant with which he has recently been connected in an advisory capacity, the name of which is, for obvious reasons, not given. The plant presents an example of "How not to do it." The machinery was started in Oct., '91. Everything looked well—commutator nicely polished and lamps giving more than rated illumination. No consulting engineer having been engaged for preliminaries, it was shortly evident that the engine was not right, discovered to be "not sufficiently powerful," and consequently thrown out, it having in the meantime developed a bent shaft. As an incident having apparently no connection with this misfortune, it was mentioned to the writer that the only steam employee was a "fireman" (!). Another engine was purchased, presumably on this fireman's recommendation, the regulation of which is so delightfully uncertain that not only has the voltage needle an irregular swing, but the speed decreases at the end of every



stroke. The only "electrician" in connection with the plant is one whom the authorities honestly called a lineman! The dynamo is out of date, and has a system of excitation that no college student would endorse. The transformers are of three different makes and unascertainable efficiency, and were installed without any reference whatever to the dynamo periodicity; no tests were ever made as to economy or efficiency, and great indignation was expressed when the plant didn't even pay interest on investment. The poor lamps were burning at all kinds of voltages, and the whole affair rapidly falling into innocuous desuetude. Reasons were not far to seek. No professional advice was obtained, the cheapest plant was bought, quite inexperienced men employed to run it—hence the result. As a great contrast to the above, the little town of Aurora presents an example of a little plant where the conditions have been carefully studied, and a result worked out, whereby a minimum of present expense has secured quite sufficient for present lighting requirements; and possible future extensions have been kept well in view, so that when they become necessary, additions can from time be conveniently made, without in any way disarranging the present plant.

Aurora possesses a population of almost 2,000. There are the usual stores of all kinds, hotels, stables, private houses, altogether a very compact little place. In April, '94, Mr. W. D. Murray, the owner and superintendent, started up with one 500 light alternator, made by the Royal Electric Co., that being considered sufficient for a start. Reference to the diagram will show the arrangement of machinery. The building is 20 x 30, brick walls and shingle roof, and is so divided that sufficient space is given, and not too much. The coal and wood piles are so situated as to be quite near the boiler room door; the well at this door is fed from the little creek, and the pump lifts water from it and forces it through the exhaust steam heater into the boiler. The workshop is fitted with bench and shelves, and here are kept all the stores, wire, lamps, etc., and oil. The man in charge stands at the door by the switchboard, from which position he can watch his indicators, steam and water gauges, and has everything under his eye. The particular feature of this whole arrangement is that engine, dynamo and boiler constitute one unit, very compactly placed; if the lighting requirements grow sufficiently to justify the purchase of another 500 light dynamo, another such unit of engine, dynamo and boiler of same sizes will be installed; a small 10 x 30 extension will be built on where the shaded part marked "extension" is seen, which will contain the engine and dynamo, and another boiler will be added in the workshop, which can readily be adapted. By this design no capital is wasted. Boiler setting is ordinary brick, and engine foundations consist of a course of good building stone, solidly laid, 3 feet thick, with 3 feet of brick on top of that, coming level with the floor. Piping is covered with asbestos, and comes directly across, with no bends, to the engine. The dynamo is the usual ordinary alternating dynamo, giving 1040 volts on the primaries, and separately excited, all switches being on the switch board, where are also the usual instruments and indicators. There is nothing special about the lines, except that in one or two central spots are placed transformers of comparatively large capacity, and from these are led secondary mains from which are tapped off the service wires to the house and store lamps. Transformers give 104 volts on the secondary, and by the use of a few large transformers supplying secondary mains, instead of installing small transformers for each group of lamps, a reduction of first cost and of electrical efficiency is obtained, large transformers being more efficient and costing less per light than small ones. The lighting of houses, &c., is by 16 c.p. lamps of 104 volts, and a number of incandescent lamps are placed in the streets, on the well-known "street system." This latter seems to present some advantages worthy of consideration. A small town like Aurora does not require a great deal of street lighting, so that if arcs were used it would mean a quite small machine and extra space and more attention, which can all be given equally satisfactorily as far as results go, to one dynamo combining both street and private lighting. In a small plant it is quite an object to minimize handling of apparatus, as well as to make a little capital outlay go a long way, and both these objects seem to be attained by the installation of the alternating street lighting system. The conditions obtaining in Aurora itself seem particularly favorable to this system, as, on account of the street lighting contract calling for the shutting off of the lights at midnight, and that being also the time for the shutting down of the entire plant; while the plant is actually running, it is always running on a reasonably large percentage of its rated capacity. The policy of the town in shutting off its lights at this hour is beyond the scope of this article, but its advantage to the plant is obvious. This installation of street system is probably of use in keeping the load line



so fairly even during the hours of service as it is. The diagram gives this approximately, and a useful deduction from it is that the number (total) of house lamps installed being very nearly 300 or 3-5ths of the lamp capacity of the dynamo, the load diagram shows (allowing about 4 A. for the street lamps) that only about one-third or less than one-half of these are in use at the same moment, which allows a considerable overloading of the dynamo. Probably plants will operate under similar conditions in other towns of the same size. Mr. Murray takes great care of his machinery; being an old engineer he appreciates the necessity of cleanliness and attention. His boiler, in which he burns coal and wood mixed, is thoroughly washed out with a hose every month or so, the tubes and smoke flue being cleaned every night after shutting down. An inspection of lines is made every week and every few days the transformers are examined and cleaned out. He is his own chief engineer, superintendent and clerk, and finds he can get along very well with one smart man to fire and generally look after things, and a small boy to do any little odd job around town—wiring lamps, &c. He is very particular in watching his pressure indicator, so that there is no trouble with lamps burning out. The lights are very satisfactory, and already the plant is earning a very fair dividend.

This plant has been selected for description as showing: 1. The necessity of thoughtful planning and designing of power house and capacity before purchasing. The conditions were carefully considered; a convenient unit put in; extensions provided for. 2. The advantage of using one type of machine instead of several. Off one alternating dynamo Aurora has house and street lights, a good load line, simple machinery, and not too much of it. 3. The satisfactory results of combining the two above advantages, and the evident possibility that a town of even 2,000 inhabitants presents a good solid investment to a cautious man. There are very many small towns in Ontario, some possessing even a good water power, who may achieve the same results with the same cautious planning.

It is intended in a future article to consider more especially the commercial features of a typical station, and to regard them in the light thrown on them by theory.

Incorporation has been granted by the Ontario government to the Magnetawan Tanning & Electric Co., to conduct a tanning business and supply electricity for light, heat and power. The promoters of the company are: Messrs. G. and W. T. Martlett, of Oakville; John Waldie and William Cameron, Toronto, and R. J. Watson, of Burk's Falls.

Messrs. Davey & Foley, of Thorold, Ont., are negotiating for possession of the water power at the village of Sturgeon Falls, where they propose to erect a $50,000 pulp mill, and supply electric light and power. They also ask for a bonus of $7,000, which the town is willing to give if the necessary power can be obtained from the Ontario government for that purpose.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

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

TORONTO ASSOCIATION NO. 1.

The members and friends of the above Association to the number of one hundered or more spent a very pleasant evening on November 21st at the Association rooms, Shaftesbury Hall, the occasion being a smoking concert which this year was substituted for the usual annual dinner of the Association. The chair was occupied by the President, Mr. E. J. Philip. An excellent musical and literary programme was provided, followed by an oyster supper. Messrs. Mackie and Langdon, of Hamilton, and Bassett of Kingston, were amongst the guests from a distance.

HAMILTON ASSOCIATION NO. 2.

At the last regular meeting of the above Association, interesting papers were read as follows: "Boiler Compounds," by Bro. Mead; "The Coming Steam Engine," by Bro. Batty; "Railway Power Stations," by Bro. Nash. These papers evoked an interesting discussion. It is the intention of the officers of the Association to endeavor to provide papers at each regular meeting through the winter.

BROCKVILLE ASSOCIATION NO. 15.

On the occasion of the installation of officers of this recently organized association, an official visit was paid to the lodge by J. J. York, of Montreal, Executive President, and A. E. Edkins, Toronto, Provincial Deputy, who performed the installation ceremony. Following the installation an address of welcome was presented to Bro. Edkins. An adjournment was then made to the dining room of the St. Lawrence Hall, where a banquet was spread in honor of the visitors. Mr. W. F. Chapman, President of the new association, gracefully presided, having on his right Rev. W. A. McKenzie and Mr. York, and on his left Mr. Geo. A. Dana, M.P.P., and Mr. Edkins. Letters of regret were read from several prominent citizens who were unable to be present.

The toast list was as follows: "Canada Our Home," responded to by Mr. Dana, M.P.P.; "Brockville, the Island City," responded to by Mr. V. R. Marshall; "Commerce and Manufacturs," responded to by Messrs. D. Derbyshire, John M. Gill and Mr. Garson, ex-M. P. P.; "Education, the Engineer's Aid," responded to by Messrs. Geo. R. Webster and T. J. Storey; "The C. A. S. E.," responded to by Bro. J. J York; "The Ontario Association of Stationary Engineers," responded to by Bro. A. E. Edkins; "Kindred Societies," responded to by Rev. W. A. McKenzie; "The President and Officers of the Local Branch," responded to by Mr. W. F. Chapman.

The interest and pleasure of the occasion was heightened by the services of a male quartette, composed of Messrs. W. Bryant, Wright, Smith and Geo. Smart.

TORONTO, November 20th, 1894.

Editor ELECTRICAL NEWS.

SIR,—ON November 6th, I had the honor of organizing in Carleton Place, a branch of the C. A. S. E., which will henceforth be known as Carleton Place Association No. 16. C. A. S. E. I was ably assisted by Bro. F. Robert, President of Ottawa No. 7, Bro. F. W. Donaldson. and Bro. Cohen, of Ottawa. This branch starts out under very favorable circumstances, with about twenty charter members. After the organization and installation of officers had been effected, several of the members were called upon to express their views. Among them was the Mayor of the town, who is an old engineer. In his remarks he eulogized the C. A. S. E and its objects very highly.

President Robert of Ottawa No. 7, gave the members some good advice based on the work of the Association in Ottawa, and expressed his belief that No. 16 would prove a progressive and useful Association.

Bro. F. W. Donaldson also spoke in very high terms of the good work that the Association was doing, and urged the members of the new Association to attend the meetings and make them interesting.

The newly elected officers from the President down, expressed their intention of leaving no stone unturned to make the Association a success. The writer was also called upon for a few remarks, and to the best of his ability outlined the aims and objects of the C. A. S. E. The meeting then adjourned, after having spent a very pleasant evening.

On November 8th, Brockville Association No. 15, was instituted by our worthy Executive President, Bro. York, assisted by the writer. It was expected that Bro. Devlin of Kingston, Bro. Past President Wickens, of Toronto, and Ryan and Hunt, of Montreal would have been with us; but unfortunately, Bro. Devlin was stricken down the night before with inflammation, and for some days was in a very serious condition, but is now on the way to recovery,—a fact which all our members will be glad to hear. Bros. Ryan, Hunt and Wickens, were unable to be on hand, which was a disappointment to all. During the afternoon, Bro. President York and myself were taken in hand by Mr. Storey, the genial Superintendent of the Canada Carriage Co., and shown through their extensive and well managed establishment. Mr. Storey also very kindly drove us out to the new Asylum buildings, and other points of interest. In fact we were treated with the utmost kindness by everyone, and shall long remembered our visit to the Island City. The banquet in the evening was the most pleasant affair I have yet attended in connection with the C. A. S. E.

Yours very truly,
A. E. EDKINS, Prov. Dep'y.

MOONLIGHT SCHEDULE FOR DECEMBER.

Day of Month.	Light.	Extinguish.	No of Hours
	H.M.	H.M.	
1	P. M. 7.30	A. M. 6.20	10.50
2	" 8.20	" 6.20	10.00
3	" 9.10	" 6.20	9.10
4	" 9.50	" 6.20	8.30
5	" 10.40	" 6.20	7.40
6	" 11.00	" 6.20	7.20
7	" 11.50	" 6.20	6.30
8		" 6.20	
9	A.M. 1.00		5.20
10	" 2.10	" 6.20	4.10
11	" 3.30	" 6.20	2.50
12	No light	No light	
13	No light	No light	
14	No light.	No light.	
15	P. M. 5.10	P. M. 8.40	3.30
16	" 5.10	" 9.50	4.40
17	" 5.10	" 11.20	6.10
18	" 5.10	A M 12.20	7.10
19	" 5.10	" 1.00	7.50
20	" 5.00	" 1.20	8.20
21	" 5.00	" 2.20	9.20
22	" 5.00	" 3.10	10.10
23	" 5.00	" 4.20	11.20
24	" 5.00	" 5.30	12.30
25	" 5.00	" 6.30	13.30
26	" 5.00	" 6.30	13.30
27	" 5.00	" 6.30	13.30
28	" 5.00	" 6.30	13.30
29	" 5.00	" 6.30	13.30
30	" 5.00	" 6.30	13.30
31	" 8.10	" 6.30	10.20
		Total,	244.40
		Grand Total,	2272.10

THE MARITIME PROVINCES.

(Correspondence of the ELECTRICAL NEWS.)

ST. JOHN, N. B., November 21st, 1894.

Last week a well-known civil engineer was in the city making enquiries with reference to constructing an electric railway between this city and Fredericton. Persons who were spoken to about the matter expressed themselves in favor of it. They thought such a road could be constructed at a nominal cost, and that it could be made to pay a good dividend. The distance from St. John to Fredericton is 85 miles. The road would run through a rich farming section nearly all the way. There are several pretty little summer resorts along the river where city people spend the hot weather and where large numbers go for Sunday, returning to their work on Monday morning. The trains make only one trip between St. John and Fredericton daily. If the electric railroad is built the cars will make several trips daily between the city and these suburbs. They will make a trip to Fredericton and return same day. The gentleman who has interested himself in the scheme, told the writer that he would stop the cars wherever there was a person to get on or off. They would carry mail and light produce. There would be no depots. He thought the cars should be a little larger than those in use in the city. He thought they could travel twenty miles an hour without any difficulty. Another thing that would tend to make the road pay is the high rates of fare charged by the C. P. R. officials. It is calculated that persons patronizing the electric cars could make several round trips as cheaply as they can make a single trip via the C. P. R.

St. Stephens' new electric street railway is giving good satisfaction. The cars are twenty feet long on the inside, and can seat thirty persons quite comfortably. They are heated and lighted by electricity. The cars are richly upholstered in plush and are in keeping with the general excellent equipment of the entire road. They were built by the Jackson & Sharpe Company, of Wilmington, Del.

The snow storm that struck this city a few weeks ago caused more damage to the telegraph, electric light and telephone wires than any storm for over twenty years. Business was practically paralyzed for three days. The offices and stores on the main streets were lighted with oil lamps and candles for two nights. There was no telegraphic communication out of the city for some time. The telephone company suffered to the extent of several thousand dollars. They have not yet completed repairs.

A bonus and right of way has been granted to Capt. Carter, of Descronto, for an electric railway to run from the G. T. R. station, Oshawa, to Oshawa-on-the-Lake.

HOW TO DEAL WITH APPARENT DEATH FROM ELECTRIC SHOCK.

By Augustin H. Goelet, M. D.

Much interest has recently been excited by the report from France of the resuscitation of a man apparently killed by electricity, and by the announcement of the French scientist d'Arsonval that a person so shocked should be treated as one drowned. The suggestion is a good one but may be somewhat misleading unless understood; that is, unless the person undertaking the resuscitation appreciates what is to be accomplished and just how it is to be done.

As this authority says, electric shock may produce death in one or two ways, viz:

First Position.

(1) By producing destructive tissue changes, when death is absolute; or (2), by producing sudden arrest of the respiratory and heart muscles through excitement of the nerve centres, when death is only apparent; in other words animation is merely suspended. The subject may be aroused from this syncope if efforts at resuscitation are not too long delayed.

The alternating current, which is usually regarded as the most deadly, strange to say, nearly always produces death in this second manner

To say that a person has received a shock from a wire conveying a current of four or five thousand volts, does not necessarily signify that the body has been subjected to the full force of the current, even if the meter does register nearly one ampere during the time of the accident. In view of the fact that the human body offers a resistance of several thousand ohms, which resistance is greatly increased by imperfect contact, and by charring and burning the tissues at the points of application, it is not often that the internal structures or vital organs are submitted to a very considerable volume of current, though it apparently passes through the body. It must be borne in mind that when the clothing is moist with perspiration or wet with rain, it offers a circuit of less resistance than the human body, and in this event the body receives only a shunt current very much less in quantity than the main current. The bulk of current in this instance, passes over the surface and does not enter the body. This may explain the survival of some who have apparently withstood very powerful currents.

Second Position.

It must be presumed, therefore, that electricity seldom kills

outright, though the condition of suspended animation, which it induces, would result in death if not counteracted.

All things considered, it is rational to attempt the resuscitation of those apparently killed by electricity, and if not too long delayed, the effort promises fair chances of success, provided proper means are instituted.

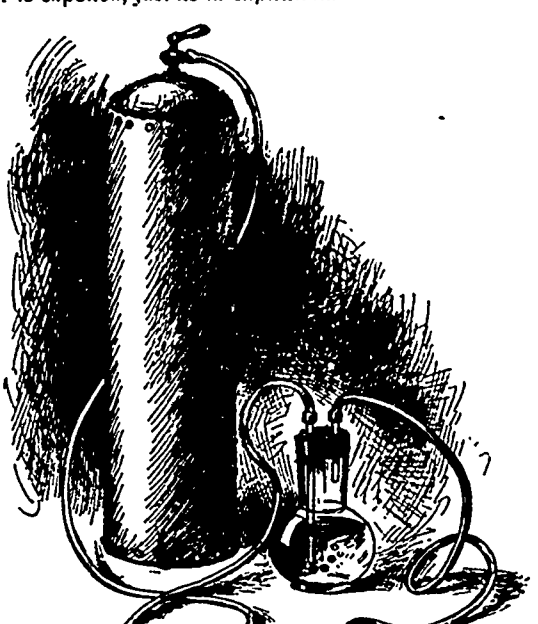
If the body has actually been submitted to a current of sufficient volume to produce destructive tissue changes, all efforts at resuscitation will, of course, be futile.

If, on the other hand, only respiration and the heart's action have been temporarily arrested, there is a condition of syncope simulating apparent death by drowning, or from anæsthetics, and the physician knows that patients in this condition are frequently revived. Laymen will appreciate the nature of this condition if it is explained as one of exaggerated faint and would not feel appalled upon encountering it if previously instructed how to cope with it. In an ordinary fainting spell the necessity to stimulate is universally appreciated. In syncope resulting from an electric shock stimulation is likewise indicated, but more vigorous measures are required. This is the only difference.

As said above, the direction to treat one shocked by electricity as one drowned may be misleading, as the conception of the layman of the necessities in this case would be to roll the body on a barrel. Let him understand that the condition is one of exaggerated faint, that the necessity is for prompt stimulation, and that the quickest and most powerful stimulent which can be employed is artificial respiration. *The man must be made to breathe*, if this is possible, and efforts to induce respiration must not be suspended until breathing is fully and normally restored or until it is absolutely certain that life is extinct. This cannot be assured in less than an hour's persistent, energetic, tireless effort.

The accompanying illustrations will serve to make intelligible the following directions for artificial respirations.

The body must be placed upon the back. A roll made of a coat or anything else convenient (*rolled*, not folded) is placed under the shoulders and must be sufficiently large to so prop the spine up as to drop the head backwards. The operator should kneel behind the subject's head, facing him, grasp the elbows and draw them well over the head, so as to bring them almost together above it, and hold them there for two or three seconds. Then he carries them down to the sides and front of the chest, firmly compressing it by throwing his weight upon them. After two or three seconds the arms are again carried above the head and the same manœuvre is repeated, at the rate of fifteen or sixteen times per minute. At the same time the tongue must be drawn out to free the throat. This manipulation stimulates respiration in the following manner, viz: When the arms are extended over the head, the chest walls are expanded, just as an inspiration, and if he throat is clear the air will rush into the lungs. When the arms are brought down to the sides of the chest, compressing it, the air is expelled, just as in expiration.



OXYGEN CYLINDER AND APPLIANCES.

This is the most convenient and reliable manner of inducing artificial respiration It is known as Sylvester's method. The operator must, however, appreciate the fact that this manipulation must be executed with *methodical deliberation* just as described and never hurriedly nor half-heartedly. To grasp the arms and move them rapidly up and down like a pump handle is both absurd and absolutely useless.

In addition to this, if an assistant be at hand, the tongue, held by a cloth or handkerchief to prevent slipping, should be seized and drawn forcibly out during the act of inspiration or when the arms are extended above the head, and when the chest is compressed it may be allowed to recede. This rhythmical traction upon the tongue is in itself an excellent stimulant of respiration. It acts not only by freeing the throat of the tongue, which may fall back and obstruct breathing, but also by reflex irritation, through the fraenum or bridle under the tongue being drawn forcibly against the lower teeth.

Should these efforts fail to elicit any response or arouse any signs of life, recourse may be had to another method of stimulation by exciting the dormant nerve centres. This should, however, be reserved for the physician, who should always be summoned when it is possible to get one, or should be made use of only by one who realizes the injury that may be done if it is carelessly practiced. Still, when the necessity is great and other means have been exhausted, some risk is allowable.

AN IMPROVISED MOUTHPIECE.

I refer to forcible stretching of the sphincter muscle controling the rectum or lower bowel. It is well known to physicians that this muscle is the last portion of the body to lose its sensibility and that by irritating it by forcibly stretching, a gasp will often be elicited from one actually moribund.

The method of procedure is this.

Turning the patient on the side, the index finger or thumb is inserted into the rectum and the muscle, which, if sensible, will be felt to resist, should be forcibly and suddenly drawn *backwards*, towards the spine. Care must be taken not to introduce the finger roughly, or to use sufficient force to lacerate or wound the parts.

Having obtained one gasp, artificial respiration should be continued and a repetition of the proceeding should be reserved until respiration again fails. In some instances, however, it may be necessary to repeat this with every effort at inducing inspiration, that is, every time the arms are extended over the head. The subject then being on the back, the knees are drawn upwards to facilitate access to the rectum.

If the accident occurs in a city or large town, oxygen, which may be obtained at every drug store may be used. This is a powerful stimulant to the heart if it can be made to enter the lungs.

This gas comes in cylinders furnished with a stop-cock and tubes and bottle, which latter is to be half filled with water through which the gas passes when turned on. [See figures.] If a cone or mouth-piece is not furnished with the apparatus, one can be hastily improvised from a piece of stiff paper and attached by a string to the ordinary mouth-piece. To use the oxygen, place the cone over the patient's face and turn on the stop-cock until the gas is seen to bubble freely through the water in the bottle. Efforts at artificial respiration should be kept up while the gas is being administered to favor its entrance into the lungs.

The use of electricity to re-awaken the heart and lungs to action offers another auxiliary to the resuscitation process, but implies the skilled employment of special electrical apparatus purely within the possession of the physician, who naturallly does not require instruction.

When I was requested by the editors of The Electrical World to contribute this article I gladly accepted because:

(1) I am convinced that many who have died in consequence of electrical shocks might have been saved if those at hand had been properly instructed in the methods of reviving suspended animation, and,

(2) I hope all electrical companies will be impressed with the importance of having their linemen and other employees engaged in the vicinity of dangerous currents, so instructed and trained that without delay methods of resuscitation can at once be instituted.

Thus the giant electricity will more surely become man's servant, a faithful and ever obedient one, instead of as now, occasionally, through man's carelessness, his slayer.—Electrical World.

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THEY have their exits and their entrances. Exit the electric fan enter the electric heater.

OF the 12,000 miles of street railway lines in the United States and Canada, about 7,200 miles are operated by electricity.

IT is understood that the Royal Electric Co., of Montreal, have made arrangements with the Stanley Electric Mfg. Co., of Pittsfield, Mass., to manufacture their apparatus in Canada under royalty. The Royal Electric Company have issued new bonds to upwards of half a million dollars. The money received from this source will, it is understood, be laid out in improvements to manufacturing plant and buildings. The company some years ago, started out to invent and manufacture apparatus on original lines. This policy is understood to have involved them in financial loss. The present arrangement, under which they will manufacture apparatus that has been well tested, will undoubtedly prove to be a less troublesome and in every way more satisfactory and profitable one, especially if accompanied by up-to-date methods in business management.

IN the case of the recent explosion of a boiler in a saw mill near Orangeville, Ont., which resulted in the death of two persons and in serious injury to others, the factory inspector for the district was obliged to consult the government before ordering an investigation, as under the Factory Act he was not authorized to hold an investigation unless there were at least six employees in the mill. In this particular case the employees numbered only five. As it is in the smaller mills and factories that the greater number of such accidents happen, owing to the employment of incompetent workmen and the neglect of proper safeguards, it would seem to be desirable that the Legislature at its approaching session should consider the advisability of amending the Factory Act in such a manner as to bring within its provisions the smaller mills and factories.

AT a meeting of the Executive Committee of the Canadian Electrical Association held a few days ago, twenty five new members were elected. This must be regarded as a gratifying rate of progress. Each member of the Association has been asked to secure at least one new member during the present year. If this is done, the Association will become, what it ought to become, one of the largest and most influential organizations on the continent. Mr. Dunstan, the newly-elected President, is manifesting the deepest interest in the advancement of the Association. It is to be hoped that his enthusiasm will be copied by every officer and member.

PRICES in certain lines of manufactured products, have decreased fully fifty per cent. within the last ten years. If the manufacturers of these products had been told in the previous decade the price at which they would be obliged to sell in the present day, they would have seen nothing but ruin staring them in the face, and in many cases would no doubt have gone into other lines of business. But the result has not proved to be so disastrous as in that day must have seemed certain. Increased competition, followed by lowering of prices, has been accompanied by improvements in manufacturing processes, by means of which the cost of production has been largely reduced. The electric light has performed valuable service in this direction. By its use it is possible to operate a manufactory as perfectly by night as by day, and by running twenty hours instead of ten, the output of many factories has been doubled, and the larger production has enabled the owners to sell at a closer margin of profit.

THE Hamilton, Grimsby and Beamsville Electric Railway is the first of the Canadian electric suburban lines, so far as we are aware, to be operated by steam railroad methods. The company employ a train despatcher, and issue tickets from point to point on the line, which are collected and punched by the conductors. Under this system the passenger simply pays for the distance he wishes to travel, and not a fixed rate regardless of distance, as heretofore has been the rule on most lines of this character. The system is said to work most satisfactorily, and the road has already developed such an amount of business that the necessity for a double track and second power station at Grimsby is forcing itself on the attention of the directors. The fact that the methods of operation employed by steam railroads have been found to be necessary for electric suburban roads, is another proof of the contention made in our article last month regarding the duty on steel rails, that the suburban electric roads are not street railways, but railroads to all intents and purposes.

THE Dominion Government is called upon by some of the admirers of protection to encourage the manufacture in Canada of steel rails, by putting a stiff duty on rails imported from abroad. So far as rails for use in the construction of electric railroads are concerned, this has already been done. Steel rails imported for this purpose must pay a duty of 30 per cent., which in our opinion ought to be encouragement enough. If the government is determined to maintain the present duty on rails for electric railroad purposes, consistency demands that it should lose no time in imposing a like duty on rails for use on steam railroads. As was shown in our article on the subject last month, there is at present a distinction made where there does not exist a difference. If the imposing of 30 per cent. on steel rails for all purposes, would lead to the manufacture of rails in Canada, we presume the electric companies would be willing to bear their share of the burden for a limited time—say ten years—which should be sufficient to place the home manufacturers in position to compete with those abroad, as the Americans are now doing. If a steel rail industry cannot be established in Canada, under a protective duty of thirty per cent., it should be concluded that the conditions for cheap production are here lacking, or that our manufacturers do not possess the requisite knowledge of the economics of the business. Whatever policy the government may deem to be the proper one, should be announced at as early a date as possible, in order that the development of electric railways in Canada, which has so promisingly set in, may not be retarded, and above all, whatever the policy may be, let it be a consistent one.

ALL honest business men will read with pleasure Judge MacDougall's commendation on the upright course pursued by the Toronto Electric Light Co., under trying circumstances, when a most important contract was at stake. These bribe takers, influence sellers, and trust breaking commission receivers, are the pest of honest business. It is the special evil of all such dishonest and underhand methods of doing business that they doubly tend to make impossible any straightforward sale of goods on their merits alone. A sale effected by disreputable or dishonest means, is not only an increase of business to those dealers who will use such means, but it is at the same time a loss of business to some upright dealer. Every honest business man who wishes to prosper honestly is concerned in withstanding corrupt or underhand approaches, and owes thanks to all others who do the same.

JUDGE MacDougall's interim report on the investigation concerning the electric lighting contract, more than bears out the position taken by the CANADIAN ELECTRICAL NEWS. From the beginning of the municipal electric plant controversy we have uniformly contended that the crucial point in the question at issue is the unfitness of our municipal institutions to be intrusted with the control of any industrial department. With the possibility of jobbery in letting contracts for supplies, the probability of favoritism and political influence in making appointments, and the certainty of slackness in control of details, the futility of all estimates of running expenses under municipal ownership should be manifest. These evils are sufficient to condemn any such project, but added to these there must now be taken into account a form of corruption graver than mere jobbery, namely, direct bribery and the sale of votes for money. Judge MacDougall's report finds at least one Toronto alderman guilty of soliciting a bribe for his vote.

THAT prejudice dies hard even in this age of newspapers and modern improvements is seen in the objection taken by the farmers of Waterloo county against the building of an electric road in that locality, because the scheme would do away, in a great measure, with horses, and the latter would, consequently, depreciate in value. Everyone knows the trouble encountered when the spinning-jenny, the sewing machine, and the agricultural improvements of recent years were first introduced. All these had to run the gauntlet of prejudice and narrow minded criticism, and their history ought to prove to anyone who thinks or observes that the wheels of progress cannot be blocked in any such manner as this. When Stephenson was asked what was to become of the cow when steam became the propelling power with railroads, and the risk of slaughtering cattle in this manner increased, he simply answered that it was so much the worse for the cow. All men with a spark of humanity in their breasts love the horse, and from an economic standpoint know how much this noble animal has done to advance the best interests of city and country. He will still have his place in the commercial economy of the age, but let the farmers near Berlin and Preston make up their minds that it will be unsafe for him or them to run up against an electric motor. Agricultural communities have been immeasurably benefited by the opportunities the railroads have given them to carry the produce of their farms, not only conveniently to the adjoining market places, but to get this produce forwarded to the uttermost marts of the earth. The electric road is simply going to further their interests along these lines. Besides our good friend Rustic will be a more intelligent farmer, as he manages to get away occasionally from his hay forks and threshers and learns something of the big world around him.

IN the suit for damages brought against the Toronto Electric Light Co., the Holmes Protection Co. and the Bell Telephone Co., of Toronto, by a lady who suffered injury by coming in contact with an electric wire dangling in the street, a Mr. Cross, designated as "Electrician of the Cooper Institute, New York," was called to give expert testimony on behalf of the plaintiff. Mr. Cross is reported to have condemned in no uncertain terms, the character of the insulation employed in Toronto. For the purpose of testing the right of the witness to pose as an expert, a lineman of one of the defendant companies was despatched to procure a piece of wire from the scene of the accident. This piece of

wire, with two pieces of new wire, was submitted to Mr Cross for his opinion as to the character of the insulation After having critically examined the three samples of wire, the witness is reported to have stated that they were all of good quality, and on being asked which of the three in his opinion was the best, he selected the sample taken from the scene of the accident. This demonstration of ignorance led to enquiries being made concerning this so-called expert. The result is, that he is declared to be unknown to the authorities of Cooper Institute, and so far as known, has held no position of importance which would entitle him to regard himself, or to be regarded by others, as an authority on electrical matters. It is due to the reputation of the local electrical companies, as well as to the public welfare, that we should protest against the statements which have been made by this self-styled "electrical expert," and which have been made the text for alarmist articles in the insurance and other papers. We would call attention to the fact that in the case in question, Judge McDougall had no fault to find with the character of the insulation.

A STATION load curve is drawn by plotting the load (in amperes, horse power or kilowatts) measured by vertical lines opposite the hours measured on a horizontal line. It is very easily done, and however small a central station may be, it's load curve should always be plotted from time to time. Although the manager knows in a general way, how the load varies at different hours during the daily running time, and at different seasons of the year, he can have no such clear knowledge of the variation as a plotted curve will give him, and nothing can bring home to him so forcibly the possibilities of improvement. The area between the load curve and the horizontal line, whose length is the daily running time, is the actual daily output of his station The area of the rectangle whose base is the same line and whose height is the full load capacity of his plant, is the possible daily output of the same plant. And when these are reduced to figures there will be few managers who will not be surprised at the small percentage the actual is of the possible output "Load factor" is the convenient term which has been introduced to express this percentage, and a load factor of 40% is rare, 20 is more like the average results. Take for instance a load factor of 25%, with a station which pays 6% dividends. This means, that with one quarter its greatest possible output, the investment is earning the whole of its interest in addition to the running expenses and depreciation, due to the actual output. Consequently, if additional load can be added to the same plant, any excess of income from it, over the entire running expense and depreciation due to it, is so much net profit. For special services limited to the slack hours, the station can profitably make special prices. With the load curve before his eyes, showing plainly and definitely the hollows to be filled up and the low levels to be raised, the manager can best apply his local knowledge of his customers and possible customers, to devising plans for meeting their needs without increasing his plant—plans increasing his customers or their profits, and showing to his own satisfaction on his annual balance sheet.

WHAT may almost be called the distinguishing characteristic of the electric railway as compared with its competitors, steam railroads on the one side and horse railroads on the other, is its ability to give with economy a service both rapid and frequent. With the same frequency as horse cars, the superior speed of electric cars induces greatly increased travel in towns, whilst on suburban lines running at somewhat less speed than competing steam roads, traffic flows to the electric and is built up by it, owing to the more frequent service given by the latter. Suburban electric service is most economical as well as most convenient when it is diffused over the day, whilst for economical steam service the traffic must be concentrated into the larger and consequently more infrequent units which have much less tendency to promote increased travel. But this characteristic has applications to other uses besides passenger traffic, though from the force of custom such uses are not readily discerned by the general public, and indeed do not always at once strike those whom they specially concern. An instance in point is the watering of the track allowance in summer by electric tank cars, as was done last summer in Toronto, better and at less cost than by watering carts. Another and much more important application is to local mail service. The carriage of mail matter from the post office to the railway station, as is done by the electric street railway in Ottawa, is only a small part of such service. In the United States the post office authorities have given the subject much attention, and Sir Adolphe Caron, postmaster-general, recently inspected the system in use at Brooklyn where the application of trolley cars to mail service has been carried further than in any other place. Besides carriage of mails to and from trains, from main post office to branches, and direct interchange between branches instead of through main post office; carrier delivery is quickened by a car which, running on schedule time, takes out carriers' bags, sorted for distribution, and delivers them to the men on their beats, receiving from them letter box collections. For suburban service a car, with a compartment fitted up like a regular mail car, carries a mail clerk, who receives, sorts and delivers letters between post offices en route. Enough has been said to show the value of this use of electric cars, which will no doubt be extended as time goes on. As suburban roads are extended, improved mail service by them will be a great boon. At present a post office seven or eight miles from a large town may easily have poorer mail communication with it than Toronto has with Montreal.

THE reappearance of the Auer or Welsbach gas burner, and the vigorous way in which it is being pushed into use, render it a matter of interest to all concerned in electric lighting, and especially to those incandescent plants which have gas competition The standard of perfect light is sunlight, and the ideal artificial light to be aimed at is the nearest possible approach to this standard of white light. The ordinary gas jet, oil lamps and incandescent electric lamps fail of this standard through the predominance of the yellow rays in their spectra. The arc light has the brilliancy which the incandescent light lacks, a brilliancy due to the extension of its spectrum well into the violet region, but unfortunately the violet rays are disproportionately powerful, with the result of giving not a white, but a bluish white light The Auer light has something of the brilliancy lacking in incandescent lights, though not so much so as the arc light, but it has also a predominance of green rays, making it a greenish white light, with the usual rather ghastly effect which is inseparable from green light. Inquiries from users of the Auer light show that one of these burners, whose annual cost for gas is the same as the annual current cost of an incandescent lamp, gives much more light than an incandescent lamp; but has offsetting disadvantages. It is a gas light with all the disadvantages of gas, and a few more added on its own account. It gives out heat, consumes oxygen, and produces carbonic gases and sulphurous fumes like any other gas jet. It requires the use of matches; each burner must be lit separately and the globes or glass chimneys must be kept clean. The cones or mantles are frail, their life is reported to be about 700 hours. They are renewed annually free of cost, but if broken or burnt out in less time they cost for renewal twice the present price of incandescent lamps. It cannot be said that the color of the light is popular, and some reports state that long before the mantles are burnt out, the bright greenish white light of the new mantles becomes very much less bright and very much more green. This last defect, if true, may perhaps be got rid of by improved manufacture, and policy may dictate free renewals. But giving the Auer light the benefit of every doubt, what remains? A cheaper but rather more troublesome gas light, of a not pleasant color, and too glaring for agreeable use in offices or dwellings. It is not easy to see that there is anything in this to send electric light stocks tumbling. Incandescent lamps, clearer than gas jets and no brighter, forced themselves into use in the face of established gas lights. The fair inference is that their use is largely based on other qualities than brightness and cheapness, and these qualities are not infringed by the new gas burner. If the Auer light is deserving, and has its sphere, it will find it; but it does not seem likely that this sphere will much if at all overlap the legitimate sphere of the incandescent light. If they do seem to come into competition, it will probably be in that no-man's-land which lies between the ordinary incandescent and the ordinary arc light, and a very promising electric claimant for this poorly occupied territory is coming to the front in the form of the small arc or subdivided arc. In the meantime

the present Auer light is something new to the public, doubtless many people will try it, doubtless also many of them will discard it; and during this trial stage it behooves the electric light companies to see that they do not lay their light open to just criticism by poor regulation, low pressure, or worn out and blackened lamps. The Auer light is not a recent thing; it has been more or less in the field for some years; the present form is presumably an improvement, and its present use is greater than ever before, but some months must elapse before anyone can judge whether it is here to stay or whether this is merely a boom. In the meantime let the electric light companies "keep their powder dry," by carefully maintaining the quality of the light they furnish.

THE ONLOOKER.

"A fortune is in store for the man," said W. E. Davis, electrical engineer of the Toronto Street Railway Co., "who will invent a trolley wheel that will give satisfaction to street railway companies." At the time Mr. Davis made this remark the conversation was interrupted by the entrance of a workman from the shops, who was endeavoring to overcome some of the difficulties resulting in loss of power sustained by the present trolley wheels. The remark was made that there was, perhaps, not another electric road in the country that lost as much power in this manner as the Toronto Company. The Onlooker asked for an explanation, and Mr. Davis was disposed to credit a good deal of the trouble to the style of rails that were in use in Toronto. He said. "You notice the frequent flashing out of light that one will see at night as a car proceeds along the road. This is due to the kind of rails in use, causing unevenness and jumping, and especially is this the case using trailers to the extent that we do on the system here. However, this is the only rail that has met the requirements of the city engineer and the company will have to do the best it can under the circumstances." The Onlooker asked Mr. Davis if it was the intention to heat the cars this year with electricity, and he answered with an emphatic "No." The cost, as compared with the use of stoves was altogether too heavy. It would require about 400 horse power, said Mr. Davis, to satisfactorily heat the cars by electricity and there would be no money in that. Noticing in the works near by the remains of an old guard for preventing accidents, the Onlooker enquired if the company had got at anything satisfactory in that direction. "There is just this about it," replied Mr. Davis, "we are now using a guard that meets with the approval of the city engineer, though probably a score of different guards have been submitted to us for trial. The one in use is the same as is being used in Buffalo." It is most necessary that every precaution should be taken against loss of life through the rapid transit system in use to-day in nearly all large cities. But the more complete solution would seem to be outside of anything as imperfect as a guard in front of the motor. Perhaps the electric brake, fully described in the paper by Mr. Elmer A. Sperry, of Cleveland, and read before the recent meeting of the Canadian Electrical Association is destined more completely to meet this necessity than any other scheme. Mr. Sperry has succeeded in bringing the electric brake to a high degree of practicability, and it does not need much observation or thought to recognize that where accidents occur on electric roads these are due to the fact, usually, that the speed of the car has not been more quickly arrested. Mr. Sperry's patent combines the two methods of braking by converting the car motor into a dynamo, and by utilizing the current as an intermediary for the generation of magnetism to operate the magnet, and applying them together simultaneously.

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In the field of practical electricity, one hears less, perhaps, of development in telephonic affairs than in some other branches of the science. Touching on this matter in conversation with Mr. K. J. Dunstan, manager at Toronto for the Bell Telephone Co., and the genial president of the Canadian Electrical Association, this gentleman remarked to the Onlooker: "It would be a mistake to judge from this fact that no progress was being made in this department of electrical science. We go on our way quietly, giving apparently satisfactory service to the public, but I question if in any other field greater advances are being made than in handling the telephone business. Constant improvement in all the details of the business is the order of the day, and it can be understood that in a work like ours where the smallest details are of great importance, where, in fact, in the matter of time, we count by seconds and the fraction of a second is an item of importance, marked development may take place and yet only those who are closely watching the work will realize the fact. I might, for the moment, refer to the new switch board that is being placed in the Exchange at Toronto, and to which the ELECTRICAL NEWS has already made some reference. Just take the case of the automatic drop that will be a feature of the new switch board. It will prove a saving of time and labor in the handling of the business of this Exchange that will materially help operations at this end of the 'phone, as well as each individual subscriber." The Onlooker, however, will not draw further by way of illustration on the new switchboard, as when it is fully completed, which will be shortly, a description in detail, which will, no doubt, be interesting to readers, will be given in these columns. Whilst the principle of the telephone dates back many years, as readers of this journal will know, it remained to Alexander Graham Bell, of Boston, in 1877 to discover the method by which all the characteristics of sound, pitch, intensity and quality could be transmitted. This is less than a score of years ago, and when one recognizes this fact and thinks of the perfected character of the telephone business of to-day, then is realized the force of Mr. Dunstan's remark as to the progress made in this department of electricity.

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The matter did not come up directly in conversation with Mr. Dunstan, but enough was said to suggest to the Onlooker that with the improvements being made in the telephone there will also come a remedy for some of the abuses that are common to the service. This may be said to be a commercial, rather than a scientific phase of the business, but the abuse of the telephone service grows to such an extent in all towns and cities that companies are seeing the necessity of applying remedies more vigorous than have yet been adopted in many places. One evil is overcome in some cities by making a charge for the telephone to cover simply so many calls; beyond that figure within the period of lease an extra charge is made. It may be expected that this plan will in time be more universally adopted. The new device for registering the calls made on telephones has reached that degree of efficiency that no trouble need be realized in keeping a record of these between the exchange and the subscriber. How convenient it is to drop into a neighbor's and use the telephone! Everyone, of course, realizes this, but from the standpoint of the telephone companies, while this may be "nuts" to the invidual it is not business to the company A remedy in this direction would doubtless lead to a considerable extension of the service, and the convenience that would follow would be realized by many to-day, who clandestinely employ the service, and to the extent that everyone appreciates an article better when it actually becomes his own, so it would be in the case of the telephone.

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To the splendid equipment of the Toronto Street Railway Co. has recently been added a new 1,600 horse power engine from the factory of Laurie Bros., Montreal The engine is one of the largest in use in Canada to-day and the largest used by any electric railroad. The Onlooker had an opportunity lately of inspecting this engine, which had then been in operation three weeks, and had particulars of its operation fully and intelligently described by Mr. Ross, mechanical superintendent of the Laurie Bros., who was giving the engine the usual manufacturer's test. He said, that from the moment the engine had been started perfect satisfaction had been given, and this remark was confirmed by Mr. Davis, electrical engineer, who kindly showed the Onlooker through the power house. This engine is the only one in Canada not belted. It possesses a steam jacket 4 cylinder, and is the only engine in use in the Dominion with a water jacket. The large wheel is a sight to look at, being 20 feet in diameter, and the rim of it 18 inches square. Some conception of the size of the engine may be obtained when we state that the rim weighs 40 tons, a 22 inch shaft 17 tons, the discs 6 tons each, and the generator 23 tons. The construction of the engine is such that it may be worked in two separate parts, or together. If an accident happens to one part it can be closed off and the other part worked singly. The Onlooker, whilst inspecting the engine with Mr. Ross, had the pleasure of meeting Mr. Rutherford, chief engineer for the Toronto General Electric Co., who furnished the generators. This machine is classified as M.P. 10-800-90, having 10 poles, being 800 k.w. capacity, and running at 90 revolutions per minute. It is the same size machine as the one which was operated so successfully at the Intramural Railway and of which there have been over 50 sold in the United States and Canada, within the last year. The frame consists of two steel castings weighing, together with their pole pieces and spools, nearly 40 tons; the armature is of the iron-clad type and weighs nearly 25 tons, making a total weight of 65 tons. The machine is rated for a regular running load of 1,500 amperes, but as much as 2,400 amperes have already been taken from it for short intervals. This current at 550 volts is equal to close upon 2,000 indicated horse power at the engine. The machine is connected to the bus bars through *one of the Canadian General Electric Company's latest type* "K" circuit breakers which when opened at 2,500 amperes when the machine was under test, not only showed itself to be everything that could be desired, but proved that the dynamo could stand a strain of this description without bad results of any kind. Indeed the neutral points for no load and full load are so close that it was not even found necessary to move the brushes. It may be interesting to know that this machine was delivered at the power house within one month after receipt of order.

The Hutton Electric Co., of Huttonville, have installed a new 750 light incandescent dynamo. Another copper conductor will be erected to carry the current from this new machine to Brampton.

The council of the town of Farnham, Que., have declined to renew their contract with the electric light company at that place, and are considering the question of owning and operating their own lighting plant.

LIGHTNING ARRESTERS.*

By James Burnett.

Lightning Arresters, or perhaps more properly, Lightning Diverters, are included in the list of appliances that are requisite for the proper maintenance of a modern lighting or power plant that has connected with it any considerable stretch of outside or overhead lines. The subject of Lightning Arresters is of considerable importance when the number of burn-outs and shut-downs, in consequence of lightning, is taken into consideration, and a large variety of ingenious types of lightning arresters are now furnished for arc lighting—low tension, continuous current, alternating current and street railway circuits.

Probably the first and pioneer device under the above heading is the lightning rod, over which so much learned discussion was spent even an hundred years ago. We are told that there were two factions—the ball and the point—one advocating that every rod should terminate in a ball, and their opponents clamorously championing the merits of a rod finishing off in a point or series of points. Even this question has not received its quietus yet. A few notes on this subject will be given later.

Generally speaking, for electric lighting purposes, an efficient lightning arrester should be possessed of the ensuing features:

1. To provide discharge circuits which shall operate automatically and repeatedly, and which shall with certainty forestall and prevent a short-circuit of the dynamo, in case both lines are struck by lightning simultaneously.

2. To provide lateral discharge circuits, so arranged that they shall invariably offer a certain path for the lightning to ground, in preference to the other part of the system, which includes the dynamo, motor, etc., to be protected.

3. To be constructed so that free access may readily be had to its essential parts—an important consideration at all times, and often overlooked in the design of some lightning arresters.

The lightning which it is proposed to guard against has certain peculiar though pretty well-known qualities. Its chief characteristic consists in the fact that in the event of its coming in contact with a path of comparatively low resistance for normal currents, it may find in this path a high impedance to itself. This is especially the case when convolutions or sharp bends are inserted.

Lightning has in consequence a tendency to discharge laterally on coming in contact with a path of this description.

This phenomenon of impedance is termed self-induction or electro magnetic inertia.

Fig. 1 exemplifies an experiment that bears out this statement. A current of high voltage and of a highly oscillatory character (which possesses analagous properties to lightning) is passed from A to C, and instead of going over the path A, B, C, it jumps the gap at G in preference.

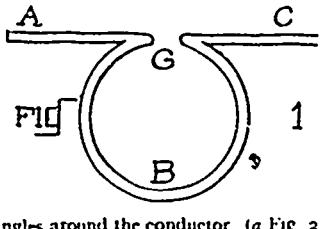

Fig. 1

Several theories of this peculiar and characteristic effect of self-induction are given—one of them being, that when current passes through a conductor it opens out magnetic lines of force at right angles around the conductor (*a* Fig 2) When the conductor is straight, these lines of force do not interfere with one another, but when any convolutions B or sharp corners *c* are inserted, then the magnetic lines or whirls cause an impedance or obstruction on the passage of a current analogous to

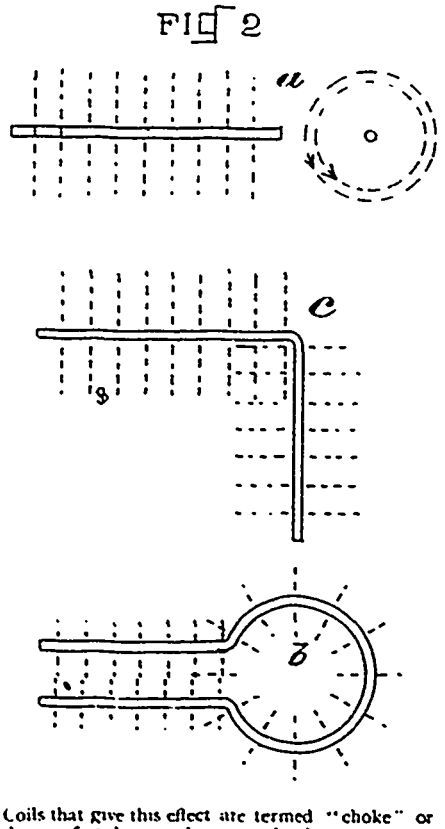

Fig. 2

lightning. Coils that give this effect are termed "choke" or "reactive" coils, and only manifest this peculiarity with alternating currents. It has been demonstrated that a flat spiral will offer a maximum impedance with a given length of wire. The impedance does not continuously increase with the number of turns, but reaches a maximum at about the seventeenth turn. The impedance is not perceptibly increased by the introduction of an iron core to the coil, if the core be thoroughly laminated.

We may now proceed to enumerate a few of the best known types of lightning arresters.

*Paper read before the Montreal Electric Club.

The magnetic type is the one most in use, and combines many good features, with simplicity of parts and principle. It has no moving pieces, and all parts are readily inspected. This type is based on the well known principle that an arc, except of static origin, cannot exist when its path interposes a strongly excited magnetic field. An interesting experiment neatly illustrates this. An arc is struck between electrodes *a* and *b*, Fig. 3, and the magnet M is brought near. The arc is in consequence deflected, as shown on the dotted line, by the repelling force of the magnet, and in consequence its length and resistance are increased. An increase in the repelling force (such as nearer proximity or increase in excitation of the magnet) tends to rupture the arc.

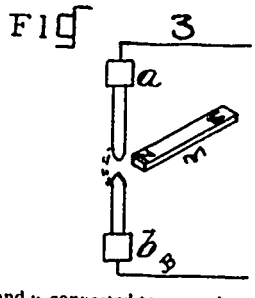

Fig. 3

The Thomson Lightning Arrester, (Fig. 4,) for arc and low tension continuous current circuits, has a magnet *m*, and two metal wings *a* and *b*, about ⅛" distant at *g*; *c* is a small contact piece placed ⅛" from *b*, and is connected to ground; *a* is connected to the line. The other side of the circuit is similarly connected. In the event of the line wire being struck by lightning, the inductively wound coil, *m*, offers an impedance, and the gaps at *a-b*, and *b-c*, are jumped, thus affording a good path to ground. A heavy current from the dynamo usually follows, and the magnet is highly excited,

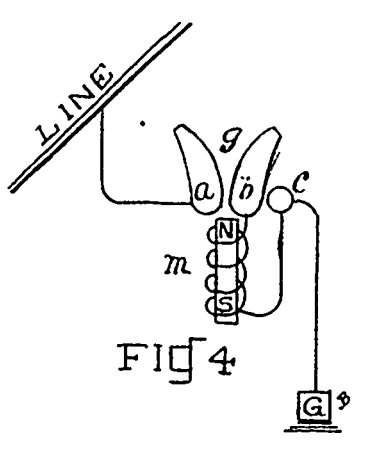

Fig. 4

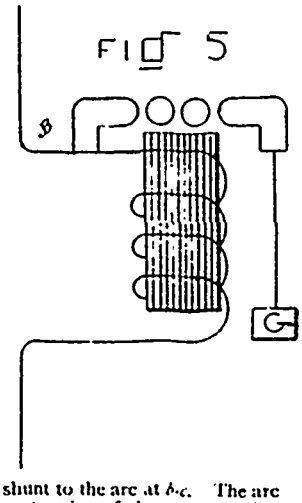

Fig. 5

taking current from the dynamo, as it is in shunt to the arc at *b-c*. The arc is immediately repelled to the furthermost extremity of the wings, and is broken by either its own resistance or its own heat, causing a draught of air, which blows it out.

The Thomson Arrester appears also in another form for alternating currents. In this type the magnets are laminated and are excited at all times by the line current being in series with the line. This is a desirable feature, as the magnet does not take any precious time to build up its strength, as in the continuous current types. Anyone who has observed what a short time it takes for an alternator—especially smooth core—to burn out on a short circuit, can appreciate this feature. This lightning arrester often may work without appreciable flickering of lights.

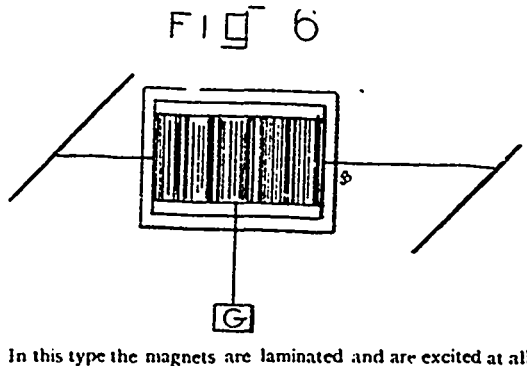

Fig. 6

Fig. 5 shows the connections of this arrester.

The recent discovery of what is known as "non arcing metal" has brought out arresters of novel type, principally by the Westinghouse Electric and Manufacturing Company. A very neat and novel arrester is the alternating non-arcing, which I think is destined to adorn many a switchboard in Canada before long.

The arrester for high tension alternating circuits consists of a number of rollers—usually seven—about an inch in diameter and separated slightly, the gap being about 1-16 inch wide. (Fig. 6). These rollers are composed of what is termed non-arcing metal. This metal is understood to consist of an alloy—copper, antimony and lead, in suitable quantities. The arrester is neatly mounted on a marble base. The gaps readily permit of the passage of a spark of static origin, but the normal current is effectually debarred from passing. This alloy is only "non-arcing" for alternating currents, straight currents not being checked in this manner.

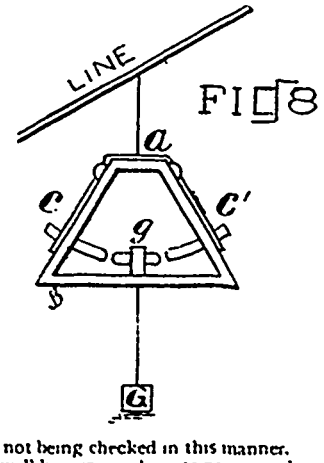

Fig. 8

The Keystone type (Fig. 8,) is also well known, and as its name implies, takes the shape of a keystone of an arch. This arrester is adapted for continuous currents. The line is permanently connected to *a*, which terminates in two carbons, *c* and *c'*; carbon *g* goes to ground. Lightning passes the gap at *c-a*, and the heavy normal current from the dynamo rapidly

heats the air enclosed by the marble box *m*, and in expanding, the air forcibly blows out the carbons *c* and *c*¹ (hinged at *h*) and the arc is immediately ruptured. The carbons return at once to their original positions, ready for the next discharge.

The Wurtz arrester (Westinghouse) for continuous currents, is based on the principle that if an arc be struck between two metal pieces, and the whole enclosed in an air tight box, the arc dies a natural death, not enough metallic vapors being generated to furnish a path of good enough conductivity. This arrester consists of the two brass blocks *a* and *a*¹ (Fig. 9), both held by a wooden block of walnut W. A walnut cover fits over the metal pieces, acting as a cover. A lignum vitae strip L is interposed between *a* and *a*¹. The surface of this strip is charred in serrated grooves, nine in number, to offer a high resistance path from *a* to *a*¹, which is connected to ground, *a* is permanently connected to the line wire. The box is about 6x8 inches and about 4 inches deep. It is made of iron, with rubber gaskets under the cover, and neat stuffing boxes for the lead wires. This prevents the entrance of much air to "feed" the arc. This type is recommended for use on continuous current circuits up to 1000 volts. This arrester has many neat features, but being enclosed in a box, is not readily accessible for inspection.

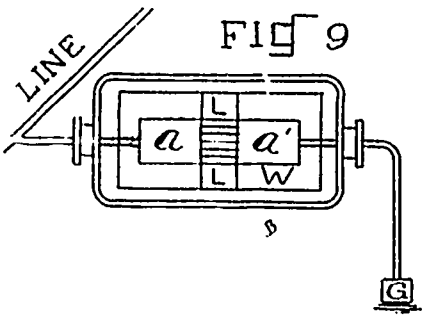

FIG 9

A simple type is the Tank lightning arrester, shown in Fig. 10. This is merely a high resistance path to ground, with circuit opener or fuses inserted. It is well adapted to railway ground return circuits, and is usually only connected in on the approach of threatening weather. The tank *t* is filled with acidulated water and the brass supports hold up a series of carbons *c*. One set is connected to line and the other to ground. An arrester of this type may be seen at the Montreal Street Railway power house on William Street. It is connected to the line wires by a flat ribbon of copper to obviate self-induction.

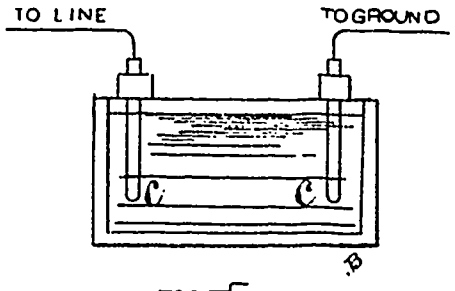

FIG 10

Fig. 11 shows a method of connecting any ordinary type of arrester. The inductively wound choke coil is inserted between the dynamos and the line. This increases the resistance of the line to the dynamo, and is easily constructed. The value of any well known type of arrester is strengthened by this simple device. Many notes of interest may be found in Mr. Wurtz' paper on "Arresters" in recent numbers of the electrical journals of the United States.

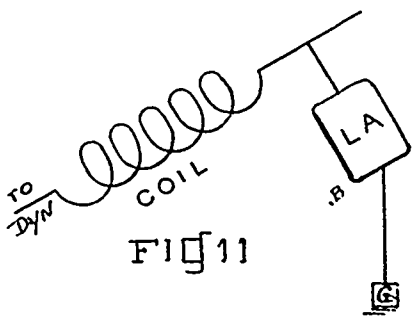

FIG 11

Lightning rods, as before stated, are not an absolute protection, however well made. Dr. Oliver Lodge has said: "An idea at one time got abroad that my experiments proved existing lightning conductors to be useless or dangerous, this being an entire misrepresentation. Almost any conductor is better than none at all, but no known conductors are reliable. However, they are essential to anything like security."

Some curious and interesting facts about lightning have been compiled by Mr. Alex. McAddie, of the U. S. Weather Bureau. Statistics compiled by him show that in 1892 in the United States 251 lives were destroyed and 839 fires were caused by lightning, the latter causing damage to the amount of three million dollars. One interesting point which appears to be shown by statistical studies of lightning stroke is the decreased liability to accident in thickly settled communities. The risk in the country may be taken as five times that in a city.

The function of a lightning rod is two-fold: first, that of conducting the charge to earth, and second, the prevention of a disruptive discharge by silent neutralization of the cloud electrification. This latter explains why a rod should terminate in a point and why points well grounded are desirable on buildings. The efficiency of a rod is reduced by blunted points and discontinuity of connections. The Lightning Rod Conference in England reported in 1882 that "to carry the lightning flash the lightning conductors should offer a line of discharge more nearly perfect and more accessible than any other offered by the materials or contents of the edifice to be protected." Roughly speaking, a rod will protect a conical space around it, the radius of whose base is equal to the vertical height of the rod above the ground, but whose sides are curved inwards instead of being straight.

In conclusion, a few salient points regarding lightning rod construction may be given:—

1. Make rod of iron or copper in tape form if possible, terminating in a short rod which is plated or composed of some metal which does not oxydize. The rod should be as straight as can be erected.

2. Insulation from building is not necessary; in fact, connection with tin roofs or large masses of metal is desirable.

3. Grounds should be carefully made. Earth plates should be of large capacity and covered by water or damp earth. Water or gas mains are desirable as grounds, but mains of small diameter, such as an inch or under, should be discarded on account of their liability to fuse.

4. Large buildings should have a series of points connected to separate grounds, and also connected to one another.

SPARKS.

The Midland Electric Light and Power Co., Midland, Ont., is applying for incorporation.

Kincardine has decided to place the management of its electric light system in the hands of commissioners.

The town council of Buckingham, Que., has granted right of way to the Buckingham Electric Light and Railway Co.

It is understood that large extensions are to be made to the capacity of the Northwestern Electric Co.'s works at Winnipeg.

Additional plant is being installed by the Portage la Prairie Electric Light Co., by means of which the lighting capacity will be brought up to 1200 lights.

The London Street Railway Co. have appealed to the Supreme Court to set aside the judgment of the Court of Appeals, preventing the company from double tracking their lines on Dundas Street.

The New Westminster & Burrard Inlet Telephone Co., of Vancouver, has arranged with the Canadian Pacific Telegraph Co. for the use of its lines for telephone purposes between Westminster and Washington Territory points.

It is said to be the intention of the Ottawa Railway Co. to extend their line to Aylmer, Que., via Hintonburg, Skead's Mills and Britannia, crossing the Ottawa river at Deschene Rapids by means of a bridge to be constructed at a cost of $150,000.

It is reported that the stock of the Montreal Street Railway Co. is largely going into the hands of private investors. Mr. Jas. Ross is the largest individual shareholder, his interest in the company amounting to upward of half a million dollars.

The town council of Aylmer, Que., has granted a twenty years' franchise to the Hull Electric Railway Co. The proposed road between Hull and Aylmer, a distance of eight miles, will be lighted, it is said, by arc lights, placed a quarter of a mile apart.

Philadelphia street cars are said to be fitted with electric buttons, which are used by passengers to stop the car. This is certainly an improvement on the system generally in use, by which passengers are obliged to rise to their feet and pull the bell rope.

Mr. E. Franklin Clements, of Yarmouth, N. S., is one of the leading promoters of the proposed railway between St. John, N. B., and Yarmouth, N. S. It is said to be the intention of the promoters of this road to attempt to use tidal water power, and by this means to greatly reduce the expense of operating the road.

The Galt and Preston Street Railway Co. expect shortly to receive authority to increase their capital stock and extend their line to Hespeler. The intention is to clear the ground during the coming winter and commence track laying early in the spring, with the object of having the extension in operation by the first of June next.

The Ottawa Street Railway Co. is issuing new stock to the amount of $187,700. This will bring the total capital stock of the company up to $813,300. The new stock is offered to shareholders at par. The company thus far have paid eight per cent. on their capital stock, and the stock is quoted at 150. The object of the new issue is to pay off the floating indebtedness, and to provide for extending the road.

Mr. A. J. Corriveau, promoter of the Montreal Park & Island Railway and other electric railway enterprises on the Island of Montreal, brings suit against Mr. W. S. Williams, his late partner, to recover $250,000 of paid-up stock in the Montreal Park & Island Railway Co., which he claims was secured under false pretences. Mr. Corriveau states that Mr. Williams undertook to bring into the company a large amount of American capital, which he failed to do.

Mr. W. E. Rathbun, of Deseronto, the principal stockholder in the proposed Oshawa electric railway, has deposited with the municipality bonds to the amount of $2,000 as a guarantee that the first section of the road will be completed by the 15th of June next, the second section by the 15th of July, and the third section by the 30th of September. Mr. Rathbun stated to the council that $15,000 had already been expended on the enterprise, and that not less than $100,000 would be expended before the road was completed.

A company has been organized at Summerside, P. E. I., with a capital of $10,000 to supply electric light and power. The provisional directors are: T. B. Grady, Pres.; Leonard Morris, Secretary; R. T. Holman, Neil McQuarrie, Neil McKelvie, Neil McLeod and H. W. B. Stavert. The necessary plant has been purchased from the General Electric Co., through Mr. Freeman, their agent at Halifax. The company expect to start operations before the first of the year. The town council have make a proposition to the company to light the town with thirty-three incandescent 32 candle power lights for a term of three years, at the price of $600 per year.

The annual report of the electric light department of the City of New Westminster, B. C., shows that the city lighting plant, which is owned and operated by the municipality, consists of 1 Corliss engine, 180 h.p.; 1 Doty high-speed engine, 150 h.p.; 1 Ideal high-speed engine, 150 h.p.; two arc dynamos of 2000 candle power each; two 1500 x 16 candle power nominal, with extra armature; and one 650 x 16 candle power incandescent dynamo, with two extra armatures and other appliances complete. There are now 87 arc lamps on the streets, and 3,125 incandescent lights installed in public and private buildings. There are about 45 miles of wires on the streets. The lighting committee make the following complimentary reference in the report to the work of the manager of this department, Mr. P. T. Bowler:—"Too much cannot be said in praise of our Manager. It would be impossible for him, if the concern were his own, to take a greater interest in the working of the institution, and he is frequently found at his duties until all hours of the night, in order that the best possible satisfaction may be given to customers, although he is the poorest paid electrician (where similar responsibility is undertaken) upon the Coast, whilst second to none in point of competency. So economically has the department been managed that it is almost impossible to convince the public that everything is being charged to it that should be." It is proposed to add to the plant an additional boiler, should the present demand for lighting continue.

QUESTIONS AND ANSWERS.

"Doubtful" writes: Kindly inform me through your valuable paper whether or not (1) there are any incandescent lamps in practical use that are made with platinum filament? (2) If so, where are they made, and (3) about what proportion of cost to correspond with the ordinary lamps? (4) If they are made, is there any advantage in using them?

ANS.—No. Platinum filaments were frequently used in early experiments, but a high resistance lamp is essential to the distribution of light by incandescent lamps; otherwise the size of the copper conductors would have to be greatly increased. The solution of the problem was the invention of a carbon filament.

J. L. M., Orillia, Ont., writes I would like to know if it is possible to make a permanent magnet about 8 inches long by about 1½ inches square to hold about 8 lbs. on one side. If it can be made, where could I get such made, and about what should it cost? I wrote to one manufacturing firm; they replied that they would not undertake to make it, but would give no reason.

ANS. A bar magnet of the size given would not hold up as much as eight pounds. Any blacksmith can cut off a piece of steel of the required size, and it can be magnetized at any place where there is a dynamo. The best quality of tool steel should be used, and it should be hardened and tempered to a dark straw color at the ends. The cost of such a piece of steel, hardened, should not be more than 50 to 75 cents.

L. O'C. writes: We have been having some trouble with the armature on one of our Ball machines, owing to the wires which connect the armature to the commutator web breaking. Can you assign any cause for this? The machine was shaking a good deal when the trouble first occurred, but we have corrected this to a great extent, and still the trouble goes on. The wires are not rubbing on the field magnets, or any other part of the machine. I have soldered them as they break, but in two or three instances the new wire I have put in has broken—not where it was soldered, but the wire itself. The machine is a 35 light, 4 amp., Ball arc. If you know of anything that will remedy this, kindly let me know.

ANS. This is a common trouble in Gramme ring armatures with long lead wires to commutators, when there is any possibility of sustained vibration of lead wires. For this reason the lead wires are commonly stayed together by a weaving of cord or rope in and out between them, extending from the commutator to the armature. We shall be pleased if any of our readers who have had a similar experience will state what means were found successful to remedy the trouble.

"HOUSE ORGANS."

IT IS announced that another of the "house organs," *i. e.*, a regular publication issued by a manufacturing concern, is to be discontinued; and this leads us to remark (at the risk of seeming to talk shop) that advertising by means of such publications has been repeatedly proven to be the most expensive possible way for machinery makers to advertise.

It is quite natural, perhaps, for a manufacturing concern which does a large business, and whose advertising bills are large, to conclude that by publishing a small sheet of its own, and attempting to make it more or less interesting in a general way, it can insert its own advertisements on a liberal scale, and by scattering these sheets broadcast among those who are buyers, do its own advertising at the mere cost of printing and postage. It seems all very simple and easy, but nevertheless experience shows that it is a mistake. People will not read nor preserve such publications; they never acquire any standing whatever; are never quoted or referred to as authorities on the subjects of which they treat, and are far more expensive than they are expected to be.

Lots of money is thrown away by machinery manufacturers in advertising, by the selection of "cheap mediums" and by general inattention, but there seems to be no more effective way of getting rid of money without return than by starting an organ and publishing one's own advertisements.—American Machinist.

PERSONAL.

Mr. A. G. Brown, of Wroxeter, has been appointed engineer of the Teeswater waterworks.

Mr. C. F. Sise, President of the Bell Telephone Co., Montreal, has been on a somewhat extended visit to Boston, Mass.

Mr. John Mullarkey, has been appointed manager of the Montreal Island Belt Railway. Mr. Mullarkey has had an extensive railway experience.

Mr. John Fenson, of Toronto, has been appointed consulting engineer to the East Hamilton Improvement Co., and will accompany Mr. J. N. Lake, the manager of that Company, to Pittsburgh, for the purpose of learning the latest improvements in inclined railway construction and operation.

Mr. Geo. Wilson, for several years employed in connection with the Bertram Engine Works, Toronto, has been appointed superintendent of the mechanical department of the St. John, N. B., Street Railway. Mr. Wilson carries with him the best wishes of many Toronto friends for success in his new position.

LUBRICANTS AND THEIR APPLICATION.

ONE of the most important things in connection with running machinery is its proper lubrication, writes a contributor to an exchange. Nine times out of ten those troublesome delays caused by a hot bearing are traceable to the lubricant, which is either entirely wanting or improperly applied. Frequently the men who attend to the oiling in factories do not take sufficient pains to do it properly. They allow the oil holes to become clogged with dust and dirt, so that but a small part of the lubricant reaches the bearing. Some others seem to think that a great deal of oil is necessary to the proper running of a bearing and they apply it so freely that it stands in pools about the bearings and machines. I have seen engines that almost stood in oil, yet they did not run any smoother than others which were properly cared for. A bearing needs but a small amount of oil at a time, but it needs it often. It is a good plan to fill oil boxes with wool or woollen yarn, as this allows the oil to reach the bearing in small quantities and also filters it. If a bearing becomes dry and heated, and consequently rough, there is nothing better than to apply powdered graphite with the oil, but, of course, it will not run through the wool. Where there are oil cups with tubes on the inside, as Fig. 1, it is a good

Fig. 1.

Fig. 2.

plan to take two or three strands of woollen yarn and coil them around the tube, putting one end down into the tube. This wick will feed the bearing as long as there is oil in the cup.

I was once bothered with the eccentric on an engine which I was running. Grit frequently dropped into the oil hole from above, which was just a hole drilled in the eccentric and countersunk on top. I tried putting yarn in, but it would not stay any length of time. I finally took a piece of wire and bent it in the shape shown in Fig. 2, and sprung it into the hole and put the yarn in the loop at the top, and it has not troubled me since.

THREE STEAM QUESTIONS.

(1) What is superheated steam?
(2) What is "latent heat," spoken of in work on steam?
(3) Will the material of a boiler affect the temperature of the steam made in it?

Vapor of a temperature above the boiling point corresponding to its pressure, is brought into the condition of a permanent gas instead of a vapor, and it said to be "superheated."

In passing from the liquid state into steam, the temperature of the water remains at the boiling point, which is determined by the pressure of the vapor produced. To make evaporation continuous, a certain quantity of heat must be added to the water or to the steam, for each unit of weight or steam formed. That heat does not raise the temperature of the water nor of the steam, but disappears, being used in keeping the water in the gaseous state; and the amount so used up without being perceived as heat, is called the "latent heat of evaporation."

Conversely, while steam, or any other gaseous substance or vapor, passes into the liquid state, its temperature remains stationary at the boiling point (or condensing point, which is the same thing) corresponding to its pressure, and a quantity of heat equal to the latent heat of evaporation at that temperature is produced in it. In order that condensation may continue, that heat must be transferred from the water (or other liquid) to some other body.

The boiling of water or other liquid will be retarded by its being in a vessel which is of a material which attracts the liquid. This will cause the boiling to take place by starts instead of regularly.—Power and Transmission.

PUBLICATIONS.

The J. Perkins Co., Toronto, have just issued a finely printed and illustrated catalogue devoted to fire hydrants, valves, water towers, &c., of which they are manufacturers, as well as of steam engines.

One of the interesting features of the December Arena is a symposium which discusses war and peace. The writers advocate the principles of the Peace Society and claim that the world has reached a plane of civilization at which all domestic and international disputes can be settled by arbitration.

At the recent annual meeting of the Peterboro' Carbon & Porcelain Co., the following officers were elected: President, Wm. Cluxton; A. P. Poussette, J. W. Taylor, Jas. Stevenson, Thos. Brooks, H. LeBrun, T. E. Bradburn, A. E. Dixon, A. L. Davis.

ELECTRIC RAILWAY DEPARTMENT.

EXPRESS AND FREIGHT SERVICE ON ELECTRIC RAILWAYS.*

THE answers to circulars showed that thirty-five roads are now engaged in the express business, while fifty five are hauling freight. As a matter of fact, however, few roads through the country are doing a regular freight business, most of the so-called freight services partaking more of the nature of express. As operated upon street railways, the distinction between express and light freight service is so ill defined that it is deemed best o consider both subjects together.

There are many points in the street railway as now conducted which make it almost an ideal agent for the transportation of packages and light freight. The great number of points reached by the cars, the absolute certainty with which they run, the thousand and one precautions taken against any stoppage of however short a duration, the rapidity with which distant points are reached, and many other causes combine to make the street railway of to-day a common carrier of exceptional advantages, when only short distances are considered. Many conditions will suggest themselves to railway managers in which an express or freight service may be made a paying institution. In the case of a town in which the railway station is some distance from the business part of the town, there can be no quicker, safer and better plan of conveying express and freight to some distributing point in the heart of the town, than by the street railway. Whether or not this will pay depends upon the amount of material, the competition, the distance, and the scope of the street railway franchise. A case often met with through the country is that of two towns connected by an electric railway, one of which, having no steam railroad, is obliged to get all its supplies through the other town. The installation of a freight service of some kind would at once suggest itself in this case, and the profits would depend upon the size of the towns, the character and occupations of the inhabitants, the distance between the towns, etc.

The operation of an express service on large city systems has not been attempted to any great extent. An example of a city road operating an express and freight service involving collection and a house to house delivery, is the case of the Southern Railway of St. Louis, which has been operating an express service on this plan for almost two years. The Southern Electric Railway begins in the heart of the city, and runs in a southerly direction for seven miles, following the general direction of the river to Carondelet. The territory penetrated is thickly settled for almost the entire distance, and in no essential does the road differ from the ordinary city street railway. Three trips per day are made upon schedule time by the express car, which is entirely independent, being mounted upon motors of its own. At the down-town end is a receiving station where a clerk receives all express consigned to the company, and keeps all the books pertaining to the service. The especial feature of this service, however, is the collection and delivery. This is effected by means of wagons, two of which are kept at the down town end of the road, and three of which meet the car on all trips at certain points along the line. On receiving notice by mail, telephone, or otherwise, a wagon calls for a package, delivers it at the car, from which it is handed to the proper wagon, and delivered to the address marked on the package. A charge of ten cents a package is made for this delivery, and trunks are taken from houses to the Union Depot, checked, and the checks returned, for the sum of fifty cents. A corresponding charge according to size is made for the delivery of large boxes and bundles. A compliment to the efficiency of the service is paid by the large dry goods and clothing houses, which have ceased to run their delivery wagons into this part of the city, and now consign all of their bundles to the railroad company. Where formerly one delivery daily was made by the wagons, three are now made by the railway. An interesting feature of the service is that several large factories located in the southern part of the city consign all their freight to the electric express. The goods are put on the car, taken to the proper railroad stations, shipped, and the bill of lading returned to the consignor. Packages are received by the express car, C. O. D., the charges collected, credited to the proper account, and settlements made at the end of each month. The railway company assumes all the responsibilities of a common carrier, holding itself liable for all loss and damages.

Up to this point we have considered an express and freight service merely as a paying or non-paying institution, to be adopted in the one case and to be rejected in the other. There is another view which may be taken of the case, however, which is in many instances the most proper solution of the problem. This is to regard the establishment of this service merely as an auxiliary to the passenger traffic, operated whether or not it pays in order to gain increased passenger travel. The most notable instances of this sort are the roads which run from the hearts of our large cities out into the suburbs. It is manifestly o the interest of these roads to promote building and settlement along their lines, and how can they better attract builders than by giving their patrons all the advantages of city life, not only in furnishing them with rapid transportation to and from the city, but in aiding them in receiving their provisions and supplies. This calls for some form of express service, and although the receipts from this source may not equal the expenses, the increased passenger receipts and the advertisement given the road must also be taken into account.

If mail bags may be thrown on the front platform of a car, carried to their destination and delivered without causing any long stops, this is perhaps the best way of solving a mail service on a small scale; but in a freight or express service it is better that the work should be done with cars especially devoted to such service and by men especially trained for it. A single box car equipped with motors of its own will handle the light freight and express of quite a territory without any interference with the regular running of cars. A twenty-five foot car, equipped with double trucks, supplied with the most approved form of motors and controllers, and fitted up either as a mail car, express car, or combination car, can now be obtained for two thousand to twenty five hundred dollars. A smaller car mounted on a single truck can be obtained for less money. If heavy freight is to be hauled, it should be carried in motor and trailer cars built especially for this purpose.

The rate charged on express matter is usually five or ten cents per package, while the freight rates vary from four to ten cents per one hundred pounds.

* From a report of a Committee of the American Street Railway Association.

SPARKS.

An electric railway from Parry Sound to Ahmic Harbor is talked of.

A meeting of the shareholders of the Winnipeg Street Railway Co. has been called at the Board of Trade Building, Montreal, on the 5th instant, to sanction the issue of bonds of the company secured by mortgage on the assets of the company, to the amount of $400,000.

The Honolulu Electric Railway and Power Co., Limited, is being organized to construct an electric railway system in Honolulu. The promoters of the company are: James Dunsmuir, John H. Turner, Thos. B. Hall F. W. McCrady, R. Menaugh and Clinton Graham Ballentyne, all of Victoria, B. C. The capital stock of the company is to be $625,000.

The town council of Niagara Falls are said to have recently discovered an old lease for a railroad right of way along the Niagara River. This lease is said to provide that the company using this right of way shall pay a rental to the town of $10 000 a year. The council, it is said, will endeavor to enforce this provision against the Niagara Falls Park & River Railway.

Application has been made to the county council of York by the Toronto and Suburban Electric Railway Co. for a franchise for the construction and operation of an electric railway from the end of its present system in Dundas Street, westward to Lambton and Islington, along Dundas Street. It is the intention of the company, if the franchise is granted, to commence construction at as early a date as practicable.

An electric railway is projected from Port Erie to Port Colborne, Ont. The Point Abino Street Railway Co. are applying for incorporation with a capital stock of $100,000 to carry out the enterprise. The promoters of the company are Leonard McGlashan, Humberstone, T. F. White and Donald McGillivray, Port Colborne, Ont., John Foy, Toronto; William M. German and Edward C. Raymond, Welland, Eugene Coste, Buffalo, N.Y.; Henry C. Symmes, Niagara Falls, Ont., and Robert G. Cox, St. Catharines.

The Toronto World thus expresses its opinion regarding the interpretation placed by the Controller of Customs on the clause in the tariff referring to steel rails —"The Government should do one of two things: it should either put a 30, or better still, a 50 per cent. duty on all rails, whether for steam or electric railways, fading this, it should remove the duty altogether. The present duty is inconsistent. It neither encourages, as it should, the rail making industry, nor does it aid it, the development of the country in the way it was expected to do."

At the recent annual meeting of the Montreal Street Railway Co., the election of directors resulted as follows: L. J. Forget, James Ross, H. A. Everett, K. W. Blackwall, G. C. Cunninghame. At a subsequent meeting of the directors Mr. Forget was made president, Mr. Ross, vice-president and managing director, Mr. Cunningham, manager. Mr. Ross takes Mr. Everett's place on the board as vice-president, and Mr. Cunningham as managing director. It is reported that Mr. Everett will shortly resign from the Board altogether and that Col. Henshaw will take his place.

The following statistical statement accompanied the annual report of the Montreal Street Railway Co. presented to the shareholders at the recent annual meeting of the company:

	1894.	1893
Gross passenger receipts.	$896,090 89	$750,751 78
Increase 1894 over 1893, 19.36 p.c.	145,339 11	. .
Operating expenses	617,668 14	594,041 71
Increase 1894 over 1893, 7.52 p.c.	44,626 43	.
Operating expenses (per cent. of car earnings)	71.10	79.0
Net earnings	258,422 75	157,710 07
Increase 1894 over 1893, 63.86 p.c.	100,712 68	
Passengers.	20,569,013	17 177,952
Increase 1894 over 1893, 19.74 p.c.	3,391,061	.
Transfers	6,828,653	5,094,113
(Per cent. of passengers).	33.20	29 65
Cars run per day (average).	135	117

Mr. W. Forsythe, on behalf of the Hamilton Radial Railway Co., has made application to the city council of Hamilton for a bonus of $400,000, and right of way over Cannon Street from the eastern limits of the city to Railway Street. The bonus is to be payable on completion of each section of the road as follows: Hamilton to Niagara River, $100,000, Hamilton to Woodstock, $100,000, Hamilton to Guelph, $125,000, Hamilton to Berlin, $75,000. The city is to be given paid up stock of the company for an amount equivalent to the bonus, the city to guarantee interest on the bonds of the company for a period of ten years. The company promise to pave Cannon Street with asphalt, and build car shops and barns and a passenger station at a cost of $75,000.

CANADIAN GENERAL ELECTRIC CO.

(LIMITED)

HEAD OFFICE

65 TO 71 FRONT STREET WEST

TORONTO, ONT.

BRANCH OFFICES

1802 Notre Dame St., Montreal; 60 Main St., Winnipeg; 138 Hollis St., Halifax; Granville St., Vancouver.

TORONTO, Oct. 26th, 1894.

DEAR SIRS:

Having by the removal of our Lamp Manufacturing business to Peterboro', consolidated this Department with our other manufacturing interests, we have been able to materially reduce the cost of production and at the same time improve the quality of our lamps, which are now the best on the market.

We have decided to give our customers the full benefit of this reduction, and will therefore from this date supply our INCANDESCENT LAMPS in not less than barrel lots at the following prices, viz.:

16	**c. p. Lamps,**	**25**	**Cents**	**each net**
24	"	**30**	"	"
32	"	**35**	"	"

Five Cents per Lamp extra when ordered in less than 100 lots.

With many thanks for past favors,

Yours very truly,

THE CANADIAN GENERAL ELECTRIC CO.

LIMITED.

SPARKS.

The adoption of the electric light is being talked of by the town of Sweetsburg, Que.

A new 600 light alternating dynamo has recently been installed by the Sackville, N. B., Electric Light & Telephone Co.

The sum of $100,000 has been voted by the citizens of Vancouver, B. C., for the purchase of a municipal lighting plant.

It is proposed to utilize the electric plant in connection with the pulp mill at Sissiboo Falls, N. S., to supply light to the town of Weymouth.

Mr. T. W. Ness has again commenced the manufacture and sale of electrical supplies under the registered title of Messrs. T. W. Ness & Co.

The Victoria Electric Light Co., of Lindsay, Ont., are moving into new and more commodious premises, and are adding to their plant a Wheelock condensing engine, a large steam boiler, new generators, etc.

The Vancouver, B. C., Street Railway and Lighting Co.'s property is said to have been purchased by an English syndicate, and the present employees of the company are reported to have received notice of dismissal. The name of the new owner has not been disclosed.

Mr. Peter McGregor, of Ottawa, is said to have perfected improvements on electric heaters which will reduce the amount of current consumed, increase the heat product, and prevent the oxidization of conductors. The manufacture of these heaters will, it is said, be commenced shortly.

An Ottawa company composed of Messrs. J. W. McRae, Dr. Henderson, N. C. Sparks, S. Maynard Rogers, H. B. Spencer, Arch. Stewart, J. A. G. Trudeau, and E. T. Hubbell, has been formed, with a capital of $45,000, to manufacture a primary battery, the patent for which has been purchased from Mr. Charles H. Hubbell, of Washington, D. C.

The Wm. Hamilton Mfg. Co., Peterboro', have been given a contract for a Payne Automatic Corliss engine of 350 h. p. for the Victoria, B. C., Electric Light Works. Attached to the engine will be a Northey duplex condensing pump, which will be fed with salt water. The engine, which will be connected direct to shaft, is guaranteed to regulate within one per cent.

The People's Electric Co., of Windsor, have requested the privilege of submitting to the Council a tender for the city lighting. The municipality is at present operating its own lighting plant, but finds it necessary to purchase additional machinery. The People's Electric Co. believe that they can furnish the light at a cheaper rate than the city can manufacture it.

A resolution was recently passed by the shareholders of the Hamilton, Grimsby & Beamsville Railway Co., limiting the amount of stock to be placed upon the market at $100,000, and authorizing the directors to issue bonds sufficient to complete the road to Beamsville. It is understood that the traffic on the road has been so heavy that the advisability of double tracking the line is already under consideration.

SPARKS.

The electric light and power plant at Carberry, Man., formerly owned by McMillan & Oliver, has been purchased by Mr. H. Boyd.

Application is to be made to the Nova Scotia legislature for a charter for an electric light and power company to operate at Parrsboro', N. S. The capital stock of the company is to be $10,000.

Mr. Geo. E. Kidd, Solicitor, has given official notice to the government of the intention of a company to apply for incorporation to construct an electric railway between Ottawa and Brockville.

A paper on the "A B C of Electricity," referring especially to the relation of the electric magnet to the permanent magnet, was recently delivered by Mr. H. Breck, Jr., before the members of the Kingston Association, C.A.S.E.

The Yarmouth Gas and Electric Light Companies were recently amalgamated. Subsequent to the amalgamation some of the shareholders of the Gas Co. brought suit against the directors, whom they charged with having fraudulently procured a controlling interest in the Gas Co., and by means of this interest having purchased at an exorbitant price the electric light plant of which they were the owners. It is reported that judgment has been given in favor of the plaintiffs for the sum of $248,000.

A series of interesting and instructive lectures on "The Steam Engine Indicator," are being delivered by Mr. A. C. McCallum to the Peterboro' Branch of the Canadian Association of Stationary Engineers.

The incandescent lighting business of the Royal Electric Co. in Montreal has rapidly increased. In March, 1893, the company supplied 28,917 lights, in March, 1894, 40,279, and 17th November, 1894, 50,316.

The report comes from Ottawa that a company with a capital of $100,000 is negotiating for the establishment in that city of a factory for the production of porcelain and carbons for electrical purposes. At Kingsville also, application has been made to the town council for certain privileges on behalf of a company who propose to engage in the manufacture of bicycles and carbons.

The Bell Telephone Co. have lately taken possession of their new exchange building at Ottawa. The new exchange is said to be most complete in all its arrangements, having been built for the special use of the company. The switchboard is wired for 1200 subscribers. The switch bells are operated by an electric motor in the basement. The wires are brought into the building through underground cables. These cables at present carry 2800 wires, but have a capacity of 7200 wires. The present length of underground cable is 47,811 feet. There are in use in the city upwards of 1000 miles of wire. The apparatus of the new building was installed under the superintendence of Mr. W. A. Tower.

SPARKS.

The Halifax Street Railway Company's receipts for the year 1894, exceeded those of 1893 by $12,000, the amount being $104,152, of which the city received $8,332.

Below are given the gross receipts of the Montreal Street Railway Company for ten years, commencing 1885 and ending at the close of the company's business on the 30th September, 1894 1885, $222,063; 1886, $252,186; 1887, $346,022, 1888, $386,468; 1889 $412,216, 1890, $131,389, 1891, $401,862; 1892, $569,810; 1893, $750,751, 1894, $880,000.

Mr. F. E Handy, late engineer of the Hamilton and Beamsville Electric Railway, writes the ELECTRICAL NEWS from Worchestershire, England, where he is at present visiting, that he is surprised at the slowness of things electrical in England. Large cities and towns have not the electric light yet. There is a grand field for a concern to manufacture dynamos, lamps and motors. The field is practically untouched and railway work is not properly started yet. There is a poor affair at Walsall, a fairly good road in Liverpool and one in London—but that is all.

Application is to be made to the Ontario legislature at its next session to incorporate the Toronto, Hamilton & Niagara Falls Electric Railway Co., with power to construct an electric railway from Hamilton to Toronto, and from Hamilton to some point on the Niagara River, at or near Niagara Falls; and also a branch line from the village of Grimsby south through or near the village of Smithville to the village of Dunnville; and also for the usual powers to sell, lease and distribute electrical power. Messrs. Briggs & Lewis, of Toronto, are acting for the promoters of the enterprise.

The following patents for electrical devices have recently been granted in Canada: Commutator Connector, Electric Mining Machine, Electric Railway Block System, Canadian General Electric Co., Toronto; Electric Car, E. M. Boynton, West Newburgh, Mass; Regulating Sockets for Incandescent Lamps, etc., Elias E Ries, Baltimore, Md.; Electric Railway Signal, Frank E. Seagreave, Toledo, Ohio; Electrodes for Secondary Batteries, Henry C. Porter Chicago, Ill.; Electric Conduit System, Hyrum S. Woolley, Paris, Idaho; Alternating Current Motor, Alternating Current Generator, Frank H Sleeper, Coaticook, Que., Electric Railroad Signal, Benjamin C. Seaton, Rochester, N. Y.; Electric Block System, The Electric Signal Co., New York, N. Y., System of Electrical Distribution, Waldemar Meisner, Konigsberg, Prussia, Germany, Rheostat, Chas. A. Hussey and Chas. C. Eadie, New York, N. Y., Method of Propelling Vehicles by Electricity, Ries & Henderson, Baltimore, Md.