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IN THIS NUMBER:
Original Discovery in Toronto, Canada, of the Incandescent Electric Light.

CANADIAN ELECTRICAL NEWS AND ENGINEERING JOURNAL

OLD SERIES, VOL. XV.—No. 2.
NEW SERIES, VOL. X.—No. 2.

FEBRUARY, 1900

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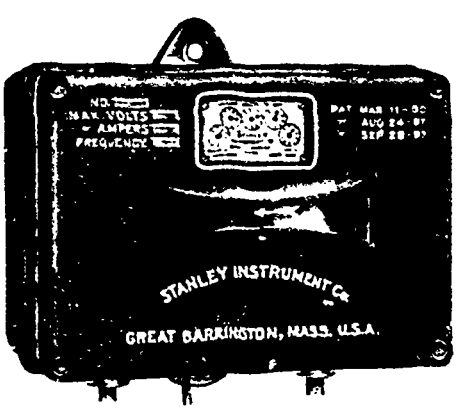

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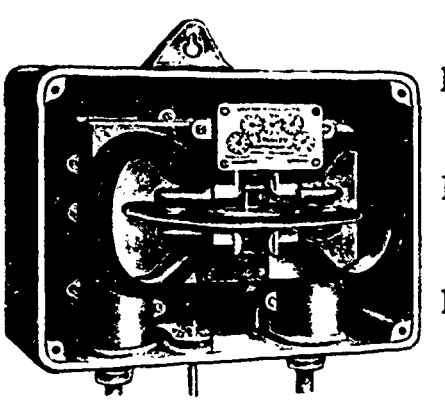

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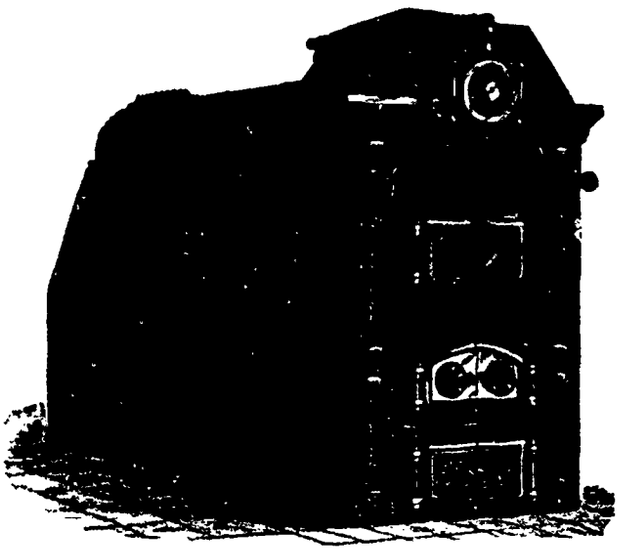

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Scientific American, Oct. 14, 1899.

THE AUTOMOBILE MAGAZINE has at last come to hand and is the most thoroughly satisfactory periodical which we have seen in any language on the subject. It is of regular magazine size and has 111 pages. The quality of the articles is very high and the illustrations are of the best. Everyone who is at all interested in the automobile will find something in the new magazine which will interest him. Even the social side is far from being neglected, as there is an article on the recent floral parade at Newport and on the Automobile Club of France. The Automobile Index, which occupies some nine pages, is exactly what has been needed. On the whole the magazine is a most satisfactory one.

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N. Y. Evening Post, Oct. 9. 1899.

The new illustrated AUTOMOBILE MAGAZINE (New York: U. S. Industrial Publishing Co.) has a very attractive appearance, and is so varied in contents, without undue padding, that one wonders how the editor can fill his pages hereafter. Still, the list on page 101 shows that there is a considerable "foreign automobile press;" and what foreigners can do in the way of furnishing "copy" to the printer, Americans can. The society feature of the new vehicle is brought to the front with news from the Newport festival—the driver, by the way, not always sitting on the left. There are competent-seeming book reviews, and some concessions are made to the general reader in comicalities of pencil and verse. The magazine seems free from bias.

The M'Cormick Will develop more power from a given quantity of water than any other Turbine.

OUR WHEEL GIVES MORE THAN DOUBLE THE POWER OF MOST WHEELS OF THE SAME DIAMETER, BY REASON OF WHICH THE COST IS LESS PER HORSE POWER.

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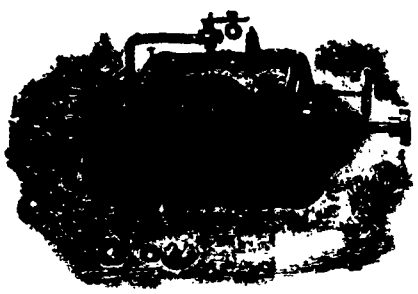

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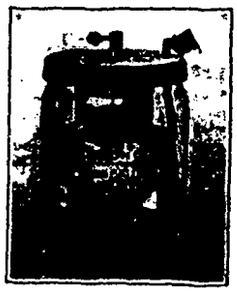

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A Great Chance For Wiremen!

A PREMIUM OF $0.50 for every Lamp installed on

THE FLAT RATE SYSTEM

PAID AT OUR OFFICE to Contractors on presentation of our lighting contract duly signed and the work passed by our Inspector.

(See Clause 5 and foot note in Rules Governing Wiremen Below) . . . .

RULES GOVERNING WIREMEN

NOTE.—It is the intention of this Company to give the best light possible, and if the rules which are tabulated below appear to be rigid, it is not because the Company desires to act with any unnecessary severity towards any contractor, if its inspector enforces these rules, but simply because the Company wants to see its customers get satisfaction which they would not do unless the wiring is of the highest order.

(1)- The Company reserves the right to refuse to accept any new installation unless the work has been done strictly in accordance with the existing rules of the Fire Underwriters' Associatic . for this class of work.

(2)—The Company reserves the right to refuse to make connection to an installation where the voltage drop is greater than one volt at any lamp when the maximum number of lamps are burning.

(3.)—This Company will furnish the first installation of lamps in all cases and in the case of Meter Rate consumers, burnt out lamps will be exchanged for new ones at the Company's office. If the lamps are purchased elsewhere they must yield an efficiency of not less than one Candle Power for each 3.1 watts energy expended, and they must be of a make which is satisfactory to the Company.

(4)—No charge will be made for service connections and no meter rent will be charged.

(5) —For each lamp on all new installations connected to this Company's service mains, the following premiums will be paid to the contractor having brought the signed contract to the Company's office and having done the work :—

FLAT RATE SYSTEM.—50 cts. for each lamp installed.

METER RATE SYSTEM.—10 cts. for each lamp of 16 C. P. or its equivalent installed. Such payments to be made to the contractor when the proper application, duly filled out and signed, has been presented, and the Company's inspector is satisfied that the installation has been done in accordance with the above rules.

(6) —An opal or equally good reflector or shade shall be furnished for each lamp on all new installations.

(7) —No connection will be made for less than two lamps, and no meter will be furnished for less than ten lamps.

NOTE.—"All New Installations" in Clause No. 5, means only for places which were not already wired. No commission will be paid for extra lights, or lights changed over to this Company from other existing companies.

Pending the Completion or Inspection of Installations a receipt will be given for all signed contracts brought to the Company's Office, on presentation of which, and if the work has been accepted, the Commission will be paid to the bearer.

Jacques Cartier Water Power Company

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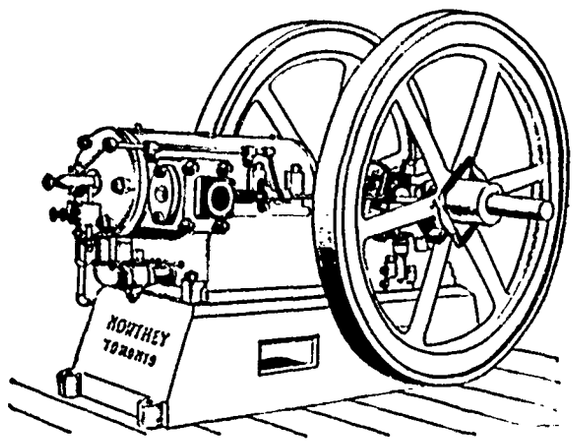

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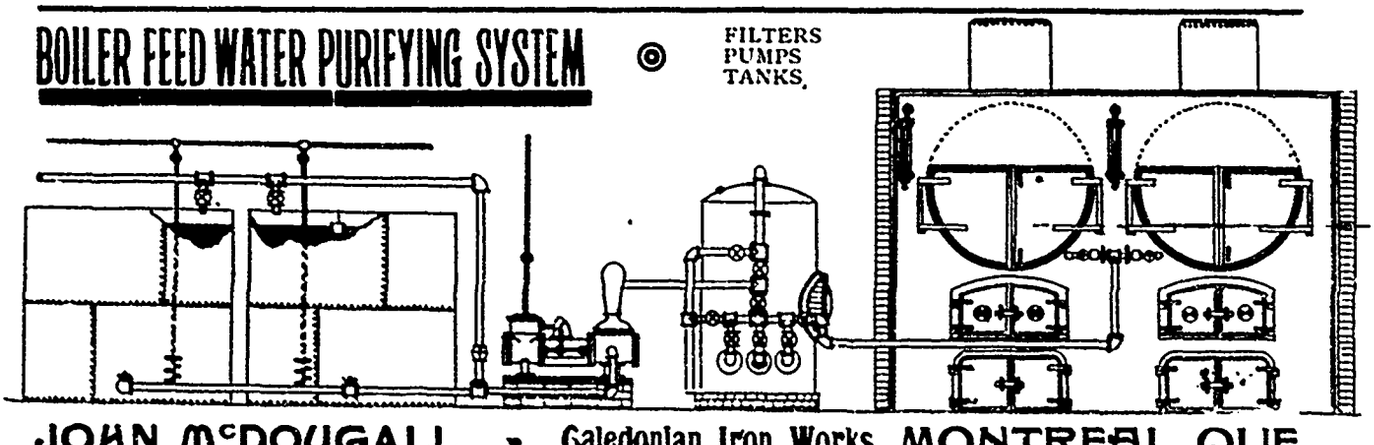


JOHN McDOUGALL - Caledonian Iron Works, MONTREAL, QUE.

CANADIAN
ELECTRICAL NEWS
AND
ENGINEERING JOURNAL.

VOL. X. FEBRUARY, 1900 No. 2.

The Incandescent Electric Light

DATA SHOWING ITS ORIGINAL DISCOVERY IN TORONTO, CANADA. DR. WOODWARD'S PATENT ANTE-DATES THE PATENT OF MR. T. A. EDISON, AND IS PURCHASED BY THE AMERICAN INVENTOR.

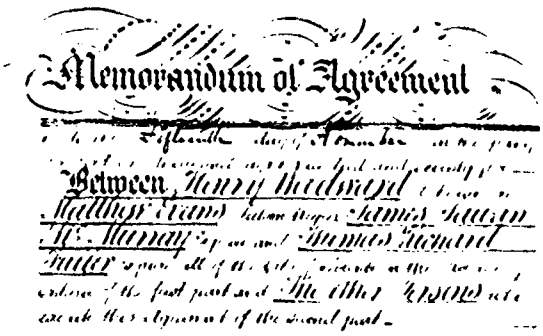
Some interesting historical data has recently been placed at our disposal and is herewith presented to readers of THE ELECTRICAL NEWS, relative to the original discovery of the principle of the electric light. It will interest our readers to learn that this discovery appears to have been made in Toronto, Canada, and patented in Canada and the United States prior to the time when a patent was granted to Mr. T. A. Edison. It is quite as interesting to know that the patent for the Canadian discovery was purchased by Mr. Edison in New York City at the time when he was making his original investigations and before he obtained his patent.

To Henry Woodward, a medical student, and Matthew Evans, a hotel keeper, of Toronto, Ont., appears to be due the credit for the first discovery of the principle of the incandescent electric light. They were neighbors and frequently experimented together with a large Smead battery and induction coil, of which Woodward was the possessor.

DR. WOODWARD'S PIONEER ARC LAMP.

While seated at dusk one evening watching the buzzer of the induction coil, the light of the spark at the contact post drew their attention. Evans was the first to notice it, and drawing out his watch exclaimed, "Look at the light from that spark! Why you can see the time!" "My!" said Woodward, "if one could only confine that in a globe of some sort, what an invention we would have! It would revolutionize the world!"

From this beginning, in the early part of 1873, Woodward and Evans worked to perfect the idea, and on August 3rd, 1874, were granted a Canadian patent. The method of exploiting the discovery is set forth in the accompanying agreement by the original promoters:



Memorandum of Agreement

Between, Henry Woodward

"Whereas the said Henry Woodward having invented a new and improved method of obtaining light by means of electricity, and having received advances and other assistance from the said other parties hereto of the first part, agreed to grant, convey, transfer and assign to each of them a one-fourth share of interest in the said invention and in letters patent therefor whenever and wherever obtained.

"And whereas the said parties of the first part being desirous of raising a further sum of one thousand dollars for the purpose of obtaining letters patent from Washington and of making certain experiments, agreed to and did by the instrument herein recited grant, transfer, convey and assign seven thirty-fifth parts or shares in the said invention and in letters patent therefor whenever and wherever obtained to the following parties to wit: Rupert Mearse Wells, W. J. Gibson, George Trimble, E. Heimrod, Messieurs McMurray and Fuller, Emma Pepler and M. Sheppard, all of the said city of Toronto, J. E. O'Reilly of the city of Hamilton, and A. M. Sutherland of the town of Barrie.

"And whereas the said instrument is in the words and figures following, that is to say .....

"Whereas Dr. Woodward has invented a new and improved method of obtaining light by electricity, and has obtained letters patent for the said Dominion of Canada, and has made application for letters patent to the patent office at Washington.

"And whereas Matthew Evans, James Sa in McMurray, and Thomas Richard Fuller have each made adv ces to the said Dr. Woodward for the purpose of assisting him in carrying out the said invention, and are e. ch equally interested with him therein.

"And whereas it is deemed necessary for the purpose of procuring the said letters patent from Washington, and for the purpose of making certain practical experiments with and trials of the said invention, to procure a further advance of one thousand dollars.

"And whereas the said Woodward, Evans, McMurray and Fuller have agreed to divide and apportion their interests in the said invention into thirty-fifth parts, so that each of the last named parties shall hold seven thirty-fifth parts or shares, and that the parties making the said new advance of $1,000, shall also hold seven thirty-fifth parts or shares therein, each new subscriber or contributor to have an interest in the seven thirty-fifths of the invention pro rata according to the amount of his subscription or contribution.

"And whereas the parties hereto hereby agree to the arrangement above mentioned.

"The said Henry Woodward, Matthew Evans, James Saurin McMurray and Thomas Richard Fuller, all of the city of Toronto, in consideration of the said new subscriptions to be obtained and of five shillings to each of them in hand paid, hereby convey, transfer and assign to the other parties hereto a seven thirty-fifth interest in the said patent or invention pro rata amongst themselves according to the respective subscriptions or contributions, and the said other parties hereby agree to pay to the said Wood-

THE LATE MATTHEW EVANS.

ward, Evans, McMurray and Fuller, for the purposes above mentioned, the amounts set opposite their respective names. And the said Woodward, Evans, McMurray and Fuller agree to use the said money exclusively for the purposes above mentioned in procuring the said letters patent from Washington, and for making the said experiments or trials. It is understood that so soon as the said subscriptions are made, all the parties hereto are part owners in the said patent or invention, and that their interests therein are as above set forth.

"It is further understood that the Gramme electrical machine purchased by and imported from Paris by the said McMurray and Fuller, shall, in the event of the ultimate failure of the said invention, be the exclusive property of the said McMurray and Fuller, but in the event of success, it becomes the property of the partnership hereby created on payment of $1300.00.

It is further understood and agreed by and between the parties hereto that Dr. Woodward shall at once proceed to Washington for the purpose of procuring the said letters patent, and that the said experiments and trials shall be proceeded with continuously immediately after his return. And the said Woodward, Evans, McMurray and Fuller promise and agree with the other parties hereto that the said Woodward shall immediately after the said $1,000 shall have been subscribed, proceed to Washington, and shall, if possible, procure the said letters patent, and shall immediately, after his return, proceed continuously for a period of three months with the said experiments or trials, said experiments or trials being made with the view of practically proving that at least fifty electric lights can be shewn from the said machine at the same time.

"And they further agree that the said sum of $1,000 shall be sufficient for the purposes aforesaid.

"Dated at Toronto the fourteenth day of May, one thousand eight hundred and seventy five".

"And whereas the said instument is executed by all parties hereinbefore named

"And whereas the whole of the said one thousand dollars has been properly expended.

"And whereas it being desirable to raise a further sum of money by way of additional subscription for the purpose of taking out letters patent at Washington, the parties hereto of the second part have agreed, in consideration of receiving a further interest in the said invention and in the letters patent therefor whenever and whereever issued, each to advance to the parties hereto of the first part a further sum of thirty-three ($\frac{33}{100}$) dollars.

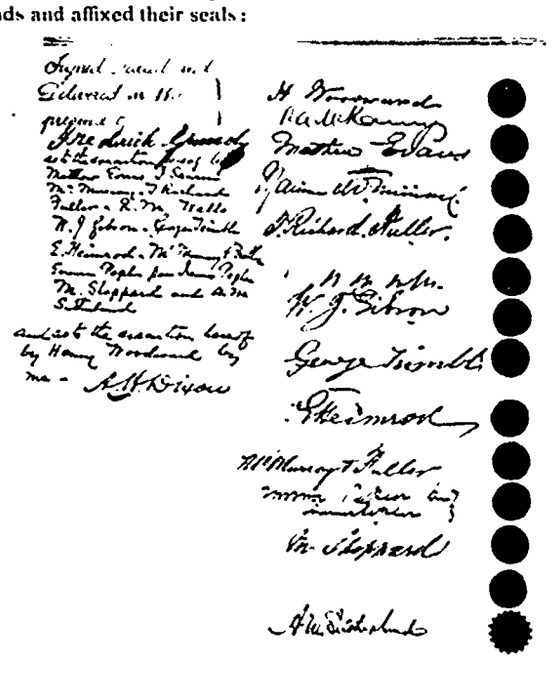
"Now this indenture witnesseth that, in consideration of the said additional subscriptions of five shillings to each of the parties of the first part, the receipt whereof is hereby acknowledged, the said parties of the first part, and each of them do hereby sell, transfer, assign and grant to the parties hereto of the second part their and each of their executors, administrators and assigns respectively, three thirty-fifth shares or parts in the said invention and letters patent in addition to the shares or parts granted and assigned by the said recited instrument.

"And whereas it is hereby agreed by all the parties hereto that the shares, parts or interests of all of the said parties in the said invention and in the letters patent therefor whenever and wherever the same may be issued, shall be as follows the said Henry Woodward shall have own possession and be entitled to six thirty-fifth shares or parts; the said Matthew Evans to seven thirty-fifth shares or parts; the said James Saurin McMurray to seven thirty-fifths shares or parts; the said Thomas Richard Fuller to seven thirty-fifth shares or parts; and the said Rupert Mearse Wells, W. J. Gibson, George Trimble, E. Heimrod, A. M. Sutherland, Emma Peplar, M. Sheppard, and J. E. O'Reilly each to one thirty-fifth share or part, all of the said parties being joint and several owners and not partners, and for the purpose of more effectually vesting the said shares, parts or interests in the several parties entitled thereto, the said Henry Woodward hereby, in consideration of the premises, grants, transfers and assigns unto the said Matthew Evans, and to the said James Saurin McMurray, and to the said Thomas Richard Fuller, each of them their and each of their executors, administrators and assigns, seven thirty-fifth shares or parts in the said invention, and in the letters patent therefor, and to each of the following parties, namely, Rupert Mearse Wells, W. J. Gibson, George Trimble, E. Heimrod, A. M. Sutherland, Emma Pepler, M. Sheppard and J. E. O'Reilly their and each of their executors, administrators and assigns, one thirty-fifth share or part thereof, and the said Matthew Evans, James Saurin McMurray and Thomas Richard Fuller join and concur in the said grant or transfer to the said other parties and acknowledge the same to be valid and binding.

"And the said parties of the second part hereby agree to pay to the said parties of the first part each the sum of thirty-three ($\frac{33}{100}$) dollars, the receipt of the said Thomas Richard Fuller being a valid discharge therefor.

"And the said parties of the first part agree to use the said money exclusively for the purpose of procuring the issue of letters patent at Washington, and the said Henry Woodward hereby agrees after the issue of the said letters patent, to execute to the other parties hereto their and each of their executors, administrators or assigns, such further instruments and assurances for the better and more effectually conveying to them their said respective shares or interests as may be reasonably required or legally necessary."

In witness whereof the parties hereto have hereunto set their hands and affixed their seals:



Mr. A. M. Sutherland, one of the signers of the above agreement, in response to the request of a relative in Toronto for information on the subject, wrote as follows :

64 Carnegie Ave., East Orange, Nov. 24, 1896.

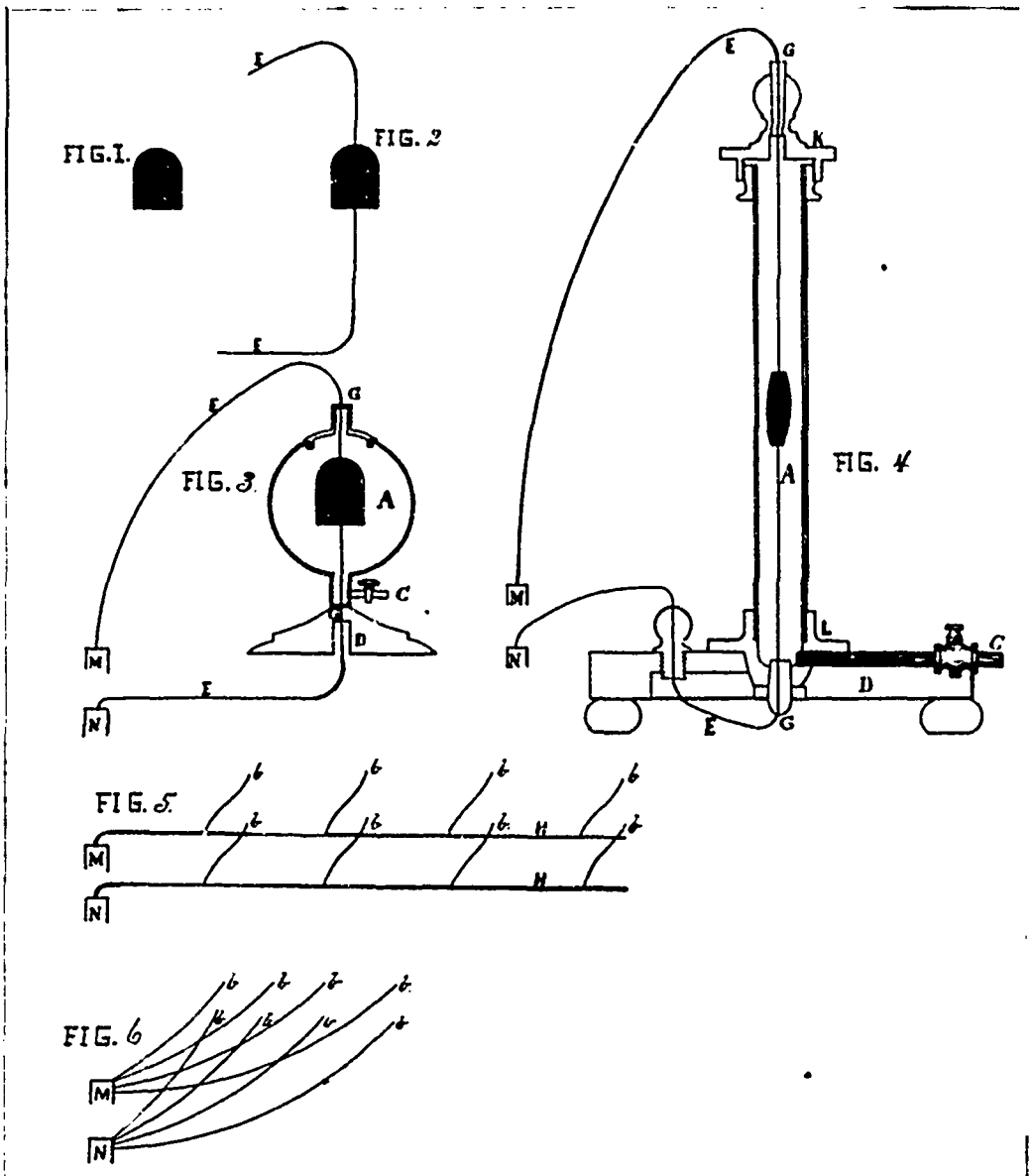
My Dear R——

M——tells me that somehow you came across a document signed by me some years ago showing some connection with electric incandescent light, and wishes me to tell you what I know of the matter. It is this. Somewhere between 1867 and 1875, I think it was, I was introduced by Mr. T. R. Fuller, a son of the late Bishop Fuller of Niagara, to a medical man named Woodward who was deep in the study of electricity. I was told that this gentleman had discovered two very important facts unknown to students of electric science, viz., the possibility of dividing the current, and the fact that placing a thin film of carbon between the poles in a circuit and enclosing the same in a vacuum would, by the incandescence of the carbon film produce a strong light. I recollected that a year or two before I had seen in the "Universal Exposition" at Paris a strong light shown by M. Gramme of that city, which was produced by an arc formed between the ends of two heavy carbon rods through which a very strong current of electricity was passed ; but the whole affair was so clumsy that I took very little "stock" in it. Therefore, when I heard that something neat and apparently serviceable was discovered by one near home, and that he wanted help to follow up his experiments and to obtain patents, I readily joined a number of friends and others and agreed to furnish the sum then supposed to be sufficient.

Two patents had been applied for in Washington at the same time for almost identically the same thing. One of these was Dr. Woodward's and the other was by a Russian whose name, I think, was Ladigan. Dr. Woodward and this Russian were declared in "interference" and had to fight each others' application before the patent authorities in Washington. Dr. Woodward won by proving priority of invention. After this it was found that so much money was required and apparently so little progress made towards completing the invention, that after our first investment, we decided to put in no more money until we could personally see the lights, which up to this time none of us had ever seen but had taken on faith. This displeased the inventor so much that he left for England and for years we knew

H. WOODWARD.

No. 181,613 ELECTRIC LIGHT. Patented Aug. 29, 1876.



WITNESSES
Geo T Smallwood
John Roby

INVENTOR
Henry Woodward
By- John J. Halstead
Attorney.

nothing of his whereabouts. A few years after this I moved to New York, and in the course of business I was thrown into more or less intimate relationship with the now famous electrician, Thomas A. Edison, who was at that time experimenting with the electric incandescent lamp at Menlo Park, N.J. In talking about it one day, I chaffingly said: "Why Edison, you are nowhere! I am part owner of a patent several years older than yours on about the same thing you claim." He asked what patent I referred to and I told him, he remarking: "O, I know that patent, it is no good." The next day one of Mr. Edison's men, whom I knew very well, asked me how much I would take for my claim in the Woodward Patent, and that day I sold it to this gentleman, who in turn made over the papers to Mr. Edison. This is all.

Yours truly,

Sgd) A. M. SUTHERLAND."

UNITED STATES PATENT OFFICE.

Henry Woodward, of Toronto, Ontario, Canada, Assignor, Mesne Assignments, To Rupert Mearse Wells, Thomas Richard Fuller, and Ernest Heimrod, of same place, and Charles H. Woodward, of Lindsay, Canada.

IMPROVEMENTS IN ELECTRIC LIGHTS.

Specification forming part of Letters Patent No. 181,613 dated August 29, 1876; application filed Jany. 4, 1875.

To All Whom It May Concern:

Be it known that I, Henry Woodward, of the city of Toronto, county of York, in the province of Ontario, Canada, have invented new and useful improvements in the art or process of obtaining artificial light by means of electricity, and I do hereby declare that the following, taken in connection with the drawings which accompany and form part of this specification, is a description of my invention sufficient to enable those skilled in the art to practice it.

In the first place, I use a gas engine or other suitable motive power, for the purpose of rotating a magneto-electric machine, and at such a velocity as shall create electricity sufficient to heat certain pieces of carbon hereinafter described. The magneto-electric machine should be of sufficient power for the purpose of heating the carbon to a state of incandescence. A piece of carbon of suitable size is scraped and shaped until fitted for the purpose; one pole is then attached to the top of the carbon, and the other to the bottom thereof, by suitable electrodes. It is then enclosed in a globe or other vessel, either of glass or other suitable material. The air is then exhausted from the said globe or vessel after it has been hermetically sealed at the ends, and the globe is then filled with a rarefied gas that will not unite chemically with the carbon when hot. Electricity is now supplied, and in sufficient quantity to heat the carbon within the vessel to a state of incandescence. The rarefied gas previously introduced now becomes luminous, and constitutes the light herein designated as "Woodward's electric light."

This arrangement and process will give a light of any required intensity, and there is, practically, no limit to the number of lights that may be obtained from one magneto-electric machine.

In the accompanying drawings, the same letters of reference indicate the same parts in all the views, and also in this specification.

Figure 1 is an elevation or front view of a piece of carbon, and is marked B. It is supposed to be scraped and shaped until suitable for the required purpose.

Figure 2 is also an elevation or front view of a piece of carbon with the electrodes E.E. attached thereto leading to and from the positive and negative poles of the battery, one being attached at the top and the other at the bottom of the carbon.

Fig. 3, is a sectional elevation, showing a globe marked A, but which may be a vessel of any other suitable form. The prepared carbon, B, is also shown therein with the aforesaid electrodes E.E. attached thereto; showing also a tube C, with an air-tight stop-cock, to be used in exhausting the air from the globe A, and for the injection of rarefied gas into the same; showing, also, the hermetical sealing of said vessel at the ends G.G. of the tubes, and showing also the stand D.

Fig. 4 is a sectional elevation, showing the adaptation of another form of vessel, A. This drawing is on a larger scale, in order to show the manner of closing the ends of the vessel which is done by brass sockets; that at the top being marked K, and that at the bottom being marked L; showing also a carbon B, different in form from that in the other vessel, and having the two electrodes E.E. running to and from the poles N and M.

Fig. 5 is an elevation, showing one mode of connecting the various lights with the machine by means of two trunk wires or electrodes H.H. running from the positive and negative poles M and N of the machine, with branches b, b, &c., therefrom, to each light.

Fig. 6 is also an elevation, showing another method of connecting the lights with the machine, each light having a distinct wire b, running to each pole M N of the machine or battery. Having thus described my invention, I claim: A carbon B, in combination with a lamp or other suitable vessel, A, filled with rarefied gas, possessing the property of not chemically combining with the carbon when in a state of incandescence, in connection with the described arrangement and mode of connection of the electrodes E.E. with the carbon, all as shown and set forth.

HENRY WOODWARD,

Witnesses { WILLIAM FITCH, GEORGE T. SMALLWOOD.

The first incandescent lamp was constructed at Morrison's Brass Foundry, Adelaide St. West, Toronto, and was a very crude affair. It consisted of a water gauge glass with a piece of carbon filed by hand and drilled at each end for the electrodes and hermetically sealed at both ends, having a petcock at one end with a brass tube to exhaust the air. Woodward made the mistake of filling the tube or globe of this lamp with nitrogen after having exhausted the air. If, as Professor Elihu Thomson has said, he had stopped when he had the tube exhausted, he would have had the honor of being the inventor of the incandescent light as used for commercial purposes.

Six of these primary lamps were made up and connected in series. Evans was accustomed to tell of the excitement which attended the watching of these lamps coming to incandescence. To use his own words, 'There were four or five of us sitting around a large table, Woodward at the head. The six lamps were strung in series from two supports on the table. Woodward closed the switch and gradually we saw the carbon become first red and gradually lighter and lighter in color until it beamed forth in its beautiful light. This was the most exciting moment in my experience." Evans was also accustomed to express the opinion that the inventor never gets the reward of his labor, and that by right he should have been the man to reap the benefit of this invention, in the perfecting of which he had expended $20,000.

As the result of his experiments, Woodward decided that a much stronger battery would be required to obtain the desired effect, and in company with Evans he went to New York City to see what they could obtain in the shape of a stronger machine. Finding that such a machine could not be obtained in New York, Woodward was dispatched to Paris to obtain, if possible, from M. Gramme a machine that would do the work. He was absent four months and succeeded in purchasing a machine from Gramme which he shipped to Toronto by sailing vessel. The arrival in Toronto of this machine gave rise to much excitement among the electrical fraternity of that day. The machine stood about four feet high and cost £500. One of similar capacity could be bought to-day for $35.

The machine was first tested on the premises of a hardware company on King St. West, near the Gurney Foundry Company's premises. Permission was obtained to couple the machine on to a line shaft which was propelled by a 60 h. p. engine, but on attaching a single light to the dynamo the engine was immediately shut down or the belts thrown off. Finally the machine was made to run successfully a single arc lamp which, as above stated, was of very crude construction and was

controlled by hand feed. The machine was supposed to have a capacity sufficient to operate 50 incandescent lights. The single lamp, backed by a reflector, gave out such a strong light that Evans declared that the street car horses stopped opposite the building in which it was, while people from the surrounding neighborhood ran over to the factory, thinking it was on fire. The machine, however, would never run more than one light at a time. This first arc lamp was invented by Woodward also, and is said to have been manufactured by a machinist named Nesbitt. Woodward and Evans were the subject of much public ridicule, being frequently called "cranks." After the invention had been thus far tested, outside capital was obtained, and a company formed for the supply of incandescent and electric lights to the city and private individuals. It is interesting to note from Mr. Sutherland's letter that some of the original stockholders put money into the enterprise before having ever seen the light, and that when they declined to put up more money on the same conditions, Woodward became much displeased and left for Europe.

Dr. Woodward is said to be now residing in London, Eng., while Mr. Evans, who was his partner, and whose portrait accompanies this article, died in Toronto last year.

We are indebted for much of the above data to Mr. J. J. Wright, manager of the Toronto Electric Light Co., and Mr. Patriarche, of the Electrical Maintenance Company, Toronto, who sometime ago purchased the original of the agreement printed above, and other documents relating to the subject.

QUESTIONS AND ANSWERS.

Subscriber writes: Will you kindly answer the following questions in the next issue of THE ELECTRICAL NEWS:

1. What is the situation of Shawenegan Falls, where the new power plant is to be located.

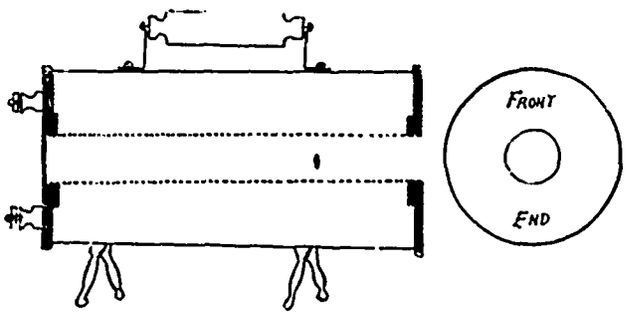
2. Where did the name of "Bus-bar" originate, and why is this term used? I have noticed that English electrical papers term it "Ominbus-bar."

3. What length and size of wire would be required for winding a curling tong heater for 114 volt circuit?

ANSWER.—1. The St. Maurice river, as is well known, is one of the most important northern tributaries of the St. Lawrence, emptying into it at Three Rivers, Que. Seventeen miles from the mouth of the St. Lawrence is located Shawenegan Falls, where the water power development has been undertaken. These falls are, therefore, about 90 miles distant from the city of Quebec and 4½ miles from the line of the Great Northern Railway, while the Canadian Pacific Railway passes within ten miles of the falls. A map showing the proposed development of the falls appeared in THE ELECTRICAL NEWS of March, 1899.

2. It is difficult to say just where the name "Bus-bar" originated. It was used in the early days of the incandescent light and signified the common bar to which the terminals of all dynamos were attached and from which all circuits extended. The word is shortened from omnibus, which is Latin, and the dative case of the pronoun omnes, signifying "all." Omnibus, therefore, is literally "for all." Hence also its application to the well known vehicle of that name.

3. If our correspondent will take about 35 feet of No. 24 or 25 B. & S. gauge German silver wire, wind same on a piece of brass tube of sufficient diameter to admit of entering the tongs, and sufficient length to admit of their heating ends, previously wrapping the pipe over with a layer of asbestos cloth, he will then have accomplished the bulk of his task. The wire, of course, should be uninsulated, and space should be left between each convolution as it is put on. The wire will have to be drawn on quite tightly (not sufficiently so to cut through the asbestos), as it will expand slightly when the current is on. As all the wire will probably not go on one layer, repeat the process, that is, cover the first coil with asbestos and wind back on top again, and so on until the length of wire is all coiled. Bring the start end and finish end to binding posts on the outside of the outer shell, said binding posts being insulated from the shell with mica washers, and mica or fibre tube around the screw. If the bare wire comes close, or if you require to make a cross-over, use pieces of clay pipe stem to insulate one from another. When finished the coil should have an outer layer of asbestos, and any further space can be filled up with asbestos clippings so as to keep the heat in as much as possible. The accompanying sketch shows the finished article, dotted lines show-



ing inner tube on which asbestos and German silver wire are placed. It will be observed that the whole can be made out of brass tubing of suitable diameter, and the ends cut from thick brass sheet. Do not solder anything, as it will melt; tap and thread one into the other, or fasten pieces with machine screws.

NOTE.—An easy method to ascertain the amount of wire required for any heating device is as follows: First determine on a size that will not take too much current for the work to be done; then stretch out a quantity (be sure there is not too much) on pins spaced along a board, take wires from current supply, attach one to one end of this spaced out German silver wire, use the other end as a sliding contact, beginning at distant end and sliding it along the wire, which, of course, becomes hotter and hotter as resistance is being cut down, until the wire assumes a blue shade owing to heat. Stop then, and cut off the piece between the current contacts and use it for your heater. When enclosed from air it will be hotter, therefore we advise stopping when it assumes the blue shade.

PERSONAL.

Mr. James A. Hicks has been appointed electrical inspector in Montreal for the Royal Electric Co.

Mr. J. M. Clark, a director of the Smith's Falls Electric Light & Power Co., and a prominent business man of that town, died last month.

Mr. George White-Fraser, E.E., has returned to Toronto, after an absence of more than one year in the Yukon district on a government commission.

We learn with regret of the death, on January 9th, of Mr. Jas. D. Smith, of this city, father of Mr. J. Norman Smith, electrical engineer of the United Electric Co., Limited.

Mr. R. A. Ross, of Montreal, consulting electrical engineer of the C.P.R., recently left for Rossland, B. C., to inspect the plant installed at the company's round house there.

Mr. Joseph Lappin has resigned his position as electrician for the Metropolitan Railway Company, of North Toronto, and is now in the employ of the Canadian General Electric Company.

Mr. D. A. Shiles, traffic manager at Vancouver for the British Columbia Electric Railway Co., has been transferred to New Westminster, as local manager there, and is succeeded by Mr. J. J. Franklin.

Mr. Mark. B. Thomas, who was manager of the Hamilton & Dundas Railway, which road has passed into the hands of the Cataract Power Co., has been appointed to a responsible position in connection with the street railway system of this company.

Archibald Rowan, inspector of gas and electric light at St. John, N.B., died in that city on January 10th, at the age of 70 years. He was appointed to the above position in 1875, previous to which time he had been prominent in civic affairs and a candidate for the mayoralty.

Mr. Herbert J. Somerset, manager of the Winnipeg Electric Street Railway, has accepted a lucrative position as general manager of the tramways at Perth, West Australia. Mr. Somerset was much esteemed in Winnipeg, and carries with him the best wishes of numerous friends.

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

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EDITOR'S ANNOUNCEMENTS.

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

The "Canadian Electrical News" has been appointed the official paper of the Canadian Electrical Association.

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Electric Light Invention in Canada.

We are privileged to publish in this number some interesting data regarding the history of the invention of the electric light. Canadians will no doubt be surprised to learn that the principle of incandescent electric lighting was discovered in Toronto prior to the time when Edison's invention was placed before the public, and that this Canadian invention was sold to Mr. Edison, and were no doubt used by him in the further exploitation of his inventions and discoveries. We are largely indebted for this interesting data to Mr. J. J. Wright, manager of the Toronto Electric Light Company, himself a pioneer in the electric light industry, and to Mr. Patriarche, manager of the Electrical Maintenance Company, who secured much of the information by personal interviews with Mr. Matthew Evans, one of the original promoters of the discovery. It is gratifying to learn that Canada is not only the scene of some of the greatest achievements in the applications of electricity, but is also the home of some of the most important discoveries relating to the science.

An Incident in Electric Lighting.

The accident which caused the death of Mr. Alphonse Girouard, and which is referred to by our Montreal correspondent is, to say the least, peculiar, and so far as the electrical fraternity is concerned, no entirely satisfactory explanation has been given. It appears that two rival electric lighting companies had their primary alternating lines, operating under a pressure of 2,000 volts, in close proximity. This voltage in some way came in on the secondary mains, which normally were at 52 volts. The theory is advanced that the primary wire came in contact with a guy wire, and this in turn with secondary supply wires, bringing the 2,000 volts in on one side. In order to permit of the accident, the inside wiring must have been grounded, so it is surmised that the deceased stood on an iron rail in front of the hotel bar to raise himself up sufficiently to grasp the socket. Rain was falling and a strong gale of wind blowing at the time, and it is possible that the wind may have blown the dangerous wire into contact, as the trouble patrols were unable, shortly after the accident, to find high voltage in the premises. It has not been ascertained whose primaries caused the accident or how they came in contact with the secondaries. The transformers are reported to have been in good order. The accident is unfortunate, as it already has had a tendency to make customers afraid to turn on their sockets. It may truly be said, however, that the peculiar combination of conditions which resulted in this accident will very rarely be met with, and are almost impossible in dwelling houses. Nevertheless, it is in the interest of electrical progress that the matter should be thoroughly investigated and all the facts concerning the case placed fairly before the public. This will be the best means of dispelling prejudices against electricity based upon erroneous versions of this accident.

Central Station Practise.

The address of the president of the North-Western Electrical Association, delivered at the eighth annual convention held in Milwaukee on January 17th, contains food for thought for central station managers. His remarks were confined to a review of the conditions surrounding the operation of central stations. The changes in practice to which he refers have had practical

demonstration in Canada as well as in the United States, and the suggestions offered regarding operating methods are likewise applicable on this side of the border. Sketching the progress made in central station machinery, Mr. Doherty expressed the opinion that the constant current transformer is here to stay, and that street illumination by series alternating enclosed arc lamps is a decided improvement over the old series direct-current open arc. The distribution of light is materially improved and a more uniform illumination obtained. Instances are cited where two central stations had adopted gas engines as prime movers, using sizes as high as 650 h.p. It might be mentioned that in Ontario the Sandwich, Windsor & Amherstburg Railway Company have just installed a 150 horse power gas engine for operating their electric road, to replace a Corliss steam engine. The president referred to the necessity of a better distribution of street lighting, and his opinion is that this may be accomplished by the greater use of the incandescent lamp. He thought there had been little improvement in the past few years in direct current methods, but this could not be said of alternating current appliances and methods. In the past, "unaccounted for current" in alternating current stations had often amounted to 80 per cent. of the output, but modern transformers, up-to-date methods and equitable rates promised to reduce this loss to an almost negligible quantity. The average central station was handicapped for four reasons, namely, improper and insufficient education of operators, poor accounting, lack of capital, and inequitable rates. He strongly recommended the further education of present employees. When speaking of employees, Mr. Doherty might have gone further and said that the remuneration which is sometimes given to those in charge of electrical apparatus is not such as could be expected to induce such persons to put forth their greatest efforts towards self improvement and the welfare of the business. The subject of municipal ownership was discussed at some length. The conclusion reached was, that the main protection against municipal control lies in educating the people with regard to its fallacies.

The Proposed Dodge Telephone Company of Canada, Ltd.

We have had the opportunity of examining the prospectus of the Dodge Telephone Company of Canada, Limited, and the circular letters accompanying the same. Some of the features of this prospectus seem to call for particular mention and enquiry. The first of these is, that, while the company has not yet been granted a charter or completed its board of directors, it is soliciting from the public applications for stock, such applications to be accompanied by a deposit of 10 per cent., a further payment of 25 per cent. to be made upon allotment, and the balance subject to call as required. These deposits accompanying applications for stock will, it is stated, be deposited in the Imperial Bank of Canada in Toronto in the name of the trustee of the proposed company. We do not observe that the name of this trustee is printed in the prospectus. The only names there printed appear to be those of the bankers, the solicitors, and the promoter of the proposed company. Can a company thus organised legally accept applications for shares and payments on account of stock thus applied for? The prospectus states: "The ordinary telephone system has been materially improved by Mr. Burton R. Dodge, of Post Mills, Vermont, an inventor of marked ability, and a gentleman possessed of a lengthy experience in the practical operation of telephone lines. These improvements are completely protected by patents; the number of his Canadian patent being 60,912, and of the United States patent 606,803. And it is now proposed to incorporate a company under the Joint Stock Companies Act to operate Mr. Dodge's improved invention in the city of Toronto, and elsewhere in the Dominion of Canada, with the ample capital of $3,000,000, divided into 3,000,000 shares of one dollar each. One-half of this gross number, or 1,500,000 shares, will be set apart in 8 per cent. fixed, cumulative preference shares- dividends payable half-yearly; and the remainder, the other 1,500,000 shares will be written as ordinary stock under the direct control of Mr. Burton R. Dodge, his heirs, or assigns." If we rightly understand the meaning of the latter clause of the above paragraph copied from the prospectus of the proposed company, the purchase by Mr. Burton R. Dodge of a single share of stock, in addition to the 1,500,000 shares which are to be transferred to him in exchange for the use of his patents, would give that gentleman entire control of the company. This understanding of the terms of the prospectus seems to be verified by the following additional clause in the prospectus: "A rapacious and unscrupulous monopoly has in various instances elsewhere destroyed all immediate chance of competition, either by buying up a controlling interest in the stock, or by paying a lump sum for the stoppage of the business; and with the view of preventing such a culmination in connection with the operation of this company, Mr. Dodge will retain the controlling interest in the stock." Another clause to which we desire to direct attention reads as follows: "All applications for shares should be made upon the form attached to this prospectus, and should be promptly forwarded to the bankers of the company, together with the ten per cent. payable on application. But if no allotment of stock be made, such deposit shall be returned less such expenses as may be incurred up to that time." It is here clearly stated that the company assumes the right, even in cases where no allotment of stock is made, to retain such amount of the applicant's deposit as may be considered necessary, to be applied to the payment of expenses incurred. What is to regulate the amount of the expenses, and what guarantee has the applicant that the whole of his deposit will not be held by the company and applied to expense account? What right has a company to retain the money of an applicant whose application for stock has not been granted? The form of application for stock reads as follows: "I hereby request that you will allot me .... shares of one dollar each in the proposed Dodge Telephone Company of Canada, Limited, upon the terms and subject to the conditions mentioned in the prospectus." Thus, the applicant for stock, when signing his application agrees that the stock shall be issued "upon the terms and subject to the conditions mentioned in the prospectus." It would be interesting to learn how many applications for stock have been received by the promoters of this proposed company.

Mr. Thos. Jackson, for fourteen years manager at Stratford, Ont., for the Bell Telephone Co., has retired, owing to advanced years. He has been succeeded by Mr. J. H. Martin.

ELECTRIC POWER TRANSMISSION.

The publishers of the Electrical World and Engineer, New York, have issued a second edition of that valuable work "Electric Power Transmission," by Louis Bell, Ph.D., Mem. Inst. Elec. Eng. The first edition was printed in January, 1897, and was very favorably received, but the changes that have taken place since in the art of electrical power transmission called for another edition. The book contains fourteen chapters, classified as follows: Elementary Principles; General Conditions of Power Transmission; Power Transmission of Continuous Currents; Some Properties of Alternating Currents; Power Transmission by Alternating Currents; Current Reorganizers; Prime Movers; Hydraulic Development; The Organizations of a Power Station; The Line; Line Construction; Centres of Distribution; The Commercial Problem; The Present State of High Voltage Transmission. In this latter chapter is recorded such change in practice as has taken place during the three years intervening between the two editions. The most important advance, it is stated, has been in the matter of power transmission at very high voltage and to long distances.

By permission of the publishers we give below extracts from this chapter:

Much of our knowledge of the subject is due to the exhaustive tests made by Mr. Ralph D. Mershon at Telluride, Col. These are fully described in a paper by Mr. C. F. Scott before the American Institute of Electrical Engineers. Briefly, the essential points established are as follows:

With first-class glass or porcelain insulators there is little to fear in the way of leakage in good weather up to say 50,000 volts, unless the insulators break from mechanical causes. Rain and snow seldom cause trouble, although of course they may do so. Dry air, snow and clean water are tolerable insulators, although dirt of any kind on the insulators is to be feared. Cross-arms and pins should be filled to prevent infiltration of moisture. There is good reason to believe that oil insulators are quite needless, and they certainly are apt to

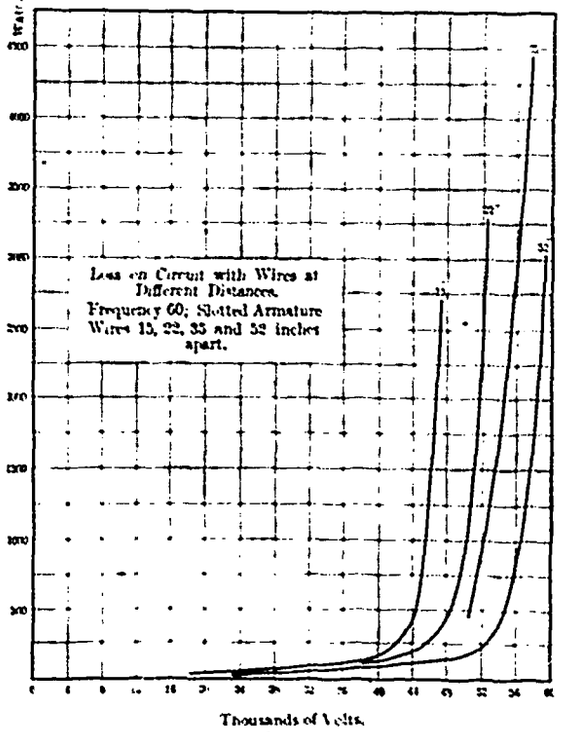

FIG. 1.

accumulate dirt without giving any compensating advantage.

Loss of energy through leakage over the surface of the insulator is very trifling perhaps not more than two or three watts per insulator, even at 50,00 volts between lines. In bad weather this is likely to increase; but the leakage itself tends to dry the surface of the insulators, and while if high voltage is suddenly thrown on a line leakage may cause immediate trouble, gradually raising the pressure to the full working point tends to correct this difficulty, and there is no trouble experienced. Rain is the only thing likely to cause difficulties, unless we except a heavy snow storm, and neither is much to be feared at 40,000 to 50,000 volts, although above this point troubles increase rapidly. A heavy sea-fog, with salt-laden atmosphere, is serious, however, as has been shown on lines of far lower voltage than the above, and sometimes has caused the burning of pins, cross-arms,

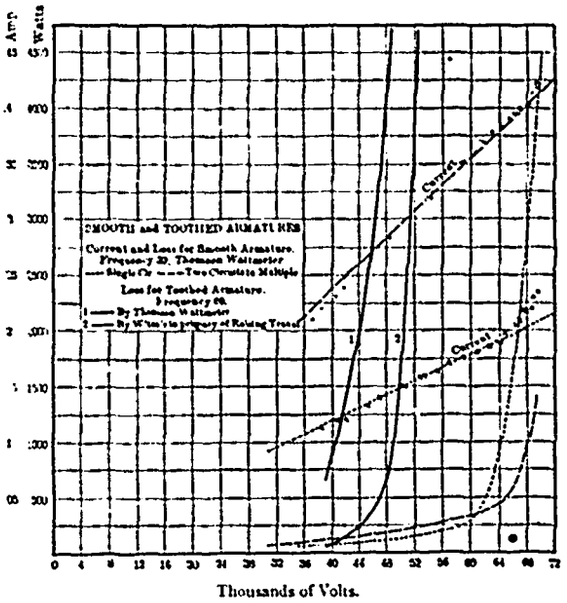

FIG. 2.

and even poles. Sappy cross-arms and poles have been a not uncommon source of damage.

The most interesting fact brought out in the Telluride experiments was the leakage at very high voltage between wire and wire through the air—a true brush discharge akin to that seen about the wires proceeding from a big induction coil. At about 20,000 volts the line wires begin to show at night traces of luminosity, which rapidly increases with the pressure, until at 50,000 volts and upward the wires are plainly visible for a long distance, and the hissing sound characteristic of fierce brush discharges is audible at the distance of a hundred feet or more. This discharge involves a real and quite considerable loss of energy, increasing with appalling rapidity at still higher voltages. This loss increases with rise of voltage, with diminution of the distance between wires, and with diminution of the diameter of wire. Anything on or about the wire which increases the electric density at any point shows as a noticeable brush discharge. Fig. 1 shows the loss on the Telluride circuit, 2¼ miles in total length, with line wires at different distances apart on the poles. The curves begin to turn upward at between 40,000 and 50,000 volts, and, once the elbow of the curve is past, rise very fast.

It is clear that this phenomenon sets a real physical limit on high-voltage transmission of a sort not hitherto realized. A loss of say 2 k.w. per mile of wire is a pretty serious matter on a long line, even when the total energy transmitted is very considerable, and obviously in any practical case of transmission the voltage must be kept well below the elbow of the leakage curve. Hence the wires should be kept well apart.

As might have been expected, the shape of the E.M.F. wave given to the line is a very important matter under these circumstances. Fig. 2 illustrates this fact in a sufficiently startling manner. By changing from a non-sinusoidal wave of the peaked type to a wave nearly sinusoidal the elbow of the curve was pushed up from 40,000 volts to 60,000 volts under conditions otherwise the same. For such work there is every possible reason for using the sine wave on account of this leakage effect as well as for other practical reasons already set forth. But even with favoring conditions leakage must be reckoned with, and present data indicate that in nearing 50,000 volts one is on dangerous ground quite aside from any questions of insulators or apparatus. We cannot expect to improve the dielectric strength of the air, and although the conditions may

be improved by using good-sized wires when conditions permit, or perhaps by heavily insulating the wires, thus both increasing their diameter and somewhat improving the general insulation, it is quite probable that a limitation of voltage from this cause is an unpleasant reality.

With proper precautions, however, there seems to be no very grave difficulty in working at 40,000 to 50,000 volts. Besides the Telluride experiment, in which the short line mentioned was worked steadily for a month at 50,000 volts without serious interruptions, there has now been in operation for over a year a commercial transmission over 55 miles at a working pressure of 40,000 volts. This is the plant of the Telluride Transmission Co. at Provo, Utah. The power is utilized for driving the Mercur mills and other work in connection with a large mining property. The generating plant consists of a pair of 750 k.w. three-phase generators, directly connected to turbines. They run at 300 r.p.m., giving 60 alternations, 800 volts. The raising transformers of 250 k.w. each are set up in the star connection with the neutral points of both primary and secondary grounded. The line involves a rather tough bit of mountain construction, reaching an extreme altitude of over 10,000 feet. The insulators are of glass and of ample dimensions, 7 inches in diameter.

This plant has done good steady work ever since it was started. It has not been exempt from troubles, of course, but there have been no serious breakdowns.

In ordinarily dry weather the line has uniformly worked well—as well as lines at a much lower voltage. In rainy weather there has been some trouble from leakage, sometimes enough to blow the fuses. In almost every instance of line trouble the cause has been found to be a broken insulator—cracked from strain or smashed by a bullet. The first time the author crossed the continent on power transmission business he received a vivid idea of the bullet as a factor in the situation, for nearly every switch target between Kansas City and Los Angelos had from one to a dozen bullet holes in it.

The Provo plant has been in operation since February, 1898, and in spite of the terrific voltage and occasional difficulties on the line it has done, and is doing, exceedingly good service. Such pressure, however, must be regarded as somewhat experimental, and it should be borne in mind that the kind of work on which it is employed is such that trivial disturbances are not noticed much, and brief interruptions at infrequent intervals are not serious—simply annoying. What a similar plant would do in the way of furnishing a general service of light and power is still problematical.

An innovation which has found some favor is the use of generators wound to deliver directly 10,000 to 12,000 volts. Such machines are always built with stationary armatures and revolving fields. Prior to the introduction of this construction, generators for such pressures were out of the question, but there are now in use eighteen of these high-voltage machines, nearly all above 500 k.w. capacity, which are uniformly doing good service. The ultimate economy of this practice is not yet clear. One set of transformers is saved, reducing the loss about 2.5 per cent., while on the other hand the very large insulation space required tends to considerably reduce the capacity of generators of given dimensions. Exact figurrs cannot be had, since the intrinsic merits of the matter are mixed up with commercial considerations involving the competitive and advertising value of novelty, the question of adaptation of standard sizes and speeds, and other matters which are of temporary rather than permanent importance. It is the author's impression, however, that when these matters are eliminated there will prove to be little or no difference in cost, including depreciation and efficiency, between the high-voltage machine and a low-voltage one plus the raising transformers. At present, inasmuch as the high-voltage generators are excellent and reliable machines, their use is advantageous so long as a good bargain can be driven as to price as compared with the low-voltage machine and its raising transformers. Although none of these high-voltage generators have been long enough in use to get a definite idea of their liability to electrical troubles, there is not much to be feared in view of our present knowledge of insulation.

The phenomena of line capacity and inductance, resonance, unbalancing of three-phase transmission circuits, and divers other unpleasant things which are theoretically present on long-distance or high-voltage lines, have been shown by experience to be of no sensible account in a well designed and constructed plant. Line inductance and the rest are, of course, always with us, but from an operative standpoint they are not at all serious at any pressure or distances now in use. They must be considered and taken into account just like ohmic resistance and line insulation, but are not material obstacles at any voltage or distance yet tried.

As regards the generation and distribution, the work in this country is about equally divided between the two-phase and three-phase systems, the latter being rather in the majority. As might be anticipated, there is found very little difference in the general properties of the two systems, the tendency being to use two-phase in many cases where an existing alternating lighting system is to be supplied, and three-phase for heavy motor work or when the whole system is installed de novo, although neither this nor any other plan is consistently adhered to in practice.

The generating and transforming units have been steadily increasing in voltage and capacity. Some 2,500 k.w. transformers have recently been ordered for the Niagara plant, while those of several hundred kilowatts are common enough. Barring the general objection to putting too many eggs in one basket, this tendency is a good one, giving units at once cheaper and more efficient.

Accessory apparatus has hardly kept pace with the general progress of the art. Switchboard appliances for high-voltage work are notably undeveloped into standard forms. They have particularly suffered from the too common straining after compactness. A liberal factor of safety is always a good thing, and nowhere is it more necessary than in dealing with voltages such as are used in electrical power transmission.

The question of frequency is gradually settling itself. Except in plants intended mainly or entirely for use with rotary converters, a frequency of about 60 alternations is the general rule, and this is the figure adopted in the great majority of transmission plants. In those intended for general distribution of power and light, the lighting sets a lower limit to the frequency that must be respected. In the neighborhood of 30 alternations incandescent lighting becomes decidedly troublesome, and if alternating arcs are to be used the frequencies must be kept above 40 alternations. On the other hand, induction motors give the best results at moderate frequency, say not over 50– 60 alternations at the most. All these facts point to the advisability of keeping within moderate limits, and the usual 60 alternations is for moderate distances and ordinary distributions very satisfactory. In the writer's judgment, it is rather high for heavy long distance work—45 or 50 alternations would be rather better, but there is no excuse whatever for going as low as 30 alternations except when rotary converters are the principal load and no lighting whatever is to be done for the transmission lines.

In this connection it is well to call attention to the fact that alternating arc lamps, particularly of the inclosed type, are now in a fairly satisfactory state, and that the series arc is being very largely replaced by constent-potential arcs, often inclosed, working off the ordinary lighting system. It therefore appears probable that special devices for arc lighting will form a less troublesome feature of transmission work than hitherto.

The induction motor has come into wider and wider use as transmission plants have increased in number, and particularly the larger sizes have been well developed. These very large induction motors are particularly valuable for hard service and starting with considerable loads, although in view of the value of synchronous motors in improving the power factor of transmission plants, these latter machines are not likely to be entirely superseded.

MONTREAL

Branch Office of the CANADIAN ELECTRICAL NEWS,
New York Life Building,

FEBRUARY 6th, 1900.

The Star's recent editorial anent recent civic elections is all very well in its way, but some of the "electrical" items in same are worthy of comment. Take overcrowding of cars: This is the "whole truth and nothing but the truth," and the systems at Ottawa, Quebec, and Toronto simply make Montrealers ashamed of their's To see a car going up Windsor street hill with the back platform so overwhelmed with humanity as to cause the rear fender supports to scrape on the cobble stones (in some cases even the rear lower step is scraping on the ground), is disgraceful, to say nothing of the rear motor then doing 70 per cent. of the work and the front motor nearly lifted off the rails. To say that the public won't stop getting on is absurd; if the conductor refuses to move his car until late crowders step off, the balance of the passengers inside would probably take care of the result; if not, then call a policeman, and in Montreal—CALL LOUD. Then cheap light. This item deserves a word of protection for the illuminating companies. As to public arc service it is an open rumor that it cost so much to secure the contract that even at alleged high figures there has not been much profit in it for the company who got it. Taking the incandescent service, it is well known that there are two large competing companies, both basing their price list at ¼ of a cent per ampere-hour at a pressure of 50 volts, one company offering a cash discount of 33⅓ per cent., and the other 40 per cent. Surely there is not much to complain of here, and I think other cities will agree with this, and wish they were as well fixed. The question of power rates for motors has not been touched upon, but here again there is little or no cause for complaint. We may be higher than some other cities for small power units, say from ½ to 3 h. p., but for large powers we are certainly as good, and for extra large motors away better off. Lastly, be it remembered that our city council are doing their best to tax everything, almost down to the glass insulators and tie wires.

A shocking accident was that which resulted in the death of Alphonse Girouard a hotelkeeper, doing business at 176 Vinet street. It seems that the wife of the deceased, while about to turn on an incandescent light, felt a slight electric shock. Calling her husband, she asked him to turn on the light. He had no sooner taken hold of the lamp than he sank down with a groan. The electric current held him so fast that the assistance of three men was required to extricate him. Before a physician arrived he had expired. The accident is attributed to the crossing of a high pressure wire with the wire which entered the house of the deceased. An examination of the premises failed to disclose the cause of the accident, and it is more than likely that this matter will never be fully explained, as well as others, such as: why insurance inspectors should be so particular as to fire risk without looking at life risk; why lighting companies should be so careful to have porcelain tubes, etc., yet not look out for "grounds;" why the process of resuscitation is not resorted to, and promptly, to persons hurt in this manner.

The Bell Telephone Company have lately installed a private exchange for the Merchants CottonCompany in this city; the signals in some departments being inaudible owing to the rumble of machinery, here take the form of a relay drop closing a circuit through a red lamp, thus making a visual signal that party is desired.

It would be interesting to know just what is the longest distance we can talk to direct over the Bell Telephone Company's wires with success. Perhaps some of the readers in their employ will enlighten us. In a recent advertisement the Bell people couple Quebec with Omaha and Montreal with Key West, which, of course, can be taken "cum grano salis," but if going in for "so much" they might as well be killed for a sheep as a lamb, and make it Winnipeg with Valparaiso

The order for a 600 k. w. D.C. A.C. generator, secured by the Westinghouse people from the Quebec Street Railway and Light and Power Co., has been filled. It is understood that this generator will be installed at the power house adjacent to Montmorency Falls and utilized to run the trolley road to St. Annes de Beaupre, that is, as soon as the old Quebec, Montmorency and Charlevoix Railway is arranged for electric transportation instead of steam. The generator in question is said to stand 14 feet in height. A "rotary" will probably be placed at the St. Annes end of the line, with usual step-up and step-down transformers for suitable voltages.

The astonishing electrical activity last fall (as foretold by your correspondent) is only now beginning to abate. The mild weather was a boon to construction firms, as it is impossible to expect wiremen to get through the usual amount of work in a given time with their fingers half frozen. Complaints as to fall business are not forthcoming from either the supply men or construction firms, and the outlook for the balance of the winter (generally a slack time) is more favorable than is usually the case.

Instead of the expensive alarm clock bell ringing outfits, if one with any knowledge of electricity will only remember that the winding thumb key on all nickle alarm clocks keeps turning when the alarm is ringing, he can easily use it to operate some form of circuit closer, and with the addition of a few feet of wire, a bell and dry battery, have a good "awakener."

Would the Boers be "shocked" that the Hague Conference had overlooked this? Coulpe arc light dynamos used for the search light, in series, "to required voltage," ground one pole, and connect the other to the protective enclosure, viz., barb wire fence!

Square wire is coming into vogue largely for the purpose of increasing the kilowatt capacity of certain alternating generators which have machine wound coils, allowing of such an exchange being made. It is easily seen that the corners being filled in is quite an advantage over the ordinary round wire, and in many cases the gain is great enough to warrant going to the expense.

The dry goods establishment of Bernier & West, corner of St. Catharines and University streets, was recently damaged by fire to the extent of $30,000. The local press, as usual, announced that the fire was supposed to have been caused by electric wires. The report of the Fire Underwriters' Association, however, was that "there is no evidence to the effect that the fire was caused by electric wires; on the contrary, the fire seems to have started on the second flat in the vicinity of a sewing machine." The verdict of three experts, one of them perhaps the most capable man in the country on the question of electrical fires, was unanimous on the above point. If electrical firms would adopt some form of reprisal, say in the shape of cancelling advertisements, it might make certain newspapers who are so fond of ascribing fires to electricity without any proof, a little more careful.

THE TORONTO ELECTRIC LIGHT COMPANY.

The Toronto Electric Light Co. are about to enter upon a number of extensive improvements for the purpose of extending and perfecting their service.

They have recently purchased a block of land adjoining the east side of their present property, having a frontage of 150 feet on the Esplanade and extending 1,064 feet southward to the wind mill line. It is the intention to erect immediately on this land a large machine and repair shop, and a little later on a new power station in which will be installed direct driven units of single phase alternators, of 750 kilowatt capacity each, of the Canadian General Electric Co.'s type, for incandescent lighting.

The present machine shops will be removed to allow of the extension of one of the present power stations to accommodate four more Heine boilers with a total capacity of 1,500 h. p., one vertical marine type compound engine of 1,500 h. p. capacity, and a single phase alternator of 500 kilowatt capacity.

The company have had plans and specifications prepared for a steel steamer of 600 tons capacity, to be used for bringing coal from American ports.

LARGE ORDER FOR ELECTRICAL APPARATUS.

One of the largest and most interesting industries in Canada is that of the Dominion Iron & Steel Company, of Sydney, C.B. They purpose operating practically their entire plant electrically, and have just placed an order with the Canadian General Electric Company for a complete electrical outfit, consisting of: Three 500 kilowatt 250 volt direct driven generators, one 100 kilowatt Booster set, direct driven by motor; two 60 kilowatt single phase alternators, direct driven by motors, mounted on same base with alternators; three No. 12 125 light brush arc dynamos, direct driven by motors; 250 D. C. series enclosed arc lamps, and a complete equipment of marble panel switchboards and wiring supplies. This, together with an order for two 125 kilowatt direct connected units, recently placed with the same company, constitutes one of the largest orders ever given in Canada for electrical apparatus.

TELEGRAPH and TELEPHONE

THE COPENHAGEN "AUTOMATIC" TELEPHONE CALL BOXES.*

In December, 1898, the Automatic Telephone Company, of Copenhagen, began erecting telephones on the "penny-in-the-slot" principle. At the present date there are about 465 instruments connected to the telephone exchange, and this number is being gradually increased. These telephones are placed in nearly all public buildings and theatres, and also in a number of houses where people live in flats. The test of about a year's use has shown that these instruments are thoroughly reliable. The inventors are Mr. L. M. Ericsson, of Stockholm, and the manager of the Danish company Mr. Sophus Ritter. Compared with the call-box instruments employed in this country, the chief advantages of this system are :

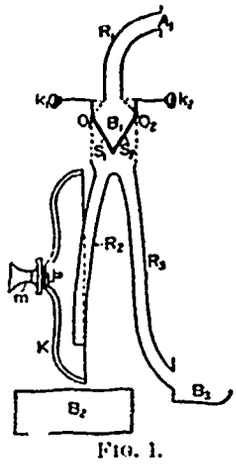

FIG. 1.

1. The exchange can only be called up after a coin (10 ore, about 2½c.) has been dropped in; this prevents a deal of unnecessary trouble at the exchange.

2. In case the exchange cannot connect through, the coin is recovered by pressing a button.

3. Ringing off is avoided, as this is performed automatically by replacing the receiver on the hook.

4. By special arrangements for receiving extra coins, telegrams can be forwarded through the exchange.

Fig. 1 shows arrangement for receiving the coin. This is dropped in at A_1, and passes through the flat tube R_1 into the receptacle B_1. S_1 and S_2 are two forks, pivoted on O_1 and O_2 and insulated from one another. When a coin is resting in B_1 it connects S_1 and S_2, thus completing the circuit through the magnets I to the exchange (see Fig. 2), and the latter can now be rung up in the usual way.

After receiving the caller's demand and making the engaged test, the operator at the exchange answers either "Connected" or "Engaged." In the first event the caller pushes the button k_1 and the coin drops through the passage R_2, strikes the gong K, and falls into B_2. The operator at the exchange hears the coin strike against the gong, and only then connects through. If the reply "Engaged" has been received, the button k_2 is pressed and the coin is returned through the passage R_3 into the box B_3 placed on the outside of the telephone, whence the caller can recover it.

The connections are shown in Fig. 2. When not in use the receiver hangs on the hook N, and contact is made between a_2 and a_3. The one pole of the magnets I is in direct connection with the line L_1, while the other line, L_2, is broken beeween S_1 and S_2. After a coin has been dropped in, the circuit through the magnets is completed through O_1 S_1, the coin S_2 O_2 a_1 Na_2, and a_3 to line L_2, and the exchange can be called in the usual way. On taking the receiver off the hook N the circuit is broken between a_2 and a_3, and contact is made between a_2 and a_1, and the connections are the same as in a usual telephone.

When the receiver is replaced on the hook the line L_2 is connected through a_4 and a_5 to earth, and the clearing signal is given automatically at the exchange ; this is arranged on the "ringing through" principle.

Telegrams are telephoned to the operator at the exchange, and he telephones the amount to be paid. The necessary coins are then dropped through two slots at the right-hand top corner of the instrument ; on their way they strike against gongs, by means of which the operator can control the amount paid in.

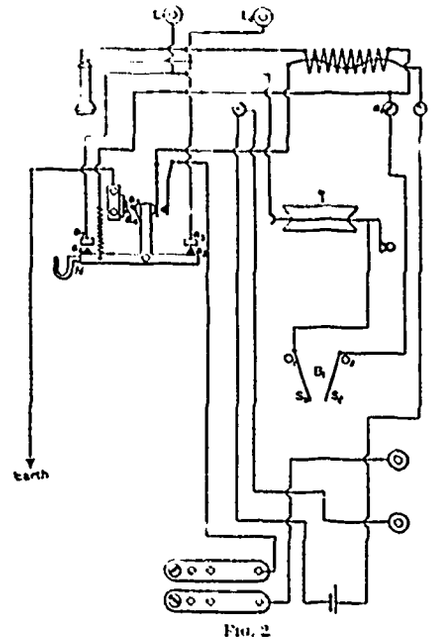

FIG. 2

The apparatus is mounted in oak cases, and on the outside of these are illustrated instructions for the public.

*From the Electrician, London.

AMERICAN TELEPHONE PRACTICE.

THE above is the title of a very valuable work just issued by the American Electrician Company. 120 Liberty street, New York. The author, Mr. Kempster B. Miller, M.E., is recognized as an authority on telephone matters, and has presented in a concise manner the general principles of telephony, the design and construction of commercial apparatus, the circuits connecting such apparatus into operative systems, and the methods used in the construction, operation and maintainance of these systems. The book contains 458 pages, divided into 33 chapters and containing 357 illustrations. The subjects treated include : History and Principles of the Magnetic Telephone ; The Telephone Receiver ; Transmitters ; Batteries ; Commercial Calling Apparatus ; Self-Restoring Switch-board Drops; Transfer Systems ; House Systems ; Distributing Boards ; Overhead and Underground Cable Construction, etc.

The Dommion government has decided to proceedat once with the construction of the telephone line from Atlin to Quesnelle, to connect with the eastern telegraph system, so that messages can be sent direct by wire to Dawson. Mr. J. B. Charleston will have charge of the work.

The Bell Telephone Company have recently made improvements in their exchange at Acton, Ont., having installed a new combined local and long distance switchboard and made other improvements. The work was executed by Messrs H. E. Fairbank and Joseph Curzon. The local manager is Mr. A. T. Brown.

ENGINEERING and MECHANICS

ICE, NATURAL AND ARTIFICIAL, AND REFRIGERATING MACHINES.*

By E. J. Philip.

Ice is the solid crystalline form which water assumes when exposed to a sufficiently low temperature. Natural ice assumes different forms, such as hoar frost, snow, hail, and as we usually see and recognize it in sheets of ice on our rivers and lakes. Natural ice is also to be seen on a gigantic scale in glaciers and icebergs far north. To give an idea of the gigantic scale in which *nature works in the matter of ice-making*, an iceberg observed by Sir John Ross and Lieut. Peary was 2½ miles long, 2 1/5 miles broad, and 153 feet high. The mass above water was apparently 150 million tons, and the total mass, calculated from what appeared above the water, must have been 1,500 million tons, and this was not an unusually large berg. You will see by this that nature does what we cannot do.

I will give a short description of the manner in which ice forms and show the wise provision of Providence in connection therewith. As the temperature of the air falls the surface water in a lake or river gradually cools; as it cools it becomes heavier and sinks, due to the laws of expansion and contraction. The warmer water takes its place and is in turn cooled and sinks. This process goes on until all the water in the lake reaches a temperature of 4° C. or 39.1 F. At this point water has reached its maximum density; if its temperature continues to fall it will expand. In cooling from 4° C. to zero, the surface water cools first, expands, and remains on top. This is surely a wise provision of Providence, for if it was not for this exception to an almost universal rule, all our rivers and lakes would freeze at the bottom first and the accumulated heat of summer would never thaw it out, because it would only melt a little on top, and then, as it got warmer, it would expand and remain there and convection could not take place in heating as it does in cooling from the top. Convection can only take place in heating by applying the heat at the bottom. If the water froze at the bottom we would have no fish, or in fact any life on this planet, as the large bodies of water have a great deal to do with life on earth.

There is one feature about melting ice that should be thoroughly understood, and that is the fact that if you take ice at a temperature of say zero, chop it up, take it into a room and let it melt, you will observe, if you place a thermometer in the ice and watch it, that it will rise from zero or whatever it was at until it reaches the freezing point 0° C. or 32° F., and at this point the temperature will stop rising, no matter what heat be around the vessel. This is why the *freezing* point of water is easily fixed, as it remains there at that temperature until all the ice is melted. Ice by itself behaves as solids do, expands by heat and contracts when cooled.

Ice will melt at a slightly different temperature if subjected to pressure, as shown by Thompson & Helmholtz, but it is only the fraction of a degree, so it does not affect any operation that we are connected with. In the upper provinces of India water is frozen on cold clear nights by putting it out in porous vessels, or in bottles wrapped in wet cloths. The water in these cases freezes by virtue of the cold produced by its own evaporation (or by the drying of the moistened wrapper). In Bengal the natives have a *more elaborate scheme for forcing or aiding the natural conditions* pits are dug about two feet deep and filled three-quarters full of dry straw, on which are set flat porous pans containing the water to be frozen. Exposed to a cool dry gentle wind, the water evaporates at the expense of its own heat and cooling takes place with sufficient rapidity to overbalance the influx of heat from above through the cool dry air, or from below through the dry non-conducting straw. These are only aids to nature, and in this country where we can store ice they are unnecessary. Freezing mixtures, such as the familiar salt and snow, sulphate or phosphate of sodium, and dilute nitric acid, have been used to produce an intense cold, but I will pass over these, as they have no relation to this article or to practical refrigeration to-day.

The demand for ice for domestic, medicinal and other purposes has led not only to the development of an organized ice trade, but to the invention of machines for ice-making and for the more economical refrigeration of rooms or buildings than can be done with ice no matter how cheap it can be obtained. These machines are of the greatest value to countries where there is no natural supply of ice, but they have advantages over ice in the cooling of rooms for storage that are of as great benefit as the cooling effect itself. All ice machines of any practical value can be grouped under two heads, viz., those that utilize the lowering of temperature that follows the rapid expansion of a compressed gas, and those that make use of a like cooling effect that results from the volatilization of some liquid. In machines of the first type the gas usually employed is atmospheric air, which is first compressed to three or four atmospheres, and then cooled by circulating water or other means. It is then allowed to expand, and the heat necessarily absorbed during expansion is drawn either from the water to be frozen or from brine that does not freeze at ordinary freezing temperature and thus becomes a vehicle for storing or conveying the cold, so to speak. In 1849 Gorrie constructed such a machine, but it was unsatisfactory, principally because of not cooling and drying the air properly. Kirk's machine, patented in 1863, and Windhaussen's in 1870, were more efficient. Windhaussen exhibited one at Vienna Exposition that produced 30 cwts. of ice per H. P. at a cost of 20 cents per cwt. The mode of operation of this machine is as follows: The air is compressed in one end of a cylinder, then cooled, passes to the other end of the cylinder, and is admitted for a portion of the stroke; the supply then being cut off and the air expanded during the rest of the stroke; this reduces it to a low temperature. Part of this cold air is used for cooling purposes, and another portion of it is used for cooling the heated air after expansion. The air *that passed to the refrigerrtor is forced on by more air coming in*; and after passing over the course is forced back to the compressor side of the piston, still comparatively cool, where it is again compressed, cooled, expanded, and the circulation kept up continually. Such machines to work economically must have large cylinders with tight fitting pistons working with little friction, easy and perfect working valves. These conditions are a most impossible to obtain or maintain, consequently they are almost a failure. Another of this kind of machine was invented in Glasgow, using as the cooling agent the gas distilled from carbonaceous shale. The gas was compressed to 120 lbs., and after cooling and expanding was carried off and used as fuel. This machine is not used for the production of ice but for refrigeration, and has been used successfully on board ship (recompressing the gas, of course) for preserving meats, etc.

Among the machines of the second class there is a great variety of construction because of the difference in the property of the liquids used, viz., water, sulphuric ether, bi-sulphate of carbon, ammonia, methylic ether, sulphuric acid, and even other substances have been employed as refrigerating agents. In all cases it is the latent heat of vaporization that is utilized, and did the efficiency of the method depend only on this, water would undoubtedly be the best material on account of the great latent heat of its vapor; but as important as this is the pressure and temperature at which the liquid boils. As early as 1755 Dr. Cullen froze water by its own evaporation in a vacuum. This method was developed by others, but can only be used for producing small quantities of ice and has no practical value. The same objection applies to sulphuric ether, bi-sulphate of carbon or any substance which boils under ordinary atmospheric pressure at temperatures above the air. Ether boils at 34.8° C., bi-sulphate of carbon at 46.2° C., and their vapor pressures are respectively .377 and .267 of an atmosphere. They volatize more readily than water and require a comparatively slight vacuum to render their evaporation sufficiently *rapid for refrigerating purposes. Naphtha, gasolene and chymogene* have been used in place of ether, but ether is the best, while having the objection that it is hard to prevent leakage, consequently it is hard to maintain a vacuum. It has also the tendency to change itself into less volatile vapors. The great characteristic of ice machines that employ ammonia, methylic, ether or sulphuric acid, as compared with those of the ether type, is the fact that they work at increased instead of diminished pressures, since these substances are gaseous at ordinary temperatures and pressures, and require for the liquefaction either the production of low temperatures or the application of high pressures. I might just state here that the boiling point of ammonia is 38.5° C., its vapor pressure as taken from a table at 10° is 6.1 atmospheres, at 20° 8.5 atmospheres, and at 30° 11.6 atmospheres. The boiling point of methylic ethers is 23.65° C., and its pressure in atmospheres at the same temperatures as given for ammonia is 3.5, 4.8 and 6.5. Sulphuric acid boils at 10.68° C., and its pressure in atmospheres is 2.3, 3.2 and 4.5 at the respective temperatures of 10°, 20° and 30°. You can see by these figures at once the reason or cause of the refrigerating action of these liquids?

The ammonia machine is the best known in this city, and, in fact, many do not know that there are other agents that can be used in place of ammonia. I will now try to make the action of mechanical refrigeration plain to you. We know that if we heat a liquid until it evaporates, it will absorb a quantity of heat that is not accounted for by the thermometer; that is, latent heat. We know if we suddenly reduce the pressure on boiling water that is under high pressure it will turn into steam. This latent heat evaporates it. Now, if we can get a liquid at low temperature that will evaporate into a gas at ordinary temperature, all we have to do is to compress it. That will give it a pressure, thereby increasing the boiling point; then if we cool this by the application of water we have a liquid at a lower temperature than is due to its pressure. If we now reduce the pressure we will reduce the temperature *at which the liquid will boil, consequently it will boil on* the reduction of pressure. Now, to boil, it must have heat just as water has, but as no heat is applied it must take up heat from surrounding objects. This is mechanical refrigeration. In the ammonia machine the gas is compressed thereby, raising its pressure and temperature. This gas passes from the compressor to a set of pipes over which cold water is running; this cools the gas and liquefies it or a portion of it. If it is then allowed to expand from high pressure to a low pressure, it will in expanding evaporate, and in evaporating it will take up heat from whatever surrounds the pipes containing it, that is, the air, thereby cooling the room. If the pipes are surrounded by water it will freeze; if by brine it will cool it down, and this brine can be pumped to any

*Abstract of a paper read before Toronto No. 1 C. A. S. E.

part of the building where it is not suitable or safe to use direct expansion of ammonia for cooling, and the brine will do the cooling instead. After the ammonia has expanded and evaporated to a gas it is returned to the compressor carrying the heat it picked up during expansion, and the compressor squeezes the heat out of it, so to speak, or makes it show, and it goes on through this cycle continuously. This system is known as the compression system, and the cycle of compression, condensation and expansion as explained before embodies the whole principle.

There is another system, known as the absorption system. This system I will not go into to-night. I have tried to make these few remarks as simple as possible, and to use no technical terms other than what anyone can understand. I have not touched on the application of refrigerating, which would take up a paper in itself.

BOILER FEED WATER.*

By J. M. Williams.

This subject, one especially interesting and very important to all users of steam plants, will be treated under four heads: Water in the abstract; Water as we find it; Water for the boiler; Water in the boiler.

At the commencement of this survey of the subject in hand, among the items to be borne in mind is the axiom "matter is indestructible." It will appear later on how this idea applies to the subject. Illustrating this, your attention is directed to what occurs when a match is struck, the friction rubs off the coating which protects the phosphorus with which the sulphur is tipped and warms the phosphorus up to the igniting point, it bursts into flame and ignites the sulphur, it in turn sets fire to the wooden splint, and it, as you see, burns first to charcoal, and it in turn to ash. None of the material or the elements of the material are annihilated—they are still in the room and in their altered form and condition will form part of the atmosphere. Some will condense on the objects or walls of this room, some will be inhaled by us and be absorbed into our system or condensed on our clothes and be carried away with us, but not destroyed, not annihilated, only separated from the combination in which they existed as a perfect match and recombined as a trace of phosphorus acid, a trace of sulphuric acid and the same of carbonic acid, gases, and a little ash containing the silica, potash lime, etc.; we thus have all the material that formed the match, every atom still exists.

Water in the Abstract.—Water, the familiar fluid, is a chemical combination of two gases, hydrogen and oxygen; it may be made from these two gases and it may be resolved again into its original elements. This may be done by electric force or chemical action or by heat. These dissimilar disintregrating forces will make and unmake water. The apparatus which is used to illustrate the electrical decomposition of water will demonstrate the proportion of its two elements; two glass tubes filled with water and inverted over two terminals from a battery will be slowly filled with gas displacing the water and one tube will be found to have twice the volume of gas of the other. This larger quantity will be found to be hydrogen, and this proportion will be maintained as long as the decomposition lasts; this proportion is that of volume. Two volumes of hydrogen combine with one volume of oxygen. The weight of these volumes is in the ratio of two to sixteen, and each unitor atom of oxygen weighs sixteen times as much as one unit or atom of hydrogen. In the chemical decomposition of water, such as the familiar one of forming acetylene gas from carbide of calcuim, the oxygen is taken up by the metallic element and the hydrogen set free, also in the case of adding water to metallic sodium or potassium.

Water as we find it. This would naturally suggest the large reservoirs of the earth, oceans, seas, lakes, rivers, etc., and the supplies in the form of snow and rain. These different supplies of water vary between the two extremes of pure and heavily charged with salt. Some lake waters are chemically pure, and the extreme is reached in the Dead Sea, where we find the water simply loaded with salt. Water is recognized as the universal solvent—it will dissolve to a greater or less extent nearly everything. The familiarity of this calls for little illustration, but it may be mentioned that solids, liquids and gases are dissolved by it. One example will be well recognized in the case of dissolved gas, that of soda water.

Water for the Boiler brings us to the particular features of the water supplies above mentioned. It will be accepted that water for the boiler should be clean, it also should be free from avoidable contaminations of injurious nature. The water supply will be of such a quality as the composition of the soil and the nature of the deposits in the locality, and any chemical refuse must be prevented if possible from getting into the supply. It will be found that in some cases the soil yields much matter to the stream flowing over it, and it occurs that water contaminated in one locality will be freed from its dissolved material by passing through a locality having a different composition of soil. In iron districts water will often be found freed from those elements which are destructive to boilers, the metallic deposits having taken up those elements. Some of the substances which are thus found in water supplies are there because of the decomposition of the material forming the water course by the action of the water itself; in other cases it occurs that the district is of volcanic origin, or it may be the remains of ancient ocean beds, or the accumulations of large deposits of organic matter, bogs, marshes, etc. We may here consider the nature of the substances which we find in water supplies. The usual ones are chlorides, sulphates, carbonates and nitrates, the elements so combined being calcium lime, magnesium, sodium, potassium, ammonium. Metallic compounds also in particular localities will include some of the heavy metals, such as lead, copper, etc. These, like the above, are carriers of injurious elements and are not dangerous excepting from forming deposits in the boiler. Another form in which water receives substances which may have bad effects is in gaseous condition in the air; from this source ammonia will carry into water chlorine and sulphur. Carbonic acid gas and even free nitric acid are substances which are features of the atmosphere, and to a greater or less extent injurious constituents of a water supply.

Referring to volcanic deposits having a tendency to affect the water in their neighborhood, it may be mentioned that so acid are some streams from the sulphuric acid formed from the sulphur that the copper sheeting of vessels is cleaned of oxide and the copper made bright by the solvent action of the acid in the water, and in certain rivers of this continent it is estimated that thousands of tons of sulphuric acid pass annually into the sea, and it is noted as a fact that in the civil war in America, the telegraph batteries of certain localities depended on vitriolic streams for their acid.

Water in the Boiler.—This part of the subject brings altered conditions. Water in its ordinary state has a temperature of about 40 to 50 degrees F., and the solvent quantity differs according to temperature. In many instances water will dissolve more when hot than cold, but conversely the earthy salts usually formed in water supplies are precipitated mainly because these salts are held in solution by carbonic acid gas, and this with other gases is much more soluble in cold water than warm, and is dissipated from hot water, with the result of the throwing out of solution of the earthy salt. This, together with the evaporation of water leaving the solids behind in making stream, is the cause of scale and boiler mud.

Not only is the mud left behind, but the elements which form the chlorides, sulphates, etc., remain also, and these, under the influence of the high temperature in the presence of moisture, decompose with the liberation of the radicle or acid part of the substance, which is then free to act on the iron plates or tubes, which it does to the sorrow of many a boiler owner. It will be recalled that the permanency of water was referred to at the beginning of this paper. We here meet with the system which operates when matter is subjected to altered conditions, if the alteration is considerable, to the extent which we have observed to occur in the boiler; then the combinations which previously existed will be broken up and other combinations will occur—calling to mind the match—and the metal of the boiler is called on to take its part in forming these combinations. A water containing chlorides is fed into a boiler and concentrated by the loss by evaporation into steam of the water. This concentration brings with it the breaking up of the chlorides. Carbonic acid gas being present, free and also combined, is liberated by the decomposing effect of high temperature as referred to already, and by that law which governs matter and which couples atoms, to themselves if nothing else is available; this carbonic acid gas displaces the chlorine combined as chlorides, and this in turn seeking to obey this law of combination, unites itself to its heat affinity, the iron of the boiler plate.

It will here be concluded that the chlorine having done its best or worst is out of the game, but no, chloride of iron is not more stable than chloride of calcium, magnesium, potassium, sodium or any chlorides which may pass into the boiler in the feed water. Chloride of iron will take up oxygen, which as atmospheric air is taken into the boiler, dissolved in the water, and if this were not there the water would be called on to furnish oxygen and an oxychloride formed passing on into a further addition of oxygen, and the formation of an insoluble oxide of iron and the chlorine is again on its cruel mission after an atom of iron, and so goes on moment after moment to a misroscopical extent, it is true, but like the coral insect, a little at a time if carried on long enough will accomplish much. As with the chlorine, so with the other salts; just the exact changes and processes it is not presumed to define, but the foregoing will throw light on the cause of the corrosion of boilers. Having surveyed to a limited extent the origin of scale and the cause of corrosion, we will consider the action of boiler purges. We have observed the liberation of corrosive acid elements, and to neutalize these most purges are alkalies, and remembering the decompositions just referred to, we can see that if these neutralized acids now in the form of salt, generally a soda, are allowed to remain in the boiler, we can expect to experience similar results again, calling apparently for more alkali, but the precautions which will best combat these dangers are emptying the the boiler, washing out and filling with fresh water. This has its limit, however, and must of necessity be controlled by fuel, time and circumstances, but it can be seen how valuable is blowing off which only deducts from the contents of corrosive matter in the ratio of what is blown off—and more especially cleaning out.

[Two samples of boiler feed water were shown, one from a supply tank which showed presence of sulphuric acid and which had been complained of as being continually corroding. The other sample showed chlorides, both samples indicated by tests presence of free acids. The action of phosphate purge was also illustrated in conjunction with lime and magnesia, showing precipitation of the same.]

*Paper by J. W. Williams, of J. Winer & Co., chemists, Hamilton, read before Hamilton No. 2, C.A.S.E.

At the regular meeting of Toronto No. 1, Canadian Association of Stationary Engineers, held on the second Wednesday in January, there was a good attendance of members. A paper relating to ice making and refrigerating machines was read by Mr. E. J. Philip, chief engineer of the T. Eaton Co. This paper, which is printed in this issue, created considerable discussion, and many questions were asked and explained. It has been arranged to hold an "At Home" in the large assembly hall of the Confederation Life Building on Wednesday, February 14th. The tickets are $1.

ELECTRIC RAILWAY DEPARTMENT.

CANADIAN STREET RAILWAY SYSTEMS.

During the past month several of the largest street railway companies in Canada have held their annual meetings. The statements presented, as outlined below, show that generally the business of the year was of satisfactory character.

HAMILTON, GRIMSBY & BEAMSVILLE ELECTRIC RAILWAY.

The annual meeting of the shareholders of the Hamilton, Grimsby & Beamsville Electric Railway Company was held in the city of Hamilton on January 22nd. Mr. A.J. Nelles, manager and secretary, submitted the financial statement, which was evidently satisfactory, there having been an increase of $1,934.33 in the revenue over that of 1898. The revenue for 1899 was $44,670.75, and the disbursements amounted to $27,729.87, leaving $16,940.88 of a surplus. Of the surplus $4,250 was paid in interest on bonds, $2,152.24 interest on borrowed money, and $5,665 as dividends, quarterly at 1 1-4 per cent.; total, $12,067.24. The balance, $4,873.64, added to $2,950.11 brought forward from 1898, made a total surplus of $7,823.75. The assets were given as $277,474.38. The liabilities were:—To the public $128,702.21, to the shareholders $113,300 capital stock, and $35,472.17 profit and loss account. A by-law was passed for the issuance of $35,472.17 of stock to paid-up shareholders, pro rata, this being 33 1-3 per cent. of the capital stock, $113,300. Officers and directors were elected as follows: C. J. Myles, president; W.J. Harris, vice-president; R.S. Martin, treasurer; L. Bauer, A.H. Myles, Robert Ramsay, R.S. Morris, directors. Mr. Morris was elected in place of John Gage, sen., who retired. Mr. A. J. Nelles was re-appointed manager and secretary.

LONDON STREET RAILWAY.

The twenty-fifth annual meeting of the London Street Railway Company was held at the company's offices in London. The annual report, which was read by Mr. C.E.A. Carr, secretary treasurer, showed a falling off in gross revenue, as compared with the previous year, of $53,864.10, and the working expenses exceeded the receipts by $6,928.54. This was due to a strike of employees which commenced on May 22nd and continued for several months. The gross revenue for the year was $59,947.58, as against $113,811.75 for the previous year. The operating expenses were $66,872.10, an increase over the previous year of 1.8 per cent. The quarterly earning statement showed that the revenue increased during the first quarter of the year, when there was no strike, 10.2 per cent., so that had the system remained in operation without interruption a most satisfactory year would likely have been the result.

The old board of directors was re-elected: Mr. Everett, president; Mr. Smallman, vice-president; Mr. Carr, general manager and secretary-treasurer, and Messrs. Moore, Wasson, Spencer and Broderick, directors.

OTTAWA ELECTRIC STREET RAILWAY.

The Ottawa Electric Railway Co. experienced the most successful year in its business history. The statement presented at the annual meeting showed that the total number of passengers carried was 5,833,829, an increase of 700,000 over the previous year. The net profit was $85,280.37. Four quarterly dividends were paid, amounting to $65,184, and the sum of $20,093.37 was carried forward to the credit of profit and loss. The gross earnings for the year were $263,545.05, as compared with $231,800.02 in the preceding year. A duplicate plant was installed during the year, consisting of a set of horizontal water wheels of a capacity of 1,800 h.p., directly connected to a generator of similar capacity. The Britannia extension is expected to be in operation by May 1st.

The following were elected directors: Messrs. T. Ahearn, J. W. McRae, George P. Brophy, Warren Y. Soper, Peter Whelan, Thomas Workman and Alex. Lumsden, M.P.P. At a subsequent meeting of the board Mr. Thos. Ahearn was elected president, Mr. J. W. McRae vice-president, and Mr. James D. Fraser, secretary-treasurer. Mr. Redmond Quain was appointed auditor.

TORONTO STREET RAILWAY.

The eighth annual meeting of the Toronto Street Railway Co. was held on Wednesday, January 17th. The report of the year showed a net profit of $432,869.43, compared with $404,738.80 for the previous year. Out of this amount, after paying dividends of $240,000, and deducting pavement charges paid to the city, the sum of $12,869.43 is left to carry forward. The gross earnings during the year were $1,333,542.44, an increase of $122,924.20 over the preceding year.

The operating expenses were increased by 1.4 per cent as compared with those of 1898, this being ascribed chiefly to a general advance in the cost of materials. A capital expenditure of $240,000 was made for an engine, generator, boiler, rolling stock, teed wires and car sheds. During the year 80 cars and two electric sweepers were added to the rolling stock. Two car sheds, capable of storing 100 cars, and a brass foundry were built.

During the year the company paid to the city the following amounts: Percentage on earnings, $111,425.66; pavement charges, $64,000; taxes on rails, poles and wires, $2,641.12 and on real estate $$9,365.85, or a total of $187,432.63. In addition there was also paid the provincial tax, amounting to $4,748.21.

As shown by the financial statement, the assets of the company total $10,263,615.27, made up as follows: Road and equipment, real estate and buildings, including pavements and suburban lines, $10,089,953.01; stores in hand, $30,874.87; accounts receivable, $19,764.63; cash in bank, $106,210.84, and cash in hand, $16,811.92. The liabilities are: Capital, $6,000,000; bonds already issued, $2,999,953.33; and incidentals, which, with nearly $1,000,000 carried to profit and loss, bring the total to $10,263,615.27.

A comparative statement of the last four years is as follows:

Gross earnings—1896, $997,273.20; 1897, $1,077,612.53; 1898, $1,210,618.24; 1899, $1,333,542.44.

Operating expenses—1896, $507,760.31; 1897, $525,801.25; 1898, $578,857.26; 1899, $650,324.55.

Net earnings—1896, $489,512.67; 1897, $551,811.28; 1898, $631,760.98; 1899, $683,217.89.

Passengers carried—1896, 23,537,911; 1897, 25,271,314; 1898, 28,710,388; 1899, 31,826,940.

Transfers—1896, 7,354,895; 1897, 8,160,022; 1898, 8,287,239; 1899, 10,538,279.

Percentage of operating expenses to earnings—1896, 50.9; 1897, 48.8; 1898, 47.4; 1899, 48.8.

SPARKS.

An agitation has been commenced to have the village of Granton, Ont., lighted by electricity from the power house in the village of Lucan.

The St. Catharines Cold Storage Co., Ltd., have ordered a 20 horse power 500 volt multipolar motor from the Canadian General Electric Company.

Residents of Crediton, Ont., are said to be looking into the question of profitable investment in an electric light plant for street and commercial purposes.

The Canadian General Electric Company are installing several of their two phase induction motors at the works of the Hamilton Bridge Works, Hamilton, Ont.

The Slade Electric Company, of Quebec, has secured the contract for electric wiring of the Franciscan church, sacristy and presbytery on Grande Allee, in Quebec city. Nearly 1,000 lights will be required.

The authorities of Winnipeg general hospital are installing an electric lighting plant, and have placed an order with the Canadian General Electric Company for one of their standard direct current 60 kilowatt generators of the multipolar type.

Application will be made to the Dominion Parliament for an act to permit the Buffalo Railway Co. to acquire the assets and franchise of the Niagara Falls Park & River Railway Co., the Clifton Suspension Bridge Co., the Queenston Heights Suspension Bridge Co., and the Queenston Heights Bridge Co.

The Pratt & Letchworth Co., of Buffalo, who are about to open a Canadian factory for the manufacture of steel castings, etc., at Brantford, Ont., have placed their order for electrical equipment with the Royal Electric Co. This order includes one 40 h.p. and two 15 h.p. S.K.C. induction motors, with transformers and condensers.

Mr. F. B. Brothers, well known in street railway circles, returned to Montreal from Demarara last month. Mr. Brothers is now manager of the Demarara Electric Co., Limited, and his mission is to purchase equipment for the trolley system to be built at Georgetown, British West Indies, by Montreal capitalists. He states that about 15 miles of track will be laid down in the city and that considerable extensions will be made later on.

The South African Mutual Life Insurance Co., of Port Elizabeth, Cape Colony, has awarded the contract for a complete electric light plant to the Royal Electric Co., of Montreal, Canada. This plant consists of two 50 h.p. locomotive boilers two 8 x 10 high speed engines, direct connected to two 22½ k.w. direct current generators, a marble switchboard and a set of storage batteries, the whole to be installed in the South African Mutual Life Insurance Co.'s new premises at Port Elizabeth.

The shareholders of the Toronto & Suburban Railway Co. held their last annual meeting at Toronto Junction on January 24th, at which the following directors were elected: Frank Turner, C.E., R. Wilson Smith, Robert B. Henderson, Allan Boyce, sr., E. P. Heaton and R. L. McCormack. At a subsequent meeting of the directors, Frank Turner was elected president and E. P. Heaton vice-president. It was decided to look into the advisability of extending the road further into the county.

The third annual session of the International Mining Congress will assemble in the city of Milwaukee, Wis., on Thursday, June 19th, 1900, and continue for five days. It is expected that this congress will be of great importance in promoting the interests of the mining industry. Large committees have been appointed, and visitors will be given every attention. Information regarding the congress will be cheerfully furnished by Mr. T. J. Sullivan, secretary of the local executive committee, Sentinel Building, Milwaukee.

The annual meetings of the Hamilton Radial Railway, Hamilton Street Railway, and Hamilton and Dundas Railway, three corporations controlled by the Cataract Power Company, were held on January 15th, when the following officers were elected: Radial Railway Company - John Patterson, president; Hon. J. M. Gibson, vice-president; J. Moodie, treasurer. Hamilton Street Railway Company—Hon. J. M. Gibson, president; John Dickenson, vice-president; John Patterson, secretary; John Moodie, treasurer. Hamilton and Dundas Railway Company—John Dickenson, president; J. A. Kammerer, vice-president; J. Patterson, secretary; John Moodie, treasurer.

At 11 o'clock on the night of Tuesday, January 9th, fire occurred in the power house of the St. Jerome Light & Power Co., St. Jerome Que., which totally destroyed their electric plant. On Wednesday afternoon at 3 o'clock the Royal Electric Co. was instructed by the St. Jerome Company to forward to them, as quickly as possible, a 75 k.w. S.K.C. generator, complete with exciter and switchboard. The entire outfit went forward that evening, was received in St. Jerome Thursday morning at 10 o'clock, the destroyed plant was removed, and the new one put in its place and the lights turned on as usual at 5 p.m. on Friday. Forty-eight hours after the receipt of the order by the Royal Electric Co. in Montreal lights were again burning in St. Jerome. This is quick work, and shows what can be accomplished by thoroughly wide-awake people.

MOONLIGHT SCHEDULE FOR FEBRUARY.

Day of Month.	Light.	Extinguish.	No. of Hours
	H.M.	H.M.	H.M.
1....	P.M. 5.40	A.M. 6.15	12.35
2....	" 7.00	" 6.15	11.15
3....	" 8.00	" 6.15	10.15
4....	" 9.20	" 6.15	8.55
5....	" 10.30	" 6.10	7.40
6....	" 11.30	" 6.10	6.40
8....	A.M. 12.30	" 6.10	5.40
9....	" 1.30	" 6.10	4.40
10....	" 3.00	" 6.00	3.00
11 ...	" 3.30	" 6.00	2.30
12....	No Light.	No Light.	.....
13....	No Light.	No Light.	.....
14....	No Light.	No Light.	.....
15....	P.M. 6.00	P.M. 8.30	2.30
16....	" 6.00	" 9.30	3.30
17 ...	" 6.00	" 10.30	4.30
18....	" 6.00	" 11.20	5.20
19? ..	" 6.00	A.M. 12.00	6.00
20....	" 6.00	" 1.00	7.00
21.. .	" 6.10	" 2.00	7.50
22 ...	" 6.10	" 3.00	8.50
23....	" 6.10	" 4.00	9.50
24....	" 6.10	" 5.00	10.50
25....	" 6.10	" 5.40	11.30
26....	" 6.10	" 5.40	11.30
27....	" 6.20	" 5.40	11.20
28....	" 6.20	" 5.40	11.20
		Total.....	185.00

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Power Factor—
Complete Circuit Series
Lamps with Regulator—.90.

Manhattan Regulating Reactance Coil.

Regulator loss constant at all loads, 200 watts.
Regulators to provide for any percentage of circuit, from 10 to 100 per cent.

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At 6.6 amp., 72-volts, 430 watts. Total loss in lamp, 5 watts.
Power Factor .91. Efficiency .99.

Terminal and Arc Voltage the same. Concentric mechanism, but one magnet used in lamp. No springs.

MANHATTAN GENERAL CONSTRUCTION CO., TORONTO, CAN. Office: 409 Temple Bldg.

TRADE NOTES.

The Goldie & McCulloch Co., Limited, Galt, Ont., recently supplied a boiler for the Hamilton Steel & Iron Co., Hamilton.

Walter E. H. Massey has purchased from the United Electric Co., Toronto, a motor for operating fans at his Model farm.

Messrs. Lawry & Sons, pork packers, Hamilton, Ont., have added to their electrical equipment a 7 h.p. S.K.C. induction motor, purchased from the Royal Electric Co.

We are indebted to the National Carbon Co., of Cleveland, Ohio, for copies of their calendar for 1900, accompanying which is the moonlight schedule for the year.

At a meeting of belting manufacturers and dealers held in Montreal a fortnight ago an advance in prices was decided upon, due to the advanced cost of the raw material.

The Canadian General Electric Co. have received an order from the corporation of the town of Drummondville, P.Q., for one of their standard 45 kilowatt 500 volt multipolar generators.

The Toronto & Hamilton Electric Co., of Hamilton Ont., have recently removed to larger premises, in which they have installed considerable new machinery, which is driven by electricity.

The Calgary Water Power Co., of Calgary, N.W.T., has been compelled to increase its plant, and is installing a 150 k.w. S.K.C. two-phase inductor alternator, supplied by the Royal Electric Co., of Montreal.

The Gutta Percha Rubber Co. of Toronto are increasing their electric lighting plant, and have ordered another 50 kilowatt generator, direct connected to an Ideal engine, from the Canadian General Electric Company.

Messrs. Ahearn & Soper, of Ottawa, Canadian agents of the Westinghouse Electrical and Manufacturing Co., are sending out a very neat paper knife, which will be appreciated for its usefulness and serve well the purpose of an advertisement.

The attention of the electrical companies is directed to the advertisement of Mr. E. J. Brown, of Brantford, on the last page of cover of this number, in which he intimates that he is in a position to make repairs to all kinds of electrical apparatus on short notice.

The National Cycle & Automobile Co., who have recently commenced the manufacture of bicycles, automobiles, etc., in the city of Hamilton, intend operating their works by electricity, and have placed their order with the Royal Electric Co., of Montreal, for two 30 h.p. S.K.C. induction motors.

Messrs Collyer & Brock, electrical engineers and contractors, Montreal, are now engaged in installing 350 incandescent lights and 18 telephones in the residence of Hon. G. T. Fellford at Brockville, Ont. They have also been awarded the contract for fitting up electrically the Eastern Townships Bank at St. Hyacinthe, Que.

The Canadian General Electric Company have received an order from the Trenton Electric Company for one of their standard three-phase alternators, 250 kilowatt capacity, wound for 2,300 volts, together with switchboard, step up and step down transformers and distributing panels, for their sub-station at Belleville, Ont.

The gyrator system of flour milling, of which the Goldie & McCullough Co., Limited, Galt, Ont., are the sole Canadian makers, is meeting with much favor among millers. They have put this machinery in mills in nearly every province in the Dominion. Recently a car-load was shipped to the Farmers' Milling Co., Fort Saskatchewan, N.W.T.

The town council of Neepawa, Manitoba, in accepting the electric light and power plant recently installed by the Robb Engineering Co., passed the following resolution: "That this council have much pleasure in bearing testimony to the efficient manner in which J. F. Porter has installed the engine and boilers in connection with our electric plant, and that a copy of this resolution be sent to the Robb Engineering Co."

A completely equipped electrical supply house is that of Mr. John Forman, of Montreal, whose new quarters are at 708 and 10 Craig street. The building is four stories high, beside the basement, and is admirably lighted and fitted up. In the basement is found the heavy goods, such as cables, conduits, heavy wires, insulators, etc. Mr. Forman's private office is located on the second floor, together with a new laboratory equipped with various instruments for testing incandescent lamps. In this laboratory instruments may be tested by the public free of charge, a privilege which will no doubt be appreciated by users of electricity. The two upper stories will be devoted to manufacturing. Mr. Forman has purchased the plant of the Canadian Bryan Electric Co., and will manufacture a complete line of cut-outs, switches, rosettes, sockets, etc.

An ingenious arrangement to prevent overcrowding of stairways and elevators when entering or leaving a building is used in main office of the International Correspondence Schools, Scranton, Pa. The time of entering and leaving the building is regulated by clocks on each of the five floors. On the lower floors the clocks are set correctly, but on the upper floors they are a few minutes slow, so that the employees on the lower floors are at their desks before those on the upper floors are due at the building. In leaving the building the employees on the upper floors do not leave their desks until several minutes later than those on the lower floors. Over 500 people are employed in the building, which is used exclusively by the International Correspondence Schools. This institution has over 70 courses of instruction by mail and its students may be found in all parts of the world.

The United Electric Company, Toronto, report the following sales: The Tate Optical Co., Peterboro, a motor for operating their plant; Ritchie & Ramsey, New Toronto, a dynamo for lighting their works; Dodge Mfg. Co., Toronto Junction, Ont., dynamo for lighting their works; Hamilton Steamboat Co., dynamo for lighting the steamship Macassa; The E. S. Stephenson Co., St. John, N.B., several motors, among others two of 8 h.p., two of 6 h.p., and one of 2 h.p.; F. B. Allan, of Toronto, for the Nonsuch Mfg. Co., a 15 h.p. motor with which they intend to operate their manufacturing plant; Jas. Fenwick, Preston, a 75 light arc dynamo, with a number of lamps, for lighting the town of Preston; J. Forman, Montreal, a number of their standard type motors, including one of 6 h.p., and one of 8 h.p.; H. Phillips, Toronto, one of their 6 h.p. standard type motors for operating his manufacturing plant. The United Electric Company have also just completed an installation for lighting the factories and yards of the Northumberland Paper & Electric Co., of Campbellford, Ont.

ELECTRICAL REPAIRS

In the large and well equipped factories where the manufacture of electrical apparatus is carried out under the piece work system, they find that repair work or apparatus sent in to be repaired or rewound interferes with this system, and in many cases they would prefer not to do this kind of work, as it is almost impossible to do it with dispatch and at a reasonable price. Knowing the above to be a fact,

MESSRS. FRED THOMSON & CO.
774 Craig Street, MONTREAL, P.Q.

have arranged their works for repair work only. They keep armatures of nearly all makes of dynamos in stock, which they loan while repairs are being made. Their factory is so arranged that they can run night and day, and work can be finished in the shortest possible time. Telephone Main 3149.

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Lubricating Oils and Greases, Flue Cleaners, Cotton Waste, Pipe Covering, Asbestos Goods, Rubber Packings, Brass Goods, Belting and Lace Leather

We Buy the Best and Sell at the Right Price. If You Want to Save Money and Get Superior Goods Write Us.

THE WM. SUTTON COMPOUND CO.
186 Queen Street East - - TORONTO

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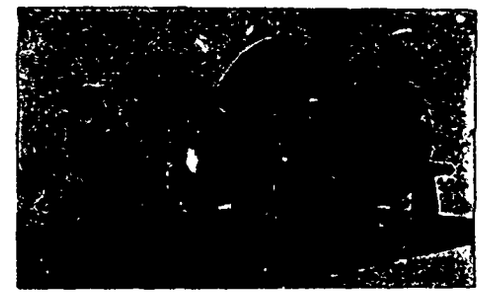
OPERATING DYNAMOS



That there are more Victor Turbines in use supplying power for electric generators than any other, is due to the many points of superiority possessed by this Turbine.

FEATURES WORTH REMEMBERING

High Speed, Close Regulation, Great Capacity
High Efficiency, Perfect Cylinder Gate, Steady Motion

RECENT PLANTS INSTALLED: Lachine Rapids Hydraulic & Land Co., Montreal, Que., 12,000 h.p.; Chambly Manufacturing Co., Montreal, Que., 20,000 h.p.; West Kootenay Power & Light Co., Rossland, B.C., 3,000 h.p.; Dolgeville Electric Light & Power Co., Dolgeville, N.Y.; Honk Falls Power Co., Ellenville, N.Y.; Hudson River Power Transmission Co., Mechaniesville, N.Y.; Cataract Power Co., Hamilton, Ont.

CORRESPONDENCE SOLICITED.

The Stilwell-Bierce & Smith-Vaile Co. - *DAYTON, OHIO. U. S. A*

SPARKS.

A committee has been appointed by the Ottawa city council to investigate the civic lighting plant question.

The Scotstown Mills Co., of Sherbrooke, Que. has obtained a charter for lumbering, mining and electrical purposes.

The foundation for the power house of the Cascade Water Power & Light Co., at Cascade City, B.C., has been completed.

The town council of Welland, Ont., is negotiating with the Electric Light Company for a renewal of the street lighting contract.

It is rumored that the Cataract Power Co., of Hamilton, are considering the building of a power canal from the Chippewa creek to connect with their canal at Allanburg.

The Department of Railways and Canals of Canada have invited tenders for the construction of two non-condensing marine engines and a Clyde boiler for the St. Lawrence canals.

The town council of Woodstock, Ont., has authorized the Fire and Light Committee to obtain figures for the installation of an electric light plant and the introduction of an all-night service.

The Ingersoll Electric Light & Power Co., of Ingersoll, Ont., are installing an electric light plant in the condensing factory in that town. It is said that the company may install a power plant at an early date.

It is expected that the civic lighting plant at Winnipeg will be completed shortly. The electrical apparatus was furnished by the Westinghouse Co., of Pittsburg, and the boilers and engines by the Polson Iron Works Co., of Toronto.

Suit has been entered by James Ellicott against the Lachine Rapids Hydraulic & Land Co., of Montreal, for $5,000 damages for injuries received while in their employ by coming in contact with a live wire. Deficient insulation is alleged.

The Canadian Locomotive & Engine Co., of Kingston, Ont., have gone into voluntary liquidation, Mr. A. Riddell, of Montreal, having been appointed provisional liquidator. The company is understood to be fairly prosperous and to have large orders on hand.

The bright advertising man of an electric lighting company recently perpetrated the advertising bull of the season by announcing that his company was prepared to furnish a "matchless electric lighting service." The rest of the boys are now using the matches to light the cigars he buys for them.—Newspaper Maker.

The sulphuric acid for use in the Ottawa Electric Co.'s storage battery plant was procured in England, through Messrs. Evans & Sons, wholesale druggists, of Montreal. There were 5,000 pounds, which is said to be the largest quantity of that article that has ever been imported into Canada in one shipment.

The Brown Brothers Company, of Toronto, are removing to their new commodious warehouse on Wellington street west. They purpose operating their entire machinery by electricity, and have placed an order with the Canadian General Electric Company for a number of form H moderate speed motors.

A Moffatt feed water heater and oil extractor is being put in the Goldie Milling Co.'s mill at Highgate, Ont. These heaters are made by the Goldie & McCulloch Co., of Galt, Ont. Every engineer should send for a catalog of them, as they are meeting with great success.

The town council of Dartmouth, N.S., has decided to apply to the legislature for authority to borrow $40,000 to provide the town with an electric light plant. It is proposed to utilize the water power at Port Wallace locks, and an engineer will be engaged to report on the quantity available. Mr. Sieberts is the municipal electrician.

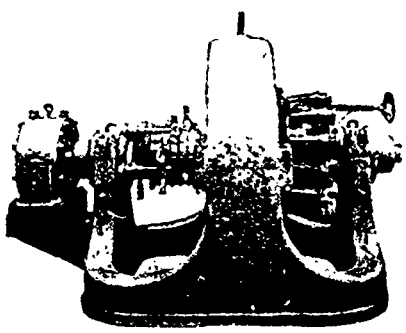
The Canadian General Electric Company have just received an order from the Toronto Electric Light Company for two 450 k.w. 250 volt direct current power generators and one 400 k. w. revolving field single phase 2400 volt alternator. These machines are to be used in the new power house of the company, to meet the ever increasing demand for light and power.

The annual meeting of the Brandon Electric Light Co. was held on January 18th, at which the question of securing cheaper power was discussed. As a result it is probable that steps will be taken to utilize the water power of the Little Saskatchewan river, which flows into the Assiniboine about eight miles west of Brandon. Mr. Geo. Patterson is manager of the company, and Judge Walker, of Winnipeg, is a member of the board of directors.

The Canadian Electric Light Company, of Levis, P.Q., are undertaking a very extensive electric power transmission scheme, and have placed their initial order for electrical apparatus with the Canadian General Electric Company. This order consists of two 750 kilowatt revolving field three phase alternators. These are to be wound for 10,500 volts, thus eliminating the necessity for step-up transformers. The Canadian General Electric Company are also furnishing the necessary exciters and marble switchboards.

Messrs. Lever Bros., Limited, of Port Sunlight, England, have awarded to the United Electric Company the contract for equipping their entire new works being built in Toronto, which will be known as the Sunlight Soap Works, with a complete electric plant for power and lighting. The plant will consist of generators direct connected to high speed automatic engines, and fifteen multipolar motors. The securing of this contract speaks well for the apparatus of the United Electric Company, as we understand it was obtained in competition with Canadian, American and English firms, and was awarded to them after a thorough investigation into the merits of the different types of apparatus.

Westinghouse Rotary Converters



ROTARY CONVERTER.

Give Satisfaction for all kinds of Service . . . .

Ahearn & Soper - Ottawa

AGENTS FOR CANADA

SPARKS.

The Belleville electric street railway will be sold by public auction under mortgage on March 1st.

The ratepayers of Rat Portage, Ont., have voted in favor of the town purchasing the electric light plant.

The Truro Foundry & Machine Co., of Truro, N.S., contemplate installing an electric plant for lighting their works.

Davidson & Henderson, of Toronto, have purchased from the United Electric Co. a motor for operating their printing presses.

Mr. Geo. F. Macdonald, superintendent of the Ottawa fire alarm system, has recommended that at least ten more improved boxes be installed.

The Montreal Electric Company have placed an order with the Canadian General Electric Company for two marble feeder panels and instruments.

The Goldie & McCulloch Company, of Galt, Ont., recently shipped some heavy special machinery to the St. Charles Condensing Company, Ingersoll, Ont.

The Sherbrooke Gas & Water Co. are again compelled to increase the capacity of their plant, and during the coming summer will install an 8,000 light dynamo.

The Canadian Corundum Co. purpose erecting a crushing and concentrating mill on the Madawaska river north-east of Bancroft, power to be obtained from an adjacent water fall.

The lighting of the streets of Welland, Ont., is now receiving attention by the town council. Some of the members favor the purchase of the electric light plant by the corporation.

The city engineer of London, Ont., has estimated the cost of installing sufficient plant to use the surplus electric power at Victoria hospital to illuminate the city buildings at $4,700.

The Fire and Light Committee of Toronto Junction council have recommended that an electrical expert be engaged to report on the required alterations and improvements to the town's electric lighting plant.

The Underwriters' Association has recommended that the town of Barrie, Ont., install an electric fire alarm system. The council of that town is considering the extension of the electric lighting system to Allandale.

Mr. Edward Irving, electrican, of Hamilton, is understood to be preparing plans for St. Andrew's Falls Power Co., of Winnipeg. This company purposes developing 3,000 horse power from a fall 17 miles from Winnipeg.

Mr. W. T. Stewart, electrical engineer, of Toronto, estimates the cost of a civic electric light plant for Toronto at $250,000, and operating expenses at $78,020. At the present time, he says, the city pays $107,482.49 for electric lighting.

Messrs. Conroy Bros. are building a new power house at Deschenes, Que., they having entered into a contract to supply the E.B. Eddy Co., of Hull, with 2,000 horse power for a period of ten years. The price per horse power is reported to be $15.

John Gillis, an employee of the armature department of the Canadian General Electric Co., Peterboro, recently met with an accident by which 2,400 volts are said to have passed through him. Both arms were badly burned and other injuries sustained.

The Renfrew Electric Light Co., Limited, of Renfrew, Ont., has been granted a provincial charter. M. A. A. Wright is president and manager, Mr. A. Hough vice-president, and Mr. Howard Wright secretery-treasurer. The capital of the company is $75,000.

The Midland Electric Co. are now negotiating with the town council for a renewal of their lighting contract. They have offered to supply arc lamps of 1,200 c.p. at $45 per year per lamp for service until 2 a.m., or $60 for an all night service on moonlight schedule.

The city engineer of Hull, Que., has prepared plans for for the dynamo station to be built in connection with the water works power house. The plans provide for 75 arc lights, covering about six miles of street and eight miles of wire. There will be .. 50 light dynamos.

The eighth annual meeting of the shareholders of the Galt, Preston & Hespeler Street Railway Co. was held on February 1st. The statement presented showed that there were carried during the year 232,361 passengers and 15,515 tons of freight, making the total earnings $19,579.42. It is understood that the Cataract Power Co., of Hamilton, have secured a controlling interest in the road.

The Canada Atlantic Railway have lately placed new electric safety signals at the intersection of several streets in the city of Ottawa. As a train approaches, when 1,600 feet from the first crossing, and electrical connection is made. Immediately the light at the crossing lights up and the bell starts ringing vigorously. This keeps up till the train crosses the street, when the bell is cut off. This system of signalling is in vogue in the United States, but the Canada Atlantic Railway is said to be the first to introduce it in Canada.

In connection with the suggestion of our Montreal correspondent in last issue that the correspondence schools should so arrange their courses as to eliminate the dry mathematics and preliminaries and get right at lectricity, the International Correspondence Schools, of Scranton, Pa., have sent us a copy of their aplication blank, and point out that the method of instruction is graduated so as to suit the needs of each individual student. If a student is qualified to pass an examination in any subject, they state that he may be excused from doing work on that subject.

JOHN R. BARBER, President. *GEO. E. CHALLES, Sec.-Treas.*

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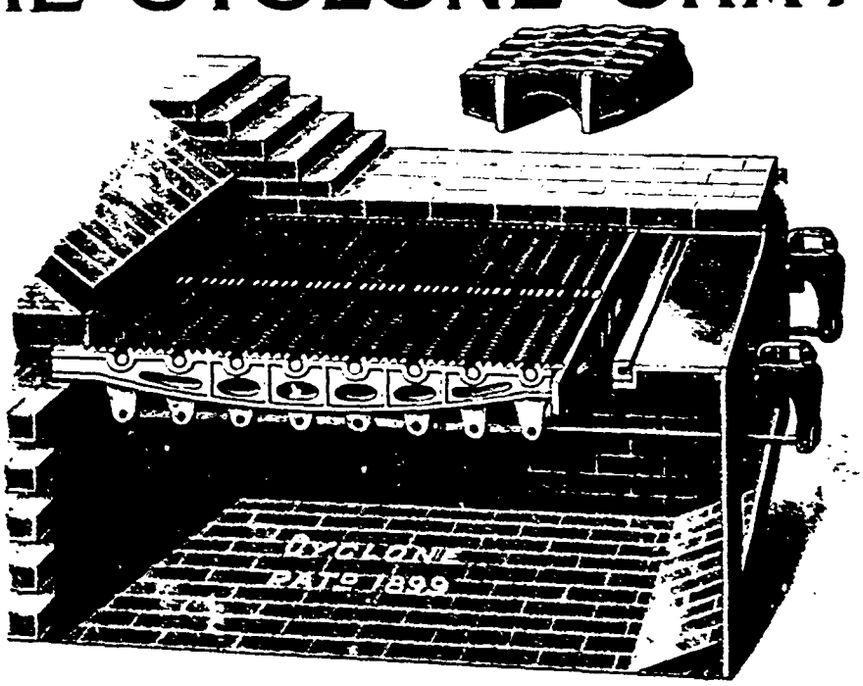
Cut shows construction of the Grate. No alteration of Plant necessary.



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Yours truly,
D. Gunn, Brothers & Co.

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Telephone 1106. Office: 10 King Street West, TORONTO, CAN.

A Series Alternating Street System

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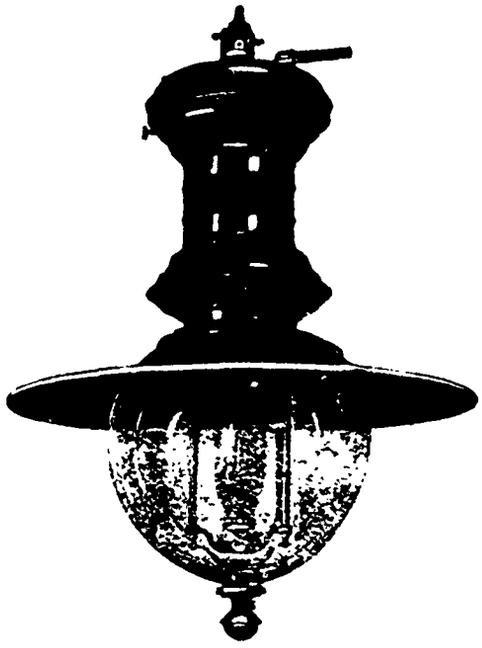
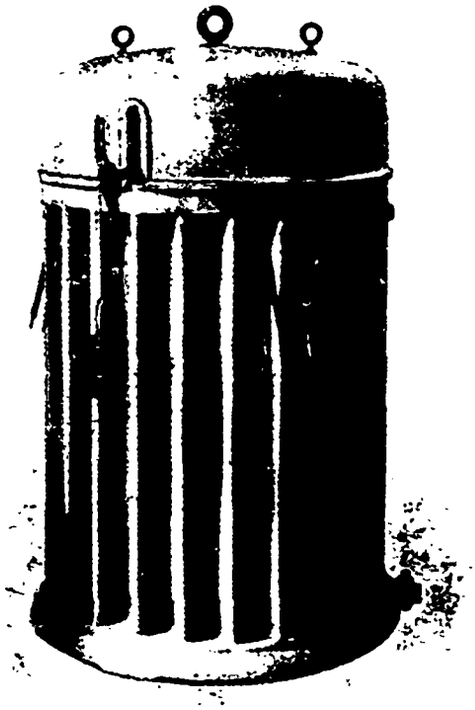


Our Constant Current Transformer can be operated on any Potential, or any periodicity, and on one, two or three circuits without additional constant Potential Transformer as required when so called "regulator" is used.



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No destructive grounds or short circuits with other lines where our Transformer is used.

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FACTORIES:
PETERBORO', ONT.

BRANCH OFFICES:
HALIFAX MONTREAL WINNIPEG ROSSLAND VANCOUVER

SPARKS.

Mr. J. de Froment, of Rathwell, Man., has invented an electric fire alarm for which he claims many points of merit.

Mr. H.C. Symmes, a New York electrician, has joined at Guelph, Ont., the second Canadian contingent for service in South Africa.

At the municipal elections the ratepayers of Prescott, Ont., voted in favor of handing over the management of the electric light plant now operated by the town to the water commissioners.

The United Electric Co., of Toronto, have closed a contract with Messrs. Darling Bros., of Montreal, for motors to be used direct connected to elevators at the Longue Pointe Asylum near Montreal.

The Goldie & McCulloch Co., Limited, of Galt, Ont., have just shipped two of their Ideal high speed engines, one to Sarnia for the Canadian General Electric Company, and the other to the Montreal Rolling Mills Company, Montreal.

The Sandwich, Windsor & Amherstburg Railway Co. have purchased a 150 horse power gas engine from Westinghouse, Church, Kerr & Co., of Detroit. The engine will be used for operating their electric road and will replace a Corliss steam engine.

The Electric Light Committee of the city council of Victoria, B.C., will recommend the installation of an incandescent plant of 1,000 lights capacity for lighting the city hall and other civic buildings. The corporation now operates the arc plant for street lighting.

R.F. Prefontaine, Q.C., of Montreal, and associates, have applied for the incorporation of the Labrador Electric Light & Power Co., to acquire and develop for electrical purposes water powers on the Murray Bay River, and to operate electric railways in the districts of Charlevoix, Chicoutimi and Saguenay, in Quebec.

The Hoepfner Refining Company, of Hamilton, have placed an order with the Canadian General Electric Company for two 1500 ampere 120 volt generators, to be used for electrolytic purposes. These machines are to be direct connected with Stanley motors, and the power will be supplied by the Cataract Power Company, from their DeCew Falls transmission lines. The plant when completed will be one of the most interesting in Canada.

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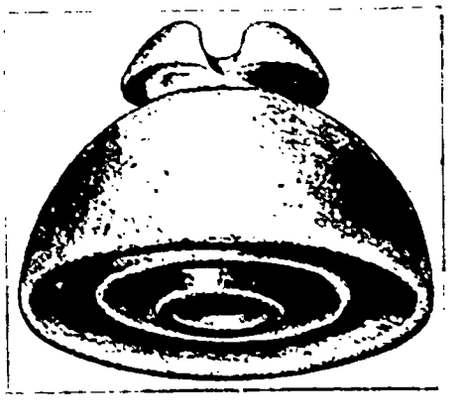

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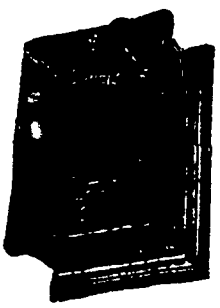

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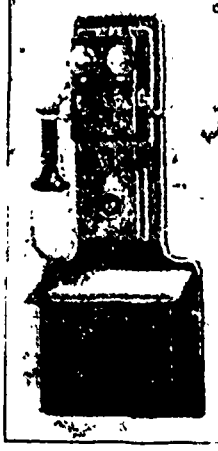

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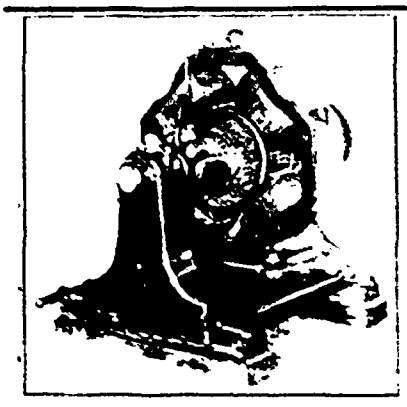

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