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ELECTRICAL NEWS
AND ENGINEERING JOURNAL

OLD SERIES, VOL. XV.—No. 7.
NEW SERIES, VOL. IX.—No. 7.

FEBRUARY, 1899

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CANADIAN

ELECTRICAL NEWS

AND

STEAM ENGINEERING JOURNAL.

VOL. IX. FEBRUARY, 1899 No. 2.

OFFICERS OF THE MONTREAL STREET RAILWAY COMPANY.

It is with much pleasure that we present to our readers the accompanying group of portraits of the officers of the Montreal Street Railway Company.

HON. L. J. FORGET. MR. JAS. ROSS, C.E.
MR. D. A. L. McDONALD. MR. F. L. WANKLYN, C.E. MR. W. G. ROSS.
MR. MARTIN H. WATTS.

OFFICERS OF THE MONTREAL STREET RAILWAY COMPANY.

Hon. L. J. Forget, the president of the company, is a native of Terrebonne, and a Senator for the division of Sorel. In addition to occupying the presidency of the Montreal Street Railway Company, Mr. Forget is president of the Richelieu and Ontario Navigation Company, a director of the Royal Victoria Insurance Company and of the Montreal Trust and Deposit Company, and vice-president of the Board of Governors of Laval University, Montreal.

Mr. F. L. Wanklyn, C. E., the manager and chief engineer, was born in Buenos Ayres in 1859, and educated in England. In Canada one of his first appointments was as assistant mechanical superintendent of the

Grand Trunk Railway, and later manager and master mechanic at the Point St. Charles locomotive works. Besides discharging the duties of these positions, he acted as consulting mechanical engineer to the Montreal Street Railway during the construction of the power house. He was appointed general manager of the Toronto Street Railway Company in January, 1897, resigning in the fall of the same year to assume the position he now fills. He is a member of the Canadian Society of Civil Engineers and an associate member of the Institute of Civil Engineers, England.

Mr. James Ross, C.E., vice-president and managing director, was born in Scotland, coming to Canada in the seventies. Since then he has been identified with the construction and management of various well-known steam railroads, his most notable work in that direction being the construction of the line of the Canadian Pacific Railway across a considerable portion of the prairies and through the Rocky mountains and the Selkirks into British Columbia. Since 1892 Mr. Ross has directed his attention and energies chiefly to street railways, and the cities of Montreal, Toronto, Winnipeg and St. John owe the successful construction and operation of their street railway systems largely to Mr. Ross' directive ability. In 1896, in conjunction with Mr. William McKenzie, of Toronto, Mr. Ross acquired the tramways systems of Birmingham, England, with the object of converting the system to electricity, and in 1897, in conjunction with the same gentleman and others, secured a charter and franchise from the Government of Jamaica to build electric tramways on the island. Mr. Ross is vice-president of the Toronto Railway Company, president of the Winnipeg Electric Railway Company, and of the St. John Railway Company, and president of the Dominion Bridge Company.

The comptroller of the company, Mr. W. G. Ross, was born in Montreal in 1863, and was appointed to the position in 1896. Previous to this he was engaged in the reorganization of the accounting departments of the Montreal, Toronto, Winnipeg and St. John Street Railways, which all have a uniform system of accounts. Mr. Ross is a prominent member of the Street Railway Accountants' Association of America, and one of the organizers of the same.

Mr. Martin H. Watts, the secretary of the company, is a native of London, Eng., where he was born in 1861. He came to Canada toward the end of 1886, and in December of that year entered the service of the Canadian Pacific Railway, where he was employed for four years in the law department of the company. In April, 1893, he secured the appointment of private secretary to Mr. Henry A. Everett, the well-known street railway promoter of Cleveland, Ohio, and at that time vice-president and managing director of the Montreal Street Railway Company. He filled this position, and subsequently that of secretary to Mr. Granville C Cuningham, late manager and chief engineer of the company, until June, 1896, when, upon the death of Mr. Edward Lusher, Mr. Watts was appointed secretary.

Mr. Duncan A. L. McDonald, the superintendent of the Montreal Street Railway Company, was born at St. Thomas, Que., in June, 1859, and removed to Montreal in 1875. He entered the service of the Montreal Street Railway in 1881 as a "knight of the whip," in order to acquire a thorough knowledge of street railway work from its very commencement. He was soon advanced to conductor, and after about twelve months' service in that capacity, was promoted to the position of road-master. In 1886 he severed his connection with the company, but anticipating the progress that the trolley system would make, he went to St. Paul and Minneapolis in 1889 and secured a practical knowledge of the operation of electric tramways. He returned to Montreal in 1892 and re-entered the service of the Montreal Street Railway in the capacity of inspector. He was appointed to the position he now occupies in 1894.

QUESTIONS AND ANSWERS.

"J. M.," Toronto, writes as follows regarding the Arthur transmission plant: "Your article in January number, regarding above, for which I have to thank you, has been carefully read. On figuring out the line on the basis of the figures which you give, namely, that it delivers to the primaries of the step down transformers, over 13 miles of No. 4 wire, 9 amperes at 2,080 volts, I find that the loss in line only is 15½ %. To get the total transmission loss, you must add to the above the losses in the transformers and in the secondary wiring, which will bring the total to something over 19%, instead of its being less than 5%, which your November article states it to be. If I am mistaken in above, I should be glad to be corrected. If my figures are correct, the publication in your February issue of an article correcting the November article will be much appreciated."

ANSWER.—In answer to the above, we believe the calculations given are correct, but the article in the November issue did not state the number of amperes transmitted at that time, which, for our correspondent's satisfaction, we may state was only five amperes, and at the pressure then in use, the ohmic loss was less than five per cent. In our reply in January, we perhaps should have noted that the loss was more than five per cent., owing to the transmission of nine amperes of current instead of five, for which the line was originally laid out. The business in Arthur has grown to such an extent that the owner of the plant has found it necessary to purchase a 1,500 light machine, and to operate at 4,000 instead of 2,000 volts, which will leave the losses, owing to the increased voltage, very small again.

"H.W." asks: (1) Will common iron wire serve as lightning arrestors when strung on electric poles from top to bottom, with the lower end connected with water? Will lightning jump from the electric wire to the ground wire or iron wire when placed an inch or two apart? (2) Is there any probability of acetylene gas or lime-light taking the place of electric light? (3) Is the system of using 220 to 240 volt lamps likely to come into general use? Do the underwriters accept these lamps?

ANSWER. (1) If ordinary fence wire is placed as described, with a few inches projecting above the top of the pole, and the lower end buried, it will be of great assistance as a lightning guard to the machinery, especially if lower end reaches water. Such wires should be placed quite frequently, say every fifth pole. Do not, however, take out the station arrestors. An inch gap is a rather long distance for the lightning to strike across, especially if there be any "grounds" on the system. (2) It is not wise to prophesy, but in the writers' opinion acetylene or lime-light will never displace electricity. Advantages claimed for acetylene

over electricity are brighter light for less money. At the present, the best incandescent lamp is not very efficient, using only about five per cent. of the energy it dissipates. Scientists are experimenting all the time, with a great probability that in the near future incandescent lamps will have an efficiency of double what they have now. That means either same light for half the money, or double the light for the same cost. Anyone who prefers the rather ghastly light of acetylene to the clear, cheerful glow of electric lamps is entitled to his preference, but he must take the risk of unpleasant smells, and quite possible explosions. (3) Underwriters accept 220 and 240 volt lamps in Europe and the United States when special precautions against leaks, etc., are taken. The only reason why such voltage is not more generally used is that the lamps are rather less efficient than those of lower voltage; and there seems to be some little doubt of the manufacturers being able to produce a really good and durable lamp. No doubt, however, both these points will before long be satisfactorily settled.

"INDUCTION" writes: (1) What would be the resistance and line loss on a two-phase system carrying a load of 40 amperes (17 amperes and 23 amperes on each phase) at a pressure of 2,000 volts? The station voltmeter connected to a transformer of 20 to 1 ratio requires to register 118 volts to overcome loss, resistance and induction. The distance from power house to center of distribution is 25,300 feet, and the wires used are No. 3 B. & S. (2) How can I color incandescent lamps for decorative purposes that they may be cleaned at any time? (3) What does each division on an S.K.C. static ground detector denote when connected to a 2,000 volt primary?

ANSWER.—(1) The resistance of 25,300 feet of No. 3 circuit under the described conditions with 23 amperes is 97.3 ohms. As, however, the circuit contains joints, etc., it will be somewhat higher. The loss on such a circuit carrying 23 amperes (for copper resistance) will be 238 volts. The "inductive" drop will somewhat increase this loss, but unless some other data are given, such as distance apart of wires, it is not possible to accurately calculate it. The dynamo voltage, to overcome the above resistance, and leave 104 volts at the lamps, should be 2,318 volts—the indication on a 20-1 volt meter should be 116. No doubt the other two volts are required for joints, etc. (2) A very weak solution of shellac with the color added can be cleaned off by alcohol. (3) This information can best be furnished by the Royal Electric Company.

ELECTRIC LIGHT INSPECTION IN CANADA.

The report of the Commissioner of Inland Revenue for the Dominion, for the year ending June 30th, 1898, gives particulars regarding the inspection of electric light. The total revenue derived therefrom was $9,472, made up as follows: Fees for inspection, $5,388.25; registration of companies, $3,970; penalties, $114. The expenses of inspection were $3,236, and there were expended on standard instruments, $3,768.80, leaving a net revenue of $2,467.35. There were inspected during the year 3,754 meters. Of these 3,496 were found correct, 141 fast, 48 slow, and 10 unsound. A number were accepted after first rejection.

PERSONAL.

Mr. S. W. Jenckes, of the Jenckes Machine Company, has been elected a member of the town council of Sherbrooke, Que.

Mr. W. P. Cooke, of Port Arthur, was, at the municipal elections in January, elected as Railway and Light Commissioner for the town. He was also chosen as a councillor.

Mr. John C. Gardner, formerly secretary and manager of the Canadian Manufacturer Publishing Co., Limited, has been appointed president and managing director of the Might Directory Co., of Toronto, Limited, vice Mr. J. M. Might, retired. No doubt the energy and success which marked Mr. Gardner's career in his former capacity will be brought to bear upon the duties of his new position.

Many Canadian friends of Mr. F. C. Armstrong, who in May last accepted a responsible position in connection with the electrical department of Dick, Kerr & Company, of London, England, were pleased to have the opportunity within the past month of again meeting him. The purpose of his visit, however, was matrimonial in character. On January 12th he took as a life partner one of Cobourg's society favorites, in the person of Miss Helen McCallum. Before their departure for England, Mr. and Mrs. Armstrong visited some of the principal cities in the United States.

MOONLIGHT SCHEDULE FOR FEBRUARY.

Day of Month.	Light.	Extinguish.	No. of Hours.
	H.M.	H.M.	H.M.
1....	P.M. 5.50	A.M. 12.20	6.30
2....	" 5.50	" 1.00	7.10
3....	" 5.50	" 1.30	7.40
4....	" 5.50	" 2.40	8.50
5....	" 5.50	" 3.40	9.50
6....	" 5.50	" 4.50	11.00
7....	" 5.50	" 5.50	12.00
8....	" 5.50	" 6.00	12.10
9....	" 5.50	" 6.00	12.10
10....	" 6.00	" 6.00	12.00
11....	" 6.00	" 6.00	12.00
12....	" 6.30	" 6.00	11.30
13....	" 7.30	" 6.00	10.30
14....	" 9.00	" 6.00	9.00
15....	" 10.30	" 6.00	7.30
16....	" 11.10	" 5.50	6.40
17....	"	" 5.50	5.40
18....	A.M. 12.10	"	
19....	" 1.10	" 5.50	4.40
20....	" 2.00	" 5.50	3.50
21....	" 2.40	" 5.50	3.10
22....	No Light.	No Light.	.....
23....	No Light.	No Light.	.....
24....	No Light.	No Light.	.....
25....	No Light.	No Light.	.....
26....	P.M. 6.20	P.M. 9.00	2.40
27....	" 6.20	" 9.20	3.00
28....	" 6.20	" 10.20	4.00
.....	.....	.....	.....
.....	.....	.....	.....
....	....	.	. .
		Total.....	183.30

Mr. J. R. Rayden, master mechanic at the Trail smelter, was killed by a shock received while repairing the switchboard in connection with the electric plant.

The town of Goderich, Ont., will seek authority from the provincial legislature to raise $5,000 for the purpose of improving he electric light and waterworks plants.

The Laurention Water and Power Company, of Lachute, Que., have requested extensive powers from the provincial legislature. The company propose to operate in the northern counties of Quebec, supplying electric light, gas, heat, power, etc., and constructing telephone lines. Mayor Prefontaine, of Montreal, and Mr. Pierre Laforest, of Joliette, are interested in the company.

The Canadian Marine Engineers' Association, Toronto, have elected officers for the ensuing year as follows: Hon. president, O. P. St. John, president, Harry Parker, first vice-president, A. J. Woodward; second vice-president, D. F. Campbell; secretary, S. A. Mills; treasurer, H. Brownley; inside guard, H. Bowler; auditors, D. L. Foley, E. J. O'Dell, Owen Sound; council, Thos. Good, Wm. Harwood, Rees Bench, Toronto; P. J. Carr, Port Dalhousie, and J. E. Kane, Kingston.

CANADIAN ASSOCIATION OF STATIONERY ENGINEERS.

NOTE.—Secretaries of Associations are requested to forward matter for publication in this Department not later than the 6th of each month.

VALVE-SETTING.*

By W. SWEET.

THE paper which I present to-night is upon valve-setting of steam engines, which is known to engineers throughout the world as a most essential feature. My paper is divided into three parts, namely, dead centre, valve-setting, and the relative position of the valve to the piston at all points of the stroke. I make this division for the purpose of treating each one separately. First I will take up dead centre. Nearly every engineer has a way of his own for finding the dead centre of an engine. The method which I have adopted is no doubt familiar to the most of you. The first thing to be done is to take a piece of wire and sharpen one end, and bend the wire almost in the shape of a figure 3; slip this piece of wire over the guide bar, so that it is comparatively firm, and let the sharp point project as close to the crosshead as possible. Then place the crosshead about one inch from the end of the stroke; now make a mark with a scriber on the crosshead, and move the wire so that the point is directly opposite the mark. Next take another piece of wire and sharpen both ends of it; then bend one end so that it projects at angles. Go to the fly-wheel or disc, make a mark on the floor, let the long end of the wire rest in the mark on the floor, and the projecting point come in contact with the wheel, and scribe a mark with it. Now turn the engine on the centre so that the mark on the crosshead comes directly opposite the point of the wire, go back to the fly-wheel again, and scribe another mark with the trammel in the same position as before. If this is done correctly, the centre between these two marks (which can be correctly obtained by the use of the compass) brought to the point of the trammel will be the dead centre of the engine.

Now we proceed to set the valve. This is a point which should receive very careful attention. Make sure that the valve has the correct travel; after this has been ascertained, proceed to give the valve the proper amount of lead, which depends upon the speed of the engine. The greater the speed the more lead is required. I might state that there are three kinds of leads; proper lead, improper lead, and permanent lead. I might also state that permanent lead can only exist in four-valve engines, but is most likely to be given to the valve of Brown engines, as these engines have their valve spindles screwed into the dash pot pistons; and engineers that are not thoroughly practical men, and not knowing what the results would be, are very apt to screw the dash pot piston down instead of moving the eccentric or cam ahead on the cam shaft. By screwing the piston down on the spindle to get the proper lead will give permanent lead. The position that the valve occupies to the piston may be determined in various ways, but the most accurate way, in my opinion, is to remove the steam chest cover, then place a piece of paper between the valve and face of the ports, attach a string to a reducing motion attached to the cross-head, the same as would be used for an indicator, pass the string around the pulleys, and bring it down past the centre of the steam chest; to the string attach a lead pencil, then by turning the engine over by hand and holding the pencil so that it will move up and down by the motion of the string from the crosshead, and using the face or the edge of the valve as a guide, an oval will be traced on the paper by the pencil, and by laying off the ports on the oval on the opposite side, according to the travel of the pencil, using a scale of one, two, or three inches of the crosshead travels to one of the pencil, this will give the position that the valve is to the piston at any part of the stroke.

Mr John Philp, of Grand Valley, is supplying the town of Grand Valley and the town of Arthur, which is thirteen miles distant, with incandescent light from his incandescent lighting plant in Grand Valley. He has met with such success with his transmission plant that he has purchased from The Royal Electric Company a 75 k.w. S.K.C. two-phase alternator, which he is installing in his power station. This will enable him to deliver at least 1,000 lights wired up in Arthur, and also to serve everything in sight in Grand Valley. As heretofore noted, this is a new departure in electric lighting, and we are glad to hear of Mr. Philip's success. It shows what pluck and enterprise will do.

*Paper read before Hamilton No. 2 C. A. S. E.

CANADIAN ELECTRICAL STUDENTS' COMPETITION.

The publishers of the CANADIAN ELECTRICAL NEWS hereby offer a first and second prize of $15 and $10 respectively for the best thesis submitted by an undergraduate of a Canadian university on any one of the following subjects, viz.:

1. "The Magnetic Circuit of Dynamos."
2. "The Incandescent Electric Lamp."
3. "The Electric Meter."
4. "The Relative Advantages of Low and High Frequency in an Alternating Electric Lighting Plant."
5. "A Concise Description of a Method of Testing Transformers for Efficiency at Various Loads, both as Regards Regulation and Core Loss."
6. "Comparison between Two and Three Phase Installations for the Long Distance Transmission of Power."

It is required that each thesis submitted in this competition shall consist of not less than 5,000 nor more than 6,000 words, and shall be written in the third person, and typewritten for publication on one side only of foolscap paper.

To admit of a fair comparison of the merits of the theses which may be submitted, keeping in view variety of subjects, a system of marks will be employed such as is generally used in college examinations, and with which the competitors in this competition are familiar. These marks will be allotted under three heads, viz.:

1. Subject Matter.
2. Arrangement.
3. English.

Taking 100 as the combined total, the maximum and minimum marks for each of the above classifications will be as follows:

Maximum.		Minimum.
50	Subject Matter	25
25	Arrangement	15
25	English	15

If any of the theses submitted should not be entitled to receive the minimum of marks as above, they will be entirely rejected.

There are three sources from which competitors must draw their subject matter, viz., books, periodicals and floating literature, personal or private channels. In judging of the subject matter, the following relative values will be attached to the above mentioned sources of information:

(a) Books	10
(b) Periodicals and floating literature	20
(c) Personal or private sources	20
	50

Where extracts are used, their source and names of authors should be clearly given.

Where diagrams are required to illustrate the text, they should be drawn with pen and perfectly black ink on pure white drawing paper, bristol board or tracing linen, and in such manner as to admit of their reproduction to a small scale.

Each thesis shall be submitted by motto only, and shall be accompanied by the name of the author enclosed in a sealed envelope bearing the same motto. This envelope will remain sealed in the hands of the publishers until the competition shall have been decided.

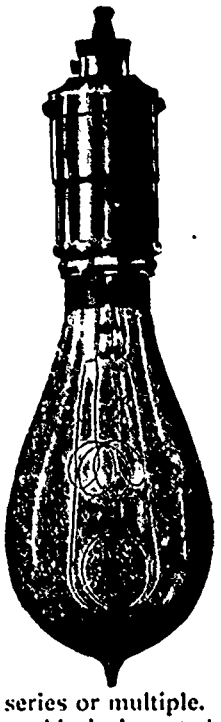
Theses submitted in this competition must reach the C. H. Mortimer Publishing Company of Toronto, Limited, Toronto, Ont., publishers of the ELECTRICAL NEWS, before the first day of October, 1899.

A competent judge has been chosen to decide the competition in accordance with the method explained above. This gentleman, whose name will be given at a later date, will no doubt be acceptable to all concerned.

The result will be published as soon as possible after the close of the competition.

The publishers of the ELECTRICAL NEWS reserve the right to publish such of the theses submitted as in their judgment may appear to be desirable for that purpose.

NEW REGULATING LAMP.



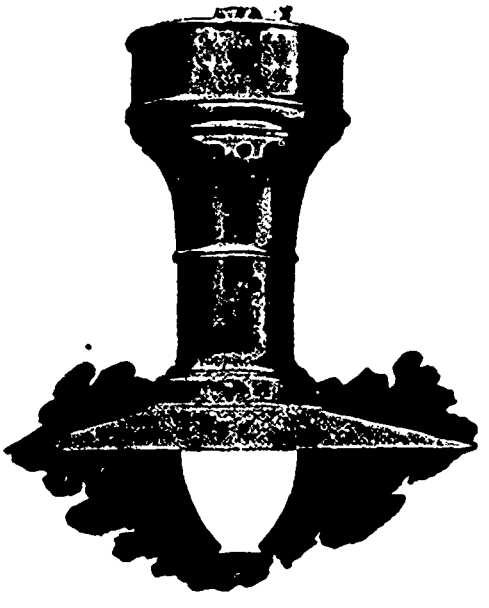
The Truitt regulating lamp which has just been placed on the market in Canada appears to be likely to fill a need which exists among electric light consumers, viz., that of being able to regulate the light of each individual lamp without having to pay for more current than is being used.

It is claimed for this lamp and socket, of which we give an illustration herewith, that it contains no coils whatever, consequently being vastly superior to the old style of regulating sockets, the coils of which were liable to become damaged or burnt out, and also wasting considerable current unnecessarily.

By using two separate filaments a slight turn of the lamp in its socket gives, first, a one candle power light suitable for a sick room or as a night light; the next light is eight candle power, then 16, and then 24, this being arranged by the different contacts in the socket connecting either of the two filaments separately or in series or multiple. A special socket is required so as to enable the lamp to be turned either way. No key or switch is used, as a further turn of the lamp cuts off the current entirely. We understand that Messrs Ness, McLaren & Bate, of Montreal, control the sole agency for Canada.

A NEW COMPETITOR FOR THE INCANDESCENT GAS LAMP.

We take pleasure in illustrating below a new competitor for the incandescent gas lamp, in the form of an enclosed arc lamp made in very miniature dimensions, and of an exceedingly neat and original design. This "Tiny Lamp," which is rapidly replacing cluster incandescent lamps, is only thirteen inches in length, and consumes only 275 watts per hour, giving about eight hundred candle power, and using considerably less



current than the average cluster incandescent lamps, and less than one-half of the amount used by the regular standard enclosed arc lamps made by the same company.

The station managers in many places are using these lamps in show windows and for store lighting at the regular prices—flat rate per month for the standard five-ampere enclosed arc lamps—and are claimed to be making a very material saving in operating expenses, while the customer is getting the same amount of light as he would from the large lamp with the double alabaster globes so commonly used. The customer is even better pleased if the central station is willing to reduce his current bill a trifle, and will hasten to explain the advantages of the new light to his friends, with the outcome of much good to all parties concerned. The "Tiny Lihtan Lamps" are made in a variety of styles, and are sold at reasonable prices. At the present time the factory, which is crowded with work, is being extended, and in a short time will have double its present capacity.

In their Tiny Lihtan lamp the manufacturers claim the easiest lamp to trim ever introduced, and a person once using them can readily appreciate the difference between the old and cumbersome methods of getting out the inclosing globes and replacing the new carbons in proper alignment. There is a very effectual automatic "cut-out" in the lamp, which prevents its being injured by letting the lower carbon burn down too far and breaking the inner globe. This is entirely new and original.

These lamps are being turned out in large quantities by the Safford Arc Lamp Manufacturing Co., of Buffalo, N.Y., and immediate shipments can be made. Circulars give prices and further particulars.

ELECRICAL TRANSMISSION PLANT FOR ORILLIA.

By a vote of 399 to 61, the property-holders of Orillia, Ont., on the 6th inst., decided in favor of installing the first long distance electrical power transmission plant in America, if not in the world, which will be owned and operated by a municipality. This plant, the construction of which will be begun immediately, will cost not less than $75,000, and is intended to convey the current generated at the Ragged Rapids, on the Severn river, to the town, a distance of over 19 miles. Eight hundred horse power will be delivered as a first instalment, but the system will have a capacity for delivering 1,000 horse power, and can ultimately be increased to a capacity for 3,000 horse power at comparatively small additional expense.

The hydraulic power was investigated by Mr. Wm. Kennedy, jr., of Montreal, who prepared general plans to govern reception of tenders, and the electrical plant and transmission line were designed by Mr. Roderick J. Parke, consulting electrical engineer, of Toronto, who also prepared the necessary plans and specifications for reception of tenders for these sections.

The contract for the entire equipment has been awarded to the Central Construction Co., of Buffalo, N. Y., at $67,200. The electrical machinery will be furnished through the W. A. Johnson Electric Company, of Toronto, the plant to consist of two 400 h.p. revolving field Westinghouse three-phase 60 cycle generators, each having an overload capacity of 60 per cent., provided with the necessary high tension switchboards and controlling apparatus. Six step-up 100 k.w. static transformers, self-cooling type, will raise the voltage to 22,000 for the transmission line. At the receiving station at Orillia there will be six step-down 100 k.w. transformers, of a similar type, to reduce the pressure to 1,000 or 2,000 volts, so that the alternating incandescent circuits now used for commercial lighting can be connected direct to the above transformers. There will also be provided a 25 h.p. Tesla induction motor, for driving the waterworks pump, now operated by steam, and a 50 h.p. motor of same type to drive the three Ball 25 light arc dynamos, which have been used for street lighting for some years. The switchboard apparatus, lightning arresters, etc., have been carefully selected and so arranged that uniform service and safety in handling can be relied upon, notwithstanding the high voltage.

The Stillwell-Bierce & Smith-Vaile Co., of Dayton, Ohio., are sub-contractors for the water wheels.

The plant will be installed under the supervision of Mr. Parke, who will have associated with him Mr. Chas. H. Mitchell, hydraulic engineer, of Niagara Falls, who will supervise the construction of the hydraulic plant at the rapids. The work will be pushed to completion with least possible delay, and it is expected to have the system in operation before the end of October next.

TELEGRAPH and TELEPHONE

NEW C. P. R. TELEGRAPH OFFICES.

THE business of the C. P. R. in Winnipeg having outgrown its office accommodation, steps were taken last fall to provide new quarters. The building at the corner of McDermott and Main streets was secured, and remodelled for the purposes of ticket and telegraph offices. A few weeks ago possession was taken by the staff. The installation of the plant, which is one of the most modern and up-to-date on the continent, was superintended by Mr. W. J. Camp, chief electrician of the company. On the ground floor is the city ticket office, the telegraph office, the private offices of the city manager, Mr. John Tait, and the general delivery office and messenger boys' head-quarters. On the second flat is the office of Mr. B. S. Jenkins and his assistants, while the fourth floor contains the large operating room, battery room, and other neccessary apartments.

The battery room contains 200 cells of storage battery of the chloride accumulator type, arranged in seven banks of 43 cells, each giving a current of 90 volts. There are also six larger cells used for the purpose of working the sounding or reading instruments. These cells take up the place of 2,400 cells of chemical batteries as used in the old office, effecting not only an economy in space and a saving in cost of maintenance, but giving a much more satisfactory current. It is expected that these cells will last four or five years, requiring during that time scarcely any attention.

The operating room contains 36 sets of instruments. Some of these are what is known as quadruplex, originally invented by Thomas A. Edison, but greatly improved by F. W. Jones, electrical engineer of the Postal Telegraph Company, by means of which four men work on one wire—two sending and two receiving. Thus four different messages are flashing back and forth on the same small wire, with never a collision or sign of confusion.

In order that the operator may hear only his own instrument, it is placed in a small box raised to the level of his ear, a device that does away with the old system of glass partitions. One peculiar feature of the room is the entire absence of wires, these being conveyed to the tables in cables that run under the floor. Above the switch-board is a large number of incandescent lamps, whose peculiar function is to light up when anything goes wrong on any one of the lines. The interruption is thus located without the trouble that would otherwise be occasioned.

The outside wires enter by cables which terminate in a row of porcelain fuse blocks and earth plates. By means of these any abnormal current, such as would be caused by the contact of the telegraph wires with electric light or trolley wires, is arrested and the circuit broken. Lightning is another source of abnormal current which, without these precautions, would ruin the instrument.

The fifty-two operators employed by the company in Winnipeg have means of recreation provided for them in the building in the shape of a reading room and billiard and pool room.

SHORT-CIRCUITS.

Mr. J. P. Gardiner, who has had charge of the Bell Telephone exchange at Kingston, has been promoted to the management of the Stratford office.

Seventeen telegraph poles on the C. P. R. line near Stittsville, Ont., fell down recently, owing the weight of ice on the wires. Telegraphic communication was completely broken off for a time.

A company has been formed to construct a telephone system in the counties of Iverness and Victoria, N. S. The company will make Baddeck their headquarters, and anticipate little trouble in raising the neceesary capital to carry out the project.

Mr. Ruben Stiber, who had been employed in the head office of the C. P. R. for 12 years, died at his home in Toronto recently. He was a well-known musician, and at different times filled the position of organist in some of the largest churches in the city.

Mr. H. P. Dwight, president of the Great Northwestern Telegraph Company, states that the general increase in Canadian business has caused a marked improvement in the business of his company all over the country. People are busy, and in consequence are using the telegraph wires to a greater extent.

The Bell Telephone Company has now about one and one-quarter miles of underground wires in the city of Hamilton. It is said that in the spring steps will be taken to double the present underground system, to meet the requirements of the increasing business and to relieve the pressure on the poles.

The Union Telephone Company, Limited, of Taylorville, N. S., has been organized to construct a telephone line from Middle Musquodoboit to Taylorville. Mr. Edger Archibald is president and Mr. Sidney Lindsey secretary-treasurer.

The Victoria & Esquimalt Telephone Company are about to make some improvements in their system at Victoria, B. C. A new switch-board will be installed, and as soon as this is placed in position the puttting in of a metalic circuit will be commenced.

A settlement has been reached between the Grand Trunk Railway and their telegraph operators. The result is, we understand, satisfactory to all concerned. The minimum salary will be as follows: Agent and telegrapher with dwelling, light and fuel, main lines, $38; branch lines, $35. Agent and telegrapher, without dwelling, fuel and light, main lines, $43; branch lines, $40. Telegraphers, main lines, $38; branch lines, $35; relieving agents who are on the permanent staff and are telegraphers, main lines, $50, branch lines $50.

The prospectus was issued in England recently of the Canadian, British Columbian and Dawson City Telegraph Company, Limited, with a share capital of £300,000. The directors are:—Sir James Grant, Sir A. P. Caron, Ottawa; J. H. Turner, M.P.P., Victoria, B. C.; Alderman J. Hyde, Mayor of Banbury; W. P. J. Fawcus, M.I.C.E., M.I.E.E., director Edison & Swan United Electric Light Company, London. The consulting engineer is Sir T. S. Tancred, Bart., C. E.; resident engineer, E. G. Woodford, C. E., late state mining engineer, Tranavaal; secretary, W. Young, 64 Victoria Street, London.

SPARKS.

The village of Kamloops, B. C., will probably purchase another dynamo for the electric light plant.

At Whitby, Ont., there is said to be a feeling in favor of installing a municipal electric light plant.

The Ottawa Street Railway Company are said to be considering the extension of their road to the rifle ranges.

Harry Pope, of Peterborough, Ont., while engaged in wiring a building in Montreal, fell a distance of 15 feet, breaking both his arms.

At the Parliament buildings, Toronto, a competitive test was recently made of the steam producing qualities of coal and compressed peat.

The Montreal Island Belt line Company have contracted with an ice dealer for the transportation of 35,000 blocks from Bout de l'Ile to Moneau street.

Mr. W. Sills, an extensive mica dealer of Chicago, announces that he has made arrangements in European countries for the reception of a large quantity of Canadian mica. The mica will be shipped direct from the mines near Ottawa to the European markets, and it is hoped to be able to compete with the India supply, which, on account of the cheapness of labor, is sold at a low figure. The methods of mining and transportation in India are crude, the entire operation being performed by hand. For this reason the Canadian product, worked by modern methods, should have the advantage in price on the European market.

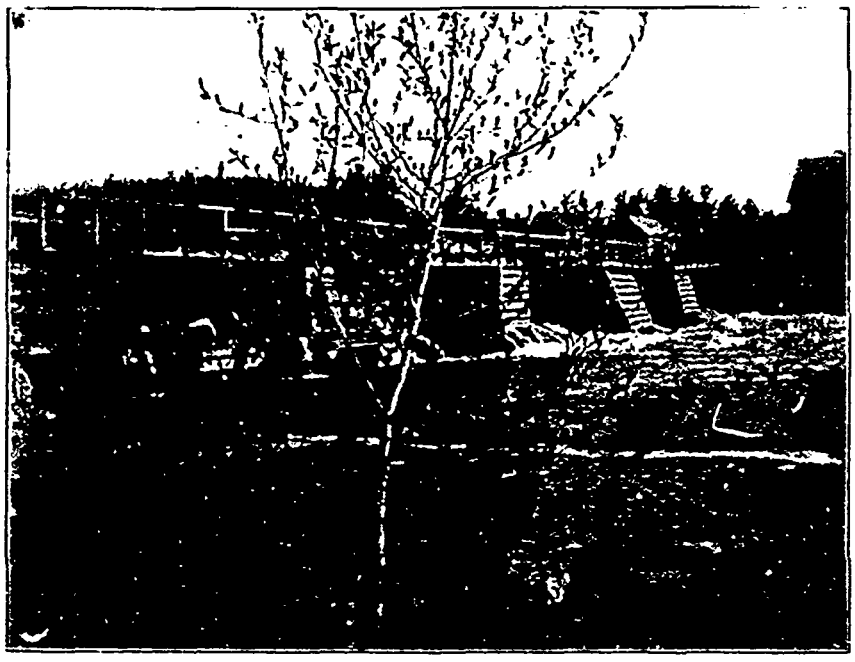
A neat automatic oiling device for the ordinary four-bar guides and crossheads of steam engines is made by drilling a hole through from side to side of the crosshead jaws through the middle of the wrist pin, tapping one side for an oil cup and the other for a plug. Then drill a hole in the top face of each jaw and one in the top of the wrist pin to intersect the long hole. If the pin is larger than the thickness of the jaws, plane a groove across the top of the hole to make the top of the three holes on the same level. The overflow will oil the top guides and pin. Another hole in each jaw clear through will conduct the oil to the bottom guides. A self-feeding oil cup or a wiping device can be used according to choice, or soft grease may be used instead of oil by having the holes drilled, the jaws intersecting the long hole, and by having a spring greace cup.

Acting under authority from the goverement, Mr. Phillips recently made an inspection of the Port Arthur Electric Railway. He has made a lenghty report on the condition of the road. He finds that on some portions of the line within the limits of Fort William there is no planking inside or outside the rails, and that on other portions the planking is in very bad condition, that the rails in places are about street grade, and the earth filling below the level of the rails, and that the ends of the ties are exposed. At some street intersections there are no crossing planks. Frogs at turnouts are not packed as required by law. The trolley wire, No. 4 copper, is too small, and it appears from the number of splices that there has been considerable trouble with the wire breaking. At places the wire is too low, being only 12 to 14 ft. above the rails; on account of the span being slack, the poles on the sides of the streets leaning toward the roadways owing to the soft nature of the soil, or imperfect setting. There is no guard wire over the trolley wire to protect telephone and telegraph wires from contact with the trolley wire. A great number of the insulators used in attaching the trolley wire to the span wire are in bad condition, and must allow the spad wires to become charged with electricity in a number of places.

WATER POWERS OF ONTARIO.*

By Thomas W. Gibson.

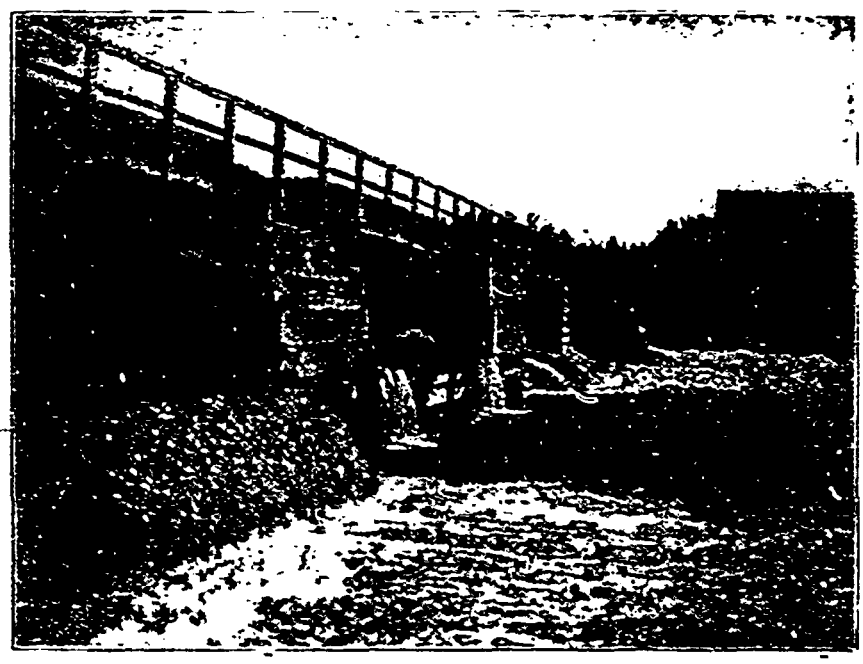
If Mr. Tesla's conclusion be correct, namely, that a waterfall affords us the most advantageous means of getting power from the sun for all our wants, excelling for this purpose not only muscular force, but wind and steam as well, the rocky uplands of northern and western Ontario may yet be reckoned among the most valuable parts of the province by reason of the vast number of waterfalls situated there. The main water-



Lower Dam and Bridge at Palmer's Rapids, on the Madawaska River.

shed dividing the system of the great lakes from that of Hudson bay runs in a northwesterly direction from the eastern boundary of the province north of lake Temiscamingue to the head of lake St. Joseph, on the northern boundary, a distance of about 500 miles. It consists of a tableland or plateau rather than a sharply defined ridge, and is estimated to have an average width of about 70 miles, or an area of about 35,000 square miles, thus with the slopes on both sides affording an extensive catchment surface for the streams running to the north and south. Its elevation will average perhaps 1,400 or 1,500 feet above the level of the sea, or 900 feet above lakes Huron and Superior. In places it approaches the shore of the latter lake, and for the greater part of its extent is situated at a comparatively short distance from either of these bodies of water. The consequence is that the rivers and streams which flow from it into the great lakes, though mostly of considerable volume, are not of great length, and their descent is therefore usually rapid and abrupt, and marked in many places by cascades and falls.

The value of a river of given volume for purposes of water power does not altogether, or even chiefly, depend upon the amount of its fall from source to mouth. Of course, the greater the fall the greater the energy possessed by the stream as a whole. But it is apparent that if the descent be gradual and uniform, or approximately so, there will be few places in its course where the fall is large enough to afford any considerable quantity of power. It is only where sudden falls or rapids occur, which create a decided difference in the level of the water, that the energy of the river is concentraded, as it were, within a short space, and can be utilized. The nature of the soil or surface of the country through which the river runs has an important effect in influencing the habit of the stream in this respect, and so determining its value as a producer of power. If it be composed of sand, clay, gravel or even the softer or more easily decomposed rocks, it will usually be found that the river has worn its bed to a fairly uniform slope throughout, in which case there will be few opportunities of developing power from its waters. Even if a slight drop should occur, a dam would probably be required in order to obtain any considerable head, and the erection of dams, while often necessary and advantageous, involves additional expense both in construction and maintenance. In a river whose bed is composed of hard rock, such as is usually comprised in the Laurentian and Huronian formations of northern and western Ontario, the eroding force of the water meets with much greater resistance, and its course is more likely to be marked by abrupt changes of levels in rapids and falls, and indeed this is characteristic of many if not most of the rivers in those parts of the province. Another prominent feature of the topography of these districts is the very large number of lakes, varying in size from mere ponds to large and important sheets of water. These are either



Section of Lower Dam and Bridge at Palmer's Rapids.

* From the report of the Ontario Bureau of Mines.

the sources of or tributary to the rivers, or expansions of them, and act as reservoirs or storage basins, tending to regulate the flow of the water and to render it constant and steady throughout the year.

The character of the country in northern and western Ontario is therefore such as to provide an almost illimitable amount of water power readily available. Taking into account the annual precipitation of moisture in the form of rain and snow, there is no reason to doubt that hundreds and thousands of horse power could be generated from the waters of streams flowing into the great lakes with a minimum of trouble and expense. A shorter watershed running from the main one southwesterly round the western end of lake Superior divides the streams falling into that lake from those which find their way into lake Winnipeg and so into Hudson bay, and the waters running in both directions from this divide furnish many fine water privileges, similar in character and equally available; while tributary to the Ottawa river, and in that part of the province included within the boundaries of Algonquin National Park, as well as to the south and west, are numerous rivers of considerable fall and volume, from which a very large additional amount of power could with little difficulty be obtained. The streams flowing into Hudson bay, such as the Albany, Kenogami, Missinaibi, Mattagami and Abitibi are of greater average length than those running into the great lakes, and as they descend to the level of the sea, say 600 feet below that of lakes Superior and Huron, many falls are to be found upon them, particularly in their upper reaches and in the neighborhood of the "long portages," where their waters are interrupted by the hard rocks of the old formations on their way to the more level Devonian plains bordering on James Bay. For the present, however, these rivers are too remote to be regarded as sources of available power, though the time may come when they will be called into requisition.

On the Seine, Atik-okan, Wabigoon, Winnipeg and Rainy rivers; on the Mattawin, Kaministiquia, Nipigon, Steel, Pic, Magpie and Michipicoton; on the Mississaga, Thessalon, Spanish, Vermilion, Wahnapitae and Sturgeon; on the Montreal, Ottawa, Petawawa, Bonnechere and Madawaska; on the Muskoka, Magnetawan and Severn; and on many others, there are numerous falls and rapids waiting to be utilized and capable of doing the work now being done by all the steam engines in Ontario a hundred or a thousand times over. This is leaving out of view the waterfalls already developed and in use in the older portions of the province, as well as the stupendous energies of the falls of the St. Mary and Niagara rivers, which are already, one on the Canadian and the other on the American side, to some extent made use of.

PRACTICAL USES OF POWER.

The rivers enumerated above are situated among the forests of pine and hardwood which cover so considerable a portion of New Ontario, and in many cases they are contiguous to valuable deposits of ore or mineral. The raw material for many industries lies around them. The sawmill, planing mill, sash and door factory, pulp mill, match factory and many other wood-working industries might happily combine abundant raw material and cheap power on these streams, while stamp mills and other mining plants might be worked with profit and success. Other industries, such as woollen, cotton and flour mills and chemical manufactories, might avail themselves of the cheap power without necessarily locating in the immediate neighborhood of the waterfall, by connecting themselves with it by means of the electric current, though for textile, paper and other industries whose processes necessitate the use of large quantities of clear water, a waterfall convenient to means of transportation forms an ideal site. Electrically driven railways seem likely to come into vogue in this and other parts of the world because of their low first cost and inexpensive maintenance, and it appears feasible to operate electric roads by currents generated by the waterfalls on the rivers in many parts of the districts referred to. Such railways might serve a very useful purpose in carrying lumber, ore, raw and finished material and supplies of all kinds in a country where perhaps the volume of traffic might not be sufficient to render an ordinary steam railway a profitable undertaking.

Water power, whether employed directly to operate machinery, or converted into electric energy for the same purpose, has many advantages over the steam engine. For the same quantity of power, its first cost is not usually much greater, and often not so great, and once installed it requires little or no attention. Its danger to life and property is less. It needs no fuel, a consideration specially important in Ontario, which has no coal beds, and where in time even the present abundant supplies of wood will be exhausted. Hitherto the chief disadvantage of water power has been its immobility. If a waterfall was not conveniently situated, it was of little or no use. If it did not pay to place a manufactory alongside a waterfall, the fall could not be brought to the factory. Now this has to a large extent been changed, and power can be delivered without serious waste many miles from where it is electrically produced. The change will be still more marked when the problem of transmitting electric energy through long distances has been thoroughly solved, and Nikola Tesla looks forward to a speedy solution.

The presence of so many available water powers in the Lake of the Woods, Seine river, Wahnapitae and other mining districts of Ontario is a fortunate circumstance and cannot but have a very favorable effect upon their development. Cheap power means economy in working, and will permit of ore bodies being profitably utilized which would otherwise not pay for treatment. The immense deposits of low grade ore which are found north of lake Superior and on the Upper Seine are in many cases situated in proximity to waterfalls capable of yielding hundreds and thousands of horse power at comparatively little expense. The importance of preserving these water powers as far as possible for the general benefit and preventing their being locked up in the hands of speculative individuals who would not use them themselves, but who would demand heavy toll for their use by others, has led to the adoption of new regulations under the Act respecting Water Powers, (61 Vict., chap. 8) passed at the last session of the Legislature. The principal features of these regulations are those which provide for the leasing of such powers by the Crown, instead of patenting them outright, and for the furnishing of surplus power by the lessee to others on terms to be fixed in case of disagreement by the Lieutenant-Governor in Council.

The full text of the Act, which was assented to January 17, 1898, and of the regulations, which were

apopted by order-in-council dated June 21, 1898, is as follows:

AN ACT RESPECTING WATER POWERS.

Her Majesty, by and with the advice and consent of the Legislative Assembly of the Province of Ontario, enacts as follows: The Commissioner of Crown Lands may reserve from sale any water power or privilege on the Crown Lands of the Province, and a sufficient area of land in connection therewith for the erection of buildings and plant, together with the right to lay out and use such roads as may be necessary for passage to and from such water power or privilege and land, and may under regulations be approved by the Lieutenant-Govenor in Council make terms and conditions upon which such water power and land so reserved may be sold or leased, and developed.

REGULATIONS RE WATER POWERS.

1. These rules and regulations shall not apply to water privileges which in their natural condition at the average low stage of water have not a greater capacity than 150 horse power.

2. In granting or leasing otherwise than under these regulations any Crown lands upon which a water privilege is situated, the said privilege shall be reserved to the Crown, together with such an area of land in connection therewith as shall in the opinion of the Commissioner of Crown Lands be required for the proper development of the same, and the construction of all necessary dams, weirs, tunnels, races, flumes, sluices, pits and other structures of works, and the erection of buildings and plant for the employment and utilization of such privilege, and storing grounds and yards in connection therewith; and there shall also be reserved in any such grant or lease the right to flood any such portion of the lands so granted or leased upon compensation to be made to the owner or lessee thereof by the person or persons to whom such privilege shall afterwards be leased; and the said water privilege, land and right so reserved shall form a separate property to be dealt with as hereinafter provided.

3. The right to lay out and use such roads as may be necessary for the passage to and from such water privilege or land shall be reserved in all grants or leases of contiguous or adjoining lands.

4. The applicant for a water privilege situated on Crown lands shall, if necessary, file in the Department of Crown Lands a plan and field notes by an Ontario land surveyor of survey thereof; and also a statement setting out:

(a) The location of the water privilege applied for, and a description of the land required in connection therewith.

(b) The height of the fall or rapid, the volume of water at the average high and low stages of same, the estimated capacity in horse power of the fall or rapid in its natural condition at the average low stage of water, the height of the dams or weirs (if any) which it is proposed to construct, and the increase in the level of the water which such dams or weirs will bring about.

(c) The nature and location of the business, plant or manufactory in connection with which it is proposed by the applicant to utilize the water privilege, and the number of horse power which the applicant proposes to develop and use (1) within two years, (2) within five years.

(d) The plan by which the applicant proposes to develop the water privilege, showing the dams, weirs, tunnels, races, flumes, sluices, pits and other structures of works which it is proposed to build or make in connection therewith, the estimated cost thereof, and the form in which the power is to be used or transmitted, that is, whether by direct energy, electricity, compressed air, etc.

(e) The land or lands which would be over-flowed or otherwise affected by the raising of the water or the construction of the dams, weirs, sluices, races or other works in connection with the development or use of such water privilege and the owner or owners thereof.

5. The Commissioner of Crown Lands shall have power to call for measurements, plans, specifications, descriptions, levels, profiles, elevations and all such other information as he may deem necessary for the proper consideration of the application, which shall be furnished at the applicant's expense. The plans and specifications for the construction of the necessary dams, weirs, tunnels, races, flumes, sluices, pits and other works for the development of such water privilege shall be submitted to the Commissioner of Crown Lands, if so required by him, and such works shall not be proceeded with until the Commissioner has approved the plans and specifications.

6. The applicant shall submit such proof of his financial standing and ability to develop the said water privilege as shall be satisfactory to the Commissioner of Crown Lands.

7. On approval by the Commissioner of Crown Lands of an application for a water privilege, he may order a lease of same to issue therefor, such lease to be for a term of ten years, with the right of renewal for a further term of ten years at the same rental, if the covenants and conditions have been performed and fulfilled, and thereafter with the further right of renewal for a term of twenty years upon such terms and conditions and at such rental as may then be provided by law or regulation.

8. The rental under any such lease shall be such sum as may be fixed by the Commissioner of Crown Lands, and shall be payable yearly in advance. Where application is made for the right to develop not more than half the maximum estimated capacity of a privilege at the average low stage of water as aforesaid, and where the granting of such application would not prevent or interfere with the development by other parties of the remaining capacity of the said privilege, the Commissioner may grant the same and may, if he thinks proper, reserve a portion of the land connected with the water privilege, provided that in any such case the Commissioner may issue a lease or leases for the remaining capacity of the said privilege, and the remaining lands connected therewith.

9. The right of timber owners and other to drive their logs down any river, stream or other body of water, as now by law established, shall not be interfered with, lessened or restricted by the granting of any such lease; and if any dam, weir or other structure be erected or built in connection with the development of any such privilege, with the object, intention or effect of damming the water or impeding the flow thereof, full and proper provision as now by law required shall be made by the lessee for the passage of logs and timber over and through same.

10. The lessee under any such lease shall not destroy or obstruct the navigation of any river, stream or body of water previously navigable, but shall provide such locks, canals, passages and other means as may be necessary for the proper and safe surmounting or passing of any dam, weir or other work made or erected by the lessee.

11. The lease shall provide—

(a) For the development and use within a period to be named in the lease of at least one-half the power proposed to be developed and used, and for the development and use of the full capacity of the privilege estimated as aforesaid, or of the remainder of the power proposed to be developed and used as the case may be, within a further period to be named in the lease.

(b) For the use by other parties than the lessee of surplus or unused water or power not required by him for the purposes of his business, plant or manufactory on such terms as may be agreed upon; and failing an agreement between the parties as to the terms and conditions on which such surplus or unused water or power may be used, and the remuneration to be paid therefor, the Lieutenant-Govenor in Council shall have power to fix and determine the same, and any Order in Council fixing such terms, conditions and remuneration, shall be final and conclusive and binding upon all parties concerned.

(c) For the erection and maintenance by the lessee of a durable and efficient fishway when so required by the proper officer or authority in that behalf.

(d) Failure or refusal of the lessee to comply with the conditions of the lease, or default in payment of the yearly rental for ninety days after the same falls due, shall work a forfeiture of the lease.

(e) During a continuance of the lease, the lessee shall keep and maintain all dams, weirs, tunnels, races, flumes, sluices, pits and other structures and works necessary for the development and use of such privilege in good repair and condition, and shall not wilfully or otherwise injure or destroy the same or any part thereof, but at the expiry or sooner determination of the said lease, shall leave all such structures and works in good repair and condition, and so that their subsequent usefulness shall not be lessened by any act of the said lessee.

(f) At the expiry or sooner determination of the lease, the water privilege shall revert to and become the property of the Crown as fully as if no such lease had been granted, together with all dams, weirs, tunnels, races, flumes, sluices, pits and other structures or works made or erected by the lessee in connection therewith, and all buildings erected on and covered by the lease; but the lessee shall be allowed a reasonable time to be fixed by the Commissioner of Crown Lands in which to remove all machinery employed by him in the development and use of the privilege, failing which removal such machinery shall become the property of the Crown.

(g) Where there is more than one applicant for a water privilege the Commissioner of Crown Lands may, at his discretion, put the same up at public auction or tender, subject to the foregoing conditions, to be awarded to the highest bidder or tenderer for a lease thereunder.

(h) If at any time or times after the water privilege has been developed, either in whole or to the extent to which the lessee is bound by the lease to develop the same, the said lessee shall continuously neglect for the space of one year effectually to produce power from the said privilege, either for his own use or for that of other persons, unless hindered by unavoidable accident, the Lieutenant-Governor in Council may order and direct the said lease to be forfeited and cancelled.

12. Where a water privilege is applied for by a municipal corporation for the purpose of supplying water, power, light, or heat for the use of the inhabitants thereof, the Commissioner of Crown Lands may issue a lease of said privilege to such corporation if otherwise entitled to receive and hold the same, on such special terms and conditions and at such rental as he may deem proper.

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

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

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TORONTO BRANCH NO. 18.—President, John Dixon; Vice-President, John H. Venables; Recording Secretary, Thos. Graham, 570 King street west.

MONTREAL BRANCH NO. 1.—Meets 1st and 3rd Thursday each month, in Engineers' Hall, 1863 Craig street. President, Geo Hunt; 1st Vice-President, Wm. Ware; 2nd Vice-President, J. G. Robertson; Secretary, Henry Wilson; Treasurer, Thos. Ryan.

ST. LAURENT BRANCH NO. 2.—Meets every Monday evening at 43 Bonsecours street, Montreal. R. Drouin, President; Alfred Latour, Secretary, 306 Delisle street, St. Cunegonde.

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

HAMILTON BRANCH NO. 2.—Meets 1st and 3rd Tuesday each month in Maccabee's Hall. Wm. Norrie, President; G. Mackie, Vice-President; Jos. Ironside, Recording Secretary, Markland St.

STRATFORD BRANCH NO. 3.—John Hoy, President; Samuel H. Weir, Secretary.

BRANTFORD BRANCH NO. 4.—Meets 2nd and 4th Friday each month. Arthur Ames, President; T. Pigrim, Vice-President; O. S. Merrill, Brantford Carriage Co., Secretary.

LONDON BRANCH NO. 5.—Meets on the first and third Thursday in each month in Sherwood Hall. Duncan McKinley, President, William Blythe, Vice President; W Allan, Secretary.

GUELPH BRANCH NO. 6.—Meets 1st and 3rd Wednesday each month at 7.30 p. m. H. Geary, President; Thos. Anderson Vice-President; H. Flewelling, Rec.-Secretary; P. Ryan, Fin.-Secretary; Treasurer, C. F. Jordan.

OTTAWA BRANCH NO. 7.—Meet every second and fourth Saturday in each month, in Borbridge's hall, Rideau street; Frank Robert, President; T. G. Johnson, Secretary.

DRESDEN BRANCH NO. 8.—Meets 1st and Thursday in each month. Thos. Steeper, Secretary.

BERLIN BRANCH NO. 9.—Meets every Friday evening. G. Steinmetz, President; J. Heyd, Vice-President; W. J. Rhodes, Secretary, Berlin, Ont.

KINGSTON BRANCH NO. 10.—Meets 1st and 3rd Thursday in each month in Fraser Hall, King street, at 8 p.m. President, F. Simmons; Vice-President, C. Asselstine; Secretary, J. L. Orr.

WINNIPEG BRANCH NO. 11.—President, G. M. Hazlett; Rec.-Secretary, J. Sutherland; Financial Secretary, A. B. Jones.

KINCARDINE BRANCH NO 12.—Meets every Tuesday at 8 o'clock, in McKibbon's block. President, Daniel Bennett; Vice-President, Joseph Lighthall; Secretary, Percy C. Walker, Waterworks.

PETERBOROUGH BRANCH NO. 14.—Meets 2nd and 4th Wednesday in each month. W. L. Outhwaite, President; W. Forster, Vice-President; A. E. McCallum, Secretary.

BROCKVILLE BRANCH NO. 15.—Meets every Monday and Friday evening, in Richards' Block, King St. President, John Grundy; Vice-President, C. L. Bertrand; Recording Secretary, James Aikins.

CARLETON PLACE BRANCH NO. 16.—Meets every Saturday evening. President, Jos. McKay; Secretary, J. D. Armstrong.

Mr. Tesla and His Critics.

FOR having been so bold as to call i question some of Mr. Nikola Tesla's recent statements before the Electro-Thereapeutic Society, the New York Electrical Engineer has called down upon its head a storm of personal abuse from the pen of the erstwhile brilliant experimenter and inventor. It is gratifying to observe that some of the leading electrical journals refuse to print the illogical and abusive epistles which Mr. Tesla is seeking to hurl at the heads of the editors who have offended him. The fact is that Mr. Tesla has of late talked a great amount of nonsense, which, nevertheless, owing to the position which he occupies, or has occupied, is calculated to temporarily unsettle the value of electrical investments. He has promised to do a great many things which he has failed to do, and in consequence has lost caste with the electrical fraternity. It was time that he should be "called down," and the Electrical Engineer is entitled to credit for having performed the disagreeable task in a gentlemanly manner.

Electric Railway Development in Toronto.

IMMEDIATELY following the approval by the citizens of Toronto of a by-law authorizing an expenditure of $150,000 for the building of a public market, comes the proposal of the Toronto Railway Company to construct a system of radial electric lines connecting the city of Toronto with all parts of the county of York. Whether viewed from the standpoint of the city resident or of the farmer living in the county, the carrying out of both these enterprises seems to be highly desirable. It is somewhat doubtful whether a modern market established on so large a scale as is proposed could be successful in the absence of a system of radial electric lines which would make tributary to it the products of one of the richest agricultural counties in Canada. On the other hand, the market is almost if not quite as important an adjunct to the success of the electric railway enterprise, as the necessary freight cannot be obtained unless an outlet be provided for its disposal in Toronto. The success which has attended the operation of the Hamilton, Grimsby & Beamsville road affords strong foundation for the belief that a system of radial lines, having as their terminus in Toronto an extensive and well managed public market, would be certain to prove a paying investment.

Niagara Power.

BUFFALO capitalists are reported to have engaged the President of the Franklin Institute, Mr. John Birkenbine, to prepare plans for the utilization and transmission of 35,000 h.p. from the Whirlpool Rapids below Niagara Falls. At this point, where the speed of the current is 21.75 miles per hour, it is proposed to divert five per cent. of the flow of water through a canal to be built inside the tracks of the Gorge road. The scheme is no doubt a feasible one. The greatest problem would seem to be to find a profitable market for so much power in addition to that which is now being produced at the Falls. Representatives of New York and Philadelphia capitalists waited upon the Commissioner of Queen Victoria Niagara Falls Park on the 4th inst. for the purpose of seeking to acquire the power franchise now held by the Cataract Construction Company, in case the present holders should forfeit their rights.

Fires from Electric Wires.

EITHER maliciously or through ignorance, the Fire Commissioners of Montreal have, in their annual report, endeavored to injure the business of electric lighting in that city, by attributing to defective wiring the bulk of the fires which occurred in buildings in the year 1898. The statements made by the commissioners are so unreasonable as to require no refutation by the trade, and it is probable for this reason that no action has been taken. Of a total fire loss during the year of $1,382,753, the commissioners attribute to electricity a loss exceeding $1,000,000, in the following words: "During the last year from this source alone the losses by fire have been greater by over $1,000,000 than from any other causes." The statement made is absolutely and unqualifiedly untrue. There is no basis or warranty for the statement that electric wires have caused greater losses than other causes, and particularly is there no basis for the statement that the losses from electric wires have been greater by one million dollars than by any other causes. If the statement concerning electric wires were true, then the losses from all other sources would be less than $383,000. The report states the number of fires investigated to have been 567; the number alleged to have been caused by electric wires 29, or only about 5 per cent. of the entire number. If the 29 fires alleged to have been caused by electric wires caused a loss of over one million dollars, that would mean an average loss per fire of about $35,000, whereas the losses from the other 538 fires would average only about $700 per fire. As a further evidence that the report is not based upon facts, we may say that the Fire Underwriters' Association at Montreal is not willing to incur the expense of a corps of inspectors for electric light wiring, and the insurance companies will not refuse to give insurance to parties who have not received a certificate from the Board of Fire Underwriters that their wiring is in accordance with the rules and regulations. The Board of Fire Underwriters do not believe that the danger to be apprehended, as determined by their experience in the past, is sufficient to warrant their incurring this expense, and in fact, the committee of the Canadian Electrical Association who have taken up the matter of underwriters' inspection have been unable to make any progress with the underwriters because of their apathy on the subject. If it were true that the 29 fires alleged to have been caused by electric wires had caused a loss of more than one million dollars the public might rest assured that in self defense the underwriters would take hold of the matter vigorously; as it is, the only inspection that is insisted upon is that which the operating companies themselves undertake to apply. We trust we have said sufficient to show the utter absurdity and untruthfulness of the report. We observe that the Canadian Fire Underwriters' Association has submitted a memorial to the Montreal City Council urging that body to obtain the necessary legal authority to have all electric wiring executed under the supervision of an inspector, to be paid by means of a small inspection fee. It is very improbable that any resistance would be offered to the course by the competent wiring contractors, who are equally interested with the public and the insurance companies in securing perfect work. Those unable to do such would be forced out of the business, to the advantage of all concerned.

Canadian Electrical Association.

THE Executive Committee of the Canadian Electrical Association especially desire that the coming Convention, to be held in Hamilton, Ont., in June, shall be of the utmost practical value to every member, whether operator, manager or owner of an electrical enterprise. With that purpose in view, it is intended that the subjects of papers to be read and submitted for discussion shall be those which appear to the members to be of most interest and of practical utility. Request has been made of the members to advise the Secretary what topics they would like to have discussed, and from what point of view. Already a number of valuable suggestions have been received, as well as the promise of several papers. A meeting of the Executive Committee will be held at an early date to consider the necessary arrangements for the approaching meeting and appoint sub-committees to carry them into effect. It will be remembered that Hamilton was the scene of the first convention of the Association. Since then the city has become the home of many important electrical enterprises. The Hamilton, Grimsby & Beamsville Electric Railway stretches a distance of more than twenty miles through the vineyards and orchards of the Niagara Peninsula; the Hamilton & Burlington Electric Railway operates between the city and the far-famed Burlington Beach; the Hamilton & Dundas Electric Railway affords the visitor views of the picturesque Dundas Valley. The Bell Telephone Company's exchange, which so interested the members at the former convention, has since undergone many improvements, and is an up-to-date object lesson in telephony. In addition to these and other interesting features of the city which might be mentioned, full opportunity will be given to inspect the entire equipment of the Cataract Power Co., described and illustrated in these columns recently. Those of our readers connected with any department of the electrical industry, who may not yet have become members of the Canadian Electrical Association, should join now, and share in the pleasure and profit of the approaching convention.

The Corporation of the Town of Bothwell have awarded a contract to the Canadian General Electric Co., for a 500 light plant, to be used for commercial and street lighting purposes. The lighting of the streets will be done by 15 enclosed arc lamps, of the latest type, which will be operated from the same machine.

MONTREAL

(Correspondence of THE CANADIAN ELECTRICAL NEWS.)

SUBMARINE TELEGRAPHY.

Dr. A. E. Kennelly, of Philadelphia, delivered four lectures at McGill University on January 30th and 31st, on "Submarine Telegraphy." The lectures were extremely interesting, and were largely attended, not only by students of the University, but by electrical people of the city. I am indebted to Prof. Owens, of the Electrical Department of the University, for the following brief abstract:

The history of submarine cable telegraphy is replete with interest, not only to the student of electromagnetics, but also to the student of sociology. Its annals indicate the immense amount of labor which has had to be expended by a large number of men in the best years of their lives' work, in developing conjointly the knowledge and experience which now enables us to set geographical time and space at defiance.

Practically all of this work has been accomplished during the last half of the century which is now about to close. The first submarine cable stretched timidly across the Straits of Dover about the year 1850, consisting of but a single copper wire, insulated with gutta percha. It had no mechanical protection of any kind. Although the cable lasted but a few hours, being destroyed either by the violence of the elements or the hook of an unkind fisherman, nevertheless it demonstrated its electrical capabilities, and paved the way for greater successes in the years to come.

It was not long before shallow water cables spread themselves around the shores of the Mediterranean, and in 1859 the first cable bridged the depths of the Atlantic. This was, indeed, a triumph of electrical engineering at that time, but the triumph was short lived, since the cable died a natural death in a few weeks' time. It was replaced, however, by a far better cable, in 1866, the experience of the earlier trial having come to fruition, and since that time Europe and America have never been beyond speaking distance.

At the present time there are some 150,000 miles of cable laid throughout the world, and a fleet of more than thirty telegraph ships is employed to minister to their needs. Although this length of cable would be sufficient to girdle the world some six times, yet the actual girdle is incomplete at present, at the Pacific ocean, but it is now confidently expected that ere long this gap will be completed by a cable from the western coast of America to China or Japan.

The amount of the capital which has been expended in the enterprise of cable laying will be evident from the fact that cable costs roughly about one thousand dollars per mile.

Enormous improvements have taken place in the speed of signalling or telegraphing through cables, since the ocean was first spanned, a great deal in this direction being due to the inventive skill of Lord Kelvin. The mirror galvanometer instrument, which is so valuable an adjunct in the electrical laboratory, has been yet more valuable to the electrical fraternity in the operating room, as a commercial signaling instrument, while the siphon recorder of later date has caught the fitful flickerings of the beams of light, and has left their record traced upon a moving band of paper.

There is no difficulty in laying a cable anywhere, but there is a considerable difficulty in laying a cable in such a manner as to minimize the risk of its fracture after being laid. It is a matter of experience that wherever a cable rests upon a rock, it will break, and its rupture is only a question of attrition and time. Those who build upon rock, so far as cables are concerned, build to their destruction, while only those who build upon sand can expect dividends. The course on which a cable is to be laid should be thoroughly investigated beforehand, by a ship which makes a zig-zag path over the course, and sounds at frequent intervals so as to insure the provision of a smooth and soft bed, on which the cable shall be laid to rest, otherwise its slumbers will be interrupted by the rude shocks of rupture.

The size of a cable, and therefore to some extent its cost per mile, varies with the depth of water and the nature of the bottom. In deep water a cable is made slender and light; in shallow water it is made of relatively great weight and diameter, with large protecting steel wires to resist attrition.

The speed of signaling does not become any serious consideration until a cable is several hundreds of miles in length; in other words rapid speed of hand signaling can be obtained over almost any kind of practical submarine cable up to a length of several hundred miles, but after a length of, say, five hundred miles has been passed, it is necessary to employ delicate apparatus, and with long cables it is necessary to employ a comparatively large size of copper wire or strand conductor and insulating gutta percha envelope.

There is scarcely any series of engineering operations which has a greater fascination or possesses more romantic interest than submarine telegraphy, in the picking up or repairing of cables. It is governed largely by time and tide and weather, and its fortunes are governed by a great variety of circumstances; nevertheless, cables have been successfully repaired in the deepest water to which they have yet been committed. The expense of repairs in deep water, say in two miles of water, is naturally much greater as a rule than the expense of repairs effected in shallow water, while in some cases very shallow water repairs may be effected in a small boat or sailing yacht, at an expense that is relatively trivial.

COMPETITION FROM UNITED STATES.

We are credibly informed that the contractors for the new London & Lancashire Insurance building, themselves American, have engaged a Boston firm to do the electric light wiring. While this is a matter more nearly affecting Montreal electrical contractors, it evidently affects all Canadian building contractors to know that whilst American workmen can be brought over here, literally taking the "bite out of the Canadian workman's mouth," the alien labor law prevents our returning the compliment and sending our men to do work in the States. Surely "what is sauce for the goose is sauce for the gander," and there should be some way of remedying such a glaring anomaly. The sooner our contractors see to it the better for their own interests. "Verb sap."

QUESTIONS.

"Subscriber" writes: "I have a General Electric induction fan motor, 16,000 alternations, 52 volts. Tried to run it on 8,000 alternations, 52 volts, by putting kicking coils in series. Kicking coil wound with same size of wire as fields of motor. Leaving the matter of speed out of the question, why should armature of motor heat excessively after a short run, and fields remain cool? On 8,000 alternations, with kicking coil in series, armature appears to be a block of laminated iron with pieces of No. 10 copper wire threaded through."

"Doctor" asks: "Why does sparking with explosive reports happen in mercury cup of Rumkhoff X-ray apparatus? Six cells of accumulators are used, and a subsidiary battery of two cells to work interruptor. Main current appears to enter the Rumkhoff coil via the pillar of the interruptor and mercury contact cup, in which a pointer, attached to arm of interruptor armature, dips. On top of the mercury in cup is placed a layer of alcohol. When interruptor and coil are in action, loud sparks are heard in cup, accompanied by flashing in the Crookes tube."

THE VOLTAGE MAGNIFIED.

In your Montreal news in January there is surely a slight inaccuracy in the item "A Charmed Life." The wire was amply large enough, no matter what its size was, to carry 2,500 volts. The current which it was carrying in amperes was not mentioned, but it would not take much of it at pressure named to seriously injure a man That the voltage received was actually 2,500 is very much open to question. There was iron wire acting as a conductor, which in itself had considerable ohmic resitance, not to speak of its kick-back effect with alternating current; further, the original contact was probably of an arcing nature, and by no means what might be called "good contact."

THE FIRE COMMISSIONERS' REPORT.

Your correspondent had hoped that an official refutation would have been given before now to the late report of our Fire Commissioners, so far as amount of damage said to be caused by electric wires is concerned, but it has evidently been treated with the silent contempt that such an extraordipary statement merited. The Commissioners must say something to retain their sinecures, and evidently act on the rule "when in doubt, blame electricity." For the satisfaction of your readers, I have interviewed one of the inspectors (whose name, for obvious reasons, I do not give), and one who is competent to give an opinion on this subject, which, with all due deference to them, our noble Fire Commissioners are not. His answer was that "that portion of report was simply ridiculous"—to which I must heartily say "Amen."

NOTES.

One of the "deadly electric wire" fires chronicled in the daily press here as having occurred at the Balmoral Hotel turns out to be from grease upset on a stove. As the idea is popular, however, none of the papers have had the temerity, so far, to make retraction.

The plant mentioned in your "Sparks" column, January issue, for the C.P.R. steamship Alberta, is well under way, the dynamo and switchboard being supplied by the Canadian General Electric Company, and the wiring being executed by the Montreal Electric Company.

Mr. P. H. Hover, representing the New York Insulated Wire Co., was in Montreal lately, reminding his friends of the fact that rubber covered wire is "moving up," and that rapidly. He seemed to have his pockets well filled with orders, judging by his jovial smile.

Mr. White-Fraser apologizes for his late comments on the London specifications. Although late in one sense, they are indeed timely, as, judging by conversation here, your correspondent can safely say that he has struck the mark by calling a "spade a spade," and the trade applaud his criticism.

Mr. S. A. Chase, of the Western Electric Company, New York, was in Montreal last month. He reports business booming, his company having lately purchased more land and intend building at once a factory larger than either that on Thames street or Bethune street. Mr. Chase is managing the Canadian Bryant Company's factory in Montreal at present.

Mr. Hallberg, of the Standard Thermometer Company, of Peabody, Mass., paid a visit to this city a fortnight ago. He spent most of his time at the headquarters of his Montreal agent, Mr. John Forman. Mr. Hallberg is a Swede by berth, and well posted in matters electrically. He is the inventor of the Upton arc lamp, enclosed type, which is already to be found in many places of business in Montreal.

Of ill luck the Lachine Rapids Hydraulic & Land Company have had more than their share. After keeping up service through particularly trying weather, such as 20° below zero one day and 40° above the next, they have had their "head" lowered by a jam occurring, which has raised the water, and which does not seem to want to move off quickly by aid of nature alone. It is hard luck, and they have the sympathy of the public at large; meanwhile, "it is an ill wind that blows nobody good," and the Royal Electric Co., their opponents in the field, are reaping the benefit of the misfortunes to the Lachine Co., which, however, now appear to be about at an end.

SYSTEMS OF METER RATES.*

By Edwin J. Dekell.

The study I have been able to give this subject has greatly increased its importance in my estimation, and impels me to urgently advise all central station operators to give it more serious consideration than it has yet received. We all know that our properties are operated at a poorer rate of economy than any other class of power plants, being in effective operation only a few short hours out of each twenty-four. Have we given due consideration to the cause of this defect; what means, if any, be employed to remedy it, and a surprising amount of benefit would result thereby to ourselves and our customers? I think not, and the object of this paper will be an attempt to show how these conditions are effected by the systems of rates employed.

The contract, or flat rate system, although still in quite extensive use, is neither logical or satisfactory. In the early days of electric lighting the service was employed mainly in the business places, and only the number of lights needed for regular daily use were installed; lamps were all of one size, and the station usually run until twelve or one o'clock at night. Under these conditions, flat rates were fairly successful, and could not be greatly abused. The fixed charges on the property, however, were very high for each hour of operation, and high rates had to be charged.

Nowadays the use of the service is more varied. Business places require a large number of lights for display and other occasional use, and we are called on to supply current to dwelling houses, shops, churches, halls and other intermittent consumers. Lamps are supplied in sizes from 2 to 50 c. p., and most of our stations are now operated all night, if not the entire twenty-four hours daily. Under these changed conditions, the flat rate privileges can be, and are, grossly abused. The central station is not only compelled to supply a large quantity of current for which no pay is received, but also to invest additional money in machinery to supply it.

The justice of charging each customer for the exact quantity of current used, and the employment of suitable devices for ascertaining that quantity, cannot be questioned. The number of recording meters installed within the past few years, and the constantly increasing use of them, indicates clearly that this is generally accepted as the true basis on which to frame the charge for electric current.

This proposition being accepted as true, we now come to the main question involved in this paper. What system of rates will be most just and satisfactory to our customers, and at the same time maintain and improve our present earnings?

First, let us study prevailing methods and see if they are founded on the true cost of production. The usual custom is to charge a fixed rate per unit, with discounts proportionate to the quantity used. The rate per unit has been determined either by the present average cost of the total units produced, by estimation, or by the rates in most general use by others. In any case, the cost has been made to include all fixed expenses on the property, such as interest, taxes, insurance, management, clerical work, etc., and which generally amount to 75 per cent., or more, of the total cost of each unit produced. As the great bulk of the station's output is accomplished in three or four hours of heavy load each day, a like proportion of the fixed expenses are charged against that period. Thus, according to our own calculations, each of the remaining twenty or twenty-one hours has to stand but a small fraction of the fixed expenses, yet we charge our customers the same amount for each unit used in those hours as in the heavy load period. The process is one of average, and does not distribute the expense ratably to each customer.

It may perhaps be claimed that the process is fair on account of the manner in which we have to operate our stations, but it is a matter of great doubt whether this manner of operation is responsible for the present system of rates, or if the rates are responsble for the poor operation.

When we charge nearly all of our fixed expenses against the current used during a few hours, and then assess it again on each unit used in the remaining hours, it makes the cost of the service especially burdensome, if not prohibitive, to those using it for long hours at a time. These customers are the most valuable to the central station, and should be encouraged by every possible means. We should do everything we can to keep them, and to secure more of them, as they keep our investment employed a longer time each day and add to our receipts, without any increase whatever in our fixed expenses, and very little in running expenses.

Let us study how a system of differental rates would affect this question. In order to apply such rates we first have to determine *the total cost of production per unit, including fixed and running* expenses of every kind. Next determine how much of the cost is for fixed expense and how much for running expense. If exact records of the costs have not been kept, a close enough estimate can undoubtedly be made to answer the purpose. It will be found that the running expenses form but a surprisingly small portion of the whole. This is not a supposition or guess work, but has been proved by the records of many well conducted stations.

The report of an examining board to the authorities of Aberdeen, Scotland, in 1897, gives some very interesting arguments on this feature. They refer to the poor fate of economy of the electrical plant owned by that city, and compare it with their gas works. They show that the former has to install and hold ready for use generating machinery sufficient to meet the maxium requirements of all their customers at any given moment; that their plant had a capacity, if run twenty-four hours daily, the same as the gas works, sufficient to supply three and three-fourths millions units per year; yet in the preceding year, only 214,000 units, or less than 5¾ per cent. of the capacity of the works, had been supplied. A load diagram of the station was shown, almost identical with those common to our own stations. The opinion of the board was that this unfavorable condition would be improved by a varying or differential system of rates, based on the true cost of production and giving discounts according to value of the customer to the station, in contradistinction to the total quantity consumed.

They submitted a statement showing a comparison between their best and worst customer for the preceding year. The best was a comparatively small consumer of current, employing less than two horse power of the station's capacity, less than $400 of its capital, and chargeable with but $27.50 of the annual capital

*Paper read before the Northwestern Electrical Association.

charges. He employed the service for 2,000 hours during the year, however, producing a revenue of $288, or about $260 over capital charges.

The other employed 177 h. p. of the station's capacity, nearly $37,000 of its capital, and was chargeable with $2,582 of the annual capital charges. He used the service 61 hours during the year, paying therefor $823, or less than one-third of his portion of capital charges.

These are undoubtedly extreme cases, one showing a very large load on the station for about twelve minutes, and the other a small load for six and two-thirds hours per day for 300 days in the year. The system of rates recommended by the board would compel the larger customer to pay a very much higher rate, or to abandon the service and make way for customers of the other class, who would be encouraged by the lower rates the system would give them.

Mr. Arthur Wright, electrical engineer to the corporation of Brighton, England, and originator of the Wright demand indicator, gives some figures covering the ratio of fixed and running expenses in the Brighton plant, in a phamplet published in 1896.

To show what a small portion of the total cost of production lies in running expenses, and why it follows that the output of a station can be enormously increased with only a small addition to total expenses, he has selected and given figures on two periods of three months each, one ending July 31, and the other Dec. 31, 1895. In the first period the cost of coal and engine stores amounted, in round figures, to $2,500, and the station supplied 110,000 units. In the other period, coal and engine stores cost $6,000, and the station sold 366,000 units. The fixed expenses were alike in each period, and with the possible omission of some unimportant items, the running expenses were increased only $3,500 to increase the output of the station three and one-third times. The company's record show that of the total cost of operating the Brighton plant in 1895, less than one-sixth part was for actual running expenses. This is the ratio, with coal at $2.50 per ton, and Mr. Wright states that at the lower cost of coal in nearby towns, it would be less than one-ninth.

To come back to the application of the differential rates. After fixed expense has been determined, a ratable portion should be charged against each customer. A number of devices have been introduced to determine this ratable portion, further reference to which will be made later on. A sufficient rate is to be charged to cover both fixed and running expenses, until the customer has paid his share of fixed charges, after which the rate may be reduced so as to cover only the running expense incurred in supplying him, with, of course, a reasonable profit added. The plan does not necessarily reduce rates, except to such customers as are found profitable at reduced rates. Those who use a large quantity of current at different and irregular intervals, or whose demand is largely during the hours of the station's heavy load, would not be affected in that way, and by the use of some of the devices employed the most undesirable of such consumers would be subjected to a higher rate. The tariff may be arranged to suit varying local conditions, as in present methods.

The main object to the differential rate, and which, if accomplished, is obviously of the greatest importance to all central stations, is to induce longer hours for our product, and enable us to make special low rates to those who can find use for current during our slack hours. Our best customer is he who employs our capital the greatest number of hours per day, and our present rates are calculated to repulse, rather than encourage him. He now uses as little current as possible, and that usually at the time when it is most valuable to the station. The remainder of the time, when we would be making most profit, even at a low rate of charge, he "pieces out" with other kinds of light or power.

How plain it is to us when we pass a store in the evening and see in use only a few of the electric lights installed, that our revenue from that store is but a fraction of what it used to be, while our expenses go on the same as before. We feel this still more acutely when we see our service dispensed with entirely, and who of us can say that such sights are uncommon? Observation will prove that those most inclined to give up the service are meter customers running long hours, the very ones the station can least afford to lose.

In considering the adoption of differential rates, local conditions should be studied. If little or no demand can be found for current during the station's slack hours, even at a very low rate, the success of the system would be doubtful. If, on the other hand, a large demand could be worked up, the system would be highly profitable to the station and prove satisfactory to the public. The hours of effective operation would be increased, without any increase at all in fixed expenses. So large a part of the total cost is incurred in getting ready to supply current, and so little in actually supplying it after the machinery is started, that if central stations could be operated continuously up to their capacity, they could produce current so cheaply as to render competition out of the question. Of course, this is an ideal condition and will probably not be reached in the near future, if ever. It should be possible, however, to improve existing conditions to quite a large extent, and think we should not cease our efforts until we have found work for our stations that will materially increase their output through prolonged hours of operation. It seems clear that only by this means can we increase our business or even hold what we now have. If we can accomplish this, even to a moderate extent, it will so decrease the cost of production per unit that each of our present consumers could have more current at the same, or less, cost than now, and the remainder, even if sold at a very low rate, would bring sufficient revenue to largely increase the station's profits.

New business for our maximum load period will not accomplish this, as it entails an almost proportionate increase in fixed charges and does not extend the hours of operation. A system of rates giving the service, to customers who can use it outside of rush hours, at prices they can afford to pay, seems to be the most logical and feasible way. It may not appear an easy matter to find such customers, but if we first thoroughly inform ourselves how extremely low we could really afford to make the rates for a fair quantity of this class of business, the difficulty would not appear so great.

As to the devices intended to carry out the plan of differential rates, they are of several forms. The Wright demand indicator, as its name implies, records the greatest amount of current issued by a customer at any one time, the theory of its use being that such maximum demand on the station should regulate the portion of fixed expenses to be borne by the customer. It is assumed that the customer will use his maxmium demand a certain length of time each day, coincident with the maximum station load, and for that much of the total amount consumed he should pay a rate sufficient to cover fixed and running expenses. For the balance consumed, as shown by the usual recording meter, a lower rate is charged.

The double recording, or two-rate meter of the General Electric Company, appears to be their regular type with the addition of an extra set of dials and a clock mechanism. The clock is wound half-hourly by the action of current, and may be set so as to cause the meter to register on set of dials all the current consumed during any predetermined period, and on the other dials at all other hours. The theory of the use of this meter is that a customer's portion of the fixed expense should depend on the total amount of current he uses during the stattion's heavy load and a lower rate be charged him for all consumed at other times.

It is claimed that it enables the customer to use current liberally during all the hours of the station's light load. Although costing about $25 more than the simple recording meter, it possesses the good quality of performing the entire work without the aid of any other device. The customer can readily see how much each of high or low rate current he has used, and it is adapted to use on both direct and alternating systems. It has a mild tendency to prevent a heavy load during the station's rush hours, but not in the remaining hours when heavy consumption is rather desirable than objectionable.

The Oxley multiple rate meter controller, described in The Electrical Engineer of January 18, 1898, is a small electro-magnetic switch, to be installed at each point of consumption, and to be operated by a controlling switch in the central station. It may be used in connection with two recording meters, closing the circuit in one or the other at the will of the station operator by his manipulation of the station controller, or it may be used with a single recording meter, in which case it employs resistance to retard the speed of the meter during the low-rate period. The theory of its use is the same as that of the General Electric Company's two-rate meter, although I am informed it cannot be applied to alternating systems.

No attempt is made herein to give a technical or lengthy description of these devices, more than a brief mention of them, as means with which to carry out the differential rate system would be of no practical value in this place. If any of you wish to consider such a method of rates, you will want to study the various devices yourself, and decide upon their relative merits according to your local conditions.

The theory of differential rates may be applied in a modified

orm with the use alone of the ordinary recording meter. Mr. Thayer, of Belle Plaine, Iowa, describes a plan in The Electrical Engineer of December 23, 1897, stating that he had then been using it for about a year, and that it had been highly satisfactory in the cases to which it is adapted. He appears to have adopted it largely in order to avoid straight flat rates, and does not refer to it as a differential rate plan, yet it appears to be somewhat on the same lines.

To a customer who installs more lamps than are needed for regular every day use he makes a fixed charge of 33 cents a month for each light used during the hours of the station's maximum load, and 5 cents besides for each kilowatt hour consumed. The 33 cents may be considered a charge for fixed expenses, incurred in getting ready to supply him with current, and the 5 cents per kilowatt hour a charge for running expenses after the machinery has started supplying him. Mr. Thayer states that this plan has proved a good one for a large class of his customers. It prevents any wide variation in the monthly bills, which is a frequent source of complaint from customers during the winter months. At the same time, the certain revenue of 33 cents per light will, in most cases, cover fixed expenses, and the 5 cents per kilowatt hour a reasonable return for the service. It does not make the charge burdensome to the customer burning long hours, the very one we should seek to get. The monthly charge for a light burned daily two hours would be 48 cents; four hours, 63 cents; eight hours, 93 cents, and twelve hours, $1.23. Thus, a customer using lights until 9 o'clock p.m. daily throughout the year would burn about two hours per day in the middle of the summer, making the cost per light 48 cents, and about five hours per day in the middle of the winter, costing about 70 cents, or an average the year round of a trifle less than 60 cents per month for each light.

A device such as the Wright demand indicator should be useful to stations selling current on the flat rate plan. Monthly rates could be made for each individual or class of customers, based on the greatest number of lights they would use at any one time, an additional charge to be made if that number should be exceeded.

In case of dwelling houses, notice could be given the station when a large number of lights were to be used on special occasions, and the indicator could afterwards be reset. This would give the station knowledge of the frequency and extent that lights were used in excess of the agreed manner. It would check waste of current to a large extent, and reduce the maximum loads, especially in dwelling houses, where it is most serious, under the flat rate plan. The maximum station load would also be reduced, increasing its capacity and earning power, by making room for more customers with the same amount of machinery and coal consumption.

Any of the foregoing methods embody the differential rate theory in a greater or less degree, and should result in improved efficiency in the operation of our stations. If the system cannot be adopted in its entirety, some features of it might be applied that would meet local conditions more nearly than present methods, and work alike to the satisfaction of customers and the benefit of the central station.

To my mind, the question merits the careful study of every station operator, and is of so much importance that if we fail to give that study voluntarily, the trend of our business will force it on us sooner or later.

SPARKS.

Angus H. G. MacDonald, city electrician of Halifax, N.S., is dead.

The British Columbia Electrical Supply Co., of Rossland, B.C., is applying for incorporation.

The town of Liverpool, N. S., purposes installing an electric light plant, tenders for which have not yet been invited.

The city council of Montreal have decided to purchase a new boiler for the upper level pumping station.

The Dominion Coal Company, of Nova Scotia, propose doing away with horses for hauling purposes, and will utilize electricity entirely.

A shipment of 110 barrels of mica, valued at $6,000, was forwarded recently from the St. Anthony mines, near Ottawa, to W. H. Sills & Co., of Chicago.

The Grand Jury in the Criminal Assizes, Toronto, in their presentment, recommended that a boiler of larger capacity be purchased for heating the jail building.

The corporation of Peterboro', Ont., will ask the Ontario legislature for permission to acquire and develop water power on the Otonabee river, and to supply light, heat and power.

As a result of the boiler "sagging," the streets of Port Arthur, Ont., were recently without light for a short time. It is probable that another boiler will be added to the plant in the near future.

The War Eagle Mine expect to operate their works by electricity this month. Power will be furnished by the West Kootenay Power and Light Company, from their generating plant at Bonnington Falls.

The city of Halifax, N. S., invites tenders up to Wednesday, March 8th, for the supply of an electric light plant for lighting the streets and public buildings of the city. Particulars may be obtained from Mr. F. W. W. Doane, city engineer.

The Imperial Oil Company has absorbed the Bushnell Oil Company and the Eastern Oil Company, and a monopoly of the oil business of Canada is thus practically secured. The head offices will remain in Petrolia, while the Queen City Oil Company, Toronto, will continue to handle the Ontario business. Mr. C. J. Mills, the present manager of the Imperial Company for western Ontario, will be general inspector in Toronto.

J. B. Loyer, of New York, has purchased the Gold King mica mine at East Templeton, Que., and intends developing it.

The ratepayers of the village of Bradford, Ont., have voted down a by-law to raise $6,000 for installing an electric light plant.

A by-law to raise $67,750 by debentures for the purchase of the gas and electric light plants of a private company was defeated by the property owners of Galt, Ont., on January 9th.

The residents of Birchton, Ont., are endeavoring to make an arrangement with the Metropolitan Electrical Company, of Ottawa, to supply that village with electric light.

Mr. A. A. Dion, general superintendent of the Ottawa Electric Company, recently gave an interesting talk on "Electricity" before the Literary and Scientific Society of Ottawa.

The town council of Toronto Junction is considering the advisability of adopting an all-night service and of putting in additional plant to permit of supplying incandescent lighting.

A by-law has been approved of by the Lieutenant-Governor-in-council permitting the town of Fort William, Ont., to issue debentures to the amount of $11,000 for extending and improving the electric light plant.

The Fire, Water and Light Committee have recommended that the council of Rat Portage, Ont., take steps to purchase the electric light plant from the Citizens' Telephone & Light Company.

It is said that J. R. Booth will build a power house at the Chaudiere, and that an electric plant will be installed therein capable of operating all the machines in the shops at the deep cut and of supplying the required light.

The Stanstead, Que., Journal of recent date says: "The acetylene gas apparatus at the Marbleton Hotel exploded last Friday, setting fire to the hotel and destroying apparatus. Landlord Cote had a narrow escape, and others who assisted in extinguishing the flames were badly burned.

A deputation from Morrisburg, Ont., intervied the Dominion government recently with a view of obtaining water power from the Morrisburg canal to operate an electric plant for the town. A Lindsay deputation has asked for similar privileges from the Trent valley canal.

The Winnipeg Electric and Gas Light Co., now supplying the city with electric light, have been asked to submit a proposition for supplying 125 arc lights for another year. A motion that tenders be invited for electric lighting for a period of five years was voted down in council.

The annual meeting of the Canadian Rubber Company was held in Montreal last month, at which directors were elected as follows: A. Allan, president; H. McLennan, vice-president; H. M. Allan, W. H. Benyon, F. Scholes, J. B. Learmont, Andrew A. Allan, C. P. Smith and J. O. Gravel.

E. S. Jenison has completed the surveys for his power canal from Kakabeka Falls to Port Arthur. It is said that 100,000 horse power can be developed. The reservoir will be a large lake 4 miles long, covering an area of 4,000 acres, with a depth of 50 to 75 feet. Its surface will be 303 ft. above Lake Superior.

At the annual convention of the International Association of Fire and Police Superintendents and Municipal Electricians, to be held at Wilmington, Del., in September next, Mr. George F. MacDonald, of Ottawa, vice-president of the society, will read a paper on "Progress and Development of the Municipal Electric Interest of Canada."

A large driving pulley in the power house of the Ottawa Electric Railway Co. flew to pieces recently, badly wrecking the interior of the station. Michael Leroux, who was in charge, escaped uninjured. The wheel weighed 7,700 lbs., was 97 inches in diameter, and 52 inches across the face. The accident is said to have been caused by a flaw in the wheel.

The steamer Pro Patria of Halifax, is being equipped electrically, and for the purpose of lighting the steamer and operating searchlight, an order has been placed with the Canadian General Electric Company for the complete outfit, which will consist of one of their standard C. G. E. direct connected equipments, including engine, dynamo, switchboard, searchlight, and wiring complete.

Mr. Wells, manager of the St. Catharines Electric Light Co., has recently gained some notoriety. Mr. Quinn, proprietor of the Russell House, St. Catharines, changed the combination of his safe and locked it before making note of the numbers. He was informed by the safe manufacturers that the combination could not be worked out, it being a five-numbered one and impossible of solution. This fact becoming known to Mr. Wells, he volunteered to open the safe, and in two hours his efforts were rewarded by the combination working out.

A conference of manufacturers of carbons was held in Chicago on January 12th, as a result of which a carbon trust may be formed, with a capital of $10,000,000. It is said that the following companies in the United States are in the combine: The National Carbon Company, Cleveland, Ohio; Brush Carbon Works; Standard Carbon Works; Crouse & Tremaine Carbon Company, Fostoria, Ohio; Thomson-Houston Carbon Company, Freemont, O.; Faraday Carbon Company, Jeannette, Pa.; Phoenix Carbon Company, St. Louis; American Carbon Company, Noblesville, Ind.; Washington Carbon Company, Pittsburg; Partridge Carbon Company, Sandusky, Ohio. It is further stated that the syndicate will own a half interest in the Ottawa Porcelain & Carbon Company, at Ottawa, which controls the carbon industry in Canada.

SPARKS.

The electric light plant for the new Victoria hospital at London, Ont., has not yet been purchased.

The Canadian General Electric Company, Toronto, are again to the front with one of the prettiest lithographic calendars which has yet come to our notice.

The Canadian General Electric Company have recently sold a 50 light dynamo to be installed in the premises of one of their customers at Edmonton, N. W. T.

The city council of Hull, Que., received tenders up to February 6th, for the supply of an electric light plant. The tenders will be opened by the council on the 17th instant.

The process used by the National Electrolytic Co., of Niagara Falls, N. Y., for the production of chlorate of potash, is the invention of Mr. T. Gibbs, of Buckingham, Que. The details of the process are kept a secret.

The Hawthorn Woolen Mills Company, of Carleton Place, Ontario, are increasing their lighting plant, and have placed their order with The Royal Electric Company for one of their 25 k. w. bi-polar direct current generators.

An arrangement was consummated on January 20th for the sale of the Edison Electrical Illuminating Company, of New York, to the New York Gas and Electric Light, Heat and Power Company. The issue of bonds will be limited to $21,000,000.

The Canadian General Electric Company have recently sold to Messrs. Evans & Hastings, printers, Vancouver, B. C., a 6 kilowatt Edison dynamo, and to Braid & Company, of same city, a 10 h.p. motor for use in their spice mills.

The E. T. Wright Company, of Hamilton, are having installed in their factory a 50 h.p. S.K.C. motor to drive their machinery. The power by which this motor is driven is taken from the Cataract Power Company's wires. This is the tenth installation from their service into factories in Hamilton up to date.

The directors' statement presented at the annual meeting of shareholders of the Toronto Electric Light Company, held a few days ago, was of a satisfactory character. It showed the payment of four quarterly dividends at the rate of 7 per cent. per annum, with a small balance carried forward to the credit of profit and loss account.

The Montreal Water & Power Company, of Montreal, are installing in their pumping station a 400 h.p. S.K.C. two-phase motor, operating at 180 r.p.m. This motor is intended to operate the water works pumps, and will be driven by current generated at Chambly Rapids, a distance of sixteen miles away. This is one of the largest single motor installations in Canada.

The Royal Electric Company have received an additional order from the Hamilton Electric Light & Power Company for a 500 h.p. S.K.C. two-phase synchronous motor, which will operate a shaft driving their arc circuits and street railway power circuits. This is an addition to the 350 h.p. motors noted in these columns in our last issue. The first of the two mentioned has been in operation for some time with perfect success.

Mr. M. Hutchson, superintendent of the municipal electric light plant at Victoria, B.C., refers in his annual report to the breaking of the terminal wires in the armatures, the main cause being excessive floor vibration. To remedy the breaking off of lamp loops during windy weather, he recommends that flexible safety loops be placed on all lamps in exposed positions. The total number of lamps now in use is 230, and the annual cost per lamp per annum, exclusive of interest and sinking fund, is given as $53.

The Metropolitan Electrical Company, of Ottawa, are about to proceed with the development of their water power at Britannia, Mr. George A. Wanless, the secretary-treasurer, having invited tenders for the excavation of canal and wheel pits, and the construction of dams, cofferdams, cribwork, flumes, embankments, roads, masonry, concrete work, etc. The company will probably erect a transformer station near the Maria street bridge, and will transmit the current at a pressure of 10,000 volts. The entire plant will cost probably $250,000.

The corporation of Barrie, Ont., has engaged Mr. Roderick J. Parke, E.E., of Toronto, for a period of one year, to take charge of the re-arranging and re-construction of the electrical lighting system recently purchased from the Barrie Electric Light Company, and to supervise its operation. About $15,000 will be expended in additions and improvements; among the additions will be a 2,500 light alternator, an 80 light arc generator, 65 arc lamps for street lighting, 125 h.p. engine, and an extension to the present station building. The street distribution lines will be replaced by modern and efficient construction. A 15 station fire alarm system will also be installed at an early date.

The Canadian General Electric Company report the following recent sales: To the Comstock Concentrator, of Silverton, B. C., a 25 light Edison dynamo, to be used in lighting their premises; to the Athabasca Gold Mining Company, of Nelson, B. C., a 100 light Edison dynamo, to be used in lighting their buildings at the mine; to the Savoy Theatre at Vancouver, B. C., a 250 light incandescent lighting dynamo, of their multipolar slow speed type; to the Scottish Colonial Mining & Milling Company, of Three Forks, B. C., a 100 light 16 c.p. incandescent dynamo for lighting their buildings at the mine; to Messrs. McKenzie Bros., of Victoria, B. C., a 6 kilowatt Edison motor; to the B. C. Electric Railway Company, to be used in driving the blower apparatus in their power house, a 12 kilowatt Edison motor; to Messrs. Hoffmeister Bros., of Vancouver, B. C., a 25 light incandescent lighting dynamo; to J. C. Woodrow, of Vancouver, B. C., a 3 kilowatt Edison motor; to Messrs. Hinton & Company, of Vancouver, B. C., to be installed on a steamer navigating Lake Bennett, a 25 light incandescent dynamo

The Lambton Oil Company, Limited, of Sarnia, Ont., has bee incorporated, with a capital stock of $20,000.

At the next open meeting of Hamilton No. 2, C.A.S.E., Mr. Wm. Turbayne, E.E., will read a paper on "Arc Lighting."

The Westinghouse Electric Company, of Pittsburg, Pa., is reported to have placed orders for 60 boilers with the Babcock & Wilcox Company, of London, Eng.

The Guelph Light & Power Co. have recently purchased a new 1000 light single phase alternator from the Canadian General Electric Company, together with marble switchboard panels for the control of two machines.

The town of Essex is to have an incandescent system of electric lighting. Mr. C. E. Naylor, of that place, having undertaken the operation of the system, has purchased from the Canadian General Electric Co. a 750 light machine for the purpose.

Messrs Corley & Collins, of Mount Forest, have experienced such an increased demand for lighting during the past two months that they were compelled to increase their facilities, and have purchased from the Canadian General Electric Co., one of their standard 1000 light single phase alternators, with marble panel switchboard and exciter, for the purpose of meeting these requirements.

The town of Port Arthur, Ont., has been operating its street railway, which extends from Port Arthur to Fort William, at a loss, and will likely adopt a new schedule of fares. The present rates are: Cash fares, 5 cents; blue tickets, 6 for 25 cents; morning and evening tickets, 8 for 25 cents; school children, 10 for 25 cents. For one fare passengers are permitted to ride from end to end of the line—over seven miles.

Andrew Holland, of Ottawa, has prepared an estimate of the various water powers in the Ottawa valley. His calculation is as follows: Ottawa river, 664,000 h.p.; Rideau river, 1,300 h.p.; Mississippi river, 14,700 h.p.; Madawaska river, 20,600 h.p.; Bonnechere river, 3,400 h.p.; Petite Nation, 2,000 h.p.; Blanche river, 2,000 h.p.; Lievres river, 98,450 h.p.; Little Blanche, 300 h.p.; Quyon river, 100 h.p.; Coulonge river, 27,600 h.p.; Black river, 24,000 h.p.; Gatineau river, 31,675 h.p.; total, 890,225 h.p.

A copy of the prospectus issued by the Bedford Electric Company, of Halifax, N.S., is to hand. The company, which is capitalized at $250,000, proposes to install an electric plant at St. Margaret's Bay, to transmit light and power to Halifax and other points in the vicinity, and to furnish power for the operation of an extensive pulp mill to be erected. The transmission line will be 18 miles in length, and the pipe line from the power house to the dam about 4,000 feet in length. It is also proposed to operate an electric tramway to Halifax. Mr. M. M. Keefe, of Halifax, is president of the company, and Mr. A. E. Soulis, manager and secretary.

The Canadian General Electric Company have been awarded by the Department of Railways and Canals, the contract for the erection of a power house, and the complete equipment of the Soulanges canal with electrical apparatus, for operating the locks, by means of electric motors. The entire canal, covering a distance of 14 miles, will be illuminated by arc lamps. Owing to the success met with, by the Department, in the operation of electricity at the canal at Sault Ste Marie, Ont., as applied to the locks, they decided to make a more extensive application of the use of electricty, in the illumination and electrical operation of the locks of the Soulanges Canal.

A 6-inch belt, travelling through 4,000 feet of space per minute, will run machinery equal to a 24-inch belt only running at the rate of 1,000 feet per minute. A belt should never be laced too tight, for the belt will be hard upon itself. The motion that is produced between the pulley and the belt is maintained by friction. Belts laced too tight will cause friction to such an extent that it will consume all the power of engine. Under a given load, it is wonderful to see how much power of resistance there is in a good belt. It can be strained for months, and after a short period of rest will return to its original strength and length.

THE FIRST INTERNATIONAL ELECTRIC RAILWAY.

OTTAWA, January 28th, 1899.

Editor CANADIAN ELECTRICAL NEWS:

DEAR SIR,—In your issue for January, 1899, you state that the Niagara Falls Park and River Railway has the honor of operating the first international electric railway between the United States and Canada. This road began operations in 1898, the first car crossing on July 1st of that year.

There is another road which may fairly claim to be the pioneer. The Calais & St. Stephen Electric Railway has the right to the honor. The first car crossed the bridge over the St. Croix river (dividing Maine and New Brunswick), from Calais to Milltown, in July, 1894, and the first car over the bridge between Calais and the town of St. Stephen crossed in June, 1895. This would give the Niagara Falls Park & River Railway third place.

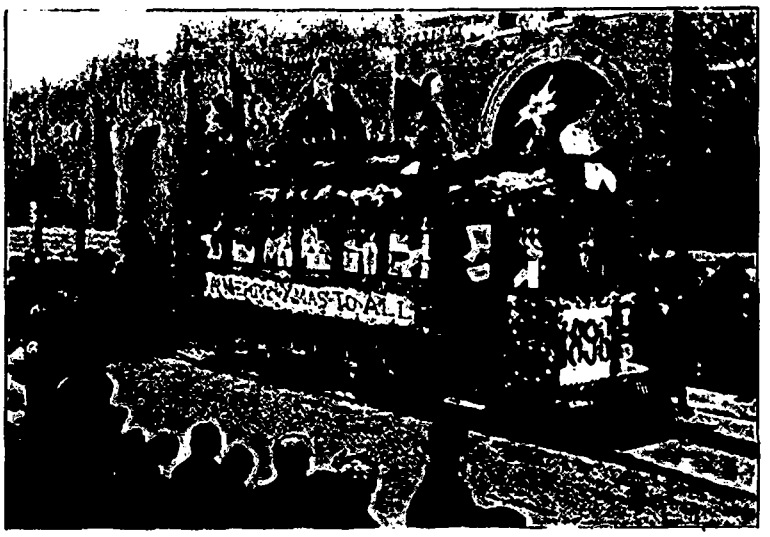
Yours truly,
GEORGE JOHNSON.

ELECTRIC RAILWAY DEPARTMENT.

A CHRISTMAS TROLLEY CAR.

THE children of Ottawa appeared on the streets of that city in large numbers on Christmas eve last, to await the arrival of the Santa Claus car which has become such a welcome annual visitor, and which is responsible for gladdening many a young heart.

For some days before the event Mr. Soper, in whose mind the idea first originated, caused letters, under the signature of "Santa Claus," to appear in the Ottawa papers, to the effect that the writer (Santa) would visit Ottawa and go through the streets of the city mounted on top of an electric car, accompanied by a suite of brownies, and that oranges would be distributed to the children en route. The letter excited intense interest among the children, and during the progress of the car the principal streets were crowded. Santa Claus used a tally-ho horn to give the call, and the brownies created a great deal of amusement by their grotesque antics. Some 5,000 oranges were distributed. The car was not in any way an advertisement, but was simply the outcome of a desire on the part of Mr. Soper to afford amusement and pleasure to the youngsters of Ottawa.



CHRISTMAS CAR—OTTAWA ELECTRIC RAILWAY COMPANY.

A splendid illustration of the car, and portraits of the brownies, are presented on this page.

ANNUAL MEETINGS OF ELECTRIC RAILWAY COMPANIES.

THE TORONTO RAILWAY COMPANY.

THE annual meeting of the shareholders of the Toronto Railway Company was held last month, at which the board of directors was re-elected. The report presented showed net profits for the year 1898 of $404,738, out of which $240,000 had been paid in dividends and $64,000 in mileage allowance, leaving a balance of $100,738. The receipts from the operation of the Sunday car service showed a steady increase, being $367.24 per Sunday greater than in 1897. During the year 30 closed and 20 open motor cars had been added to the rolling stock, and 40 additional open cars are now being constructed. There were also purchased during the year 70 electric motors and 50 improved steel trucks.

The following statistical statement, showing a comparison of the business and earnings of the company since its purchase of the franchise in 1892, was presented:

Gross earnings—1892, $820,098.49; 1893, $900,-232.59; 1894, $958.370.74; 1895, $992,800.88; 1896, $997,273.20; 1897, $1,077,611.53; 1898, $1,210,618.24.

Operating expenses - 1892, $590,333.26; 1893, $637,579.15; 1894, $517,707.53; 1895, $489,914.76; 1896, $507,760.31; 1897, $525,801.25; 1898, $578,-857.26.

Net earnings 1892, $229,765.23; 1893, $362,-635.44; 1894, $440,663.21; 1895, $502,886.01; 1896, $489,512.97; 1897, $551,811.28; 1898, $631,700.98.

Percentage of operating expenses to earnings in 1892, 71.9; 1893, 59.07; 1894, 54; 1895, 49.3; 1896, 50.9; 1897, 48.8; 1898, 47.4.

Transfers 1892, 5,592,708; 1893, 8,477,147; 1894, 7,438,171; 1895, 7,257,-572; 1896, 7,354,895; 1897, 8,199,022; 1898, 9,287,239.

Passengers carried—1892, 19,122,022; 1893, 21,215,010; 1894, 22,609,338; 1895, 23,353,228; 1896, 23,537,911; 1897, 25,-271,314; 1898, 28,710,338.

OTTAWA ELECTRIC RAILWAY COMPANY.

At the annual meeting of the Ottawa Electric Railway Company, held recently, the annual report submitted showed the gross earnings for 1898 to be $231,802, an increase of $8,000 over the preceding year. During the year four quarterly dividends of two per cent. each were paid. Six open and six closed cars were added to the rolling stock of the company. The report mentions that the outlook for a large development of both passenger and freight traffic is very promising. The number of passengers carried was 5,200,000, while five years ago the number was only 2,394,000.

The following board of directors was elected: T. Ahearn, president and manager; J. W. McRae, vice-president; Warren Y. Soper, G. P. Brophy, Thos. Workman, Alex. Lumsden, M.P.P., and Peter Whelan.

HAMILTON, GRIMSBY AND BEAMSVILLE ELECTRIC RAILWAY COMPANY.

At the annual meeting of the Hamilton, Grimsby and Beamsville Electric Railway Company, held in Hamilton a fortnight ago, the president, Mr. C. J. Myles, presided. The annual statement presented by Mr. Nelles, manager and secretary, showed the receipts during the year to have been $42,736.42, an increase of $735 over 1897. The net earnings were $13,981.11. The passenger business during the year amounted to $34,060.15; freight, $5,521.66, and express, $1,618.13. President Myles estimated that the company lost about $1,000 owing to the big snowstorm in December. A dividend of 5 per cent. was declared. The directors were re-elected as follows: Messrs. C. J. Myles, president; W. J. Harris, vice-president; R. S. Martin, treasurer; L. Bauer, R. Ramsay, A. H. Myles, J. Gage. Mr. A. J. Nelles was reappointed treasurer and manager.

CHRISTMAS CAR—THE BROWNIES.

SPARKS.

Mr. B. B. Osler, Q.C., has been elected president and Mr. Mark Thomas manager of the Hamilton and Dundas Railway.

The Hamilton Street Railway Company have elected Mr. Edward Martin, Q.C., as president, and Mr. John A. Bruce as vice-president.

A bill respecting the inspection of steam boilers and providing for the security of the lives of those working around steam engines has received a second reading in the British Columbia Legislature.

The directors of the Hamilton, Grimsby and Beamsville Railway Company have been asked by the residents of Vineland to extend their road to that place, five miles distant from Beamsville.

The Niagara Falls, Wesley Park and Clifton Tramway Company have made a proposition to the village councils to convert the horse car line between Niagara Falls and Niagara Falls South into an electric system.

Several Canadian street railway magnates, including Mr. James Ross and Mr. R. B. Angus, have been on a tour of inspection in the United States, with a view of obtaining pointers looking to the improvement of the street railway systems in Canada.

The Montreal Street Railway Company have decided to concentrate the whole of their constructive work at the Hochelaga shops. In the spring the company will build a large brass foundry for the manufacture of brasses and a large iron foundry for the iron work required in connection with their vehicles, an important part of this being the car wheels, which they intend to manufacture for themselves in future.

A new agreement has been entered into between the town council of Toronto Junction and the Toronto Suburban Electric Railway Company. One privilege granted the company is the extension of the franchise for 23 years from September 1st last. The company agrees to extend its lines to Cooksville or Woodbridge in two years, and to reach both places before the expiration of the present franchise.

A statement has been compiled showing the yearly earnings of the street railways in Montreal and Toronto for the years 1897 and 1898. In 1897 the Montreal street railway earned $1,397,383 and in 1897 $1,526,457. The respective earnings of the Toronto street railway were $1,048,273 and $1,187,622.

The C.P.R. Company several years ago discontinued running steam cars between Aylmer and Hull, Que., and gave over the road to the Hull-Aylmer Railway Company. Within the past month this latter company have purchased the road, paying therefor a sum in the neighborhood of $100,000.

The Galt, Preston and Hespeler Street Railway Company held its seventh annual meeting on January 31st. The business of the year was ahead of the previous one in both freight and passenger departments. Officers were elected as follows: Hugh McCulloch, president; Martin Todd, vice-president; W. H. Lutz, secretary-treasurer.

For the last three months of 1898 the gross earnings of the Quebec, Montmorency & Charlevoix Railway Company's system were over $79,000 and the operating expenses less than $34,000. After deducting one-fourth of the cost of removing snow in the winter, which is estimated at $12,000, the net revenue for the three months was over $42,000.

At the annual meeting of the Hamilton Radial Electric Railway Company held a few days ago, the reports presented were eminently satisfactory. The old board of directors was re-elected as follows: A. Turner, president; W. A. Wood, vice-president; John, Moodie, sr., treasurer; Stuart E. Malloch, secretary; James Dixon, Adam Zimmerman, John Moodie, jr.

The annual meeting of the London Street Railway Company was held on January 12th. The gross earnings for the year were stated to be $12,000 more than in 1897. The number of passengers carried was 2,841,568, and the number of miles travelled 1,074,302. The total gross earnings were $113,811.73. Mr. H. A. Everett was re-elected president, and Mr. T. H. Smallman was chosen vice-president in the place of Mr. E. W. Moore. Mr. Carr retains his position as manager.

At the request of the promoters of the proposed electric railway from Thamsville to Rondeau, an estimate of the cost of construction has been made by Mr. G. S. Johnson, general manager of the Consolidated Street Railway Company, of Grand Rapids, Mich. The length of the proposed road is 25 miles, and Mr. Johnson places its total cost at $257,068. Of this the power house, generators, boilers, etc., represent $50,000, and the cars, wire, equipment, etc., $125,000. To pay 5 per cent. on an outlay of $250,000 the road would have to earn $12,500 per year over running expenses.

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TRADE NOTES.

The Canadian General Electric Company have just received another order from the Montreal Ry. Co. for 12 of their standard G. E. 1000 railway motors.

The Stanstead Electric Light Co., of Stanstead, P.Q., have recently purchased a 2000 light single phase alternator from the Canadian General Electric Co.

Messrs. A. Gagnon & Co. of Arthabaskaville, have recently installed a new 2000 light single phase alternator of the Canadian General Electric Co's. new type.

The Canadian General Electric Company have closed a contract with A. S. & W. H. Masterman, of Montreal, for one of their new type multipolar 200 light generators.

The Ottawa Electric Co., Ottawa, have recently added to their arc lighting equipment one No. 12 125-light Brush arc dynamo, purchased from the Canadian General Electric Co.

The Department of Railways and Canals have placed an order with the Canadian General Electric Company for additional apparatus to be used at the Sault Ste. Marie canal.

The Hawthorn Woolen Mill Co., of Carleton Place, Ont., are increasing their lighting plant, and have placed their order with The Royal Electric Company for a 25 k.w. bi-polar generator, which is to be installed at once.

The Canadian General Electric Company are installing for H. A. Lozier & Co., Toronto Junction, one of their 200 light dynamos, with marble panel, and are wiring up some 200 incandescent lights in their new factory.

The Watson Mfg. Co., of Thorold, are removing to their new factories at Paris, and have placed an order with the Canadian General Electric Company for the wiring up of these factories, and installing a plant to furnish some two hundred and fifty 16 c. p. lamps.

The R. & O. Navigation Company have placed an order with the Canadian General Electric Company for one of their standard 30 kilowatt direct current generators, to be direct connected to an "Ideal" engine, as manufactured by the Goldie & McCulloch Co., of Galt.

The Canadian General Electric Company have recently installed for Messrs. Robertson, Rowland & Co., of Walkerton, a 2000 light single phase alternator. This company have been operating a 60 kilowatt machine, of a similar type, for the past four years, and have met with great success in the their electrical undertaking.

Mr. N. P. Tanquay, of Weedon, P.Q., has contracted with the Canadian General Electric Company for one of their standard 55 kilowatt new type multipolar generetors and a 35 h.p. motor, together with marble panels and all line material and supplies required for carrying out the transmission of the above power.

The London Electric Company have placed an order with the Canadian General Electric Company for another No. 12 4-circuit 125-light Brush arc dynamo, and an additional 300 kilowatt revolving field single phase alternator. When these are installed, the above company will have one of the most complete lighting stations in Canada.

At the last meeting of Toronto No. 1, C.A.S.E it was resolved that the association deeply deplore the loss of life and personal injury to the innocent victims who suffered as the result of the recent boiler explosion at the icehouse in the east end of the city. And be it further resolved that we, as a body of engineers, wish to place ourselves upon record as concurring with the verdict of the Coroner's jury, which clearly set out the fact that the man in charge was incompetent; and be it further resolved, that all steam boilers should be under the charge of practical engineers, who have certificates, and each boiler be inspected yearly by some competent person."

A peculiar accident occurred to a motorman of the Toronto street railway recently. He had charge of a Queen west car, and when approaching Spadina avenue the trolley wire broke, the loose end falling through the window of the vestibule and touching the motorman on the shoulders, thus making a connection with the ground. The motorman was thrown through the vestibule window onto the car track, but fortunately the car had stopped. His clothes were badly burned and his face and head cut, although the current had not affected his body.