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**CANADIAN**

# ELECTRICAL NEWS

**STEAM ENGINEERING JOURNAL**

OLD SERIES, VOL. XV.—No. 4.  
NEW SERIES, VOL. III.—No. 7.

AUGUST, 1893

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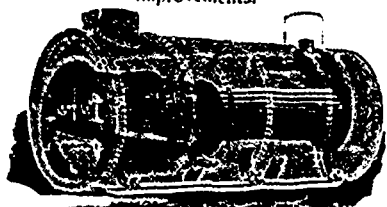
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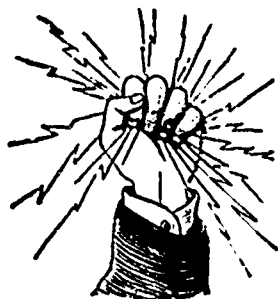
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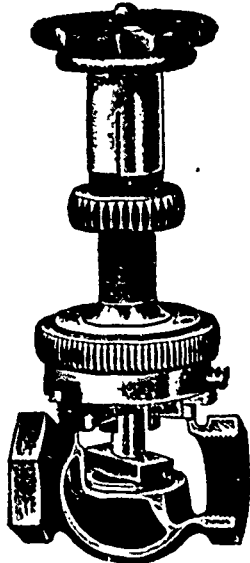
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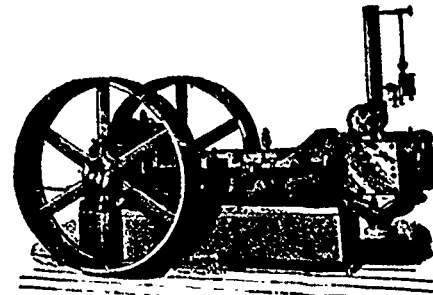
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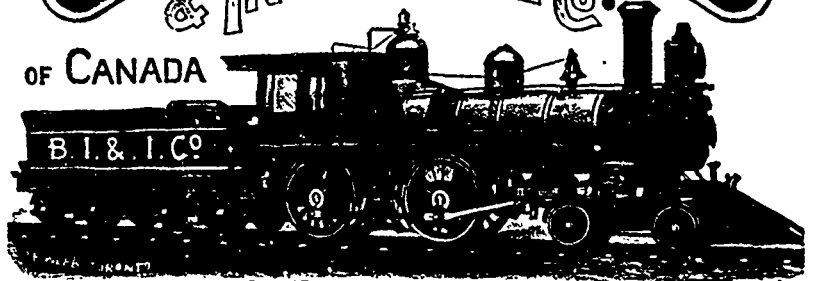
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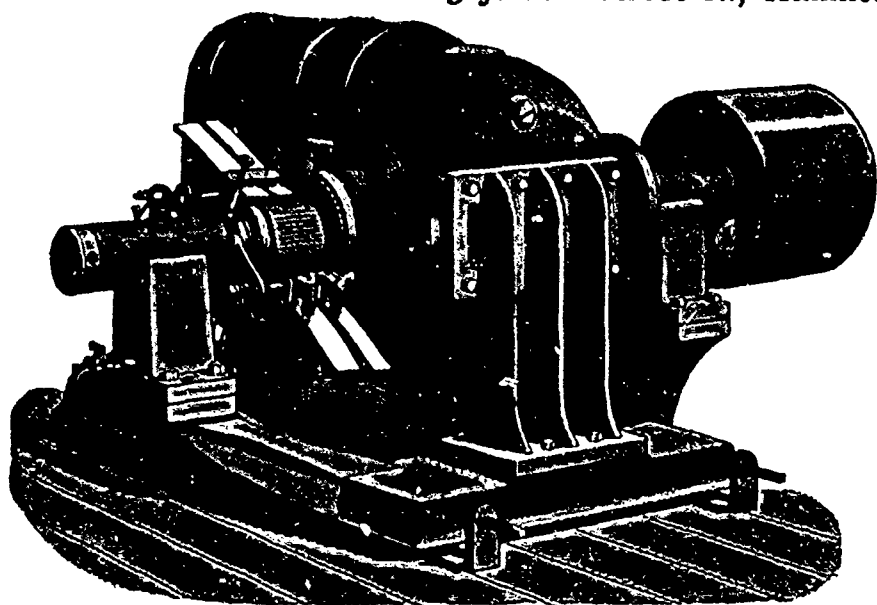
Dear Sir,—Making reference to J. C. Taylor & Co.'s Boiler Composition which you supplied us a few months ago, beg to say that we have given it a thorough test, and find it to fully verify all your representations as to its excellence in being able to remove all scale from the tubes and inside of boiler, and we find in using it, that it takes even a less quantity than is represented to do the work of keeping the boiler clean. We have, in consequence of the use of it, set aside all other appliances which we had for removing and preventing scale accumulating in our boiler, and are so much pleased with it that we can cheerfully recommend it to all and every one who have steam boilers and wish to save money in fuel by keeping their boiler perfectly clean, and cannot recommend it too highly.

Very truly yours,

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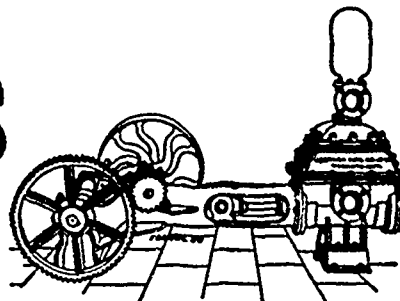
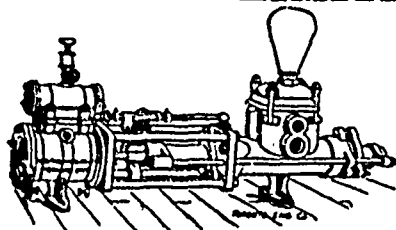
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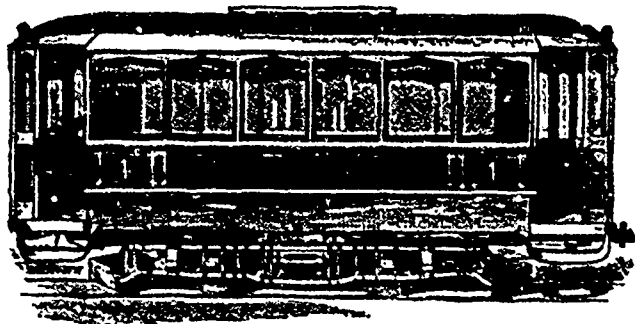
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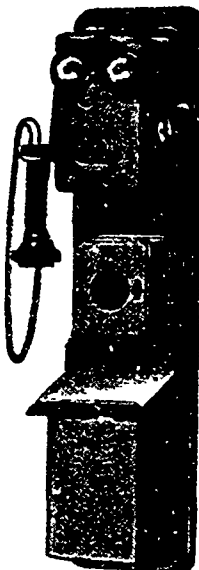
ST. JULIE, Sept. 5th, 1892,  
T. W. NESS, ESQ., Montreal.

DEAR SIR,—We are happy to state that your  
telephones and switches are giving us good satis-  
faction. We have three sorts of switches and  
we find yours far preferable. There is now about  
forty of your telephones in operation on our line.  
Every one works well, and we intend to use no  
other.

Yours very truly,  
THE MEGANTIC TELEPHONE CO.

Write us when you want anything electrical.

- Key Sockets,
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Canadian Headquarters for  
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749 Craig Street, MONTREAL.

# CANADIAN ELECTRICAL NEWS

AND  
STEAM ENGINEERING JOURNAL

Vol. III.

AUGUST, 1893

No. 8.

## ELECTRIC LIGHT STATION, ST. THOMAS, ONT.

THE accompanying illustration, reproduced from a photograph kindly furnished us by Mr. F. Revell, shows the interior of the electric lighting station of the St. Thomas Gas Company, St. Thomas, Ont. In 1887 the Gas Company introduced electric arc lighting by installing a Royal  $\frac{1}{2}$  arc dynamo of 50 lamps capacity. Since that time the Company have made many changes and improvements in the plant, which at present consists of three Reliance arc dynamos of 25 lamps each, one Westinghouse alternator and exciter of a capacity of 750 16 c. p. lamps; a 60 h. p. Corliss engine manufactured by Messrs. John Inglis & Sons, Toronto, and a 50 h. p. Leonard-Ball engine. The Company are now about to install a 90 h. p. Reliance generator, and are busily engaged in constructing the power circuit.

The Company is under the management of Mr. H. Brown, Mr. F. Revell is the electrician, Mr. G. A. Pretty, lineman, and Mr. W. Noble, trimmer.

## DEADENING THE NOISE FROM A GAS ENGINE.

AMONG the various engineering investigations which for some time have engaged the attention of mechanical experts is that having in view some ready method for deadening the objectional noise made by puffs from the exhaust pipe of the gas engine, but only an indifferent amount of success has hitherto attended these efforts. The most recent contrivance of the kind is a device described in a French journal, and claimed to be simple, and inexpensive. Briefly, a pipe split for a distance of about two metres is attached to the end of the exhaust, with the split end upwards, and, beginning at the lower end of the cut, which may best be made by a saw, dividing the pipe into two halves, the slotted opening is widened out toward the top until it has a width equal in extent to the diameter of the pipe. Under this arrangement the puff of the exhaust spreads out like a fan, and the discharge into the open air takes place gradually, the effect produced depending somewhat on the flare of the tube.

Work has been commenced on the Montreal Street Railway Company's new power house of which mention was made in the last issue of the News. Mr. Everett says the rate of construction of new lines is ten miles per month. A line has been opened on Fulton and St. James Sts. to relieve the cars on Notre Dame and St. Antoine streets.

## INTERNATIONAL ELECTRICAL CONGRESS.

IN common with a number of other Canadians interested in electricity, we have been favored with an invitation to attend the International Electrical Congress to be held in connection with the World's Fair, Chicago, on the 21st of August next. A copy of the preliminary program of this Congress is before us. The general Congress will be divided into three sections as follows:

A—The section of Pure Theory, including electric waves, theories of electrolysis, electric conduction, magnetism, etc.

B—The section of theory and practice, including studies of dynamos, motors, storage batteries, mica, wiring, instruments, materials for standards, etc.

C—The section of pure practice, including telegraphy and telephony electric signalling, electric traction, transmission of power, systems of illumination, etc.

These sections will meet for organization and work at 10 a.m., August 22nd.

The following topics will be considered by the Chamber of Delegates:—"Adoption of definition and values of fundamental units of resistance, current and electro-motive force;" "Adoption of definitions and values of magnetic units;" "Adoption of definitions and value of the unit of self-induction;" "Definitions and values of light, energy and other units;" "The consideration of an International system of Notation and Conventional Symbols and of a more uniform and accurate use of terms and phrases in electrical literature;" "A commercial standard of copper resistance". Together with such other topics as may properly come before this body.

Papers have also been invited upon a wide variety of subjects.

Public lectures of a popular character will be delivered by eminent electricians at 8 o'clock, p.m. on Tuesday, Thursday and Friday of the Congress week.

Application for incorporation has been made by the Brockville Light and Power Company.

About 140 omnibuses in London, Eng., are provided with electric light. A small battery, weighing only about 8 pounds, is placed under a seat in a small box having two brass terminals which make contact with the battery. The lamps are small and have horizontal filaments, so that they may not be any inconvenience to passengers. The only work required is the exchange of the battery, and its capacity is such that it only requires once charging for a day's service.



ELECTRIC LIGHT STATION, ST. THOMAS, ONT.

## ELECTRICAL EXPERTS.

Editor CANADIAN ELECTRICAL NEWS

SIR,—As electrical matters are making great progress in Canada I think it might be of interest to Canadians to know how Electrical Experts are made by the different large electrical manufacturing companies. All the electrical apparatus manufactured for lighting and power purposes requires the care and attention which can only be given to it by men understanding their business, and as each large manufacturing company has a particular interest in installing its apparatus, it has also an interest in having a man in charge of that apparatus who knows how to run it. This is one of the reasons why the Expert Course has been instituted.

I will now try to tell you something about the training of an expert as it is done at the works of the Thomson-Houston Electric Co. in Lynn, Mass. A young man desiring to enter the course must be not less than twenty-one years of age, and have received a technical education, such as can be obtained in the School of Practical Science in Toronto or almost any of the Universities, or have had two or more years of practical electrical experience, with of course a fairly good education.

Being able to qualify under either of these conditions, and upon giving proper references his application is accepted. After waiting probably six months for an opening, he will receive a letter from the manager of the expert department saying that his services will be required on we will say Monday morning at 6.45, and on payment of a fee of one hundred dollars he commences his course. The first few weeks will probably be devoted to what is known as "humping"—that is, he may be started in the railway motor department, and for three weeks will set up railway motors for testing, and after they are tested take them down again. This is a splendid department for the cultivation of muscle and an appetite, and as board is rather high in Lynn, it is as well to have an appetite and get all you pay for.

When an "expert" commences the course he may imagine he knows something about electricity, but that feeling soon wears off, and at the end of the railway motor period, he concludes that although he is quite competent to set up a railway motor there are a few things around the factory he never saw before.

In each of the regular departments a certain time is spent, as for example four weeks on railway generators, five weeks on alternators, five weeks on arc machines, etc. Several months are spent on special work, such as making the tests on various machines, helping in work of an experimental nature, some office work, such as writing up data, plotting curves, making corrections in record sheets for errors in the instruments used, as a voltmeter sometimes reads too high or an ammeter too low.

All "experts" commence and quit work at the regular time of all the employees, except office men, viz.: 6.45 a.m. and 6 p.m., and have to wear overalls and jumpers, and do their full share of the work in the different departments, be that work dirty or clean, and this is the only practical way of learning anything about the different machines. For instance, if you actually put the commutator on an arc dynamo once you would understand better how to do it than if some one had told you a hundred times how to do it, but you had never gone through the operation.

The work all through the course is thoroughly practical. A man is not simply told how to run motors, but he is given charge of a number of motors driving machinery in different parts of the factory, and for four weeks he has to start them, stop them, and keep them oiled and cleaned. He may be tired of running motors before four weeks have passed, but if he doesn't know how to run them by that time it is not the fault of the Expert Department. Another thing I may mention is, no one objects to an "expert" asking questions, and as there are so many things to ask about this is quite a boon to an inquisitive man. We heard one youth go so far as to ask which was the positive lead of an alternator. He hasn't found out yet, but knows more about an alternator than he did before asking.

## MOTOR.

"As Others See Us," is the title of a neat pamphlet issued by the Penberthy Injector Co., of Detroit, Mich. It contains letters from many of the largest steam supply houses and traction engine manufacturers in the United States and Canada, all speaking in the highest terms of the celebrated Penberthy Automatic Injector. They are letters which carry weight, as they are from persons who have sold and used this machine for from three to six years.

## QUESTIONS AND ANSWERS.

"T. M.," Goderich, writes. Where is the greatest pressure in a steam boiler, at the top or bottom?

ANS.—When a steam boiler is got ready for raising steam and has water in it at the proper level, there is only the pressure of the atmosphere at the surface of the water, but at the bottom of the boiler there is a pressure due to the weight of water. When steam is raised it does not take away the action of the force of gravity, and the hot water still has weight, hence at the top of the boiler there is the pressure due to the steam, which may be measured by the steam gauge. The pressure at the bottom of the boiler, however, is that due to the weight of water and the pressure of steam on the surface of the water. Hence there must be a greater pressure at the bottom than at the top.

"E. P.," Toronto, writes: What is the cause of racing in an Armington & Sims engine when you attempt to speed it up? How can they be speeded up and yet run steady?

ANS.—The governor of the Armington & Sims engine is adjusted for the speed at which engine is to be run. To try to change the speed without a proper understanding of the principles involved in the operation of the governor, would be sure to produce unsatisfactory results. Any attempt on our part to give instructions would in all likelihood only tend to increase the difficulty. The best plan would be to write to the maker of the particular engine, stating at what speed engine has been running and the speed at which it is wanted to run, and ask for instructions.

"Old Subscriber" writes: (1) Can you give me the name of the best book on Galvanism? (2) What steps are necessary in order to undergo examination for certificate of the Ontario Association of Stationary Engineers, and what is the cost of obtaining certificates?

ANS.—(1) It is not clear from our correspondent's letter exactly what character of book he requires. A series of primers treating of electricity and magnetism, and suited to the requirements of students, has been published by the Electrician Publishing Co., Salisbury Court, London, Eng., and would no doubt meet our correspondent's requirements. We would also recommend Desmond's "Electricity for Engineers" as worthy of his attention. (2) Our correspondent should correspond with Mr. A. E. Edkins, 139 Borden street, Toronto, who is chairman of the Board of Examiners, and who if requested will appoint a time and place for the examination to be conducted. The candidate for examination is required to give proof of his experience in engineering, and in order to obtain a 3rd class certificate must have had at least two years practical experience. The cost of a 3rd class certificate is \$2, of a 2nd class certificate, \$3, and of a first class certificate, \$5.

## TRADE NOTES.

Messrs. Siemens Bros. & Co., of London, manufacturers of electrical apparatus, have appointed as their Canadian agent, Mr. Jas W. Pyke, 35 St. Francois Xavier st., Montreal, who succeeds in that capacity the late Mr. Geo. Reaves.

The Ball Electric Light Company have supplied the Toronto Board of Trade with an incandescent dynamo; Messrs. Smith Bros., carriage makers, with a 15 h.p. motor; The Oriental Steam Laundry, with a 20 h.p. motor; and George McFarlane, leather merchant, with a 15 h.p. motor.

The Penberthy injector Co., of Detroit, Mich., report that in spite of the dull times their business is steadily increasing. Since completing the additions to their factory, they have added eight new speed and monitor lathes to their plant, also a new Reed Engine Lathe and a Universal Milling Machine to their tool room outfit. The capacity of their works is now 2000 machines a month, and they are yet unable to accumulate any stock, but are frequently behind their orders.

The Northey Manufacturing Company, of Toronto, the well-known manufacturers of pumping machinery, have just removed their business to new and commodious premises erected specially for their accommodation, near the King street sub-way. The main building is 250 feet long, with pattern shops, brass foundry, boiler house, pattern storage, offices and other subsidiary buildings in proportion. The buildings are equipped with machinery plant of the most improved description. Fuel gas is employed for firing the boilers and for heating the factory, forges and melting pots. The factory is lighted by electricity, by which means also the travelling cranes are operated.

In one day recently, the Montreal Street Railway Company carried 106,000 passengers.

**CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.**

Note.—Secretaries of the various Associations are requested to forward us matter for publication in this Department not later than the 10th of each month.

**THE ANNUAL MEETING.**

Thursday, Friday and Saturday, Sept. 7th, 8th and 9th, are the dates chosen for the annual convention of the Canadian Association of Stationary Engineers, and the place of meeting the City of Montreal.

The time chosen for the convention coincides with that selected for the Montreal Exposition, and in connection with the Exposition the engineers propose to make an interesting exhibit of models of engineering appliances.

The delegates to the convention will have the advantage of the reduced rates which the railways will offer to visitors to the Exposition. The return fare from Toronto in former years has been about \$7.00. At this rate there should be a large attendance.

It is learned that accommodation for delegates from outside of Montreal has been arranged for at the Balmoral Hotel.

We have been informed that the delegates from Toronto, Hamilton, London, and other towns in Western Ontario will probably number about 30. The statement has appeared in print that a considerable delegation is expected from the United States, but what foundation exists therefor, we cannot determine. It is to be hoped, however, that at least some of the Executive officers of the National Association will be in attendance.

Among the papers to be read at this convention is one by Mr. A. M. Wickens, Chief Engineer, Ontario Parliament Buildings, on "Wasted Heat," and one by Mr. Chas. Kinsey, Toronto, on "The Duties of the Engineer Twenty Years Ago as Compared with the Present Day."

Unfortunately the particulars concerning the arrangements and program of the convention have not been made known to the extent that is desired among the members of the Association in the West. It is in the interest of the convention that the information should be given at the earliest possible moment.

**EXAMINERS APPOINTED.**

At a recent meeting of the Board of Examiners of the Ontario Association of Stationary Engineers, A. E. Edkins of the Boiler Inspection and Insurance Co., was elected President, in place of the late J. A. Wills, and E. J. Phillips, Engineer of the Incandescent Electric Light Co., was elected an Examiner in place of A. E. Edkins.

**TORONTO NO. 1.**

The regular meeting of this Association was held on July 14th. The following officers were installed: Wilson Phillips, president; W. M. Butler, vice-president; Herbert Terry, recording secretary; Geo. Mooring, financial secretary; Sam. Thompson, conductor; John Thompson, doorkeeper. Bros. Mooring, Phillips, Lewis, Gilchrist and Sutton were appointed delegates to the annual meeting in Montreal. Mr. Chas. Heale was appointed as the representative of the Association on the Toronto Technical School Board.

**HAMILTON NO. 2.**

Two meetings of the above Association have been held since the report of the annual meeting appeared in THE NEWS. At the first of these the newly elected officers were installed by Bro. A. M. Wickens, of Toronto. Bro. Edkins, President of the Executive Council, was also present, and by invitation of the President, presided. Both brethren addressed the meeting touching the progress of the C. A. S. E., their remarks being of a very encouraging character. It is the opinion of the members of No. 2 that much of the progress which the order has achieved is due to the indefatigable efforts of these brethren. The Association is always pleased to receive visits from them or from any other brethren whose experience would fit them to impart information to young engineers.

At the second meeting the most important business was the selection of delegates to represent the Association at the annual convention to be held in Montreal in September. The choice fell upon Bros. P. Stott and D. Robinson. Bros. Wm. Sweet and E. Johnson were appointed as alternatives should the delegates first chosen be unable to attend the convention. The gentlemen who have been selected to represent the Association

at Montreal are a pair of reliable old-time engineers, who however have not failed to keep themselves posted on every new departure in steam engineering, and may be depended on to give a good account of themselves at the convention in connection with the various subjects which will there come up for consideration.

**LONDON NO. 5.**

The above Association at its last meeting elected the following officers: Fred Mitchell, president, (acclamation); G. B. Risler, vice-president; Geo. Taylor, secretary-treasurer (acclamation); W. McLean, conductor; Henry Goldhardt, doorkeeper; Wm. Westhead, P. Teene and T. Patterson, trustees. At this meeting two new members were initiated. We are pleased to learn that the London Association is now one of the most prosperous in connection with the C. A. S. E., having a membership of 30, well officered. If the enthusiasm which at present animates both officers and members be maintained the Association is bound to grow in numbers and influence.

**OTTAWA NO. 7.**

At the regular meeting of the above Association held on the evening of July 26th, the members were addressed by Bro. A. M. Wickens, of Toronto, President of the Ontario Association, who expressed his gratification at the progress which the C. A. S. E. was making. The attention of the members was specially directed to the clauses in the constitution prohibiting members of the organization from attempting to dictate in any way to their employers. The advisability of establishing evening classes for the instruction of the members was suggested. After a hearty vote of thanks had been tendered to Bro. Wickens, the election of delegates to the approaching annual convention of the C. A. S. E. in Montreal was proceeded with. Bros. J. H. Thompson and Frank Robert proved to be the choice of the meeting.

**OBITUARY.**

It is our painful duty to chronicle the death on the 22nd of July of Mr. T. B. Griffith, manager of the Hamilton Street Railway Company. Ten days prior to his death Mr. Griffith was prostrated by the heat while out directing the business of the railway. Subsequently the hope was indulged that he would recover, but his constitution had been run down by overwork consequent upon getting the new electric railway into shape, and lacked the strength necessary to rally. Mr. Griffith was recognized as being one of the most energetic and upright citizens of Hamilton, and his loss is deeply felt. He was born in the County of Norfolk, on the 4th of August, 1854, and consequently was at the time of his death in his 39th year. In his earlier days he was for a number of years employed as a telegraph operator and later on as ticket agent by the Great Western Railway Co. He quitted the position last mentioned to assume the management of the Hamilton Street Railway, in which he and his brother, J. B. Griffith, subsequently secured the controlling interest. A wife and five children are left to mourn his loss.

The Town Council of Annapolis, N. S., recently decided to purchase the electric plant which has been used to furnish light for the streets.

A single leather belt will stand a working strain of from forty to fifty pounds to each inch in width, with comparative ease, and double leather from seventy to eighty pounds.

To lessen the noise from gas engines, open the gas exhaust pipe for about three or four feet and open out the halves of the pipes so as to make a flaring outlet; by this means the "bark" will be much lessened. Splitting down the pipe by four cuts instead of two, so that the four parts can be opened out in funnel shape, will be still better.—*Disse.*

The car building business of Mr. W. W. Wylie, of Ottawa, was on the first of July formally handed over to the Ottawa Manufacturing Car Company, which is applying for incorporation. The provisional directors are Messrs. W. W. Wylie, T. Ahearn, J. W. McRae, W. Y. Super and W. Scott.

The Restigouche Telephone and Electric Light Company has been organized at Campbellton. It is the intention to construct a telephone line to Dalhousie, a distance of 16 miles, and to Metapedia, a distance of 12 miles, taking in the principal towns on the Restigouche River. The provisional directors of the Company are: James Reed, George Moffatt, W. W. Doherty, Kilgour Shives, A. E. Alexander, J. P. Mowatt and David Richards.

The ingenious assessment commissioner for the City of Toronto, in casting about for means to increase the assessment, has decided to tax the mains of the Consumers Gas Company, which are valued at \$700,000, and also the wires of the electric light and telephone companies. No doubt this new departure on the part of the assessment commissioner of Toronto will be the means of carrying the question of the liability of the gas and electric corporations to assessment in this manner into the courts for decision, and the outcome will be looked for with much interest by similar companies in other localities.



## ELECTRICAL SHOP EQUIPMENTS.

THE subject of separate motors for machine tools which are directly connected to the moving parts of a machine is coming forward as an important element in manufacturing establishments, and although a comparatively recent innovation it promises to play an important part in the economy of operation of the workshop.

We learn from *Electricity* that some interesting data on this subject was given in a paper read before the *Electrotechnische Verein* by Mr. Richter, chief engineer of Siemens & Halske's works.

The subject was considered under three different heads :

1. The factory is driven by an electromotor in the same way as by a steam engine, a turbine, or other motor ; in other words, the electromotor takes the place of the steam engine, etc.
2. The factory is divided into several groups, each of which is driven by an electromotor ; so called group working.
3. Each work machine receives its own electromotor ; so-called separate or single working.

As an example of the first method may be mentioned a spinning mill at St Blasien, in the Black Forest, which is driven by turbines, and where the water that has driven these turbines is utilized again, about one kilometre below the factory, by another turbine installation, and the 200 horse power obtained there is transformed into electrical energy and transmitted back to the factory to yield 150 horse power to the main shaft.

The same mode of working also occurs in factories consisting of separate buildings at some distance from one another, and where electromotor working, compared with steam working, will be found economical. Mr. Richter mentions an example of this from his own experience.

It was a question of replacing in a sugar refinery a 35 horse power steam engine, placed in a distant building, by an electromotor to be supplied with current from an electric central station working at a high efficiency, while the steam-engine received its steam from the same boiler plant.

The steam dynamos of the central station consume 7 kg. of steam per effective horse power per hour. At an efficiency of only 90 per cent. for the steam dynamos, of 95 per cent. for the line, and of 90 per cent. for the 35 horse power electromotor, we find a total efficiency of 77 per cent., which means that in the central station 9.1 kg. of steam per hour would have to be expended for each effective horse power produced in the distant building.

The steam consumption of the 35 horse power steam engine amounted at least to 17 kg. per horse power hour, and was in fact inclusive of the loss in the long pipes, 20 kg. A saving of 54 per cent. was thus effected by electric working.

As an example of group working Messrs. Siemens & Halske's Charlottenburg factory may be mentioned. The arc lamp factory, opened in 1890, is provided in each of its six rooms with an electromotor driving a short transmission shaft with two safety couplings. From these two electric couplings two shafts running the length of the room are driven, and from these latter, by means of an intermediate gearing fastened to the ceiling, are driven the tool machines. Thus every room is independent of the others, and is besides by the safety coupling divided into two parts independent of each other, so that if from any reason the work has to be interrupted in one place this derangement need only extend to half the room.

There is yet another advantage attached to this arrangement and that is that all the transmissions from one room to another are avoided, and consequently also those dangers caused by the openings in the ceilings made for belt transmission, and which have often contributed to the spreading of fire. And, further, the main transmissions, which are a source of great loss of power, are avoided by group working.

After the favorable results obtained by group working, the 100 horse power steam engine installed in the oldest portion of the Charlottenburg works has been put out of operation, the various sections of the transmission have been divided into five groups, and each group has been driven by an electromotor of proper size. The working current was supplied from the electric station, which is fitted with a highly efficient boiler and machinery plant.

In addition to the saving of energy by suppression of the main

transmissions, this arrangement has also the advantage that for night work of individual tool machines the whole transmission need not be run, but only a special portion of a certain section.

Mr. Hartmann, of the firm of Hartmann & Braun, Bockenheim, who has made similar tests, found that the losses of energy caused by transmissions were by no means so small as is generally supposed. He ascertained that a triple transmission had an efficiency of from 13.7 to 66 per cent., or a mean of 47 per cent., and a double transmission of from 52.1 to 71 per cent., or a mean efficiency of 64 per cent., according to the size and extent of the transmission. The numerous investigations made by Messrs Siemens Halske have given similar results. In triple transmissions an efficiency of less than 50 per cent. has repeatedly been found, and in double transmissions the mean of many observations was found to be 56.6 per cent. The results, however, are entirely different in installations where all the machines are not always in operation, a condition which obtains in most of the factories. In several of the workshops of the Charlottenburg works Mr. Richter has for some time kept a careful record of the actual working hours of the tool machines, and has found that these hours amounted to from 47 to 74 per cent., or a mean of 62 per cent. of the whole working time. The mean efficiency of a triple transmission is hereby reduced to 29 per cent., and that of a double transmission to 40 per cent.

Now, as regards electric group working, it will be clear that by arranging the tool machines in smaller groups, so that the intervals of work always affect a whole group, this running without a load can be avoided. If, further, the installation is made in such a way that a double transmission can be dispensed with, a considerable advantage, from a commercial point of view, will be obtained by electric working.

Assuming 90 per cent. to be the efficiency of the generator, 95 per cent. that of the line, and 85 per cent. that of the electromotor (all these values are taken rather low), we get a total efficiency of 72½ per cent., as against 64 per cent. or 40 per cent. for double transmission.

To distribute the machines in such a way that all the machines of the same group are always simultaneously at work will be found difficult because it must naturally tend to making the groups smaller and smaller and thus lead to single motor working. At first sight it may seem strange to provide each tool machine with its own electromotor. The objections against such an arrangement are that it renders the installation too expensive, and that on account of the low efficiency of small motors such a system is not economical. Both these contentions are true to a certain extent. As regards, first of all, the prime cost, Mr. Richter has made a large number of calculations, and has found, for instance, that in one of the rooms of the arc lamp factory, where, as has been mentioned, group working has been adopted, and which contains 42 tool machines driven by a 25 horse power electromotor, the prime cost would only have been 13 per cent. dearer if, instead of the one electromotor with transmissions and belts, 42 electromotors with their accessories had been employed. In another room containing 29 tool machines, driven by an 8 horse power electromotor, the result would have been even more favorable, so that a mean of 10 per cent. may be assumed. It must, however, be pointed out that this 10 per cent. only refers to the prime cost of the motor installation and not to the cost of the tool machines, so that on comparing the total cost of single working with that of group working of the whole installation the additional expenditure would hardly amount to more than 3 or 4 per cent.

Now, as regards the efficiency, we will at once assume the most unfavorable case. An electromotor of ¼ horse power, the smallest to be used for similar purposes, has an efficiency of 70 per cent.; taking the efficiency of the line at 90 per cent., and that of the generator also at 90 per cent., we get a total efficiency of 57 per cent. Supposing, further, the tool machine to be joined to the motor by an intermediary piece absorbing 10 per cent., we get a total efficiency of over 51 per cent. Comparing this with the 40 per cent. efficiency of a double transmission it will be seen that the result is not nearly so bad as might be expected. It is clear that in a factory where the working hours of the tool machines exceed 62 per cent. of the total working time the result would be more unfavorable, but even in this case the efficiency would only be inferior to a double transmission if the

above percentage amounted to 80 per cent. In basing our calculation, not on the smallest, but on motors of average size, for instance of one horse power, we find that the above figure of 57 rises to 61 per cent., and that of 51 to 55 per cent.; assuming the working hours of the tool machines to be 81 per cent. of the total working time, the efficiency of single motor working will be found equal to that of a double transmission. Compared with group working which, on account of the larger motors employed, has a higher efficiency than single motor working in proportion of 9.8, we may say that single working with motors of one horse power mean capacity, assuming the working hours of the tool machine to be 75 per cent. of the total working time, gives the same efficiency as group working where the whole of the machines of one group are either working or standing still at the same time.

Single motor working presents special advantages which will, in many cases, compensate for the higher prime cost. In the first place, by combining the motor with the tool machine, the belts, which so greatly obstruct the light, are dispensed with; the appearance of the room and the light are improved and the existing space can be utilized for the erection of galleries. The building, not having to support transmissions, can be of lighter construction; the tool machines can easily be shifted for certain work, requiring only an alteration of the electric wires; the cost of maintenance is diminished by the absence of long belts, and finally a complete independence of the various tool machines is obtained, so that for working after hours or during the dinner hour any one of the machines can be operated without being obliged to run a transmission consuming much power.

#### TURBINE EFFICIENCY.

EXPERIENCE has proved says C. R. Tompkins in *Milling*, that to obtain the best results with any turbine wheel, the supply must be equal to the capacity of the wheel. For example, a wheel of good modern construction that has the capacity for using one thousand cubic feet of water per minute under a given head will return in useful effect from 80 to 85 per cent. But if the supply to the same wheel were cut down to one-half quantity or five hundred cubic feet under the same head, it is very doubtful whether more than from 40 to 45 per cent. of useful effect would be realized. There is also another important point to be taken into consideration by those who are about to purchase a new wheel, that those wheels which have been tested and show a high percentage of power in the testing flume whether it be at Holyoke or at any other place, are always tested at their best and under the most favorable conditions and with full water. But this is not always a safe criterion, for how many wheels are there in daily use that are ever run strictly with full water. There must always be a surplus to regulate the speed by, otherwise the speed could never be uniform or depended upon for regularity and the probabilities are that a large majority of wheels are running most of the time upon three-quarters to seven-eighths water.

The term water instead of gate is used for the reason that the term half-gate or three-quarters gate does not always convey a correct idea of the amount of water used by the average turbine. Therefore the amount of gate opening is no safe criterion in estimating the quantity of water used, for most of the wheels at the present time are so constructed that the combined gate-openings represent an area nearly, if not quite, double that of the combine openings in the wheel, so that half-gate may really mean three-quarters, seven-eighths or nearly full water. Now in order to show that this is not exaggerated, take the following, which is quoted from the catalogue of one of the prominent manufacturers of turbine wheels at partial gate and this may be taken as a fair sample for most others. The catalogue says "with full gate, using 2,751.80 cubic feet of water, .867 per cent. of useful effect was returned. With half gate, using 1,996 cubic feet of water, the percentage of useful effect was .654 per cent. With three-eighths gate, using 1,621 cubic feet of water, .581 per cent. was returned." Now it requires but little figuring to show that in this case one-half gate discharges within less than sixty-eight cubic feet of three-quarters the capacity of the wheel at full gate, so that in this case half-gate really means three-quarters water. Again at three-eighths gate, the quantity of water discharged being 1,621 cubic feet, does not by any means represent three-

eighths of the full supply, for  $\frac{3}{8} \times 2751.87 = 1031.95$  cubic feet which is 590 cubic feet in excess of that amount, for if the gate openings had been in proportion to those of the wheel, that is to say, only sufficiently larger to compensate for the friction of the water in passing through them, then at three-eighths gate it should have used 1,031.95 cubic feet of water instead of 1,621, while at half gate it should have used 1,375.93 cubic feet instead of 1,996. Again if we take the same average percentage of power from the quantity of water used and apply it to the quantity of water that should have been used provided the gates openings were in proper proportion to the wheel, the percentage of power at half-gate would have been 40 per cent. instead of 66, and three-eighths gate would have fallen off in the same proportion, and probably less than 30 per cent. of useful effect would have been realized. In another wheel of different manufacture, the published test showed the greatest efficiency at a point about half way between three-quarters and seven-eighths gate and from seven-eighths to full gate the percentage of useful effect fell off about 10 per cent. Now there must certainly be something wrong in the construction of that wheel, otherwise if the gate openings were in proper proportion to the wheel the efficiency should gradually increase as the gate openings increased and the greatest efficiency should be at full gate. Now the probabilities are that the relative size of the gate openings were such that when it arrived at seven-eighths gate the wheel had all the water it could discharge and a further supply acted as a detriment to it rather than an advantage and in this case seven-eighths gate really was full gate or full water. If any one can explain this upon any other hypothesis we should be glad to hear it. The makers of the wheel, however, claim that as one of the peculiar advantages possessed by their wheel, viz., its greater efficiency at part gate, but the probabilities are if they should stop at seven eighths of the gate opening and call it full water and then figure back upon the same principle, or, in other words, drop the gate opening entirely and figure strictly upon the actual amount of water discharged, that is to say call one-half the water discharged one-half gate, three-quarters water three-quarters gate, and so on, the chances are that those same wheels as well as many others that have shown such remarkably high tests in the testing flume based upon the gate opening, when tested strictly upon the quantity of water discharged under those conditions, those remarkable results that are claimed upon half gate tests would fall off materially and they would fall into line with many others that make no such pretensions or have never seen the inside of a testing flume, either at Holyoke or any other locality, aside from the mills where they are in use.

#### HOW TO FIGURE ON LIGHTING A GIVEN SPACE.

IN answer to an enquiry of a correspondent, the *Architects Electrical Bulletin*, gives the following:

The number of incandescent lamps required to illuminate a given space is arrived at from a computation of the square feet of flooring, allowing one lamp to so many square feet, according to the kind of illumination required.

On this plan it is presupposed that chandeliers are employed, and not ceiling work. Chandeliers should depend from the ceiling uniformly at a distance of about seven and one half feet from the floor in order to get the best results. At this distance it is correct to allow one 16 c. p. lamp to forty square feet for excellent lighting; for good lighting it is customary to allow one 16 c. p. lamp to sixty four square feet, and for general illumination, one 16 c. p. lamp to one hundred square feet of floor.

In ceiling work which is becoming more and more popular where expense is not considered, lamps may be used ad libitum. In this kind of work no rules can be observed, as height of ceiling, color of decorations, effect intended, and many other things may be taken into account by the artist.

The candle power of arc lights is so variable that their use is limited to big spaces, and the best result from any given light is simply a matter of experiment, and cannot be arrived at by any rules at all. In regard to the cost of the installation of the Interior Conduit system, including wire and labor, it is safe to say that a fair average is \$3 a lamp. This does not include fixtures.

A company is being formed at Kalso for the purpose of lighting the streets of Kalso, B. C., by electricity.

## SPARKS.

The new electric railway at Peterboro is now in readiness to go into operation.

The construction of the new Electric Street Railway at Kingston, Ont., has been commenced.

The receipts of the Toronto City and Suburban Railway are said to average over \$1,200 per week.

It is said that the Reliance Electric Manufacturing Company will shortly install a lighting plant at Tilbury Centre, Ont.

The Ball Electric Light Company, London, Ont., are putting in a large drain to carry water from the river to their works.

The Port Dalhousie, St. Catharines and Thorold Railway Company has been incorporated with a capital stock of \$100,000.

The Ball Electric Light Company, of London, have secured the contract for lighting the grounds and buildings of the Western Fair.

The Toronto Street Railway Company propose to extend the Toronto Mimico road, which they purchased recently, to Long Branch.

The construction of an electric railway is under contemplation at South Edmonton, N.W.T. The cost would be about \$100,000.

On the first of July, the new incandescent plant lately purchased by the Renfrew Electric Light Company was successfully put in operation.

The St. Jean Baptiste Electric Light Company of Montreal, have lately installed a new alternating electric light dynamo, at a cost of \$5,000.

The London Street Railway Company are laying the rails on the extension of the Dundas street line. The Baker rails are used, being 35 feet long.

The City Council of Port Arthur, after a lengthy discussion, decided at a recent meeting to purchase the electric light plant, the price to be settled by arbitration.

The Carter Motor Company, of Stratford, has been incorporated with a capital stock of \$300,000 to manufacture the Carter motor and the Carter rotary engine.

The operation of the Toronto and Scarboro Electric Railway was commenced on the 1st of July. Everything worked satisfactorily and the road was well patronized.

The municipality of Cote St. Louis has granted a 30 years franchise for an electric railway to the Montreal Street Railway Co. The construction of the road will commence immediately.

Geo. H. Campbell, manager of the Winnipeg Electric Street Railway Company, has purchased a number of new cars. He says that extensive additions to the line will be made at an early date.

Mr. Wm. Kennedy, hydraulic engineer, of Montreal, is investigating at Port Arthur the feasibility of using the Current river power for the operation of an electric street railway and a lighting plant.

Mr. J. J. Myles, of the Hamilton, Grimsby and Beamsville Railway Company, states that work will be commenced on the road at once, and that it will be completed to Grimsby by next winter.

The proposition has been made at Ottawa that steps be taken to decide the capacity of the Chaudiere and Rideau Falls. It is said that at present an undue share of the power is monopolized by a few firms.

Messrs. McRae & Company, of Ottawa, are now operating Messrs. Allan & Fleming's Wakefield mica mines. They have 30 employees, and use steam power. The mica is prepared for the market at Ottawa.

On the recommendation of Mr. Collingwood Schrieber, Government Engineer arrangements are being made to put in an electric plant with which to open and close the locks of the Sault Ste. Marie canal.

Owing to the trouble that has been experienced by the Toronto Street Railway with the Edison motors heretofore in use, the manager has decided to replace them with Westinghouse motors, at a cost of about \$50,000.

An agitation is on foot at Moncton, N. B., for the construction of an electric street railway. It is proposed to construct a belt line, with double track, 3 miles in extent, and equip with 6 cars, at an expenditure of \$75,000.

Owing to the death of Mr. John A. Wills, the inspection of the boilers and machinery of the various government institutions, has devolved upon Mr. A. M. Wickens, chief engineer at the new Parliament Buildings, Toronto.

It is said that Mr. Van Horne, President of the C. P. R., contemplates using electricity for the purpose of drawing trains up the Kicking Horse Canyon. It is proposed to procure the necessary power from the Kicking Horse River.

The Dominion Government has granted a subsidy of \$2,100 towards the construction of a telephone system from Lethbridge to Lac Junction, N.W.T., a distance of 23 miles. The Mormons in the locality have also contributed to the undertaking.

On the evening of the 10th of July, George Lanthier, a dynamo attendant in the employ of the Royal Electric Company, of Montreal, was caught by the machinery and instantly killed, his body being terribly mangled. There was no one present when the accident occurred.

Electricity is now used in traction, in illumination, in telegraphy, submarine and terrene, in engineering, medicine and surgery, in agriculture, horticulture and floriculture, in many kinds of mechanism in manufacturing, in heating, in cooking, and in yet other service. There are thousands of miles of electric railway; a new electric ship is nearly completed at one of our Pacific ports; and we have a promise of a new kind of electrical balloon.—*Electric Power.*

Mr. W. J. Gilmour, of Brockville, district manager of the Bell Telephone Company, has been making arrangements to improve the telephone service at Renfrew. About 20 additional telephones will be put in, and a long distance communication and an all night service furnished.

The shareholders of the Ottawa Electric Railway and the Ottawa City Passenger Railway Company have been informed that there has been reserved for them \$12,000 of the stock of the new Ottawa Car Company. The capital stock is \$50,000, only \$25,000 of which will be issued at present.

The Railway Car Heating and Ventilation Company are seeking incorporation with a capital stock of \$1,000,000. The directors are Wm. McKenzie, J. C. Close and H. A. Everett, of the Toronto Street Railway Company, and Major S. Hughes, M.P., of Lindsay, the latter being the inventor of the system.

The electric railway between Vancouver and New Westminster, B. C., is the longest straight line in Canada. It passes through the primeval forest, and the scenery along the road is said to be of the loveliest description. The road is said to be thoroughly equipped, and the possibility of accidents reduced to a minimum.

As soon as the City Councils of St. Stephen and Milltown, N. B. shall have located the line, the electric railway company will proceed with the building of the road. It has not been definitely decided what action will be taken by the citizens of St. Stephen, but it is stated that in any case the road will be built in Calais.

Sunday cars is the all-absorbing topic in Toronto at present. A vote of the citizens on the 26th inst. will decide for the present whether or not the cars shall be allowed to run on Sundays. Should the majority vote yea, the profits of the Street Railway Company will be increased by many thousands of dollars.

The City Council of Belleville has granted the request of Messrs. Close and Fraser, of Toronto, for an extension of time in which to commence the construction of the proposed Belleville Electric Street Railway, on condition that a deposit of \$1,000 be made with the City Treasurer, to be forfeited if the agreement be not carried out.

A person named O'Connor recently sued the Nova Scotia Telephone Company for having, as he alleged, mutilated his trees while stringing wires. The case was carried through the various courts and reached the Supreme Court at Ottawa a week or two ago, where the decision of the inferior courts in favor of O'Connor was reversed.

The Kingston Street Railway Company have purchased the water power and buildings at Kingston Mills. During six months of the year, when the canal is closed, there is obtainable 1,000 horse power; and during the balance of the year, 300 horse power. It is proposed to use the power for the operation of the new electric street railway.

A petition has been presented to the Hamilton City Council, by the President of the Hamilton and Dundas Railway Company, asking for an amendment to the city by-law under which the road is chartered, so as to admit of the road being operated by electricity instead of steam. It is proposed to rebuild the road as a double track system.

At a meeting a few days ago of the Brass Manufacturers' Association, dissatisfaction was expressed with the difference in duties imposed by the tariff, on electric and gas fixtures. Electric fixtures bear a duty of 25 per cent., while gas fixtures are taxed 30 per cent. The Finance Minister has been communicated with on the subject, and has promised that the matter will be attended to.

The Council of the village of Markham propose to sell the electric light plant, which has been operated by the municipality. A local paper states that the Council have spent enough money in legal expenses to run the plant for a year or more, and that on several occasions the town has been left in darkness because of the failure of the Council to supply the necessary fuel to operate the plant.

The following gentlemen have been elected as the officers of the Sandwich, Windsor, and Amherstburg Electric Railway: Dr. Coventry, president; G. M. Hendrie, vice-president; W. S. Pulling, secretary-treasurer; with the following directors: W. Hendrie, R. Thomson, Hamilton; W. J. McKee, James Anderson and John Davis. Mr. James Anderson has been appointed manager of the electric light department.

The City Council of Vancouver, after having placed in the estimates \$350,000 for the purchase of the street railway property, recently voted down a motion to submit a by-law to raise the necessary amount. It is now proposed that the city shall guarantee interest on \$400,000 of debentures of the company, and allow the company to exist, but the city to have a controlling interest. It is not likely that this will receive the endorsement of the ratepayers. The Westminster and Vancouver Tramway Company have offered should the city secure the road, to lease the property from them, and pay interest on \$400,000.

A sub-committee of the electric railway committee of the Montreal City Council has recommended that permission be granted to the Montreal Belt Line to construct a road from east to west through the City via St. Catharine, Delormier, Craig and St. James Streets, the Company to pay \$2,000 per mile to the City, and be responsible for the damages. The committee also recommend that Robert Bickerdike be permitted to build and operate a line from Dominion Street along St. James Street to Little Craig Street and along Craig Street to the Champ de Mars, on payment of \$1,500 per mile of the line for the first year, and \$2,000 per mile subsequently. The road to extend west from the city limits a distance of 3 miles, passing through St. Canegonde, St. Henri and Cote St. Paul.

MOONLIGHTS SCHEDULE FOR AUGUST.

Day of Month.	Light.		Extinguish.		No. of Hours.
	H.M.	H.M.	H.M.	H.M.	
1.....	P. M. 7.50		P. M. 10.30		2.40
2.....	" 7.50		" 10.50		3.00
3.....	" 7.40		" 11.10		3.30
4.....	" 7.40		" 11.40		4.00
5.....	" 7.40		A. M. 12.20		4.40
6.....	" 7.40		" 1.00		6.20
7.....	" 7.40		" 1.10		5.30
8.....	" 7.40		" 2.00		6.20
9.....	" 7.30		" 3.10		7.40
10.....	" 7.30		" 4.10		8.40
11.....	" 7.30		" 4.10		8.40
12.....	" 7.30		" 4.10		8.40
13.....	" 7.30		" 4.10		8.40
14.....	" 7.40		" 4.10		8.30
15.....	" 8.00		" 4.10		8.10
16.....	" 8.20		" 4.10		7.50
17.....	" 8.50		" 4.10		7.20
18.....	" 9.10		" 4.10		7.00
19.....	" 9.50		" 4.20		6.30
20.....	" 10.20		" 4.20		6.00
21.....	" 11.00		" 4.20		5.20
22.....	" 11.20		.....		.....
23.....	.....		" 4.20		5.00
24.....	A. M. 12.20		" 4.20		4.00
25.....	" 1.20		" 4.20		3.00
26.....	" 2.40		" 4.20		1.40
27.....	No light.		No light.		....
28.....	No light.		No light.		....
29.....	No light.		No light.		....
30.....	P. M. 7.10		P. M. 9.20		2.10
31.....	" 7.00		" 9.50		2.50
Total,					153.40

THE ELECTROLYSIS OF WATER PIPES.\*

By C. H. MORSE.

WHEN electric cars were first put in operation in Cambridge (Mass.) they depended upon mother earth, the water pipes, the gas pipes, and anything over which the current could flow, to convey it to the station or act as a sewer. No thought was given to the loss which would result to the Company from doing this, to say nothing about the effect upon pipes. I can, perhaps, illustrate this loss by saying that three months ago, in parts of Cambridge, the loss of pressure due to the power which was required to force this current back over this uncertain path was 20 per cent.

When the railroad company put in their power plant, they run large numbers of feeders and one wire between the rails, and attached the two rails to this return wire. This became very soon an uncertain path, as it was found that electrolytic action took place upon this wire and it disappeared in places. They thought at first that it was due to something in the soil, but it was very soon traced to the enemy, that is, electrolytic action. I remember the practical experience we had with these dead rails, as we call them. When this wire was eaten off and a car came on to that section, if by any chance you placed one foot upon the rail and another upon the ground near it, shocks could be obtained.

Mr. Nevons and I went to the different places where we had traced these difficulties, or where they had been called to our attention rather, and found that lead pipes had disappeared in a short space of time, some even in six or eight weeks. Iron pipes had been tried with the same result, also galvanized iron; brass pipe had been put in, and deterioration was noticed at once. Rustless iron was tried, and it did rust decidedly. It was not the work of any mysterious agent, but was the result of what almost all of you have seen in school experiments, that is, the decomposition of water. A speedy remedy for that, of course, was easily apparent, that was to reverse the current. So the officials of the West End Railroad Company were invited to a conference with the Water Board and myself, and I am pleased to say the Company were willing and anxious to do anything in their power to obviate this difficulty. A certain amount of credit belongs to them for that, although, of course, they had themselves a reason for wanting to do it. They were losing anywhere from 5 to 20 per cent. of their power in this return.

Observations were made by several of the waterworks employes unintentionally. Such an immense amount of current

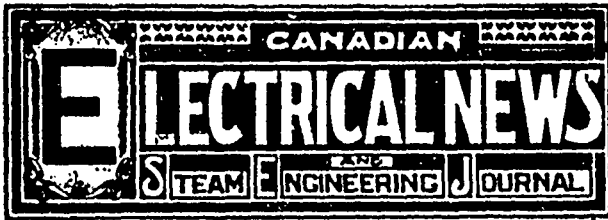
was flowing over the pipes that upon attempting to make a joint by putting oakum around the pipe, it was found that the electric arc was sufficient to set fire to the oakum, frightening the men considerably. Tests were made in different parts of the city by means of instruments adapted for the purpose, and we found between North Cambridge, Harvard Square, Central Square, and East Cambridge a fall of potential all the way from 25 to 45 volts. Now, there should be no fall of potential, but there was a loss of from 25 to 45 volts, from 500 volts, which is the maximum pressure, making more loss than can be allowed with economy. When we attached to the negative pole of the machine and made our tests from Harvard Square, we found a loss of 100 volts, or 20 per cent. of the pressure. You can now see, as I said before, why the Company was very ready to take hold of this matter.

How are we to remedy the difficulty? I know of no way by which we can use the single trolley wire system and overcome this difficulty without putting up an immense amount of overhead returns, through which the resistance will be reduced to almost nothing. How far the Company will be willing to go in this I cannot say. Their spirit has been so admirable in the past I have no right to suppose but what they are willing to carry it to that extent. Certainly, the city will require it carried to such an extent that the pipes will be in perfect safety. The maximum amount of current which can be allowed to go over them I am unable to tell you at present, but a series of experiments are being conducted now at my house to determine this. I have some pipes buried in the earth, the current flowing over them, and I am watching carefully the deterioration daily. I am in hopes to make a report soon to the Water Board upon the maximum amount which can be allowed to flow upon iron pipes.

By doing what we did, reversing the current and attaching our water pipes to the negative pole of the dynamo, we hurt one of our old friends seriously, that is, the Gas Company. You see the effect. The current will flow on the water pipes, and it has an easy chance to leave them through their connection with the negative pole of the dynamo. Now it flows along on a gas pipe and as soon as it can it will leave the gas pipe to take to the water pipe. I felt it my duty to make this clear to the President of the Gas Company, and called his attention to it, saying that something ought to be done to protect him, and a conference was had between the railroad people and the Gas Company, and I was invited to be present. At that time we made an arrangement with the Company which will help it somewhat in that direction, and help us as well as them. We propose now to connect the gas pipes and the water pipes together in all parts of the city. It will be done in buildings. A man from the West End Company has been appointed who goes as a gas man to the different stores and factories, and in those places he will solder a wire to the gas pipe and also to the water pipe. This can do no injury to either, but will decidedly help both companies.

I was somewhat surprised at the way they attempted at first to return the current. There are girder rails that have, we will say, 10 sq. in., some of them have as high as 14 sq. in., sectional area. That would have a carrying capacity equal to a piece of copper 2 in. square. And yet these rails are bonded by a No. 4 copper wire, a wire smaller than a lead pencil. It seems quite ridiculous that they should require this little bit of fine copper wire to carry as much current as a big rail, where they should have a piece of copper wire, as I said before, for these big rails, of at least 2 sq. in. sectional area. There is another remedy also which we hope to carry out early in the spring, and that is to abolish completely this return wire between the rails, by cutting it into sections of about 400 ft., and connect each of these sections with the return wires. Most of the current will then return by these copper wires. Of course, some of it will flow over the water pipes; that cannot be helped as long as one side of the machine is connected with the earth. Another remedy which is to be adopted, is a special line of feeders attached only to the water pipes; that is, a feeder will be run from the central power house to the different parts of the city, which will not be connected with the machines at all, but will be connected with the water pipes at the central power house and with the pipes in all sections of the city. This will also materially reduce the electrolytic action.

\*Abstract from a Paper read before the New England Waterworks Association.



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WE gather from recent personal interviews with persons interested in electrical matters in the United States, that the line of action taken by the General Electric Co. towards manufacturers of incandescent electric lamps, is regarded as a huge mistake. Most of the lamp manufacturers stood prepared to pay the General Electric Co. a fair royalty on the production of their factories if a liberal disposition had been shown towards them. The attempt to crush them out of existence has aroused the determination that by some means they will survive. The minds of inventors have been stimulated to produce lamps which could not be proved to infringe the Edison patents, and in many instances they have succeeded. This fact, as well as the decision in the case of the Columbian Lamp Co. and the brief period constituting the future life of the Edison patents, has resulted in the entire failure of the coercive policy of the General Electric Co., which is likely to find little comfort in the reflection that its treasury is minus many thousands of dollars which, had its methods been more conciliatory, it might have enjoyed possession of.

THE apparently growing desire on the part of a certain proportion of Canadian engineers to improve their educational status is to us a gratifying sign of the times. It means that in the future steam plants will be better cared for and more economically managed, that in consequence a higher value will be placed on the services of competent engineers, and that they will receive better remuneration. It should be the aim of every engineer who is ambitious to rise, to pass the examinations and obtain the certificate of the Canadian Association of Stationary Engineers. We desire that this journal should be of assistance to engineers who are seeking to qualify themselves to pass these examinations. With this purpose in view we have arranged with a gentleman who is a well known authority on steam engineering to contribute to the NEWS a series of articles which we have every reason to believe will be found helpful to those who propose to present themselves for examination. The first of these articles, under the title "Notes for Steam Engineers," will be found in the present issue, followed by others in succeeding numbers. We commend them to the careful attention and perusal of engineers, and shall be pleased if as many of our readers as feel interested would criticise and discuss through our columns the points raised.

THE electric car system has been roundly abused by the newspapers as a wholesale destroyer of human life. While unquestionably the danger of accident has to some extent been increased by the enhanced speed at which electric cars travel as compared with horse cars, it is nevertheless true that two-thirds at least of the persons who have been killed by the cars since their introduction into Canada, lost their lives through their own carelessness. If, as we have observed, people will cross the path of electric cars at a snail's pace, with their attention absorbed by every passing object, instead of being on the alert against a danger which they know exists, their injury is certain to follow in spite of all the care which can be exercised by those in charge of the cars. In this connection the fact should be stated that the bicycle has come to be a greater source of danger to pedestrians than the electric cars. The cars run only in the middle of the streets, and only upon certain streets; the bicyclist runs everywhere unless prevented by the law. The popularity of the bicycle is such that at certain hours the streets are literally filled with riders, male and female, travelling at every rate of speed from five to twenty miles an hour. A business man of Winnipeg while descending from an electric car a few days ago was struck by a bicycle and so seriously injured that he died.



shortly after. There is reason for the demand that the speed at which bicycles may be ridden on public thoroughfares should be limited by law to five miles an hour.

ONE of the things which we have to deplore is the loss of a large number of our brightest and most ambitious young men, who for lack of opportunity of making the most of their talents and energy, migrate to the centres of population in the United States. It should be the aim of every patriotic Canadian to find openings for the employment of as many as possible of these young men in their native land, where they would assist to build up a great nation, such as we hope this Dominion will one day become. It is in the hope of retaining one such young Canadian that we publish the following extract from a letter received a few days ago from Lynn, Mass. :—"In about three weeks I shall have completed the expert course with the Thomson-Houston Electric Co., and when through would like to return to Canada. Having seen in your paper lately notices of quite a number of new electric roads being built, I thought you might know of some openings for an electrician. I have had altogether six years of practical experience in electricity. I do not want an office position with nothing to do, but a place where there is plenty of work, such as electrician for a street railway company or electrician of a lighting and power company in a town of good size." The writer of the above is possessed of the requisite training and energy to perform good service in a position such as he is seeking; his letter is accompanied by excellent Canadian references, and we would be greatly pleased to place him in communication with persons in need of his services.

ONE of the essential things about an electric plant at this time of the year is means to protect it from damage by lightning. No station or power house is fully equipped until such means have been provided. Not only does this apply to the larger plants but to the small ones as well. It is just as necessary to protect a plant running a single dynamo as it is one operating many of them, and since there are efficient lightning arresters made for all classes of circuits it is almost inviting the destruction of the plant not to apply them. There is perhaps more need for them on a power plant than on any other, particularly one with a grounded circuit such as is used to operate street railways. In such case it becomes imperative that they be used. They should not only be placed inside the power house but at intervals along the line as well, and in places where the lightning discharges are usually of a severe character such intervals should be very short indeed if absolute protection is desired. On ordinary power circuits operating stationary motors there should be a lightning arrester with its ground wire well connected in every place where a motor is used, or very close to it, otherwise there will be a constant tendency to crippling of the motor from lightning discharge, particularly if such discharge occurs close to the place in which the motor is being used. A perforation of the shunt winding or armature then follows and repairs become necessary. This means an expenditure that would not have been necessary had there been a lightning arrester in use at or near the motor. It may appear to some that the discharge should take what would seem to be the easiest path to earth through the lightning arrester at the station, but if that station happens to be a mile away, the small volume of current that is carried by the wires at the enormous pressure will find its path to earth by way of the machine frame in preference to travelling back that mile to find it. This, of course, would not be if the voltage was not high. To successfully protect your plant from lightning discharges, be it arc, incandescent, or for the supply of current for power purposes, you must use a good arrester and plenty of them.

A FEW days ago we were invited to accompany a party of representatives of the press, who, through the courtesy of the management of the Niagara Falls Park and River Railway, were given the pleasure of a trip across the lake and a ride on their new electric cars up and down by the cataract and its rapids, above and below, with opportunities of stopping off and viewing from all standpoints the attractions of nature there presented, and were entertained most hospitably, so that we carried away a kindly remembrance with the inspiration imparted by the majesty and beauty and the untiring activity and giant power

displayed in this fascinating region. Elsewhere in this issue is given an account of the electric road as an engineering accomplishment. It is neat and sightly throughout and thoroughly and efficiently built and equipped, and the company are sparing no pains or expense which may further add to the safety, accommodation or pleasure of their passengers. Their safety is especially looked after by placing guard rails and rail braces on curves to prevent cars going off the tracks, or getting away if they should go off along the precipitous banks which they skirt. Besides this the wheels and trucks are extra heavy and the speed is moderated at these curves. Part of the way down the long grade at Queenston a siding has been made, which remains always closed, so that if by any chance a car should get away, or if the brake and reversing the motor should fail to work, it would run upon this, and so prevent a runaway down the Heights, with its consequences. Most people are familiar with the sights about Niagara, but none have seen them to as great an advantage with as great convenience and at as little expense as the passengers on this road now do. Starting with the historic scenes about Queenston and the Heights, the remains of the old suspension bridge and the fine view out towards Lake Ontario over the quieter portion of the river, we pass through a panorama of rapids and ravines, the whirlpool and its rapids, of bridges and glassy though swift water beneath with foam from the Falls; the Falls and the rapids and islands above; till we stop in the quiet of Chippewa—twelve miles, which seem one, so much is our attention occupied. To those within reach of it, and especially to the people of Toronto, when taken in connection with the sail across the lake, this trip will no doubt prove the most attractive to those desiring a day's recreation of all the many attractive excursions that are to be had hereabouts.

LUBRICATING oils for use on electrical machinery are now in such steady demand that oil manufacturers are vying with one another in attempting to turn out something better than has been supplied heretofore. This leads us to remark that the bad working of a dynamo can often be traced to a non-suitable lubricating oil, not necessarily a bad oil, but one that might be good for other uses. If there is any piece of machinery that requires a distinctive oil for use on its bearings it surely is a dynamo, the only suitable oil for which is a purely mineral one, not one containing as oils frequently do an animal or vegetable admixture. The use of oil of this character would make very little difference as far as the bearings themselves are concerned, but when it gets to the commutator, as it is bound to do, there is constant danger of the animal or vegetable part of it carbonizing or charring from the constant friction of the brushes and from the spark. This is liable to produce a short circuiting of some of the segments and make the machine so much less efficient, to say nothing of the damage it may cause if continued until a deposit of such charred oil settles itself into all the small cavities that are frequently found in the mica insulations, particularly after the commutator has been to some extent worn. That such an oil will char there is not a particle of doubt, and that it might be the cause of internal trouble in the armature itself we feel sure is a fact; that it can find its way into the general run of armatures by being splashed or sucked in from the vicinity of the shaft is also true. If this thin layer of oil is subjected daily to a temperature such as is usually found in a well loaded machine after a few hours run, it will eventually oxidize, then carbonize and become a conductor to a greater or less extent; trouble is then bound to be the result. We are of the opinion that this will be found to be the cause of fully one half the armature failures. We have positive knowledge that a large quantity of the oils bought for dynamo lubrication contain either lard or tallow oil as an admixture. This should not be, and the sooner oil men find this out the better it will be both for themselves and the users. We do not mean to say that oils containing these ingredients are not good lubricants, the reverse being decidedly the case, but they are out of place around a dynamo and should never be used. This applies equally as well to motors and generators. A motor grease for street railway use should be made entirely of mineral products, and should not possess any animal fats, such as lard, stearine or tallow. We believe that this is fast being recognized as a fact by the makers of such greases. It will only be a matter of a very short time

before oils or greases containing these animal or vegetable admixtures will be entirely tabooed by users of electrical apparatus.

WE have several times referred to the extensive deposits of mica existing in different parts of Canada, and to the fact that these would likely prove of great value on account of the rarity of the material in other countries. Large investments in mica mines in Canada have lately been made, based on this belief, and upon the growing demand for the material from Europe and America. It is a matter of regret therefore, to be told by one of the largest buyers of mica for the British Admiralty and other concerns, who has lately returned from the World's Fair, that the mica exhibits from Bombay, Calcutta, and Australia, are greatly superior to those of Canada, and that if specimens of such size and quality as are to be seen at Chicago can be supplied from the places mentioned, they will rapidly command the markets of the world. Owners of Canadian mica mines state that the Canadian exhibit at Chicago does not fairly represent the Canadian mica industry, and that this is due to the lack of encouragement on the part of the Government in the way of free transportation, etc.

#### NOTES FOR STEAM ENGINEERS.

The tendency to-day is towards the use of higher pressure. Not very many years ago one of the fittings required on steam boilers was a valve opening inwards, so that when steam went down this valve would open and admit air and so prevent the boiler from being injured by a vacuum forming inside. The construction was such that internal pressure of a few pounds per square inch could be safely carried, yet the pressure of the atmosphere applied externally was sufficient to put the boiler out of shape. Steam boilers as made now do not need this form of safety valve.

As higher pressures are used more intelligence and greater ability are called for in the men who undertake to manage steam boilers. The notion that anybody who can stir a fire is good enough to manage a steam boiler is almost as effectually exploded as were some of the old style boilers in which steam of a lifting pressure was raised by the fire stirring attendants.

The man who takes charge of a steam boiler should make himself acquainted with it. He should measure it, and examine it both externally and internally, and know what it is he is going to raise steam in. He should know what pressure might with safety be carried and at what pressure the safety valve can prevent the pressure from increasing after it does open. He should also examine the furnace and flues and chimney and find out how he can regulate or control the chimney draught. He should see for himself where the water supply is obtained and judge of its being sufficient or otherwise. The pumps and valves, or injector and connections, used for putting water into the boiler ought to be tested. It is too late to discover that the pump will not work, after steam is up and the boiler is needing more water.

The water gauges are often at fault, sometimes from dirt in the connecting pipes and frequently from carelessness in puffing them up. The careful man will find out for himself the exact position of the water as shown by the gauges, and the top of the tubes, or other heating surface which must be kept covered with water. If the boiler is a horizontal tubular one with water gauges at the front end, he will try whether or not the boiler is level, as it may be down at the front enough to injure the tubes at the back end unless by carrying the water higher than is necessary to cover them at the front end. Having made sure that the water supply is all right and that water can be put into the boiler when steam is on, and that he can tell just how high the water really is, he will next see how it can be got out if need be. The blow off cock should be dissected. Some blow-off cocks are made to sell and many a fire stirrer has been sold by them. If the blow-off cock cannot be safely opened and shut again with steam on in the boiler, then either the boiler should stay without steam or the cock be removed to safer quarters, and a better one put on.

The steam gauge which is intended to show the amount of

pressure raised in the boiler should be tested and compared with a proper standard. It should either be correct or its amount of error known. The connecting pipe from boiler to steam gauge should be examined, as sometimes the pipe becomes choked with dirt and the pressure does not reach the gauge. The steam shut off valve and steam pipe becomes choked with dirt and the pressure does not reach the gauge. The steam shut off valve and steam pipe should be tried so that the engineer will know that the valve is actually on the spindle—that it fits its seat, and can be opened or closed by turning the wheel.

When the man who is to take charge of a boiler has gone over all the points mentioned his next business would be to get up steam. There are some men who still seem to think that it is a sign of smartness and ability to get up steam with as little loss of time as possible and they will make a boast of the number of minutes it took to get 60 lbs. pressure from cold water. The careful man of experience will, however, rather take as long as possible to get up steam, especially if it is a new boiler, with new brickwork about it. The great consideration should be to heat the boiler as uniformly as possible, in order to avoid having it strained by unequal expansion. After the water is hot and there is some steam pressure on, the fire may be made brighter and the process hastened a little. All sudden changes, either from a lower to a higher pressure, or from a higher to a lower, should be carefully avoided.

The duty of the man in charge may be summed up as consisting in keeping up steam with safety to boiler and all its fittings and with the most economical use of fuel. The motto should be safety first, economy second, and faithful diligence and cleanliness all the time.

## CANADIAN ELECTRICAL ASSOCIATION

PARTICULARS REGARDING THE SECOND ANNUAL CONVENTION.—AN INTERESTING PROGRAM.

AS the present number of the ELECTRICAL NEWS goes to press, a meeting of the Executive Committee of the Canadian Electrical Association is being held in Toronto, to formulate the program and advance the arrangements for the second annual convention. While we are not in a position to print the program of proceedings, we are able to outline to some extent the character which it will probably assume.

The Executive, at a meeting held a couple of months ago, decided that the convention should be held on the Toronto Industrial Exhibition grounds on Tuesday and Wednesday, the 13th and 14th of September, during the second week of the Exhibition. Subsequent events indicate that the proceedings of the convention will occupy Thursday also. In our last issue it was stated that half a dozen papers on as many different subjects, and relating to the various departments of electrical work, had been promised. These will include a paper by Mr. E. Carl Breithaupt, of Berlin, Ont., on "Electric Street Railways"; a paper by Mr. A. C. McCallum, of Peterboro', on "Water Wheels"; a paper by Mr. E. B. Merrill, Toronto, on "Electrical Education"; a paper by Mr. L. B. McFarlane, Montreal, on "The History of the Telephone in Canada;" also papers by Messrs. Fred C. Robertson, of the C. P. R. Telegraph Co., and John Langton Toronto, the exact titles of which we are at present unable to state. The authors are now at work on these papers, manuscript of which it is hoped will be in the hands of the Secretary by the 20th of the present month, in order that printed copies of the papers may be obtained and forwarded to members of the Association for perusal prior to the convention. If this can be accomplished the discussion on the papers should be of a more intelligent and valuable character than it was possible for such discussion to be under the impromptu method which obtained at the two former conventions.

It is hoped that the authors of the papers will see the importance of completing them by the date mentioned, and that members will thoroughly digest them and come to the convention prepared to express their views thereon.

At the last convention, notwithstanding the disadvantage

under which members were placed, by reason of not having had the opportunity of perusing the papers in advance, the discussions were a most interesting and valuable feature of the meetings. We doubt not that on this occasion they will be increasingly so.

In addition to the papers, there will be the addresses of the retiring and incoming presidents, together with reports of the year's transactions, consideration of required amendments to the constitution and by-laws, report of the Statistical Committee, which has succeeded in collecting a considerable amount of valuable data relative to the number and capacity of electric plants in Canada, and the conditions under which they are being operated. The need of statistics of this character has been felt on many occasions, and no doubt the committee's report will furnish valuable information as well as food for thought and discussion by members whose capital is embarked in the electrical business.

This being the annual convention, the members will be called on to select a competent staff of officers to manage the affairs of the Association for the succeeding twelve months. We need not enlarge upon the importance of this matter further than to say that every member who has the interest of the Association at heart should be present and assist to make the selection the best that could possibly be.

All that we have said thus far has related exclusively to the business features of the Convention. We fancy we hear more than one member soliloquize: "What about the social side of the Convention?" Ay, what indeed! Was there not a social side to both the former conventions? Those who were there, as well as those who read the reports of the proceedings, need no answer to this enquiry, knowing that on both occasions the sociability was pronounced and enjoyable.

At the approaching convention a rare opportunity is to be afforded the members of combining enjoyment with instruction. An invitation has been received from Mr. W. A. Grant, manager of the Niagara Falls Park and River Railway, to the delegates to the convention to take a trip over the line on Thursday, 15th Sept. In his invitation Mr. Grant says: "We will supply a special car for them, and will do everything in our power to add to the enjoyment of their trip." A description of this most interesting piece of electric railway construction appears elsewhere in the present number, and the opportunity which will be afforded of examining it in detail is one which no member of the Association should forego.

But this is not all. An invitation has likewise been extended to the delegates by the owners of the celebrated steamer "Maid of the Mist," to take a trip on the Niagara river and view the beauties of the cataract from on board the steamer, of which Capt. Carter, Superintendent of the Niagara Falls Electric Light and Power Co., is the well known commander. In this connection the following program has been suggested: Embark at Toronto on Niagara Navigation Company's steamer at seven o'clock a.m., landing at Queenston shortly after nine o'clock; trip of inspection over Niagara Falls Park and River Railroad from Queenston to Chippewa, then back to the power house at Table Rock; next under the Falls at Table Rock; back to New Bridge for lunch at Cliff House; shortly after two o'clock take the boat on Canadian side; cross to American side; go up elevator to Prospect Park; take electric cars to tunnel district; return to tower; next back by elevator to boat; boat by way of the Falls to Canada side; take cars for Queenston at 4.30, and at Queenston take steamer for return to Toronto.

We have no doubt that a program similar to the above will be adopted by the Executive Committee. We have to congratulate the members of the Association on the delightful prospect which awaits them. We learn that the Association will bear the bulk of the expense and that the cost of the trip to each member will not exceed one dollar. Under these circumstances, no one should fail to share in the enjoyment and instruction which the occasion will afford.

Too much cannot be said in praise of the generosity of the railway and steamboat companies in placing such a pleasant outing at the disposal of the Association. The Industrial Exhibition Association also, through their manager, Mr. H. J. Hill, have promised to assist in every way possible to enhance the interest of the meeting. It is also learned that several elec-

trical manufacturing and supply firms have secured the necessary space and are making arrangements for an attractive exhibit of electrical appliances.

In addition to all this there is the Industrial Exhibition, which of itself attracts several hundred thousand visitors each year to the city.

Therefore, whether viewed from the standpoint of profit or pleasure, the second annual convention of the Canadian Electrical Association gives promise of being by far the best that has yet been held.

Persons interested in electricity who have not as yet connected themselves with the Association should send in their application for membership at once to the Secretary and take a part in the convention.

#### MUNICIPAL ELECTRIC LIGHTING.

The report of the Electric Light Department of New Westminster, B.C., for the past year shows that the municipal electric light plant has earned a considerable profit for the city during the last three months of the year. During this period, the receipts for lighting were \$6,112, including \$2,000 for street lights. The expenses for maintenance, etc., were \$3,699 and for interest and sinking fund, \$1,505, making a total of \$5,204.

The station, which is under the management of Mr. P. Bowler, the city electrician, is conducted as if it were a private institution, and a charge is made to the various city departments for the lights furnished them. A general lighting business is carried on and lights are furnished the citizens, but at higher rates than those charged the city departments. These rates are, however, as low as it is possible to make them, and are as follows: 2,000 c.p. arc lights burning all night for public lighting, 25 cents a night; commercial lights burning till midnight, 50 cents; current for incandescent lights, by meter, one cent an hour for a 16 c. p. lamp; by contract, one dollar a month.

The station has a capacity of 2,115 incandescent lights, and 100 arc lights, current being furnished by Royal alternating and arc light dynamos. The steam plant consists of a 150 and a 180 h. p. Corliss engine and four 80 h. p. tubular boilers. The refuse from a large saw mill is used for fuel.

To meet the demand for lights, \$15,000 has been voted to extend the station, and a 1,500 light alternator with new engine and boiler has been purchased.

#### PERSONALS.

Mr. L. E. Marple, of Chicago, has been appointed electrical engineer of the Montreal Park and Island Railroad Company.

Mr. J. Henry, formerly tool designer with the Canadian General Electric Company, Peterboro', has accepted a position in New York.

Mr. J. B. Griffith has been appointed to succeed his brother, the late T. B. Griffith, as manager of the Hamilton Street Railway Co.

Mr. John Albinson has been appointed chief engineer and electrician of the Hotel Vancouver and the C. P. R. Opera House at Vancouver, B.C.

G. H. Campbell, manager of the Winnipeg Electric Street Railway Co., paid a visit of inspection to the Toronto, Montreal and Ottawa railways, recently.

Mr. H. Woodman, who has been for a long time with the Royal Electric Co., has resigned his position with that company to accept one with the Montreal Street Railway Co. and is now in charge of the power house of the latter company.

Mr. Lewis Burran has severed his connection with the Royal Electric Co. and accepted the position of electrical engineer of the Montmorency Electric Power Co., of Quebec. Mr. Burran has had an extensive practical experience in electrical matters and is very well qualified for the position he is to fill.

Mr. John Inglis has been appointed successor to the late John A. Wills, as chairman of the Toronto Technical School Board. Alderman John Bailey has been appointed vice-chairman. At the meeting at which these appointments were made, several of the members expressed a sense of their deep regret at the sudden death of Mr. Wills.

The cost of construction of the C. P. R. Telegraph line from Revelstoke to Kalso and Nelson, B. C., will be about \$20,000. The work has been commenced and will be completed by the middle of September.

Messrs. W. G. Moncrief, G. A. Larkin and A. M. Macdonell, of Toronto; Arthur Goodby, of Portland, Ore., and W. C. Buckley, of Chicago, under the name of the Southwick Oil Company (Ltd.), have been granted letters of incorporation for the purpose of acquiring and controlling the business formerly carried on by Messrs. W. G. Moncrief and G. A. Larkin, dealers in lubricating oils and similar engineers' supplies. The capital stock of the company is \$25,000.



## ELECTRIC RAILWAY DEPARTMENT.

### THE NIAGARA FALLS PARK AND RIVER RAILWAY.

A new electric railway which is intended to give visitors the best opportunity of viewing to advantage America's greatest wonder—Niagara—has lately been completed and put in operation. This road extends for twelve miles on the Canadian side of the Niagara river, from the wharf at Queenston, where it connects with the Toronto and other boats, to the village of Chippewa, three miles above the Falls, keeping along the bank of the river all the way excepting for a short sinuous detour which it makes in climbing the Heights at Queenston. It gives a complete view of the river throughout those parts which are visited by the tourist, following the windings of the bank so as to keep it continually in sight. It has been a year and a half in building, and though it has only been running since about

freight, such as fruit, etc., down to Queenston to be shipped to Toronto and other lake ports. The running conditions for the winter are as yet somewhat uncertain, but it is intended that at least the part of the road about the Falls shall be run continuously throughout that season.

The road in construction and management is wholly Canadian. Mr. E. B. Osler, Toronto, is the President of the Board of Directors, Mr. Wm. Hendrie, Hamilton, vice-president, and Mr. R. A. Smith, Toronto, secretary. Mr. W. A. Grant, who has been connected with the Grand Trunk and Canadian Pacific railways for a number of years, is the general manager of the road. He was in the superintendent's office of the G. T. R. in 1884, and with the general superintendent of the C. P. R. in 1885, and was Mr. Van Horne's secretary from 1887 to 1892. He is a gentleman of energy and capability, and has risen rapidly to the place he now holds. Mr. W. Phillips, who is a member of the Canadian and Ontario Associations of Stationary Engineers, from the latter of which he holds a first-class certificate, and who has had an extended experience in steam and electrical engineering, is the mechanical and electrical engineer in charge.

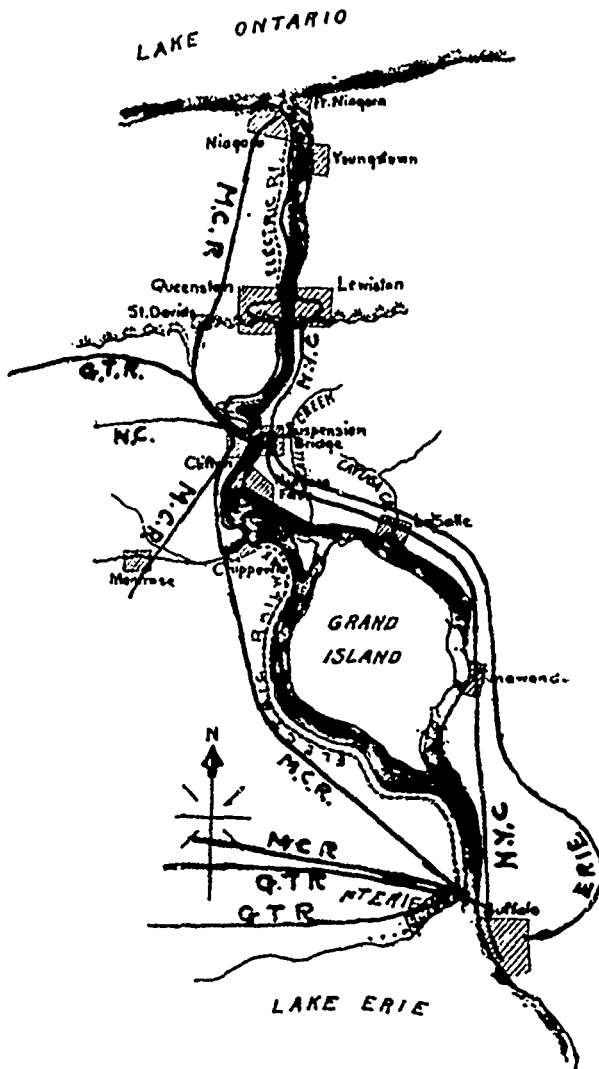
Following are some of the more important details of construction and equipment:

#### THE ROAD-BED.

The road was laid out under the direction of Mr. W. T. Jennings, C.E., of Toronto, who also planned the power plant at the Falls, the tail-race tunnel, wheel pit, etc. In general construction the road-bed is similar to and follows the best railroad practice, excepting that quicker curves and steeper grades are here allowed. The curves, however, are not as sharp nor the grades as steep as are found on most street railways using similar equipment. The road following the river bank, there are many curves. The quickest of these, above the Falls, has 85 feet radius. The grades also vary considerably. The most severe is that at Queenston,  $1\frac{1}{2}$  miles long and from 3 to 5.5 per cent., with a total drop of 346 feet. Besides this there is a short grade of 5.5 per cent. near the upper suspension bridge and several more of from 3 to 4 per cent. The road-bed is 16 feet wide on fills and 20 feet in cuttings. 56 lb. standard C. P. R. steel T rails are double-spiked to hemlock and cedar ties with broken stone ballast and for a considerable part solid rock bottom, making a very smooth and firm track. Guard rails and rail braces are used on all curves. Automatic split-rail switches are used. The bridges are mostly of steel or else standard railway trestles, and were constructed by the Hamilton Bridge Company. Over the ravine running west from the whirlpool there is a trestle bridge 500 feet long and 135 feet high, and at the Dufferin Islands there are three truss bridges, the longest of which has a span of 400 feet. Platforms are built for the accommodation of passengers at the more important stopping places along the route.

#### THE LINK.

The Canadian General Electric Co., of which Mr. Frederic Nicholls is general manager, had charge of the pole and overhead construction, and have furnished and placed the electrical equipment generally, the pole work etc., being under the direction of Mr. T. S. Russell, the company's civil engineer, and the electrical work under the direction of Mr. Wm. Rutherford, its electrical engineer. Excepting for two and a half miles through the park, the poles are of cedar set about 90 feet apart and six feet deep, about half of them being imbedded in rock concrete. They are painted black below and white above, and give the road a very ship-shape appearance. The pole brackets are neat and are so designed that one may be placed on each side of a pole, as they are in the case of turn-outs or as they would be used for a double track, the poles being between the tracks. Through the park the poles are constructed of 6 in., 5 in., 4 in. and 3 in. standard steel tubing, provided with brackets rather more ornamental than those on the wooden poles, and each surmounted by a hood, beneath which are five incandescent 32 c. p. 100 volt lamps, which are fed from a separate circuit, and grounded on the poles, the poles themselves being carefully grounded. The overhead parts



SKETCH SHOWING ROUTE OF NIAGARA FALLS PARK AND RIVER RAILWAY.

the first of June, the accommodations are being taxed to the utmost to supply the demands of the increasing traffic. The company, however, are meeting this by increasing their equipment as fast as possible, and some forty cars, or twenty trains of motor cars and trailers, are now in use.

There is at present a single track, with some twenty turn-outs, but it may be advisable in the near future to have a double track to facilitate the moving rapidly of such large crowds as are met with in excursion traffic. As it is, the road has made a good record, carrying 1200 passengers from the Falls to Queenston in an hour and a half at one time, and at another moving six loaded trains of twelve cars up the long grade at Queenston at once, the lower power house supplying the power.

Though built primarily for passenger traffic, there is some likelihood of its also being used lucratively for carrying light

*Contributed*

are of T. & H. design. The trolley wire is of 00 B. W. G. copper, hard drawn, divided into sections insulated from one another and separately fed at their centres. From the upper station there are seven feeders, two running south of  $\frac{1}{2}$  and  $1\frac{1}{2}$  miles length No. 0 B. & S., and five north; one and two  $\frac{1}{2}$  and 2 miles of 0 B. & S.; three, 3 miles of 000 B. W. G.; four 4 miles 0000 B. W. G.; and five consisting of  $5\frac{1}{2}$  miles 000000 B. W. G. in series with three miles 00 B. W. G.—All are weather

attached to the bottom plates for the water wheels. The penstocks are carried on cast iron box girders which are supported by cast iron pillars. These girders are planed off, and the bottom plates of penstocks are turned so as to ensure true even bearing surfaces. The water wheels are the well known "New American" turbines and are particularly adapted for electrical work. There are two 45 inches in diameter, with accommodation in the wheel pit for a third, and each capable of developing

1,000 horse power under the head of water mentioned above. They make 221 revolutions per minute when at work. The upright shafts are forged steel 6 inches in diameter; they are supported by four iron bridge-trees in each penstock, and are fitted with lignum vitae boxes and thrust bearings. The



POWER HOUSE OF THE NIAGARA FALLS PARK AND RIVER RAILWAY.

proof insulated wire and the sizes larger than 00 are in cable.

The lower power house feeds directly into the trolley wire at two points on the grade in front of and behind the station, and supplies a section of about  $1\frac{1}{2}$  miles, which includes the long heavy grade at Queenston.

Switches are so arranged that the whole line may be supplied from either power house on occasion. For a time the lower one supplied the whole line before the upper one was started.

Double copper bands well riveted and sweated on, connect successive rails. Cross connections are made every third or fourth rail and grounds are made to the river at intervals of about a half mile.

POWER PLANT.

There are two power houses; a large stone structure, designed by Mr. J. A. Balfour, of Hamilton, stands just above the Falls. It is shown in end elevation in the accompanying cut, from a photograph taken before completion. In side elevation it is really a very handsome building. The second one is of less architectural pretensions and is situated a short distance from the wharf at Queenston.

The chief engineer, Mr. Jennings, entrusted Mr. W. Kennedy, jr., to design plans for the construction of the water power, as also the arrangement of the machinery in connection therewith in the power house at the Falls. The head of water utilized is 57 feet. The wheel pit is 85 feet deep, the tail water at the bottom standing at about 12 feet. The tail race tunnel is 600

feet long and discharges underneath the Falls. The water is carried in a headrace from the foot of the upper rapids into a cut stone forebay which is fitted with iron headgates  $7\frac{1}{2}$  feet in diameter. From this forebay the water is conducted through two intake pipes to two vertical penstocks 44 ft. deep and  $7\frac{1}{2}$  ft. in diameter, made from  $\frac{3}{8}$  steel plate. These penstocks are enlarged to 106 diameter for five feet up from the bottom to receive the water wheels, and have steel draft tubes 9 feet long

driving gears on the tops of the upright shafts are mortise wheels 75 inch diameter, 18 face and  $5\frac{1}{2}$  pitch. The iron pinions on the line shaft are  $66\frac{1}{2}$  inch diameter and the teeth are dressed on both sides. These gears are banded with heavy wrought iron bands. Each pair of wheels weighs over 6 tons. They run about four-fifths of a mile per minute at the pitch lines. The water wheels are set on a line parallel with the sides of the power house. The line shaft is forged steel  $7\frac{1}{2}$  inches in diameter, and is carried on four massive cast iron box bridge-trees supported on four heavy box girders or beams which lie over the mouth of the wheel pit. The outer sides of this shaft are carried on heavy iron stands, provided with ball and socket boxes. The pinion gears and driving pulleys are fitted on it, the pulleys being furnished with very neat friction clutches capable of picking up and transmitting 350 horse power each.



As either of the water wheels is capable of developing more power than is required to drive the whole of the present electric plant, only one is used to do the work, the other being held in reserve in case of accident, the shafting having been designed to provide for such contingencies.

The regulation of the turbine gates is at present accomplished by hand, but it is intended to have automatic regulators consisting of resistance shunts connected with each of the generators

*at the power house at the Falls*

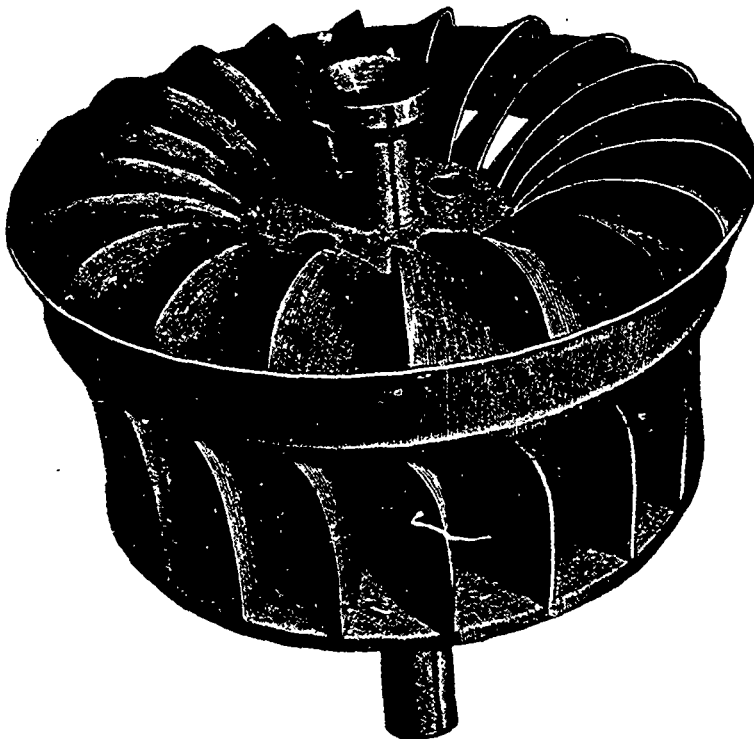
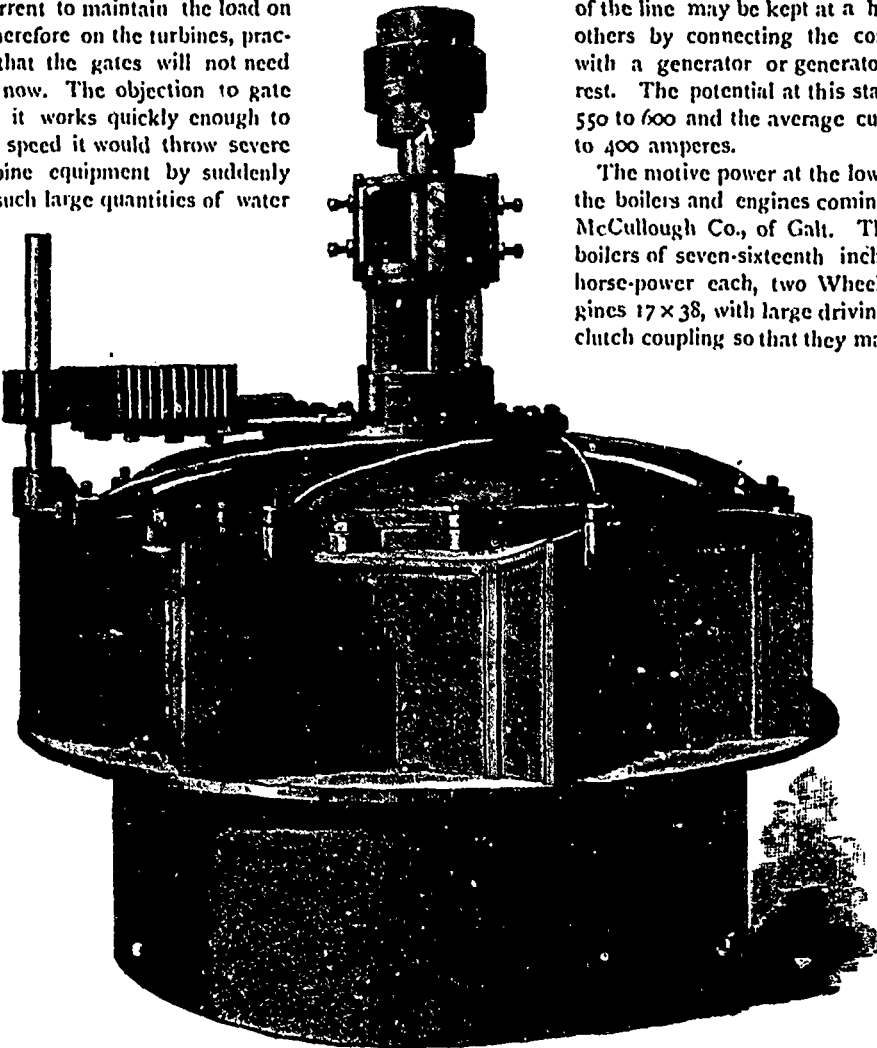
to take sufficient current to maintain the load on the generators and therefore on the turbines, practically constant, so that the gates will not need constant attention as now. The objection to gate regulation is that if it works quickly enough to maintain a constant speed it would throw severe strains upon the turbine equipment by suddenly stopping the flow of such large quantities of water as are here employed, and of course the sudden changes of load which are met with in railroad practice act very severely upon the whole power plant.

Messrs. Wm. Kennedy & Sons, of Owen Sound, Ont., were the contractors for the water wheels, penstocks, shafting, gearing, etc., etc., and although the bulk of the work in connection with placing this machinery had to be done during the cold stormy weather of the latter part of last winter, without covering from the heavy spray from the Falls, and under other very difficult surroundings, yet, without any preliminary run the machinery was set to work on the 10th of June last and run continuously for 15 hours per day ever since without stop or trouble of any kind, which is certainly an indication that their work has been well done.

The power house and wheel pit have been constructed to allow for extension, as there is some probability of the company supplying power to run stationary motors in the neighborhood of the Falls. Illustrations of the water wheels employed are given herewith.

For each turbine there will be four generators, the style selected has been the T. H. multipolar of 200 kwt capacity. These generators, as well as the motors in the cars, and indeed the whole of the electrical apparatus, were manufactured at the Peterboro' works of the Canadian General Electric Co.

The switch board is divided in seven sections and is of polished slate set in an iron frame. Following the course of the current from the positive brush we have in order: three-way switch machine meter, buss-bar, in three sections, for the three machines at present running, feeder switches, feeder meters of the Edison type, then out to the feeders; returning from ground through total meter, ground, buss, then through machine circuit breakers of T. H. pattern, to three-way switch and back to machine passing through series field and negative brush. Switches also provide that parts



of the line may be kept at a higher pressure than others by connecting the corresponding feeders with a generator or generators isolated from the rest. The potential at this station is kept at from 550 to 600 and the average current runs from 300 to 400 amperes.

The motive power at the lower station is steam, the boilers and engines coming from the Goldie & McCullough Co., of Galt. There are two tubular boilers of seven-sixteenth inch steel, rated at 150 horse-power each, two Wheelock condensing engines 17 x 38, with large driving wheel and with a clutch coupling so that they may be run in conjunction. At present these drive an Edison and a T. H. generator of 100 kwts each. The two are not used continually, one being sufficient for the average load. The other is thrown in on special occasion.

The switch board is in two sections and the current passes from the positive brush, through three-way switch, T. H. meters, buss-bar, feeders, ground, buss, circuit breakers, three-way switch and back to the generator.

#### CARS AND CAR EQUIPMENT.—The

cars have been constructed by Patterson & Corbin, of St. Catharines, and include: 10 observation motor cars, with three seats running lengthwise and with double truck, 10 open motor cars with reversible cross seats, 3 closed motor cars of ordinary type, 1 parlor car, 1 baggage car, 12 open trailers with reversible cross seats and 4 closed cars. They are handsome and well built

and in keeping with the general excellence of equipment of the road. The trucks furnished by the McGuire Manufacturing Company of Chicago, are specially heavy, the wheels are 33 in. diam. with 3½ in. tread and 1½ in. flange. Each car is run by two T. H. W. P. 50 motors of 25 h. p. each. They are operated with the new series parallel controller, there being no field commutation as in the Edison system. The gradations in power are obtained by the use of a rheostat and by changing the two motors from parallel to series with respect to each other or vice-versa.

There is at present one car house, situated near Chippawa, with accommodation for 25 cars; a

second one will soon be built near the centre of the line.

At the whirlpool rapids there is an incline railway which is run in connection with the road, and which is worked after a novel though simple manner. There are two cars with seats in steps

made to hold from 15 to 20 people. These are on the inclined rails and are connected to each other by a double steel cable which passes over a drum at the top of the slope, so that when one car is descending the other is ascending, and when one is at the bottom the other is at the top. The drum, and with it the cars, is stopped by a friction brake worked by a man at the top. Each car is provided with a large tank underneath the seats and when the car is at the top, water, which is supplied from a neighboring stream, is poured rapidly into this until there is sufficient to overbalance the car below, which has in the meantime been discharged when it reached the bottom. The capacity of the tank is sufficient to allow the car going down light to bring up the other loaded.

**SPARKS.**

The Calgary Light, Power & Heating Company is seeking incorporation.  
 The Edmonton Electrical Company have made application for incorporation.  
 The Keegans-Milne Company, of Montreal, who were burned out last February, have assigned.  
 The Hamilton, Grimsby and Beamsville Electric Railroad bonus by-law has been carried at Hamilton.  
 The Steam Boiler and Plate Glass Insurance Company has received a license to transact business in Canada.  
 Mr. George Perkins has purchased the Links Mica Mine in Hull Township, and has about 16 men employed thereon.  
 The Town of Waterloo, Que., intend using the water power at Brome Lake outlet, for running an electric light plan.  
 The Lethridge Waterworks and Electric Light Company have let the contract for the construction of their power house.  
 The Hamilton Street Railway Company have recently placed another dynamo and engine in their power house.  
 George Barbeau a line man in the employ of the Standard Electric Company, Ottawa, was killed a few days ago by coming in contact with a live wire.  
 Captain Lorway, manager of the Bras D'Or Steamship Company, has purchased the steamer "Blue Hill," of Yarmouth, at a cost of about \$13,000. The Blue Hill will run between Mulgrave, St. Peter's, and East Bay.

The General Electric Company, of New York, is working two Canadian mica mines, one at Sydenham, (near Kingston,) and the other at Cantly, Que.  
 The Reliance Manufacturing Company, of Waterford, are now manufacturing alternating dynamos and have just completed one of 1,000 lights capacity.  
 Messrs. Geo. H. Harper & Company have been granted the privilege of erecting poles and wires for the distribution of electric light, heat and power in the streets of Dundas, Ont.  
 There seems to be a steady demand for Canadian mica both from England and the United States. The two principal American buyers are the Westinghouse Company, of Pittsburgh, and the General Electric Company, of New York.  
 The Toronto Electric Light Company will furnish the power for the operation of the Toronto and Scarborough Electric Street Railway, to produce which they have had a 150 h. p. generator placed in their power house by the Reliance Manufacturing Company, of Waterford.  
 An injunction was granted restraining the Street Railway Companies of Ottawa, from carrying out the agreement signed recently, of which mention has been made. The work on the street railway lines has been stopped and about 125 men thrown out of employment.  
 President J. W. McRae of the Ottawa Electric Street Railway Company says that the gross receipts for the Company's financial year were \$109,000, of which \$10,000 was carried to the reserve fund after a dividend of 8% had been paid. The number of fares collected was 2,394,000.  
 The Toronto Incandescent Light Company have added a 700 h. p. vertical cross-compound engine to their plant. They will have two large dynamos directly connected with the engine shaft. This will give an additional capacity of 10,000 sixteen candle power lamps, the present capacity is over 25,000 lamps. A new brick chimney 150 feet high is also being erected.  
 It is understood that the Canadian General Electric Company is about to establish a factory for the manufacture of electric elevators, and will combine with it the incandescent lamp manufactory, at present located in Hamilton. These combined works will require the employment of about one hundred men, and will probably be located at Toronto.  
 An arrangement has been concluded by the Ottawa Electric Street Railway Company, the Ottawa Horse-car Street Railway Company and the City Corporation, by which the two companies amalgamate and give a complete electric service, and receive a thirty years' franchise. The company will pay a rental of \$150 per mile, and will keep the streets clean of snow, except what is required for sleighing. The two companies have about fifteen miles of track.

**THE RELIANCE ELECTRIC MFG. CO., LTD.**

**WATERFORD, ONT.**

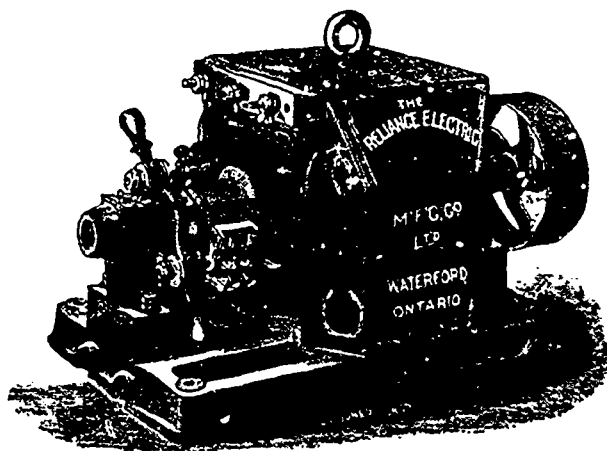
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**SPARKS.**

Burlington (or Hamilton) Beach was lighted by electricity for the first time on the night of July 3rd. A plant consisting of a 30 light T. & H. arc dynamo and 25 2,000 c. p. arc lamps was installed by the Hamilton Electric Light & Power Co. This plant was put in, pole line built, (covering about 1 1/2 miles,) house erected, 3 miles of wire strung, engine and boiler installed, a well sunk for water and 25 arc lamps hung all in 10 days time—one of the quickest installations on record.

Although it has only been running some seven years it is now quite a curiosity to see the double, suspended trolley and the Vandepoele car equipment on the oldest Canadian electric road, between St. Catharines, Merriton and Thorold. It illustrates how rapidly electrical methods and appliances are changing. But this will soon be seen no more, for the road has recently changed hands and under the control of Messrs. Dawson & Symmes with Mr. H. D. Symmes as general manager, it is being rapidly remodelled. A large part of the track has been relaid with T rails and bonded preparatory to the use of the single trolley with ground return, three new cars provided with T. H., W. P. 25 h. p. motors, three new trailers have been added to the rolling stock and a new car-house with accommodation for 14 cars, with commodious offices and machine shop and blacksmith shop in connection has just been completed, being located in a central position on St. Paul St., St. Catharines. The company have still 7 cars equipped with the Vandepoele system, which are mostly kept as reserves. The power plant now consists of two turbines, a Cole wheel of 135 h. p., and a new Bass wheel made in Peterboro', of 185 h. p., and the generators are a Vandepoele 75 kw. and a new Edison 100 kw. It is located on the line near Thorold, and is supplied with water from the canal. There are at present about 8 miles of track in two lines, starting from the corner of Ontario and King Sts., St. Catharines, passing along Ontario and St. Paul Streets and dividing, one branch going to the cemetery out near the new canal, and the other following the road through Merriton and Thorold. If satisfactory arrangements can be made with the Dominion Government regarding the crossing of bridges on the canal the road will be pushed through from the St. Catharines terminus to Port Dalhousie, thus improving the connection between this city and Toronto and the lake ports.

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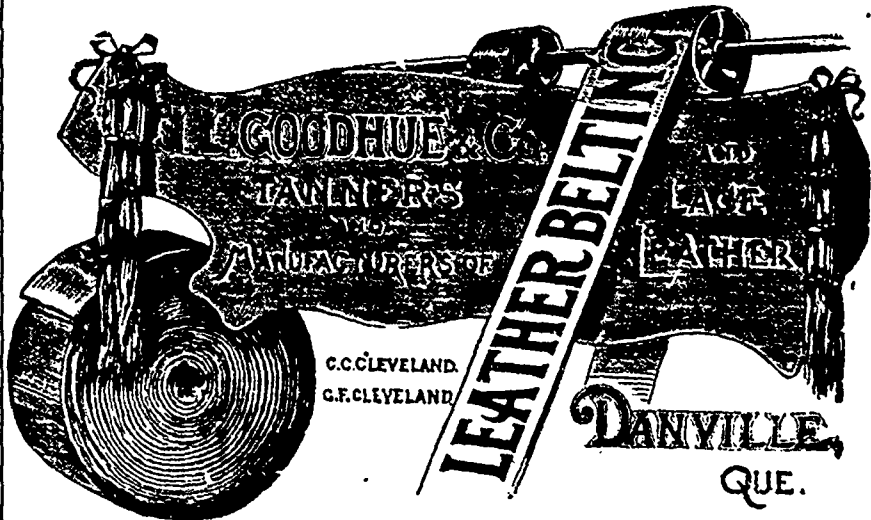
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**SPARKS.**

The engine in the Windsor electric light station is said to be giving trouble and will be replaced by a new one.

The new power station of the Toronto Street Railway is claimed to have the finest switch board of the kind in America.

At the annual meeting of the American Boiler Manufacturers' Association of the United States and Canada, held at Chicago on June 13th, Mr. F. E. Leonard, of London, Ont., was elected third vice-president.


The Toronto Street Railway Co. are substituting iron for wooden poles on some of the principal streets of Toronto. It is a subject of wonder that these new poles should have been painted red. Is it to further emphasize the danger which the public has been taught to believe attaches to everything electrical.

The telephone has lately been arranged for use of divers. A sheet of copper is used in place of one of the glasses in the helmet, and to this a telephone is fixed so that the diver, when at the bottom of the sea, has only to slightly turn his head in order to report what he sees, or receive instruction from above.

The Buffalo Street Railway are now operating a large number of cars requiring on an average from 1,800 to 2,000 h. p. The plant is capable of supplying some 4,000 h. p. They use high speed cross compound condensing engines in units of 500 h. p. and of two types—the Ball horizontal, and a Wilson vertical, the latter made by a firm in the city. A peculiarity of their switch board is that they use no circuit breakers, relying upon fuses instead, and they claim that these work very satisfactorily. They have quite a number of double truck cars on their lines.

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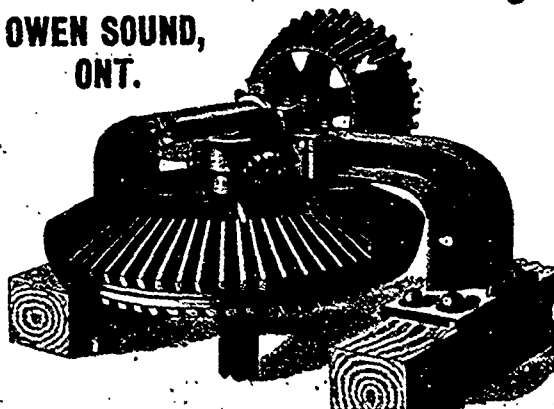
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Dr. Elsasser, of Berlin, states that a new kind of telephone wire, having a low electrical resistance and of great tensile strength, is being experimented with in Germany. It consists of an aluminum bronze core in a copper-bronze envelope.

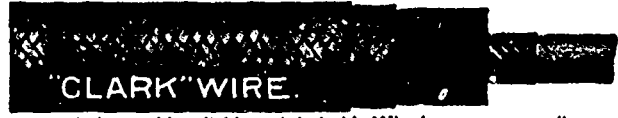
The original telephone patent of A. Graham Bell, which expired recently, was perhaps the only patent controlled by the Bell Company which was never disputed. Its broad claim was: "The method of, and apparatus for, transmitting vocal or other sounds, telegraphically, as herein described, causing electrical undulations similar in form to the vibrations of the air accompanying the said vocal and other sounds, substantially as set forth."

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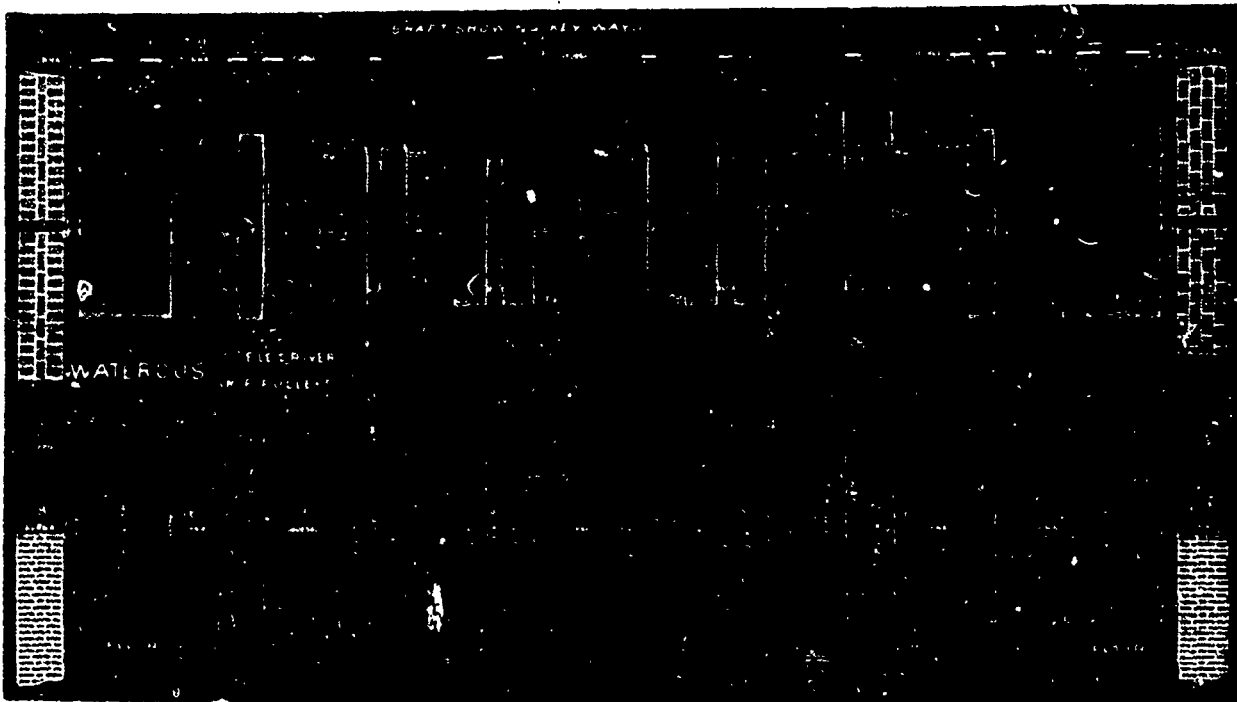
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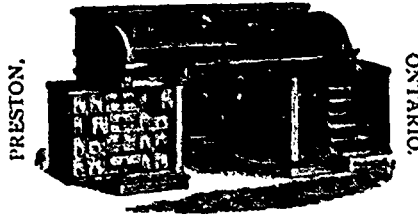


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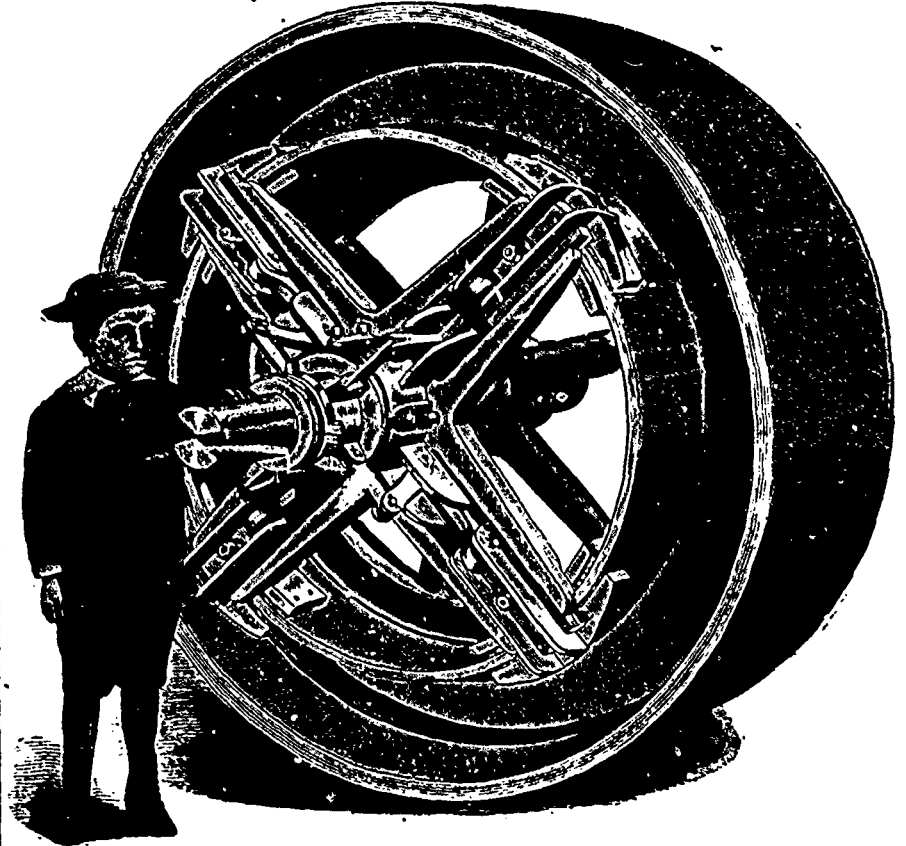
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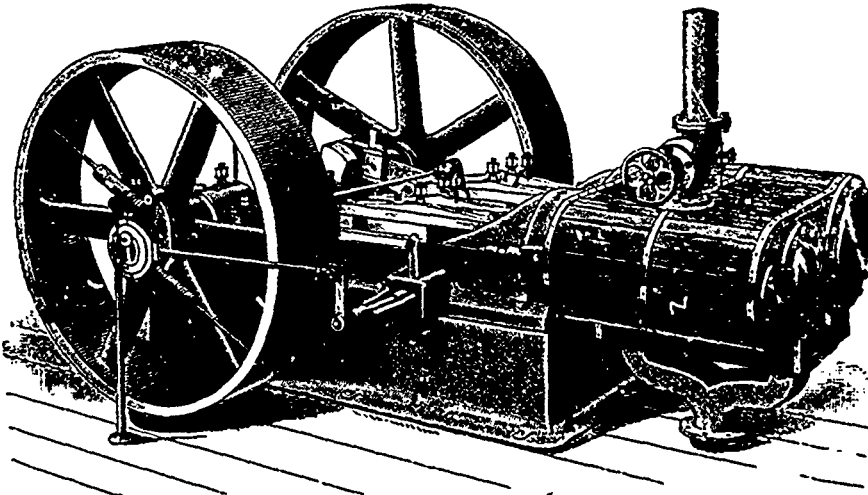
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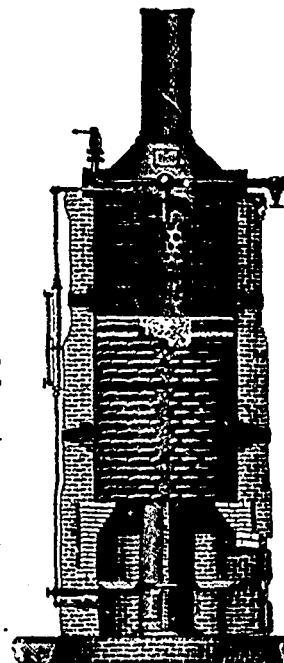
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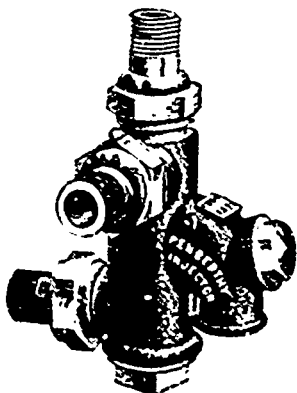
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