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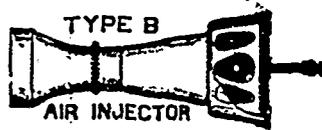
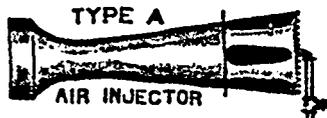
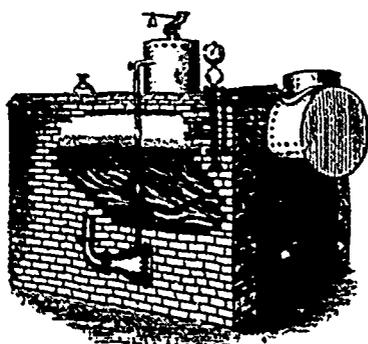
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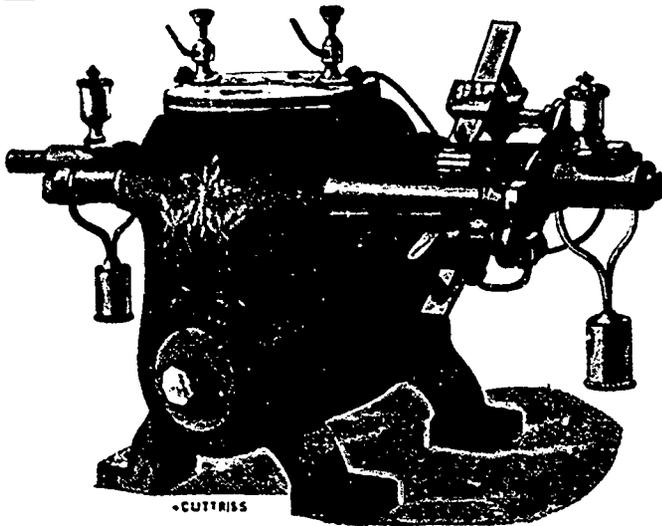
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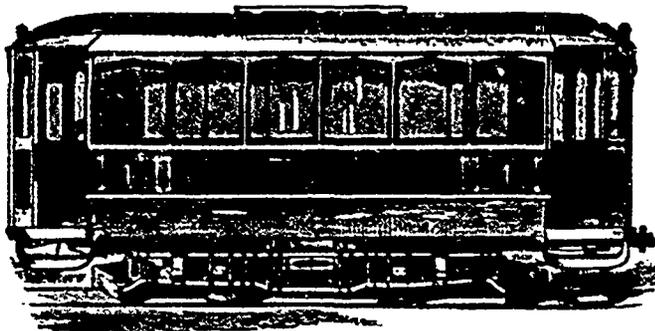
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CANADIAN
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VOL. II.

TORONTO AND MONTREAL, CANADA, OCTOBER, 1892.

NO. 10.

BOILER EXPLOSION AT STAPLES, ONT.

On Saturday, the 17th of September, a serious boiler explosion occurred in the village of Staples, County of Essex, Ontario. Staples is a village of recent origin, and is a station on the branch line of railway from Comber to Leamington. The village contains four saw mills and dwellings of the workers. It is surrounded by hard-wood bush, and the chief employment at the mills is cutting and bending the wood and the making of staves for barrels.

Messrs. Force & Dickson had two steam boilers in their

were suggested, such as that the tubes were rotten, and that scale inside caused the bottom to become red hot, but the jury very wisely did not endorse any of these opinions.

An examination of the remains of the exploded boiler showed that several portions had gone completely out of sight, nobody knew where.

The boiler was an ordinary tubular boiler, built in Detroit about nine years ago, and made of charcoal hammered iron plate fully one quarter of an inch thick. It had been twelve feet long and four feet in diameter, and had a dome about 20 in. diameter.



SCENE OF BOILER EXPLOSION AT STAPLES, ONT.

stave mill. They were horizontal tubular boilers, encased in brick-work. On Saturday morning a few of the men had reached the mill before starting time, and as it was chilly, were near the boilers to warm themselves.

The engineer was preparing to start one of the engines, and was in the act of turning the fly wheel to bring the engine in proper position for starting, when one of the steam boilers exploded.

The explosion was a very violent one, causing the death of seven men and the complete destruction of the mill. The accompanying illustration gives some idea of the destruction caused by it.

The exploded boiler was torn into a number of pieces and scattered about the mill yard and into the bush beyond. The other boiler was driven out of its brick setting and broken in several places.

A coroner's inquest was held, and the jury found that the death of the man whose body formed the subject of enquiry was caused by the boiler explosion, and that the explosion was accidental and from a cause not known to the jury. Various theories

The dome had parted from the shell, tearing the plate near to the dome flange. The part of the shell immediately under the dome was flattened out and lay only a few feet from the original position of the boiler. The upper part of the front of the shell had taken a flight upwards, and lay not far from the dome. The other portions of the shell plates were missing.

The explanation of the cause of the explosion does not seem very difficult. The dome having gone up, and the shell plates under it being flattened out and left near the original site, suggest that the rupture commenced around the dome. The appearance of the fractured plate still rivetted to the dome agrees with this idea, as one part seems wasted and reduced in thickness to about one-half that of the rest of the plate. The man-hole plate was not among the remains, and if it were found might give a better explanation than the one suggested.

The boiler had been covered over with brickwork, and a leak at the dome flange could not have been seen and was probably the cause of the corrosion now visible.

The boiler had not been inspected by anyone competent to do

such work since it was erected in Staples. The number of killed in this case, and the distressing condition of some of the families left, are strong arguments in favour of some plan being devised for the prevention of boiler explosions.

The jury, in their verdict, said: "We would earnestly recommend that users of steam should be compelled by law to have their boilers thoroughly tested at least once a year, and that some law enforcing a system of examination for engineers of stationary engines should be enacted and certificates granted to those passing such examinations, proving themselves competent to take charge of engines, and that a penalty be imposed upon any person assuming the charge of an engine who had not a certificate."

THE ACTION OF THE FLY WHEEL.

A fly wheel acts solely by its inertia. While the engine is up to its speed, the fly wheel is absorbing power. Any sudden and momentary tendency of the engine to increase its speed is counteracted in great measure by the fly wheel, which if heavy enough and of sufficient diameter, absorbs nearly all the excess, paying it out gradually until its normal speed is again reached; thus making of what might otherwise be a running away or racing, only a slight gradual increase of speed, followed by a gradual decrease to the normal amount, if the conditions remain normal. In the same way any sudden and momentary tendency of the engine to slow up would be met by the fly wheel by a giving out of momentum; so that what might be a very considerable momentary slowing up, is changed to a very slight and gradual decrease of speed, followed (if the conditions are restored to their normal state) by gradual return to the normal speed. In other words the fly wheel acts as a store house of power. Its inertia causes it to oppose any tendency either to slowing up or speeding up. The greater the weight of fly wheel rim for a given diameter and rotation speed, the heavier the rim for a given diameter and rotation speed, and the faster the rotation speed for a given rim weight and diameter, the more efficient it is in keeping the rotation speed uniform; so that where there are expected great variations of pressure or of load, or where great regularity is intended, it is only necessary to sufficiently increase either the rim weight, the diameter, or the rotation speed.

It must be remembered that a fly wheel can take off only momentary variations in pressure or in load. It only distributes through many rotations an excess of power that would be inconvenient if used up during a few; or stores up in retaining the regular rotation speed, enough power to keep the engine going for a few turns at nearly the regular speed, in case of momentary increase of load or decrease of pressure or of load. If the load were taken off and the pressure kept up, or the load kept the same and the pressure doubled, the engine would run away and probably wreck itself, despite the fly wheel; and *vice versa*, if the load were doubled and pressure not increased, or if the load remained the same and the pressure fell to one half, the engine would slow down, fly wheel or no fly wheel.

SOME OF THE TROUBLES OF MANUFACTURERS OF INCANDESCENT LAMPS.

WE suppose it will be conceded that every trade has its troubles and every manufacture its difficulties, and that these conditions govern to no small extent the selling price of the commodities; those who vehemently complain of the price they have to pay for their incandescent lamps will do well to bear in mind this platitude. There is scarcely any manufacture that could be instanced in which there is more loss from what may be termed "spontaneous" breakage. Finished lamps apparently well made and of the best material will for no very obvious reason crack without having been subjected to any shock or blow. Manufacturers of incandescent lamps always expect a reasonable amount of loss from breakage, but when a certain limit is exceeded some special cause is generally suspected to be operating, such as carelessness in the glass-blowing department, imperfect annealing, &c. Lamp-bulbs may exhibit this spontaneous cracking as a rule in three *loci*:—1. Where the platinum wires are sealed in. 2. Where the "stem" carrying the wires and carbon filaments is joined to the bulb proper. 3. Where the exhausting tube is sealed on at the apex of the bulb. Now in addition to the internal stresses existing in any such class of work, the lamp bulb when finished is subjected externally to the full atmospheric

pressure, and in, perhaps, the majority of lamps in use, the bulb is subjected to sudden heat stresses due to the instantaneous turning on of the current. This combination of stresses being considered, it is evident that differences in the glass used for the bulb and "stem," and consequent differences in the values of the coefficients of expansion will become of special importance; although in the case of ordinary glass-work subjected to no particular stress, such differences would be negligible. Glass blowers know by experience that similar grades of glass should be used together, but they are skilful enough to be able to work up grades of glass differing in composition far more than is permissible in incandescent lamps. Dr. Durand Woodman has had his attention called to this matter by an American firm of incandescent lamp makers, and he was able to investigate the character of the glass at a time when a percentage of spontaneous breaking was abnormally high, whilst every care in making up the lamps, in annealing, &c., was unavailing. A number of samples of glass rod and tubes used in making the bulbs were examined chemically. From the results Dr. Woodman concluded that the high spontaneous mortality was caused by using different grades of glass in making the lamps. The lesson to be derived from this investigation is obviously that it is desirable to use the same glass in every part of a lamp, or at least glass of practically the same composition. It has been asserted that some glasses of different composition may have similar coefficients of expansion, owing to the constituents compensating each other's effect, but the determination of this characteristic involves problems connected with the coefficient of expansion, which after all are unnecessary trouble, since it is a simple matter to obtain glass of practically the same composition for all parts of a lamp, or for any other complex glass-work.—*London Electrical Review*.

PLAYING CHESS BY TELEPHONE.

LAST December two chess clubs, one in London and the other in Liverpool, played a match game of chess by telephone. The distance between the two cities is about 200 miles. The telephone company arranged to have the receivers and transmitters connected with a direct wire between the two clubs, and stationed in the club room at each end. The success was perfect. As each move was made on the chess board it was at once telephoned to the other club, and the two games proceeded without any hitch or interruption. Several hours were consumed in the games, and when they were concluded every one was congratulated on the success of the experiment. Chess playing is a recreation which is peculiarly adapted to electricians, and many of them are good players and members of chess clubs. One reason why there have been so few team matches between different clubs has been the difficulty of gathering a team which could spare the time and expense involved in inviting another city to play the match. But the telephone affords a ready means by which games and matches can be played at a comparatively small expense, and without the members of either club leaving their own comfortable rooms. The success of the London-Liverpool experiment opens the way to many such experiments here, and there is no reason why the clubs in the cities should not play telephonic matches not only with each other but with clubs in adjacent cities.

AN ADVERTISER WHO TALKS BY THE BOOK.

ON Friday, an advertiser who has sent us a good many checks, says the *Northwestern Lumberman*, comfortably filled up a good arm chair, and talked considerably about advertising. "When I buy advertising," he said, "I want to feel assured that the paper in which I have space goes to the men whom I desire to reach, and, further, that the people to whom it goes have a good opinion of it. I place my advertising on that basis. I used to think that I did not receive my money's worth unless I could trace a certain number of sales to some particular ad. I am over that. I meet the demand of machinery in my line, and having done that I want to be known, and known all the time. I advertise, say in a dozen papers, and a man comes along and buys a big bill of goods. Can he tell me what particular paper directed him to my work? No; not once in a hundred times. I have been advertising for years so he may know where I am, and when he wants to buy he comes to me. Make first-class machinery, and let everybody know where the machinery can be had, and then treat your customers white, is the way to get business."

ELECTRIC HEATING.

SOME interesting and successful experiments in the line of heating by electricity have been in progress at Ottawa, Ont., for nearly a year past. The apparatus employed is the invention of Mr. Ahearn, general manager of the Ottawa Electric Street Railway. We reproduce from the *Western Electrician*, the following particulars and illustrations of the apparatus :

A cross-section of the electric boiler for car heating is shown in detail in Fig. 1. It consists of a shell or tube *a* of oval cross-section, within which is placed another similar but smaller shell

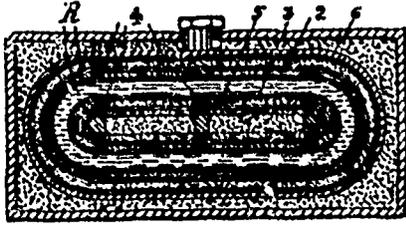


FIG. 1.

b, the two having their ends suitably joined to form a water space between them, nozzles being provided for the circulating pipes. The vessel thus formed has its exterior surfaces insulated with strips of asbestos *d*. A core, *e*, also insulated with strips of asbestos, and wound with a resistance coil *R* of German silver inserted in the inner vacant space of the shell *b*, and is of such a size as to press the wires *R* against the insulation of the shell *b*. A similar resistance coil *R* is also wound upon the insulated shell *a*, the terminals of the coils projecting. The vessel thus formed is placed in a casing *6*, the terminals of the coils passing through insulators, and all the vacant spaces inside the casing being filled with powdered whiting. This casing is then wrapped in sheets of asbestos and inclosed in a wooden box secured to the under side of the car floor. Two of the boilers are used in each car, being placed in diagonally opposite corners, each supplying a set of circulating pipes. The resistance coils are placed within the car circuit. The nozzle in the upper side of the boiler

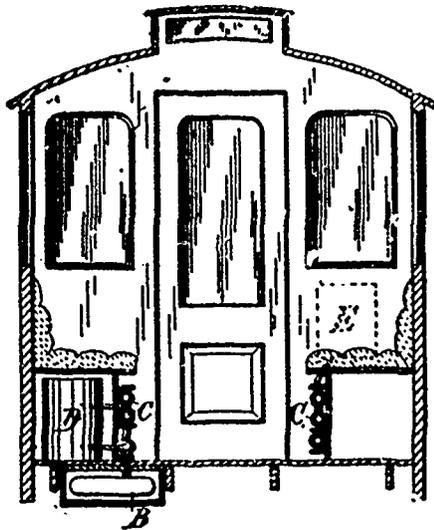


FIG. 2.

is connected with an upright supply pipe ; from this the radiating pipes *C* branch off, running to the other end of the car, where they are connected with another upright pipe. From this last mentioned upright pipe a return pipe passes through the floor and enters the boiler by the lower nozzle. A water reservoir *D* is placed under the seat and communicates with the flow and return pipes to keep the circulating pipes full of water and to compensate for evaporation. An expansion tank *E* is placed at the end, away from the boiler, one in each set of pipes. This tank being high and flat, is concealed in the end panel of the car, and it provides for the variations in the level of the car and the water.

The liquid heater shown in Fig. 3 was next devised. This heater is of handsome design, with a water glass on its side showing the height of the water within it. This type is wound for all voltages, and has, it is stated, been used for the last three months with most satisfactory results by patrons of the *Chaudiere Electric Light Company* of Ottawa, which company uses the Westinghouse alternating system. These heaters are

used by barbers, druggists and for domestic purposes. A livery stable keeper uses a three gallon heater, the hot water being applied to clean harness and bathe horses' feet. The heater shown in Fig. 3 requires 3½ amperes at 50 volts. Such is its construction that when in use in barber shops the water in it is



FIG. 3.

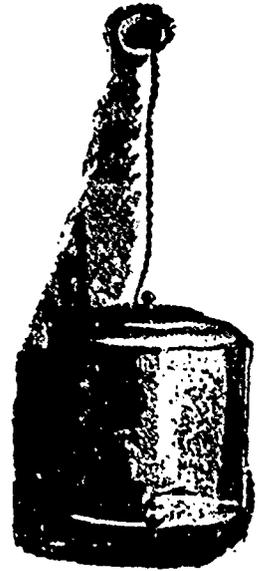


FIG. 4.

found sufficiently hot for shaving in the morning, although the current has been off all night.

In March last Mr. Ahearn had constructed and put in operation in the residence of ex-Alderman Johnstone the electric furnace shown in Fig. 5. This outfit has been in successful and continuous operation since being installed, and has attracted much attention. The large coal furnace abandoned for the small perpendicular electric furnace shown in Fig. 5 suggests immense possibilities for electric heating. The heated water passes upward into the 63 gallon tank in the corner, from which it flows to the two upper stories of Mr. Johnstone's residence, supplying three bathrooms and one kitchen sink. The fact that hot water is being constantly drawn off, and cold water taking its place, is a much more severe test upon the furnace than if the water was being used for heating purposes only, as in the latter case the water is being circulated always. Mr. Ahearn

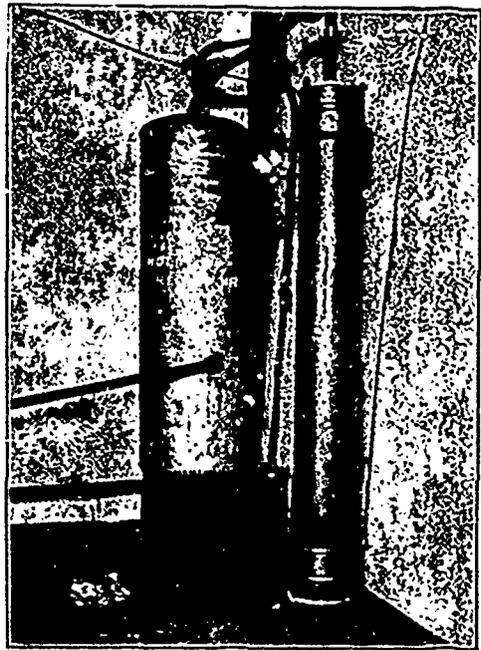


FIG. 5.

has applied this principle to the hot water apparatus employed for car heating.

Mr. Ahearn, proposes this year to equip all the cars, the car shops and the new power house, with his new system of electric hot water heating. He has also arranged with C. F. Sise, president of the Bell Telephone company of Canada, to heat the new telephone building now being erected in Ottawa. This installation alone will require 6,000 feet of pipe. For this undertaking the 50 volt alternating current will be used.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

THE third annual Convention of the above Association was held in Maccabees Hall, Hamilton, Ont., on August 30th and 31st.

The President, Mr. A. M. Wickens, being unavoidably absent, the Convention was formally opened by the Vice-President, Mr. Mackie.

The minutes of the last Convention were read and adopted.

Moved by Bro. Hunt, seconded by Bro. Blackgrove, that Bro. Edkins read the

PRESIDENT'S ADDRESS.

"In opening this, our third convention, my first duty will be to congratulate you upon your fortunate selection of the ambitious city as your place of meeting, and to express myself as exceedingly pleased to see so many of our oldest and best tried members here as representatives. I also wish to thank the officers of the Executive Council and the officers of the different Associations for the very cordial support they have given us during our term of office, now extending over two years. Our Associations are steadily increasing in membership, in usefulness and influence. The older Associations are receiving a support from the manufacturer and the steam user, proving conclusively that we are working in the right direction, that our principles are such that no man, whether employee or employer, can afford to ignore us, that we are founded on a rock, the name of which is "Education," and that if we are true to the constitution, true to the promises we made when joining the order, we must become a grand influential and useful body, looked up to and respected by all classes of citizens. Our Associations are spreading to the east, to the west, to the north, and I can confidently say the time is not far distant when we will extend from the Atlantic to the Pacific an unbroken chain of careful, energetic and brave men who will not be left behind, no matter how fast the Inventor and Engine builder may improve and change the steam plants that may be placed under our charge. We are proud of the fact that the members generally are developing a strong fraternal and brotherly feeling, and are in reality helping each other over the hard sports in our journey through life. Brothers, always remember that a complete rope is stronger than a single strand. While our increase during the year has not been as rapid as it might have been, we are pleased to report the opening of one new association in Montreal (D. D. Bro. Thos. Ryan) and the members of Montreal No. 1. Have done well in assisting to organize the French Engineers of that city: who were granted a charter as "St. Laurent No. 2, of Montreal," and the privilege of working in their own language was also granted by the officers of the executive. It is to be hoped that the good work will not end at the one French Association, but that we may yet report several.

Unity Association, No. 5, of London, which had lapsed, has been mainly through the efforts of Bro. Edkins, reinstated, and is now in a fair way to show good work and eventually be of great assistance to the engineers of that city. I am sure all the delegates present will join me in wishing both new Association *God speed.*

The legislation to come before us at this session, while it is not great in amount, is of the utmost importance, and will include a few changes in the constitutions of the C. A. S. E., the consideration of some kind of an accident and life insurance scheme, the adoption of a pin, button, or badge, and the organization of some plan to assist the Association to a regular system of educating their members.

I hope the delegates will earnestly examine everything which comes up and let us sift out, and adopt such measures as will strengthen our order and bind us more securely together.

Our Recording Secretary will give you an account of the membership and finances of the order in as far as he can, I would ask the delegates to impress upon the minds of their Association Secretary the necessity of forwarding these reports to the Secretary of the executive, say during the month of July, so that he may have time to make out a correct report before the convention meets. Let us all do our whole duty and make this coming year a red letter year in the history of the C. A. S. E.

I again thank you for your cordial support of the executive officers and hope you will continue it in a greater and if possible stronger sense to our successors in office.

The Secretary presented his annual report as follows :

SECRETARY'S REPORT.

In making out my annual report for the past year, I regret that I cannot present to you a full report of the financial and numerical standing of the Order. For some reason the Secretaries of some of the Associations have not sent in their half yearly reports with the per capita tax, as provided for in the constitution of this Executive. It would be well in future if the different Secretaries of the Association would attend to this matter of detail, as without such reports, it is impossible for the Executive Secretary to get out a proper statement to present at the yearly meeting for the information of the delegates. I would also remind the brethren that no Association is entitled to receive the password for a new term until the said half yearly re-

port has been sent in. The only Associations from which I have received a proper half-yearly report are: Brantford, No. 4, and Montreal, No. 2.

	Members on Roll.	Expelled.	Cash Received	Expenses.	Cash in Bank.
Brantford, No. 4.	13	N. P. D. 2	\$34.95	\$43.45	\$20.15
Hamilton, No. 2.	37				
Montreal, No. 1.	74	3	\$234.35	\$211.03	\$126.02
Montreal, No. 2.	88	2	\$260.25	\$119.31	\$60.94
Toronto, No. 1.	68		\$246.85	\$338.78	\$172.15
London, No. 5.	19				
Brandon, No. 1.		No Report.			
	299	7	\$773.40	\$792.57	\$380.15

Moved by Bro. Hunt, seconded by Bro. Ogle, that the President's address be received and placed on file. Carried.

Moved by Bro. Hunt, seconded by Bro. Sweet, that a vote of thanks be tendered to Bro. Wickens for his valuable work during the past year. Carried.

Moved by Bro. Hunt, seconded by Bro. Mooring, that Bro. G. Robertson, of Montreal, assist Bro. Edkins as Secretary of this Executive. Carried.

Moved and seconded that the Convention adjourn till 7:30 p.m. to-night when the meeting be open to all Engineers and the public. Carried.

EVENING SESSION.

The Convention opened at 7:30 p. m., with President A. M. Wickens in the chair.

A paper was read by Bro. A. E. Edkins, on "the Care of Steam Boilers," at the conclusion of which a long discussion took place, and was most interesting.

Bro. Wickens then gave a very interesting address on "The Stationary Engineer, and what Constitutes an Engineer."

After considerable discussion on Bro. Wickens' paper, it was moved and seconded, that a vote of thanks be tendered to President Wickens and Secretary Edkins for their valuable papers. Carried.

Bros. Wickens and Edkins replied in suitable terms.

Ald. McAndrew, who was present, was then called on for a few remarks, and in response made a eulogistic speech. He spoke very highly of Hamilton No. 2, and its members, and the order generally as he had observed it.

SECOND DAY.

The Convention resumed at 10 a. m., President A. M. Wickens presiding.

The Committees on "Constitution" and "Good of the Order" reported progress.

The Finance Committee reported as follows :

Your Committee have examined the books and vouchers and found the receipts and expenditures for the current year to be as follows:

Receipts.....	\$77.05
Disbursement.....	\$12.50
	\$64.65
Outstanding dues.....	\$11.85

Your Committee recommend that an order book be procured and all demands on the treasurer be signed by the President and Secretary.

Your Committee would also recommend that the mileage rates be paid the various Delegates and members of the Executive Council as follow :

Executive Council (5).....	\$7.20
Montreal (2).....	\$39.40
Toronto (1).....	\$2.40
Brantford (1).....	\$1.50
London (1).....	\$4.30
Brandon (1).....	\$2.50
	\$57.20

E. J. PHILLIP.
WM. A. SWEET.
CHAS. HEAL.
FRED G. MITCHELL.

Moved by Bro. Hunt, seconded by Bro. Blackgrove, that the Convention adjourn till 11 a. m. to give the various Committees a chance to prepare their reports. Carried.

The Convention reopened at 11 a. m.

The Committee on "Constitution and By-laws" presented the following report :

"We recommend amendments to the Constitution as follows : "

- 1st. That the preamble of constitution be placed first on the constitution of the Executive council.
- 2nd. That in article 6, section 1, the word "thereof" be struck off and "ten" be placed therein.
- 3rd. That in article 12, section 2, the following addition be attached.

That no subordinate Association receive the password until the Secretary receives their report and per capital tax."

4th. That in article 8, section 6, the duties of the Doorkeeper read as follows: he shall have charge of the door and shall not allow any member to enter or retire during opening, closing or Initiatory ceremonies, or whilst a member is addressing the chair.

5th. That heading read "Constitution for Subordinate Associations, that the by-laws be detached from the Constitution, that all printed matter be purchased through the Executive Council.

6th. That article 10, section 1, of the Subordinate Constitution read as follows: "That this Association will authorize a badge as evidence of membership, also pass or travelling card."

GRO. HUNT.
JOS. OGLE.
WM. NORRIS.
G. C. MOORING.
E. F. BRISBOIS.

It was moved and seconded that the report be discussed clause by clause. Carried.

The different clauses were read and adopted.

Moved by Bro. Blackgrove, seconded by Bro. Mooring, that the report be adopted. Carried.

The Committee on "Good of the Order," presented the following report:

"We recommend that button No. 3 design be adopted as our emblem, with suitable lettering thereon, and that the same be purchased through the Executive Head.

That subordinate Associations be recommended to have a clause inserted in their by-laws to the following effect: That the Association accept any legally authorized Stationary Engineer's Certificate in lieu of an examination; that open meetings be held and an educational instructor appointed, also that the Association appoint an Educational Committee to encourage members to read papers on different subjects.

R. MACKIE.
A. M. WICKENS.
J. ROBERTSON.
A. E. EDKINS.
E. J. PHILIP.
W. G. BLACKGROVE.

Moved by Bro. Hunt, seconded by Bro. Mooring, that the report be adopted. Carried.

Under the heading of "New Business," Bro. Hunt spoke on the advisability of the members of the Association investigating the merits of different kinds of steam plants for electric lighting and railway purposes, with the view of finding out which of the many engines would be most suitable under the many conditions met with in electric power stations.

Quite a lengthy discussion took place on the advisability of the members of subordinate Associations taking up the study of electricity as needed by the engineer of the future. Many of the members spoke on this subject, among them Bros. Brisbois, of Montreal No. 2, Bro. Norris, of Hamilton No. 2, and Bro. Mooring, of Toronto No. 1.

Moved by Bro. Philip, seconded by Bro. Heal, that the Secretary of the Executive be instructed to obtain stationery with the crest of the Association thereon, so that same might be bought by individual members for use in their correspondence. Carried.

The convention next proceeded with the election of officers.

The nominations for President were, Bro. A. E. Edkins, Bro. Mackie, Bro. Hunt.

The ballot was taken and found to be in favor of Bro. Edkins, who was accordingly declared elected.

The following were elected without opposition: Vice-President, Bro. Hunt; Secretary, Bro. Blackgrove; Treasurer, Bro. Mackie; Conductor, Bro. Heal.

For Doorkeeper, the nominations were: Bro. Brisbois, Bro. Mooring. The ballot was cast and found to be in favor of Bro. Brisbois.

It was moved by Bro. Blackgrove, seconded by Bro. Heal, that the next annual executive meeting be held in the city of Montreal, the date to be fixed later in August or September by the Montreal brethren. Carried.

Moved by Bro. Hunt, seconded by Bro. Robinson, that a hearty vote of thanks be tendered to the retiring officers for the able manner in which they have performed their duties during the past year. Carried.

Moved by Bro. Robinson, seconded by Bro. Hunt, that the thanks of this Executive be tendered to the members of Hamilton No. 2, for the royal manner in which they have entertained us during this Convention.

Moved by Bro. Philip, seconded by Bro. Brisbois, that this Council convey its thanks to the publisher of the ELECTRICAL

NEWS AND STEAM ENGINEERING JOURNAL for his advertisement of our Association. Carried.

Moved by Bro. Hunt, seconded by Bro. Mitchell, that the President and Secretary be a committee to get the proceedings of this convention printed in pamphlet form for distribution in subordinate Associations. Carried.

The President declared the Convention adjourned to meet in the city of Montreal in September, 1893, the date to be fixed later by the Montreal brethren.

THE SEITZ AND LINHART TELEGRAPH.

We know that it would be advantageous to trace Morse lines not along the length of a paper tape, but crosswise, as they do in the Etienne telegraph. A new apparatus using this method of writing is constructed by Messrs. Seitz and Linhart, at Schaffenburg, Bavaria.

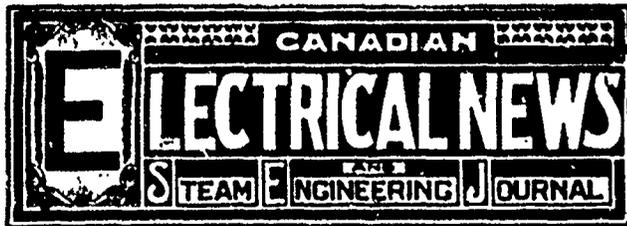
The unrolling of the paper is made by an electrical arrangement replacing the ordinary clock movement. This is operated by an automatic interrupter, whose armature draws a band of paper, as its coils are electrified by the current of a local battery closed by a commutator. The principal difficulty in writing across the paper is to prevent the paper from running too far during the writing of a line. The inventors have very skillfully overcome this difficulty. They have added an automatic interrupter to the circuit. The function of the electro-magnet is to apply the paper band against the little writing roller. When at rest, the level of this armature touches a special contact by the intermediary of a little spring that it carries at its lowest end. When the armature is attached by a telegraphic current, it interrupts the local current by which it is displaced at a certain length, because at this moment the spring leaves the special contact. The interrupter acts at the same time for the transmission of a dash or dot. The dots are simply marked upon the paper when a current of short duration passes through the writing electro-magnet; the ink-wheel is not displaced.

Besides the main electro-magnet, they insert into the line a second electro-magnet acting as a relay; but this has a certain inertia, and does not act until it is called upon by the current of long duration transmitting a dash. Its armature closed, then the local battery on the second parallel circuit to that of the interrupter contains four electro-magnets; the latter then attracts its armature, and the writing table placed upon the end of a lever goes across the paper and writes a line.

This telegraph can also be used upon lines with a continuous current. It is necessary to modify somewhat the mechanism. —*La Lumiere Electrique.*

Before any general change in the direction of permanency in the type of steam engineering equipment of electric lighting plants can be expected, says the *Engineering and Mining Journal*, there must be a more general testing of the efficiency of the various kinds of equipment now in use, covering the efficiency of the boiler, as shown by the water it evaporates per pound of coal, of the engine, as shown by its steam consumption per indicated horse-power, and of the combination of the engine and the dynamo, as shown by the electrical horse-power generated by the dynamo in comparison with the indicated horse-power of the engine. It is to be hoped that there will be a series of tests made at the World's Fair of the efficiency of these various elements and combinations, and this should do much toward establishing that permanency of type which has been reached in many other branches of engineering.

Many times little occurrences come up in an engineer's practice where some kind of cement which will stand the heat and pressure of steam can be used to excellent advantage. Perhaps a blow hole in a casting opens up and a stream of steam or water escapes. In such a case it would be most desirable if there was some cement handy which could be put upon the defective spot and would set within a few moments and afterwards remain tight. Many other circumstances often come up where a good cement that would set solid and strong would be found most useful. To be sure, one of the best ways of fixing such things when they occur is to replace the defective by new material, but as this cannot always be done without the expenditure of more time and trouble than is convenient to give it, something that will serve a good purpose instead is desired. A contemporary gives the following recipe for a preparation which, we think, will be found quite useful as we have often used a cement of similar composition to this. Five pounds Paris white, five pounds yellow ochre, ten pounds litharge, five pounds red lead, four pounds black oxide manganese. The whole is to be well mixed and a little asbestos and boiled oil added. This cement will set hard in from two to five hours and is not subject to expansion and contraction to such an extent as to cause leakage afterwards. Leaks that occur in places which are difficult to get at and remedy, may often be stopped by the application of a little cement composed of the above materials in about the proportions specified. —*Stationary Engineer.*



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EDITOR'S ANNOUNCEMENTS.

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

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

CANADIAN ELECTRICAL ASSOCIATION.

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NOTICE OF REMOVAL.

The offices of the "Electrical News" have been removed to the Confederation Life Association's new building, Rooms 106, 107 and 108.

My opinion is, said a level headed citizen of Toronto, that instead of compelling the electric cars to travel at horse car speed, the public should be educated to adapt its movements to a rapid transit gait. Exactly ' else the rapid transit idea is a myth.

THE authorities of the School of Practical Science, Toronto, have kindly signified their willingness to place the use of their building at the disposal of the Canadian Electrical Association in connection with the meeting to be held in January. The School contains many objects of interest, the examination of which should add largely to the pleasure and profit of the occasion.

Electricity figures out that the General Electric Company will require to make a profit of \$2,000 per day over and above operating expenses to pay dividends which have been guaranteed to stockholders, and declares that in the face of the competition of other concerns this cannot be done.

THE consolidation of the Thomson Houston, Edison and Toronto Electrical Supply Companies' interests in Canada, foreshadowed in the last number of the *ELECTRICAL NEWS*, has been consummated. The new company will be known as the Canadian General Electric Co. The capital stock is fixed at \$2,000,000. The head offices of the concern will be in Toronto, while the manufacturing will be done at the shops erected by the Edison Company at Peterboro', Ont.

THE rapid introduction of electricity for street railway purposes, made it necessary for the managers of electric roads to place in charge of motors men with practically no training for the position, and this has led to accidents which would probably not have occurred had experienced motormen been in charge of the cars. The safety of the public and the interests of the electric street car companies both demand that men who are placed in charge of motor cars hereafter, shall first receive the necessary training.

WE commend the following from the New York *Electrical Review*, to those who have not yet joined the Canadian Electrical Association: "We make our membership in the National Electric Light Association pay us," said the manager of a large central station in New York city "Every paper of a practical nature read before the Association is dissected in our station and all the kinks, short cuts and experiments are tried under the conditions existing in our work. We have made several valuable discoveries in central station practice in this way, and regard our membership in the Association as indispensable."

THE severest test to which an electric street railway could be put will be encountered in the city of Montreal, in connection with the enormous quantities of snow and intensity of frost, which is the usual accompaniment of winter in that locality. It is proposed to cart away the snow and ice from the streets, leaving only sufficient to provide sleighing. The expense of removal, which will be no inconsiderable item, will be borne by the Street Railway Company and the city jointly. Under the new order of things, the citizen of Montreal, will be able to recognize acquaintances across the street, which the accumulation of snow and ice has heretofore made it impossible to do.

IN another column will be found an article descriptive of experiments in the use of electricity for heating purposes, which have recently been in progress at Ottawa, Ont., together with illustrations of the devices employed. So successful have these experiments been, that the new method of heating is soon to be put to a practical test on an extensive scale. The result will be watched with much interest, more especially in view of the advancing price of coal. A vast waste of money and labor is involved in our present methods of heating. It may be regarded as certain that there will be substituted for them in the near

future a method not less efficient but more cleanly and economical. It is by no means unlikely that electricity will be the chief agent in the reform.

MANUFACTURERS of electric machinery should be careful to see that the persons they send to install apparatus are possessed of sufficient knowledge to enable them to set it up properly, so that it may not prove a source of danger to life and property. For want of this knowledge an electric motor was installed in a Toronto printing office in such a way that when put into operation the machine was burned out and the building badly scorched, while the employees received such a scare as will tend to make them, in future, ill-at-ease in the vicinity of the motor. One of the best means of popularizing electric motors is to take pains to see that they are properly installed.

At the recent meeting of the Dominion Trades and Labor Congress, held in Toronto, a resolution was adopted recommending that all railway, telegraph and telephone lines should be owned and controlled by the Federal Government, and all gas and electric light plants, water works, ferries and street railway lines should be owned by the municipalities in which they are situated. We fear that those who voted for this resolution did so on the impulse of the moment, and without a full acquaintance with the subject. Governmental management of public enterprises in this country in the past has not been marked by such economy or efficiency as should warrant the extension of the principle. The same is to a large extent true of municipal management. Beyond all this is the fact that if the most important business enterprises are to be placed under government and municipal control, capital will be driven out of the country.

A DECISION of considerable importance to electric street railway companies, has just been given by the Railway Committee of the Privy Council, arising out of the application of the Davenport Street Railway Co. for leave to cross the tracks of the G. T. R. Co. at Davenport. The solicitors of the G. T. R. and C. P. R. petitioned the Committee to compel the Street Railway Company to stop at the crossings, and to bear the cost of necessary precautionary measures to protect the public at these points; also that the men in charge at each crossing should receive their instructions from the railway company, but should be paid by the street railway company. The decision of the Committee, practically settles the matter on the basis suggested by the railways viz., the cost of the protection of the public devolves upon the electric company and no electric car must approach within 400 feet of a crossing, at a greater speed than six miles an hour.

AN increased number of exhibitors of electrical apparatus, was a noticeable feature of the recent Industrial Exhibition in Toronto; this applies, however, to exhibits of the smaller kinds of apparatus only. So far as arc lighting machinery is concerned, there was only one exhibitor, viz., the Ball Electric Light Co. of Toronto. No doubt the large street railway contracts which some of the manufacturing companies have at present on hand, prevented them from making an exhibit this year. There should be ground for the hope that in connection with the convention of the Canadian Electrical Association next year, there will be such an exhibit in this line as will indicate the progress which electricity has made and is making in the Dominion. We might suggest to the management of the Industrial Exhibition Association, that there is room for improvement in the facilities at present offered to machinery exhibitors. It is to be hoped that these improvements will be made before the exhibition of 1893.

If it be true as reported that an electric lighting company in a neighboring city has accepted the renewal of their contract for one year at 23½ cents per lamp for all night service, we can but deplore the causes by which such state of affairs has been brought about. While aware that the company use water as a motive power, this fact is not sufficient to warrant such miserable rates and our prediction is that the city will fail to get good lighting at this figure and the company will find that it cannot afford to give a good and efficient service at such a price. We are inclined to blame past bad service by the company for present unsatisfactory conditions, in view of the fact that the

city council tried to pass a by-law empowering them to borrow money and establish a plant of their own, which would have proved to be a foolish and expensive experiment. Right here let us emphasize our remarks on this subject in our last issue, by again calling the attention of those operating electric lighting plants to the fact, that it is imperative that their contracts should be fulfilled in the best manner possible at all times, if they hope for their renewal.

THE handling of the enormous traffic incident to the holding of the Industrial Exhibition was a severe test of the efficiency of the Toronto electric street railway. The completion of the King street line, which was designed to carry the bulk of this traffic, had to be pushed with the greatest possible speed, and when finished there was no time for experimenting. The visitors were flocking in thousands to the city, and it was necessary that the road should be put into practical operation at once. Not only so, but, as already stated, the circumstances required that it should be immediately subjected to the severest possible test. The results have excited the surprise and admiration of all beholders. Hundreds of thousands of passengers, many of whom had never before seen an electric street railway, were transported to the Exhibition grounds and back, a distance of eight miles, without injury to a single individual. We congratulate the management upon such a splendid achievement, which has done much to allay the apprehension excited by some of the daily papers regarding the danger attendant upon the operation of the trolley system. These papers are now forced to admit that with the exercise of reasonable care on the part of the employees of the company and the public, the danger is but little if any greater than under the old horse car system. The adoption of some device calculated to push off the track any obstruction, human or otherwise, which might chance to get in front of a moving car, and a regulation, such as is proposed, to compel the conductor to stop his car on the near, instead of the farther side of street crossings, would tend to further reduce the probability of accidents.

A RECENT number of the London *Electrical Review* comments strongly on a paper published in one of the U. S. electrical journals on the candle power of American incandescent lamps, in which, to use the *Review's* extract, "it is made to appear that so called 16 candle power lamps range in candle power from 8 to 18 by actual photometric tests." While such a state of affairs would be deplorable, we are in a position to know that for efficiency, long life and candle power, there are no lamps manufactured in the world which will excel the lamps made by the principal lamp makers in the United States. We may be permitted to point out to the *Review* that the lamp or lamps, if there were more than one, must have been defective and never meant to be put upon the market as a commercial article. The article continues: "and, further, that American lamp manufacturers seem to divide lamps into two classes, viz, a high efficiency, short lived, lamp for use when current is supplied by contract, and a low efficiency but more durable lamp, for use when current is supplied by meter, and it is suggested that these are supplied to central station managers, and through them to their customers, according to the method in which their current is charged for." The *Review*, in commenting on this, calls it American "cuteness" on the part of the lamp manufacturers and station managers. To get the opinion of a person prominent in electrical matters, and who has had the handling of a great number of incandescent lamps, we submitted to him the article in question asking his opinion on it. His reply in substance was as follows: "I know of but one lamp manufacturer out of the hundred or so in existence in the United States, who makes it a practice to manufacture a short lived, high efficiency lamp, and a long lived low one, and he does not make a point of advertising, as formerly, this specialty, having probably discovered that station managers generally are desirous of pleasing their customers not only as regards amount of light, but also with regard to price. With the general run of electric lighting companies doing incandescent lighting under contract, the customer is charged for his lamp renewals at cost price. Does it not therefore seem reasonable that no station manager who has the welfare of his company at heart will supply his customers with a lamp that will have to be bought over again, as it were, by him,

say after two or three weeks use for ordinary lighting, neither would many customers using the light submit to such an extortion for more than a few weeks. Looking at it from a meter point of view, there are very few station managers who would knowingly purchase a low efficiency, long lived lamp to supply to meter customers for the sake of the few additional hours that such lamps would last. It is decidedly to their benefit to have their meter bills moderate in size and their customers pleased, rather than to have meter bills large, customers growling about the price and declaring that their meter is worthless. We feel positive that it is the lamp manufacturer's main endeavor on this side of the ocean to make an incandescent lamp which will give the proper candle power, with a consumption of current and length of life equal to any made in the world. We know for a fact that he is doing this, and is selling lamps at a low price and making money; can our neighbors across the water say as much for their manufacturers?

THERE was a motor exhibited at the Toronto Exhibition which was said to be a mechanical device for the increase of power. The inventor and promoters stated that they had no perpetual motion scheme, but a genuine mechanical discovery by which power was increased. The machine when driven by a ten horse power engine was said to be capable of doing fully thirteen horse power of work. If it could be made to do so much more than the engine driving it, no doubt further improvements could make it do fifteen horse power. Suppose a ten horse power engine driving one of the improved motors, and fifteen horse power is available at the belt from the motor. This belt could drive another motor and the fifteen horse power would then become twenty-two and a half horse power. From this second motor let a ten horse power belt be carried back to a pulley on the shaft of the steam engine, and the ten horse power required at the steam cylinder is brought directly to the shaft, and the steam cylinder may be removed or the steam shut off. The machine will now continue to drive itself, and have twelve and a half horse power to saw wood with or to run a dynamo to light up the room so that all the world may come and see the greatest motor of this or any other age. The perpetual motion idea is evidently not dead yet, notwithstanding all the efforts of schools of practical science and other methods in vogue for teaching men they can only withdraw from the bank an amount equal to that which they have put in, and that without even 3% of interest.

THE construction of the Toronto electric street railway was delayed for several months and a considerable amount of expense incurred by the city, in order to satisfy those who were of the opinion that the storage battery would be an improvement on the trolley system. The result was not unexpected to those acquainted with the subject, in whose minds it was a foregone conclusion that no other system than the over-head trolley could be made successful at the present time. In view of the experience which the city of Toronto thus gained, and of the time and money spent in its purchase, it is somewhat surprising to find that a similar agitation in favor of the storage battery is at present confronting the Street Railway Co. of Montreal. With a view to settling the matter, Mr. James Ross, President of the Company, has made the following offer:—"I will refer the question of the case of the storage battery to a committee of three, to be selected from the leading civil engineers of Canada and the United States, including the presidents of the societies of civil engineers of England, Canada and the United States, and the professors of practical science in the McGill and Toronto universities. If this committee shall decide that the storage battery system is fit to be used for the whole street car service of the city of Montreal I will pay the whole expense of this investigation and donate \$5,000 to any charity to be previously agreed upon, provided that the storage battery advocates will agree to do the same should the decision be adverse to their system. I have named the civil engineers to conduct this investigation in order to avoid the suspicion that electrical engineers may be biased in favor of the trolley." It is safe to say that Mr. Ross's challenge to the advocates of the storage battery will not be accepted.

It is reported that Mr. Briolman, of Chatham, will be appointed manager of the Bell Telephone Company at St. Thomas.

"DEAD WIRE" ON ARMATURES.

ALTHOUGH the modern dynamo is very nearly perfect in its construction, both scientifically and mechanically, yet there exists in certain machines some dead or inert material, which cannot be avoided. We refer to what is known as the "dead wire" on drum armatures.

As may be inferred, this "dead" wire is dead as far as practical results are concerned, and is simply a dead load to carry.

This "dead" wire is located at the end of the armature opposite the commutator, and consists of the continuation of the windings of the conducting wire from one side of the armature to the other. It is "dead" because it produces no practical results for the reason that it does not come within the influence of the magnetic field; it is therefore a sort of necessary evil, because it is, as far as known at the present time, the only practicable means of carrying the current from one side of the core to the other.

In the case of large armatures, when the conductors are of large diameter, or of such form and mass as to render them comparatively inflexible, it is impracticable to continue the windings over the end of the core in the manner adopted on ordinary sized armatures. Some special devices are employed; such as half-circle segments, discs, etc. In any case the cross-diameter connections cannot be dispensed with, hence the necessity of making them as short as possible so as to reduce the resistance. This is necessary in order that as little energy as possible may be consumed, because the greater the resistance of a wire the more the current strength will be expended in passing through it.

The active wire on drum armatures is located parallel to the axis, and the more wire we can pass through the magnetic field at right angles the better.

The percentage of active wire of the total length varies greatly—from 30 to 60 per cent. That portion of the wire which is wound over the end of the core is not wholly inactive, however, but the electromotive force produced therein is so slight that it has little effect on the general result; what little electromotive force is produced is due to the fact that these portions of the wire cut the magnetic lines obliquely. (The electromotive force varies inversely as the obliquity of the wire with reference to the field of force.) The greatest electromotive force is produced when the wires cut the magnetic lines at right angles, and none is produced when the conductors pass through the field of force parallel to the lines.—*Electrical Age.*

LINES OF FORCE IN THE FIELD OF A DYNAMO.

Dr. Fleming estimates the lines of force in the fields of the best dynamos at from 6,000 to 10,000 per square centimeter. A definite value must be found for the maximum magnetization of iron; that is, the number of lines that can be forced through it per square centimeter, with a given magnetizing current must be ascertained. Ever since the investigation by Dr. Rowland of the laws of the magnetic circuit attempts have been made to settle this question. The nature of the iron bears so strongly upon the conditions, however, that it appeared for a long period almost hopeless to arrive at a definite basis for a workable theory. Later researches bearing upon the permeability (magnetic conductivity) of the iron have, however, proved so fruitful that, knowing the nature of the iron, it is possible to predict the number of lines that would result from a magnetizing current of so many amperes in the exciting coils.

From numerous experiments it would appear that the maximum number of lines of force which usually traverse a bar of soft, annealed iron one square centimeter in cross-section is about 32,000. In some of Prof. Ewing's experiments, however, a magnetization under extraordinary conditions, as high as 45,350 was attained. But beyond a certain limit the magnetizing current has to be so relatively enormous that in dynamos even the maximum here stated is almost unknown. There is probably, however, no theoretical limit to the magnetizability of soft iron.

Incorporation has been granted to the External Journal Loose Pulley Company, Toronto, with a capital stock of \$50,000 to manufacture wood split driving pulleys, shafting coupling, hangers, etc. Mr. C. T. Brandon is the President.

THE LATE C. N. GISBORNE.

MR. GISBORNE, Superintendent of Government telegraphs brief mention of whose death was made in our last issue, was born in Broughton, Lancashire, England, on the 8th of March, 1824. After having made a tour around the world in 1842, he settled in Canada in July, 1845, and commenced life here as a farmer. In 1847, he left the farm to accept a position in the offices of the Montreal Telegraph Co., and shortly afterward opened the first office of the Company in the city of Quebec.

In 1850, he was appointed chief officer of the Nova Scotia Telegraph Co. While occupying this position, he conceived the idea of constructing a telegraph line, which would bring St. Johns, Newfoundland, into communication with the American continent, and by means of which news from Europe could be received in 48 hours less time. The project contemplated the erection of a telegraph line through a wild stretch of country 400 miles in length, and ultimately the running of a submarine cable across the Gulf of St. Lawrence. A grant of £500 was secured from the Newfoundland legislature, to cover the cost of preliminary surveys; land grants were also obtained, following which the Newfoundland Electric Telegraph Co. was organized.

Financial aid was obtained in New York, and in 1852, a submarine cable was laid from Cape Ray to Prince Edward Island. This cable was the first of any length to be put down in America.

In 1853, Mr. Gisborne's New York backers became discouraged, and left him without means to carry out the project he had undertaken. The creditors of the company had him arrested, and to regain his liberty cost him every dollar he possessed. He still had faith, however, in the success of his idea, and in 1854, renewed his efforts in New York, to obtain the necessary means with which to complete the undertaking. Becoming acquainted with Mr. Cyrus W. Field, who was a civil engineer and railroad builder, he interested the latter in the scheme, which was finally carried out.

Mr. Gisborne then, in conjunction with Mr. Field, projected the laying of the Atlantic cable, and it was under his charter that the Transatlantic Telegraph Company first began its operations. After enormous difficulties had been surmounted, the undertaking was finally successfully carried out.

Shortly after, Mr. Gisborne was appointed Superintendent of the Dominion Government Telegraph and Signal Services, which position he held until his death. He was one of the founders of the Royal Society of Canada, and the inventor of a number of electrical and other appliances.

RATES FOR ELECTRIC LIGHTING.

By C. W. SWOPE.

At the present time the price of any commodity is regulated by its demand, the location of the demand from the source of supply and the first cost of manufacture. In most cases the selling price, within certain limits, varies inversely with the demand, the larger the scale of production the less the cost for a given quantity; also the rates for transportation, although varying directly with the distance, decrease to some extent with the amount carried.

In like manner the rates for supplying current for electric lighting are dependent upon similar conditions. The elements that generally do, and should fix the price of supply, are the demand for service and the locality, the latter fixing the price of water and fuel. Considerable disparity exists among the various companies in their rates of service, some of which are no doubt due to the above named elements, but much also, in many cases, to the method or manner in which the rates were determined. In determining the latter, two methods have generally been followed, one by towns and the other by cities. In the first case the method of procedure has been something like this. The matter of the electric lighting for the town having been consider-

ed by a few of its prominent business men, from standpoints of convenience, and more especially as an investment, a company with the necessary directors and officers is formed. The first step is the selection of apparatus or system to be adopted, a tour of inspection of plants in the immediate vicinity "to see what other people have" is strikingly natural and very proper. This problem having been solved, then comes the question "what rates shall we charge for lighting?" Letters are sent to towns of about the same population, asking "their prices," and from these replies the price is generally determined by averaging the prices charged elsewhere, regardless of their own condition and locality and what is determined by them. It is here where the mistake is made that has caused much dissatisfaction between the company and the consumer in more than one instance; these same men, often times very capable and shrewd business managers, would not think of treating matters of law or building operations in such a manner, yet this evil course is entered upon, and the consequences are: the capital invested is more than would otherwise have been required, the prices for lighting are inadequate, poor returns discourage the investors or expensive lighting becomes unpopular with the public. Current is generally supplied by contract or by meter. The former has many disadvantages and objections, especially for domestic electric lighting, where the price is so much per a standard lamp, as a 16 c. p., or a certain rate per candle power per month or year, when various sizes of lamps are used, as 8, 10, 12 c. p., etc., satisfaction has only been given to stores using quantities of light and for long periods. The private consumer desiring to fit up his house with numerous outlets, for convenience, is charged for the entire candle power, that is, no matter what percentage of the lights are burned or how long used. To remedy this, various complicated scales of prices have been devised, charging for lamps according to their location such as halls, parlors, bed chambers, etc., which, however, is objectionable, as it requires much time and care to keep track of the various sizes and their location, disputes often occurring when the little paper label indicating the candle power is detached. It seems strange that the candle power, voltage, and watts per candle power are not stamped on the metallic portion of the lamp, instead of being printed on a label and pasted upon the glass only to be wiped or washed off. Electrolytic and electro-magnetic meters for measuring



THE LATE C. N. GISBORNE.

currents have been in use for some time now, and although some imperfections exist in these methods of measuring current, which will no doubt soon be remedied, considerable success and satisfaction have resulted where they are used. They are certainly more accurate than any candle power contract system, and fairer to consumer and station. A consumer naturally wishes to pay "for what he burns," not "for what he can or may burn," and the meter is the only solution of the problem.

Our second method of determining rates, generally followed by our large cities, is accomplished in a more accurate and business-like manner. The best results and the most fair and satisfactory prices have been obtained when the price for supplying electric lighting is based upon the price of gas in the same locality. The latter having been used for some years its illuminating power and cost are well known. If the company would start by furnishing current at the same relative price as gas, they would not be far astray, and, if after some time the price was found to be too high in some localities, it could be readily reduced, it being an easy matter to diminish the price, but an exceedingly hazardous and difficult matter to increase it.—
Electricity.

A number of Ottawa capitalists, including Messrs. Thos. Ahearn, R. Blackburn, William Scott, J. W. McRae, G. P. Brophy, Thos. Woodman and Peter Whelan, are seeking incorporation as the Ahearn Electric Heating and Manufacturing Company (Limited), to take hold of Mr. Ahearn's patent heater, elsewhere described in this paper, and supply heat and light by electricity in all its branches. The capital stock of the proposed company is \$250,000.

ARRANGEMENT OF STEAM PIPES.

WE have, from time to time, says *the Locomotive*, called attention to the importance of suspending and securing steam pipes properly and providing for their expansion and contraction. In this article we wish to call attention to a common but dangerous method of connecting boilers with main steam pipes.

Fig. 1 shows the way in which the connection is frequently made, the stop valve being near the boiler, and the pipe entering the steam main below. The action of this argument is as follows: The boiler being out of use, entrained water from the other boilers in the battery, as well as water of condensation, settles in the

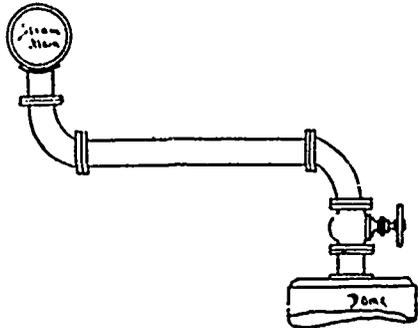


FIG. 1.

space between the stop valve and the steam main. Then, when the boiler is put in use again, in order to prevent any sudden strain from being thrown on the boiler, the stop valve is not opened until the pressure in the boiler has risen slightly above that in the main steam pipe. When it is opened there is a sudden outflow of steam, which raises the water in the connections, throws it against the first elbow, and, if that does not break, hurls it the full length of the horizontal pipe, against the second elbow, and then into the main steam pipe. The shocks so produced are greater than can be imagined by one who has not had experience with water hammers. In one case that came under our observation recently, three elbows were fractured in succession from this cause. When the first one broke the superintendent of the mill considered that there must have been a flaw in it. It was replaced by another which lasted only a few days. A third elbow was put in, with a precisely similar result, and by that time the superintendent had become satisfied that something was wrong with the arrangement of the piping. The defect was pointed out to him, the pipe was re-arranged, and there has been no trouble since.

It might be said that the stop valve should be opened when the pressure in the boiler is just equal to that in the main. This is true, but it is not easy to determine, with any degree of precision, when these pressures are equal, and the engineer very

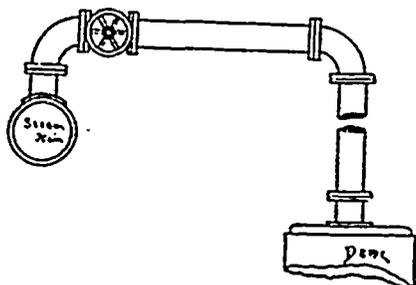


FIG. 2.

properly prefers to err on the safer side, and have his boiler pressure a trifle too great, rather than too little.

The danger may be greatly lessened by putting in a drip pipe. The drip should enter the valve at as low a point as possible, and care should be taken, when the idle boiler is about to be thrown into use, to blow all the water out through this drip pipe immediately before opening the stop valve. If this were carefully attended to each time, the arrangement of piping shown in Fig. 1 should give no trouble, but it is a matter of every day experience to find engineers who perhaps do not fully realize the importance of the drip pipe, growing somewhat careless about it. After they have conscientiously used it fifteen or twenty times there is a tendency to slight it a little and open the main valve before the water is all out. If no trouble results this is apt to fix itself on the man as a habit; and some day, when he is in a hurry, he may pay no attention at all to the drip and open the

main valve at once, exposing himself to the danger described above.

It is a far better plan to fix the pipe right and do away with the drip. A proper arrangement of the connections is shown in Fig. 2. The piping passes up above the main steam pipe which it enters at the top; and the top valve is placed in the horizontal part of the connection, and as near the steam main as it can be, conveniently. It will be seen with this arrangement there is no danger of trapping water. The entire connection, from boiler to main, remains dry, and no water-hammer action is possible.

Fig. 3 shows another way of arranging the connections so as to avoid the trapping of water. In this arrangement the pipe enters the steam main at the side, the elbows are done away with, and an angle valve is used to connect the horizontal and vertical pipes. When new work is being put in we usually recommend this arrangement, but if the piping has already been put up, in the

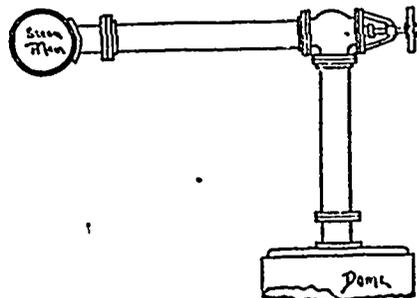


FIG. 3.

manner shown in Fig. 1 or in any similar manner that involves the same element of danger, the arrangement shown in Fig. 2 is cheaper to put up, because it enables one to use the same valve that was in use before.

A POINT ON SETTING A SLIDE VALVE.

SUPPOSE you are called upon to adjust a slide valve on an upright engine $1/32''$ lead on top and $1/16''$ on the bottom; after ascertaining by the usual means that the eccentric rod connection is the right length, adjust the valve so as to equalize the lead on both ends, then increase the lead $1/64''$ on the bottom, revolve the eccentric around on the shaft until you decrease the lead on the bottom to $1/16''$; you will then find you have $1/32''$ on top. For instance you had $1/8''$ on both ends; you increase the bottom $1/64''$ by lengthening the rod; you then have $9/64''$ lead on the bottom and have decreased the top to $7/64''$. You now revolve the eccentric on the shaft away from the crank enough to decrease the lead on the bottom to $4/64''$, you will find $2/64''$ or $1/32''$ on top and $1/16''$ on the bottom. If this rule is strictly adhered to it will simplify the setting of valves requiring more lead on the bottom than on the top.—*Master Steam Fitter.*

TRAINING WOULD-BE ELECTRICAL ENGINEERS.

ACCORDING to the *Engineering Magazine* (New York), the question as to the best course of study to be pursued by young men seeking to gain a thorough knowledge of electrical engineering received considerable attention at the late annual meeting of the American Institute of Electrical Engineers. Most of the leading technical colleges were represented by their professors of electrical engineering and physics, and the proceedings, which were quite animated, served to contribute much valuable information on this important subject. In a paper read at this meeting Prof. Owens pointed out that at the present day there were really three distinct classes of electrical engineers—installing engineers, who superintend the construction and operation of lighting and power plants; designing engineers, whose province relates to the construction or manufacture of machinery apparatus, and a third class who are engaged more particularly in laboratory, standardizing and experimental work. He thought that a course of any technical school ought to recognise these distinctions, and that it should be so shaped as to conform to the different requirements of the specialized divisions of electrical engineering. While it is neither desirable nor possible that the courses in the different schools should be alike, it is obvious that much waste of effort might be avoided if the different institutions would observe a certain unity of purpose and treatment. All were agreed that the importance of mechanical drawing and of manual training as factors in elementary education could not be over-estimated. "The practical engineer," said Prof. Jackson, "must be pre-eminently an enthusiast, while he is at the same time a candid and careful thinker."

SOME NOTES ON THE EXECUTIVE MANAGEMENT OF STREET RAILROADS.

By A. K. MCKAY.

THE importance of this branch of railroad operation will not be gainsaid by any one. Executive ability is born, not bred, and as a manager has this quality so also is his worth. By the executive branch of the management may be understood the whole management of employees, from the officer directly under the manager, to the day laborer on the track; also the management and direction of all supplies bought, promotion of travel, accidents, and the dealings with the municipal government.

The writer will assume that an entirely new road is being built ready for the executive officer to take charge, and will briefly refer to the departments and to the problems to which a manager should particularly apply himself. But before going into details the writer wishes to impress upon owners and directors of street railways the absolute necessity of allowing the manager *full and free* control; he should be the absolute and not the nominal head, directing and guiding its policy in every branch. It has been demonstrated too often that a board of directors *cannot* successfully operate a street railway. Choose your man, in whom implicit confidence can be placed and who has the best and permanent interests of the road at heart, whose zeal and experience are known; then allow him to exercise unhampered and unfettered control.

When these powers have been conferred, the manager will begin by appointing his assistants, namely, the electrician and superintendent; these two offices can be combined in small roads. The conductors, motormen, car cleaners and inspectors will be under the superintendent, and should be engaged by him. The engineers, firemen, oilers and linemen will be under the electrician and he should be allowed to engage them. This matter of allowing the superintendent and electrician to engage their own men is a great help to them in maintaining the discipline of the road. The men will work better, have more respect, and be more strictly obedient to the man who engages them than to one they recognize as subordinate to the manager. The moment they see that the manager reposes confidence in the electrician or superintendent, the same moment will they accord him additional respect and prompter obedience.

A time-table should be prepared and submitted to the manager, together with a code of rules, and conductor, engineer and car inspector reports. Every day these various reports should be handed to the superintendent and electrician, so that each morning they can in person report to the manager, noting in detail anything which may have occurred the previous day.

Having then thoroughly organized his force, through his two lieutenants, and having gone through and sifted the rules and reports and satisfied himself as to their usefulness and practicality, the manager can turn to the purchasing of supplies. These should all be bought from the manager's office; the superintendent and electrician inspecting whatever comes to their respective departments, recommending or disapproving, together with reasons, in writing, their supplies. In this manner the best of coal, oil, grease, etc., as suited to the exigencies of the occasion, will be secured.

The question of travel will next engage the manager. It is assumed that the road is situated in some city of moderate size where the cars are not overcrowded, and that travel must be more or less created, or at least encouraged. Having made the schedule, and having operated the same for a short while, the conductor reports should be examined. From these can be readily obtained the hours of the day when travel is the heaviest. Extra cars should be run during these hours, and during the lightest hours cars may be taken off.

Of course, on some days of the week travel will be lighter than on others. These should be noted and if possible special attractions should be offered to promote travel. During the summer months this can be very easily done by concerts held in some park or hall at the end of the line. The manager should exercise every ingenuity to furnish attractions of one sort or another which can be obtained without *too much cost*, which shall attract crowds. The writer knew a case in which a manager spent some five dollars on a set of negro camp-meetings, feeding the colored people till they became self-supporting, which was in a day or so, and receiving back some three hundred dollars in car fares during the time the meetings were

held. A manager must be quick to grasp the opportunity of carrying the crowds on such occasions, giving full and ample accommodations for riding, as nothing will detract from amusements so much as a poor return service. If he has insufficient car capacity, try to move them in sections, prolonging the entertainment to hold part of the crowd while a portion is being moved.

In winter the same plan should be pursued; a skating carnival, a dance, or a concert in some hall towards the end of the route will prove attractive and increase receipts. Too much attention cannot be paid to this branch, with liberal assistance to any enterprising individual who wishes to open a pleasure ground at the end of the route.

Accidents will happen on the best regulated roads; and only one piece of advice is offered, that is, to compromise. The writer knew of a road which was unfortunate enough to run over a capitalist and kill him. The widow had ample means to fight the company; but by excellent management of the case, it was compromised at *two hundred* dollars! The road should endeavor to pay such claims by tickets, or privileges; actual cash being the last and final resort. Delay is a very potent factor in the settlement of such cases, and the collection of evidence *at the time* may be *irvaluable*. The rules should state, that in case of an accident, the conductor and motorman should get the names and addresses of *all eye-witnesses*, and make a written statement of the affair to the superintendent, who in turn will report to the manager.

Every manager will be called upon to cope with the city fathers, either in getting a new franchise, a side track, or placing a pole. A general piece of advice which may prove useful is to meet and conquer them individually before being called before them collectively. Count noses, only be sure they are counted correctly. A manager who requests a grant from the council and who does not consult them individually before presenting the same, is not wise, and will oftener be denied than granted the privilege.

An executive officer who is thus equipped, with a pair of good lieutenants, the best men obtainable as employees, a ready and facile ingenuity for promotion of travel, and a mild form of diplomatic ability in dealing with the aldermen, cannot fail to render a good report both for himself and for his road. *Electrical Engineer.*

TELEGRAPH COMPANY'S LIABILITY.

IN the case of The Western Union Telegraph Company vs. James, the Supreme Court of Georgia held that while the contractual limitation of sixty days for presenting a claim for damages against a telegraph company does not apply to a statutory penalty for delay in delivering a message it does apply to all claims for special damages and operates not alone against the sender of the message, but against the receiver of it, where the message in question relates to the business of both parties and is a reply to a previous message sent by the receiver. The court said that where the damage done to the latter by delay in delivering the message was in breaking up negotiations for the sale of cotton of a low grade and preventing a sale which would otherwise have been consummated, the measure of damages would be the difference between the price which would have been realized by the sale contemplated and the value of the same cotton on that day in the market; or if there was no market for such cotton at the place where stored its value at the nearest market to that place at which it could be disposed of, together with the expense, if any, of transporting it thither. That if it had then no market value anywhere, the measure of damages would be the contract price less the best price which could afterwards be obtained for it on the first day it could be sold, and the expense of holding it until that day; that presumptively, in the absence of proof to the contrary, cotton had some market value on every day in the year; and that consequently a claim for damages would be practicable, and might reasonably be required, within sixty days from the time the message was sent, delivery having been made on the following day.

We are pleased to notice that the business of Messrs. Patterson & Corbin of St. Catharines, has developed to such an extent as to render it necessary for them to enlarge their works to almost double their former capacity. The Company manufacture a new style of vestibule electric car, which is almost a duplicate of the vestibule railway car.

SPARKS.

A patent was recently granted to Mr. W. T. Jennings, late City Engineer of Toronto, for a rail for street railways.

Mr. A. Shaw, proprietor of the Nanaimo, B. C., Electric Light Co., has found it necessary to make an assignment.

Wm. M. Boomer, owner of the horse street car line at Windsor, proposes to extend the same and adopt the electric system.

The City of Toronto has received from the Toronto Street Railway Co., during the last year, as mileage, the sum of \$60,000.

A new company has been incorporated at Lansdowne, Ont. to build and operate a telephone system between that town and Rockport.

The Edlson Co. have purchased the plant of the Citizen's Electric Light Co., Windsor, Ont., and together with the Reliance Co., will operate the plant.

It is said to be the intention of the Department of Railways and Canals at Ottawa, to connect the several lock stations of the Rideau Canal by Telephone.

A syndicate has purchased the Ward mill and water power at Smith's Falls, and will use the power estimated at 300 horse power, exclusively for electrical purposes.

The Royal Electric Co. has been given permission to lay rails for an electric street railway, to enable them to connect their different works and to test electric cars.

Mr. Mullan, of the Ottawa Street Railway Co., is the inventor of a self lubricating gear for trolleys, which it is claimed does away with the necessity of frequent oiling.

A by-law to give the telephone company exclusive privileges for the period of ten years, after having received its first reading in the Winnipeg City Council, was filed.

By the first of November, the Montreal Street Railway Co. expect to have in operation 31 miles. An all night service on the principal routes, has recently been inaugurated.

We are informed that H. H. Brown, No. 5 Moulton Ave., Montreal, has been granted a patent for the latest improvement on a non-inflammable and weatherproof electric light wire.

A new power house and car stables are being erected at Brantford, by the Edison Electric Co. It is said to be the intention of the company to conduct a general lighting business.

Mr. Smith, proprietor of the Electric Light plant at Digby, N. S., has decided to dispose of the plant and business to Messrs. John Daley and G. T. Lettney and Bro., of that place.

Incorporation has been granted to the Rat Portage and Keewatin Electric Street Railway Co., with a capital stock of \$300,000. The Company proposes to supply light, heat and power.

The Dominion Electrical Manufacturing Co., of Toronto, is seeking incorporation for the purpose of manufacturing electrical apparatus. The capital stock of the Company will be \$40,000.

The National Electric Light Co., of Eau Claire, Wis., have the contract to furnish dynamos for the supply of current to 2000 16 c. p. lamps for the Citizens' Electric Co. of Rat Portage, Ontario.

James McMillan, employed as lineman by the Hamilton Electric Light and Power Co., while constructing wires on a roof, fell a distance of fifty feet and sustained severe, though it is hoped, not fatal injury.

The Canadian Whitney-Hoyt Electrical Instrument Co. has been formed, with a capital stock of \$300,000, to manufacture and sell electrical instruments. The headquarters of the company will be Manchester, N. H.

The Nova Scotia Power Co. announces its intention to construct an electric street railway from the deep water terminus of the Intercolonial Railway at Halifax, to the south end of the city, by way of Water St.

The Eastern Electric Co. will push forward as rapidly as possible the equipment of the whole street car system of St. John, N. B. It is expected that the electric cars will be started on the road in about three months.

It is understood to be the intention of Mr. Bickerdike, of Montreal, to construct electric railways in St. Cuneconde and St. Henri, suburbs of Montreal, together with a suburban line to Lachine and St. Anne's, next year.

Incorporation has been granted to the Amprior Electric Light and Power Co., Amprior, Ont., to furnish electricity for commercial purposes and to manufacture electrical apparatus. The capital stock of the company is \$30,000.

The Winnipeg Street Railway Co. have filed a bill against the Electric Railway Co., alleging that the new company has been trespassing on their rights, and requesting that it be not allowed to run cars. A long and bitter legal fight is anticipated.

The Bell Telephone Co. are said to have offered to pay the city of Brantford, \$450 per year, for the sole right to do a telephone business in the city. The company also agree to make concessions respecting the use of poles, the price of telephones, etc.

A new electric street railway has been completed and put in operation in Yarmouth, N. S. The new road is two miles long, and the equipment is said to be first-class in every particular. Yarmouth is the first town in the Maritime Provinces to adopt electric transit. All the stock of the company is held by citizens of the town.

In St. Hyacinthe, Que., the voting on the by-law to purchase the apparatus of the Electric Light Company resulted in its defeat by 158 votes to 53. In Nanaimo, B. C., a by-law providing for the purchase at \$40,000 of the electric light plant has passed its second reading in council.

John Douglas, of this town, has a necktie pin in which a real electric light of half a candle power. The current is from a small battery carried in the vest pocket. The light which is set among the jewels gives a very pretty effect and can be turned on or off at will.—*Truro Headlight*.

An action has been entered against the Harbor Commissioners of Montreal, by the Royal Electric Co., for refusing permission to carry out a contract held by the insolvent firm of Craig & Sons, the assets of which firm were purchased by the Royal Co. Damages to the amount of \$13,000 are claimed.

The Bell Telephone Co. at Ottawa, expect shortly to take possession of their new exchange. A multiple metallic switch board, designed for a present capacity of 1,500 subscribers and an ultimate capacity of 3,000 subscribers, is being constructed for the exchange, at the Company's shops at Montreal.

There is a dispute as to the title of the land along the Canadian bank of the Niagara river upon which a company was empowered by the Provincial Government to construct an electric road. The Dominion Government lays claim to the title of the land, and has recently had it surveyed. Pending the settlement of the dispute, the undertaking will not be proceeded with.

An agreement has been reached between the Bell Telephone Co. and the city of Guelph, by which the Company is given the exclusive right, for five years, to erect poles on the streets. In return for the privilege, the Company are to connect their wires with several of the outlying villages, and to allow the city to stretch fire alarm wires over their wires and on their poles, and give the city a metallic service.

On the Ann street extension of the Ottawa Electric Street Railway, a steel trolley wire has been used instead of copper, and the trolley wheel, instead of revolving, is fixed. To give the proper conductivity, the cross wires are of copper. It is believed that the steel wires will withstand the constant friction better than copper, although it is expected that the current will not be maintained at so high a standard.

Work is progressing rapidly on the addition to the Toronto Electric Light Company's station. A huge chimney stack has been erected, the foundations of the building and steam plant are approaching completion, and a battery of boilers is in position. In short, the most difficult part of the undertaking is finished, and in a comparatively short time the Company's central station facilities will be double what they now are.

The Electric Light and Tramway Co., of Victoria, B. C., whose power house was recently destroyed by fire, entailing a loss of some \$80,000, have lost no time in re-building and purchasing the necessary equipment, to enable them to resume business. The new building, composed of brick, stone and iron, is in course of erection, and it is expected that business will be resumed almost immediately. There was an insurance of \$45,000 on the property which was burned.

Notice is given of application for letters patent to incorporate the Central Electric Light Company, of Montreal, capital \$200,000. The following are the names and addresses of the applicants: Louis Perrault, printer; Honore Beaugrand, journalist; Trefle Berthaume, journalist; E. M. Lovelace, merchant; Odilon Dupuis, merchant; Jos. Melancon, notary; Jos. A. Rodier, doctor; Alphonse Raza, architect; Charles Berger, contractor; Jos. Brunet, contractor; James Cochrane, contractor; Louis Cousneau, contractor, and Emmanuel St. Louis, contractor, all of the city of Montreal. The said Louis Perrault, Honore Beaugrand, Trefle Berthaume, E. M. Lovelace, and Odilon Dupuis, are to be the first directors of the company.

The Street Railway Construction Co., Limited, with a capital stock of \$80,000, has recently been incorporated. The objects of the company are the construction, building and equipment and contracting for the construction, building and equipment of street railway lines, and of the apparatus and supply of motive power therefor, by electricity or otherwise. The promoters of the new Company are as follows:—Marshall D. Barr, of Toronto-electrician; Henry W. Darling, of Toronto, electrician; Robt. Bickerdike, of Montreal, merchant; John Torrance, of Montreal, shipping agent; Chas. Morton, of Montreal, merchant; Herbert M. Linnell, of Montreal, electrician; Alex. J. B. Close, of Toronto, real estate agent; Sam. Insull, of New York, electrician; John Muir, of New York, electrician; and Albert W. Atwater, of Montreal, advocate.

The Supreme Court of Appeals of West Virginia held, in the case of *Woolwine's Adm'r vs. Chesapeake & Ohio Railway Company*, reported in the *Railway and Corporation Law Journal*, that a person who, without invitation, visits a telegraph office merely for the purpose of paying a friendly call to the operator, which office is owned and occupied by a railroad company for its purposes and convenience, and which is located on its land and near its track, from which occasional messages are sent and received for outside parties for pay, visits said office as a mere voluntary licensee, subject to the concomitant risks and perils; that no duty is imposed upon the owner or occupant to keep its premises in safe and suitable condition for such visitors; that the owner is only liable for such willful or wanton injury as may be done such licensee by the gross negligence of its agents or employees, and that where there is no controversy in regard to the facts or inferences that may be fairly drawn therefrom, the question of negligence is one of law for the court to determine.

WHAT ELECTRICIANS MEAN BY "EARTH."

BY SYDNEY F. WALKER.

PERHAPS no science has a more puzzling nomenclature than electricity. Electrical engineers have named their units after the great men who have worked in their ranks, and by so doing have perpetuated the names of those men, as possibly nothing else could have done. But the names themselves, volts, ohms, amperes, farads, &c., are sad stumbling blocks to those who would like to know a little of the science, but who have not time to make a set study of it.

But of all terms used by electrical engineers, probably "earth" is the most puzzling.

Even the trained electrical engineer, the man who has spent a large portion of his life in the service of the science, has sometimes to think what is meant by "earth," in a particular case. How, then, can those who have not studied the subject follow its different meanings?

In the early days of electric science, before we knew anything like as much of it as we do now, and when its use was confined almost entirely to experiments shown in the laboratory, we had not these difficulties.

In those days "earth" meant earth, and nothing else. Electricity being looked upon then as something very much like water, only that it flowed in wires instead of pipes, it was natural to refer to mother earth as the great natural reservoir of electricity. As it is well known, you can always procure water if you dig down far enough in the earth, and the earth will always soak up or carry off, more or less readily, all the water that may descend on it. So, too, the early electricians found that by connecting one side of their frictional machines to earth—in this case the floor of the room—they could go on generating electricity as fast as it was discharged from the prime conductor. They found, too, that connection to earth in the form of their own person was fatal to a certain class of experiments.

Later on, also, when it was discovered that an electric current sent through a wire carried above the ground would return to the place of generation through the ground, the same idea prevailed. Old text books tell the student to regard a galvanic battery as an apparatus something like a pump drawing water from a well, able to draw an inexhaustible supply of electricity from the ground at one place, and to pour electricity into the ground, *ad infinitum*, at another place.

A study of old text books, and even some modern ones, will play rare havoc with the ideas held about "earth" in connection with electric lighting supply, for instance.

In charging the electrophorus, for example, the student is told to put the brass plate to "earth," to discharge it, in fact, by touching it with his finger. And the plate was, and is, so discharged. Fancy trying to discharge a 10,000 volt transformer in that way.

About the time of the advent of the telephone, it began to be realised that the part played by "earth" as a return for telegraph circuits was not exactly what it had been supposed. It was gradually recognized that the return current passed through the surface of the earth's crust, using whatever paths might be open to it, very much in the same way that the current passed in the wire forming the other portion of the circuit above ground. The only difference between them was that, while the locality of the current passing in the wire was fairly certain, that of the current passing through the ground was not so certain. A portion of the return current from Manchester to London, for instance, might go round by way of Glasgow or Aberdeen, if there happened to be a path for it by either of those routes.

The development of the telephone, with its often troublesome "cross talk," which was traced to earth connections, in a great measure gradually drove the old ideas of the reservoir quite out of the field. Especially was this so when it was reported from America that messages sent in one telephone wire had been heard on another telephone wire separated six miles from the first, the only possible connection being the earth's crust to which both wires were connected.

Gradually it came to be recognized by practical men that "earth" consisted of the conducting matter, such as moisture, mineral veins, &c., held in the earth's crust, with any metals buried there. But then came another trouble over this question of earth. How did "earth," affect a lightning discharge? and what was "earth" for a lightning rod? Surely the old idea held good here? Lightning came down the copper rod to "earth," and was discharged. Unfortunately, lightning does not always behave in this proper fashion. Prof. Oliver Lodge has rearranged our ideas upon this point. He has even maintained that the "earth" our forefathers worshipped is rather a drawback than otherwise. Some of us still believe in "earth" for lightning rods, though we prefer it of a different form usually to the old patterns; our views in the matter being based upon what we have learnt as to the use of the conductors in the earth's crust and in connection with other apparatus.

And, now, when we are congratulating ourselves upon having at last reached the dignity of supplying electric light from generating stations, just as gas has been supplied during the memory of the oldest of us, comes "earth" again, but it means something quite different, and yet the same.

Now, if a man standing on the ground touches an electric light wire carrying a high tension current, and receives a smart shock, he is said to have "earthed" the line, or the electric light service through his body. So, too, when a naked copper wire, used for delivering current to a series of arc lamps, touches an iron lamp-post, and thereby interferes with the working of the lamps beyond, it is said there is "earth" on. Again, when the possibility of users of electric light, who are supplied by high tension currents, getting shocks is discussed, we are shown various devices for putting the circuit to "earth," should such a contingency arise.

But in these cases the meaning of "earth," though sufficiently the same as in those previously noticed to warrant the retention of the name, is really quite different. "Earth" is not necessary in these cases, as it was in the early days of electricity, with frictional machines. Nor do we use "earth" to save us one cable, as we do with telegraph wires, and as we may with telephone wires.

It is true that in a recent lawsuit over some electric lighting patents "earth" was brought very much in evidence, but it was shown that what was meant was an uninsulated metallic return cable, and that the cable might be insulated if you like.

It is also true that certain electric tramways in America, and in this country, use what they call "earth" for their return current; but they do not mean "earth" in the old sense—they mean a set of conductors, the rails that happen to be on the ground. In electric lighting work we get as far away from "earth" as possible. To any but electrical engineers of considerable experience a recent report that has been made by a Board of Trade inspector must be exceedingly puzzling. Shocks were obtained from the water service in a house in St. James, and a gas meter had one of its sides, which rested against the damp wall, eaten through by electrolytic action. The water and gas service is referred to as being several volts above the conduit in which the cables of the Electricity Supply Company were laid; and further on it is stated in one part of the report that earth, which should be absolute zero of electrical potential, had a difference of 190 volts with one of the supply mains, the normal pressure of the service being 220 volts? What does all this mean? What does "earth" mean here?

In connection with electric light supply, where two insulated cables are used, "earth" may be taken to mean any conductor, such as water and gas pipes, iron conduits, &c., that may be present in the ground, and which are all more or less all in electrical connection with each other, by reason of the moisture which is held in suspension in the soil, as well as in bricks, wood, and even in the hardest stones present.

But, and here is the point where this "earth" varies from what we called "earth" before. These masses of metal, damp ground, &c., should have no connection with the electric lighting service at all; they are at absolute zero, because they are, or should be, absolutely neutral. Whenever they become connected, either directly or indirectly, with any portion of the electric lighting circuit, they are no longer at zero of electrical potential, because no longer neutral, and form part of the electric lighting system, just as if they had been regularly calculated for and laid as the cables were. and the danger, when such a connection exists, is not from any reservoir having been suddenly tapped, as a water-bearing fissure may be in a mine, but in the suddenly bringing within the influence of the electrical pressure created at the central station, of a system of conductors that are of uncertain and varying measurements, and quite beyond the control of the engineer.—*London Electrical News.*

SPARKS.

Mr. O. Higman, of Ottawa, has been appointed by the Dominion Government Inspector of Electric Lighting and is at present engaged in formulating rules for governing the installation and operation of electric plants.

At the Windsor Hotel, Ottawa, Ont., recently, the Mayor and a number of other notable men were invited to partake of a banquet, the components of which had been cooked to a nicety in an electrical oven, located at the rear sheds, where the company afterwards had the pleasure of inspecting it. A local paper gives the following description of the cooking apparatus.—"The oven is of brick, about six feet wide, and somewhat deeper, and about six feet high. In the lower part of the oven are two Ahearn heaters fed by a wire from the Chaudiere Electric Light Company, giving a power of fifty volts. There is no water about this system, as in the house heating. It is just the dry heat. The maximum warmth produced by the two heaters is literally sufficient to roast an ox so intense is it, but of course can be modified away down, and that easily. The beauty of the new system is that everything so cooked is done equally all through. There is no scorching in one part and half-done-ness in another part. To avoid loss of heat by opening and shutting of the oven door in cooking there are at the side of the doors peepholes, as it were, protected by heavy plate glass. The progress of cooking can thus be watched without disturbance to the articles being cooked."

With the assistance of the Provincial Secretary the town authorities have reached an agreement under which the Port Arthur electric railway will be extended to Fort William. The agreement provides that Fort William West will have a railway in full operation by next autumn. The whole length of the line will be eight miles, and a certain number of cars will run continuously from one end to another every day. Certain provisions were made as to Fort William taking a joint ownership if it so elects, and certain protective clauses were put in guarding Port Arthur's interests in the event of the portion of the road within the limits of Fort William being taken over by the municipality. Port Arthur is to have the right to run the road for 20 years from Dec. 1, 1893. At the end of that time Fort William may buy the property of the railway which lies within its own limits at a valuation to be settled by arbitrators. The railway plant and property are not to be taxed by the council of Fort William. Until Fort William pays for an interest in the road, the road is to be managed by the council of Port Arthur, who shall be entitled to the whole income derived from the railway. The line when completed will be a great boon to the citizens of Fort William and the large number of people who have occasion every summer to pass through that locality.

ELECTRICITY IN MINING.

I AM on record as being of the conviction that a successful electric percussion drill is the key to the general introduction of electricity in mining operations, writes Nelson W. Perry in *Electricity*. As the statement thus stands it might be misleading, and I wish at this point to make myself quite clear. It is a fact that at the present time considerably less than one per cent. of all the mines operated employ power drills of any kind, or feel the need of them, or, in fact, would use them if you furnished them a completely equipped plant free of charge. To send solicitors among these, would therefore be not only useless, but a waste of time and substance. There is, however, another class of mines where power drills are not used but might be used to advantage. Here, intelligent presentation of the case might result in business, but how is our tenderfoot electrician or solicitor to distinguish between the two? But among those mines which do use power drills how useless it is to attempt to induce the management to put in an electric plant which will do but a portion of the work, whereas it already has a steam or compressed air plant that will do it all. The representative of the electrical company offers to light the mine with electricity, and will guarantee to work the pumps, hoists and drills by the same agency, but he knows nothing of pumping, hoisting or drilling, and his ignorance is at once apparent, and as to lighting, that is a luxury, and our western brother is unused to luxuries.

But if a few of these mines which can use power drills could be equipped with a perfectly satisfactory electrical drill, the entering wedge would have been driven, and the moral effect upon others would indeed be salutary, and in my opinion do more for the general introduction of electricity to mines of all classes than any other one thing. But the fact is that the electric drill has not yet given entire satisfaction. The manufacturers have put it on the market somewhat prematurely, making claims for it from shop tests which have not yet and cannot be borne out by continued use. If less had been claimed, greater satisfaction would undoubtedly have been given; but when the claim is made that a certain amount of work can be done with an expenditure of 4 H.P., and in practical work but a fraction of this is accomplished with 7 H.P., the reputation of the machine is seriously damaged. Manufacturers must understand that shop tests of 12 or 20 minutes or an hour's duration give little indication of the practical working of a machine.

Some of the objections urged by practical men against the electric drills of the present day are that they are too heavy and heat up to an abnormal degree. Both of these objections must be met before the electric drill will be a practical success. We know of one instance in which a lot of electrical drills of a prominent make were thrown out because they would not clean the hole well. This was not an electrical difficulty, but probably entirely due to a faulty bit. It emphasizes, however, what I have been contending for all along, viz: the importance of employing for all mining work—both in the shop and in the field—of men who know their business. It will not do to copy after accepted practice unless the conditions in both cases are exactly the same. A drill bit that will clean at 300 strokes per minute may choke the hole at 600 strokes, or vice versa; and one which will work satisfactorily with a true reciprocating motion may not give satisfaction when this is departed from. Attention to details of this kind by men who thoroughly understand their business, I am sure, would have saved the electric companies much trouble.

Then as regards water power. While there are but few electricians who are also mining engineers, the proportion who are also hydraulic engineers is still less. The opinion that to run a plant by water power it is only necessary to find the water power, install a wheel and connect the latter to a dynamo, has already resulted in many disastrous failures in the mining regions. In the first place the water powers are often gauged at the wrong time of the year and an estimate made which is far in excess of the minimum, which for steady running must always be regarded as the maximum. This is due to two things—first an ignorance of the business; and second, to taking the measurements at the wrong time of the year, when the water supply is not at its minimum. Throughout a large portion of our western country the proper time to gauge the streams is in midwinter, and early in the morning when every-

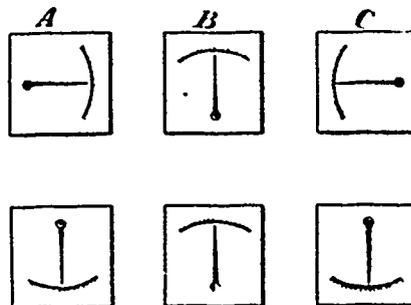
thing is frozen up tight. Those familiar with the western mountain streams know that the volume of water carried by them is sometimes double at 4 P. M. what it is at 6 or 7 A. M., but the difficulty is that at the season of the year most favorable for gauging in other respects, the localities are often almost inaccessible on account of the snow. Then in regard to the proper regulation of the wheel. This is of the utmost importance, and nothing short of automatic regulation will answer the purpose. A lack of attention to this caused the utter failure some years ago of one of the largest electrical plants for mining purposes that has ever yet been erected.

In the case above referred to, a river had been diverted from its usual course in order to enable the company to wash the gravel for gold. The water of the river furnished the motive power for wheels which drove the dynamos, and current was carried for about 12 miles to a series of motors located along the exposed river bed. These were employed to operate cranes to remove the large boulders that were in the way of these placer miners. Occasionally as one of these boulders was being lifted it would slip from its fastenings, thus suddenly removing the load both from the motor and from the dynamo. The result was that either one or both burned out, and this occurred so often that the plant was declared a failure, and finally abandoned entirely, having discredited electricity in that section of country to such an extent that it feels the effect of it to this day.

PLACING OF AMMETERS.

Prof. C. W. Pike gave the result of some experiments with a Weston Ammeter, made to show the effect of two or more instruments on each other when placed near together.

It is much handier when making tests to have the instruments arranged as near together as possible, yet they must not be placed so as to affect the correctness of the readings. Several



When two instruments only are used place them as A and B or B and C. When three; place in this position.

tests were made to ascertain a safe distance for placing so as not to affect the other instrument or be affected by it, and several interesting points were brought out.

The outline sketches will make clear the correct positions for the least error, although the instruments need not set square with each other if placed over a foot away; i. e. one foot between the nearest points of their frames.

TELEPHONE COMPANIES LIABILITY.

IN the case of *The Southwestern Telegraph & Telephone Company vs. Robinson*, reported in the *Washington Law Reporter* the Circuit Court of Appeals for the fifth circuit decided that a telephone company which for several weeks permitted its wire to remain suspended across a public highway, a few feet from the ground, was liable to a traveler who came in contact therewith during an electrical storm, and was injured by a discharge of electricity which had been attracted from the atmosphere, since the electricity would have been harmless except for the wire. The court said. "The duty on the part of the telephone company was clear to prevent its wire from becoming an obstruction on the highway. Under the circumstances shown the defendant in error might have been hurt by coming in contact with the wire of the telephone company, and injuries to the defendant in error might have resulted independent of the fact that the wire at the time was loaded with a charge of electric fluid from the clouds and storm then prevailing. So that it is difficult to see how this verdict could be disturbed even if the contention of the plaintiff in error is correct, that the electricity with which the wire was charged at the time was the proximate and immediate cause of injury to the defendant in error, for which the telephone company cannot be held responsible."

THE POSSIBILITIES OF THE TELEPHONE AS FIRST VIEWED BY THE INVENTOR.

THE following interview took place recently between Prof. Graham Bell, the inventor of the telephone, and an old newspaper acquaintance on the staff of one of the Boston papers :

"Did you appreciate, Professor Bell, the possibilities and tremendous scope and influence of the telephone when you described your invention to me in 1876?"

"No, I did not ; but I was much more sanguine of its success than were my business associates at that time. Like all inventors I saw what no one else could see at that early day. I saw a fortune for some one and hoped that it might be for me. But really, you newspaper gentlemen place my fortune too high. You are responsible for a too exalted impression in the mind of the great public as to the colossal proportions of my estate. I am said to be a millionaire, and people charge me for everything as if I were a millionaire. The telephone has made large fortunes for many men who were courageous enough in the infancy of the invention to invest in the enterprise, but the amount of money made by telephone companies is not so large as the public supposes.

"Has the telephone reached its highest stage of improvement did you say? Oh, no ; I sincerely believe that its possibilities are much greater than any of us imagine. What we must now do is to discover some method by which to simplify the complicated system which has grown up and surrounds my original invention. The telephone proper is the same to-day that it was 15 years ago, when the first line was run from Somerville to the office of Stone & Downer, the State street bankers and brokers. Mr. R. C. Downer, now president of the Broadway National Bank, was really the first to use the telephone, and when I recall the crude manner in which the line was then constructed, I am surprised that it worked at all.

"In the summer of 1876, when you so kindly published a sketch of my invention, and when the *Boston Journal* told the world about my achievements, I could then talk as far as North Conway, N. H., and south to New York. The night when you were obliged to decline an invitation to meet myself and Sir William Thomson, the celebrated English electrician, who has since been made a peer of Great Britain in recognition of his invaluable contributions to science, I had secured the use of the line of the then Mutual Union Telegraph Company, and we conversed with New York, but, of course, the conversation was not so easily carried on as it has been since the construction of what is known as the metallic circuit.

"At the outset we experienced a difficulty in 'calling up' people at the other end of the line, and \$50,000 were expended in merely developing a 'call bell.' To do that it was necessary to use an induction coil, or two high resistance coils of fine wire at either end of the line, making four in all. That necessitated a new transmitter, for originally the hand telephone was used as a transmitter and receiver, and the new transmitter called for more resistance coils and a battery at either end of the line. And thus addition after addition has been made, while the telephone principle remains the same as it was originally."

"The public is disposed to grumble at the prices charged for the use of telephones, and think that because the company is doing such an enormously large business that it ought, therefore, to reduce rather than increase, the rates. The fact is, that the telephone business is unique in this respect. It costs more to do a large wholesale than a retail business, and is less remunerative. It is difficult to convince the public of this, but it is nevertheless, true. To meet the demands of the public expensive additions have been made. The 'call bell' was a necessity, but it cost money to introduce it. A transmitter was a necessity, and that cost money. Improvements have been made in many directions. Every genius has been encouraged to invent something that would enhance the value of the telephone to the public, and that has cost money. In fact, the increase in expenditures in perfecting and adding to the original invention have been, not in arithmetical, but in geometrical proportion. The original charges were not sufficiently high ; consequently, it has been necessary to increase the amount, and unless some device shall be discovered whereby the expenses can be reduced it will be necessary to make a further increase."

"Americans are averse to the tollage system. They prefer to pay a lump sum and to use the telephone as often as they wish,

for all sorts of purposes. What is the result? The business man, who has occasion to use the telephone many times a day pays no more, in most cases, than the man who only actually requires it two or three times a day. A great deal of useless and unnecessary talking is done every day over the telephone. Servants gossip over it to their friends ; people call up their neighbors many times when they would not do so if they were charged a certain sum every time they did so. If the tollage system were introduced the number of calls would be reduced ; it would require fewer employees to transact the business, fewer wires would be necessary and in a thousand and one ways would reduce expenses, while the men who did need the telephone frequently for business purposes would pay for it.

"The telephone, as at present constructed, needs the open air to obtain the best results. To use wires placed underground a metallic circuit will be necessary, similar to the one used now on long distance lines. To place the wires underground and to make a metallic circuit, which means to use two wires where one is used at present, will materially increase the expenses of the company, and the public must pay for the luxury. As the number of wires is increasing rapidly it is evident that they must, ere long, be buried.

"To simplify the telephone opens a wide field for inventors, for it is in that direction that we must turn. Pay a visit to the central office in Boston, New York or any other large city, and you will be astonished at the complex system which has grown up almost unnoticed within a few years. There is a labyrinth of wires such as no outsider ever dreamed of. The telephone is so simple in itself and the people have become so familiar with its use, that they would be astonished if shown a modern switchboard. It cost \$150,000 to construct the switchboard for the central office in New York city, and if you were to see it you would be surprised that it could be constructed for even that large sum.

"Of course, I am not speaking now from the standpoint of the business manager of the telephone. I am merely a stockholder ; I have nothing to do with the business management ; but it is patent to me and to others that the problem to solve now is, How can the telephone business be simplified and expenses reduced without impairing the efficiency of the service? It is needless to say that business will increase. New subscribers are clamoring daily for the service, and this means more wires, or better facilities for using what we now have."

THE TELEPHONE INSPECTOR.

HE apparently was a visitor from the rural districts who was totally unacquainted with city ways. He entered, says a Chicago paper, one of the offices at the city building and finally attracted the attention of a clerk, who rather gruffly inquired : "Well, what is it? What can I do for you?"

"Where's your telephone?" asked the caller, taking a survey of the room.

"Over there."

Without saying another word the caller walked across the room, timidly took down the receiver, placed it to his ear, and stood for a minute as still as a statue, evidently listening and waiting for the mysterious instrument to "say something" to him. Then he carefully hung up the receiver, glanced around the room and noticed that the face of every clerk was stretched out of its normal shape by a smile of generous proportions. Again he returned to the attack. After listening as before, he tapped on the transmitter several times. Again he waited. Then he glanced about him, put his lips close to the 'phone, and said quietly—very quietly, "Hello!"

This was too much for the amused clerks to stand, and after a hearty chorus of laughter one of them kindly volunteered to show the old man how to operate the new-fangled talking machine.

"Hang up the receiver just as you found it. Turn that little crank at the right, which rings the bell. Then take down the 'phone, place it to your ear, and when the central girl answers tell her—"

The old gentleman slowly turned, and gazing long and steadfastly on his young friend, remarked, in that same, sad, sweet voice.

"Say! Don't get gay, now. I'm the inspector, and I'm just testing your telephone."

TRADE NOTES.

The Toronto Electrical Works report themselves very busy on contracts for the Toronto Street Railway Company, for whom they are making the cut-out boxes, switch boxes and trolley wheels. Business generally they find very good and improving. Owing to the demand they have increased their machinery list and space to meet the requirements of a growing trade.

Messrs. Darling Bros. have made recent sales of Claussen clutch pulleys as follows: Hobb's Hardware Co., 1 3/8 in. x 12 in. clutch pulley; Wm. Clendenning & Son, Montreal, 1 25 h. p. clutch coupling; R. White & Co., Montreal, 1 60 in. x 12 in. clutch pulley; 1 3/8 in. x 10 in. clutch pulley; 1 24 in. x 8 in. clutch pulley; 1 50 h. p. coupling; Standard Drain Pipe Co., St. John's Que., 1 44 in. x 12 in. clutch pulley.

F. E. Dixon & Co., manufacturers of leather belting, of this city, have received an order from the Toronto Electric Light Co. for two enormous leather belts for the addition to their works on the esplanade. These belts are to be 33 inches wide, double thickness, and 260 feet long. F. E. Dixon & Co. have already supplied to this company four large double belts, 36 to 38 inches wide, averaging each over 100 feet long, one of which has been in steady use for over 7 years.

The Ball Electric Light Company report the following recent sales:—Mount Forest Electric Co., 500 light alternating plant and installation; Citizens' Telephone and Electric Co., Rat Portage, Ont., 1,000 light alternating meandescend dynamo and station apparatus; Imrie & Graham, Toronto, combination motor and incandescent lighting plant, 50 lamps; E. Hool & Co., Toronto, hoisery manufacturers, combination motor and incandescent plant, 50 lamps; Messrs. Geo. Hees, Son & Co., Toronto, window shade manufacturers, electric motor; Messrs. Anderson & Godard, Ottawa, Ont., electric motor; Hart & Co., stationary manufacturers, Toronto, electric motor.

The St. John's Electric Light Co., of St. John's, Newfoundland, whose station was completely wiped out in the recent conflagration, have completed a new brick station on a much larger scale than their old one. This is equipped by John Starr, Son & Co., Ltd., of Halifax, who have contracted with the Electric Light Co. for the supply of two Leonard-Ball Compound Engines of 100 h. p. each, two 50 light arc dynamos and one 1200 alternating incandescent dynamo, as well as the wires and supplies. The dynamos were made by the Royal Electric Co., of Montreal, and will be in operation in a few days. The Messrs. Starr have installed a plant of the Lahmeyer system in the machine shops of James Angell & Co., St. John's, and are about completing another of the same system for the new bakery establishment of Messrs. A. J. Harvey & Co. The Starr Co. are also doing a large business in "Unique" Telephones, of which they are sole manufacturers. The principal advantage claimed for these, over other instruments lies in the transmitter, the adjustment of which does not depend on any springs or screws, the adjustment of this transmitter is all done in the manufacture, after which no further attention or adjustment is required. This is claimed

to be the only transmitter that fulfills the above requirements and it is certainly a strong point in its favor both for exchange and private use. They are handsomely gotten up in different styles for exchange and warehouse purposes. The Valley Telephone Co. of Nova Scotia, after six months satisfactory test of these have extended their lines throughout the Annapolis Valley, a distance of 85 miles and have now 65 of the "Unique" standard telephones in use with good prospects of largely increasing that number. Messrs. Starr sell these instruments outright at a very low price and will be pleased to communicate with telephone companies or private parties wanting telephones.

PERSONAL.

We had the pleasure of a call a few days ago from Mr. H. C. Whitney, agent for the Crocker Wheeler Electric Co., of New York, who is here with the object of extending the Company's business in Canada.

Our congratulations are hereby extended to Mr. A. M. Wickens, who recently resigned his position as chief engineer and electrician of the Toronto *Globe* to assume the duties of a similar, but more important position, in the new Legislative Buildings, now nearing completion in Queen's Park.

PUBLICATIONS.

The contributions to the October *Arena* are varied, interesting and able. The *Arena*, besides being the most fearless and aggressive of our reviews, is always varied and exceedingly interesting. It combines the intellectual wealth and profound thought of the serious review, with the entertaining qualities of the popular magazine.

Alex. Anderson's electrical works, Adelaide St. Toronto, were severely damaged by fire a week ago.

Mr. Samuel St. Jaques, head clerk C. P. R. Telegraph Company, at Ottawa, was waited on by the leading newspaper correspondents of the city and presented with a handsome diamond pin on the occasion of his approaching marriage to a Brockville lady.

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The cheapest, simplest and most effective Electric Telephones in the world.

The "Unique" Transmitter is the only one made which does not require adjustment and that is not affected by atmospheric changes, or rust up.

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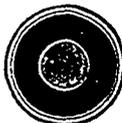
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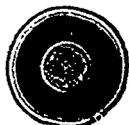
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In a letter from the Inspector of the Boston Fire Underwriters' Union, he states: "A thoroughly reliable and desirable Wire in every respect."

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Clark Joint Gum should be used for making waterproof joints. This is put up in half-pound boxes, in strips about one foot long and five-eighths inch wide, and when wrapped about a joint and pressed firmly it makes a solid mass. For railway and motor use, we make all sizes of stranded and flexible with Clark insulation. We guarantee our insulation wherever used, Aerial, Underground, or Submarine, and our net prices are as low, if not lower, than any other first-class Insulated Wire. We shall be pleased to mail Catalogues with terms and discounts for quantities.



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SPARKS.

The Crosson Car Works at Cobourg, are manufacturing 20 electric cars for the Montreal Street Railway.

The Brantford Electric Light Co. has agreed to accept 3½ cents per lamp per night for 35 lights under a yearly contract with the council.

The new central station of the Guelph Gas and Electric Co., went into operation on Sept. 18th. The building is a most substantial one, and in point of equipment is said to rank in the first-class.

At the instance of the Bank of Montreal, the sheriff of Essex has been appointed receiver of the Windsor and Sandwich Electric Railway. The Third National Bank of Detroit is said to have a claim against the road for nearly \$50,000, and the Bank of Montreal a claim of \$3,000.

A new power station for the Eastern Electric Co. at St. John, N. B., is in course of erection. It will be built of brick similar in design to the present station, which it will adjoin. It will be 35 ft. by 50 ft. in size, two stories high, and the size of the combined buildings will be 130 ft. by 50 ft.

The inaugural ceremonies in connection with the opening of the Winnipeg Electric Railway, were attended by great enthusiasm on the part of the citizens. The first trip was successfully made with about three hundred passengers aboard. The company carried passengers the first day free of charge. At a meeting of representative citizens a vote of thanks was passed to the company in recognition of the energy displayed in the construction of the road.

A new company has been formed for the purpose of endeavoring to secure the right of operating electric cars in the City of London, Ont. The company has made a proposal to the City Council, which has been met by a counter proposal from the existing company, which under a city by-law, have the practical monopoly of certain streets until the year 1925, and have the first claim to extend their lines on these and other streets. Action has been deferred by the council, pending a complete proposal from both companies.

The Eugene Phillips Electrical Works, as assignee of William Henry Sawyer, of Providence, have been granted a Canadian patent for an electric cable, consisting of a series of insulated conductors, braided loosely together with respect to each other into tubular form, each conductor being thereby held apart from its adjoining conductor, practically surrounded by the air occupying the pores and interstices of said fibrous filling, whereby a high insulation resistance and a low inductive capacity is maintained for the said conductors, and means for centrally supporting the conductors of said series and for maintaining them in position.

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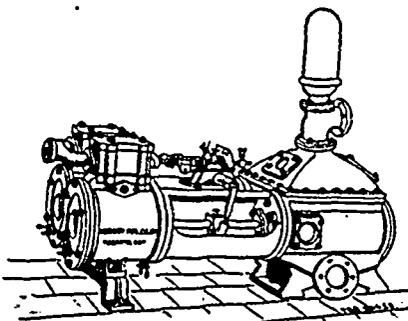
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"Juggernaut" is not such an inappropriate title for the trolley car after all. In India the benighted heathen in the dark days of the past deliberately cast themselves beneath the ponderous wheels. Here in the full light of the nineteenth century, and in Christian Canada, the same thing is done. There is, however, this marked difference in the impelling causes in India the sacrifice was due to religious fanaticism; here it is the result of fool-hardiness. —Toronto News.

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in the form of a large sized lithograph, in eight colors, with key to same, can be had by sending your address with twenty cents in postage stamps, to Geo. H. Heathford G. P. A., Chicago, Milwaukee & St. Paul R'y., Chicago, Ill. As the supply is limited, applications must be made early. Should the supply become exhausted the postage stamps will be returned to applicant.

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HAVE THE RIGHT KIND OF GOODS

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SIMPLY, THERE IS NOTHING LIKE IT.

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Superintendent's Office, Water Works Dept.,
TORONTO, January 6th, 1892.

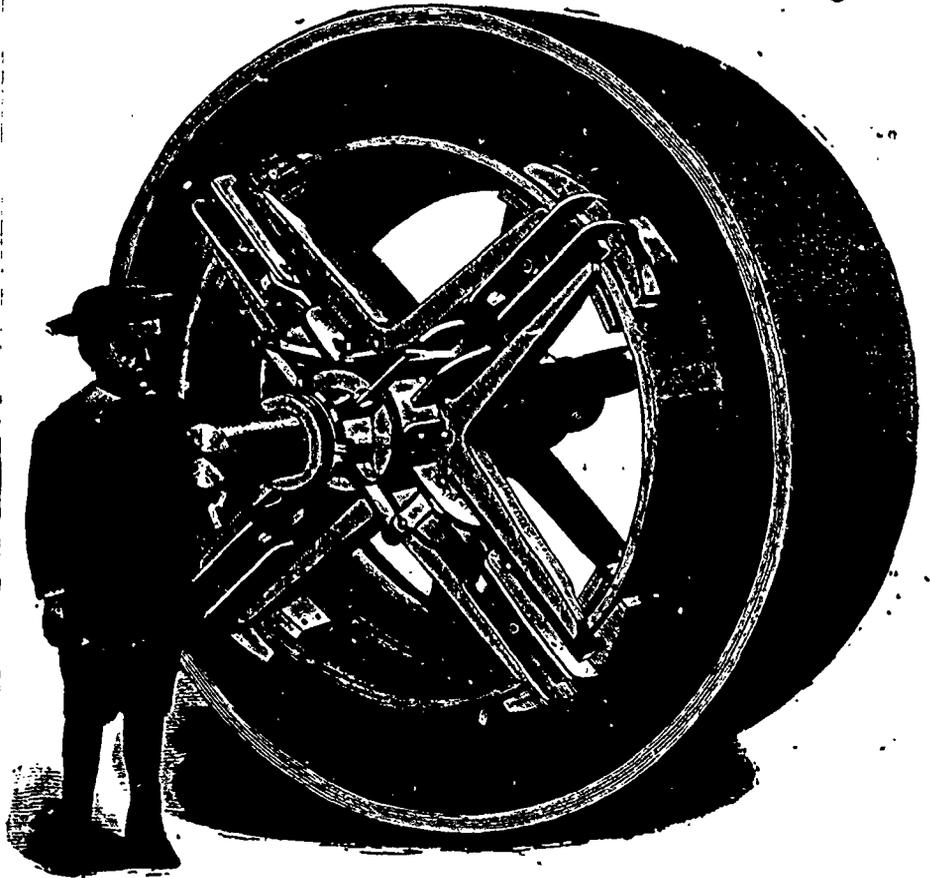
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