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CANADIAN
ELECTRICAL NEWS
AND
STEAM ENGINEERING JOURNAL

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

JUNE, 1895

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CANADIAN
ELECTRICAL NEWS
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STEAM ENGINEERING JOURNAL.

VOL. V. JUNE, 1895 No. 6.

THE BRINTNELL ELECTRIC MOTOR.

MR. Archibald H. Brintnell, of Toronto, has invented and patented an electric motor which so far departs in construction from the standard types at present in use that the accompanying illustration of the device, together with the inventor's claim, will doubtless be examined with interest by our readers :—

The object of the invention is to devise a simple slow-speed motor, incapable of being burned out, and which may be reversed at full speed and with a full potential current, without damage to the motor, and which also may be instantaneously stopped at any desired point, without the necessity of using any brake, and it consists essentially of a series of double field magnets held in a circular non-magnetic frame, supported on suitable standards and having the inner ends of the pole of the magnets flush with the inner circle of the frame and a number of spool armatures journalled free to rotate in bearings in supporting discs secured to the main shaft of the motor and in direct successive contact with the poles of the magnets, a commutator of peculiar construction being provided to throw the current into both magnets and spool armatures, so as to cause a pull upon the spool armatures in succession, and rotate the shaft as hereinafter more particularly explained.

Fig. 1 is a side elevation, showing the upper half of one side of the commutator and face rings broken away.

Fig. 2 is a vertical section through the motor on a line with the shaft.

In the drawings like letters of reference indicate corresponding parts of each figure.

A-A are the vertical standards in which are journalled the main shaft B. C are a series of double magnets supported in a circular open frame, D, of non-magnetic metal. The horse magnet core, c, of each magnet, C, is laminated as shown and straddles the outer rim, D^1, while the inner ends of the magnets extend into notches, d, in the rim, D^2, and are concentrically flush with the interior surface of such inner rim. C^1 are the coils of the magnet C, which are supported in the openings D^3, in the circular frame D.

E-E are two rings substantially Z shaped in cross-section, which extend around the magnets and are secured to the ring D, close to the horse-shoe cores of same on each side by screws,

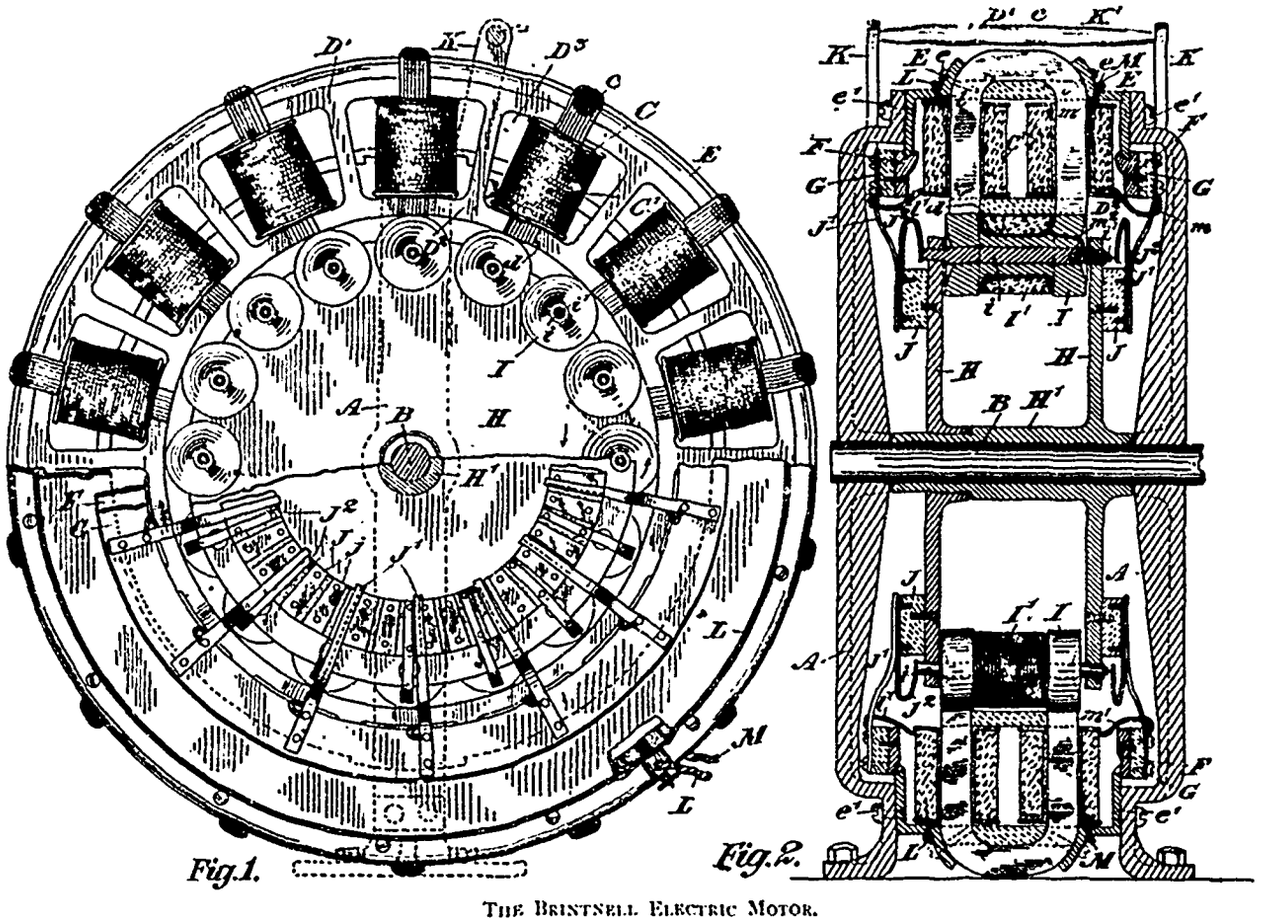


Fig. 1. Fig. 2.

THE BRINTNELL ELECTRIC MOTOR.

e. The rings are secured at the outer face by screws, e^1, to the standards, A. By this means the frame, D, is maintained in position. F-F are supplemental rings secured within the inner edge of the ring, E, and G-G are rings of insulating material suitably secured to the rings, F.

H-H are two discs preferably of non-magnetic metal secured to or forming part of the hub, H^1, which is keyed to the shaft. I are a series of spool armatures having coils, I^1, and spindles, i, which are journalled near the outer periphery of the discs, H-H, and extend through the same. The spindles, i, are made of non-magnetic metal. The ends of the spool armatures are preferably recessed as shown.

The spool armatures and magnets are arranged in diametric pairs. The commutator is comprised of two rings, J-J, of insulating material, each situated to the outside of the discs, H-H, and a plurality of brushes, J^1-J^1, corresponding in number to the

magnets and a plurality of brushes, J, corresponding in number to the armatures and situated directly opposite to them.

The brushes, J', extend from the insulating ring, F, to the ring, J, and are bent at their outer ends so as to form spring ends. The brushes, J, at one side press upon the ends of the spindles, i, and at the outer side press upon insulated pins, i, in the opposite end of the spindles, i. The insulating rings, I, of the commutator, are provided with a number of dead metallic sections, j, extending between the spring contact brushes, J, which dead sections are designed to prevent sparking as commutator revolves within the brushes, J', and to give a smoother running surface.

K K is a double arm secured to the rings, F F, and connected by a cross rod, K. By means of this double arm, K, the position of the brushes, J', are changed either to increase or decrease the speed of the motor, stop it, or to reverse the direction of rotation as hereinafter described

The wiring is as follows We will suppose that L is the positive wire and M the negative. The current comes in to each diametric pair of coils (see Fig. 2) successively, it being necessary that two of the brushes, J', are over two of the brushes, J, each brush being diametrically opposite the other. The first brush, J', to the left hand side of the standard, A, is shown partially over the first brush, J. The brush diametrically opposite is also in the same position. The second brush, J', to the left is also shown partially over its corresponding brush, J, and its diametric brush will also be in the same position circumferentially In fact, two pairs of diametric brushes will always be in circuit, so that their corresponding magnets will be exerting a pull upon the armatures. The current would consequently pass in each case from the positive wire, L, in upon the wire, l, through one of the coils, C', of the magnets, C, the wire, l, brushes, J' and J', through the spindle, i, and coil, I, of the spool armature, I, thus magnetizing such spool armature out through the wire, m', pin r', opposite brushes, J' and J', wire, m, through the other coils, c', and out by the wire, m, to the negative wire, M.

It will consequently be seen that the pull upon the diametric spool armatures, I, will be such as to cause the discs, H, to rotate in the direction indicated by arrow. Each successive diametric pair of brushes, J, pass on to the brushes, J', serving to continue the rotation of the discs in the same direction, and the result of the pull of the magnets upon the spool armature being to rotate them in their bearings in the opposite direction.

The nearer the brushes, J', are placed circumferentially to the magnet core the less will be the speed, and the farther away the greater, except that there is a maximum distance in which they must be placed, and that is indicated as closely as possible in the drawings.

To reverse the direction of rotation of the motor, it will necessarily be seen that the brushes J, attached to the ring, G, may be moved by the double arm, K, so as to place them in the same relative position circumferentially on the opposite side of the cores.

It will be noticed in the construction of my machine that there is no air space between the armatures and poles of the magnet, but that they rotate directly thereon, and consequently I am enabled by the construction shown to always maintain a very strong pull between the spool armatures and magnets. As soon as the armature comes opposite magnet, of course the curren is thrown out, and both magnet and armature are demagnetized.

By bringing around the brushes, J', opposite to the magnets the machine may be stopped practically instantaneously, and held from rotation by the magnetism being retained in the field coils and armatures as the current is still on. This, it will be readily seen, is very important when my motor is employed to run elevators, or for other purposes in which it is necessary to stop the machine instantaneously and hold it in any desired position. No brake, therefore, would be required, as the impetus is checked immediately.

From the construction lopted it will also be seen that the direction of rotation may be reversed at full speed, with a full potential of current, without burning out or otherwise damaging the motor.

CLAIMS.

1. An electric motor comprising a plurality of magnets circularly arranged in a suitable frame, so that the poles touch and are circumferentially flush with a common circle, and a number of spool armatures journalled in bearings in discs secured to the main shaft and caused to rotate in their bearings by the pull exerted by the poles of the magnets with which they come in direct and rolling contact as and for the purpose specified.

2. The combination with a plurality of horse shoe magnets supported in a circular frame of non-magnetic metal, and with their poles extending through notches made in the sides of the inner rim of the frame, so that the ends of the poles are circumferentially flush with the inner rim, of a series of spool armatures journalled in discs secured to the main shaft and means whereby a current is thrown into one or more diametric pairs of magnets and armatures successively as and for the purpose specified.

3. The combination with a circular non-magnetic frame D, provided with a plurality of laminated horse shoe magnets, with coils and the rings, E, secured to the outer ends of the magnets and supported in the frame, and the rims, F and G, provided with spring contact brushes, J', of the spool armatures, I, provided with spindles, i, which are journalled in the discs, H-H, secured to the shaft, B, the insulating rings, J-J, the brushes, J', secured to the rings, J, and commutating means whereby the current is carried simultaneously and successively through the co-acting magnets and armatures, as and for the purpose specified.

4. The combination with a circular non-magnetic frame D, provided with a plurality of laminated horse shoe magnets with coils and the rings, E, secured to the outer ends of the magnets and supported in the frame, and the rims, F and G, provided with spring contact brushes, J', of the spool armatures, I, provided with spindles, i, which are journalled in the discs, H-H, secured to the shaft, B, the insulating rings, J-J, the brushes, J, secured to the ring, J, and the main current wires, L and M, connected by a wire, l, to one coil, and the current being carried by wires, l', brush, J', brush, J', spindle, i, coil I, wire, m', pin, r', brushes, J' and J', wire m', coil, C', wire, m, to negative wire, M, successively for each diametric co-acting magnets and armatures, as and for the purpose specified.

ELECTRIC LIGHTING IN TORONTO.

JUDGING by the overwhelming defeat of the by-law to authorize the purchase of a municipal electric lighting plant for the city of Toronto, the property owners regarded the tender of the Toronto Electric Light Co. as being so low that it would be unwise for the city to go into the lighting business in the uncertain hope of being able to effect a saving of a few hundred dollars per year The pros and cons of the question were discussed in detail through the public press for months prior to the submission of the by-law, so that the verdict of the ratepayers cannot be said to have been reached without full and deliberate consideration of all the arguments for and against municipal lighting. We believe the decision to be a wise one so far as it relates to Toronto and cities of large population. It is to be hoped that after all the worry to which the Toronto Electric Light Co. have been subjected for a year past, they will now be given a five years' contract on the basis of their tender

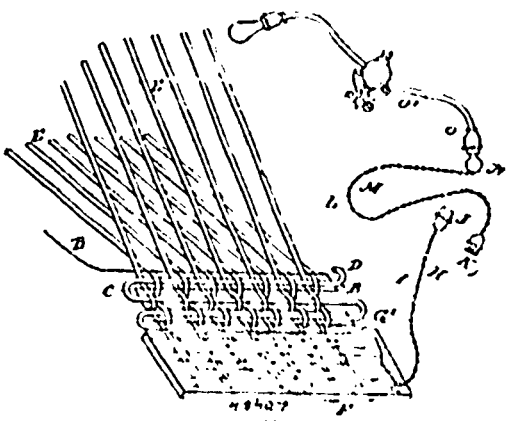
An electric light plant is to be installed at Brighton, Ont.

The Packard Electric Co., who recently removed their business from Montreal to St. Catharines, have purchased the Neelon mill property, and are fitting up the mill building in a way to meet the requirements of their manufacturing business. The property consists of about ten acres of land, a valuable water power, the capacity of which is estimated at about 700 h. p., in addition to wharves, storehouses, etc. It is understood that the company bought the property at a bargain, and have been offered a considerable advance on the price paid since closing the purchase. The mill building, which is to be used as their manufactory, is a most substantial structure, the outer walls being of stone faced inside with brick, and plastered with cement. The walls in the basement are upwards of four feet in thickness, while the wood framing of the building is equally substantial in character. The basement floor is of concrete, making a foundation for machinery so substantial as to be almost noiseless. The Packard Company are putting up a separate building in which the cementing will be done, thus preventing the possibility of fire destroying the main building. The company expect to have their new works in operation by the first of July, and contemplate engaging in some new lines of manufacture. We hope to be able to furnish additional particulars concerning their new manufactory in a future issue.

RECENT CANADIAN PATENTS.

Canadian patents have recently been granted for the following electrical devices:—

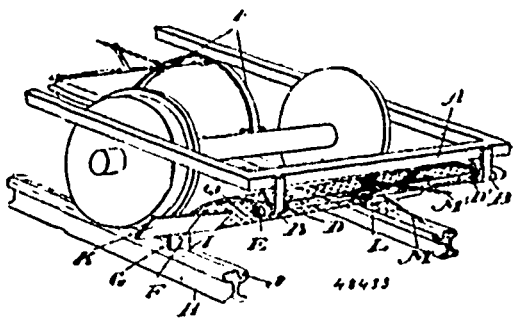
No. 48,407, for an electric heater, to John Emory Meek, New York City. The inventor's claim for this device, which is herewith illustrated, is as follows



ELECTRIC HEATER.

In an electric heater, an electric resistance fabric, consisting of a conducting wire, woven with non conducting strands, preferably asbestos, said non-conducting strands preferably forming the warp of said fabric, and having said wire preferably woven as or with the filling thereof, so that the fabric may be cut parallel with said filling strands into pieces of suitable size for use as cushions, pads, blanks, garments and for other heating purposes, each piece so cut from the fabric being in itself a complete electrical heater when connected in circuit.

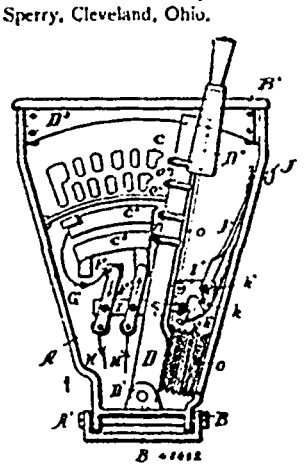
No. 48,433, for a rail cleaner, to Robert Leslie, Toronto, Ont. The claim for this device, which is herewith illustrated, is as follows



RAIL CLEANER.

A track cleaner consisting of a rock shaft, bearings for the rock shaft, means for allowing the rock shaft a side motion in its bearings, a shoe carrying arm mounted on the rock shaft and so arranged as to have an independent side motion, and also to move sideways in conjunction with the rock shaft, means for operating the rock shaft, a cleaning shoe connected to the end of the shoe carrying arm, and a coulter connected to the inner side of the shoe and arranged to scrape the side of the rail, substantially as specified. The combination with the car truck of an arm depending from each side of the car truck in close proximity with the rail, a cleaning shoe carried by each of the depending arms, and a netting connected to the said arms and extending across the under side of the car truck.

No. 48,482, for an electric controller, to James Parmelee, New York, assignee of Elmar A. Sperry, Cleveland, Ohio.



ELECTRIC CONTROLLER.

Claim.—In an electric controller, a series of contacts, an element of the controller moving to and fro over said series of contacts a co operating contact bone upon such an element, an air-discharge nozzle upon one side of the said co-operating contact, a source of fluid pressure as bellows O, means connected with said moving element whereby said source shall inhale during one, and discharge during the other of the to and fro movements of said moving element, and a duct from the said source to the discharge nozzle.

ONTARIO ASSOCIATION OF STATIONARY ENGINEERS.

The annual meeting of the O.A.S.E. was held in Brantford on May 27th. The meeting took place in the hall of Brantford No. 4, C.A.S.E.

There were present engineers from London, Hamilton, Kingston, Galt, Ayr, Guelph, Toronto and many other places, including a number of Brantford engineers

President A. E. Edkins called the meeting to order sharp at 11 a. m. and proceeded with routine business. After minutes of last meeting were read and approved the president addressed the meeting as follows:

PRESIDENT'S ADDRESS.

On this the occasion of our fifth annual meeting I feel it my duty to thank the members and officers of this Association for having shown their confidence in me at last year's meeting in London by electing me to fill the chair of this Association, and the Board for another year, when I was unavoidably detained from attending the meeting myself.

The business to be brought before you on this occasion will consist chiefly in the appointment of members to the Board to replace the retiring members whose time has expired. In connection with this matter I deem it scarcely necessary for me to impress upon you the necessity of selecting members to fill vacancies on the Board who are energetic in Association work, as the success of this institution must to a great extent depend on the perseverence and energy of the members on the Board.

I take this opportunity of congratulating you on the fact that during the past two years no complaint has been made to the Board respecting any certificate holder, either for incompetency, *intoxication, or any other action unbecoming an engineer, and* as a result we have not been put to the painful necessity of revoking any certificates for such causes.

The membership of the Association has not increased so rapidly during the past year as it did in the years preceding it, which is quite natural and to be expected, owing to the fact that in our cities and towns, all engineers who feel inclined to pass an examination (without being compelled to do so by law) have taken out certificates, therefore our hope for membership in the future must be in the direction of engineers who are in charge of plants in the smaller towns and villages.

I do not mean to infer by this that our membership in the cities will not increase, for I certainly expect it will do so materially, but not in the same proportion year by year during the next four years as it has in the past.

During the years of its existence the Association has not increased in membership to the extent that it should. When we consider the fact that (at a very moderate estimate) there are 4,000 stationary engineers in active service in the province, we must be disposed to consider that our strength numerically is far from what it should be.

I hope within the next four years to see the membership of the Association reach 2,000, and I hope that with this end in view, not only the members of the Board, but also the individual members of the Association will interest themselves in the work of increasing our membership and sphere of usefulness.

As a member of the Association I shall do all in my power to place the membership of the Association at the limit of which I made mention, irrespective of the fact whether I may continue to be a member of the Board or not.

I am sorry that at the last meeting it was decided to alter the day of meeting, as in my opinion, the 24th of May being a holiday, was a much better time, owing to the fact that many engineers who would and could attend on that day are this year prevented from doing so, as they have to be on duty, and as some of them have expressed themselves to me, they are debarred from attending the meeting and taking part in the proceedings.

During the last session of the Local Legislature, as most of you are aware, we presented a bill to provide for the inspection of steam boilers, and the examination of engineers in charge.

The bill passed its first and second readings and was referred to a special committee, by whom it was thrown out, and a resolution passed to the effect that the committee, while accepting and endorsing the principle involved in the bill, took exception to the machinery provided for its working in the event of its becoming law.

This proposed legislation was introduced by Mr. Crawford, one of the members for the city of Toronto, who, while he advised us strongly to get one of the government supporters to champion our cause, very generously informed us that if we insisted he would accede to our wishes and do the best he could.

There was, to my mind, several things about the bill calculated to raise opposition. For instance, the appointment of a chief inspector and a staff of assistants, who might do this, that and the other thing, but whose duties were by no means clearly defined. I think you will agree with me, that a measure of that kind would be very apt to be looked upon by many members (of

the opposition side of the house, at least,) as a scheme to provide soft snaps for some of the supporters of the government, who had arrived at the end of their useful period.

As far as the engineers of the province are concerned, I do not think they are very anxious for a government inspection law, but they would like to see some standard set up for the qualification of engineers of land engines, and I think we shall stand a better chance of securing moderate legislation governing the latter, than any measure dealing with both. The provinces of Manitoba and Quebec have both passed laws of this kind, which are as unique in some ways as they are useless, and I trust that when an engineers' law is passed by our legislature, it will be something useful and beneficial to all concerned.

In connection with this legislation it has been necessary to spend some of the Association's money, and if we have no other return to show for it, we can, at least, say that it has kept the Association before the public, and I have no doubt but that you will endorse the disbursement.

It is gratifying to us to know that the Association's certificates are being generally recognized by manufacturers and steam users as a guarantee that the holders thereof may be depended upon as being reliable and sober engineers. We have had evidence of this many times during the past year, when men who held certificates received appointments to positions in preference to men who were not registered, even where the latter were fully equal to the former in point of ability, etc. In several cases engineers have come from a distance to pass their examination, in order to secure positions, where none but a certificated man would be employed. This is encouraging, and it is the duty of the Association and of the Board particularly to see to it, that no certificate is issued to any person who has not had the necessary experience required by the act, and in the event of any person applying for examination who has not had that experience, or who is in the habit of using intoxicating liquors to excess, or who, for any other reason is unfit to shoulder the responsibilities of a position as an engineer, and the facts are known to a member of this Association, it becomes that member's duty to the Association and to himself, to see that the chairman of the Board is at once informed of the facts.

At a previous meeting of this Association, I suggested to you the advisability of reducing the annual renewal fees for certificates, which suggestion you saw fit to act upon, and consequently reduced the fees from $1.50, $1.25 and $1.00 to $1.25, $1.00 and 75c. for 1st, 2nd and 3rd class respectively. This reduction has been the means of inducing a larger number of members to keep up their renewals, and has, I believe, on the whole proved beneficial to the Association. Believing, as I do, that the fees for renewals should be made as low as possible consistent with the proper management and economical administration of its affairs, I would respectfully suggest to you the advisability of further reducing the renewals to $1.00, 75c. and 50c. for 1st, 2nd and 3rd class respectively. This further reduction will necessitate a slight alteration in our by-laws. I refer to sec. 3, art 5, which reads as follows, viz. "During the life of a certificate the holder thereof may apply for one of a higher grade which will be granted to him on his passing the necessary examination and paying the amount for renewal charges for such higher grade." It will be necessary for this section to read in such a way that the applicant should pay the difference between the examination fee for the grade of paper he holds, and the fee for the higher grade required.

The registrar's and treasurer's report will be submitted to you during the day, when you will be afforded an opportunity of hearing something of the numerical, and also the financial standing of the Association. I have before made reference to the fact that considerable money has been spent in connection with our efforts to secure legislation, as we had a representative constantly at the Parliament buildings, who was well known in the House, and who did most excellent work in pushing our claims before the notice of the members. I have also much pleasure in stating that during the session of the House, the members of the Board received very practical help from the officers and members of the different associations of the C. A. S. E., and in my estimation the interests of these two Associations are so identical that I am sometimes inclined to feel it a pity that there should be two organizations in place of one Association incorporated by act of the Dominion Parliament, and having all the powers and privileges of the two Associations combined. The Ontario Association is of course an outcome of the C.A.S.E., and might almost be called a branch of it, but I am inclined sometimes to think that one Association instituted as I have said, would prove much more effective and beneficial.

I am pleased to be able to report that during my terms of office in this chair, and so far as I am aware, only one loss by death of a member has been reported to the Association, that one being Mr. J. Campbell, engineer Parry Sound waterworks. The first intimation I had of Mr. Campbell's death was when, having occasion to write to him on business for the Association, I received a letter from his wife informing me that he had been dead over a month. Mr. Campbell was of Scotch nationality, a thoroughly practical engineer, an ardent member of this Association, and a genial and good living man, and I am sure that his wife and family have the sincere sympathy of this Association in the sad loss which they have sustained.

There is one other matter which I would like to bring to your notice, and in my estimation it is one of considerable moment to us as steam engineers. I refer to the detestable action of some manufacturers of engineers' brass goods and fittings, who in order to save a few cents worth of metal, are in the habit of coning out the squares of blow-off cocks, and otherwise reducing their strength, until they are positively dangerous to handle or move under steam pressure. Several cases of narrow escapes from scalding of engineers have come to my notice from such causes, and I have here a specimen for you to inspect which will speak for itself, and I think you will all agree with me that any manufacturer of brass goods who would deliberately turn out such trash, especially in these days of constantly increasing pressures, when the tendency should be to increase rather than decrease the strength, is worthy of a place in penitentiary, and I hope this Association will pass a resolution severely condemning such perfidy on the part of manufacturers who for the sake of a few cents worth of metal would turn out articles that will endanger our lives while in the discharge of our daily duties.

In conclusion I would ask you all to kindly give your strict attention to the business to be brought before you, and to refrain from all useless discussion, so that the business of the Association may be done with despatch, and the meeting not unnecessarily prolonged.

Then came the registrar's (A. M. Wickens) report, which showed that 450 certificates had been issued, the income for the year from all sources amounting to $699.10, with the disbursements at $83.71 less, leaving a total balance in the treasurer's hands of $145.00.

The Treasurer's report (by Treasurer R. Mackie) was then received, showing the Association to be in good position financially. The registrar's and treasurer's report were received and referred to the auditors, Messrs. Ames, Sutton and Wells.

The appointment of special committees was then proceeded with, and the meeting adjourned at 12 noon for dinner.

At 1 p.m the meeting was called to order by the President, and the different committees were then given two hours in which to do their work.

At 3 p. m. the meeting was again called to order and the reports of the auditors, Committee on Good of Order, Expenses, etc., were received and adopted after some discussion.

The election of members of the Board to fill the positions of retiring members was then proceeded with. The retiring members were given out by the registrar as follows: Messrs. R. Dickinson, Hamilton; S. Potter, Peterborough; F. Robert, Ottawa; Ames, Brantford. Messrs. T. Elliott, Hamilton; W. Phillips, Niagara Falls; Thos Wensley, Ottawa, were elected to the board, being new members, and Mr. A. Ames, of Brantford, was re-elected by acclamation.

The election of officers was then proceeded with and resulted as follows:—A. Ames, Brantford, President; F. G. Mitchell, London, Vice-President; A. E. Edkins, 139 Borden street, Toronto, Registrar; R. Mackie, Hamilton, Treasurer.

Galt was selected as the next place of meeting. Kingston and Toronto were both nominated.

The renewal fees for certificates were reduced to $1.00, 75c. and 50c. for 1st, 2nd and 3rd class respectively, to take effect Jan. 1st, 1896.

The report of the Committee on the Strength of Boiler Appliances took the form of the following resolution:—

Resolved. That this Association express their unanimous condemnation of the practice of some of the brass goods manufacturers in reducing the thickness of their brass goods, more especially in blow-off cocks, as in practice many of them are not of the requisite thickness for strength, and we further resolve and pledge ourselves to use only those that we know are of sufficient strength to be perfectly safe in their operation.

The discussion on this resolution brought out samples of defective and weak blow-offs that were positively dangerous to use. The resolution was adopted.

After a vote of thanks to the retiring officers, and the members of the Brantford C. A. S. E. for courtesies extended, the meeting adjourned at 4.45.

Two miles of grading have been completed on the extension of the Galt and Preston railway, and a distance of three quarters of a mile has been laid with rails and ties. It is expected that the new line will be in running order by the 1st of July.

The Three Rivers Iron Works Co. has been incorporated with a capital stock of $100,000 for the manufacture and sale of iron, steel and brass goods, and the supply of electric light, heat and power. The promoters of the company are.—Antoine Aime Charlebois, gentleman, and Alphonse Charlebois, contractor, of Quebec; W. Duncan, of Three Rivers, mechanical engineer, and George Duval, barrister, of Ottawa.

QUESTIONS AND ANSWERS.

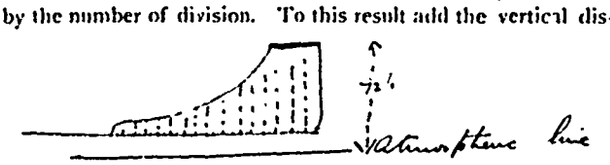
"Constant Reader" writes: 1. What is the loss of pressure in a 3-inch pipe, 100 feet long, at 100 lbs. pressure per square inch, supplying steam to an engine doing 50 horse power? 2. What would be the loss in the same pipe supposing there were four elbows and two globe valves in it.

ANSWER: 1. Loss of pressure in steam pipes is due to three causes: (*a*) The pressure required merely to overcome friction in the pipe. (*b*) The pressure required to produce the required discharge of steam through a pipe of given diameter. (*c*) That loss of pressure which is due to the difference in temperature of the steam at opposite ends of a long pipe, caused by radiation of the heated pipe surface into the surrounding atmosphere. With the data given, the combined losses of pressure due to the two first causes will be, with a straight pipe, about one-third of a pound per square inch; the globe valves will make no difference practically; the entire drop due to friction of pipes and bends and velocity through same would be one-half a pound per square inch. The drop due to difference in temperature is likely to be more appreciable, but with the data given it is not possible to more than approximate to it. Assuming 100 lbs. pressure at boiler; 100 feet of 3-inch pipe, bare pipes, and an atmospheric temperature of 60°—there would be a difference of temperature of about 10 Fahr., corresponding to a loss of pressure of about 15 lbs. per square inch. What the actual drop is, depends on the material with which the pipe is covered, and upon the actual temperature of the outside air.

"Fireman" writes: Please explain to me how to find the mean pressure on this card, also what horse power is the engine if the card on the other end is the same.

Steam, 72½; revolutions, 94; spring, 40; cylinders, 13"x30".

ANSWER.—The mean steam pressure of an indicator card can best be found by running a planimeter round the card If you have not such an instrument, then divide up the horizontal line representing the length of the stroke, into a considerable number of equal parts; draw from each point of division a vertical line cutting the steam line. Then add the lengths of the verticals between the stroke line and the steam line together, and divide by the number of division. To this result add the vertical dis-



tance between the stroke line and the atmospheric line (which you have not shown), and the figure you get will represent mean pressure in lbs.

SPARKS.

The City Council of St. John, N. B., will call for tenders shortly for electric streeet lighting.

Mr. M. Hutchison has been appointed superintendent of the electric light plant at Victoria, B. C.

A meeting of shareholders of the Guelph Railway Company will be held in that city on the 17th inst. for the purpose of organization and other business transaction.

A collision of two trolley cars occurred on the Galt and Preston street railway about midnight on June 1st, by which a motorman named Jenkins had his leg broken. Although about two hundred passengers were on board the cars at the time of the accident, all escaped uninjured.

At the annual meeting of shareholders of the Ottawa Electric Company held on the 3rd of June, the gross earnings for the year were reported to be $152,000, and a dividend of 8 per cent. was declared. The company have now in operation 48,000 incandescent and 430 arc lights, also 89 motors. The board of directors were re-elected, namely: T. Ahearn, president; Hon. E. H. Bronson, vice president; G. H. Brophy, William Scott, C. Berkeley Powell, G. H. Perley, J. W. McRae, D. Murphy, F. Clemow, R. Quain and A. Bayley, auditors.

THE STATUS OF THE GAS ENGINE.*

Mr. Chairman and gentlemen: The subject before the meeting to-night is the present status of the gas engine, and, as I understand, my sole duty here this evening is to state the case for discussion.

The status of the gas engine, as the status of every other thing whatever in the world, depends entirely upon the surrounding conditions. A plant exists merely because the sun shines and the seed has been planted. Unless the surrounding conditions are favorable the plant cannot exist, and the amount of its growth and the character of its growth depend entirely upon the surrounding conditions. The gas engine follows this general law, in that its status to-day is what it has been forced to be and what it has been allowed to be by the general commercial and engineering conditions of the world. The status of the gas engine, therefore, is the status of the power question of the world, and the importance which the gas engine takes in the field depends as much upon the condition of other forms of power as it does upon the condition of the gas engine itself. Now practically all other power that is in use is steam power. I do not mean in saying this to lose sight of the tremendous amount of water power that is in use in this country or the world to-day. But water power is restricted to certain localities and the gas engine is not. It comes into competition only with those forms of power which are applicable to almost any locality or set of conditions; and, aside from gas power, steam power is almost the only other occupant of that class of prime movers.

The condition of steam power engineering has very rapidly altered during the past few years, at any rate within the past ten or fifteen years. The steam engine started off as the forerunner of the factory. Perhaps the factory started first on water power. But practically the factory and the steam engine grew up together; and the idea that we, nearly all of us, have carried in our minds of a commercial manufacturing plant driven by any power was a set of tools driven by a central motor, through the medium of a line of shafting and a number of belts. That scheme of industrial works grew in size and importance until it had reached tremendous proportions and in certain lines of industry it still survives and will continue to survive in the future in still larger sizes, and on still more important a scale. But for the vast majority of industries, those species of manufacturing which involve a varied number of processes and departments, and involve the production of a comparatively complex commodity—such, for instance, as the building of steamships or railway cars, or the complicated machines involving wood work and iron work and steel forging work, and all that sort of thing—the modern factory is a collection of factories. The various factories may be merely departments, merely various rooms in one building or on one floor. But at any rate the factory consists of a large number of departments, and those departments are quite distinct. They often run entirely independently, have separate foremen or superintendents, run different hours and have different classes of labor. In some, labor is a small item and power is larger. In others, power is a small item and labor is the principal feature. All these varied conditions make it almost impossible for such an establishment to be driven by one central prime mover. In the first place, distance of transmission comes in, and consequent losses. In the second place come in varying conditions. Every engineer knows that no piece of apparatus can work well under varying conditions. We have therefore seen grow up in the last few years the modern industrial works in which the power has to be transmitted quite a distance, and subdivided among a large number of different sorts of tools. This, of course, was first attempted by shafting and belting or by rope drives. But it is evident that loss by transmission in all various transitions and distances of transmission are very great. Consequently we have seen other schemes tried. First came the subdivision of the steam engine itself into a large number of units, and we have only to look about us in our large factories to see steam-driven plants where the power is furnished from a central boiler plant to anywhere from ten or a dozen to seventy different engines scattered all over the works—sometimes twenty or more in one room. Sometimes the losses in steam transmission are under average conditions less than for shafting and belting. Of course, no cast-iron

*A statement of the subject by Mr Reeve, before the American Society of Mechanical Engineers at their monthly meeting April 10, 1895.

rule can be given for all conditions. But the subdivided steam plant has come in to stay. Of later years, superseding the subdivided steam plant, came in first compressed air and then electrical transmission and subdivision of power.

I have given this resumé of the changes of the power question to show that the problem of the present is economical transmission of power, not economical development of power. Of course economical development at the original point of production is of great importance, but it is vastly more important to transmit it economically, because the losses in transmission can easily exceed the largest losses possible in production.

Now those of you who have spent any time on the problem of the subdivision of power or its transmission have seen that none of the systems heretofore provided satisfy the question. They all involve tremendous losses in transmission. They all involve heavy first cost, heavy expenditure for generating plant, transmission plant and redeveloping plant at the other end. For instance, in electrical transmission, if your total works need a thousand horse power, besides your thousand horse-power of boilers you must follow with a thousand horse-power of steam engine, a thousand horse-power generator, your mains for carrying the electric power, and then on top of that a thousand horse-power of motors. That is, of course, losing sight of all small factors and percentages of loss. Now the present status of gas power in this country or any other, and also of its immediate promise for the future, depends upon this statement of the problem in this part—that gas power offers the ideal solution for the sub division and transmission of power, the mechanical difficulties for the time being lost sight of. In other words, let us suppose that a large industrial plant, requiring say 1,000 H. P., subdivided into say 50 different units, which are utilized at various points in different buildings on different floors at different speeds for different hours during the day, under different conditions of varying and steady load—suppose that in such a plant as that we install a 1000 H P. gas generator or its equivalent, and then lead from it or from the holder to a large number of large central gas mains—it is evident that the first cost is away below that of any system with the possible exception of the subdivided steam plant, where our boiler plant corresponds to our generating plant, our steam mains to our gas pipes, and our steam engines to our gas engines. But there is one big advantage which a gas plant has over a steam sub-divided plant in point of operation, and that is that in the steam sub-divided plant, no matter how large a proportion of the load be off, the central generating plant must be run, and the fixed charges of running cannot be altered. Steam must be kept up, the boilers must be kept hot, the stack, if there be one, must be kept hot, and the labor must be there to take care of the whole matter. I have myself tested one factory in which for a large proportion of each day the efficiency for the transmission of the power between the boiler plant and the work was 5 per cent., simply because they had to keep the whole plant going in order to move one small department. With the gas plant that entirely disappears. Your gas generator works for a certain number of hours a day on whatever load or capacity is best suited to produce maximum economy, and as we all know there is only one point in capacity in which any apparatus can work at minimum economy. During those certain number of hours a day the generator makes gas and stores it in the holder. The generating plant is entirely unconscious of the consumption of the power, provided it be large enough to fill all demands. The consumers of power, the foremen of different departments, are as unconscious as is the generating plant of the consumption of power. They simply know that all they have to do is to turn on their gas and start their engine. They may run twenty-four hours in a day while the gas generator runs eight, provided the total maximum production of the gas generator is large enough to cover the whole output of power. The comparison between such a gas plant and any plant relying upon transmission and sub-division of power, by compressed air or by electricity, or by any scheme wherein the power is first developed by the steam engine and then converted into another form and then converted back again—a comparison between the gas power plant and any such plant as that is really hardly possible from the economical standpoint. The operation of any such gas plant would be incomparably more economical than that of the compressed air or the electrical or the hydraulic system of transmission of power.

You will notice that I have entirely left out of the question the mechanical side of it, which I purposely wished to do. But for the merely commercial side there is an absolutely unlimited field for the development of power and its transmission and sub-division in industrial works by means of the gas generator and the gas engine.

The next big argument for any plant of that sort for division of power is that in every industrial works—the supply of power or steam—the supply of power is made to correlate with the other portions of the work. To be more plain, perhaps, in nearly all of our large textile mills in New England, and in a great many other forms of industry, the steam is used as much, and sometimes more, for heating purposes and boiling and dyeing as it is for power. In fact the big promoter of steam power in New England, where it has proved an indispensable auxiliary of water power, is the fact that the steam had to be had anyhow. That is true also of compressed air plants. There are a great many forms of factory where compressed air is indispensable for blowing, furnishing draft, cleaning, and innumerable purposes to which it can be applied, and in a great many plants compressed air is used to transmit and sub-divide power where no other system would be tolerated, simply because the compressed air has to be there anyway, and the compressed air mains have got to be there, and they might a great deal better use it for power. The same thing applies to electricity. Those factories relying on the electric current entirely for light may often bring the power question into an entirely secondary importance compared with light. If they have got to have their central engines and generators and mains for the production and distribution of light, and if they need light more than power, then of course the electrical transmission of power is the thing, without any regard to the general arguments against. But this same factor of the correlation of the system of transmission of power and the system of transmission of other forms of energy needed in the works applies also to gas. In fact the gas producer has reached its present state of perfection largely owing to the fact that gas is the most economical form of fuel for a large number of industrial devices—metallurgical, for glass works, and for a large number of sorts of cooking and heating and baking, where exact temperatures and exact control of temperatures have to be had. In all these plants the power may again become secondary to other purposes in the factory; and in those plants where generators have already been installed for the purpose of supplying fuel gas, the gas engine follows as a natural sequence.

The reply to this side of the discussion—and you will remember that I am merely stating the discussion—the reply to this side of the discussion is, that the mechanical difficulties have not yet been overcome; that the gas engine to-day, after having had spent on it the best energy, or of the best energy, in the line of mechanical engineering which the world has been able to produce for some thirty years, is still more crude in a great many mechanical features than was the steam engine of a century ago. It is still very heavy. In nearly all of the devices only one impulse is received by the fly-wheels for every two revolutions; in the case of the single acting engines only one is received; so that the fly-wheels are heavy. The regulation, as a rule, is accomplished by simply dropping out a certain proportion of the impulses instead of varying their strength; and the necessity for the ignition of the charge in a minute fraction of a second has led, until very recently, to extreme uncertainty in the matter of ignition and also on the question of perfection of combustion. That last is not so marked a feature, because even with poor combustion, the gas engine is an exceedingly economical prime mover. But the mechanical difficulties still stand in the way of the accession of the gas engine to the proper field in which it belongs—that is, the universal factor for the production and transmissions and subdivision of power in industrial works.

At the risk of being considered rather superficial in skimming over this subject, I will take one step into the future and say that while gas engines have hitherto been almost entirely run with illuminating gas, yet, already there has been considerable done in the way of supplying gas engines with special producer gas from special producers built just for that purpose. There has also come upon the field—I will just mention it—the incandescent gas burner, that has just begun to attract wide attention as being an established fact. These two coupled together—first that the gas engine can be run much more economically upon producer gas, not illuminating gas, and second, that there is a means attained of producing illumination by a non-illuminous gas—lead us to surmise—perhaps I should not state it as a surmise, I will state it as a hypothesis, which I hope to hear discussed—that the near future will see the distribution of energy—all energy—which is derived from coal in the form of a non-illuminous cheaply produced fuel gas—that this gas will be relied on entirely for power, for lighting where gas lighting at all is permissible, and where it is not, where the electric light is needed, that electric light will be produced through the medium of gas engines, and that this same gas will be used for all sorts of purposes—heating, domestic heating and cooking, and industrial heating of all sorts.

I have tried to make as brief a statement as I could of the engine problem as it appears to me to-day, not on the basis of the condition of the gas engine itself, but as a statement of its possibilities, the demands which are going to be made upon it in the near future, and what the near future may bring forth in the way of powerful auxiliary to aid in the adoption of the gas engine as the universal prime mover.

The St. John Railway Co. are considering two propositions for lighting the city. One is to light the entire city with 2,000 c. p. lights, and purchase at a valuation the city lighting plant in the north end. The other is to light the eastern portion of the city only, in the same manner as has been done heretofore.

Messrs. W. McLea Wallbank and Thos. Pringle of Montreal, will apply for permission to construct works on the north shore of the river St. Lawrence at Lachine Rapids, for the utilization of the water power from the rapids. Plans of the proposed undertaking have been submitted for the approval of the Minister of Public Works.

Tenders are invited until the 10th inst. at noon, for an electric plant with a capacity of 1,000 16 c. p. lights, and four motors of an average of 9 h. p. each, for the Montreal General Hospital. Contractors are required to supply full plans and specifications with their tenders. Tenders are to be submitted to Jas. Paton, Secretary of the Committee of Management.

VISUAL SOUND.

By W. E. Irish

It is well-known that vibrations caused by the utterances of words, musical notes or other sounds made near a telephone, or transmitter diaphragm, or stretched drum head, or any other flexible disc held firmly at its periphery, leaving its centre free, will vibrate in unison with the sounds conveyed to it.

There can be no doubt as to this fact in the mind of anyone who has ever examined and studied the "Bell" telephone. The vibrations of the diaphragm at the transmitting end of a pair of "Bell" phones varies with every sound, but for the same sound the vibrations remain a fixed quantity; therefore, it is necessary for the diaphragm at the recurring end to make exactly the same number of vibrations and in exactly the same time to reproduce the same sound, which set in vibration the transmitting diaphragm.

This being the case, it only remains for some one to devise a simple means whereby, instead of reproducing the sound as in a telephone, these vibrations are caused to be recorded in ink on paper, so as to give a distinct character or figure for every different sound affecting the diaphragm. When he has done this, he will also have discovered a key to a universal language, and will have given to the world one of the greatest labor-saving devices ever enjoyed by man.

It does not appear to be and really is not such a very great problem to solve. Such a device would, in addition to being the key to a universal language and great labor-saver, also be the key to a universal system of recording our own thoughts and the thoughts of others by means of the same simple sound characters as in writing, printing, telegraphing; but most important of all, it would be the means of solidifying the thoughts of our ablest men as fast as they could utter them. Through its agency our children would acquire more useful knowledge in two years with far less labor than they now do in five years. The letters of the alphabet and orthography as now known would be entirely abolished, and correct pronunciation and true natural and visual sound character substituted. The student would be helped by hearing the teacher pronounce the word, which the instrument would at the same time describe in sound characters.

Such a machine would write the whole of Webster's dictionary with a little over fifty different characters, all of which could be more readily learned than the spelling of fifty of the simplest words by means of the alphabet. These characters would convey more readily to the mind and senses their import, than is possible by any other means. The future generation would not be mentally taxed to reason out why if P L O U G H spells plough, D O U G H must spell dough. The arbitrary characters which we use to express our thoughts visually are by no means limited to twenty-six or to several hundred, for the reason that there are in many instances over thirty accepted different types of character representing the same letter.

The first lesson book for children should start out thus: A stands for ass, symbolical of the man who introduced the first variation in the formation of letters, for variation sake alone, making the teacher's task perplexing, the pupil's much more irksome and difficult, and the general reader's vexatious.

As true sound figures cannot be changed without altering their meaning, we may hope the characters, if they ever should come into general use, will be permitted to retain their natural form.

This machine would save the author, editor, reporter, student and commercial man a great amount of the drudgery of the pen, and their brightest ideas and most valuable time. They would simply have to talk their best thoughts to the machine to have them accurately recorded at unlimited speed, in characters which will not require transcribing to be understood by others. A person having a knowledge of these characters would be able to read German, French, Spanish, or any other language recorded by the machine, perfectly and with correct pronunciation, although the meaning might be quite unintelligible to him. It would be a great help to the traveller in a foreign land, as well as to the student learning a foreign language.

In the study of music these characters would be of immense advantage. Records of pieces played by our most able masters, with feeling such as notes alone cannot give, will represent the music sheets of the near future, and all newspapers, books and other printed matter will be published in these characters on one-fifth the amount of paper, and with larger and more distinct type and spacings.

A knowledge of these characters will be acquired without any special effort or mental training, as while the learner listens to a 'phone he will see the characters representing the words he hears within, and while speaking he will see his own words recorded. Such an instrument would be found an able automatic secretary, a trusty automatic stenographer and a reliable automatic typewriter, always ready and never tired or in the way. Sound characters would be less complex and fewer in number than any arbitrary system of shorthand. By aid of such an apparatus telephones would be brought to their fullest measure of usefulness, and all messages would be recorded without additional trouble. It would become a requisite in every office, school and home, the tutor, helpmate, slave and friend of everyone from baby to great grandpapa, and the idiot to the scholar; even to the deaf or the blind, or the dumb, or the armless, it would be a comfort and a blessing, as all could use it to advantage.

We have but to call to mind the phonograph to remember that attempts have been made in this direction, but the stylus of the phonograph makes indentations in a soft medium, such as wax, from which the sounds may in a measure be reproduced These indentations, however, have never been visually deciphered, and it is doubtful whether they ever will be. If a magnified section at the centre could be obtained, showing the variations in the depth, etc., of the indentations, it might then be possible to read them, but such a plan would have no useful application. In the successful sound-writer the stylus or pen must be free to vibrate, discharging a continuous jet of ink after the manner of the pen in Thompson's syphon recorder or in the telephonograph.

MOONLIGHT SCHEDULE FOR JUNE.

Day of Month.	Light.	Extinguish.	No. of Hours.
	H.M.	H.M.	H.M.
1.....	P.M. 11.50	.....	} 3.40
2.....	.....	A.M. 5.30	
3.....	A.M. 1.00	" 3.40	2.40
4.....	" 1.10	" 3.40	2.30
5.....	" 1.40	" 3.40	2.00
6.....	No light.	No light.	....
7.....	No light.	No light.	....
8.....	No light.	No light.	...
9.....	P.M. 8.00	P.M. 11.00	3 00
10.....	" 8.00	" 11.30	3.30
11.....	" 8.00	" 11.50	3.50
12.....	" 8.00	A.M. 12.20	4.20
13.....	" 8.00	" 12.40	4.40
14.....	" 8.00	" 1.00	5.00
15.....	" 8.00	" 1.20	5.20
16.....	" 8.00	" 1 30	5.30
17.....	" 8.00	" 2.00	6 00
18.....	" 8.00	" 2.30	6 30
19.....	" 8.00	" 3.00	7.00
20.....	" 8.00	" 3.40	7.40
21.....	" 8.00	" 3.40	7.40
22.....	" 8.00.	" 3.40	7.40
23.....	" 8.00	" 3.40	7.40
24.....	" 8.00	" 3.40	7.40
25.....	" 9.00	" 3.40	6.40
26.....	" 9.30	" 3.40	6.10
27.....	" 10.00	" 3.40	5.40
28.....	" 10.30	" 3.40	5.10
29.....	" 11.00	" 3.40	4.40
30.....	" 11.00	" 3.40	4.40
		Total,	136.50

The Consolidated Railway and Light Co., of New Westminster, B.C., is said to have under consideration the construction of a tramway, to connect New Westminster with Vancouver and Steveston. The distance between the two cities, via Steveston, is about twenty-six miles. The same company is reported to have made an offer to the city council of New Westminster to light the streets of that city at twenty-five per cent. less cost than at present. It is understood that the construction of the railway is contingent upon assistance in the shape of a bonus from the city of New Westminster and the municipality of Richmond. It is proposed to utilize the water power at Seymour Creek, and to instal an electric and power plant at a cost of about $200,000, and thus operate the whole system from a power house established at Seymour Creek.

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EDITOR'S ANNOUNCEMENTS.

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

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

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

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

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

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

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

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

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

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

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

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

ONTARIO ASSOCIATION OF STATIONARY ENGINEERS.

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

THE proposed exhibition at St. John, N. B., the coming autumn, has been named Canada's International Exhibition. The dates chosen for this Exhibition are September 24th to October 4th. The Board of Management is composed as follows:—W. C. Pitfield, president; A. S. Law, vice-president; Ira Cornwall, vice-president; Jas. Reynolds, treasurer; J. C. Mitchell, secretary; Chas. A. Everett managing, director.

THE Property Committee of the Toronto City Council have very properly refused to consider the request of the Toronto Island Residence Association, that a clause be inserted in the patents for the water lots prohibiting all kinds of vehicular traffic, and especially the operation of a street railway on the Island. Even the persons who presented the request will probably be pleased a few years hence that it did not receive favorable consideration, as it is well nigh certain that an electric railway on the Island will be an accomplished fact within a few years, and will tend to enhance the already great popularity of the Island as a pleasure resort.

THE United States Circuit Court of Appeals at Boston, on May 18th, reversed the decision given by Judge Carpenter on Dec. 18th, 1894, declaring the Berliner telephone patent to be invalid. The reasons upon which this decision is founded have as yet not been made public. The Electrical Engineer, commenting on the decision, remarks that while it complicates the situation, it does not appear to narrow the telephonic field of opportunity in any essential particular, as recourse can always be had to the magneto telephone, which had already been brought to a high state of perfection until its use was rendered unnecessary by the decisions of Judge Carpenter and that of the U. S. Supreme Court in the Bate case. The opinion prevails that the Government will not ask the Supreme Court to review the case.

THE Executive Committee of the American Street Railway Association held a special meeting in New York City a fortnight ago, to further arrangements for the Annual Convention to be held in Montreal. It was decided that the convention should open on Tuesday, the 15th of October, and continue for four days. Mr. G. C. Cunningham, manager of the Montreal Street Railway Co., who is a member of the committee, was present, and assured the committee that the Association would receive a hearty welcome from the citizens of Montreal. Col. John N. Partridge, of Brooklyn, N. Y., was elected secretary pro tem., to fill the vacancy caused by the recent death of the secretary of the Association, the late Wm. J. Richardson.

IT now appears that calcium carbide, from which acetylene gas is manufactured, will cost at least $160 per ton exclusive of the cost of the air and water tight drums, in which it is required to be packed for shipment. It will be remembered that when first this new competitor of the electric light was announced, the cost of calcium carbide was placed at $30 per ton, and electric lighting concerns were in consequence somewhat startled at its advent. The knowledge that the cost will exceed five times that sum should be sufficient to relax the electric light man's fears, at least, until the next wonderful discovery shall be announced. The fate of such discoveries thus far has served to strengthen the conviction that the electric light has come to stay.

THE truth of the wise man's saying that "A little knowledge is a dangerous thing" was very well illustrated recently in the proposal made by the "electrician" of a small lighting plant to add to the capacity of the station by the purchase of a new alternating dynamo, which should be run in parallel with the old alternator. Thus boldly stated, the boldness of the proposition does not strike one; but when investigation shows that, in the first place, the speeds of the two machines were such as to produce quite different periodicities, and that, in the second, the old machine was surface wound, non-compounded, while the new one is ironclad and compounded, it makes one wonder what would have been the result of this parallel running. Suppose them to have had the same frequency, they certainly could not be expected to have anything like the same e.m.f. curves, and the combining of the two would have given a resultant curve that would have been interesting to trace, if not conducive to high efficiency. But add to this dissimilarity the further condition of different frequencies, and we have something sublime. Let anyone draw a diagram for himself, both of assumed curves and of connection to feeders, and it will be plain that while the machines are in step (which they will be periodically) everything will be all right; but this condition of affairs will be of very short duration, and by far the larger part of the time the alternators will be more or less short-circuited through each other, until, periodically, they will be actually dead short-circuited! The "electricians" of small plants can amuse themselves with direct current machines, if they like; but they should leave alternators and induction apparatus severely alone.

THE trolley is charged with breaking seriously into the traffic hitherto controlled by steam and horse-power. The bicycle, on the other hand, is proving quite a formidable competitor to the trolley. In Denver, Col., competition from the "bike" has been so great that the wages of motormen have been reduced, and the schedule of the railway cut down at certain times of the day, and when the weather is fine. The statement is that there are 10,000 bicycles in daily use in Denver, a city of about 110,000 population. It is figured, that if each wheel takes only ten cents a day from the receipts of the street railway, a loss of $1,000 a day in gross receipts takes place, or $315,000 per year. This is, perhaps, an exceptional case, for in Toronto, where wheelmen are supposed to be on top, the maximum census has placed the number of bicycles in use at not more than 10,000. But even in the larger cities, where competition is less likely to be felt, there is a noticeable interference with the daily business of the trolley. It was stated by a daily paper, that the Toronto Street Railway was seriously considering what method could be adopted to meet the competition of the bicycle that is already recognized as a factor here. One suggestion was that cars be constructed to carry bicycles, so that those planning a trip to some of the out-lying districts might have their wheels carried for them. The suggestion hardly seems a practical one to wheelmen. One thing is certain that electrical power for railway propulsion has come to stay, and users of steam must count it as a leading element of the future. Equally so, the bicycle has come to stay, and street railway companies, and those controlling lines running out into suburban districts, have got to take the wheel into consideration in their plans for the future.

THERE is so great a difference between various makes of arc carbons, as regards their light giving qualities, that every arc plant should make careful experimental tests to determine which is the best for its peculiar conditions, before deciding in favor of any one in particular. Carbons, to be thoroughly satisfactory and economical in use, must possess a number of features, all of which require a very great deal of attention, during the various processes of manufacture, and the finished article represents years of close study and the result of experiments costing hundreds of thousands of dollars. It has been shown by a high authority recently, that the light giving qualities of several carbons of different makes varied during an experimental test among themselves, by so much as 50%, that is, that of two carbons tested under the same conditions of current, pressures, etc., one would give twice as much light as the other. If the test had also shown that the light, and life, varied inversely, then there would be no advantage in using the higher efficiency carbon (unless, of course, customers were grumbling as to the amount of light), but they did not show any such relation, as holding between carbons of different makes. On the contrary, they showed that comparing make with make, they were distinctly carbons that were better, commercially and electrically, than others that would give a better light, and in proportion would last longer than others. A careful study of the reasons for such differences, led to the very intelligible conclusion that that carbon to the manufacture of which was given the most scientific attention, was the best all round. It is unnecessary to more than suggest that complex processes of manufacture necessarily impose a higher cost on the finished product, and every intelligent station manager should decide for himself after experiments, which is the best for himself. Cheapness is by no means desirable in electrical apparatus, and there are many station managers who believe (and act on their convictions) that a $700 carbon is more than $100 dearer than an $800 one. The electrical machinery and apparatus and methods of to-day are the outcome of the knowledge gained during the last 25 or 30 years of experimental work, and modern methods of station management are based on the experience gained, often very dearly purchased, during a similar length of time. As each detail is more carefully studied, new directions are discovered in which economy is possible, and it behooves every intelligent station manager to keep himself thoroughly abreast of the advance taking place along the whole line of progress.

AN unfortunate accident occurred at the power-house of the Toronto Railway Company some days ago. The electrician, from Chicago, in charge of the new Siemens-Halske generator, that had been placed in position some three weeks previous, undertook to scrape the machine with a knife. The result was that the knife was drawn in and the current short-circuited; the machine was badly damaged, and severely burned the attendant. The accident threw on to the generator of the Canadian General Electric Company, which has been doing excellent work for the past six months, so great a strain that a portion of the foundation gave way, and throwing some parts of the machine out of gear, considerable injury was done to it. Traffic on the street railway was for a short time stopped and during repairs there was some restriction in the number of cars running. The Siemens-Halske machine had not passed out of the hands of the electrician of the firm, who had come on from Chicago to furnish the usual tests. When the accident occurred and the electrician in charge was disabled, in response to a telegraphic message, Mr. O. S. Lyford, chief electrician of the manufacturers, came to Toronto to superintend repairs. Within a week the generator was again in running order, and that of the Canadian General Electric Company some days before. In conversation, Mr. Lyford remarked that so rapid has been the growth of electric power for railway propulsion, lighting and manufacturing

purposes, that those interested have not realized the necessity there is for experienced management in handling the business. Only a week before the more serious accident mentioned some trouble had occurred with the Siemens-Halske generator through the carelessness of an employee in undertaking to perform some work, which, had the necessary experience been possessed, would have been executed in a proper and skillful manner. Since the removal of Mr. Davis, formerly electrician of the Toronto Railway Company, to Detroit, there has been no expert electrician in charge of the Company's business. The trouble of the past week would seem to indicate the unwisdom of this course, and yet the Toronto Railway Company is not alone negligent in this important particular. The writer was informed by Mr. Lyford that trouble was constantly occurring in establishments where electricity was used from the fact that skilled help was not employed. The impression is entertained, that if a man is a master mechanic it is not difficult for him to add to his knowledge a perfect understanding of electrical engineering. Experience is proving this to be a great mistake. A comparison of the methods pursued by the steam engineer in the management of an engine or locomotive with those of the majority of men in charge of electrical machinery, shows a very marked contrast. The engine or locomotive is cleaned and inspected every day, and if only a slight defect has become manifest, it is put in repair on the shortest possible notice. We fear that nothing like the same carefulness is exercised in the operation of street railway and other electrical machinery.

THE necessity for careful calculation of every feature of an electric lighting installation, was never more strikingly illustrated nor the danger of guessing more plainly shown, than in a case coming recently under the notice of the writer. It was proposed to add to the capacity of a station, and to extend the wiring into several new directions, and this necessitated running a new pair of mains, and the establishment of new centres of distribution. The old wiring system had been calculated for 5% loss, and the new machine was to be overcompounded for 10%. It may be incidentally mentioned that it was first proposed to run these two machines—the first an old type uncompounded, and the second, a quite modern, high-classed, compounded alternator—in parallel, only for some reason the electrician in charge hesitated and the plan was not carried out. However, the wiring plan was arranged, and was more or less a copy of the old 5% system. This included a pair of No. 2 mains, from the dynamo to the main distributing point, and this size was adopted for the new system to carry the same amperage, the same distance as in the old, the reason being that this was the size "in the other system that had always given good satisfaction." So that because No. 2 wire was right for 5% loss, it would be all right for 10% loss. The expression for the proper size of wire to carry any desired current, A any required distance, D with an E. M. F. of E., with any percentage of loss P, may be reduced to the following: Size $= C \times \frac{100 - P}{P}$, C being a constant depending on A, and D, and E, which expression shows that the size will vary, very nearly, inversely, as P. Taking this particular case into consideration, we find from the above, that $\frac{\text{size for } 5\%}{\text{size for } 10\%} = \frac{19}{9}$ (the general expression being) $\frac{\text{size } p}{\text{size } P} = \frac{(100-p)\,P}{(100-P)\,p}$ ("P" and "p" being the two percentages.) So that the new mains should only have been $\frac{9}{19}$ ths the size of the old ones, instead of the same size. Following this up with the particular data used, results in finding at the primary transformer terminals, about 42 volts more than there should be, and, taking the ratio of transformation into account, we should get 4% too high voltage at the lamps. Every one knows what the effect of this will be. This is probably a very exceptional case of ignorance or carelessness—let us hope so at least—but it serves to indicate the results of insufficient care in the calculation of a wiring system.

In connection with this above calculation, comes the very pertinent question, "Why was 5% loss used in the first case, and not 10%?" The distance of transmission was over a mile, and the expression shows that less than half the weight of copper might have been used, with an appreciable saving in first cost. A very easy calculation further shows that taking into account the slightly increased fuel consumption required by the 5% greater initial E. M. F., the annual saving in interest and depreciation by so reducing the capital expenditure, is quite appreciably greater than the cost of the fuel increase required. Great stress has been laid in the columns of this paper on the necessity for carrying the strictest economy into every detail of the design and operation of electric lighting and power plants, and the instance here cited clearly shows the results of such rule of thumb methods of working. Each wiring plan should be calculated for itself, and every volt drop accounted for between the brushes and the lamp, in order that the terminal voltage may be as required.

THE PROPOSED BELL TELEPHONE COMPANY BUILDING, MONTREAL.

MENTION was made in the ELECTRICAL NEWS some months ago of the fact that the Bell Telephone Company had purchased a block of land bounded by St. John, Notre Dame and Hospital streets in Montreal, as the site for a magnificent new fire-proof building, to be erected in the near future for the company's use. Since this announcement was made the architect of the proposed structure, Mr. Maxwell, has been busily engaged in designing the building, and the plans are now sufficiently advanced for us to be able to give our readers some idea of what the structure will be like. The building will have a frontage of 35 feet on Notre Dame street, 108 feet on St. John street, and 98 feet on Hospital street, and will be six storeys in height. It will be constructed of terra-cotta ashlar and pressed brick of a light salmon tint, with terra-cotta trimmings, and ornamented in the same shade of color, and will be made as thoroughly fire-proof throughout as possible. With this object in view, no stone or wood will be employed in the exterior of the building, which will be constructed entirely of steel, brick and terra-cotta. The windows of the rooms in which the telephone apparatus is located will be protected by rolling steel shutters. There will be fire escapes leading to the roof from the operating room and from every story to the basement, from whence a fire-proof passage will afford exit to the street. In addition to this there will be a stand-pipe for fire purposes, with hose on each floor.

The floors and halls of corridors will be laid with mosaic. The main entrance will be on Notre Dame street. A corridor ten feet wide and eighteen feet high, panelled in marble, will extend right through the building to Hospital street.

The ground floor of the building will be fitted up as a bank, and will be entered from the corner of Notre Dame and St. John streets. The greater part of the building will be occupied by the Bell Telephone Company, the general offices of the company being located on the second floor, and the operating room on the fourth floor. This room will be thirty-two feet wide by one hundred and twenty-eight feet long, and will be splendidly lighted by four windows on each side, as well as by sky-lights. Opening off the operators' room will be a recreation and lunch room for the operators, with steel lockers for each operator, accommodation being provided for 125 operators.

The third floor will be occupied as a battery room. The second and fifth floors will be fitted up as business offices. The building will have two elevators with a speed of 350 feet per minute, operated by electricity.

The cost of this magnificent building will be in the neighborhood of a quarter of a million of dollars. It is expected that the structure will be roofed in before the close of the present season, and will be in possession of the company by the beginning of May, 1896.

It is said that the Hamilton Electric Light & Power Co. will refuse to accept the city's offer of a two years contract at $90.00 per light. The company offer to enter into a five years' contract at $91.25 per light.

The following gentlemen have been elected as the Board of Directors of the International Radial Railway Co., which is seeking a charter from the Dominion Government: Alexander Burns, M. A., D. D., Alexander McKay, M. P.; Thos. Bain, M. P., Dundas; John Hoodless, Thos. Miller, M. D., J. E. O'Reilly, master in chancery; Peter D. Crerar, M. A., F. A. Carpenter, W. N. Myles, Thomas Ramsay, R. H. McKay, of McKay Bros.; Ald. A. H. McKeown, J. F. Smith, William Andrews, Guelph, and E. J. Powell, London.

NEW NON-MAGNETIC ARC LAMP.

By W. E. Irish.

This lamp for either constant current series, alternating or constant potential circuits from any generator, is governed by the thermal wire, lever and counteracting spring as usual, but instead of a clutch or rack, it employs a screw feed with more sensitive mechanism.

The screw feed is a new, simple and valuable feature. It retards the fall of the carbon so as to prevent over-feeding, and it is not affected by a dirty carbon rod. The carbon rod carries at its upper end a traveller which engages in the deep square cut thread of a long screw, the threads having a pitch of about half an inch. The traveller simply carries the rod, which is free to turn for convenience of trimming.

The object of the screw is to maintain a slow, regular and continuous feed, so as to obtain an absolutely steady light in place of the intermittent feed and constantly varying c.p. and e.m.f. incidental to most of the clutch and gear lamps. For constant current series circuits the lamps are equipped with a simple variable shunt resistance and an automatic switch which also acts as the cut-out.

This device tends to maintain the e.m.f. and current of the line constant in opposition to the contrary tendency of the lamp, for as the resistance of the arc increases the resistance of the shunt will correspondingly decrease, and vice versa. By employing this automatic cut-out and variable shunt, there is practically no burning out of the shunt coils or opening of the circuit. The longer the arc, the greater will the current be passing through the shunt and the less its resistance, as the resistance shunt will automatically decrease in proportion to the increased resistance of the arc.

In the event of the carbons breaking, the lever of the cut-out will act and by rapid steps vary the shunt resistance until the lever reaches the line terminal and makes a short circuit, when the lamp and shunt will be completely cut out of circuit and the line wire bridged across. As there is no breaking of the circuit within this lamp, there is no arcing or interference to prevent the perfect working of lamps and circuit.

On starting a newly trimmed lamp employing this automatic switch, the current will, when the hand switch is open, have two paths—one through the lever of cut-out and a small resistance, the other through the carbons.

The resistance of the line through the cut-out is made a trifle higher than the resistance of the lamp circuit, so that the automatic device may respond more promptly, and by opening the line force the whole of the current through the lamp. Here again the current finds two paths, one through the carbon and the other through the variable resistance shunt.

The chimney top is furnished with a cross arm and insulated hanger. The cross arm carries the wires leading to the lamp, the whole making a good substitute for a hanging board. The lamp top, chimney and cross arm may be considered as a separate part from the lamp proper. The top carries the hand switch and the automatic variable resistance, contact plugs, terminals and wires.

The wires pass through insulating and water-tight bushings to the terminals. To this upper part the lamp proper may be attached in a simple, handy and rigid manner, while the upper part is hanging, so that a defective lamp can be removed and replaced without interfering with wires, switch or circuit. To lower the globe for trimming it is simply necessary to release the clamping screw in globe holder, when the globe may be let down until its top is in line with the lower carbon holder, at which position it will be held by a flexible wire cord. When the globe is replaced the wire is coiled back into the base of lamp by the tension of a spring. To remove the globe entirely it is simply necessary to unscrew the thumb nut at the bottom so as to release the wire from the holder. The cover is readily lowered or removed by partly unscrewing the two thumb screws at the side. A glass tube encircles the carbons to increase the length of their life and keep down the resistance of the arc by excluding cold air. This lamp for all circuits is bug and waterproof, and being practically sealed, needs no spark arrester.

A branch of the Canadian Marine Engineers' Association is in existence at Halifax, and meets every Friday evening in Temple of Honor, in that city. Mr. W. B. Parkes is the secretary.

SPARKS.

An electric railway between Barrie and Allandale is being talked of.

Messrs. Dobson & Co. have become the owners of the Cannington Electric Light Co.

Permission has been granted the citizens of Vancouver to lay a telegraphic cable to the American side of Puget sound.

The Gananoque Electric Light Co. are reported to be replacing their incandescent circuits by wires of larger cross section.

Mr. P. A. Lavin, of Galt, has accepted a position in connection with the new electric road now under consideration at Oshawa.

The Toronto Street Railway Co., have rented to campers thirteen old horse-cars, which will be used as sleeping tents at Victoria Park.

The contract for steel rails for the Guelph Electric Railway has been given to Mr. Geo. Baker, of Hamilton, representing the Illinois Steel Co., of Chicago.

The receipts of the Toronto Street Railway Co., on last Queen's Birthday, were $5,700, being $1,700 in excess of the corresponding day of the previous year.

The Montreal Park & Island Railway have ordered a number of new cars for use on their several lines. Work on the St. Laurent extension will be commenced immediately.

A by-law has passed its second reading in the City Council of St. Thomas, to grant a franchise for the construction of an electric street railway through the streets of that city.

Messrs. Thos. W. Ness, Norman Westwood McLaren and Chas. Bate have been registered proprietors of Ness, McLaren & Bate, dealers in electrical supplies, Montreal.

The Ottawa Street Railway Co. have concluded an agreement under which the company's lines will be extended to Hintonburg. The work is expected to be completed by the first of July.

The proprietors of the recently organized Kay Electric Mfg. Co., of Hamilton, are adding new machinery to their manufactory, and will in future manufacture transformers and alternating machinery for lighting purposes.

The Montreal Street Railway Co. recently inaugurated an all-night service. It is reported that the enterprise of the company has been thus far poorly rewarded, and unless the traffic improves the service will probably be withdrawn.

At the adjourned annual meeting of the Toronto Street Railway Co. the following directors were re-elected: Wm. .McKenzie, Jas. Ross, Geo. A. Cox, Jas. Gunn and H. A. Everett. The statement of earnings show a net gain for April, '95, of $12,116.77.

Messrs. W. J. Thompson, O. Burke, J. MacW. Telfer, J. J. O'Donohue, E. Latimer, K. A. McRae and W. A. P. Byrch, have passed the examination for juniors in electricity and magnetism at the Toronto Technical School. Mr. W. Hahn passed the senior examination.

It is announced that the Cataract Construction Co., of Niagara Falls, will not undertake to deliver power even to local consumers until their second large dynamo shall be ready for operation. One dynamo is now in position and working order. It is expected that the company will be in a position to furnish power by the first of August.

Arrangements have been made under which the Hamilton, Grimsby & Beamsville Electric Railway will make connection with the Hamilton Steamboat Co., for the transfer of passengers and freight. There will be four freight deliveries daily at Bartonville, Stoney Creek, Fruitland, Winona, Grimsby, Smithville, Grimsby Park and Beamsville.

The construction of the Oshawa Electric Street Railway is being proceeded with by Messrs. Ahearn & Soper, of Ottawa. Mr. E. W. D. Butler is overseeing the work on behalf of the Rathbun Co., of Deseronto, who are the owners of the franchise. The road will run from the railway depot through the town, with branch lines to the principal manufactories, and will be principally used for the transportation of freight.

A syndicate represented by Mr. Beemer have made definite proposals to the city council of Quebec, for an electric railway franchise through the principal streets of the city and St. Roch; the system to be connected with the Quebec, Montmorency & Charlebois Railway. The syndicate offered to pay to the city three per cent. of the gross receipts for two years, and four per cent. for the balance of thirty years, in consideration of a franchise being given them for the period mentioned.

Mr. J. S. Larke, who recently took up his residence in Australia, as Commercial Agent for Canada, has submitted to the Sydney Board of Commerce a scheme for construction by Great Britain, Canada and Australia, of the proposed Pacific cable. It is proposed to borrow eight million dollars, the estimated cost of the work, on the credit of the countries interested, at two and one-half per cent. Mr. Larke estimates that the interest, capital and working expenses can be paid in twenty-five years out of half of the estimated business, at two shillings a word. The scheme is said to have been well received.

LEGAL DECISIONS.

TORONTO STREET RAILWAY CO. v. GOSNELL.—A decision of the Supreme Court of Canada led the Toronto Street Railway to expect that they might have the rule there laid down, that a person driving a team across a steam railway track is obliged to look both ways before he crosses a track, to see if a car is coming, applied to persons driving across their tracks in Toronto. The Supreme Court, however, did not apply the same rule to cases of electric cars in cities, and where an action was brought for damages arising in consequence of injury by a trolley car colliding with the respondent's team, and the applicants contended that he did not see if the car was coming before he started across the track, and that his own negligence, therefore, led to the accident, the respondent was held entitled to retain the verdict against the company.

The Supreme Court has dismissed the appeal of the Toronto Street Railway Co. from the decision of the lower courts, under which the company were held to be liable for damages for injuries caused by the accumulation of ice and snow on the sides of the street, part of which would come from the railway tracks, and part from the sidewalks. The court also dismissed the appeal of the company in the case of an employee named Bond, who was awarded damages by the lower courts for injuries sustained while engaged in coupling cars on the company's lines. The court held that the buffers of the cars, which the respondent was coupling together when injured, were constructed on different levels, and so over-lapped as not to prevent the cars from coming together, and that this condition of affairs was sufficient proof of negligence on the part of the company, in addition to the fact that the company had received notice that buffers were necessary for the protection of their employees.

PERSONAL.

Mr. T. Langlois has been appointed electrical engineer for the municipality of Maissoneuve.

Mr. Alexander Moffatt, electrical engineer, of New York, was married recently to Miss Madelin Spratt, daughter of Mr. Robt. Spratt, of Toronto.

Mr. J. C. Grace, Secretary-Treasurer of the Toronto Street Railway Co., has resumed his duties after an absence of several months in the South, induced by ill health.

Mr. Sam J. Heenan, formerly with the Thomson-Houston Co., and the Brooklyn Street Railway Co., has been appointed superintendent of the Yarmouth, N. S., Street Railway.

We regret to announce the sudden death at Deseronto, on the 19th of April, of Mr. E. C. French, who until recently was the Canadian agent at Montreal for the Babcock and Wilcox Co.

Mr. G. White Fraser has been appointed consulting electrical engineer for the Guelph Electric Railway and for the corporation of the town of Collingwood, in connection with the new lighting plant to be installed at that place.

Mr. Eckley B. Coxe, a portrait and sketch of whom as president of the American Society of Mechanical Engineers, appeared in this journal coincident with the society's convention in Montreal, died at his home in Drifton, Pa., on May 13th, of pneumonia.

Mr. Cecil Doutre, secretary of the Montreal Electric Club, has been appointed electrical engineer for the Richelieu and Ontario Navigation Co. He is at present busily engaged in superintending the installation of new lighting plants on six of the company's steamers. All the boats running between Hamilton and Montreal are to be lighted by electricity.

TRADE NOTES.

Two 300 h. p. tandem engines have been ordered from the Robb Engineering Co., by the Halifax Electric Street Railway Co.

The Richelieu & Ontario Navigation Co. has ordered five Robb-Armstrong engines for electric lighting purposes on their steamships.

The Halifax Electric Street Railway Co. has ordered from the Robb Engineering Co., two 300 horse-power tandem compound engines.

The Toronto Electrical Works announce that they have commenced the manufacture of the McIntosh Current Controller for regulating electric light currents for medical purposes.

The Ingersoll Rock Drill Company have added another branch to their extensive works at St. Henry, in which they are at the present time manufacturing electric railway specialties. They have completed a contract with Albert & J. M. Anderson, of Boston, who are perhaps the largest manufacturers and designers of this class of machinery, for the exclusive manufacturing right in Canada, and our electric lines can now procure this class of machinery and effect a saving of the duty. Their advertisement appears in one of our advertisement columns.

The Canadian General Electric Co. has ordered three 100 horse-power Robb-Armstrong engines with extension base and outboard bearing for direct connected dynamos. One of these is to be placed in the building of the T. Eaton Co., and the others in the Union Station of the G. T. R., Toronto.

A handsomely printed catalogue, describing in detail the Robb-Armstrong engines, simple, compound, tandem compound and cross compound, with tables of dimensions and H. P. capacity at various initial pressures and speed at the most economical point of cut-off, has just been issued by the manufacturers, the Robb Engineering Co., Amherst, Nova Scotia.

The new manufacturing works of the Ottawa Carbon and Porcelain Co. are rapidly nearing completion. The buildings have a frontage of 300 feet alongside the Canada Atlantic Railway Depot. The carbon and porcelain departments will each occupy a distinct portion of the building. The kilns are cylindrical in shape and forty feet high. The works when completed will be adapted in the best possible way to the perfect and economical production of the products to be manufactured, while the shipping facilities are first-class. The work is being done under the careful supervision of the general manager of the company, Mr. J. W. Taylor.

SPARKS.

The New Brunswick Telephone Co.'s lines are being extended from Moncton to Albert.

Mr. James Bonfield expresses his intention to establish a second electric light plant at Eganville, Ont.

A charter of incorporation is being applied for by the Lindsay Light, Heat and Power Co., of Lindsay, Ont.

The Montmorency Electric Light and Power Co. are adding to their plant two power generators, with a combined capacity of 600 h. p.

The City Council of Hamilton invite tenders until the 7th inst. for lighting the city with about 400 arc lights for a term of five years from the 1st of September next.

The foundations for the Mattawa Electric Light and Power Co.'s new power station are under construction. The station building will be constructed of brick, and it is expected will be operated both night and day for the supply of electric light and power.

It is understood that negotiations are still going on between the Canadian Locomotive and Engine Co., of Kingston, and the Siemens-Halske Co., of Chicago, with the object of having the Siemens-Halske electrical machinery manufactured by the Locomotive Company. The matter will no doubt be settled at an early date.

The Tagona Water and Light Co., of Sault Ste. Marie, have purchased a monocyclic plant from the Canadian General Electric Co., for supplying incandescent and arc lights and power to the town. The arc lighting will be done by 60 Helios alternating lamps operated from the low pressure mains.

There are at present running in France no less than 328 electric light supply stations. This number, although considerably in excess of those installed in Great Britain, does not utilise, in the aggregate, such a large number of horse-power as the English stations, the greater number being quite small works, and many of them run by means of water-power.

A very satisfactory statement was presented at the recent annual meeting of shareholders of the Northwest Electric Co., at Winnipeg. The following board of directors was elected for the ensuing year: G. H. Strevel, J. M. Graham, G. A. Simpson, J. A. McArthur and H. Cameron. G. H. Strevel was re-elected president and H. Cameron re-elected manager and secretary.

At the first meeting of the Board of Directors of the St. John Railway Co., which recently amalgamated with the St. John Gas Co., the following officers were elected: Mr. James Ross, president; J. Morris Robinson, vice-president, and F. W. Warren, secretary-treasurer. The president, vice-president and Mr. H. H. McLean were appointed an executive committee to take general charge of the business of the company.

It is learned from the Ottawa papers that a very satisfactory test was made a few days ago in that city of the Hubbell Primary Battery, manufactured by the Hubbell Battery Co., of Ottawa. Mr. Geo. A. Whistler, expert electrician for the United States Navy, Mr. Geo. H. Hill, electrician for John Forman, of Montreal, and Mr. Dion, superintendent of the Ottawa Electric Light Co., have given their testimony to the efficiency of this battery, the latter gentleman stating that its capacity per pound is 50 per cent. greater than of most storage batteries with which he is acquainted. The manufacturers propose lighting a C. P. R. and C. A. R. passenger coach in the near future as a proof of the efficiency of this battery.

ELECTRIC LIGHTING BY THE MUNICIPALITY AND BY CONTRACT.

THE advisability or otherwise of municipal ownership and control of electric lighting is engaging the attention of the City Council of St. Thomas, Ont. The City Engineer, Mr. J. H. Campbell, was recently commissioned by the Council to visit a number of American cities where municipal control of electric lighting prevails, and report as to the advantages and disadvantages of the system. Mr. Campbell has kindly furnished the ELECTRICAL NEWS with a copy of his report, which is a lengthy document, and contains much that is interesting on a subject which at present occupies considerable public attention. For the information of our readers we print a synopsis of the report as follows:—

TO THE CHAIRMAN AND MEMBERS OF NO. 3 COMMITTEE OF THE COUNCIL OF THE CITY OF ST. THOMAS:

GENTLEMEN,—In compliance with a resolution passed at a regular meeting of your Committee held on the 28th of February last, and confirmed by the City Council at its meeting held on the 6th of March, requesting me to prepare a plan of the city showing the location of the gas and electric street lamps now in use, also the location and number of electric lamps required for properly lighting the streets of the city, together with a report of the description and cost of a municipal electric street lighting plant, utilizing as far as practicable the buildings and power of the municipal waterworks system, an estimate of the cost of operating and maintaining such a plant, together with such further information as may be of service in considering the question of street lighting, I beg to submit as follows:

PLANS.

The accompanying plan shows the location of the number of electric lamps required to efficiently light every portion of the city. The radiating power of each lamp of 2,000 candles is shown by a red circle surrounding the lamps, which at a glance will show how completely the territory will be lit. It will be seen from the plan that on account of the irregular manner in which the streets have been laid out and the irregular intersections of the streets, that more lamps are necessary than would be required if the blocks were uniform and the intersections regular. For this reason I find that a less number of lamps cannot be so disposed as to cover the territory and do the lighting as efficiently as would be expected from a municipal plant. The location of the present gas and electric lamps are also shown.

DESCRIPTION OF PROPOSED PLANT.

1. One of the present waterworks boilers to be used to generate the necessary steam. A wing to the present waterworks building, containing 1400 square feet of floor surface, to be built at the south-east angle of the boiler room and to extend southerly to the line of the south end of the filter room, to provide space for engines, dynamos and necessary apparatus storage room, to have a stone foundation, brick walls and a slate roof.

2. One 120 horse-power tandem compound condensing engine and condenser, capable of operating 150 regular arc lamps of 2,000 c. p. each.

3. One boiler feed water pump and heater.

4. Two dynamos of a capacity of 60 lamps of 2,000 c. p. current, to measure 9.6 amperes and fifty volts for each lamp, with provision for an additional dynamo to be provided with switches, by the use of which the lamps can be burned at 2,000, 1,600 or 1,200 c. p.

5. One hundred arc lamps.

6. Two circuits of Number 4 and 6 B and S insulated copper wire.

7. Line poles to be placed 125 feet apart, to be iron on Talbot street, and cedar, straight, planed and painted, on all other streets.

8. Lamps to be suspended in the centre of the street and wherever practicable at street intersections.

9. ESTIMATED COST OF THE PLANT.

Building	$1,000.00
120 horse power engine and condenser	2,800.00
Heater and feed water pump	400.00
Foundation for engine	200.00
Foundation for dynamos	300.00
Boiler connections	75.00
Two 60 light dynamos, 2,000 c. p.	3,200.00
100 arc lamps, hoods, globes, suspenders, complete	3,500.00
121,000 feet of insulated wire circuit	1,870 00
68 iron circuit poles	1,360.00
472 cedar circuit poles	2,832 00
Cross arms	150.00
Insulators	100.00
Insulator pins	25.00
Labor on circuit	1,000.00
Publishing by-law and incidental expenses	188.00
Total	$19,000.00

10. If the plant is to be constructed for street lighting only, the direct system is preferable, but if it is your intention to do commercial lighting, it would be advisable to adopt the alternating system, as both arc and incandescent lights can be furnished by the same machine, otherwise you would be obliged to install arc and incandescent dynamos and separate circuits. If the direct system is adopted public buildings could be lit with arc lights and opaque globes.

I have estimated for iron poles on Talbot street only. If you wish to use a greater number of these, the additional cost will be fourteen dollars each.

There being a sufficient quantity of water in the creek wasted during the greater part of the year, I have estimated on using a low pressure engine and condenser, which will prove a great saving in the cost of fuel, as the condenser can be worked about eight months in the year.

All the lamps will be 2,000 c. p., but the plant will be provided with automatic regulators so that the lamps, or any circuit of lamps, can be immediately reduced to 1,600 or 2,000 c. p. if required, during certain nights in the year, or after a certain hour of the night, thus effecting a further saving in the cost of fuel.

MAINTENANCE.

Operating the plant from the Waterworks station will be advantageous in the matter of site and buildings, machinery, operating staff, floor-room, use of water for condenser; while to a small extent it presents some economy in fuel. This will, however, be discounted by its greater distance from the centre of electric distribution, and the extra wiring necessary.

2. The staff shall, in addition to the men at present employed at the Waterworks, consist of one engine and dynamo tender, at a salary of $700 per year, and two line-men and carboners, at $600 and $480 per year respectively.

3. One of the chief operating expenses is that of fuel. The amount of coal required, as determined by the American National Electric Light Association, averages, in a well equipped station, five pounds per i.H.P., (746 volts). On a basis of ninety per cent. mechanical efficiency for the engine and the same for the dynamo, one pound of coal will produce 120.85 watt hours. The estimate which I have prepared provides for two generators working ten hours per day each, producing 9.6 amperes under 2,500 volts pressure, making a total daily output of 480,000 watt hours. At 120.85 watt hours per pound of coal, therefore, the amount of coal necessary is 3,971 pounds per day.

4. The item of depreciation on electrical apparatus has been variously estimated at from six to fifteen per cent. of the cost of the plant. A committee of the United States Congress placed it at ten per cent., and good authorities in the United States and Europe state that this is a safe margin. In my opinion ten per cent. should be allowed for depreciation of the electrical apparatus and six per cent. for the remainder of the plant.

ESTIMATED COST OF OPERATION.

Coal, 3.971 lbs. per day, at $3.75 per ton	$2.719 25
Carbons	360.00
Salary of engineer	700.00
Salary of two carboners at $40 and $50 per month	1,080.00
Cylinder oil	75.00
Dynamo oil	7.00
Engine oil	30.00
Management	200 00
Waste and sundries	35.00
Cost of operation per year	5,006.25
Cost per lamp per year	54 0625
Cost per lamp per night	14.81
Interest on investment, $19,000, at 5 per cent.	950.00
Depreciation on $7.542 at 6 per cent.	452.52
Depreciation on boiler, $1,500, at 6 per cent	90.00
Depreciation of $11,458 at 10 per cent.	1,145.80
Insurance	10.00
Total interest and depreciation per year	2,648.32
Total cost per annum	8,054.57
Total cost per lamp per annum	80.5457
Total cost per lamp per night	22 06

Should you determine to reduce the number of lamps to 75 in order to lessen the annual outlay, the cost of the plant and the total annual cost of lighting would be reduced, although the cost per lamp per annum would be slightly increased. From the experience of other cities I am convinced, however, that it would be false economy to do so, as under municipal ownership demands would be made for more lamps, which would ultimately reach the proposed number, entailing expensive alterations and additions, while portions of the plant would be found inadequate.

$7,975 of the cost of the proposed plant is taxable, and if owned by a company, would, at the present rate, 16 mills, amount to $127.60 per annum. Under municipal ownership this would in all probability be lost to the city, in which event it should be included in the cost of maintenance.

Following the above is a description of municipal lighting plants at Norwalk, Conn., under the operation of which the average cost per lamp per year burning from dusk until 1:30 or 2 a.m., is given as $64.53¼. A plant at Marblehead, Mass., is also described, which having been in operation but a few months, affords no data. Municipal plants at Dunkirk and Jamestown, N. Y., and Aurora, Ill., are likewise described. In the case of the latter the cost per lamp per year is stated to be $53.65.

The following schedule for lighting in a number of Canadian and American towns and cities is embodied in the report:

COST OF LIGHTING IN CANADIAN CITIES.

City	No. of Lamps.	Cost per night.	Cost per annum.	No. of nights allowed for moonlight.	
Barrie	33	$0.28 8-10	$70.00	72	
Kingston	100	30	81 00	96	
Brockville	29	35	94.15	96	
Hamilton	348	28	102.20	96	
Brantford	35	23	83.95	none.	
Guelph	90	24½	79.00	72	water and steam.
Stratford	73	18	49.50	90	do.
Belleville	39	35	94.55	96	do.

City	No. of Lamps.	Cost per night.	Cost per annum.	No. of nights allowed for moonlight.
Peterborough	77	$0.25	$75.00	65 water and steam.
Chatham,	56	23½	65.80	85 do.
Galt	39	22	66 00	65
Ottawa	331	23 2-10	64 96	85 waterpower.
Woodstock	56		56.00	to midnight.
Owen Sound	30	31 7-10	90 00	72 water power.
London	226	25	81.96	60 do.
St. Thomas,	31	28	102 20	96
Windsor	108	14½	52 93	none.
Pembroke	13		65.00	moon to 10 o'clock.
Port Hope	32		45.00	65 water power.
Ingersoll	35		62.50	to midnight.
Renfrew	6		91.25	to midnight.
Perth	26		56 73	midnight water.
Wallaceburg	17		75 00	midnight.
Winnipeg.	121		102.00	moonlight all night.
Sarnia	30		80.00	moon all night.

AMERICAN CITIES LIGHTED BY PRIVATE CONTRACT.

City.	No. of Lamps.	Cost of each per annum.	Schedule.
Allentown, Pa.	114	$100.00	All night.
Auburn,	150	87 50	All night.
Burlington, Ia.	120	100.00	Moonlight.
Camden, N. J.	119	146.00	All night.
Canton, O.	120	70.00	All night.
Columbus, Ga.	40	126.00	All night.
Dallas, Tex.	125	93.85	All night.
Kalamazoo, Mich.	103	95.00	Moonlight.
Leavenworth, K.	87	96.00	All night.
Michigan City, Ind.	100	75.00	Moonlight.
Springfield, Mo.	70	114.00	All night.
Wilkesbarre, Pa.	90	120.00	All night.
Texarcanna, Ark.	31	100 00	All night.
Danville, Ill.	80	80.00	As ordered.
Jacksonville, Ill.	71	96.00	All night.
Streator, Ill.	60	96 00	All night.
Komoka, Ind.	56	100.00	All night.
Logansport, Ind.	85	100.00	All night.
Arkansas City, Ark.	35	72.00	To 12 P.M.
Fort Scott, Kan.	75	80.00	Moon, 1 P.M.
Queensbury, Ky.	32	110.00	Moonlight.
Augusta, M.	68	76.33	9 hours.
Bath, M.	31	125.00	To 1 P.M.
Grand Rapids, Mich.	120	109.50	All night.
Lansing, Mich.	100	100.00	Moon all night.
Bellaire, O.	52	90 00	Moon all night.
Tremont, O.	70	70 00	All night.
Killsborough, O.	63	70 00	Moon all night.
Lebanon, Pa.	50	80 00	To 12 P.M.
New Castle, Pa.	50	80.00	All night.
S. Bethlehem, Pa.	55	81.82	Noon to 12 m.
Houston, Tex.	92	150.00	All night.
Parkersburg, Tex.	59	102.00	All night.
Port Huron, Mich.	88	100.00	Moonlight.
Buffalo	1880	127.50	All night.
Cincinnati	254	84.90	All night.
Detroit	1279	136.00	All night.
Binghampton	256	109.50	
Syracuse	648	109.50	
Cleveland	241	88.67	
Lowell, Mass.	325	127.75	
Worcester, Mass.	410	127.75	
Toledo	600	100.00	
Pittsburg	1594	96.00	
Albany	600	144.17	

quoted in favor of municipal control, and of D. E. Price, of Paris, Ill., in favor of the contract method.

The report concludes as follows:

The statistics regarding lighting by contract were obtained from various electrical authorities and engineering journals, which have, at considerable expense, collected reliable data for use in discussing the lighting question.

The prices given in the table for lamps lit by private companies are doubtless correct, for their prices were fixed by contract, and can therefore be relied on, as showing the whole cost to the various cities for street lighting. But in the figures given as the yearly cost per lamp, where plants are operated by a city, we are at once confronted by the question whether the estimates represent the entire cost to the city. In general the chief items of error, where error exists, are first, confusion in regard to interest and depreciation on the investment, and second, where the plant is operated as an adjunct to the Waterworks station, or where private lights are furnished from the same plant, the charging to the street lights a larger or smaller sum than their fair proportion of the total expenses. In the list of Canadian cities, Windsor is the only one operating its own plant, but the cost given, fourteen and one-half cents per lamp per night, is so low compared with other cities, operating under similar circumstances, as to convince me that only the cost of operation is given. From their financial report of 1894, I find that the total expenses for the year amounted to $6,762.28. Of this amount $342 85 was apparently expended in repairs, which sum should be included in the depreciation on the plant; $500 was expended in the purchase of a lot; in all $842.85, which should be deducted from their cost of operation. The cost would then be as follows:

Running expenses	$5,919 43
Interest on cost of plant, $18,000, at 5 per cent.	900.00
Depreciation on cost of plant at 8 per cent.	1,440.00
Total cost for 1894.	$7359.43

This amount is equal to $68.14 per lamp per annum or 18⅔ per cent. per lamp per night. The lamps are only 1000 candle power. In considering these tables it is to be pointed out also that a first-class electric lighting plant for which contracts can be let to-day, is not only better and more efficient than the first-class built five years ago, but it also represents a smaller expenditure. It will be noticed that there are wide differences in prices paid for street lighting, both by municipal plants and by contract. To account for this would necessitate an analysis of each plant, but in general the divergence will be accounted for by the differences in the cost and quality of coal, in the power (water or steam) employed, and in the management; in the number and kind of lamps and in the kind of generating apparatus, etc.

It is apparent that municipal lighting plants are yearly increasing in number, although there are some reports of failures. The reason for this increase is perhaps due in many cases to the private companies themselves, which, after obtaining a valuable franchise, have no other interest than to curtail the cost of operation at the expense of good service; or it may be due to the corporations themselves insisting on a light at a rate which does not afford a fair profit. If the city would secure its light from a private company at the lowest possible price, it must make that company's investment secure; first, by making its franchise for street lighting an exclusive one, and second, by agreeing on some adjustment between the city and

MUNICIPAL LIGHTING IN AMERICAN CITIES.

City.	Population.	When Installed.	Cost of Plant.	Power.	No. of Lamps.	Candle Power.	Cost per lamp per year.	Schedule.	Do you do Commercial Lighting.	Should a municipality own its own plant.
Aurora, Ill.	20,000	1886	$17,986.12	Steam.	75	1200	$ 58.00	All dark and cloudy.	No.	Yes, by all means.
Titusville, Pa.	8,000	1887	9,000.00	do.	58	2000	57.00		No.	Yes, by all means.
Jamestown, N. Y.	18,000	'91 & '95	62,000.00	do.	271	1200	48.00	All night, every night.	No.	Yes, every time.
Ashtabula	8,300	1891	80,000.00	do.	70	2000	Expenses nearly paid by com. lights.	Till 3 a.m. except moon.	4,200 inc.	Yes.
Madison, Ind.	8,800	1886	20,907.00	do.	86	2000	66.00	Moonlight.	No.	Yes.
Metropolis, Ill	7,000	1892	51,000.00	do.	35	2000	58.00		Yes.	No.
St. Peters, Minn.	4,000	1892	15,000.00	do.	45	2000	45.00	Moonlight.	800 inc.	Yes, by all means; franchise under no circumstances.
Batavia, Ill	12,000	1889	40,000.00	do.	120	2000	Com. lights pay.	Moonlight.	Yes.	I do.
Bowling Green, Ky.	7,800	1888	15,000.00	do.	72	2000	50.27	Moonlight.	No, sir.	Yes.
West Troy	12,900	1893	32,000.00	do.	113	2000	66.00	None.	No.	If managed properly, yes.
Marshalltown, Ia.	8,900	1889	12,000.00	do.	64	1200	12.00	Moonlight and 3 a.m.	No.	Our experience has been satisfactory.
Elgin, Ill.	20,000	1887	24,000.00	do.	110	2000	64.93	Moonlight, all night.	No.	Yes.
Dunkirk, N. Y.	10,000	1887	19,000.00	do.	75	2000	43.45	8 hrs. 6 min. per night.		
Mariette, O.	8,200	1889	18,000.00	do.	110	2000	35.23	All night.	No.	Depends.
Chambersburg, Pa.	7,800	1890	31,000.00	do.	144	2000	65.39	Moonlight.	Yes.	Yes.
Madison, Ga.	5,000	1891	24,000.00	do.	40	2000	58.00	Moonlight, all night.	Yes.	Yes, if best light wanted.
Decatur, Ill.	17,000	1885	40,000.00	do.	105	2000	100.00	Dark nights.	No.	Yes.
Little Rock, Ark.	25,800	1884	35,000.00	do.	210	2000	44.88	M'nlight and dark nights.	No.	Yes, by all means.
Marquette, Mich.	9,000	1889	70,000.00	water.	100	2000	50.04 (int. and dep.)	All night, every night, except bright moon.	Yes.	We consider it advisable.
Painesville, O.	7,800	1885	12,000.00	Steam.	81	2000	40.00	Moonlight, all night.	No.	Yes.

NOTE.—Except where mentioned in the above list the cost per lamp per annum does not include interest on the investment or depreciation in the value of the plant.

All the statistics relating to municipal lighting were collected by me either personally or in answer to a circular addressed to the mayors of the various cities.

The opinions of the mayors of Ashtabula, Ohio, Aurora, Ill., Marshalltown, Iowa, Marquette, Mich., Titusville, Pa., and the Commissioner of Water and Light, Chambersburg, Pa., are

company at the termination of the franchise, which shall be equitable to both parties.

In the general rules of the Fire Underwriters is the following clause with reference to operating an electric light plant from the Waterworks station: "The pumping station must be an independent and separate first-class building, unexposed, and shall not be used for an electric light station or other purposes." But as a separate building is to be erected for the

electrical apparatus, no doubt satisfactory arrangements can be made. A number of American cities are operating the electric light and waterworks systems together, from six of which I have the following reports:

City.	Population.	No. of Lamps.	Cost per Lamp.	Cost of Plant.
Bloomington, Ill....	20,400	220	$51.60	$73,000
Madison, Ga.....	5,000	40	58.00	24,000
Dunkirk, N.Y.....	10,000	75	43.45	19,000
Marquette, Mich.....	9,000	100	50.04	70,000
Mariette, O.....	8,200	110	35.23	18,000
Metropolis, Ill.....	7,000	40	75 00	51,000

Reasons advanced in favor of municipal ownership:—

1. In the construction of a municipal station the municipality saves the profit that a private company would expect to make.

2. A city is generally in a position to borrow money at a lower rate of interest than a private company.

3. Most of the plants owned by private companies in the large cities were put in some years ago, when the cost of electrical appliances was greater that it is to-day, while their efficiency was less.

4. In the construction of a private plant capitalists will not risk investing money unless they are assured of good dividends, while all the municipality requires is a sufficient return to pay the cost of running, including interest on the outlay, with a margin for renewals.

5 A company operates usually under a franchise which is not exclusive, and under a contract which is made for a short term of years, making it inadmissable to venture capital unless the returns are so large as to warrant taking the risk.

6. There is reason for believing that a city can, by letting contracts publicly, erect more cheaply than a company which obtains the machinery by private contract.

Reasons advanced in opposition to municipal ownership:

1. In American cities, where state politics enter largely into the Council Chamber, it is urged that the situation is not always favorable to the operation of a municipal plant, but no valid reason has been advanced why, under the government of a Canadian city, a municipal system of lighting should not be as economically managed as a private plant.

2. A company furnishing light, heat and power being given a secure franchise, can, by a slight additional investment, make the capacity of their apparatus sufficient to do the municipal lighting at a much less cost than could a plant erected for street lighting only.

3. The possibility of great advancement in electric generators and transmission in the near future.

There are certain financial responsibilities which attend the ownership of a municipal plant, which are deserving of careful consideration. Among these I include, (a) the liability of loss from fire, (b) destruction of poles and circuit storm, (c) danger from a broken wire or defective insulation, and the possibility of costly litigation resulting, (d) damages from lightning, instances of which I found where as many as three armatures were burned out in the course of a year; with us this would cost $1,500; (e) the probability of great advancement in electric generation and transmission in the near future.

A company must estimate on a margin for these risks and responsibilities, and very often no doubt this margin is over-estimated; but in order to determine fairly what the cost to the city will be, and in comparing this cost with the figures of private companies, a reasonable allowance should be made and added to my estimated cost of operation and maintenance.

After going through some of the largest manufactories of electrical appliances in America, and examining machinery now being developed, and looking into recent theory and practice, I am much impressed with the fact that our means of utilizing the electric current has by no means, as some affirm, safely passed the experimental stage, but on the contrary the electric domain is changing every day; old appliances ceaselessly give way to new; methods of production, distribution and utilization vary yearly, and we may soon expect it to thrust a revolutionary force into the lighting and power system, and for this reason I do not feel in a position to estimate this margin.

On visiting a number of lighting plants owned by companies and municipalities considered to be modern, without exception I found a large floor space occupied by engines, shaftings, pulleys, belting and dynamos, presenting a giddy maze; and except a few plants driven by water wheels, gas engines and compressed air, this is universally the case. Now each step from consuming coal in the furnace to the glow of light is attended with great loss. The energy is frittered away through this complication of machinery and belting.

It is argued that the standard make of electric generators of to-day possesses a mechanical efficiency of about 95 per cent., that is, that every one hundred horse-power required to turn the armatures will be given back in the form of 95 horse-power worth of current—the other five per cent. is taken up in mechanical and electrical losses—and that, therefore, it is not obvious that any extensive improvement can be made in the generating apparatus. But actual tests prove that barely five per cent. of the current produced manifests itself, as light in an incandescent lamp. One great object to be attained, is the consolidation of the parts of machinery to prevent as far as possible the great loss of energy, and a notable stride in this direction is in the machine now being put on the market, in which the engine and dynamo is combined, yet leaves a complication of mechanism with a dynamo in which some part is not utilized every moment. With the oscillator, the recent great inveation of Tesla, fly-wheel generator balls, eccentric valves, belting, etc., are thrown aside. The piston of the engine is the only part doing work, and to this is attached the armature, which, instead of revolving between magnets, is simply darted in and out of the field of force. It is evident that such a machine must have an economy far beyond anything at present in use, and it is possible that when perfected, from its simplicity and economy, it will render valueless the machinery of to-day.

Efforts of electrical engineers are now being directed towards the conservation of energy in the transmission of the electrical currents. When this is accomplished, and it would seem to be a matter of a short time, the vast power of Niagara and others of a similar character will be turned to account, and the present system of lighting revolutionized by companies of central distribution furnishing cheap power for this and like purposes. The Niagara company has already, I understand, contracted with the city of Buffalo at a rate of fifteen cents per lamp per night, and negotiations are in progress with other cities, and even this price will be reduced as the amount of work increases.

A new arc lamp is now being tried, which promises to make an innovation in electric lighting. It may be said to be a combination of the incandescent and arc principles. It is claimed that with this lamp, carbons of ordinary length will burn from one hundred to two hundred hours instead of ten or eighteen as now. The current required to operate the lamp is only from four to five amperes as distinguised from seven to ten commonly used. The labor and carbons, if it meets the expectations of the promoters, will effect a saving in the cost of an ordinary plant.

A new illuminant, a gas called acetylene, has recently been discovered and is attracting much attention. Its illuminating power is 240 candles, whereas a like quantity of London gas is only sixteen candles. What the cost of this is likely to be has not yet been ascertained, although it is claimed that it will be very low.

I have enumerated these phases of electrical development to show the necessity of a fair allowance for these trifles.

THE TWO-PHASE SYSTEM.

To the Editor of ELECTRICITY.

DEAR SIR,—In an editorial in your issue of April 10th you say in reference to the new Westinghouse shop: "Aside from all this, these new works unboubtedly constitute the most complete electrical shops in the world of any kind, and the only ones using the two-phase currents for all operations." As to the first part of this statement it is a matter of individual judgment, and we have no comment to make; but we are certainly astonished at the latter part, as a reference to your own files would prove its inaccuracy. Our shops have long been operated by two-phase currents, and entirely so. There is not even a temporary use of direct current for elevators and cranes. The whole work is done by two-phase currents. Neither is our apparatus of such peculiar design that it can be operated only at an abnormally low frequency. All the apparatus in our shop is supplied from the central station of the town by a generator using the standard frequency of 16,000 alternations. It is not necessary for us to limit ourselves, therefore, saying that our apparatus could also be used at Niagara. It can be used in connection with any central station, and is being used in connection with many. We are surprised above all that you should undertake to decide the legal question as to the right to use two or three-phase currents for transmission purposes. Surely an anti-monopoly journal need not start in to create a monopoly in advance of the decision of the courts. Had these statements appeared in a journal known to be biased, or to be affected editorially by its advertising columns, we should have passed them over in silence as of no importance. In the millitant advocate of fair trade, however, they carry weight. We trust that, your attention having been called to their erroneous nature, in your usual spirit of fairness you will rectify them.

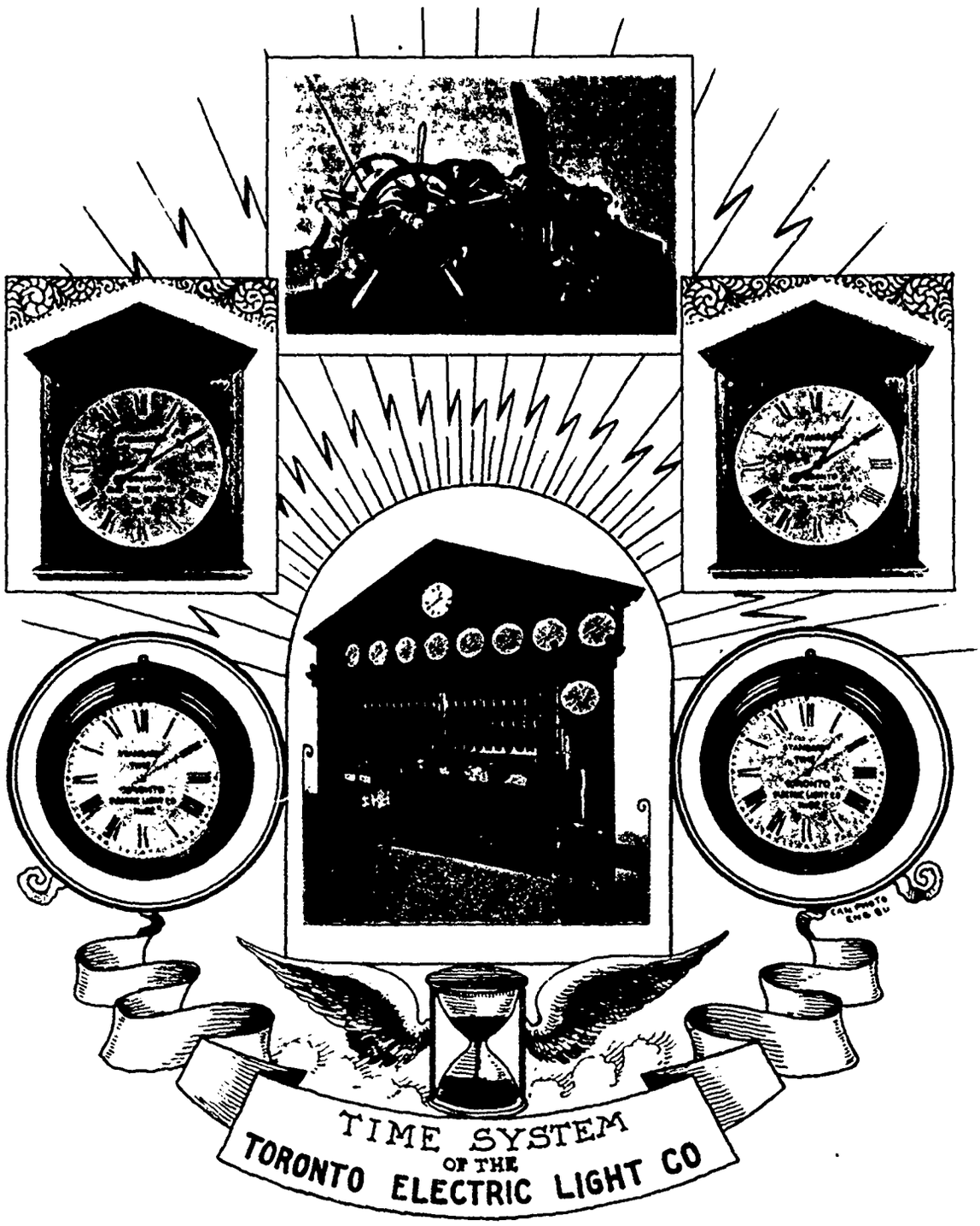
JOHN F. KELLY.

Stanley Electric Manufacturing Co., Pittsfield, Mass.

The above appeared in Electricity, and the editor makes the following comment: We thank Mr. Kelly for correcting us in making too sweeping a statement, as the Westinghouse shops are not "the only ones using the two-phase currents for all operations." More than a year ago Electricity published a comprehensive write-up showing the application of the S. K. C. two-phase system in the Stanley works at Pittsfield, which, we believe, was the first extensive installation, and which has worked with perfect success. We regret the overstatement, which was purely inadvertent. In regard to our remarks as to the legal questions involved, we made no attempt to anticipate the decisions of the courts, discussing merely the Westinghouse and Monocyclic systems, as a careful reading will show. We stated, what we knew to be a fact, that the General Electric people had *acknowledged* their Monocyclic system to be an infringement of the Tesla patents.

THE TIME SYSTEM OF THE TORONTO ELECTRIC LIGHT CO.

UNIFORM and standard time has now come to be looked upon as a necessity. To meet the growing demands for this the Toronto Electric Light Co. have inaugurated a system of time distribution from their station on the Esplanade by means of which electrically driven clocks are located wherever desired in any part of the city, giving absolutely accurate and uniform standard time corresponding with the time signal of the Toronto observatory. The system is an entirely new one, the invention of Mr. J. J. Wright. The necessary apparatus—transmitters, switchboards, etc., as well as the secondary clocks, were constructed in the machine shop of the Electric Light Company. Many of the difficulties that have heretofore been met in the distribution of time signals have been successfully overcome in this system, and clocks are now in use in the various manufacturing establishments, hotels, offices, and on the streets for the use of the railway company. The cost per year to subscribers is nominal, and the system bids fair to become exceedingly popular. The illustration is from photographs of some of the apparatus and shows different styles of clocks. In our next issue we propose to give details of the service, illustrated by drawings, which we think will be of considerable interest to our readers. Patents have been applied for covering the main points of the system.



CANADIAN ELECTRICAL ASSOCIATION.

THE Executive of the Canadian Electrical Association have commenced the necessary preparations for the approaching annual convention to be held in Ottawa in September next. The exact date will be fixed in the course of a few days. It is expected that the convention will take place in the early part of the month. Advices from Ottawa state that the members of the Association resident in that city, are enthusiastically interested in making the coming convention the best that has yet been held under the auspices of the Association. Several features in the line of entertainment have already been announced. His Excellency the Governor-General has very kindly placed at the disposal of the Executive his electric launch for a trip on the Rideau. Mr. Soper will give a garden party at his residence, and the Ottawa Electric Railway Co., have offered to do everything possible to make the event a success. A local committee will be appointed at an early date to complete arrangements for the entertainment of the visitors. A meeting of the Executive will shortly be held to arrange for the necessary papers and otherwise to provide an attractive programme.

A Halifax dispatch states that the amalgamation of the Halifax Street Railway Co. and the Halifax Gas Co., is expected to be an accomplished fact in the near future.

ELECTRIC RAILWAY DEPARTMENT.

THE BERLIN AND WATERLOO STREET RAILWAY.

THE conversion of the Berlin and Waterloo Street Railway from horses to electricity was successfully completed on the 18th ultimo. The overhead construction was done under the supervision of Mr. J. Lawson, foreman of the Canadian General Electric Co., with Mr. E. C. Breithaupt as Consulting Engineer. The car equipments are of the C.G.E. type, and the necessary power is furnished by a 60 K.W. Edison bi-polar generator, recently installed by the Berlin Gas Co. for the purpose.

THE GUELPH ELECTRIC RAILWAY.

MR. GEO. SLEEMAN has commenced active operations on the construction of his new electric railway in Guelph, and has awarded the contract for the entire electrical equipment and cars to the Canadian General Electric Co. About 4½ miles of the road will be constructed this year, extending from the Agricultural College to the Cemetery in one direction; a second line running from Mr. Sleeman's brewery to the Grand Trunk and C.P.R. depots. The power house and car sheds adjoining will be a solid stone structure of handsome design, with pits in the latter extending the full length of the tracks. The site selected is an excellent one, near the brewery, provided with an ample supply of water for condensing.

The track will consist of 56 lb. T rails, laid on squared cedar ties, and the overhead structure will be for the most part cross-suspension. The rolling stock at the start will comprise three closed and two open cars, each of the former being equipped with two C.G.E. 800 motors, mounted on Blackwell trucks. The car bodies are to be 21 feet long, with removable vestibules and interior fittings of the most elegant description.

The generating plant will consist initially of a cross-compound Wheelock engine, driving a one hundred kilowatt generator of the Canadian General Electric Co.'s multipolar type.

Altogether the Guelph road promises to be when completed at once a credit to the enterprise of Mr. Sleeman and a model of electric railway construction.

THE INTERURBAN ELECTRIC RAILWAY.*

BY S. H. SHORT.

STUDENTS in political economy deplore the tendency of our people to congregate in or immediately around cities, but the practical street railway man sees right here one of the greatest fields for his work, with the best promise of great profits, for which he is always looking. Every city of more than 50,000 inhabitants has, just beyond its limits, within a radius of fifty miles, a large population more or less dependent on it for business and supplies. These hangers on are more apt to form their own little communities and villages than to be entirely isolated, and these settlements are universally upon roads which furnish a comfortable means of access to the common centre. The steam railroads have long since catered to these "outside citizens" with local trains running at short intervals during the busiest portion of the day; but this service, being expensive and limited, has not quite satisfied the American people, who want to go just when they please, as rapidly as possible and for as small a sum as may be. Into this ready made business the interurban railway companies must step, with all the accommodation of a street railway, cheap fare, frequent stoppages and more frequent trains, greater cleanliness and even higher speed than the steam roads.

This service will be found to be of mutual benefit to both city and surrounding country. It has often been proved in street railroading that an increase in the number of trains has brought out an immediate and entirely disproportionate increase in the travel, and this can be easily accounted for. If it is possible for one to reach the business centre easily and quickly from a quiet home on the outskirts, where there are no city taxes, noises or nuisances, he will be very apt to purchase such a home and become a regular patron of the road which accommodates him. The city has the benefit of his money and trade, the country of his beautified home and the increased value of the surrounding property, and the railway of his goings to and fro, and as we are none of us disinterested, all three can rejoice. That the electric railway, when properly constructed and operated, is best adapted for this interurban service is fast being acknowledged by all classes of railroad men, and the eagerness of capital to invest in such undertakings is growing daily. I therefore propose to discuss the various points developed in this new branch of travel, from the side of the practical working, making an effort to care for both the comfort of the passengers and the assets of the company.

After selecting the country through which an interurban railway is to be run, the point of next greatest importance is, where the road-bed should be constructed. There are two possible locations, one along the existing common highway, connecting the termini of the road, the other over a private right of way similar to a steam railway. Each has a number of points in its favor, and generally local conditions must be considered in making a decision. The latter is most tempting in its freedom from obstructions consequent upon the general travel of a highway, the power to establish grades and curves, and chiefly the liberty to maintain a high rate of speed. It will be most advantageously used when the road is intended to operate between a few stations of considerable distance apart. But in most cases it will undoubtedly be best to adopt the public highway, as along this road will be found the greatest number of people, and upon them the success of the road depends. These highways are usually arranged with two roadways, one well macadamized and the other a dirt road. On either side of these is often found a considerable space, before the fence is reached, which is used for drainage purposes, and with very little work one of these spaces may be prepared for the track.

In the construction of the road I would advocate as few grades (never exceed 5 per cent., or 250 ft. per mile) and curves as possible, owing to the high rate of speed which it will be necessary to maintain, but always keeping near the highway.

The road bed itself should be prepared according to the best received practice in steam railroad construction—ties close together—a sixty or seventy pound rail and stone or gravel ballast, with the rails far above the surface of the road, which keeps them clean and dry, affording good traction and a smooth rail. As much care should be taken in holding the rails at the joints and upon the ties as though steam passenger trains were to be operated on the line.

When a single track road is constructed, sidings should be provided, not only for the passing of trains, but occasional ones where cars may be left for light freight or market produce. These sidings should be provided with the latest and best automatic switching devices, or lock switches, with signal targets and lamps attached. Where very high speed is to be maintained, or the trains to be very frequent, a double track throughout should invariably be constructed, for, while the outlay at first may seem very large, the greater convenience, safety and efficiency obtained will soon repay the additional cost.

The overhead trolley wire with the ordinary under running trolley is undoubtedly the only method to be considered for supplying the car with current. The wire should be of large size, certainly not less than No. 00 B. & S. It should be held with flexible supports, the best construction being a cross wire attached to poles on both sides of the roadway. Where this is not possible a single wire pole with brackets may be used, but some flexible support between the trolley wire and the arm must be provided in order that the trolley may be obliged to lift the weight of the wire at all times, and the wire be free to follow all slight movements of the trolley arm.

The poles should be put far enough from the cars to make it impossible to reach them from windows or platform. These same poles can be used to support the supply wires, and telephone and signal lines for the convenience of those operating the road.

Regular stopping-places should be provided along the railway

*Abstract of Paper read before the Cleveland Electric Club, May 22, 1895.

line, as it would be out of the question to stop wherever signalled. The intervals between these stops should be as great as possible without too seriously inconveniencing the people, as the time consumed in stopping and starting would make large inroads on the schedule time of the trip. Shelter should always be provided at these stations, and they can be lighted from the trolley wire.

When the interurban road enters large cities with existing street railway lines, it is generally possible to make a traffic arrangement whereby trains can be run directly into the heart of the city. This should be done, as it avoids discomfort and the delay of a transfer of passengers.

The rolling stock equipment for the interurban electric railway requires most careful and intelligent consideration. The requirements differ so greatly from ordinary street railway customs that we have little to guide us save ordinary steam railway practice. I will, therefore, endeavor to place before you information gained from the use of electric motors for tractive purposes, and apply it to the new conditions met with in this class of work. In almost every case the interurban road enters into competition with some steam railway, and is, therefore, called upon for the same or better service; so high speed is the first requirement.

The cars should be built like those found most practicable for passenger coaches on steam roads. The body should be about forty feet long—fifty, including the platforms—mounted on double swivel trucks which have thirty-three inch or thirty-six inch wheels, with wide tread and deep flanges. The wheels should all be of the same size, and the trucks centrally pivoted so the weight will be equally distributed on all the wheels. The trucks should be provided with both elliptical and spiral springs, as on all high speed coaches. Such a car will seat fifty passengers, hold 100, weigh, empty, about twelve tons, and about twenty tons when filled with passengers and fitted with its electrical equipment of two fifty horse-power motors. This car will run at a speed of thirty-five miles an hour on the level, and make a schedule time of twenty-five miles, including stops and slow speed on curves and grades.

The motors should be mounted one on each truck. The controlling apparatus should consist of the ordinary series parallel controller, worked by hand, and an air brake outfit of the regular Westinghouse type, with an air compressor operated by a separate motor automatically controlled by the air pressure.

Believing it to be absolutely necessary to use air brakes on these high speed cars and trains, we have designed an air compressor with a special small motor to be placed in the motorman's cab. When the air pressure reaches a point below normal in the main reservoir, the current is automatically turned on, and the motor pumps in air till the pressure is restored; then the current is cut off from the motor. This air pressure may be made to operate a signal whistle, and to force water from a tank under the car into wash basins, closets and drinking faucets.

The train should be lighted thoroughly with incandescent lamps, and the interior finish should be good quality and attractive. The entire train is heated by electricity directly, or probably more economically by hot water obtained by immersing resistance coils in water tanks provided for the purpose.

Trains of more than two cars, of heavier cars, or requiring higher speed, must have larger motors, preferably of the gearless type, but for such work as specified, the single reduction gear motors are best adapted. All motors should be as nearly spring mounted as possible, to save destructive blows upon rail joints and wheels.

Engineers, in dealing with problems in interurban railways, should exercise the greatest care in making out specifications for cars, motors and generating plants, as there has been very little data obtained from larger motors than the so-called twenty-five horse power machine, and their performance on ordinary street railways. I take the liberty to present a number of facts gleaned from our own experience, and all conformable with regular practice, which may form a basis for all preliminary calculations.

The standard motor will give its full rated brake horse power for one hour without heating more than 150 degrees above the surrounding air. This motor will not run continuously doing this work without danger to its insulation, but it may temporarily, in starting or accelerating a train, take 100 per cent. overload without injury or sparking, while the efficiency at this extreme overload will remain high. Such are its peculiarities.

Our last problem is that of the distribution of power to our railway system. It is seldom practicable to have more than one power station, so it is always best to place the station as near the centre of the line as possible, and feed in both directions. Where the line is short and traffic not heavy this can easily be done, but when long, several methods may be used to maintain a constant E. M. F.

The "booster" system is one which may be used where fuel is inexpensive, and consists in placing a small series machine on the long feeders, whose capacity is just large enough to supply the losses and maintain a constant E. M. F. on the distant trolley. This may be carried to any extent, but it is not economical, as the extra watts are all destroyed by the feeders and do no useful work.

The alternating current method, by which the feeders are charged with a pressure of 2,000 volts or more, and rotary transformers used at intervals to reduce the pressure to 500 volts and change the current to a direct one, is very good, but the regulating apparatus is very complicated.

A more direct and practicable method, we believe, is to have an armature wound for both 500 and 1,500 volts, with a commutator on each side. This needs no separate exciter, and can be so designed as to regulate for the drop on the trolley feeders as the load comes on, thus maintaining absolutely the full E. M. F. so necessary for high speeds.

I have recently designed machines of this character and believe they will give better results than any other method proposed.

I give below a table comparing the amount of copper necessary in the feeders for a fifty-mile road, running trains of two cars equipped with 100 H. P. motors, on a half hour headway, eight trains in operation at all times, when fed from a central station at 100 volts by the old method, and with 1,500 volts using sub-stations with these direct current transformers.

RELATIVE AMOUNT OF COPPER REQUIRED WITH AND WITHOUT ROTARY TRANSFORMERS.

Figures based on a 50-mile road, double track, 8 64-ton trains, each equipped with 2 100 H. P. motors, schedule time 25 miles an hour. R of return ⅓ of total.

1 CENTRAL STATION.	1 CENTRAL STATION.	1 CENTRAL STATION.	1 CENTRAL STATION.
Ordinary 500 Volt Distribution.	2 Rotary Transformers 1,500 Volts Transmission.	4 Rotary Transformers 1,500 Volts Transmission.	6 Rotary Transformers 1,500 Volts Transmission.
Copper = 100.	Copper = 48.7.	Copper = 23.3.	Copper = 13.9.

The ideal system of transmission, however, is an alternating current on the feeders at high pressure, stationary transformers at regular intervals between feeder and trolley lines, reducing the current to 500 volts, and an alternating street railway motor on the cars. But the last is not yet forthcoming, and while it is possible to operate induction motors successfully, their tendency to synchronism renders them exceedingly low in efficiency when run at varying speeds, and the controlling devices become very complex.

However, we await the development of the motor, which will enable us to extend our interurban railways into transcontinental lines speeding from ocean to ocean at 100 or more miles an hour.

A successful trial trip was recently made over the newly constructed electric road between the towns of Waterloo and Berlin.

A proposal has been made for the construction of an electric railway from Port Hope to Bewdley, on Rice Lake, a distance of nine miles.

Notice is given that the Canada Switch Mnfg. Co., Limited, will ask for authority to extend the powers of the company so as to enable them to engage in the manufacture, purchase and sale of all kinds of railway, electrical, chemical and contractors' supplies.

The London City Council have passed a by-law and draughted an agreement under which the street railway system of that city may be changed to the electric system. A special general meeting of the shareholders of the street railway company will be held on the 6th instant, to ratify the by-law and agreement, and to take into consideration and decide upon changing the motive power to electricity, and to authorize the increase of the capital stock of the company to $250,000 and the issue of debentures for this amount.

PERSONAL.

Mr. G. W. Moss, Vice President of the Bell Telephone Co. of Canada, died in Montreal on May 22nd, at the age of fifty-nine years. The deceased gentleman came to Canada from Lincoln, England, upwards of 30 years ago, and was for many years prominently identified with the dry goods trade. He was held in highest esteem by the business community. He had been in ill health for nearly 20 years. At a *special meeting* of the directors of the Bell Telephone Co., held on the 27th ultimo, the following entry was ordered to be made on the minute books of the company: "The directors record the death, on the 22nd May, 1895, of *their honored friend* and associate, Geo. W. Moss. Mr. Moss became a director of the company in the year 1881, and served continuously and faithfully for fourteen years Since May, 1890, he has filled the office of vice-president. He was a man of remarkable intelligence, of good business judgment, and most generous impulses. He took a most lively interest in the welfare of the company and in the plans for its future development, in all of which his advice was of great value to his associates on the board, where his place will not be easily filled. The directors place upon their minutes *this tribute of their* affectionate remembrance of Mr. Moss and of sincere sympathy with his family in their bereavement"

SITUATION WANTED

ADVERTISER HAS HAD SIX YEARS' EXperience in management of rail and tramway traffic (passenger and commodity) and would take charge *of this department, or* sole charge of *new or other* electric line; energetic and capable; age 32; understands how to work up business; best of references both as to ability and character. *Address* BOX 24, ELECTRICAL NEWS.

PUBLICATIONS.

One of the most valuable papers in the June Arena is "A Review of the Brooklyn Street Railway Strike," by G. Emil Richter.

The Canadian General Electric Co. have in press a new and most elaborate illustrated catalogue of their railway, lighting and power apparatus.

It is reported to be the intention of the C. P. R. to construct an electric tramway from Three Forks to Sandon and Cody Creeks, B. C.

Mr. T. Silvene, of Victoria, B. C., a locomotive engineer on the E. & N. Railway, has secured a patent for an air brake, which is declared by railroad men to be an improvement on the Westinghouse air brake. Mr. Silvene has already received several handsome offers for the purchase of his patent.

A pleasure park has been purchased by the Kingston Street Railway Co. on the outskirts of that city. A new branch line leading thereto went into operation on the Queen's Birthday. The Kingston Street Railway is in the hands of an enterprising company, who furnish an excellent service, and it is the boast of the citizens that the car equipment of the road is the finest in Canada.

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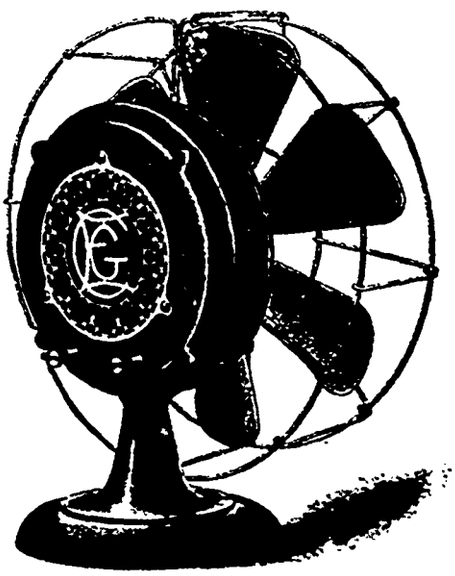

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24 " 30 " " "
34 " 35 " " "

In lots of 100 or more.

WRITE FOR OUR NEW ILLUSTRATED CATALOGUES OF RAILWAY, LIGHTING, AND POWER APPARATUS.

SPARKS.

An electric lighting company is being promoted at Sussex, N B. If it is decided to form the company, the plant will be got ready for operation by the first of September

The town of Hastings is to have incandescent light. A local company has taken the matter up and closed a contract for the necessary plant with the Canadian General Electric Co.

Incorporation has been granted to the Ingersoll Electric Light and Power Co., Limited, with a capital stock of $45,000. The company consists of Messrs. Stephen Noxon, John Gayfer, Alfred E. Gayfer, Henry Richardson and George E. Gayfer, of Ingersoll.

A special committee appointed by the Quebec city council to consider and report on the offers of the syndicate represented by Mr. Beamer, for the running of electric cars through the streets of the city, recommend that the company be required to make a deposit of $5,000 with the city treasurer on a thirty years' contract, that for the first three years the company be not required to pay any percentage of receipts to the city; that for the subsequent twenty two years, the company pay to the city four per cent. on gross receipts, and five per cent. for the remainder of the term of the contract, the franchise not to be an exclusive one, and the contract to be renewable every five years after the expiration of the thirty years for which it is originally made; the company to have three months in which to commence the construction of extensions of lines in any of the suburbs which may hereafter be annexed to the city; the company's work shop to be located in the city of Quebec; cars to run between 6 a m. and midnight, or longer at a speed not exceeding eight miles per hour, and the company is to be responsible for any damages resulting from negligence or otherwise. In winter time, the company may, if it chooses, substitute sleighs drawn by horses. A model of the proposed cars is to be submitted for approbation to the City Engineer, and he will fix the number of persons to be carried in each. All expenses of laying the rails, &c., are to be borne by the company. The first track is to be completely finished by January 1, 1897, and the whole line by June first, 1898. The price of a single ticket for adults is fixed at 5 cents, including transfers, and 10 cents after 10 p. m. Reduced rates are to be given to children. Six tickets are to be given for 25 cents, and twenty-five for $1. Each infraction of any of these stipulations is to be punishable in the Recorder's Court by a fine not exceeding $40.