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CANADIAN
ELECTRICAL NEWS
AND
STEAM ENGINEERING JOURNAL

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

AUGUST, 1896

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CANADIAN

ELECTRICAL NEWS

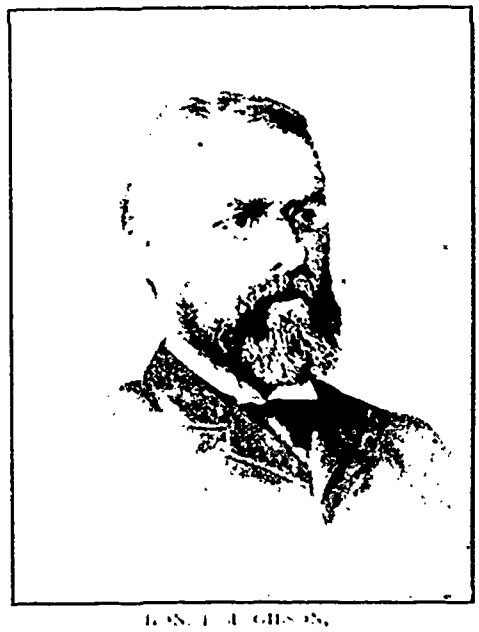
AND

STEAM ENGINEERING JOURNAL.

VOL. VI. AUGUST, 1896 No. 8.

ELECTRICAL POWER TRANSMISSION TO HAMILTON.

THE Cataract Power Company has been incorporated at Hamilton, with a capital stock of $99,000, for the purpose of transmitting electric power from DeCew Falls to Hamilton, a distance of 32 miles. The promoters of the company are Hon. J. M. Gibson, James Dixon, John Moodie, John William Sutherland, John Patterson, and Edmund Brown Patterson, all of Hamilton. DeCew Falls are situated about two miles from St. Catharines and receive a constant and unfailing supply of water from Lake Erie. The height of the fall is about 270 feet. The depth of water at the brow of the fall is about 5 inches, and the width about 18 feet. This comparatively small body of water, operating upon water wheels from the height mentioned, is capable of generating 2,500 horse power. The only purpose served at present by this magnificent water power is the operation of a couple of small mills. The Cataract Power Company have acquired the sole ownership of the water privilege, and are understood to have gone very thoroughly into the practicability of the scheme for transmitting the power to Hamilton. No particulars are as yet obtainable regarding the system or methods to be adopted for transmission, but the details are said to have been carefully worked out and submitted to Nikola Tesla and other electrical experts, who have approved of them.



H. N. [illegible] GILES,
President Cataract Power Company, Hamilton.

The company have submitted to the Hamilton Street Railway Co., Hamilton and Dundas Railway Co., Hamilton, Grimsby and Beamsville Railway Co., Hamilton Electric Light and Power Co., and other large power users, a proposition to supply them with power at a cost very much below what they are paying under present conditions. The proposition is that the power shall be supplied under guarantee, so that the purchaser is asked to assume no risk whatever. If the company succeed in getting the acceptance of their proposition from the leading power users, the work of installing the necessary plant will be at once proceeded with. The total cost of carrying the enterprise to completion is estimated at nearly a quarter of a million dollars. If carried out this will be the longest electric power transmission line in the Dominion, and one of the longest in the world.

The further development of so important an enterprise, and one which bears to some extent the character of an experiment, will be watched with much interest. The recent declaration of Nikola Tesla that he has solved the means of successfully transmitting electric power for commercial purposes to a distance of 500 miles, augurs well for the success of this and enterprises of like character in the future.

BARRIE ELECTRIC LIGHTING PLANT.

THE picturesque town of Barrie, situated on the shores of Kempenfeldt Bay, is lighted at night by two electric plants.

The steam plant, situated on Bayfield street, was designed by Messrs. Kennedy, McVittie & Co., architects. It acts as an auxilliary to the water plant, which is situated at Midhurst, six miles north.

The switch board is a substantial slate affair, equipped with Brush instruments. The switch board room is merely a platform raised about ten feet above the floor of the dynamo room. A balcony runs around behind the board, so that the operator can see all of the machines from above. Stairs lead down to the floor of the dynamo room, which is floored in maple. All the machines are set on stone foundations, and the fly wheel of the engine is supported on stone abutments.

The engine is a Brown tandem compound, 180 h. p., with a fly wheel 12 feet in diameter by 24 inches face, driving a 22 inch belt onto a line of shafting, 35 feet long by 4½ inches in diameter. The line of shafting is below the switch board room, and is on a level with the floor of the dynamo room, the pulleys on it working in a pit. From the line of shafting, a 12 inch belt drives a 1000 light Brush alternator with exciter. Three five inch belts drive three Ball arc machines of 25 lights each. The machines are neat and clean, and everything about the place has a spick and span appearance.

In the boiler room two 14' by 60" Polson 100 h. p. boilers, fed by a Chas. Smith feed pump, and fired by soft wood, generate the steam for the engine. A Polson dependent condenser, direct connected, with a capacity of 3000 gallons of water per hour at 90°, beneath the floor of the dynamo room. The brick chimney is a substantial structure of considerable height.

The switch board room, the manager's office, and the cloak room are ceiled with basswood and the floors are maple. The manager's office is neatly fitted up and overlooks the flower garden and well kept lawn. On the switch board are seven switches for incandescent circuits. The board is fully equipped, and the light is sold principally by meter. The dynamo room is lighted by an arc light, and the rest of the building by incandescent lights.

At Midhurst there are two stations, one for arc lighting and one for the alternators. The machines in these plants are duplicates of the Barrie plant. A 30 foot head of water drives the arc plant, and a flume leads down to the incandescent plant.

The company is managed by an efficient board of directors, comprising Jas. T. Burton, President; M. Burton, vice-Pres.; S. A. Sett, Secty; Jas. A. Sanford, Supt; L. E. P. Pepler, director.

BY THE WAY.

Mr. H. E. Edge, a prominent lumberman of Sydney, N.S.W., is making a tour of Canada, investigating the merits of the various electrical systems. He expresses surprise at the number of water powers. In Australia, he says, there are but two systems operated by water power, and to obtain the water for one of these a tunnel one mile in length was constructed. The rivers of Australia differ from those of Canada, in that they run for some miles and then disappear for miles. This, he says, is due to the porous nature of the ground in some parts.

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During the four or five years of business depression through which we have been passing, all classes have been on the lookout for indications of returning prosperity. As a rule they have seen little of an encouraging character, while with some things have been going from bad to worse. I met a man thus situated recently, to whom I propounded the oft-put question: "What is the business outlook?" The answer I received is worthy of preservation. Said he, "Two or three years ago, you and I were living on our Faith that the times would improve. Last year we thought we could discern signs of promise and we lived on Hope. This year I am living on Charity."

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The pathway of the sales agent of an electric manufacturing company is not always strewn with roses, judging by an experience which one of them related to me the other day. "You remember," said he, that the city of ——— was lately equipped with an electric street railway. Well, I am the individual who worked that enterprise up from its very foundation, and failed to get either credit or dollars for my labor. First of all I directed my attention to the Council, and after much expenditure of time and the breaking of more than one bottle of wine, secured for the promoters of the road a franchise, which, owing to local prejudices, they could not have obtained for themselves. I next prepared plans and specifications upon which they might invite tenders for the apparatus and construction. Tenders were called, and a meeting of the Council held to consider them, at which I could not be present on account of having to appear as a witness in a suit for the recovery of $250 misapplied funds. In my absence another representative of our company, who was totally unknown to the aldermen, was delegated to attend the meeting of the Council in the interests of our tender. The result was that the Council accepted the tender of a rival concern, and we were out the profits on a $30,000 contract, plus time, effort and incidental expenses the latter of which came out of my own pocket. When, afterwards, I ventured to ask some of the promoters if they did not think I was entitled to a little more consideration, after all I had done in getting them the franchise, etc., they frankly admitted that they had entirely overlooked that feature of the matter, and had simply voted that the lowest tender be accepted, regardless of everything else. If it had not been for that paltry law suit, I would have been certain to have got that contract. The last straw on the camel's back was the fact that the law suit went against us also, and we lost the whole business." Fortunately such extraordinarily "rough" experiences do not strike a man often, but when they do they hit him hard.

As the result of the efforts of a Canadian syndicat e the antipathy to the trolley system of street car propulsion in England bids fair to be largely overcome. This syndicate is composed of Mr. Wm. Mackenzie, president of the Toronto Street Railway Company, and Mr. James Ross, manager of the Montreal Street Railway, who have been negotiating for the purchase of the franchise of the existing street railway company of Birmingham, Eng. I met Mr. Mackenzie a few days after his return from Europe, and he informed me that the deal was considered as good as closed. He said: "There is just Mr. Ross and myself in the company as yet. The conditions of the purchase are that we secure an extension of 21 years of the lease of the road, and that the City Council permit the use of the trolley system, but we do not anticipate any difficulty in that line. Of course, the work of electrifying the system will not be commenced until next spring. The road is forty miles in length, and the population of Birmingham, I should say, about three times as large as Toronto." To the question, "Is it your intention to endeavor to secure other franchises?" Mr. Mackenzie remarked that after the Birmingham system was in operation, he thought other cities would soon fall in line. He hoped eventually to secure the adoption of the trolley system in London, where horse cars and busses are now used, and where the prejudice against poles and overhead wires is very strong. "About the best electric railway in England," he said, "is on the Isle of Man; it is eight miles in length, double-tracked, and works very efficiently. In the matter of lighting they are much further advanced, and I had the pleasure of visiting an immense installation at London. As regards electrical machinery, I do not think they are quite as far advanced in Great Britain, and it is just possible that some American machinery will be required for the proposed conversion of the Birmingham road." Mr. Mackenzie purposes making another trip to Europe this fall.

ECONOMIES IN CENTRAL STATION PRACTICE.

A paper on the above subject presented recently before the Chicago Electrical Association by Mr. Thos. C. Grier, concludes as follows:—

There are 'little' economies 'in details.' Here are a few short quotations from letters I received in response to my query as to little economies:

'The first to come to mind under your paper is discount all bills promptly, as your supply house can afford to give better prices when they know their invoices will be paid promptly.'

'If furnishing street lights, show your council and committee that you are trying to give the city all the contract calls for.'

'Treat your customers as reasonably as possible; they will reciprocate.'

'Collect all your bills before the 10th of the month.'

'Keep the stock-room under lock and key and have supplies taken out on requision; men get careless and this is a leak that foots up very fast.'

'Bad joints, that is, joints not soldered, and loose, is poor economy.'

'The use of exhaust steam for heating in winter is economy.'

Every plant in itself is a distinct problem and what may be economy in one may not answer in another.

OTTAWA LETTER.

(Correspondence of the CANADIAN ELECTRICAL NEWS.)

THE Ottawa Electric Railway Co. have purchased a large parcel of property near the Experimental Farm. Sixteen acres of this is wooded with elm, maples and birch, and is known as the "West End Park." The Somersett street cars furnish a five minute service during the evening, and less frequently during the day. The park was opened on Saturday evening, July 18th, when 4000 people were there. The company have erected an open air theatre, with seating capacity for 1600 people. A commodious stage, with electric foot-lights, a good orchestra and high class performances, fill this enclosure every evening. Edison's late invention, the Vitascope, has been running for three weeks. It requires two currents to operate it. The trolley circuit was used to revolve the films before the aperture and an alternating circuit to project the views on the canvas. The grounds are lighted by numerous arc lights. Five swings and a piano are operated by an ordinary street car motor. The company deserve great praise for supplying pleasant recreation for the warm summer evenings.

Ottawa possesses a large number of electrical firms, of which the following are a portion:

Godard, Garrioch & Co. have been very busy, and have a neat display of electric fixings connected with installations of light or power.

The young firm of O'Rielly & Murphy have in a little over a year built up a satisfactory business. They had as many as fifteen jobs on hand at once this summer.

Chubbuch & Simpson, a new firm, are doing a good business, and have a lot of work on hand.

H. McColl, agent for the Chanteloup Mfg. Co., Montreal, reports business fair.

Mr. Cotter has invented an electric carpet beater. It is a simple little affair, but is a marvel to work.

R. Anderson, general electrician, is installing an electric lighting plant of 75 lights, on the steamer Empress for the O.R.N. Co., and a 25-light plant on J. G. Brigham's ferry wharf.

Ottawa No. 7, C. A. S. E., who have a number of members on the river, hold their election of officers in December instead of May, and their semi-monthly meetings on the 2nd and 4th Fridays. Their last meeting, July 31st, was one of the best they have had. The officers are as follows: President, T. J. Merrill; Vice-President, A. Gaul; Financial Secretary, T. Robert; Recording Secretary, T. G. Johnson; Treasurer, Wm. Hill; Conductor, John Harris; Door-Keeper, J. F. Peters; Trustees, Thos. Wensley, John Cowan, F. G. Johnston. The delegates to the Kingston convention will be T. J. Merrill, F. G. Johnson and F. W. Donaldson.

VERTICAL STEAM BOILERS.

TAKE an ordinary horizontal tubular boiler, one of the kind used in hot water heating plants, with the space inside the shell completely filled with tubes—set it on end, with a furnace below and a chimney connection above, and you have pretty nearly what, for many years, has been the standard type of vertical boiler. And a good serviceable kind of boiler, too, it has been, with all its shortcomings. In cost it was moderate; no special setting was required for it; repairs were easily made, the compactness and a reasonable degree of efficiency were secured with it, so that even to-day it has not outlived its period of usefulness, but continues in favor and is employed in a wide variety of cases where, all things considered, no other form of boiler will give the same degree of satisfaction.

And yet, for large powers, for high economy, for standard use in high-class power station work, even its distinctly good points could not command its application, except in forms so modified that in many cases *little semblance remains to the early upright tubular* boiler as we all know it. The designs have been carefully worked over, all with the end in view of turning out something better than the original, and the result that while the later boilers also are vertical, in the sense, primarily, that they take up more head room than ground space, their tubes are not always vertical nor even approximately vertical, and there is not in every case the conventional shell within which tubes and flues are disposed.

Nor are the tubes always fire tubes, as in the ordinary vertical boiler, for conveying the products of combustion from the furnace to the chimney; frequently in the newer and more complex designs they are water tubes instead and do not always run in straight lines, but often curve and twist in vertical and horizontal planes, in helical paths, in almost all directions imaginable, with the one aim of making them efficient heaters of water, by promoting circulation and absorbing, to the greatest possible extent, the heat of the fuel liberated in the furnace. Albert Spies, in Cassiers' Magazine for December.

RECENT CANADIAN PATENTS.

Canadian patents have been granted for the following electrical and steam engineering devices:

Insulating joint—Chicago Gas & Electric Fixture Manufacturing Co., Chicago.

Valve for boilers—John Harrison, Winnipeg, Man.

Electrical indicating mechanism for journal boxes—Wm. B. Chockly, Denver, Col., U. S.

Electric railway—W. B. Purvis and M. M. Armstrong, Philadelphia, U. S.

Filaments and carbons for electric lamps—J. H. D. Willan, 16 Helens Place, London, Eng.

Bonding device for electric railways—Wilson Brown, Camden, U. S.

Electric lamp hanger—Wm. A. Thompson, Toronto, Ont.

Turbine water wheel—John H. Staple, York, Penn., U. S.

Steam boiler furnace—Thomas York, Portsmouth, Ohio, and James E. York, Duluth, U. S.

Turbine water wheel—John B. McCormick, jr., and James Dixon, York, Penn, U. S.

High pressure engine—John Wand, London, Ont.

Appliances for cleaning car tracks—Samuel Irwin and Albert S. Geiger, Waterloo, Ont.

Split switch—Uldarique Gilbeault, St. Isidore Junction, Que.

Force pump—Wm. E. McCall, Peterborough, Ont.

Electric safety appliance for railroads—Edward Levi Orcutt, Sommerville, Mass., U. S.

Turbine water wheel—Wm. O. Crocker, Turner's Falls, Mass., U. S.

Electric railway—John F. and John A. Jordan, Brooklyn, N. Y.

Electric railway gate—Herman Biermann, Breslau, Germany.

Machine for raising and lowering electric light—Nelson McLeod, Cammington Ont.

Electric locomotive—J. J. Heillmann, Paris, France.

Balanced steam engine—J. J. Heillmann, Paris, France.

Queen Victoria has had several telephones installed in Windsor Castle. They are placed on her majesty's study table and communicate with Lord Salisbury at the Home Office, Marlborough House and Buckingham Palace. In a few days an electrophone will be introduced at Windsor Castle, and the Queen will be enabled to hear all the latest entertainments in the London theatres and concert halls.

SOLUTION OF ELECTRICAL QUESTIONS.

By the courtesy of Mr. James Milne, we are enabled to present herewith the solution of the questions submitted for the electricity examination of the Toronto Technical School, at the close of the last session:

1. State clearly Ohm's Law. What is the unit of resistance? the unit of current? and the unit of electro-motive force?

ANSWER. Ohm's Law: The strength of a current varies directly as the E. M. F. and inversely as the R, or the intensity of the current is equal to the E. M. F. divided by the resistance, i.e.,

$$C = \frac{E}{R} \quad R = \frac{E}{C} \quad E = CR.$$

The unit of resistance is called the "Ohm" and is equal to 10^9 C. G. S. units of resistance. It is the resistance of a column of pure mercury 1 square millimeter in section and 106 centimetres long at a temperature of 32° F. The unit of current is called the "Ampere" and is 10^{-1} C. G. S. units. It is that current which will deposit 4.025 grams of silver per hour or decompose .0055944 grams of water per hour. The unit of electro-motive force is called the "Volt" and is equal to 10^8 C. G. S. units, and is also the E. M. F. necessary to send a current of 1 ampere through a resistance of 1 ohm.

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2. A battery of 15 cells, arranged five in series and 3 abreast, produces a current of .5 amperes through an external R of 5 ohms. Find the E M F of each cell if its internal R is 3 ohms.

ANSWER. Let x = Number of cells in series.
y = " " " " in multiple.
E = E M F of each cell.
R = External R.
r = Internal R.

$$C = \frac{E}{R + \frac{x \cdot r}{y}} = \frac{x \cdot E}{x \cdot r + R y}$$

$$C\left(\frac{x \cdot r}{y} + R\right) = x \cdot E$$

and substituting all the data given in the question for the above we get

$$.5\left(\frac{5 \times 3}{3} + 5\right) = 5\ E$$

E = 1 volt.

---

3. What is the best way of arranging 28 cells, each having an R of 4 ohms, so as to produce the strongest current in a circuit of 28 ohms.

Ans. In this question the internal R must be = external R,

that is $\frac{x \cdot r}{y} = R$

or $\frac{4\ x}{y} = 28$

$$x = 7\ y$$

but the total number of cells = x, y = 28, and substituting this value of x, viz.: 7 y in the equation, we get

$$7\ y^2 = 28$$

$$y = 2$$

Therefore the number of cells in multiple = 2, and as the total number of cells = 28, ∴ the number in series $\frac{28}{2} = 14$.

---

4. Compare the resistances of a wire 30' long, .06" diameter, and that of another wire 15' long and .03" diameter.

ANSWER.

R	Resistance of one wire.	R_1	Resistance of the other.
l	length of " "	l_1	length " " "
d	diameter of " "	d_1	diam. " " "

$$\text{then } \frac{R}{R_1} = \frac{l d^2}{l_1 d_1^2} = \frac{30 \times .03^2}{15 \times .06^2} = \frac{1}{2}$$

$$R : R_1 :: 1 : 2$$

---

5. 1,000 feet of copper wire .102" diameter is wound on an armature of a bipolar generator. Find (1) the total resistance of that wire, and (2) the resistance as measured at the brushes of the machine. One mil foot = 10.4 ohms.

Ans. In this question the formula is exactly the same as in the preceeding, that is

$$R = \frac{R\ l\ d^2}{R_1\ l_1\ d_1^2} = \frac{10.4 \times 1000 \times 1}{1 \times 102 \times 102}$$

1 ohm.

1 ohm represents the total resistance in 1000' of copper wire, and in an armature of a bipolar generator there would be two wires of 500' long in parallel, i. e., we have a derived circuit, each of the branches having ½ ohm resistance each, which gives us ¼ ohm as the resistance as measured at the brushes.

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6. Take the above question but substitute iron wire. What is the thickness so that the resistance will be the same in each case? The specific resistance of copper to that of iron is as 1 : 6.

Ans. The cross section will be six times that of the copper,

or the diameter $\sqrt{102^2 \times 6}$
250 mills or .25"

---

7. Prove that 746 watts make a horse power. Answer this fully.

Ans.—The unit of power is 10^7 ergs per second = 1 watt.
A horse power = 550 ft. pds. per second.
1 foot = 30.479 centimeters.
1 lb. = 453.6 grams.
∴ 30.379 × 453.6 = 1 ft. pd. = 13825.27 gram. cent.
But a gram = 981 degrees.
∴ 13,825.27 × 981 = 13,562,600 ergs,
generally denoted 1.356 × 10^7 ergs per second,
but a h. p. = 550 ft. pds. per second.
∴ 1.356 × 10^7 × 550 = ergs per second per h. p.
But 10^7 ergs = 1 watt.

$$\therefore \frac{1.356 \times 10^7 \times 550}{10^7} = 746 \text{ watts per h. p.}$$

---

8. 1000 feet of wire No. 6 B and S has a resistance of .4 ohms. Find the watts lost in an arc light circuit 5 miles long. Each lamp takes 10 amperes of current.

Ans.— The total R in the circuit =

$$\frac{5 \times 5280 \times .4}{1000} = 10.56 \text{ ohms}$$

$$C^2 R = 10^2 \times 10.56 = 1056 \text{ watts}$$

---

9. The E M F of a certain dynamo machine is 100 volts, and the total R of the circuit is 1 ohm. What H. P. would have to be expended in working under these conditions.

Ans.—

$$\text{H. P.} = \frac{C^2 R}{746} = \frac{C E}{746} = \frac{E^2}{746}$$

$$\therefore \frac{100^2}{746 \times 1} = 13.4 \text{ h. p.}$$

---

10. Distinguish between work and power. What is the unit of each? What is the British heat unit [772 ft. pounds] equivalent to in electrical units of power?

Ans.—Work is the product of a force and the distance through which it acts. The unit of work is the work done in overcoming unit force through unit distance, i. e., in pushing a body through a distance of 1 centimetre against a force of 1 dyne. It is called the "erg." Since the weight of 1 gram = 981 dynes, the work of raising 1 gram 1 centimetre against gravity would be 981 ergs or 9 ergs. Power is the rate of working, the unit is called the watt = 10^7 ergs per second. If 746 watts = 550 ft. pds., how many watts will 772 ft. pds. be equal to?

550 : 772 : : 746 : 1047 watts, answer.

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11. Describe fully the Edison chemical meter; knowing that 1 ampere passing for 1 hour between zinc plates immersed in a solution of salt of that metal will remove from one plate and deposit 1125 milligrams on the other. What would be the amount of current that would pass in the above meter if the resistance of the German silver shunt was .02 ohms, and the resistance of the other circuit in which the zinc voltameter of 2.5 ohms is inserted in series with another R of 46.46 ohms, if the deposit was 200 milligrams? Make a sketch of the arrangement.

Ans.—The answer to this question is 400 ampere hours. The Edison chemical meter was fully described and illustrated in the paper on "Meters" read before the Canadian Electrical Association by Mr. James Milne, and which appeared in the July issue of the ELECTRICAL NEWS.

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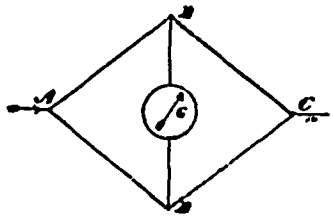
12. Describe the Wheatstone's bridge as fully as you can, and illustrate the application of the instrument by an example.

Ans.—The Wheatstone bridge may be represented by the diagram shown,

and consists essentially of wires arranged in multiple arc. Suppose current enters at A, it then divides, part going through A B C, and part through A D C, dividing itself into parts that shall be to one another inversely as the resistances in the branches. Since the current is going from A to C the point A must be at a higher potential than the point C and therefore there will be a gradual fall of potential along the branches A B C and A D C. It is therefore possible to find various parts along these branches that will be at the same potential. By altering the resistances in the branches it may be so adjusted that the point B is at the same potential as the point D. When this is so the bridge is in a condition for taking the observation. When B and D are at the same potential there is no E M F between these points and consequently no current will flow in the wire connecting them. The attainment of this condition is indicated by no deflection on the galvanometer G that connects B to D.



Let AB=the resistance in the arm AB

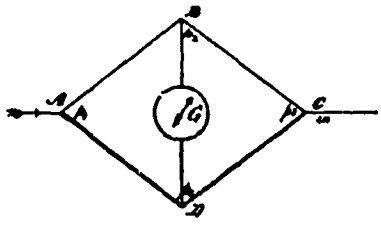
BC=the resistance in the arm BC, and so on.

We have the following simple relation when the above condition has been satisfied:

AB. DC AD. BC, and as the resistances in three of the arms are known it is an easy matter to find the fourth. Suppose DC to be the unknown, then

$$DC \quad \frac{AD.\ BC}{AB}$$

The following is a proof of the principle of the bridge: Suppose the figure represents the instrument when there is no deflection on the galvanometer, i. e., when no current is passing through B and D, and suppose p to represent the potential at B which would also be the potential at D since no current flows in BD, and let p_3 represent the potential at C.



By Ohm's law we have $C = \frac{E}{R}$; but the E M F in AB is the difference of potential between p and p_3 ∴ C in AB $\frac{E}{R} = \frac{p_1 - p_3}{R \text{ of } AB}$ and similarly the current in BC $= \frac{p_2 - p_3}{R \text{ of } BC}$, but the same current must pass through BC as that passed through AB, since none goes through BD.

$$\therefore \quad \frac{p_1 - p_3}{AB} = \frac{p_2 - p_3}{BC} \qquad (1)$$

In the same way the current in AD $= \frac{p_1 - p_2}{AD}$ and it must beequal to

$$\frac{p_2 - p_3}{DC} \text{ that is } \frac{p_1 - p_3}{AD} \quad \frac{p_2 - p_3}{DC} \qquad (2)$$

and if we divide (1) by (2) we get $\frac{AD}{AB} = \frac{DC}{BC}$ ∴ AD. BC = AB. DC.

Numerical example:

AB = 100 ohms BC = 9756 ohms

AD = 10 ohms DC = unknown

$$DC = \frac{10 \times 9756}{100} = 975.6 \text{ ohms.}$$

13. How are very high resistances measured? A galvanometer of 6000 ohms shows a deflection of 10° when a certain resistance is in circuit with it. Knowing that the same galvanometer shows the same deflection with a resistance of 1-10th megohm in circuit when shunted with a 1-99th shunt, find this certain resistance. The resistance of the battery is neglected.

ANS.—As the ordinary bridge is only capable of measuring resistances up to 1,111,100 ohms a different method is adopted for measuring resistances above this, viz: by the galvanometer.

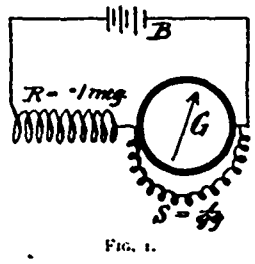


FIG. 1.

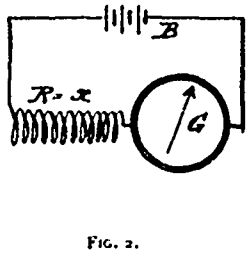


FIG. 2.

Let the first figure indicate the circuit with 1-10th megohm in series with the shunted galvanometer, and the second figure that of the circuit with the unknown resistance in series with the galvanometer without the shunt. By Ohm's law we have

$$C \quad \frac{E}{R} \quad \frac{E}{R + \frac{GS}{G+S} + B} \quad k.\ d_1.\ \frac{G+S}{S}$$

Where $\frac{GS}{G+S}$ Joint R of Galvanometer and Shunt,

B Resistance of Battery,

k a Constant to bring d. $\frac{G+S}{S}$ to Amperes,

d_1 Deflection of Galvanometer,

$\frac{G+S}{S}$ Multiplying Power of the Shunt.

In the second figure we have

$$C' \quad \frac{E}{R_1} \quad \frac{E}{R_1 + G_1 + B_1} \quad k.\ d_2$$

In the first equation we have

$$E \quad \left(R + \frac{GS}{G+S} + B\right) .\ k\ d_1 .\ \frac{G+S}{S}$$

and in the second equation we have

$$E \quad (R_1 + G_1 + B)\ k.\ d_2$$

$$\therefore\ (R_1 + G_1 + B_1)\ k.\ d_2 \quad \left(R + \frac{GS}{G+S} + B\right) .\ k\ d_1 \left(\frac{G+S}{S}\right)$$

Substituting the numbers in the question and omitting the resistance of the battery and cancelling k, we have

$$(R_1 + G_1)\ d_2 \quad \left(R + \frac{GS}{G+S}\right) d .\ \frac{G+S}{S}$$

$$(R_1 + 6000)\ d_2 \quad \left(100000 + \frac{6000 \times 60.6}{6000 + 60.6}\right) d_1 \ \frac{6000 \times 60.6}{60.6}$$

and as $d_1 = d_2$ we get

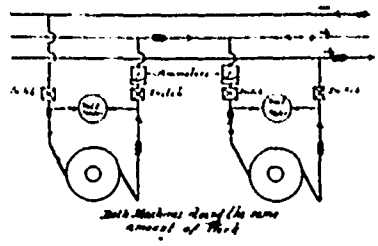
$$R_1 + 6000 = (100000 + 60) .\ 100$$

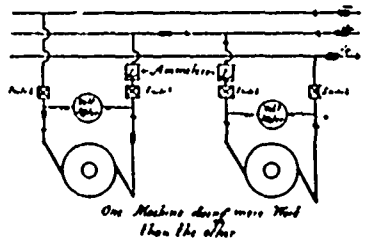
$$R_1 = 10{,}000{,}000.$$

Therefore, the resistance of R or x is 10 megohms.

14. Show by a diagram the general arrangement and connections of generators running on a 3-wire system. Show by an arrow the direction of the currents if (1) both machines are doing exactly the same amount of work; (2) if one machine is doing more than the other. Place in position ampere and voltmeters.

ANSWER.—





15. 880,000 lines of force (N) are to forced through a bar 20 in. long and 8 sq. inches in area. Find the reluctance and the magnetizing force in ampere turns to effect this magnetization. Permeability = 166.

ANS.—Reluctance $= \frac{\text{length}}{\text{area} \times u} = \frac{20}{8 \times 166} \quad \frac{1}{66.4}$

Ampere turns = N × reluctance × .3132

$$= 880000 \times \frac{1}{A.\ u} \times .3132$$

$$= 880000 \times \frac{1}{66.4} \times .3132 = 4150$$

16. In a generator which is driven by a 100 H.P. engine, belt speed 5,000 ft per minute, there are 200 conductors in the armature winding 100 sections in commutator, the gap is 45°. Find the torque and the drag on the active conductors.

ANS.—100 h.p. = 5000′ × torque

$$\text{Torque} = \frac{100 \times 33000}{5000}$$

$$= 660 \text{ lbs.}$$

The active conductors $= \frac{270}{360}$ of 200 = 150 ∴ $\frac{660}{150} = 4.4$ lbs. drag on each conductor.

HEAT IN CYLINDER WALLS.

THERE was made recently at Sibley College an interesting study of the loss of heat from the cylinder walls of an engine during each stroke. The object was to determine the varying temperature of the cylinder head during the stroke. Steam on entering the cylinder warms up the surfaces and a certain amount of heat is stored in the cylinder walls; when the exhaust opens the temperature falls and heat flows from the walls and is lost. To determine this, experiments were made with a 10 h. p. slide-valve engine, cutting off at about half stroke. The plan of investigation was as follows: A wire of small cross-section and high electrical resistance was placed on the inner face of the cylinder head, and connected in multiple with a constant current supply and a delicate galvanometer. As the temperature varies with each cycle of the engine, the electrical resistance of the wire rises and falls with it, the amount of current flowing being altered, and a corresponding deflection being thus obtained in the galvanometer. To preserve a permanent record of these pulsations, the galvanometer was of the mirror type, so that its deflections could be recorded on a sensitive photographic plate.

This galvanometer is of special interest. It consists of a minute needle and mirror, mounted with a short suspension, and surrounded by a coil of fine wire, placed in a powerful magnetic field. This instrument possesses a great sensitiveness, and since its vibrating parts are of such delicate proportions, can be relied upon to give accurate results. The field produced by the coil is at right angles to the permanent field, and the galvanometer being acted upon by these two forces, takes up a resultant position, and follows this resultant with unerring accuracy, regardless of the rapidity of the current changes in the coil.

The high shunt resistance on the engine head consists of 27" of No. 30 iron wire stretched back and forth over a sheet of mica and held in place by heavy mica strips clamped over the ends; the whole being held in place by a frame of fiber-board securely bolted to the head. This construction allows the wire to be well insulated electrically, yet exposed to the live steam.

To obtain a constant current supply, a storage battery of high potential was used, with a large resistance in series, giving a current of about .8 ampere.

As the galvanometer and resistance in the engine head were in multiple with this battery, and the change of resistance due to heating in the head was slight in comparison with the resistance in series with the storage cells, the current remained perfectly constant, and a common error in this method of operation was thus eliminated. An arc lamp, especially constructed for the purpose, furnished the light for the mirror of the galvanometer.

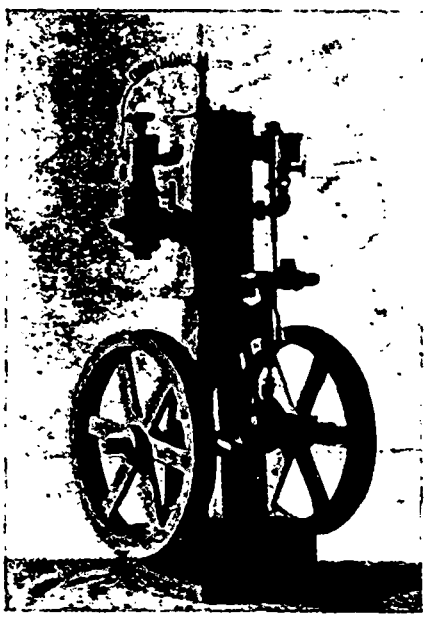
The reflected ray was moved along a slit, behind which a photographic plate was carried up and down by the indicator reducing motion.

The diagram obtained with this heat indicator was almost exactly like the regular indicator diagram in appearance, its lines representing temperatures instead of pressures. The diagrams were taken at various pressures and speeds, and all showed the same characteristics a nearly constant temperature from admission to cut-off, a slight drop beyond this point, a sudden fall at release, and a continual fall on the return stroke until compression occurred, when there was a marked rise in temperature.

Another experiment was also made to determine how deep in the cylinder head the temperature varied. It was found that at a depth of beyond .05 of an inch the temperature of the head did not vary, but remained constant some 30 lower than the temperature of the steam at initial pressure. As the depth was decreased the temperature varied with the steam, and the cards again showed the same resemblance to the first experiments. From this investigation it is evident that the depth of metal affected to cause the phenomena of cylinder condensation is very slight; that the heat cycle in the iron follows the indicator diagram very closely; and that the average temperature at the point where variation ceases is quite near the temperature of the steam.

NEW GASOLINE MOTOR.

THE accompanying illustration shows a gasoline motor of new design built by Mr. Thomas Reid, of Hamilton. The engine has an open base, the charge of gasoline being drawn directly into the cylinder, where it is ignited by an electric spark. It has an impulse at every revolution, but can at will be closed down so as to have an



impulse every second or third revolution, as desired. The engine is built in two styles, vertical and horizontal, the vertical being preferable for boats and the horizontal for carriages or power purposes. One of these motors has been at work in the maker's premises for some months past, and is said to give entire satisfaction. It is the first motor of the kind to be made in Hamilton.

When an injector fails to work, ascertain if the pipe to the boiler is free and clear, for it may have become partially filled with sediment, thus causing all the trouble.

A contemporary prints the following as a simple method of demagnetization: A strong magnet is placed in a horizontal position on a table, for instance and the watch held horizontally about half a yard off on a level with the magnet. The watch must then be brought slowly nearer the magnet, while being turned slowly, and at the same time as regularly as possible, between the fingers, as on a vertical axis. When the poles of the magnets are reached, the turning of the watch is to be continued while being gradually withdrawn until the starting point is reached.

ELECTRIC COAL MINING PLANT.

A most interesting matter in connection with a visit to the underground workings of the new Vancouver Coal Company's mine at Nanaimo, B. C., is the electric plant in operation there. It has been in operation for four years now and has worked smoothly from the first, and given perfect satisfaction. It has quite superseded mule haulage over the underground trunk roads, but for branch roads mules are still employed.

The engine used for generating the electricity is the well-known Erie Ball high speed type, 16-inch cylinder by 16½-inch stroke, automatic cut-off, centre crank, double fly wheel, and is run at a speed of 235 revolutions per minute. Its rated h. p. is 150, although the work is being done with an expenditure of 90 h. p. It is bedded on a foundation of concrete, brick and stone, immediately resting on two large blocks of dressed sandstone, which keep it perfectly firm and rigid.

Two boilers are used for supplying power. External fire, Lancaster pattern, 24 feet in length by 4 feet 6 inches in diameter, and carrying a pressure of 80 lbs., but, should more power be required, are good for 120 lbs. The steam is carried from the boilers to the engine, a distance of 200 feet, in covered pipes and without appreciable loss.

The dynamo is a large one (150 kilowatts), and was made and supplied by the Canadian General Electric Co., of Peterborough, Ontario, Canada. It is run from engine by an endless perforated belt 15 inches in width. The speed at which it is run is 640 revolutions, giving 340 amperes at a pressure of 250 volts. This low pressure, although tending to loss in the mains, gives entire immunity from danger, which is absolutely necessary in a mine where it is almost impossible to keep workmen from coming in contact with the wire. Spare armatures are always kept in reserve, so that there are never any delays for repairs.

The power house, containing engine and dynamo, is a large building 60 by 32 feet, and most complete in detail, having been specifically designed for the purpose. It has capacity enough to contain another plant the size of the present one, and in addition provides a store room and work room for winding armatures, etc., all of the work being done on the premises.

There are five locomotives, all of which were made in Canada, four by the Canadian General Electric Company, of Peterborough, and one by the Royal Electric Company, of Montreal. Four of the motors weigh 8 tons each, and are capable of hauling 40 tons of coal along a level track at the rate of 6 miles per hour. The other locomotive is a small one (4½ tons), and only draws 20 tons at a trip. The distance of road along which coal is hauled is two miles in one level, making four miles for the round trip, and in the other level where the other motor is worked the distance is one mile, or two miles for the complete run. In addition to the locomotives there is a 30 h. p. electric hoist, operating an endless rope on one of the slopes.

The line conveying the current from the surface to the shaft and down to the bottom, a distance of 1,000 feet, is a 0000 copper cable, well covered to protect it from water, and hung on strong insulators. From the bottom of the shaft and extending throughout the mine, the trolley wire is smaller—000 wire—and suspended from the roof or timbers of the gallery by specially made insulated hangers, and held in position over the rail in rounding curves by side wires or pull-offs, which are also insulated. A second or auxiliary wire (insulated) is carried in the levels as a feeder, to which the trolley wire is attached at stated distances.

The plant is fitted up with all the latest contrivances, switches, automatic cut-offs, safety fuses, etc., and in addition to the work mentioned, supplies light for the engine rooms, boilers, pit-head and other buildings on surface, and the whole of the pit-bottom and stables below ground, also all important sidings or partings. Each locomotive is fitted with head lights.

TWO SYSTEMS OF FIRING A WATER TUBE BOILER.

Below is given the results of two systems of firing a water tube boiler, conducted by Mr. George H. Barrus, at the Edison Electric Illuminating Company's power house, Boston. The first test consisted in the common method of spread firing, carrying a bed of coal 6 to 8 inches thick, and on the second trial a brick roof was inserted above the lower row of tubes, covering over half the length of the furnace, the flames passing to the rear end before the gases were discharged into the tube space. A second roof was placed above the upper row of tubes in front of the flame plate. The length of tubes was 8 feet, and the first roof extended backward 4 ft. 6 inches, leaving opening 3 ft. 6 inches. The upper roof extended forward 4 ft. 6 inches. The method of firing on the second trial consisted in the coking system, with 18-inch fire on forward part of grate, and a very thin fire at the extreme rear end. Green coal was fired only on forward part of grate.

The boiler was 325 h. p., constructed with two sets of headers connected by short pieces of pipe; the tubes, 168 in number, were of the ordinary 4-inch size, 18 ft. long, and arranged in two banks, 14 sections wide, with six in each section; two steam drums, 44 in. in diameter; area of heating surface of boiler, 3,737 sq. ft.; area of grate surface, 58.3 sq. ft.

Instead of the coking system showing a more perfect combustion of gases, as expected, the actual result was a loss, the difference being 5.5 per cent.

Data and Results of Evaporative Tests on 325 Horse-Power Babcock & Wilcox Boiler made with New River Semi-Bituminous Coal.

System of firing		Ordinary	Coking, with brick roofs over furnace.
Percentage of moisture in coal	per ct.	2.4	2.1
Date of test	1896	April 19	April 21
TOTAL QUANTITIES.			
1. Duration	hrs.	8.	8.58
2. Weight of dry coal consumed including wood equivalent	lbs.	2,631.	10,638.
3. Weight of ashes and clinkers	lbs.	357.	519
4. Percentage of ashes and clinkers	per cent.	4.1	4.9
5. Weight of water evaporated	lbs.	8,438.	97,484.
HOURLY QUANTITIES.			
6. Coal consumed per hour	lbs.	1,078.9	1,239.8
7. Coal per hour per square foot of grate	lbs.	18.5	21.3
8. Water evaporated per hour	lbs.	10,103.6	10,779
9. Equivalent evaporation per hour, feed 100 degrees, pressure 70 pounds	lbs.	9,052.	10,682.
10. Horse-power developed, A. S. M. E. basis of 30 pounds	H. P.	311.7	356.1
11. Equivalent evaporation per square foot heating surface per hour	lbs.	2.7	2.9
AVERAGES OF OBSERVATIONS ETC.			
12. Average boiler pressure	lbs.	157.7	157.1
13. Average temperature of feed water	deg.	132.1	126.2
14. Average temperature of flue gases	deg.	466.	466.
15. Average draft suction	ins.	.35	.36
16. Weather and outside temperature		Cloudy, Moderate.	Cloudy, Moderate
RESULTS.			
17. Water evaporated per pound of dry coal	lbs.	9.37	9.164
18. Equivalent evaporation per pound of coal from and at 212 degs.	lbs.	10.578	9.894
19. Equivalent evaporation per pound of combustible from and at 212 degs.	lbs.	11.053	10.491

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Influence of the Telegraph.

"THANKS to the telegraph," said Lord Dufferin at the annual banquet of the British Chamber of Commerce of Paris, "the globe itself has become a mere bundle of nerves, and the slightest disturbance at any one point of the system sends a portentous tremor through its morbidly-sensitive surface."

International Electrical Congress.

As we go to press, an International Electrical Congress is in progress at Geneva, under the auspices of the Swiss Society of Electrical Engineers. The prominent electrical societies of Europe and the American Institute of Electrical Engineers are giving their support to the undertaking. The following subjects are set for discussion: "Magnetic Units," Photometric Units," "Transmission and Distribution of Power to Great Distances by Means of Direct and Alternating Currents," "Protection of High-pressure Overhead Electric Lines against Atmospheric Discharges," "Various Disturbances Caused by Electric Traction."

Prices of Incandescent Lamps.

PROBABLY in no department of electrical supplies has competition and the cutting of prices been reduced to so fine a point as in that of incandescent lamps. Prices have eventually got down below the profit line, and as a result the American manufacturers recently held a conference in New York, at which an understanding is said to have been reached which is expected to put a stop to the disastrous under-cutting of the past. Each company is said to have deposited the sum of $5,000 as a guarantee of its willingness to abide by the agreement, and a fine of 10 cents per lamp will, it is said, be imposed for selling below standard rates. Future prices will range from 22 cents for lamps of 8 to 25 c.p., to $1.65 for

lamps of 150 c.p. in broken lots, and in standard packages from 20 cents to $1.50. The management is said to have been vested in a committee. Some of the companies interested deny that such an organization has been effected.

The Duty on Steel Rails.

THE Privy Council has just handed down its judgment in the case of the appeal of the Toronto Railway Company for recovery of upwards of $50,000 which the company were compelled by the Dominion Government to pay as customs duty on steel rails imported for use in the reconstruction of their system. The Exchequer and Supreme Courts of Canada upheld the interpretation put upon the tariff by the Minister of Customs, but the Privy Council has come to a contrary conclusion and has decided in favor of the plaintiffs' contention that steel rails for street railway purposes are entitled to free admission in the same manner as steel rails for use on steam railways. This is undoubtedly the common-sense view of the matter. The Toronto Railway Company deserve the thanks, if nothing more, of every electric railway company in the Dominion, for having fought the matter through and secured from the highest tribunal in the Empire this favorable decision which cannot be reversed.

The Kelvin Celebration.

SCIENTIFIC men from all parts of the world assembled in Glasgow the latter part of June to participate in the celebration of the 50th anniversary of Lord Kelvin's occupancy of the chair of Natural Philosophy in the University of Glasgow. During half a century Lord Kelvin has been an indefatigable investigator of the laws governing electricity and the methods of applying the same for the benefit of mankind. He is the author of many devices, notably measuring apparatus, which are the recognized standards in use throughout the world at the present time. He received the honor of knighthood for valuable services rendered in 1858 in overcoming difficulties incident to the successful operation of the first Atlantic cable, and was elected to the peerage in 1891. The celebration included a conversazione by the University of Glasgow, at which were exhibited Lord Kelvin's inventions; addresses by home and foreign university bodies, learned societies and students of Glasgow and other universities, and a public banquet by the corporation of Glasgow.

Municipal Lighting

PUBLIC lighting in England is largely in the hands of the municipalities. The extent to which this is the case is indicated by the fact that a Municipal Electrical Association has been formed, which has just held its first convention. In Canada not more than half a dozen municipalities *own and operate their own lighting plants. The citizens* of the town of Goderich have lately voted in favor of the purchase of a municipal plant, and the town of Newmarket has the subject under consideration at the present time. It is difficult to determine from a few such isolated cases whether or not the municipal control idea is likely to grow to important dimensions, as it has done in England. Should it do so, the sales agents of the electrical manufacturing and supply companies will require to be trained in the ways of the politician, so as to be able to secure the votes of the councilmen or aldermen in favor of their particular apparatus. The man who can "pull the wires" (no pun intended) most skillfully will probably secure the orders, regardless to a large extent of the superiority or inferiority of his goods. This method of selling goods promises to occupy a great deal more time and to cost more money than the selling to private individuals or companies, as at present.

Disturbance of Telegraph and Telephone Circuits.

THE German Imperial post-office has compiled statistics which show a steady increase in the number of disturbances to telegraph and telephone circuits as the result of the multiplication of electric railways. In our last issue we published the decision of the courts in an action brought against the Montreal Street Railway Company by the Bell Telephone Co., for injury sustained as the result of disturbance of their circuits from the action of induction currents emanating from the street railway company's wires. The decision was adverse to the plaintiffs. Our readers will be interested in knowing the method employed by the German authorities to protect the telegraph instruments from high pressure currents. For this purpose fuses are put into the circuits. These fuses consist of a wire 0.07 mm. in diameter, and made of a non-oxidisable alloy. They are enclosed in glass tubes 5cm. to 6cm. long, sealed at both ends, and fitted with metal contact pieces. In this way the formation of an arc at 500 volts pressure is avoided. The fusing current of the wire is 0.8 amperes. The whole fuse is kept in position between contact springs, and is easily interchangeable. Another type of fuse used by the Imperial post-office consists of a porcelain block about 5cm. high, the fuse wire running through a hole across the block. Both types have given satisfaction.

Acetylene Gas.

THE possibility of acetylene gas becoming a competitor of electricity as an illuminant, has greatly disturbed the minds of a considerable portion of the electric lighting fraternity. There is no room for doubting that the illuminating power of the gas is very greatly superior to that of ordinary gas; and that if it were merely a question of light it might perhaps become a very formidable rival to electricity. But the question of cost comes very prominently into consideration and here it is that we meet the strongest argument against it. It is not merely the cost of the carbide itself that must be taken into account, but that of all the accessory devices, the secondary receiver, the pipes, fixtures, etc. As to the cost of manufacture of the carbide, there are so many conflicting estimates, statements, and claims, that we consider ourselves amply justified in taking up a very conservative position, and saying that there will have to be a very considerable degree of higher mutual corroboration and unanimity among writers on the subject before the public can be expected even to form an *opinion* on the subject, much less to make any investments. One writer of undoubted scientific qualifications says, "Present average cost of illuminating gas in the holders of the large gas companies approximates 30 cents per M, while the cost of acetylene gas in the holder, with calcium carbide at $37.60 per ton, would be equivalent light for light, to illuminating gas at 37 7 10 cents per M, making the cost of pure acetylene per candle power approximately 20 per cent. higher than that of ordinary illuminating gas." If acetylene were mixed with air, no doubt the cost would be lower, but the advisability of distributing the mixture through

a city would be very questionable, owing to the risk of the mixing being improperly done, and the quantity of acetylene falling to such a percentage as to form an explosive combination. Any person using the gas in their houses would require a duplicate holder, so that one might be charging while the second was running. As the gas in holders would be at a pressure of over 600 lbs. to the square inch, a valve would be required to reduce it down to that required at the burners. No doubt such a valve is obtainable but would require attention which the average householder would not or could not give. A failure of the valve would entail the escape of the gas. It would appear that considerations of cost and convenience go to shew that, at the present at least, the incandescent lamp has nothing to fear from acetylene gas, which may find its way into the residence of an occasional wealthy householder, but not into general use.

Antiquated vs Modern Apparatus.

We would bespeak a most careful study of the very valuable paper presented by Mr. Gossler before the last meeting of the Canadian Electrical Association. A very large number of our readers are personally and financially interested in electric lighting stations; and as a great proportion of these stations date from the time when electrical machinery had not received the careful study that is now devoted to it, it is only reasonable to suppose that the apparatus used is of the very inefficient types that characterized the early days of electric lighting. Transformers have only of very late years received much consideration, but the study of the conditions under which they operate, and the principles involved, has led to very great and beneficial changes being made in their construction. The saving effected by the changes indicated by Mr. Gossler, resulted from the substitution of modern high-class transformers for the old type ones previously in use; and nothing can more vividly illustrate the difference in value between old type cheap goods and new type expensive ones than the fact, as stated by him, that the annual savings effected by the new transformers will pay for their cost in about 2½ years. In smaller electric lighting plants nothing is more usual than to make selection of machinery and apparatus on the basis of cost solely, i. e., they choose that one that costs the least money. This is really the most expensive policy to adopt, and as the knowledge of electrical investors extends, with respect to the machinery they operate, and what goes on while current is flowing, it will become more and more evident to them that to buy modern, superior, and therefore high-priced machinery, gives a far better investment than cheap stuff. One frequently meets men whose knowledge of electricity is so comprehensive that they know it all. These persons will of course never learn anything, but the earnest electrical student every day becomes more convinced of the fact that the more he studies, the less he finds he knows. The influence that transformers can exert on the profits of an electric plant is so appreciable that we recommend all owners to very carefully examine into the efficiency of that part of their installations.

A writer in Electricity of London, with fluent inaccuracy, says the Western Electrician, notes that the new president of the "National Electrical Association" is "Mr. Frederick, who is an Englishman. Doubtless the intention was to convey the idea that Frederic Nicholls, lately elected to the presidency of the National Electric Light Association, was born in England.

NOTES FOR ENGINEERS.

To pack piston pumps for kerosene, cup leather, such as is used in packing hydraulic pumps will be necessary.

Have a regular system for doing your work in the engine and boiler rooms and have a time and place for everything.

Long grate bars make hard work for the fireman, and he cannot always keep the back grate of the furnace in good order. A short wide furnace is the best.

When using the ordinary brass check valves, it is a good idea to use one size larger than the pipe calls for, as the water will then flow through them with less friction.

After taking a ground joint apart clean it well, and before putting it together *again, oil it thoroughly and if it is to be exposed* to heat use cylinder oil for this purpose.

When piping up a plant, use angle valves wherever convenient, as you will then have less joints to make up, and angle valves offer less obstruction to the passage of steam than globe valves.

For removing scale from boilers, or rust from any metal, use kerosene oil. To loosen a nut which is rusted to a bolt, saturate with kerosene. It is simple, but by all odds the most effective rust or scale resolvent.

There are two methods of obtaining the heat value of coal; one by burning a representative sample in some kind of oxygen calorimeter, and the other is to analyse the coal and equate the elements with their heat values. The oxygen calorimeter is generally preferred, but some engineers prefer the analysis.

One pound of good coal is equal to about four-tenths of a pound of wood without regard to the quality of the latter. Some woods contain more water and sap than others, some are dense while others are porous, but considering the pure wood fibre, all woods are practically the same so far as their value for fuel is concerned.

If you are using a power pump for feeding your boiler and there is no way to regulate the amount of water delivered, connect a ¾ inch pipe into the discharge pipe and also into the suction pipe, with a valve to regulate the circulating water. By opening this valve the amount of water delivered to the boiler may be diminished, and so a uniform water level maintained.

If the safety valve leaks and grinding it in affords only temporary relief it may be caused by impurities in the water causing a thin scale to form on the valve and seat, and after the valve has been opened once it leaks until ground in again. I have known soda ash, used as a boiler cleanser, to do this, but when its use was discontinued and oil used instead, the trouble disappeared.

On taking charge of a steam plant the engineer should at once acquaint himself with the peculiarities of the engine, and next should acquaint himself with the peculiarities of the proprietor or superintendent. One is just as essential as the other, for each will need an equal amount of "managing" if the engineer is to make an unqualified success of running the plant. Some good engineers make a mistake here and fail accordingly.

If your injector has been in use for several years and is not as reliable now as it was when new, do not throw it away, calling it worn out, until you have carefully cleaned it with a solution of muriatic acid and water. Disconnect the injector, put corks in the outlets, and *fill it up with the solution, letting it stand over* night. Wash out in the morning with water under pressure, and see if it is not as good as new. The solution should not be stronger than about two parts of water to one of the acid.

In case of accident in your boiler room, where prompt reduction of the temperature under the boiler is necessary, too great care cannot be exercised by your fireman. As a rule he will proceed at once to "draw the fire," but if the boiler is in a critical state, such an act is certainly not wise. When a fire is disturbed, the heat which it gives out is materially increased for several minutes, and unless the entire body of the fire can be removed at one stroke, the safest plan is to smother with damp ashes or fresh coal.

Many a leaky piston or valve rod which is chronically so, could be cured by *turning the piston so that the worn place at the* bottom would come at the top, or by putting a liner at the bottom to carry the piston at a higher level. Sometimes the bottom part of a piston has been drilled, and the holes filled with hard Babbitt to raise the piston up into line. Sprung rings of cast iron or brass cannot be depended on to centre a piston or keep it in line, because of the wear. Babbitt plugs will serve such a purpose, and they can be renewed when occasion requires. This is an easier and cheaper way than having a new piston made

ASBESTOS.

THERE is probably no production of inorganic nature about which there is so much popular mystery and misconception as asbestos. It is vaguely understood that the principal claim of this remarkable product to attention is that it cannot be consumed by fire, and not infrequently the effect of the mention of asbestos is to carry the hearer back to the days when the people of the Pharaohs wrapped their dead in cere-cloths, woven from fibre, in order to preserve them, the body having been first embalmed. Romantic stories have also come down to us of ancient demonstrations of magic in which asbestos has played the leading part, but the real interest in asbestos centres in the present. It is of more importance to the human race to-day than it has been in the whole range of history. Asbestos twenty-five years ago was practically not known in the laboratory of the chemist or mineralogist. It now finds its way in one form or another into every workshop where steam is employed.

To the question, "What is asbestos?" it is not altogether easy to find an answer. Geologists classify it among the hornblends. In itself, asbestos is a physical paradox, a mineralogical vegetable, both fibrous and crystalline, elastic yet brittle, a floating stone, but as capable of being carded, spun and woven as flax, cotton or silk. It is apparently a connecting link between the vegetable and the mineral kingdom, possessing some of the characteristics of both. In appearance it is light, buoyant and feathery as thistledown; yet, in its crude state, it is dense and heavy as the solid rock in which it is found. Apparently as perishable as grass, it is yet older than any order of animal or vegetable life on earth. The dissolving influences of time seem to have no effect upon it. The action of unnumbered centuries, by which the hardest rocks known to geologists are worn away, has left no perceptible imprint on the asbestos found embedded in them. While much of its bulk is of the roughest and most gritty materials known, it is really as smooth to the touch as soap or oil. Seemingly as combustible as tow, the fiercest heat cannot consume it, and no known combination of acids will destructively affect the appearance and strength of its fibre, even after days of its action. It is, in fact, practically indestructible. Its incombustible nature renders it a complete protection from flames, but beyond this most valuable quality, its industrial value is greatly augmented by its non-conduction of heat and electricity, as well as by its important propriety of practical insolubility in acids.

Asbestos has been found in all quarters of the globe. It comes from Italy, China, Japan, Australia, Spain, Portugal, Hungary, Germany, Russia, The Cape, Central Africa, Canada (Fig. 1), Newfoundland, this country, and from Southern and Central America.

Notwithstanding this wide distribution of asbestos, the only varieties which at present appear to demand serious consideration, from a commercial point of view, are the Russian, the South African, the Italian and the Canadian.

Before the development of the Canadian fields, the Italian

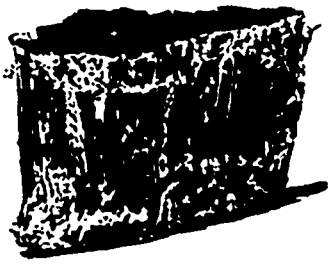

FIG. 1.—CANADIAN ASBESTOS.

asbestos was supreme in the market. For nearly twenty years Italy has been looked to for the best grades of the fibre. From a point on the northern mountain slope of the Susa valley is taken the floss asbestos fibre, the appearance of which in gas stoves is so familiar. In the same locality is found a fine white powder of asbestos, which serves for paint and other purposes. The mining is carried on at a height of from 6,000 to 10,000 feet above sea level.

But the Italian asbestos industry, once so important, is already on the down grade. The difficulties of mining are very great, and unduly increase the cost of production. The asbestos itself, judged by the latest standards, is of inferior quality; it is not easy to spin, and it does not pulp well in the making of paper. The best grade is extremely rare, and its cost of mining and transportation is prohibitive. The supply from the Italian mines is rapidly falling off. As a matter of fact, Canada contains the great asbestos region of the world, in the sense that while its mines are practically unlimited in productive capacity, the product is of a quality which fully meets the requirements of the newest and most exacting of the innumerable uses that are daily being found for it.

The process of manufacture is intensely interesting, more especially from the fact that as the industry is constantly entering upon novel phases, new methods of treatment and special machinery have to be devised. One of its special uses is for wall paper.

One of the largest branches of asbestos manufacture is that of sectional cylinders for pipe coverings, for retaining the heat of steam and other pipes, felt protective coverings for boilers, frost-

FIG. 2.—ASBESTOS MINING.

proof protections for gas or water pipes, and cement filling, which can be laid on with a trowel, for the covering of steam pipes, boilers or sills. In some of these cases, where it is only necessary to retain the heat, the asbestos is mixed with other substances; but where the protection must be fireproof as well, only asbestos is used. The utility of such covering is well illustrated in the heating system of railway cars. The main pipe from which the individual cars draw their respective heat supplies by side mains, if not covered with asbestos, would lose a large proportion of its caloric from the rapid motion of the car through the air. An interesting innovation in this class of manufacture is asbestos sponge. It is not generally known that sponge has great powers of fire resistance. The discovery was made accidentally not long ago, and the result was that a consignment of scraps of sponge picked up on the Southern coasts was ordered for experimental purposes. The sponge was finely comminuted and mixed intimately with asbestos fibre. The combination was found so successful for any covering which had to be fireproof as well as heat-proof that the material has become standard. Being full of air cells, it necessarily makes an excellent non-conductor. Another very extensive department in asbestos manufacture is that of packings. Of these there are an infinite number of forms. In these days of high pressures and ocean records, it is of supreme importance to marine engineers that they should have jointing and packing materials on which absolute reliance can be placed. In order to meet modern exigencies every possible form of packing has been constructed, particularly with asbestos and metallic wire, and with asbestos and rubber cores for gland packing. The making of asbestos paper varies from the building up of the thickest millboard to the production of a writing paper which, from its indestructibility, is valuable in case of fire for preserving charters, policies, agreements and other important documents.

To the electrical engineer asbestos is absolutely indispensable. Many parts of electrical devices and machinery and wires through which the electrical current passes become heated, and were it not for the electrical insulation and heat-resisting qualities which asbestos possesses, the apparatus would be completely destroyed, particularly in the case known to electricians as "short circuiting." For such purpose it has been found advisable to combine asbestos with rubber and other gums, and this combination is now

used universally for not only electrical, but also steam and mechanical purposes.

The newest departure in the asbestos field is the construction of electrothermic apparatus. The heating effect of the electric current is utilized by embedding the wire in an asbestos sheet or pad. The pad is used by physicians and nurses for maintaining artificial heat in local applications, and is said to be already largely used in hospitals. Another application of the same principle is to car heaters. A sheet of asbestos, with the embedded wires, is clamped between two thin steel plates, and the portable heater thus provided, or a series if need be, is connected to the car circuit quickly and easily. It gives an even and healthy heat, and can be so regulated as not to overheat the car.—George Heli Guy, in New York Evening Post.

THE TELEPHONE IN RAILROAD PRACTICE.*

THE growing use of the telephone in railroad work and its present advantages and future possibilities is a subject well worthy of consideration and study.

The telephone equipment at local points best adapted to the transmission of the internal business of a railroad, depends upon the location and the degree of concentration of the offices at each point. The value of a private telephone line connecting intermediate points and the division headquarters along the line of the road is dependant to a large extent upon the number of instruments that are enabled to secure intercommunication thereby.

In connection with the speaking tube or internal telephone system, special efforts are being made by the local telephone companies to offer the railroad companies instruments and apparatus that vary with the character of the service desired. For instance:

System A—A central switch with lines radiating from it, each line having one or more stations connected with it, the whole being arranged for intercommunication.

This system is operated in much the same manner as an ordinary telephone exchange, a switch being located at some central point, provided with a means for calling and receiving calls from each station, and for connecting the several stations with each other. The switch may be located where it can be operated by some person in connection with other work, or if the system is large, the services of a regular operator may be required.

This system (if but one station is connected on each radiating line) secures secrecy between any two stations and provides for independent communication between a number of stations at the same time.

System B—A switch at a particular office with lines radiating from it, each line having one or more stations connected with it, the whole being arranged for communication to and from this particular office, but not for communication between stations on different lines.

This system is used for transacting business between a particular office and several stations in cases where it is not required that the stations communicate with each other. A switch is provided at the main office only.

This system (if but one station is connected on each radiating line) secures secrecy between the main office and any one of the stations.

System C—A switch at each station, with means for connecting the instrument at such station with lines extending to each of the other stations.

This system is so arranged that a person at any station can call any other station over a special line and establish the desired connection without the aid of an operator. It does not secure secrecy to such a degree as systems "A" or "B." A switch being located at each station, access may be had to all circuits whether in use or not, but as the bell at the desired station is the only one operated when a call is made, secrecy is fairly assured, and interruptions are not likely to occur unless the use of the same circuit should be desired by a second party and his instrument be connected for the purpose of making a call. It is possible for parties at several stations to converse independently with each other at the same time.

System D—A single circuit connecting two or more stations.

All instruments being connected upon one circuit, no switching apparatus is required. Only two stations can use the line at one time and there can be no secrecy, as a call made from any station will ring all bells simultaneously.

Systems "A" and "B" are especially adopted and serviceable for freight offices and yards, round houses, switching towers, etc.

System "C" is perhaps the most convenient and satisfactory when the stations to be connected are not numerous.

System "D" is the most simple and inexpensive.

An outgrowth from system "A" is the present private branch telephone exchange. The benefits derived from the establishment and operation of private branch exchanges seem comparatively unknown, and especially so to those who have not been closely in touch with the growth of this particular line of the business, and it is with a view of arousing interest in this direction, as well as securing additional information through the discussion which I trust will follow this paper, that I have endeavored to collect as much reliable information as possible bearing upon the subject. This very lack of familiarity with the branch exchange frequently results in a much less efficient service from a given number of telephone lines than would be secured were they merged into the so-called exchange.

"In the march of civilization the improvements of yesterday are discarded for those of to-day. The tin speaking tube once used for interior communication gives way to the telephone. In this age when only time saving is considered more important than labor saving, and the combination of both is the prime object with all active minds, the importance of rapid and reliable communication can not be over-estimated. Especially true is this of the business conducted in a large building where the labor and delay incidental to employing messengers or office boys, make an important item of expense. In the general offices of a large railroad company, where every office can be connected one with another, and the various working departments be brought into talking relations with one another, this telephone service is a time, money and labor saver; and where the heads of departments are separated from each other by doors, stairs and passages it is invaluable."

Every railroad man is familiar with the general scheme of railroad organization, and the relationship between the various departments, their chiefs, etc. The lines of authority are closely drawn, and the flow of communication naturally follows these divisional lines.

As the division of responsibility among the several officials and employees who carry on the operation of the railroad company is plainly defined, so the use of the telephone tends to parallel those divisions of responsibility and to follow the lines which separate the duties which are to be performed.

In the application of the telephone to the transaction of internal business at local points and within a certain radius of the office building or about the yards and switching centers, the numerous communications necessary are passed to and fro easily and without loss of time.

The tendency is towards the constant growth of private branch exchanges, as they give more perfect interchange of communication for every class of business, concentrate the service within certain limits and enable the business to be transmitted direct without going through the medium of the local telephone operator, and vary the class and extent of the service desired according to the price paid.

The benefits to be derived from the operation of the private branch exchange have been recognized to a greater extent in the city of Chicago than elsewhere in the country. As a matter of fact there are at present in that city over 130 private branch exchanges, operating an aggregate of over 1,200 telephone instruments. These exchanges are operated by railroad and express companies, large wholesale and retail establishments, manufacturers, etc., and range in extent from four to 100 instruments. They are connected by means of trunk lines with the local telephone company's exchange, so that connection may be had with the public.

In a great many cases a particular telephone, while greatly needed for the handling of railroad business, has no occasion for public connection. If arranged so that they can secure such connection, the result is that the telephone will be used more or less for private ends; consequently, when the public trunk lines are required for legitimate railroad business, they will be reported "busy," while as a matter of fact, they are being used for private business.

To obviate this evil and to furnish as nearly as possible what is absolutely required, the local telephone company has recently adopted a scheme whereby it is made impossible to give certain offices public connection, although they are able to secure unrestricted intercommunication with every line radiating from

* Paper read before the Association of Railway Telegraph Superintendents, Fortress Monroe, Va., June 17, by W. W. Ryder, Chicago.

the branch exchange. In giving this limited service, the telephone company charges considerably lessened rental, although securing for the subscriber a more efficient service by not allowing the unnecessary blocking of his down-town trunk wires. This difference in expense together with the difference in price between public and branch exchange lines is almost, if not quite, sufficient to pay the salary of the telephone operator even though you have only a small number of lines, and this naturally increases with the greater extent of the system.

The success of the system can best be indicated by the statement that of all the branch exchanges put in operation in the city of Chicago, only one has ever been taken out through dissatisfaction with the system, and in this case it was only a short time before the telephone company was requested to immediately replace, the firm finding that the inconvenience and loss of time were greatly increased when the exchange was closed.

The growth of the private branch exchange system must soon extend along the lines of the individual roads; in fact, at present the Pennsylvania Railroad Company has in operation a very complete system which gives them direct connection over wires entirely controlled by them between all division headquarters on their road east of Pittsburgh. Through the courtesy of that company I am permitted to exhibit a diagram of this system. They have branch exchanges at all division headquarters and have leased from the Long Distance company necessary wires to complete connections with these points. Other large eastern lines, I understand, are now contemplating the a option of this same scheme.

With the growth of the private exchange idea, these exchanges will rapidly multiply in large cities and the necessity for means of intercommunication between them without going through the public exchange will become imperative; in fact, in the city of Chicago, at present, where branch exchanges are being operated by the Chicago & Northern Pacific, Chicago, Rock Island & Pacific, Chicago, Milwaukee & St. Paul, Chicago & Eastern Illinois, Illinois Central, Chicago & Northwestern and Chicago, Burlington & Quincy Railroad companies this necessity is very noticeable, and the local telephone company is considering the question of trunking the different exchanges together. With this accomplished, it is but a step to the connection of the branch exchanges in one city with those in another over wires controlled by the railroad companies. How this can best be done can only be decided by trial, and I believe we will have to meet this particular issue at a very early date.

When we consider the rapid growth of the telephone system, it seems a question of only a short time before the telegraph will be largely superseded by the telephone. It has been shown in actual practice in commercial service that messages of 30 words can be read and intelligently transmitted in a quarter of a minute, or 120 words per minute, which is about 3,900 better per hour than the average by Morse, using the Phillips code and the typewriter. The above record is taken from a guaranteed service where the toll service is daily performed on this basis.

The question of the telephone not being able to compete with the telegraph on account of the lack of records was happily answered, you will recollect, by Superintendent Selden in a paper read before this association at the 1894 meeting, and this feeling, I believe, is rapidly passing away.

The despatching of trains by telephone has been tried with perfect success in several instances in this country. This is the most exacting of service, and the fact that it is a success speaks volumes for its efficiency.

It is a well known fact that large corporations are slow in adopting radical changes, but the improvements in telephone apparatus are so marked and the benefits derived from its use so evident, that they are being forced to recognize its merit and consequently are rapidly advancing the movement.

One-half a square inch of piston area per horse power is a common rating for steam engines.

If the girth seams of a tubular boiler leak and chipping and caulking do not stop it, be sure there are no cracks in the plate, or that defective rivets are not the cause of it. If the boiler is sound, the trouble may be caused by unequal contraction of the plates due to the introduction of comparatively cool feed water into the bottom of the boiler. If the location of the feed pipe is changed the leakage may cease without further attention. The water should be discharged into the body of the water already in the boiler, and not on the bottom sheets.

ELECTRIC LIGHT INSPECTION.

THE divisional inspector of electric light, Mr. Wm. Johnson, of Belleville, was here several days last week, during which time he has inspected all the electric light meters and also has been looking into the voltage or pressure carried by the company. It will be remembered that the Government fitted up apparatus in the post office building, but to suit the convenience of the Light, Heat and Power Co., the inspection is now done at the premises on William street. Mr. Johnson was not stinted in his praise of the test board and other appliances supplied by the ingenuity of Mr. H. E. Reesor, who, Mr. Johnson says, in the fitting up of these, has shown his ability as an electrical engineer. It has proved fortunate for the users of electric light meters that they have been brought under Government inspection, if they are everywhere as they are here. It must be understood that the company here accepted the meters from the manufacturers as correct and had their guarantee that they were; but, when tested by the Government standards, the majority of them have been found to be too fast, or, in other words, against the consumers. One meter only was found too slow and it was sixteen per cent. that way, while many of them were from seven to nineteen per cent. fast. All the meters in town have now been adjusted or regulated in the inspector's presence and have been sealed by him. The inspector explained to us that the Electric Light Inspection Act requires each company to state to all its customers the rate of voltage at which it will supply the electricity; the company here proposes to do this at a voltage of 104, but the inspector found that the company was furnishing it at from 109 to 112 volts and informed the company that it was liable to a penalty for increasing or diminishing the voltage beyond or under three per cent. of 104 volts. The reason for this provision of the law is that if the voltage is greater than the amount specified it destroys the lamps, or if less than it should be the light is diminished. A number of our citizens visited the Light, Heat and Power Company's office while the inspector was here, and had explained to them the interior of that mystical looking object an electric light meter, also how the meters were tested, and the meaning of some of the technical terms used by the electric light fraternity. Canadian Post, Lindsay, Ont.

The inspection by the Government of all the electric light meters in town was concluded this morning, nearly one hundred and fifty having had the red seal attached to them. The Government regulations give the electric light companies until the first of next June to have all their meters tested, after which it will be unlawful for them to use any other. A penalty of $25 is to be inflicted after that date on any company or person who uses a meter which has not been inspected and stamped.

The Peterborough Light and Power Co. has done a popular thing in having its meters tested at once, and in this way again has given evidence of how well it keeps its finger on the public pulse, and have met the universal clamor for inspected meters.

The inspector, Mr. Wm. Johnston, informs the REVIEW that of the hundred and fifty meters tested, about a dozen were incorrect, six were 5 p. c., a couple 8 p. c., and two 12 p. c. too fast, or in favor of the company, while one, where the customer uses ten lights, had not registered but a small percentage of the energy, owing to part of the gearing having got wrong, the customer's bill for last quarter having been only $1.80. These cases, however, prove the value of the inspection. By a strange "irony of fate" the two meters that were twelve per cent. too quick were in the residences of two of the officers of the company.

Mr. Johnston also says that the work of inspection, which it was first intended should be done at the gas inspector's office in the Custom House, was accomplished much more quickly at the offices of the Light and Power Company where through the ingenuity of Mr. Fisk, the company's clever electrician, facilities were provided.—The Daily Review, Peterborough, Ont.

If the guides on an engine are made separate from the frame, they may be taken off and planed when they need it, but if they are cast with the frame this cannot be done.

For lubricating pump rods, a very good mixture is made from tallow, cylinder oil and plumbago; and if the water is warm, it is better to add a little beeswax. This, mixed with the fibers of the rod packing, will greatly improve the ease of running and will keep the rod in good condition; and, in fact, this and good waste may be used to replace expensive packing if the waste is properly laid up.

WIRE INSULATION.

By H. W. Nelson.

The insulation of wire for electrical purposes has grown into a large and important industry in this country during the past ten years. For the lack of the right kind of commercial and scientific attention it has grown up very badly in certain lines, viz., those relative to lighting and transmission of power, which are the lines covering by far the larger part of the business.

On the other hand, the manufacture of telegraph and telephone wires, notably the telegraph, has been brought up to a splendid state of efficiency, both commercially and scientifically. The reason is not far to seek, when we consider that such men as Lord Kelvin, Edison, etc., have not thought the minutiae of this branch too small to engross their colossal minds, and that the manufacturers have co-operated with them to turn out a good commercial article. In lighting and power transmission work, attention to the fine details of wire insulating has been positively shirked by the technical men, they having left their part to crude, untrained minds. A glance at the patents list, with its hundreds of ridiculous, foolish specifications for insulating wire, presents evidence of uneducated dabbling.

In conjunction with this neglect of the engineer there has been an almost entire absence of co-operation of the business man with the technical.

As a consequence of the striving of the one for cheap wire and the other for high quality, and no attention to the intervening details, the market has run into two channels: On the one hand a cheap and very poor insulation, and on the other, a high quality and very high price. There are a few grades between, of insignificant amounts, which do not affect the argument.

A friendly association on the part of these men, with a little more regard to the importance of the details involved, would in all probability have made a market for a fair-priced medium wire. For an instance, a wire is needed for interior and hidden work, to go on a 52-volt circuit alternating current from a 1,000-volt main line, or on a 125-volt circuit direct, constant current. For this a wire is demanded having an insulation resistance of from 800 to 1200 megohms per mile, and unless the engineer and underwriters are hoodwinked, a high-priced rubber-covered wire is put in which is capable of withstanding without rupture the shock of from 5,000 to 10,000 volts alternating. This appears an excessively large factor for safety, but with their present knowledge those on whom the responsibility lies cannot accept anything less costly, and take the risk of perhaps an early breakdown of their insulation. They have a general knowledge that an insulation compound made up with a large percentage of pure rubber will resist water and not be short-lived, and that a more attenuated compound, or another compound, may be good or rubbish. They cannot tell without the test of time, and not being familiar with its manufacture, they will not accept risks on another's ipse dixit. They therefore must stick to an extra superfine where an ordinary wire would do.

This ordinary wire, by which is meant a fair insulation resistance sufficiently long-lived, at a medium price, would undoubtedly be forthcoming if the market demanded it. In this regard, however, when the engineer does not demand anything more than an insulated wire, the purchasing agent has an opportunity to get something cheap, and the lowest tender gets the contract. This is the place where very poor stuff masquerades as electrically-insulated wire. One very prominent kind, which is literally a whited sepulchre, is a wire covered with a braid or wrap of cotton, or other fibrous material, very hygroscopic, which is saturated with pitch, or some much vaunted insulating paint, to render it non-hygroscopic, which it does not; the whole then receives a plaster of whiting and fish-glue, or similar compound, to render it fire-proof, which it does not.

Then again, where the high cost wire is put in, the ends on the cut-outs, rosettes, etc., are often left bare or worse by being insulated with sticking tape, made of cotton (hygroscopic) and poor rubber compound which quickly oxidises, and against such weak spots a wire having an insulating resistance of 200 megohms per mile should be more than ample. In addition to this the flexible drop cords to the lamps have simply been called for in specifications as rubber-covered lamp cord, and the purchasing agent buys the cheapest article which can legally be labelled "rubber-covered." If a drop of salt water be dropped on this cord when the circuit is closed its quality will probably show up in a very bright way.

The insulation called "weatherproof," which is not weatherproof, however, serves the purpose for which it is generally used very well. It is generally used as a line wire on currents at a low voltage, and providing that the pole insulators are good, it simply serves as a separator, preventing a dead short circuit if stray wires of low voltage touch it. In choosing this wire, if the choice were made more with regard to its usefulness and life, and not so much to the highly polished surface, a saving in renewals might be effected without an extra first outlay, in that the money saved by foregoing the extra work in fancy finishing could be put into the material, by having a heavier, stronger covering.

It must be remembered that this covering only acts as a separator, that it soaks up water almost as a sponge, and that the end to be gained is that the covering required be strong enough to resist the rough usage it gets from the kerb-stones, posts, trees, road-gravel, etc., when the linemen are stringing it, and from the sun and rain afterwards. To this end it is necessary to put on two or more strong jute or cotton braids, and to saturate them with a compound which will stick the braids to the wire and preserve them from rotting. There can be very little of the polish left when the wire is stretched on the poles after this handling.

The above somewhat short and imperfect remarks, if they succeed in calling attention to a very backward branch of electrical work, may suggest many ideas for improvement.

(1). It may be suggested that some of our prominent consulting engineers (men above financial interest in any particular manufacture) make a special study of this subject, in order to have more than a mere general knowledge of it.

(2). That the leading fire insurance companies together engage a man thoroughly experienced in wire insulating as a permanent inspector of insulations. (N. B. They already do something abortive in this direction.) That they fit him up with a laboratory, and have a sample of all wires tested and put on record before they are allowed to be strung, or

(3). That the government appoint this official and

(4). That a law be passed making it a misdemeanor for anyone to string wires a sample of which has not been officially accepted by the inspector.

(5). That our colleges give some open lectures on the chemistry, etc., of caoutchouc, resins, cotton, silk, waxes, and so forth, which are or may be useful as dielectrics or protectors to dielectrics.

A course on such lines as this would spread the gospel of insulation, and would make for progress, in spite of the stumbling blocks our rule of thumb men prove themselves to be, with their shellac and resin or such like compounds, of which they make such a "dark and bloody mystery."

THE UTILITY OF ELECTRIC CLUBS.

ELECTRICITY is now recognized as one of the greatest factors in the commercial world, and the number of new enterprises coming into existence, and for which the services of competent electricians, engineers, etc., are required, emphasizes the necessity of intending applicants such positions thoroughly fitting themselves for the same.

The formation of Electric Clubs in the different cities is probably one of the best means of education and improvement. The opportunity is thus afforded for the interchange of ideas and the presentation of papers on practical subjects of interest. The Montreal Electric Club enjoyed a period of usefulness during its existence, but owing to the removal from Montreal of some of its members, and the fact that the work was left largely to a few it has ceased to exist. We are pleased to learn, however, that an effort will be made this fall to revive the Club. It is a significant fact that many of the prominent members of this Club, which was composed largely of the younger electricians, have secured responsible and lucrative positions.

In the city of Toronto there is also a good field for the organization of a similar club. The number of electricians, engineers, students, etc., in Toronto, should be sufficient to ensure a fair membership. During the winter months meetings could be held, say twice a month, at which papers should be presented and discussions held upon subjects relating to the various departments of electrical work. It is hoped that steps in this direction may be taken before the season is too far advanced.

MODERN PRACTICE IN INTERIOR WIRING.

IN the course of his paper on the "Evolution of Interior Conduits from the Electrical Standpoint," before the National Electric Light Association at New York, Luther Stieringer made the following statement:

The best experience in the past fifteen years in interior wiring has demonstrated the following facts:

First—Indiscriminate wiring with staples is universally condemned.

Second—Cleat wiring is admissible in exposed work where the circumstances admit, but not in concealed work.

Third—Wires imbedded in plaster, depending on the insulation only for protection, are condemned.

Fourth—Lead-covered wires are also condemned, except where protected in a conduit.

Fifth—Wires in mouldings do not afford mechanical or chemical protection, and are only admissible in surface work.

Sixth—Wires carried in plaster, and covered with split or zinc tubes to prevent injury by trowels, are condemned.

Seventh—Glass or porcelain insulators can only be utilized in special cases of exposed work.

Eighth—Paper tubes do not afford absolute mechanical and chemical protection.

Ninth—Insulated tubes covered with a thin coating of brass or other metals do not afford absolute mechanical and chemical protection, but in exposed work they are to a certain extent admissible.

Tenth—Woven fabric conduit does not afford absolute chemical protection.

Eleventh.—Heavy insulating covering, integral with the insulation offers no absolute protection against mechanical and chemical injury, and is analagous to rubber tubing for gas distribution installed throughout a building.

Twelfth—Concentric wiring is practiced in England with satisfactory results, but it is not in use in the United States. It offers many possibilities in the direction of a solid and fixed system.

Thirteenth—Paper-lined iron or steel pipes, known as "iron-armored conduit," "builders' tube," "armorite," "Clifton," and plain iron or steel pipe, are the only conduits that can afford absolute security against mechanical and chemical injury and assure permanence.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

NOTE.—Secretaries of Associations are requested to forward matter for publication in this Department not later than the 25th of each month.

TORONTO, NO. 1.

THE regular meeting of Toronto No. 1 was held on the 15th of July. A pleasing feature of the meeting was the presentation of a family rocking chair each to Bro. T. Eversfield, engineer at Toronto University, and Bro. Wm. Butler, engineer at Nordheimer's piano factory. The presentation was made by the President, Bro. J. Fox, on behalf of the Association.

HAMILTON NO. 2.

AT the regular meeting on the 3rd of July, the newly-elected officers were installed by Bro. A. E. Edkins, after which he gave a brief address in connection with the approaching annual convention. Bro. Pettigrew also spoke along the same line.

BRANTFORD NO. 4.

The following is a list of officers of the above association for the term ending June 30th, 1897; President, J. B. Forsyth; Vice-President, Jos. Ogle; Secretary, Thos. Pilgrim, Continental Cordage Co.; Treasurer, L. Fordham; Conductor, F. Temperance; Door-Keeper, A. McKinnon.

PETERBORO NO. 14.

At the regular meeting of Peterboro Branch No. 14, held in Engineer's Hall, the following officers were elected: President, W. L. Outhwaite; Vice-President, W. Forster; Secretary, A. E. McCallum; Treasurer, W. Taylor; Conductor, G. Pogue; Door-Keeper, P. Milloy. Mr. Outhwaite was appointed as the representative to the annual convention in Kingston.

BROCKVILLE NO. 15.

James Aikens, Recording Secretary of the above branch, writes: On the sixth of July we met in our rooms for the purpose of electing officers for the ensuing year. The following was the result: President, Archibald Franklin; Vice-President, John Grundy; Recording Secretary, James Aikins; Treasurer, John McCaw; Financial Secretary, Wm. Robinson; Conductor, Fred.

Andrews; Door-Keeper, John Boyd; Trustees, Ernest Carr, Edward Devine, James McRitchie.

Immediately after the election, the Past President, Bro. W. F. Chapman, proceeded to instruct the new officers in the discharge of their duties, his remarks being well received. The next part of the programme was a speech by Bro. Albert E. Henry, on the benefits which he received in the way of technical knowledge by joining the C. A. S. E. We all hope to see No. 15 prosper in the future as it has done in the past two years, when Bro. Chapman was leader, and no doubt the President's chair will be ably filled by Bro. Franklin, the veteran, and chief engineer of the water works in this town.

THE ANNUAL CONVENTION.

The local association at Kingston have made every arrangement for the entertainment of the delegates to the annual convention to be held in that city on the 18th and 19th inst. It is expected that about one hundred delegates will be present, and as Kingston is favorably situated for a summer meeting, a pleasant as well as a profitable time is assured.

Mayor Elliott has consented to deliver an address of welcome in the Council Chamber, after which a business session will be held. On the second day the delegates and their friends will sail down the river by special steamer, visiting some of the most picturesque islands of the St. Lawrence. Among other social features will be a drive to Fort Henry and around the Kingston Mills, a visit to the penitentiary and other places of interest, a lawn party at Ontario Park, and a banquet at the Hotel Frontenac on the evening of the last day, by the courtesy of the local association.

The business programme was not finally arranged at time of going to press, but it is expected that some interesting papers on engineering subjects will be presented, and other questions of interest to the association brought up for discussion.

The members of the Kingston association are working faithfully to ensure the success of the convention, and it is hoped their efforts will be rewarded by a large attendance of members.

A NOVEL INSTALLATION.

The Royal Electric Company recently installed at Peterboro one of their synchronous motors to operate a stone crusher, used by Messrs. Corry & Laverdure, contractors for the construction of the Trent Valley Canal, to crush all stone required for that section of the canal.

The Peterboro Light and Power Company furnish the current operating this motor from their 180 kilowatt "S.K.C." generator recently obtained from the Royal Electric Company.

This plant is interesting because it is, we believe, the first of this kind and the only one in commercial operation in Canada, and because it indicates a useful, profitable and practical direction in which central stations can employ their plants during the period of the day when lighting is not required.

Mr. J. F. H. Wyse, representative of the Royal Electric Company, who directed the installation, spoke of it as follows: "The current to operate the stone crusher is transmitted from the station of the Peterboro Light and Power Company, a mile distant. The motor plant consists of a fifty kilowatt alternating current synchronous motor, with its exciter, and a five horse power starting motor. The alternating current is taken by the motor directly from the transmission line at 1,000 volts. The stone crusher is belted to one end of the shaft of the synchronous motor, to the other end being belted in tandem the exciter and starting motor.

It was intended at first to use a shifting device or clutch arrangement to connect and put into operation the stone crusher after the synchronous motor had attained the required speed. This plan was changed, however, in order to simplify the arrangement, and the five horse power starting motor relied upon to bring up to speed the synchronous motor with stone crusher attached, as well as to drive the exciter.

Although this demanded more power than the rated capacity of the motor, it did the work with ease, and readily brought the synchronous motor to above the required speed.

To indicate to the attendant on the stone-crushing plant the proper time to connect the synchronous motor with the alternating current transmission line from the station of the Peterboro Electric Light and Power Company, a regular "S.K.C." synchronizer, as made by the Royal Electric Company, is used, which consists simply of two of their "2 C" Stanley transformers, so connected that when the synchronous motor is at the required speed and in step with the generator, a mile away, a lamp connected with these transformers goes out, giving positive indication to the attendant when to connect the motor with the transmission line.

The plant was started June 17th and the stone crusher has been successfully doing its work every day. It has been put to the utmost test; the greatest possible loads have been put on; the crusher has been jammed full of the hardest stones obtainable; the greatest variations possible in load, from nothing to the extreme capacity of the crusher, have taken place rapidly, but no variation in speed occurred, the synchronous motor meeting every demand upon it without change.

Messrs. Corry & Laverdure express themselves as more than pleased at the operation of the plant. They have also bought another motor from the Royal Electric Company to operate a pile driver.

THE VALUE OF ADVERTISING.

One of the largest advertisers in London says: "We once hit upon a novel expedient for ascertaining over what area our advertisements were read. We published a couple of half-column ads. in which we purposely misstated half a dozen historical facts. In less than a week we received between 300 and 400 letters from all parts of the country, from people wishing to know why on earth we kept such a consummate idiot, who knew so little about English history. The letters kept pouring in for three or four weeks. It was one of the best paying ads. we ever printed, but we did not repeat our experiment, because the one I refer to served its purpose. Our letters came from school-boys, girls, professors, clergymen, school-teachers and, in two instances, from eminent men who have a world-wide reputation. I was more impressed with the value of advertising from those two advertisements than I should have been by volumes of theories."—Exchange.

A second edition of the Inventor's Guide has been issued by Messrs. Ridout & Maybee, patent solicitors, Toronto. It has been considerably enlarged, and contains, in addition to other interesting features, a table containing economic statistics of the population, area, industries, etc., of the different countries of the world.

In re appeal of the New Westminster and Burrard Inlet Telephone Company, the Supreme Court of British Columbia held that telephone wires, whether carried above or underneath the soil of the highway, are liable to be taxed by the city of Vancouver. A switchboard is not a fixture and therefore not liable to be taxed.

SPARKS.

The Brantford Electric Light Company propose putting in a new plant.

Only one tender was received by the Toronto City Council for the telephone franchise for the city.

The employees of the Bell Telephone Company, Montreal, held their annual pic-nic on the 25th of July.

The town of Goderich has passed a by-law to introduce the incandescent system of electric lighting.

The Citizens' Light & Power Co., Cote St. Paul, Montreal, will build an addition to their engine house.

Mackay & Guest, of Renfrew, Ont., intend erecting an isolated water power plant and putting in another machine.

The City Council of St. Thomas, Ont., will submit a by-law to the ratepayers for the establishment of an electric light plant.

The Lachine Rapids Hydraulic and Land Company have been granted permission to increase their capital stock to $2,000,000.

Judge Thos. Deacon has decided that the Bell Telephone Company at Arnprior must pay taxes on $1,000 worth of real property.

A Chicago lawyer has defined a promoter as follows: "One who sells nothing for something to a man who thinks he is getting something for nothing."

Mr. Nicola Tesla is announced to have discovered a method of successfully transmitting electricity, upon a commercial basis, *over a distance of at least 500 miles.*

The Board of Governors of the Hamilton general hospital are considering the question of installing an electric light plant. An estimate for a plant of 250 lights places the cost at $2,500.

It is said that the Lake Superior Power Company, of Sault Ste. Marie, Ont., will go extensively into the production of calcium carbide, the substance from which the new acetylene gas is manufactured.

Arthur Gagnon, a Bell telephone lineman, while working on one of the company's poles on McGill street, Montreal, came in contact with a live wire and fell forty feet to the ground, being instantly killed.

The city of Vancouver, B. C., recently made a contract for lighting the city at a cost of 27½ cents per night per lamp of 2,000 candle power. This is stated to be the lowest rate yet obtained by any city of less than 30,000 population.

Said the maiden, archly smiling:
"Why all this cathodic fuss?
Men should know we've long seen through them,
But they'll never see through us."
—San Francisco Examiner.

The town of Trenton, Ont., has moved for an interim injunction to restrain the Trenton Electric Light Company from supplying electricity to persons outside the town and from using poles planted in the streets of the town for that purpose. The case will be heard at Cobourg in September.

Incorporation is announced of the Little Salmon River Telephone Company, for the purpose of constructing a telephone line between Sussex, Clover Hill, Waterford and Havelock, N. B. The promoters are Messrs. S. H. White, W. J. Mills, A. L. Price, C. J. Armstrong and H. B. Price, of Sussex.

The Toronto Street Railway Company have under consideration the construction of an electric road from Hamilton to Toronto. The road will, in all probability, be an extension of the present line to Long Branch. Mr. McCulloch, electrical engineer for the company, is making a survey of the route.

The Auburn Light and Power Company has been organized at Peterborough, Ont., and is applying for incorporation. The personnel of the company is Messrs. James McKendry, M.P., John Carnegie and W. H. Meldrum, manager. The object is stated to be to supply electricity for power and lighting purposes.

The town of Peterboro, Ont., recently asked tenders for electric street lighting. The Peterboro' Light and Power Company tendered at the following figures for 300 nights in the year: Two year's term, $65.00 per light; three years, $62.50; five years, $57.50. The Auburn Light and Power Company tendered at $75.00, $73.50 and $72.00 respectively. No action has as yet been taken by the council.

The Lachine Rapids Hydraulic & Land Co., of Montreal, having acquired the rights from the Standard Light & Power Company to place wires under ground in the city, have applied to the city council for permission to proceed with the work. The company propose to use cement lined iron tubes, similar to those used in many cities in the United States, and vitrified tile after the style of the Niagara Cataract Construction Company's plan, and for sub-mains Edison's tubing, filled in with asphalt by hydraulic pressure.

A despatch from Chicago, dated July 27th, says: A combine has been formed for the purpose of maintaining prices, by the leading manufacturers of incandescent lamps in the United States. This agreement will practically put an end to the war in prices, which has virtually done away with all the profits in this line of business. The factories and corporations under the new combine are: *The General Electric*, the Bryan-Marsh Company, Columbia, Packard, Westinghouse, Buckeye, Sunbeam, Adams-Bagnall, Perkins, Bernstein, Beacon and Warren.

PERSONAL.

Mr. Wm. MacKenzie, President of the Toronto Railway Co., has just returned from England.

Mr. William Alcarn, jr., has been appointed manager of the Ottawa Porcelain and Carbon Co., vice Mr. J. W. Taylor, resigned.

Mr. L. B. McFarlane, of Montreal, has been appointed General Superintendent of the Bell Telephone Company of Canada.

Mr. H. B. Spencer, managing director of the Hull and Aylmer electric railway, has taken an office in the Central Chambers, Ottawa.

Mr. C. R. Hosmer, president and general manager of the C. P. R. Telegraph Company, has recently returned from a trip to England.

Mr. Harry Nuttall, financial secretary of Montreal No. 1 C.A.S.E., is at present in England paying a visit to his friends in his native land.

Mr. Geo. W. Sadler, of the well-known firm of Robin, Sadler & Haworth, has been elected as alderman to represent St. Antoine ward, Montreal.

Mr. De Hart, superintendent of the London, Ont., street railway, is said to have received an offer to manage a street railway in a large city in New Mexico.

Mr. C. J. Mullen, formerly electrician of the Ottawa Electric Railway Company, and who has recently been in South America, has arrived at Burban, South Africa.

Mr. Chas. Aird, inspector, and Mr. Geo. M. Seguin, cashier, of the Ottawa Electric Railway Co., have been appointed tram master and accountant respectively for the Hull Electric Railway.

The death is announced in London on July 7th of Sir John Pender, one of the original promoters of the Atlantic cable, and prominently connected for 40 years past with sub-marine cable companies and enterprises. Sir John Pender had reached the advanced age of 80 years.

Mr. H. W. Kent, manager of the New Westminster and Burrard Inlet Telephone Company, was married on the 8th of July to Miss Florence Emily Findley, of Charlottetown, P. E. I. Mr. Kent is well known throughout the western province, having been connected with the establishment of a number of telephone systems.

Mr. Gordon J. Henderson, of Montreal, has been appointed manager of the Hamilton Electric Light and Power Co. Mr. Henderson is a brother of Mr. C. W. Henderson, electrical contractor, of Montreal. Mr. J. J. Wright, of Toronto, under whose management the company has been for some time past, has been appointed on the Board of Directors.

TRADE NOTES.

The W. A. Johnson Electric Co. have been awarded the contract for a 40 arc light dynamo for the electric plant at Toronto Junction.

The St. Johns Electric Co., St. Johns, Newfoundland, are making extensive additions to their plant. E. Leonard & Son, of London, are supplying the steam plant.

The Le Roi Mining Co., of Rossland, B. C., have placed an order with the Ingersoll Rock Drill Co., of Montreal, for a large direct-acting winding roll, 24×40, and for three 125 h.p. boilers.

The following is a partial list of motors installed by the Kay Electrical Mfg. Co. during the last month: Messrs. Buntin & Reid, Toronto, 4 h.p. motor; Central Press Agency Co., Toronto, one electrotyping dynamo; Linden Creamery Co., Toronto, one 5 h.p. motor; Wherle Brush Co., Toronto, one 5 h.p. motor; Mr. Hutchison, wood yard, Toronto, 10 h.p. motor; Steel-Clad Bath & Metal Co., Toronto, one electroplating dynamo and one 1 h.p. 4-pole motor. Mr. A. Moore, Toronto, one 2 h.p. motor. Mr. Woods, printer, Toronto, one 2 h.p. motor; Kemp Mfg. Co., Toronto, two 6 h.p. motors; McLean Publishing Co., Toronto, one 6 h.p. motor; Mr. B. Lindman, Toronto, one 2 h.p. motor; Mr. H. R. Cuddon, St. Catharines, one 3 h.p. motor; Mr. G. C. Hinton, Victoria, B. C., one 3 h.p. motor and one 6 h.p. motor.

ELECTRIC RAILWAY DEPARTMENT.

NEW RAILROAD MOTOR.

A TEST of a new electric motor, the invention of Mr. Nicola Tesla, will shortly be made at the works of the Westinghouse Company in Pittsburgh. The motor is destined for use on the elevated railways in Boston, and is a polyphase or induction motor, applying an alternating current, which is said to be preferable for long-distance transmission. Its distinctive characteristic is the utilization of the rotating magnetic field. It does away with the commutator and the brush, necessary to the use of the direct currents in action. Mr. Tesla states that the discarding of these makes his motor less costly an important consideration more reliable, easier to handle, and less perilous to those who handle it.

THE HURON AND ONTARIO ELECTRIC RAILWAY.

THE Huron and Ontario Electric Railway Company are slowly but steadily completing arrangements for the construction of the road. According to the act of incorporation, the capital stock of the company is to be two million dollars. Mr. N. McNamara, of Walkerton, is president, Dr. Rollston, of Shelburne, vice-president, and Mr. A. McK. Cameron, of Meaford, secretary. The road will extend from Port Perry to Kincardine, with two branches, one running north from Priceville, through Meaford, Owen Sound, Tiverton, etc., around to Kincardine, and the other extending from Walkerton, through Mildmay, Teeswater, and Lucknow to Goderich, with a connection between Lucknow and Kincardine through Ripley. The entire length of the road will be something over 300 miles, and motive power for its operation will be supplied from stations at Eugenia, Glen Roden, Southampton and Thompsonville.

The company is authorized to issue bonds to the extent of $10,000 per mile for construction purposes, and $6,000 additional for each mile double-tracked. At a meeting of the shareholders held in Toronto recently an offer for construction was received from a New York firm. It was stated that most of the municipalities interested had passed resolutions adopting the by-laws and agreements with the company. A survey of the route is now being made by engineers. This will occupy about two months, after which track-laying will be proceeded with.

In Chemnitz, Saxony, no poles are used for operating the electric street railway. The method of stringing wires is by means of ornamental rosettes fastened into the woodwork or walls of houses, having projecting hooks to which the wires are attached. These hooks are firmly fastened and are tested with seven times the weight they are called upon to bear. The railway tracks are level with the pavements, and accidents are rare. The cars run at a rate of 220 yards a minute in the centre of the city. No conductors are employed, the motorman being the only person on board who represents the company. By doing away with conductors the company saves 44,000 marks annually. The fare is only 10 pfennigs, or a trifle less than 2½ cents, on all routes, including transfers. Should 150,000 persons evade payment in 12 months, the loss would be only 15,000 marks. It would take 450,000 evasions in fare to offset the company's savings by dispensing with conductor's salaries. Fare boxes are attached to both ends of the car.

SPARKS.

George Beattie was killed by a trolley car on the Hull & Aylmer electric railway.

A. W. Prestine, a carpenter of Hespeler, Ont., was killed on the Galt, Preston & Hespeler street railway by falling between the motor car and trailer.

An exhibition of Reynold's self-loading electric car was given in Montreal recently under the supervision of Mr. St. George, City Surveyor. The work done was satisfactory.

In lieu of privileges granted by the city of Hull, Que., the Hull and Aylmer Electric Railway Company have agreed to light the city for five years with thirty-two candle-power lamps.

Arrangements are being made in St. Johns, Nfld., for the construction of an electric railway, to operate between the city and suburban villages within a distance of twenty miles. The plant will be driven by water power.

The Canadian Electric Railway and Power Co. is seeking power from the Dominion Government to build an electric railway from Cobourg via Port Hope, Bowmanville, Oshawa, Whitby, Toronto, Oakville and Hamilton to Suspension Bridge and Niagara Falls.

The Vancouver, Victoria and Eastern Railway and Navigation Company is applying for incorporation to construct telegraph and telephone systems along the line of a proposed railway from Vancouver, B. C., through Manitoba, Ontario and Quebec to the Atlantic seaboard. The solicitor for the company is Donald G. Macdonell, of Vancouver.

Experiments have recently been conducted in New York by the New York Central Railroad Company, with a new hot water motor. The hot water, under enormous pressure, is stored in supply boilers and then charged into the battery cylinders of the motor. The great merit of the motor is said to be its cheapness. The cars can be operated upon any track, all that is required being a number of boiler houses along the road.

An effort is being made by the citizens of Cote des Neiges to compel the Montreal Street Railway Company to extend their line along Grey street and up Cote des Neiges Hill. The company object to building the line up the hill on the grounds that there is little traffic and the danger to life would be very great. The matter has been referred to the city attorney, with the object of learning who is the competent authority to determine where lines should be built in accordance with the terms of the franchise.

The belt line railway around Toronto which was constructed some years ago by the Grand Trunk Railway Company did not prove a paying investment, and has not been operated for some time. A company is now being formed, to be known as the Toronto Radial Railway Company, to acquire the property and franchise of the said railway, with the object of electrifying the road, and with the privilege of making extensions within a radius of fifty miles. Messrs. Dewart & Raney, Toronto, are solicitors for the company.

The directors of the proposed Carp, Almonte and Lanark Railway held a meeting on Wednesday last, when it was decided to begin preliminary surveys at once. It is proposed to have the line run from Carp to Bridgewater, a distance of some 68 miles, passing through Almonte and Lanark. From Bridgewater the line will connect with the Central Ontario R. R. and the Grand Trunk. Among the promoters are Mr. T. W. Rains, president, and Messrs. W. H. Stafford, D. M. Fraser, D. Shaw, Dr. Groves and J. W. McElroy.

The Ottawa Electric Railway Company provide amusements for their patrons at the parks owned by the company adjacent to the city. On the 22nd ultimo an exhibition of Edison's latest invention, the Vitascope, was given at "West End" park. The Vitascope is an improvement on the Kinetoscope, and instead of objects being reproduced in miniature in a cabinet, they are thrown in life size on a large screen, just the same as lime-light views. A view of Prospect Park, Brooklyn, showing foot passengers, bicyclists and horses passing, was an interesting feature, as was also the breakwater at Coney Island.

SPARKS.

The Toronto and Suburban street railway has been extended to Lambton Mills.

The Galt, Preston & Hespeler electric railway carried 23,000 passengers in June.

The Hamilton Radial Railway Company are actively engaged in the construction of their line.

A Cleveland syndicate is said to be desirous of purchasing from Col. Stacey the street railway franchise for St. Thomas.

The shareholders of the Hamilton and Dundas Railway have approved of the conversion of the road into an electric line.

Contracts will be awarded this week for materials required for the extension of the Hamilton, Grimsby and Beamsville Railway to Beamsville.

Miss Lizzie Cole was killed on Queen street, Toronto, by being struck by a trolley car. The jury brought in a verdict exonerating the employees on the car from blame, but recommended that the speed of cars be regulated by city authorities and that more efficient fenders be used.

The projectors of the Hamilton, Ancaster and Alberton Radial Railway have requested that a right of way be granted for their proposed road from Hamilton to Ancaster. Among the promoters of the scheme are Messrs. W. H. Wardrope, W. F. Walker, Q.C., F. G. Beckett and Major Snider.

The city council of Hamilton have released the $20,000 of bonds of the Hamilton, Grimsby and Beamsville Railway, held by the city as security for the continued operation of the road. This will enable the company to extend the road to Beamsville at once, arrangements for which are now being made.

The Montreal Street Railway Company will hereafter issue certificates of merit to their employees. Any man who has been in the company's service for five years will be entitled to wear one gold band; ten years' service will give two gold bands, and an additional gold band for every extra five years' service.

Mr. E. A. C. Pew, of the Hamilton and Lake Erie Power Co., has written to the Mayor of Hamilton offering to furnish power to run the pumping machinery for the waterworks for $10,000 a year. He states that arrangements have been made with capitalists to have the canal and plant constructed by November next.

Suit is said to have been entered on behalf of Dr. Rolston, of Shelburne, one of the promoters of the Huron & Ontario Electric Railway, to recover $3,000 for services, and an injunction to prevent the payment out of the moneys which the plaintiff claims have, through his efforts, found their way into the company's treasury. The company and E. A. C. Pew are defendants in the action.

The Hull Electric Railway desire to run a short spur line in front of their office in Hull, and this is opposed by the City Council on the ground that the company have no right to any part of the street other than that occupied by the main track. The question will probably be settled by law, and as the act under which the company operates gives them the authority to operate an electric road on the streets of Hull, the decision will be interesting.

The power house of the Montreal Park and Island Railway Company, at Mile End, Montreal, was completely destroyed by fire on the 30th of July. Besides the electric power plant the company lost twelve open cars, four trailers, two electric sweepers, two tar waggons and a small steam locomotive. The loss is in the neighborhood of $40,000, and is covered by insurance. The service on the road was continued as usual the following day, the Montreal Street Railway Company providing the power.

The Elektrotechnische Zeitschrift gives the following description of the arrangement recently introduced in Stockholm for the automatic control of the operation of the exchange: The exchanges are fitted for night service, and for that purpose the annunciators are provided with contact devices, which in falling close a circuit and cause a bell to ring. This arrangement is now employed during the daytime, but a call-indicator is put in place of the bell. This call-indicator consists of an electromagnet, the armature of which moves a signal behind a little window. The ring-off indicators are provided with the same device, the only difference being a different color of the signal. Besides facilitating the control of the operators the arrangement assists the operator to a large extent, as it saves the continuous and tiring observation of the annunciator board. The operator has only to watch the call-indicator and, when it signals, to look at the annunciator board. The new exchange at Christiania, just opened, has a similar device.

CANADIAN GENERAL ELECTRIC CO.

(LIMITED)

Railway Apparatus

We invite attention to the commanding position the Company has attained in the Electric Railway field.

Our Apparatus is now in use on almost, without exception, every independent road in the Dominion, and the fact that we have been awarded practically all the contracts placed during the past year for equipment either for new or existing roads, is the strongest possible testimonial both as to the superiority of the Apparatus itself, and the fair and liberal basis on which the business of the Company is conducted. Amongst the roads from which orders for apparatus have recently been received may be mentioned the following:

Hull & Aylmer Electric Ry. Co.
Moncton Electric Street Railway, Heat & Power Co.
Hamilton adial RElectric Ry. Co.
Cornwall Electric Street Ry.
Halifax Electric Tramway Co.
St. John Street Railway Co.
Montreal Street Railway.
Toronto Street Railway.
Chateaugay & Northern Ry.
Vancouver & Westminster Tramway Co.
City and Suburban Street Ry.
Guelph Electric Street Ry.
Berlin & Waterloo Street Ry.
Port Dalhousie, St. Catharines & Thorold Street Railway Co.
Brantford Street Railway Co.
London Street Railway Co.
Kingston, Portsmouth & Cataraqui Railway.

Lighting and Power Transmission Apparatus

In considering the development of our systems of apparatus for lighting and power transmission, we have kept in view the important fact, that varying conditions of service require varying methods to meet them.

We have in our **Edison Direct Current Three-Wire System,** our **500 Volt Direct Current System,** our **Single-Phase Alternating Current System,** our **Monocyclic System** and our **Three-Phase System,** a series of methods, each superior to all others, for the service to which it is adapted. We are not confined to one system only, but cover the whole range of Direct Current, Single-Phase and Multi-Phase Alternating Apparatus. Our interest in each case, therefore, lies in using the most suitable system, since we manufacture all; not in twisting the conditions to suit one particular system, however ill-adapted to the particular case.

Our recent sales of Lighting and Power Apparatus have exceeded all previous records and include the sale to the Lachine Rapids Hydraulic and Land Co'y, of twelve three-phase generators, each of 1000 h.p. capacity.

USEFUL HINTS.

The proper way to protect a blow-off pipe is to cover it with a sleeve with an air space between, and to use the blow-off cock more frequently.

According to Von Oechelhauser, says the Gas World, a Welsbach lamp gives one candle for every 33 square millimetres of its area. According to Bernstein, an electric glow-lamp filament gives off the same four square millimetres.

Electricians say the safest place of refuge during a thunderstorm is a trolley car, and that no instance is known of one having been struck by lightning. The wires and car pole are a far better protection than any lightning rod.

When buying gaskets with which to pack man-hole or hand-hole covers on steam boilers, be careful to select those that are soft and tough, and not too thin, for the inside of the heads where these are to be used, and also the covers themselves are frequently anything but smooth and true, and the gaskets must "fill the gaps," as it were.

The battery on the bell and annunciator circuit in an office building became quite weak, so much so that it would not ring the bells although it would work the annunciators, they requiring less current than the bells. Investigation finally located the trouble as being a wasted zinc in one of the cells of the battery. Fresh solution in the cell and a new zinc caused the system to work all right again.

There should be something in your ad. different from any other ad. if you wish it attract and hold attention. Novelty strikes forcibly where the commonplace is unnoticed.