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CANADIAN
ELECTRICAL NEWS
AND STEAM ENGINEERING JOURNAL

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

SEPTEMBER, 1894

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CANADIAN

ELECTRICAL NEWS

AND

STEAM ENGINEERING JOURNAL.

VOL. IV. SEPTEMBER, 1894 NO. 9.

THE LACHINE RAPIDS.

SOME OF THE ELECTRICAL FEATURES OF MONTREAL.

THE City of Montreal, where the next convention of the Canadian Electrical Association is to be held, is noted particularly for its beautiful situation on the banks of the St. Lawrence river, at the foot of Mount Royal which rises to a height of over 700 feet behind the city. The mountain has been made into a public park, and from its summit a fine view is presented of the city with its streets and squares laid out as in a panorama. Close to the mountain is the resident portion with numerous churches, further away is the business quarter with many large buildings and factories, beyond is the St. Lawrence river, here nearly two miles wide and spanned by the Victoria Bridge, in its day one of the engineering feats of the world. Along the banks of the river, are to be seen ocean and river craft moored to the wharves and also in the large basins at the mouth of the Lachine Canal. Beyond the city towards the south is a magnificent view over the surrounding plains which are dotted with villages and are broken here and there by hills, while in the distance loom up on clear days the Green Mountains of Vermont and the Adirondacks of New York. Up the river is a charming view of Lake St. Louis and the lower Ottawa Valley, which takes in towards the north a large portion of the Island of Montreal and the plains beyond with the Laurentian Mountains in the background.

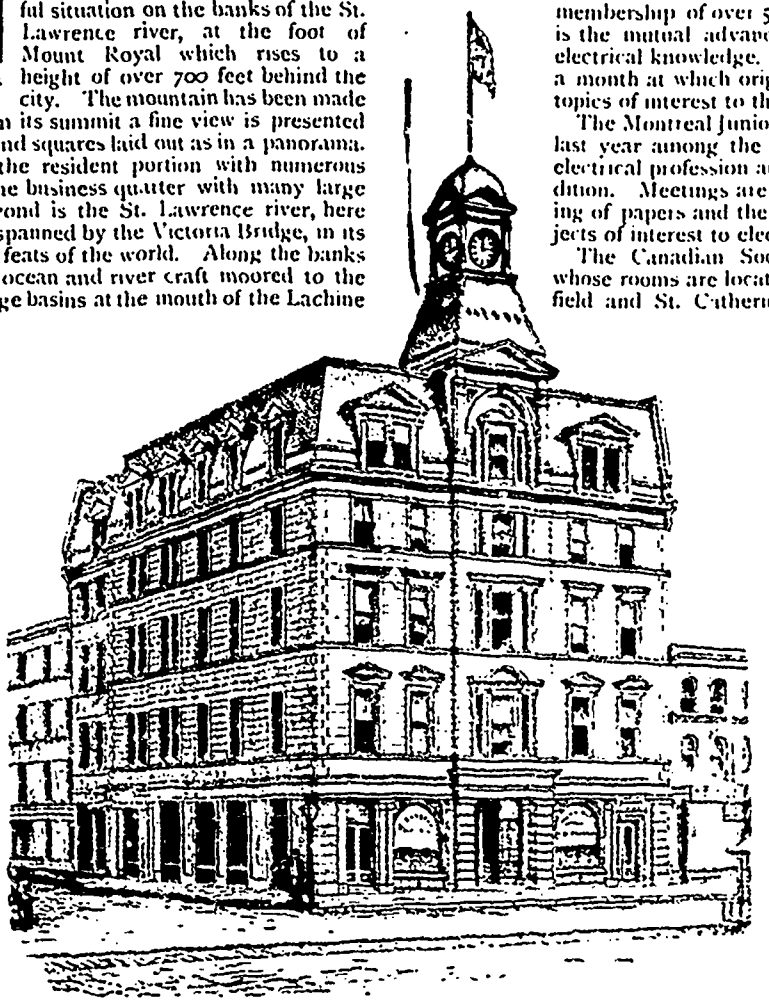
Montreal is the commercial metropolis of the Dominion and enjoys great advantages as a distributing point from its location at the head of ocean navigation on the St. Lawrence river, which is here interrupted by the celebrated Lachine Rapids. The city contains much to interest the visitor, but the scope of this article only allows the following brief description of some of the features of interest to the electrical world.

McGill University, located on Sherbrooke street near the foot of the mountain, has a number of fine and imposing buildings, among which the workshops and the Physics and Engineering buildings contain much to interest the electrician. The latter buildings, as well as the equipments of their laboratories, were the gifts of W. C. Macdonald, Esq., whose generosity has given the University unexcelled facilities for imparting instruction in electrical engineering and the other branches of applied science. The equipments of the laboratories are very complete and have been pronounced by competent judges to be the best on the continent. The electrical engineering laboratories are located in the Engineering building and contain a well chosen collection of dynamos and motors of the principal types, besides a large variety of instruments for making practical tests and measurements. The lighting station for lighting the buildings is also located here and contains two 30 k. w. continuous current dynamos directly coupled to Willans engines, and also a storage battery plant. The Physics building, devoted to the study of physics, contains, in addition to the ordinary apparatus, some very delicate instruments for conducting research and making experiments. It is located about 400 yards from the Engineering building so that its delicate apparatus is beyond the disturbing influence of the dynamos and machinery there.

The Montreal Electric Club, organized two years ago among those engaged in the various branches of the electrical profession, is in a flourishing condition, having a membership of over 50. The object of the club is the mutual advancement of its members in electrical knowledge. Meetings are held twice a month at which original papers are read and topics of interest to the members discussed.

The Montreal Junior Electric Club was formed last year among the younger members of the electrical profession and is in a prosperous condition. Meetings are held weekly for the reading of papers and the discussion of various subjects of interest to electricians.

The Canadian Society of Civil Engineers, whose rooms are located at the corner of Mansfield and St. Catherine streets, includes in its membership, which numbers over 600, nearly every engineer in the Dominion. The rooms of the society are handsomely fitted up and include a reading room with the leading technical papers and a library of engineering books.



MECHANICS' INSTITUTE BUILDING, MONTREAL.
(Meeting Place of the Canadian Electrical Association.)

The Canadian Society of Stationary Engineers has two flourishing branches in the city, Montreal No. 1 and St. Laurent No. 2, which have a combined membership of over 200. The rooms of both are at 662½ Craig street and contain a well assorted library of books and a valuable collection of models for the study of steam engineering.

The Bell Telephone Company's exchange in Montreal is one of the largest in America in proportion to the population of the city, numbering 5,700 subscribers who are served through four central offices. The main office is at the corner of St. Francois Xavier and Notre Dame streets, where the lines of 2,700 subscribers terminate. The Western District Exchange with about 1,700 subscribers is at the corner of St. Catherine and Mountain streets in a building owned by the company. The trunking wires to the Eastern Exchange and a portion of those to the Main Exchange are in underground conduits on St. Catherine street, of which there are about 1¼ miles laid. The Bell Company also has a large and well-equipped factory on Aqueduct street for the manufacture of telephone and electrical apparatus.

The Montreal Street Railway Company, which adopted electric traction two years ago, has over 65 miles of new track laid and over 110 motor cars running. The mileage of track and the equipment is being continually increased, as the system is far

from completion and construction work is now going on. The power house is on William street and is to contain 6 cross-compound condensing Corliss engines rated at 600 H. P. each. At present, four only of the engines are installed. Three are belted to twelve 200 kilowatt Edison generators, and the fourth drives by one belt and one pulley two 300 kilowatt multipolar generators mounted on the same bed plate. The pulley is on a shaft in alignment with and between the two armature shafts with which it is connected by friction clutches. The switchboard is built of hollow terra cotta bricks covered with adamantine plaster and afterwards enamelled, and presents a handsome appearance. Repair shops and commodious car barns are located at Hochelaga, and others are being built in different parts of the city.

The Montreal Park and Island Railway Company holds exclusive franchises covering almost every municipality on the Island of Montreal and has a line directly across the Island to Saul au Recollet and another to Outremont and Cote des Neiges. A branch to Lachine will soon be under way and next year the building of a line around the summit of Mount Royal is proposed. In building its lines the Company follows the practice of steam railways as far as possible and runs through an open country on a road-bed elevated from one to two feet, in preference to following the regular carriage roads and highways. Westinghouse and Royal equipments of the latest types are used. Royal generators driven by Corliss engines supply power. A special feature is that all the cars are despatched by telephone.

The Royal Electric Company has two lighting stations, one for commercial lighting and power and the other for street lighting, for which it has the contract from the city. The latter station is in a large one story brick and stone building on St. Ignace street. The electrical equipment consists of thirty 50 light T-H arc dynamos of Royal manufacture, driven from a counter shaft. Power is furnished by 3 cross and 1 tandem compound Brown engines, aggregating over 1500 H. P. On a platform near the centre of the dynamo room, is the switchboard from which the wires pass up to a tower on the roof of the building and thence are distributed in various directions. The station for commercial lighting is on the two lowest floors of the Company's new factory building on Queen Street. The steam plant is on the first floor and consists of a 1000 H.P. vertical compound condensing engine, besides three smaller horizontal engines. The electrical equipment occupies both floors and consists of Thomson alternators and power generators and T H arc dynamos, all of Royal manufacture. A fire proof brick addition to this station is to be built and equipped with the most approved devices for the saving of labor, and made a model station in every respect. The Company's factory is in the original building on Wellington street and on the upper floors of the new building and is very completely equipped for the manufacture of electrical machinery.

The Temple Electric Company, which operates the Edison three-wire system, is fitting up a new station in a central location, as its business has outgrown the present quarters in the Temple Building on St. James street. The present plant has a capacity of about 5000 lights and is equipped with Edison and Reliance dynamos driven by Corliss engines. The Company has been hampered by lack of room, but in its new quarters will be able to largely increase its output.

The Citizens' Light and Power Company is erecting a new station on the banks of the Lachine Canal at St. Henri, to replace the present station, which is operated by water power. The equipment consists of a 750 light Edison alternator, 3 Edison, 2 T-H and 1 Wood arc dynamos to be driven by two 320 H P. compound condensing Westinghouse engines, with Manning vertical boilers and mechanical draft.

The St. Jean Baptiste Electric Light Company's station is in a one story brick and stone building at 396 Montana street. The equipment is almost entirely new and consists of two slow-speed 2500 Westinghouse alternators and a 750 light T-H alternator driven from a counter shaft. Power is supplied by a 500 H. P. cross compound condensing Corliss engine and two small high-speed engines for use during light loads.

There are also a number of isolated plants and installations of more or less interest in the city, among which mention should be made of the lighting and storage battery plant at the Royal Victoria Hospital, which illustrates the best English practice, and the electrical plant for operating the Wellington Swing Bridge. The Montreal Fire Alarm Department has an interesting and finely equipped central office in the City Hall. The head office of the Canadian Pacific Railway Co.'s Telegraph is located in Montreal and the Great North Western Telegraph Co. has a large office in the city In addition, the Anglo-American Telegraph Co. has a special cable office in Montreal.

In concluding, we desire to acknowledge our indebtedness to Messrs. F. E. Grafton & Sons for the cut of the Lachine Rapids which heads this article.

MONTREAL, ELECTRICALLY AND OTHERWISE, IS ONE OF THE MOST INTERESTING CITIES IN AMERICA. YOU WILL DERIVE PROFIT AND PLEASURE BY ATTENDING THE CONVENTION OF THE CANADIAN ELECTRICAL ASSOCIATION TO BE HELD THERE ON THE 19TH, 20TH AND 21ST INST.

CANADIAN ELECTRICAL ASSOCIATION.

Wednesday, Thursday and Friday, the 19th, 20th and 21st inst., are the dates selected for the annual convention of the Canadian Electrical Association in Montreal. Following is the complete programme :—

WEDNESDAY, SEPT. 19TH.

11 A. M.—Opening of Convention ; Secretary-Treasurer's Report ; Reports of Committees ; General Business ; Paper on "The Application of Electricity for Medical and Kindred Purposes, from Light and Power Circuits," by Mr. W. B. Shaw, Montreal ; Paper on "Electrolysis," by Mr. J. A. Bayhs, Bell Telephone Co., Toronto; Paper on "Alternating Current Motors," by Mr. L. M. Pinolet, Montreal.

5 P. M.—Trip to Lachine and return via Lachine Rapids.

THURSDAY, SEPT. 20TH.

9:30 A. M. (SHARP).—Meet at Mechanics' Institute to visit McGill University by invitation of the Faculty of Applied Science and Prof. Chas. A. Carus-Wilson, of the Electrical Department, inspect the electrical laboratories and witness a practical test on a transformer of apparatus for the measurement of alternating current power.

11 A. M.—Meet in Convention at Mechanics' Institute ; Paper on "Electric Brakes," by Mr. Elmer A. Sperry, of Cleveland, Ohio ; Paper on "A Method of Distribution with Equalization of Potential Difference," by Mr. D. H. Keeley, of the Government Telegraph Service, Ottawa ; Paper on "The Possibility of Securing Better Regulation at Central Light and Power Stations by means of Fly Wheel Accumulators of Improved Construction," by Mr. John Galt, C.E. and M.E., Toronto ; Paper by Mr. John Langton, Toronto.

4:30 P M.—Special excursion on Montreal Park and Island Electric Railway to Back River. Dinner at Peliquin's Hotel, Back River, at 6 p. m.

FRIDAY, SEPT. 21ST.

10 A. M.—Paper on "Municipal Electric Lighting," by Mr. E. Carl Breithaupt, of Berlin, Ont.; Paper on "Telephone Cables, their Construction and Maintenance," by Mr. F. J. Schwattz, Bell Telephone Co., Montreal ; Paper by Mr. T. R. Rosebrugh, Lecturer in Electricity, School of Practical Science, Toronto ; Election of Officers ; Unfinished Business.

2 P. M.—By courtesy of Eugene F Phillips Electrical Works, drive to Mount Royal Park, including a visit to Montreal Street Railway Power House.

5 p.m.—Luncheon at the St. George Snowshoe Club House by invitation and courtesy of The Packard Lamp Co.

The Executive regret that the early date fixed by the railways for their annual fall excursion has rendered it impossible to make the Convention coincide therewith, and that in consequence no reduction in railway rates can be secured beyond that ordinarily given to the purchaser of a return ticket.

Messrs. Ahearn & Soper, of Ottawa, have extended to members of the Association a kind invitation to visit Ottawa at the close of the convention. Arrangements have been made for their entertainment and to show them the many interesting electrical and other features of the city. Delegates from west of Ottawa, by C.P.R. line, have the privilege of going or returning via Ottawa, and of stopping off at that city. Leaving Montreal in the morning they would arrive at Ottawa at noon, and leave at 9 p.m., arriving in Toronto the following morning.

THE BELL TELEPHONE COMPANY'S NEW SWITCHBOARD.

NEARLY a year ago, in connection with a description of the Bell Telephone Company's factory in Montreal, mention was made in the ELECTRICAL NEWS of the new switchboard then under construction at this factory for the Toronto Exchange. The finished material for this switchboard was shipped to Toronto a couple of months ago, since which twenty-five workmen have been engaged day and night in erecting into proper position the multitude of parts of which the finished structure will be composed.

The board has an iron frame which will be covered with mahogany. The wires are brought up from underground in the basement of the building, run under a false flooring to the back of the switchboard, and there connected on to drops, jacks, etc. The jacks number about 80,000. A one-half horse-power motor generator is to be employed for ringing purposes instead of a gas engine, and a storage instead of a gravity battery for transmitters, thus doing away with several hundred cells of battery.

When a call comes from a subscriber, and the armature falls outward, it throws up an aluminum cover revealing the subscriber's number. When the plug is inserted by the operator, the cover automatically falls. To each section of the board is connected an incandescent lamp, which glows so long as any drop is down. In short every improvement which was considered to be of value has been incorporated into the construction of this switchboard, which, when complete, will be the model telephone switchboard of America for a time at least, until the march of improvement shall have caused it to be superseded by others of still more modern design. Three or four months will yet be required to complete its erection. When complete, tested and in satisfactory working order, the operators will be removed from their old quarters in the Mail building to the new Exchange on Temperance street. Following their removal will come the taking down of the mass of overhead cables on Bay street.

INDIFFERENCE TO BOILER FIRING AND MANAGEMENT.*

OBSERVATIONS extending over a period of a quarter of a century in a practical and professional way have presented opportunities to note, in the greater number of manufacturing establishments, a continuous decline in the grade of service of those in positions of firemen and boiler room managers, this corps of operatives seeming at least, to have remained in *statu quo*. The evil has become so glaring and the results so palpably fraught with disaster, destruction and waste, as to warrant an effort to call the attention of those who desire to progress to the false and inconsistent position they occupy by permitting such a narrow policy in management, so widely at variance with true economy, ignoring directly that the better intelligence renders the more valuable, and hence, more profitable service.

It goes without saying, that, during the past ten years concentration of efforts by scientists and eminent mechanics looking to the more perfect development of the steam engine in its various types, has produced results which challenge the admiration of the most critical in this line of thought.

Within the same period, from every source, there has been a multitude of features in the form of designs and novel application of boilers, all converging to the important factors of increased economy, safety and efficiency. In the engine sphere, condensing, compound and triple expansion engines, with or without jackets; in brief, seemingly all the necessary refinements have received, and are receiving close attention. In the boiler domain there has been, also the evolution from the plain cylinder type to tubular, and from that through the multifarious forms of water tubes, each striving for a superior degree of excellence. Combining these forces, viz., the boiler and the engine, the amount of research and practical application that have been, and are being applied for efficiency and economy, are such as to be almost incalculable. A retrospect of the past, viewed in the light of present results, shows that these efforts have been of an exceedingly fruitful character.

The development has carried with it the imperative advancement of those in charge of engine management to such an extent as to create almost anew this body of men. Such an intellectual advancement in the department of mechanics, we believe, is without precedent, and in every sense challenges universal admiration from every quarter. Notwithstanding these favorable features, we are constrained to say that all this is somewhat like the play of Hamlet with Hamlet left out; or in other words, we are radically defective at the very threshold of this field, by reason of relegating the firing of boilers to the most ignorant of operatives; or, to put it in a plain way, there seems to be an almost unanimous idea that anyone who can shovel and throw fuel is good enough for a fireman. Close observation and contact for a period of years with numerous plants of varied character increases the conviction upon this point. Recognizing, as we all do, that the furnace of the boiler is the prime feature and great initial point from which is the source of power, does it not follow that, if economy and efficiency are deserving of efforts in the advanced stages, as has already been pointed out, this is the very point that should be treated with every consideration of intelligence? Should not the fuel, furnace and boiler receive the thoughtful attention that the engine receives from the careful engineer? I think this will be accepted by every one interested in advanced ideas. No one, I think, will question the fact of the importance of the initial point of the boiler and its furnace, and that, upon its mismanagement, the efforts of refinement are rendered, in many cases, completely void. It would seem so simple that argument would be unnecessary, were it not that, on every hand, the matter is entirely ignored, resulting in waste and destruction. We would ask: Are not the efforts of the best furnace designers completely set at naught often by reason of the manner in which they are operated? Is it not a glaring fact that in all cities where smoke abatement has been, and is being attempted, the great stumbling block is the low grade of intelligence and difference of the operatives?

In looking up this subject from a mechanical and engineering standpoint, we are fully alive to all the requirements to give complete combustion and thorough distribution of heat units; proportion of grate area and openings, proper amount of air, conduction of the heated gases, are all carefully considered. When all is completed, we have had the wonderful spectacle of these conditions being turned over to the simple treatment of ram jam shovelling and slice bar operations. I claim that the fireman should know, at least, the elements of combustion, the importance of the proper management of fires to produce the greatest results with the least expenditure of fuel. The intelligent engineer keeps this constantly in view as to steam economy; the valves, etc., receive his unremitting attention, unless he can properly be placed upon the same plane as the fireman that shovels without intelligence or judgment.

Now, it may be said that this is being greatly overcome by application of mechanical stokers, a point that is frequently (and I believe, without thinking) claimed by those interested in placing stokers. This is a great mistake, well known by those conducting tests, results always being superior with the greater intelligence of the operator of the machine.

This deplorable and absurd state of affairs is doubly aggravated by, not simply indifference, but actual encouragement, based upon the idea that anyone can shovel or throw in, or perhaps it is the idea of they put it in the slot, and we do the rest. Does it ever occur to those proprietors, or the superintendents of manufacturing establishments, that while they are straining at gnats in the refinement of every application in the various departments looking to more economic results, right upon the threshold, they are swallowing a camel with the greatest ease?

Within the past few years, in every community where cleanliness, taste and good health are considered, there has come forth a crying appeal to the authorities to lessen the great evil of smoke in the atmosphere. In response to this, inventive genius has promptly come forward. The multitude of devices that have been perfected and put in operation furnishes ample testimony to this fact. Many of these when properly operated, accomplish satisfactory results in smoke abatement, but no inventor has ever had the temerity to label his machine, "No skilled fireman required." Per contra, it is well known that the most intelligent fireman produces the best results, and it is also an undeniable fact that the best results are set at naught by incompetent operating. The writer has been brought in contact with large fields of boiler practice, and in many cases, aside from other disqualifications, the firemen were unable to speak or understand a word of the English language. It may be said, as I have heard it said, that these men are not paid to think, but to do. Well they do do. They will do up a coal pile, furnace and boiler with alarming rapidity. I say alarming to those whose views are broad enough to consider the moral and important points. On the other hand, it is a lamentable fact that there are a great number of persons in official positions, as superintendents and proprietors of establishments, who seem to be utterly incapable, or unwilling, to note the importance of the necessity for a higher grade of labor in the firing and management of boilers.

One of the most surprising features in connection with this state of affairs is the tendency of those to place boilers, claiming, among their numerous merits, that of less attention required than others, precisely on the old exploded idea applied to engines, "No skilled engineer required." I have now before me a letter from a boiler representative who claims that his boiler will give the utmost satisfaction with one half the attention that others receive.

What is greatly needed at present is to lay aside the idea that anyone is good enough to fire and manage boilers. When you engage a man for your office, do you not require that he shall possess some qualification for the position? And if aptness is shown, do you not show appreciation by advancement to a higher plane, the interest being mutual? Why not apply this to the selection of firemen? As it now stands, we cannot but exclaim, "Strange, what a difference there should be 'twixt tweedle dum and tweedle dee!"

There are a great many plants in operation where, by incompetency in this line, the steam efficiency is greatly lessened, furnaces and boilers working in neglected conditions, and the community begrimed with volumes of unnecessary smoke; and in addition to these evils, is that of jeopardizing lives and property. Unless this matter is considered, and such action taken as will improve this corps of operatives, it would seem absurd to be continually reaching and extending into the higher refinements of steam engineering, when such simple and important features are ignored at the threshold.

Under these conditions, does not the pertinent question present itself to the employer—are we not occupying a false position by this seeming indifference? Do we not retard the development of a class of labor which by recognition, by an appreciation that some skill and judgment are required, would be animated by the smallest spark of ambition to qualify for advanced position? Is not this condition of affairs a gross inconsistency, nay, a mockery, in the face of the query put by those guilty of this indifference—why can we not get better men than this? In reply to that, would say, simply, it is not sought on your part. Just as long as this class of operatives are looked upon as mere shovelers, throwers of coal and carriers of water, ignorance, with all its attendant waste, destruction of property and general demoralization, will be prominent in the boiler department.

As a fitting close to this, it would be proper to ask what degree of intelligence or knowledge would qualify one to fire boilers.

First. That the fires should be maintained with uniformity, and that no openings, in the form of bare places, show upon the bars to permit the cold air to pass through.

Second. The judgment that will enable him, by a glance at the ash-pit, to know at once, to a great extent, the condition of the fires.

Third. He should know something of the various fittings of the boilers, such as valves, etc., and the details of the furnaces.

Fourth. But not least, an ambition to grasp the details, so as to qualify him for a still higher plane, which would certainly follow, provided there was judgment enough in the superior to note such details.

Sufficient, we think, has been said to convince the most obtuse mind that the indiscriminate employment of labor for this purpose is a crying evil, and some consideration given to the claims here made, that simply because one can shovel and throw, it does not follow that he is qualified to fire and have charge of steam boilers.

* By D. Ashworth, before the Engineer's Society of Pennsylvania, Nov. 21, 1893.

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

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HAMILTON BRANCH NO. 2.—Meets 1st and 3rd Friday each month, in Maccabee's Hall. Jos. Langdon, President; Wm. Norris, Corresponding Secretary, 211 Wellington Street North.

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

BRANTFORD BRANCH NO. 4.—Meets 2nd and 4th Friday each month. C. Walker, President, Joseph Ogle, Secretary, Brantford Cordage Co.

LONDON BRANCH NO. 5.—Meets in Sherwood Hall first Thursday and last Friday in each month. F. Mitchell, President; William Menden, Secretary Treasurer, 533 Richmond Street.

MONTREAL BRANCH NO. 1.—Meets 1st and 3rd Thursday each month, in Engineers' Hall, Craig street. President, Jos. Robertson; first vice-president, H. Nuttall; second vice-president, Jos. Badger; secretary, J. J. York, Board of Trade Building; treasurer, Thos. Ryan.

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

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

GUELPH BRANCH NO. 6.—Meets 1st and 3rd Wednesday each month at 7:30. p.m. C. Jorden, President; H. T. Flewelling, Secretary, Box No 8.

OTTAWA BRANCH, NO. 7.—Meets 2nd and 4th Tuesday, each month, corner Bank and Sparks streets; Frank Robert, President; F. Merrill, Secretary, 352 Wellington Street.

DRESDEN BRANCH NO. 8.—Meets every 2nd week in each month; Thos. Merrill, Secretary.

BERLIN BRANCH NO. 9.—Meets 2nd and 4th Saturday each month at 8 p. m. W. J. Rhodes, President; G. Steinmetz, Secretary, Berlin Ont.

KINGSTON BRANCH NO. 10.—Meets 1st and 3rd Tuesday in each month in Fraser Hall, King Street, at 8 p.m. J. Devlin, President; A. Strong, Secretary.

WINNIPEG BRANCH NO. 11.—President, Chas. E. Robertson; Recording Secretary, L. Brandon; Financial Secretary, Arthur Harper.

KINCARDINE BRANCH NO. 12.—Meets every Tuesday at 8 o'clock, in the Engineer's Hall, Waterworks. President, Jos. Walker; Secretary, A. Scott.

WIARTON BRANCH NO. 13.—President, Wm. Craddock; Rec. Secretary, Ed. Dunham.

PETERBOROUGH BRANCH NO. 14.—Meets 2nd and 4th Wednesday in each month. S. Potter, President; C. Robison, Vice-President; W. Sharp, engineer steam laundry, Charlotte Street, Secretary.

ONTARIO ASSOCIATION OF STATIONARY ENGINEERS.

BOARD OF EXAMINERS.

President, A. E. EDKINS,	-	139 Borden st., Toronto.
Vice-President, R. DICKINSON,	-	Electric Light Co., Hamilton.
Registrar, A. M. WICKENS,	- -	280 Berkeley st., Toronto.
Treasurer, R. MACKIE,	- -	28 Napier st., Hamilton.
Solicitor, J. A. MCANDREWS,	-	Toronto.

TORONTO—A. E. Edkins, A. M. Wickens, E. J. Phillips, F. Donaldson.
HAMILTON—P. Stott, R. Mackie, R. Dickinson.
PETERBORO'—S. Potter, care General Electric Co.
BRANTFORD—A. Ames, care Patterson & Sons.
KINGSTON—J. Devlin (Chief Engineer Penetentiary), J. Campbell.
LONDON—F. Mitchell.

Information regarding examinations will be furnished on application to any member of the Board.

PLACE AND TIME: MONTREAL, SEPTEMBER 19TH, 20TH AND 21ST, 1894.

IN electric railway construction, equipment and management Canada is undoubtedly right up to date. In some particulars we are in advance of the United States, where the electric railway has had such an astonishing development. It is very gratifying to Canadians to observe the wide-awake manner in which the managers of electric street railways in our leading Canadian cities keep in touch with improvements, and the readiness with which such improvements as are proved to be valuable are adopted.

WITH the object of saving time, the principals of many business establishments are in the habit of instructing a subordinate to ring up on the telephone the managers of other business concerns with whom they desire to hold converse. When the manager who is thus called up, responds, he is asked by the subordinate to wait until the person who desires to speak with him gets through with the matter which at the moment may be engaging his attention. This "wait" may last one minute or five, according to circumstances. Thus the man who wants to do the talking effects a saving of time at the expense of the one at the other end of the line. If, however, this practice should grow, he will in due time find himself in the position of respondent, and will ultimately not succeed in saving any time at all.

MANUFACTURERS of steam engines and other high-class machinery in the present day must be prepared to furnish machines which will not only operate economically and in every respect satisfactorily, but which will also be attractive in design and finish. The purchaser of a steam plant wants one that will do his work in the cheapest and most efficient manner and will also by its beauty of design and finish awaken the admiration of visitors to his establishment. Many instances could be cited in which orders for machinery have been secured by representatives of Ontario manufactories right at the door of the local manufacturer in some of the other provinces, simply because the latter's goods were inferior in point of finish. It is noticeable that of

late some of the more wide-awake machinery makers in the other provinces have become alive to this requirement of their business, and by complying therewith, have succeeded in retaining their home trade and are selling their machinery in Ontario in competition with the manufacturers of this province. In the manufacture of engines a very noticeable improvement is taking place in the maritime provinces, and from that quarter increased competition is likely to come westward in the near future. It is contended by the manufacturers down by the sea that more favorable rates of freight are given on products of western factories shipped to the east than on eastern shipments to Ontario. If such be the case, the discrimination should be done away with, and every facility given for free interchange of business between the different parts of the Dominion. If this were done much of the money which now goes across the line from Canadians living alongside the border of the United States would be diverted to the pockets of Canadian manufacturers.

IT is not easy to see that a sufficiently useful purpose is to be served by the new Electric Light Inspection Act, the full text of which was published in the August number of the ELECTRICAL NEWS. It is not too much to expect that an enactment of this character should have a clearly defined aim and grasp completely whatever it does aim at. If this act had been called an Electric Meter Inspection Act, its purpose would have been more comprehensible, though its utility might have been equally doubtful. But assuming that it is advisable to secure by statute the right of purchasers to have their current metered and, that being the case, that for the protection of both purchasers and contractors the meters should be placed beyond suspicion by government inspection, and that the machinery for such inspection must consequently be provided by law, why was not the scope of the act confined to this object? The main portion of the act is devoted to this, is definite and detailed and hence respectable, though as a matter of opinion it may be considered unnecessary. But outside of the meter sections the act wanders aimlessly and inadequately over quite a number of questions, some of which if treated at all, would properly require an act to themselves. In one instance at least it is positively mischievous, where in section 7 it defines the minimum permissible ground at 5,000 ohms, and imperatively enacts that the contractor shall forthwith cut off such grounded premises, under the penalty prescribed in section 9 of a fine of $20 a day. This is a wonderful simplification of electrical formulae; whether the pressure be 50 volts or 250 volts, whether the premises contain 1 lamp or 1,000 lamps, yards or miles of wire, the exact danger point in all cases is a ground of 5,000 ohms. Put up ($20), or shut up. Most people are under the impression that this point is above all a matter for skilled judgment depending entirely upon the conditions; but they are wrong—by Act of Parliament. The statute is positive. Just at the very last it weakens for a moment and seems to have a glimmering that the illumination, which is the object of electric lighting, is not entirely gauged by even an inspected meter; but it most ungenerously throws the burden upon the Governor in Council by enacting in the last section that he "may establish rules and regulations for the testing of electric light lamps for illuminating power". The stamp of good legislation is that it should be so definite in its grasp of the main issues, and so devoid of any dependence upon the minor points of controversy, as to aid in its own enforcement whilst avoiding any interference by unnecessary definition with progress by natural development. But it cannot be said that this act answers to such a description, indeed it is hardly too much to say that it is throughout fussy, and in parts at least, futile.

SOME of our neighbors in the State of New York have taken alarm at the scope of the various plans on foot to utilize the water power of Niagara Falls, and at the unlimited character of the licenses already granted to divert water from the Falls for this purpose. A committee of the constitutional convention of the State of New York now sitting, has presented a report dealing with this matter, which is being opposed by representatives of the power companies. It is to be hoped that the subject will be thoroughly thrashed out. Certainly on investigation it does seem as if there were some grounds for the action which has been taken, and a doubt whether we have not gone a little too fast and too far in granting franchises. It is difficult to get reliable figures on the flow of water over Niagara Falls, but taking those given in the Encyclopedia Britannica 18,000,000 cubic feet per minute, with a fall of 164 feet on the American side and 150 feet on the Canadian side the gross power would be a little more than 5,250,000 H. P. With such an enormous power to draw from it would seem that we might cut and come again without risk of any appreciable effect upon the natural beauty of the Falls. But on examining the franchises granted a little in detail it appears that if they are availed of to the full extent of the projectors' anticipations, that there would result a serious impairment of the volume of water now passing over the Falls. The present tunnel on the American side is only 100,000 H. P. capacity, but the full projected power on that side is stated to be 500,000 H. P., which at the present available head of 140 ft., would require about 200,000,000 cubic feet of water gross. On the Canadian side, by agreement approved by the Ontario legislature, the power company has the right to take water for a power station occupying a tract of land not to exceed 100 ft. by 1200 ft. The present station on the American side is of 50,000 H. P. capacity, measures 68 by 200 ft., therefore the limit of the Canadian concession would be about 300,000 H. P., or about 1,200,000 cubic ft. of water. These two principal undertakings would therefore amount to 3,200,000 cubic feet, which the electric railway on this side, the old hydraulic canal on the other side, and existing private and town rights on both sides, would easily swell to 3,600,000 cubic ft., or 20% of the natural flow as given in the Encyclopedia Britannica. One fifth reduction in the volume of Niagara Falls, would involve a ruin of their natural beauty, which would be a disgrace to us as one of the custodian nations of this wonder of the world. Such a catastrophe is only a possibility, and a remote possibility. Unless further powers are granted, on the Canadian side, the concession is probably limited to less than the amount estimated above, by the provision in the agreement that the water shall be led off by the natural channel between Cedar Island and the mainland. But even the possibility of such a catastrophe in the far future, fully justifies the action which has been taken in New York. No shadow of excuse could be urged for destroying Niagara Falls for the enrichment of a few capitalists and a locality. We are far from the time when any pressure of population on our national resources could justify such utilitarianism.

EXPERIENCE has pretty well shown by this time that any new art which serves some useful purpose, is, broadly speaking, a friend rather than a foe to its apparent rivals in the same field. By cheapening or simplifying the object to be attained, and by familiarizing the general public with the advantages to be gained by its use, the new method on the whole increases the total demand by a greater amount than the share which falls to itself. Of course locally and in individual cases the rival may suffer, though even where this would seem an obvious consequence, it sometimes results quite otherwise, as in the case of the increased earnings of those New York street railways which were apparently doomed to ruin by being roofed throughout their whole length by the elevated roads. As a whole the increased recognition of the value of the idea means increased business to all concerned. As already referred to, rapid transit has greatly increased the total of city and suburban travel. The electric light gave people a new standard of illumination, and a new idea of the value of abundant light, with the result that the total use of light has been largely increased. And we should be surprised if the general use of local and long distance telephones, by introducing conditions and habits of business which made full and rapid communication a necessity, did not react to the benefit of telegraphs and all other methods of correspondence. We are apparently on the eve of being furnished with another instance of the same principle. Gas engines were just coming into use commercially some years ago when the electric motor started on its astonishing career. It supplied the demand for small powers better than the somewhat crude gas engine of that day and secured the field to itself. But it did more than secure the field, it extended it, and the additional business thus brought into sight stimulated the gas engine manufacturers to new exertions, until now a great variety of gas motors are in the market of apparently simplified mechanism and improved economy. The average gas consumption of motors is stated at 26½ cubic feet of lighting

gas per effective horse-power hour; and this is the actual consumption of one plant consisting of two 60 H.P., one 30 H.P. and one 8 H. P. gas motors. If anything like these figures can be relied upon for small motors in ordinary use the gas motor is already far on its way as a competitor to the electric motor. With gas at $1.00 per 1000 and a consumption of 26½ cu. ft., the gas motor at 2⅔ cents per H. P. hour, already beats the electric motor in its expense for power. If it can match it in first cost and ability to stand lack of care and attendance, the electric motor will have to reckon with a formidable rival.

One paradoxical result of efficient and reliable gas motors is that in many cases the most economical illumination will be electric light from dynamos driven by gas motors. Taking as a basis gas for both power and lighting at $1.00 per 1000, gas motor consumption 26½ cu. ft. per effective H. P. hour, and the usual assumption that a 5 foot gas burner equals in illuminating power a 16 C. P. incandescent lamp; we have a 5 foot gas jet costing ½ cent per hour, and an incandescent lamp costing 6-10 cents per hour (central station selling rates), to compare with a gas motor driven by private electric plant. Such a plant including the loss in dynamo and wiring should certainly give 11 16 C. P. lamps per effective horse power of gas motor, the latter costing 2⅔ cents per horse power hour for power. This would be an expense for power alone of ¼ cent per lamp per hour: half the cost of gas and less than half the cost of central station rates. To this expense for power must be added the expense for lamp renewals, attendance, insurance, taxes, interest on investment and a liberal allowance for depreciation. For the last four items, in a small plant, it would only be properly conservative to allow 25% per annum on the total investment; but even with this high rate the total cost of making light will figure out to less than the buying cost in a plant where the average hours burning per lamp per diem are of any length. The determining factor is of course the average time per day the lamps are in use throughout the year.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

Note.—Secretaries of the various Associations are requested to forward to us matter for publication in this Department not later than the 20th of each month.

THE ANNUAL CONVENTION.

As this issue of the ELECTRICAL NEWS leaves the press the delegates from the various associations composing the Canadian Association of Stationary Engineers are about to assemble in annual convention at Toronto. The sessions will extend over four days. Many matters of importance to the welfare of the Association will come up for consideration at this meeting. Papers will be read as follows: "Steam Jackets" by Mr. John Murphy, of Montreal; "Steam Separation" by Mr. Granberg, Montreal; "The Inspirator" by Mr. A. E. Edkins, Toronto; "Steam Heating," by Mr. A. M. Wickens, Toronto. The fifth annual banquet of the Executive Council Convention will be held at the Palmer House on the evening of the 5th inst.

MONTREAL ASSOCIATION NO. 1.

The installation of officers of Montreal No 1, C. A. S. E., took place on the 2nd of August. The following are the names: past president, J. G. Robinson; president, John J. York; vice president, T. Martin; 2nd vice president, A. Thompson; treasurer, T. Ryan; secretary, E. O. Granberg; financial secretary, J. Jones; corresponding secretary, A. W. Brown, 477 St. James street, conductor, P. Mooney; doorkeeper, J. Dooner.

The 5th annual convention takes place at Toronto on Sept. 4th. A special car has been engaged, and the following delegates will attend: J. J. Robinson, H. Nuttal, J. Murphy. Also the following members of the Executive Board: president, J. Hunt; secretary, J. J. York; chairman, T. Ryan, and district deputy, J. Hardestein. The Winnipeg delegates will meet those of Montreal No 1 here, and delegates from Ottawa, Kingston, Brockville and Belleville will be taken up on the way.

E. O. GRANBERG,
Secretary.

HAMILTON ASSOCIATION, NO 2.

Editor ELECTRICAL NEWS.

SIR,—The two last meetings of this Branch were of a very interesting character, the discussions being, however, of a somewhat private nature. At our last meeting we appointed as our delegates to the convention to be held in Toronto, Bros. Duncan, Robertson and E. Johnson.

As far as we can see this year's convention promises to be a very important one, and one that should tell on the welfare of the order at large. The representatives will have a good chance to make the influence of this convention felt far into the future history of the C. A. S. E., and it is the earnest wish of this Branch that such will be the case.

WM. NORRIS, Cor. Secretary.

ST. LAURENT NO. 2.

St. Laurent Branch, No. 2, Montreal, have recently elected officers as follows. R. Drouin, president; P. Marchand, 1st vice-president; Joseph R. Guillemette, 2nd vice-president; F. Latour, recording secretary; Francois Denis, financial secretary; W. Gendron, treasurer; J. J. Joly, conductor.

We learn that this Association is in a thriving condition, having added about twenty new members during the past twelve months.

KINCARDINE ASSOCIATION NO. 12.

Editor ELECTRICAL NEWS.

SIR,—The following have been elected officers of this Association: president, Jos. H. Walker; vice-president, John H. Cress; secretary, A. Scott; treasurer, D. Bennett; conductor, Percy C. Walker; doorkeeper, Jas Carroll; trustees, J. H. Walker, Percy Ashton and G. H. Lighthall; delegate to convention, J. H. Walker.

Owing to a number of our members having been absent, we have not been able to hold our meetings regularly, but at our last meeting we had a very interesting and instructive time, and we trust it was only a commencement, and that as the evenings lengthen they will be better attended. At our last meeting we had two initiations and one proposition for membership.

ANDREW SCOTT,
Rec. Secretary.

QUESTIONS AND ANSWERS.

"Young Beginner," Spadina Avenue, Toronto, writes: "I should be much obliged to you if you could answer the following questions in your next issue of the September CANADIAN ELECTRICAL NEWS. (1) Will a slide valve steam cylinder do for the purpose of compressing air, and will compressed air work a steam engine in the same manner as steam? (2) What kind of brakes are taking the lead now? Are there any, which, instead of acting by friction, so as to cause heat, conserve the energy so that it can be used to start the same object, thereby affecting a saving in overcoming the resistance of the object to be moved?

ANSWER.—(1) Slide valve engine will work with compressed air, or could be used as an air compressor, though of course motors and compressors specially made for the purpose are best. Compressors get warm and require water jacketing. Motor gives best economy with compressed air heated previous to admission. (2) Many brakes for storing power have been invented but none have come into general use; braking by friction on wheels is practically universal.

MOONLIGHT SCHEDULE FOR SEPTEMBER.

Day of Month.	Light.	Extinguish.	No. of Hours.
	H.M.	H.M.	
1.....	P. M. 7.20	A.M. 4.30	9.10
2.....	" 7.20	" 4.30	9.10
3.....	" 7.30	" 4.30	9.00
4.....	" 7.50	" 4.30	8.40
5.....	" 8.50	" 4.30	7.40
6.....	" 9.50	" 4.30	6.40
7.....	" 10.40	" 4.30	5.50
8.....	" 11.10	" 4.30	5.20
9.....	" 11.40	" 4.30	4.50
10.....	.....	" 4.40	}
11.....	A.M. 12.40	.....	} 4.00
12.....	" 1.40	" 4.40	3.00
13.....	No light.	No light.	....
14.....	No light.	No light.	....
15.....	No light.	No light.	....
16.....	No light.	No light.	....
17.....	P. M. 6.40	P. M. 9.20	2.40
18.....	" 6.40	" 10.00	3.20
19.....	" 6.40	" 10.40	4.00
20.....	" 6.40	" 11.20	4.40
21.....	" 6.40	A. M. 12.10	5.30
22.....	" 6.40	" 12.50	6.10
23.....	" 6.40	" 2.00	7.20
24.....	" 6.40	" 3.10	8.30
25.....	" 6.40	" 4.10	9.30
26.....	" 6.30	" 4.50	10.20
27.....	" 6.30	" 5.00	10.30
28.....	" 6.30	" 5.00	10.30
29.....	" 6.30	" 5.00	10.30
30.....	" 6.30	" 5.00	10.30
		Total,	159.20

BE SURE THAT YOUR LIST OF ENGAGEMENTS FOR SEPTEMBER INCLUDES THE CONVENTION IN MONTREAL OF THE CANADIAN ELECTRICAL ASSOCIATION.

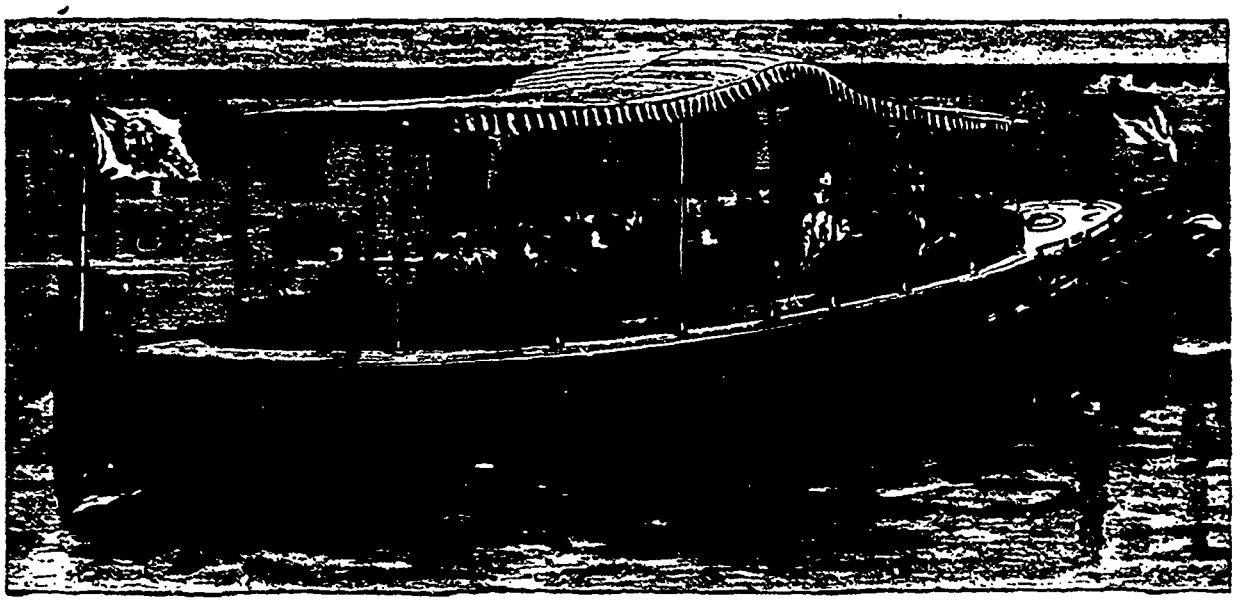
HIS EXCELLENCY THE EARL OF ABERDEEN'S ELECTRIC LAUNCH.

BELOW is a cut of His Excellency the Earl of Aberdeen's electric launch. The launch was purchased and refitted by Mr. O. Higman, electrical engineer, of Ottawa, from the Electric Launch and Navigation Company, the concessionaires of the electric launch privilege at the World's Columbian Exposition in Chicago. The boat is 35 feet 10 inches over all in length, and 31 feet 6 inches on the water line. The beam is 6 feet 2½ inches, and the draught 27 inches. The lines are as near perfection as they well can be, and at whatever rate the launch runs there is practically no wake, so that the wash on the shore, of even very narrow waterways, is of no consequence.

The hull is constructed of white oak frame, with white cedar planking. The inner panelling, decks and other parts, are finished in mahogany. All the woodwork is finished in its natural color, thus giving a very rich appearance. The launch has a seating capacity for about 30 people.

The motor is nominally of four horse power, and is placed low down in the centre of the boat. The motor was designed and made especially for this use by the General Electric Company. The storage batteries are placed around the sides of the boat, and under the seats, entirely out of sight. There are 56 cells of the Consolidated Electric Storage Company's type, of 150 ampere hours capacity. These cells can be arranged in three groups of 22 cells in series, or in two groups of 33 cells in series. The motor is coupled direct to the propeller shaft. By a combination of direct coupling and thrust bearing, all gearing and loss of power, as well as unnecessary noise and jar, are done away with.

The launch is at present charged from the Ottawa Electric Company's 250 volt power circuit, a rheostat being used to reduce the current to about 40 amperes at 90 volts. From six to seven hours time is required to charge the batteries at this rate, and when charged are good for a run of 10 hours at the normal speed of seven miles an hour. The control is by means of a small lever switch at one side of the steering wheel, which is located in the forward part of the boat. This lever allows of four speeds forward and two backward. Although the normal speed, as previously stated, is seven miles an hour; the boat has a reserve speed of from 9 to 10 miles an hour.



HIS EXCELLENCY THE EARL OF ABERDEEN'S ELECTRIC LAUNCH.

SPARKS.

Mr. R. Potter has been given the franchise for electric street lighting at Tweed, Ont.

The purchase of an electric light plant is being considered by the ratepayers of Winchester, Ont.

An incandescent electric light plant will be placed in the steamer "C. H. Merritt" at Kingston next winter.

The Bell Telephone Company have recently constructed a metallic circuit from Windsor to Amherstburg, Ont.

A by-law providing for the establishment of an electric light plant has been carried by the ratepayers of Sudbury, Ont.

Incorporation is being sought by the Mattawa Electric Light and Power Co., of Mattawa, Ont. The capital stock is $10,000.

The Royal Electric Co., have been awarded the contract for installing an electric light plant in the Seminary of Philosophy, Montreal.

A dispatch from Perth states that the council of that place has granted a bonus of $5,000 for an electric railway between Perth and Lanark.

The promoters of the electric railway for the city of Quebec have paid ten per cent. of their subscribed stock and expect to commence operations this fall.

Mr. W. R. Keating, of Kemptville, is said to have decided to establish an electric light plant at Winchester, Ont., and will commence operations at once.

A successful test was recently made of one of the three generators recently built for the Montreal electric railway. It is a duplex machine, capable of supplying a current of 1,200 h. p.

Mr. S. A Coney, of the firm of John A. Roebling, Sons & Co., of New York, recently visited Hamilton for the purpose of tendering on the machinery required for the new East Hamilton Incline Railway.

Under the supervision of Mr. J G Hampton, Superintendent of the North American Telegraph and Telephone Co, a telephone cable was recently successfully laid between Gananoque, Ont., and Fremont Park.

The Hamilton and Dundas Railway has been leased by Mr. Miles, of the Hamilton, Grimsby and Beamsville Electric Railway, and will be converted into an electric road. Mr. W. T. Jennings, C. E., will have charge of the work.

The Temple Electric Co., of Montreal, are fitting up an electric light and power station on Chenneville street in that city. The new station will have double the capacity of their present one, and is to be completed about the end of September.

The new contract made between the corporation of St. Johns, Que., and the Electric Light Company provides for 30 arc lights of 2000 candle power at $60 per annum, or five incandescent lights of 25 c. p. may be substituted for one arc light. The arrangement is certainly a very favorable one for the town.

The Citizens Light and Power Co., of Montreal, are erecting a new station at St. Henri, which is to be operated by steam power The steam plant will consist of two 320 h. p. compound, condensing Westinghouse engines and Manning vertical boilers with mechanical draft.

Last year the Western Telephone Company imported from Germany a cable half a mile long and stretched it across the Fraser River at Brownsville, B. C. The great freshet of the present summer broke one end loose, and in trying to secure it the end was lost. It is found to be imbedded in sand and clay and doubtful of recovery.

The Department of Inland Revenue at Ottawa is at present engaged in organizing the electrical inspection branch, under authority of an act passed by the Parliament last session. The result of the experiment by the Dominion Government will be closely watched, as although England and the United States have established standards of electrical units and measurements, neither of these countries has so far taken up the work of inspection.

The Niagara Falls and Port Dalhousie Electric Railway Co., with head office at Toronto, is applying for incorporation to construct an electric railway connecting Niagara Falls and Port Dalhousie, Ont., passing through the intervening municipalities of Stamford, Thorold, Merritton and St. Catharines. The capital stock is placed at $300,000.

The promoters of the Galt and Preston Electric Railway are said to have decided on the extension of their line to Hespeler. The construction of a branch line to Berlin also under consideration by the company. Mr. W. T. Jennings, C. E., of Toronto, recently surveyed the proposed route and reported that no engineering difficulties were anticipated.

Mr. T. Viau has been granted a franchise by the town of Hull, Que., for the construction of an electric railway and the operation of an electric light plant. Steps are being taken to organize a company, and a charter from the government is being applied for. Surveys have been made in connection with the erection of the power house, which will be commenced before the end of the year. The electric light plant will also be installed at an early date.

A company of Toronto capitalists, composed of Alexander Manning, ex-mayor, Senator Aikins, Col. C. S. Gzowski, James A. Lowell, M. P., W. M. German, M. L. A., and others, are reported to have purchased the street railway franchise of Niagara Falls, Ont., the price paid being given as $25,000. The road will be converted into an electric system. The ultimate intention is to extend the line to Chippewa, thus making a connecting link between that place and the G. T. R. station.

PERSONAL.

Mr. H. T. Smith, superintendent of the London Street Railway Company, has recently returned from a holiday trip to the Thousand Island.

Mr. J. F. H. Wyse has been appointed superintendent of the Westminster and Vancouver Tramway Co. Mr. G. Lubka, the former superintendent, is going to Germany.

WE HOPE TO SEE YOU AT THE MONTREAL CONVENTION. IT WILL DO YOU GOOD TO BRUSH UP AGAINST YOUR ELECTRICAL CONFRERES.

INCANDESCENT LAMPS: THEIR USE AND ABUSE.*

IN the present state of the art of incandescent lighting, in no way can central station managers increase the efficiency of their investment more than by careful study of ways and means of operating lamps in a manner which will insure an average maximum light for a minimum expenditure.

Too large a percentage of central stations judge the quality of lamps sold them almost entirely by their life, and even that poor basis of calculation is still further distorted by keeping no ampere records nor averaging results, but judging solely by the individual records of such lamps as may fail in the first hundred hours, or of those which live hundreds of hours past the point, at which, from an economical standpoint, they should have broken. The importance to central station managers of judging lamps which are sold to them from some better basis than individual or even average life, can be better appreciated by referring to diagram No. 1, showing curves of deterioration in candle-power of lamps manufactured by different companies. (In considering deterioration in candle-power, it should be stated that it is a characteristic of every lamp which has yet been manufactured and should be considered entirely independent of blackening or discoloration of the bulb. Lamps may deteriorate to 50 per cent. of their initial candle power within 200 hours and still show scarcely a trace of blackening). All lamps, the curves of which are shown, were purchased within six months in the open market in lots of from 10 to 25, and the curves are the average result obtained by starting each lamp at the particular voltage which would bring the lamp to exactly three watts per candle, maintaining its voltage constant throughout its life.

Curves Nos. 3, 5 and 6, diagram No. 1, represent the best results obtained from the product of numerous foreign manufacturers. Nos. 4, 8, 9, 10, 11 and 12 each represent a different domestic manufacturer.

While there is no reason to suppose that the average life of lamps shown by Nos. 4 and 7 will be shorter than that of lamps represented by curves Nos. 10, 11 and 12, there is also no certainty that it will be longer, and if a lamp is to be branded as poor by the central station manager, because of the breakage of a small percentage of lamps in the first 100 hours, then the advantage is in favor of the lamp which reached 50 per cent of its original candle-power in the first 200 hours, thus maintaining the carbon at a high degree of incandescence with the necessarily greater strain of the filament for only a few hours.

The carbon which maintains its candle-power must continue to burn at a higher temperature, nearer the point of vaporizing, and is more likely to be destroyed by an abnormal increase in pressure than one which cools within the first few hours to a point where considerable increase in voltage is required to bring it to its initial degree of heat or incandescence.

From the standpoint of the central station, one of the worst guarantees that you could demand from the lamp manufacturer would be an individual life (for each lamp) of 100 or 200 hours. The reason for such demand, when made on your part, arises from the erroneous impression that the lamp which lives only

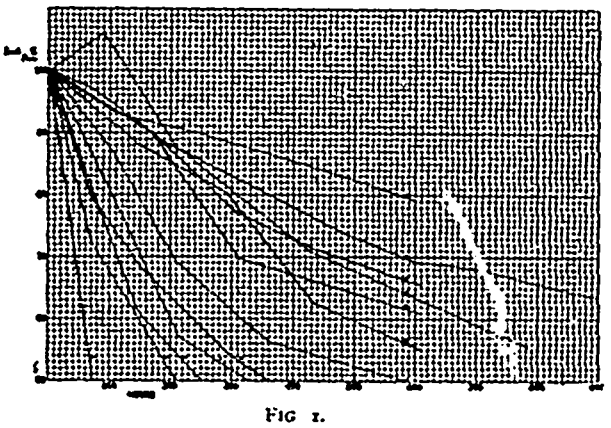


FIG 1.

100 to 200 hours is necessarily defective. Nearly every lamp sold you, and particularly those which show the best results, rises in candle-power for the first few hours (this is not shown in diagram No. 1, as in only one case was the first test after the lamps were started made before the candle-power commenced to drop).

On nearly every central station, particularly on alternating current stations, during light load, the pressure on the primary is abnormally high. Add to this the difference between drop in the transformers and secondary wiring, as between full and light load, and the result which a test is quite certain to show is pressure on the one or two lamps which the customer is burning during light load from 6 to 10 per cent high.

Referring to diagram No. 2, we find that burning a new 16 candle-power three and a half watt lamp seven per cent high would, for the first few hours, raise its candle-power to 25, and its efficiency to about 2.6 watts per candle. In less than 150 hours, even maintaining the high pressure mentioned, the candle power and efficiency would fall below normal; but in the meantime, the new lamps which have been burned under the above conditions have been abused to an extent which would be quite certain to make the showing of some individual lamps very poor, *through no fault of the lamps.*

After lamps have been in use about 200 hours, under average conditions, they could then be used where the pressure was high, without bringing the carbon to a dangerous degree of incandescence.

One of the best illustrations I can give of the importance of your judging lamps from some better standard than simply life, is to refer to an incident of which I had reliable information where a representative of the lamp company, who manufactured the lamps shown by curve No. 12, diagram No. 1, exhibited the valuable quality possessed by his lamp standing very high pressure. With a rheostat it was exhibited burning from

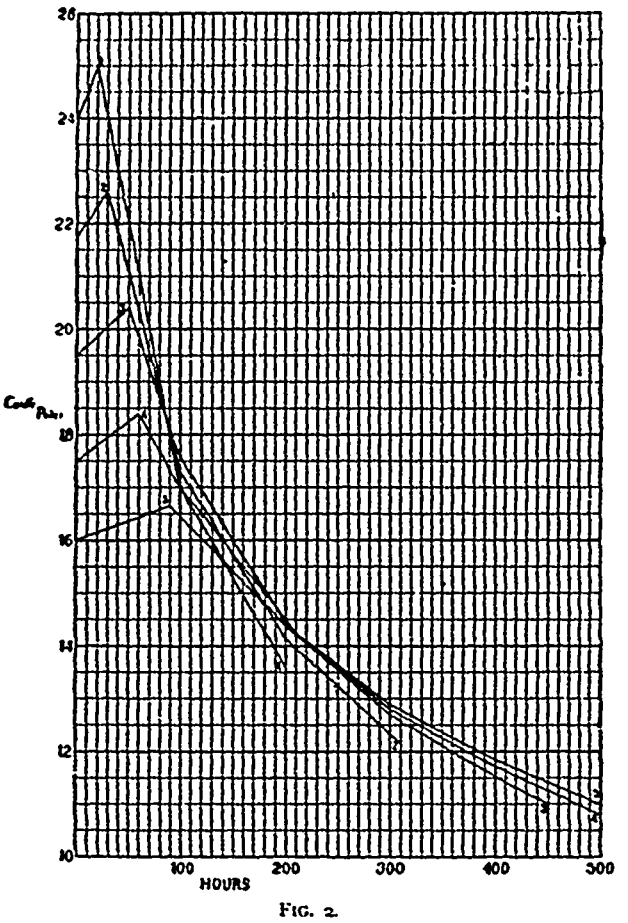


FIG. 2.

normal to a very high candle-power. He represented it as the *toughest* filament ever placed in a lamp, and I have no cause to disbelieve him.

If central stations run with a variation of from 6 to 20 per cent in pressure they will find it necessary to demand *tough* lamps, the natural product of the *amateur* lamp manufacturer. To bring a product up, however, even from curves Nos. 9, 10 and 11 to No. 4, means experience and thousands of dollars spent in experiments.

It also means that each one of over 50 different operations through which the parts of a lamp pass from start to finish, should receive careful, intelligent handling or direction. Perfection in any one particular will not attain even average results.

The manufacturer of lamps shown by curve No. 4 might have furnished the same carbons to manufacturers of lamps represented by curves Nos. 10 and 11, and the result which they would obtain would not differ materially from that secured with their own make of carbons. Curve No. 4, though it represents as high an average grade of lamp of any voltage above 100 as has yet been furnished to the customers of any lamp manufacturer, does not represent the highest point which will be attained.

Curves Nos. 1 and 2 represent experimental lamps manufactured and furnished for test by the same company, whose regular product is represented by curve No. 4, and I am informed by reliable experts that within a few months the entire product of the company will be brought up to the standard represented by curve No. 1.

That the relative value of the lamps represented by these curves may be fully appreciated, let us take the average candle-power of curve No. 1, diagram No. 1, which for 600 hours is 14-19 candles, and we find, to maintain the same average candle-power, using other lamps, we should have to break lamps represented by curve No. 4 at 530 hours; No. 7 at 170 hours; No. 8 at 100 hours; No. 9 at 120 hours; No. 10 at 90 hours; No. 11 at 75 hours, and No. 12 at 35 hours.

*Paper read before the Northwestern Electrical Association, St. Paul, July, 1894, by A. D. Page.

All of the lamps represented by diagram No. 1 are of voltages from 100 to 125 volts, and though started at a higher economy (*viz*: three watts per candle) than is commonly practiced by central stations (the 3.1 standard of Edison illuminating companies being the highest of which I have personal knowledge). Testing at three watts comes nearer to results obtained by commercial practice than a lower initial economy, as the tendency of the average central station is to run high.

Diagram No. 3 represents lamps of from 50 to 60 volts, started at three watts per candle, and tested under the same conditions, as the 100 to 120 volt lamps.

No. 1 is the product of the same factory as Nos. 1, 2 and 4, diagram No. 1.

No. 2 was manufactured by the same company as No. 9.

No. 3 was manufactured by the same company as No. 11.

No. 4 was manufactured by the same company as No. 10.

As proven by these curves, and also, I believe, as generally acknowledged, it is much easier to produce a fairly good 50 volt lamp than one of a voltage above 100; but considering the progress which has been made within the past year in the high-volt lamps, I believe that in a short time a large percentage of alternating current central stations will find it to their advantage to use large transformers and secondary mains on the three wire system, covering one or more blocks from one transformer or bank of transformers and using only lamps of over 100 volts, thus greatly economizing in copper and securing much better regulation than is now secured with numerous small transformers and 50 volts on the secondary.

The importance of good regulation or a constant voltage at the lamps is too little appreciated, the general opinion of central station managers apparently being that so long as the life of the lamp is satisfactory to themselves or their customers, if they increase the voltage either temporarily or permanently, the result would be to increase the average light. The facts are that burning lamps above their normal rating decreases the entire average

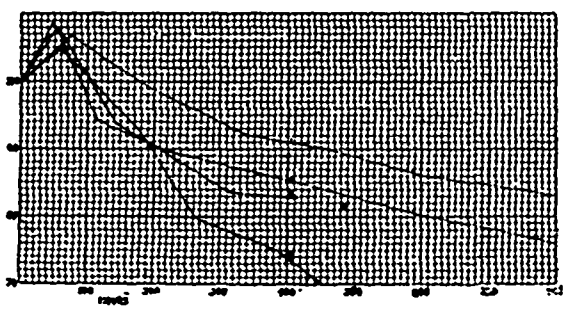


FIG. 3.

candle-power on the customers' circuits and, at the same time, if the station is on a meter basis, increasing the amount of the customers' bills. The above statement is particularly true of lamps only of average quality.

Referring to diagram No. 2, No. 5 curve represents a 108 volt, 16 candle-power, three and one-half watt lamp burned at a constant voltage and reaching 11 candles at 500 hours, starting the same lamp at 110 volts or at 17½ candles, 3.3 watts per candle and inside of 200 hours the candle-power curve crosses the one burned at normal. Starting it at 112 volts or at 19½ candles, 3.1 watts per candle, in less than 200 hours the candle-power curve crosses both the others.

Curves Nos. 1 and 2 follow the same general law. The higher we raise the voltage the more rapid the drop in candle-power, and when we consider that the lamp represented by curve No. 1 *must be kept at* 116 *volts* in order to give 14 candles of light after 200 hours, and that should the voltage be brought back to normal, or 108 volts, the candle-power would be only about nine candles, we can appreciate that on a station where the voltage varies even seven per cent, the result must be a very uneven and poor quality of light, even though the *life* of the lamp is satisfactory.

The tendency of all the central stations seems to have been to gradually raise their voltage with the intention of thus either burning out or increasing the candle-power of the old lamps on their circuits. The result is only to either burn out an abnormal number of new lamps or bring them down to the candle-power level of the old ones within 200 hours.

The only practical method of keeping the average candle-power of lamps on a station at a point which will be satisfactory to customers or on a competitive basis with other methods of of lighting, is to keep records of the average life on the entire station where free renewals are furnished, and then to take out of the sockets and break up all lamps which are dim, by this means keeping down the average life to whatever constant is decided as the best under local conditions. Where lamps are sold to the customers, to keep the candle-power of lamps in use on the circuit of a central station at a point which will ensure satisfaction or tend to keep the electric light popular, is a difficult problem. Whether the customer is on a meter or on a contract basis, it is poor economy for him to keep lamps in his sockets which are giving only 50 per cent of their initial candle-power, but for the corporation which sold him the lamps and supply him with current, to call his attention to the fact that lamps in his sockets are giving only about eight candles, and attempt to sell him lamps at 50 or 60 cents each, is not likely to bring about the desired result. To meet the above difficulties a number of central stations in different parts of the country are now selling lamps at retail to their customers at cost and a few stations even below cost, at the same time doing all in their power to prove to them that only by a liberal use of lamps can they obtain the greatest amount of light for a given expenditure of money.

As the profit on the sale of lamps is decidedly a secondary matter as compared to the sale of current and the increased

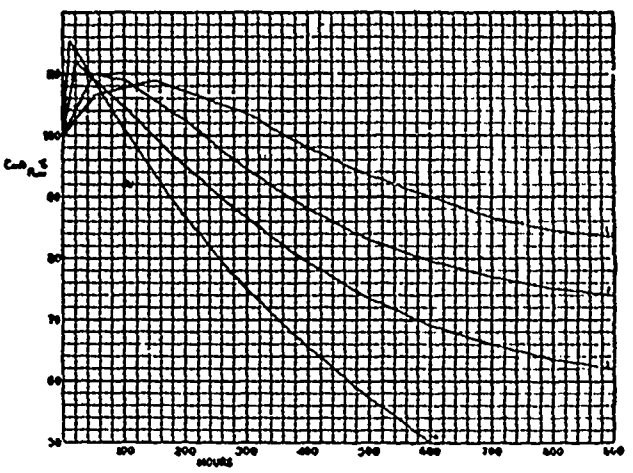


FIG. 4.

quality of the light, the above plan should commend itself to all central stations not on the basis of furnishing free renewals. It is also worthy of consideration that by adopting the above plan the station controls what lamps shall be used on its circuits without dictating to its customers, an important point, while lamps show such widely different results as those shown by diagram No. 1. And while customers continue more likely to believe that the corporation is not supplying proper current, than to believe that the quality of lamps they have been purchasing is at fault.

Another method of inducing customers to destroy dim lamps which has found favor with a number of stations, is to make a price for lamps of, say, 40 cents each and agreeing with their customers to exchange all dim lamps (which they have sold them) at half price, that is, for every dim lamp which the customer returns before the carbon is burned out, he receives a new lamp for 20 cents.

Within the past few months the question has often been asked me by central station managers: "What economy of lamps should we use?" This question should, I believe, be settled by central station managers themselves on presentation of facts, they having control of the regulation of their station, and knowledge of local conditions.

Diagram No. 4 shows the same quality of lamp manufacture as curve No. 2, diagram No. 1, and represents 16 candle-power lamps started at an initial economy of four, three and a half, three and two and a half watts per candle. The accompanying table shows candle-power, average candle-power, average economy and average candles per electrical horse-power at 100 hour periods in their life.

	64	56	48	40
200 Hours C.P.	1720	1744	168	1616
Average C.P.	168	1706	1708	1696
Average Watts Per Candle	3.9	328	28	236
Candles Per E.H.P.	191	217	296	376
300 Hours C.P.	1212	1832	132	1808
Average C.P.	1703	1694	1534	1583
Average Watts Per Candle	- 1	3.3	29	25
Candles Per E.H.P.	196	226	257	298
400 Hours C.P.	1661	1534	1382	12
Average C.P.	1600	1633	1386	1368
Average Watts Per Candle	3.77	3.38	3.03	2.61
Candles Per E.H.P.	198	220	260	279
500 Hours C.P.	1568	1488	128	1036
Average C.P.	1671	16	132	1460
Average Watts Per Candle	3.82	3.5	3.15	2.85
Candles Per E.H.P.	205	233	336	262
600 Hours C.P.	15	1378	1186	912
Average C.P.	1645	1557	1152	122
Average Watts Per Candle	3.89	3.59	3.28	3.03
Candles Per E.H.P.	182	208	277	248
700 Hours C.P.	1430	123	1101	8
Average C.P.	18	1513	1106	1243
Average Watts Per Candle	4	3.7	3.11	322
Candles Per E.H.P.	187	202	270	332
800 Hours C.P.	1302	1272	1030	
Average C.P.	1584	1478	1363	
Average Watts Per Candle	404	379	332	
Candles Per E.H.P.	185	197	252	
900 Hours C.P.	128	12	1031	
Average C.P.	158	1473	1321	
Average Watts Per Candle	41	3.48	3.02	
Candles Per E.H.P.	183	192	208	
1000 Hours C.P.	1258	1184	992	
Average C.P.	1536	1438	1268	
Average Watts Per Candle	417	4.04	3.72	
Candles Per E.H.P.	179	189	200	

TABLE

In considering these curves and table it should be remembered that the result would have been much less favorable to the higher economy lamps had the test been made and the curves plotted with a poorer quality of lamp, and also that satisfactory results with lamps of higher economy than three and one-half watts per candle can only be obtained by exercising the greatest care in maintaining a constant voltage at the lamps. Referring to the table briefly, it will be found that even at 600 hours, lamps of the highest initial economy show the best average results as

to average watts per candle and average candles per horse-power. And that at 900 hours three watt lamps show better average results than lamps of 3.6 or four watts. The greatest objection which can be urged against the high economy lamp is that while at 900 hours the four watt lamp reaches a minimum candle power of 13¼ candles and the three and one-half watt lamp about 12 candles, the three watt lamp reaches 10 candles and the two one half watt lamp at 600 hours reaches eight candles. At the present price of lamps, where fuel is high and the customers' bills are made up on the basis of lamp hours, it would, without question, pay the station to use high economy lamps, breaking them at a point which would insure satisfaction as to average light and keeping the average light comparatively short.

Whatever economy or make of lamp you decide to use, by no means can you so greatly increase the efficiency of your station as by making every possible effort in the direction of maintaining a constant voltage at the lamps. This can only be accomplished and maintained by constant use of reliable, portable instruments. No switchboard instrument should be relied on without often checking it by some reliable standard, and it should also be borne in mind that, owing to the varying drop at various loads, constant voltage *at the station* is just what is not wanted. If you do not possess a reliable, portable voltmeter, such an instrument should be your next purchase; then by constant use on your circuits at different loads and *profiting by the knowledge thus obtained*, you would soon find a marked improvement in your lighting, and would be in a position to judge which make and what economy of lamp is the best for you to purchase.

ELECTRICAL METERS.*

By Cecil Doutre.

An indispensable adjunct to the installation of the electric light supplied with current from the mains is the electric meter to measure the amount of current consumed. Up to the year 1887 there were few, if any, practical meters on the market, with the exception of a few continuous current ones which were for the most part of the Edison chemical type. In the year 1887 Prof. Forbes exhibited his heat meter before the American Institute of Electrical Engineers; where it caused considerable comment and received a great deal of well deserved admiration. Although this meter was not all that could be desired (for reasons which we will consider later on), it marked an important era in the history of recording meters, and stimulated those who had been working in this field to such an extent that in an exceedingly short time a great many meters made their appearance, the majority of which were condemned, and to-day there are not more than six or seven meters which are used to any extent in this country or abroad. Nevertheless, there are a great variety of meters which, although they may not be thoroughly practical, are very interesting indeed, as they show how the various properties of the electric current are made use of. Of these there are the following:—the motor, chemical, thermo, clock, and several others. Before discussing their good and bad features, we will consider what points a good practical meter should possess.

An electrical meter, to be practical and to achieve any commercial success, should have a direct-reading dial, should be extremely sensitive, so as to register accurately on a light as well as a heavy-load, should be free from all complicated mechanism, and where the element of friction is introduced, it should be reduced to a minimum, so as not to destroy its accuracy. A practical meter should not be affected by atmospheric changes.

We will now discuss some of the meters which are in use to-day and see how many possess the foregoing points. We will first take those which come under the head of motor meters. There are only three of these meters used to any extent in this country, viz:—the Shallenberger Slattery and Thomson meters. They are divided into two classes those actuated by inductive principles and those whose motive powers act direct, and which are similar in character to the electric motor. The Shallenberger belongs to the former class, and is a recording ammeter, and while highly practical, is scarcely all that could be desired for several reasons, all of which tend to introduce errors, as we shall see. The principle upon which this meter operates is as follows. The small armature, composed of a soft iron ring, is mounted by means of an aluminum disc, on a shaft, which actuates a recording dial; the armature is surrounded by a number of flat copper stampings riveted together, which form a short circuited secondary coil of low resistance, and this in turn is surrounded by two coils of wire carrying the current to be measured. The last named coils are in series with the lamp circuit, and which we shall call the primary. When an alternating current passes through the primary coil, alternating currents are induced in the secondary. These two fields of force produce a revolving field resulting from the lag of phase of the current between the two coils, and the armature tends to revolve in unison with this revolving field. Meters, as a class, revolve far more rapidly than is allowable in practice, and a resistance, or drag, is introduced to reduce the speed. In this meter four air fans are attached to the lower end of the spindle, and have the desired effect. This, as I said before, is a highly practical meter, for atmospheric changes have very little effect upon it, and it will stand considerable knocking around. However, the meter has its weak points, viz:—that there is no means introduced to balance friction such as are found in the Slattery or Thomson meters, and the principle involved to produce the necessary "drag," or retardation, tends to introduce errors, and the result is that the speed of rotation is not in exact proportion to the volume of current passing through the meter. The resistance of the air fans to rotation is approximately proportional to the square of the speed, but since the torque of this meter does not quite reach the square (this would indicate that the iron was approaching saturation), the retarding effect of the fans increases rather too rapidly, which naturally has a tendency to cause the speed of the meter to fall off proportionately on high loads. This meter is also affected somewhat by variation of frequency. The speed of rotation is governed by the angle between the planes of the primary and secondary coils, and attains its maximum speed when the angle is 45 degrees, and will not run at all if the two planes are either parallel or perpendicular. Summing this meter up we find that on a light load it will measure the hours, but will not correct for the angle of lag, and again on a heavy load the speed of the meter has a tendency to be reduced on account of the retarding effect increasing too rapidly, as the torque of the meter does not quite reach the square. Nevertheless, this meter has been favorably received by station managers generally, as a thoroughly practical instrument, and has been found to measure accurately enough for all commercial purposes.

The Slattery meter is somewhat similar to the Shallenberger, both in construction and in principle of operation. Two soft sheet iron rings are mounted upon a copper drum on a perpendicular shaft, or spindle, which is surrounded by a series of copper castings, and surrounding this are two coils of heavy wire which carry the current to be measured. An accessory coil of fine wire is wound upon the main coils, or primaries, and is so proportioned that the torque resulting from it is just sufficient to balance the drag due to friction and, therefore, greater accuracy is attained on light loads. The means introduced in this meter to cause the necessary drag is certainly by far the best. A small inefficient dynamo, in form of a copper tube, is attached to the lower end of the shaft and is rotated in a magnetic field. The resistance, of course, is directly proportionate to the speed, and therefore to the torque, being in fact the machine reversed. By applying this drag the only difficulty to contend with is the friction, which is fully compensated for by the accessory coil of fine wire. This meter, if properly proportioned, will give a highly accurate result both on a light and heavy load. The old style of Slattery meter was almost the same as the present one, except that instead of only having two iron rings on the drum there were five, and the mode of causing the necessary drag is somewhat similar to that introduced in the Shallenberger, only the fans were so constructed that as the speed increased they would close up, thus reducing the exposed surface.

The Thomson meter is simply a motor without iron, and is somewhat of a departure from the rest of alternating current meters, as it is not a current meter, but a power or watt meter, and will record equally as well on both alternating and continuous currents. Its construction is quite similar to the ordinary shunt motor, the conditions of field and armature being reversed. The main current flows through the field and the armature is in series with a high non-inductive resistance, and is connected across the mains. Therefore the meter is not affected by variation of frequency. An accessory coil of fine wire is introduced in this meter, as in the Slattery, which is so adjusted that its torque is just sufficient to balance friction, and as the armature is nicely poised the meter will register an exceedingly small current. Therefore, in considering the principles of this meter both friction and the accessory coil may be neglected. Rotation is retarded by a copper disc rotating between the poles of permanent magnets. The resistance is directly proportioned to the speed, and therefore to the torque. This meter proved itself so accurate at the recent meter competition in Paris, some two or three years ago, that it succeeded in dividing the first prize of 10,000 francs and a gold medal with the Aron clock meter, which we shall consider later on.

The Edison chemical meter:—The principle upon which this meter operates is electrolysis, and in its original form consisted of two copper plates suspended at the end of a balance and dipping into a solution of sulphate of copper; a current continually traversing the liquid in the same direction caused one plate to gain and the other to lose in weight, the result being that after a certain quantity has been deposited on one plate the balance swings over; in doing so it reverses the current and registers a unit on the counting mechanism; as the current now flows in the opposite direction the lighter plate gradually gains in weight, so the balance swings over again, and so the action goes on. This method of making the chemical meter register the quantity of current consumed automatically, although highly ingenious, was abandoned, as the element of friction was introduced to such an extent as to make the meter unreliable. The present form of the Edison chemical meter bears little or no resemblance to the former one, except that it depends upon the same principle for its operation. Zinc plates and a solution of zinc sulphate are used in this meter. A resistance of German silver is interposed in the lamp circuit, which shunts only a small proportion of the current through the meter. In the old style of this type the exact amount is 1-975th part of the total current, or practically speaking the 1 000th part is shunted through the cell, which is placed in this shunt circuit, and the rate at which the zinc is deposited on the negative from the positive, is in direct proportion to the current consumed. The positive plate is weighed before being placed in the cell with the negative plate, and after the cell has been in service for a stated time it is replaced by a new one and the old one returned to the station to be weighed over again to find out how much the positive plate has lost. The French metric system is used in weighing these plates. One amp. of current will deposit 1224 milligrammes of zinc in one hour, therefore it is only necessary to multiply the amount the positive has lost by 975, and divide by 1224, which will give the number of amperes, but a shorter way of doing this is to multiply the loss by a convenient constant, which will give you the amount in dollars and cents. This meter is affected by changes of temperature, and to compensate for this a coil of very fine wire is inserted in the shunt circuit (which is called the compensating coil). As the resistance of all metal solutions increases as the temperature falls, and decreases as the temperature rises, and as the effect of the temperature on a coil of fine wire is exactly the reverse, the compensating coil is so proportioned that as soon as the resistance of the cell increases from a fall in temperature, the resistance of the fine coil of wire decreases in the same proportion, so that no matter what the state of the temperature is, the resistance of the shunt circuit is always the same. Another drawback of this meter is, that the cells are liable to freeze in cold weather, and to overcome the above defect a very ingenious device has been introduced called a "thermostat," which automatically lights a lamp if the temperature falls below 27°, and which consists of two thin strips of metal—one of brass and the other of iron—riveted together. The coefficient of expansion of these two metals is not the same; as brass contracts quicker than iron it has a tendency to curve or bend the strip, and in doing so makes contact and lights the lamp, immediately upon which the surrounding air is heated, and the strip expands, breaking the circuit. This action goes on as long as the temperature is below 32°, as the solution freezes at 27°, and it is always good practice to allow 4 or 5° for the safe working of the thermostat. The zinc plates go through a regular process before they can be used again. After being returned to the station and reweighed, they are ground to a clean surface, amalgamated, dried, scraped with an engraver's scraper, and about one inch of the copper rod and the top of the plate is painted with asphalt varnish; it takes a plate from 36 to 48 hours to go through the above process. The size of the plates in this meter increase in proportion to the capacity, so that in a 200 lt. meter the plates reach a size which is very awkward to handle; it is somewhere in the neighborhood of 6½in. long, 3in. wide, and 5-16in. in thickness. Take eight such plates, four glass cells which are capable of holding 1½ quarts each of solution, and one gains an idea of what it means to change a number of these meters, especially if they are any distance from the station. In view of the above facts one wonders how the Edison meter ever came to be used to the extent it was. The reason is however not far to seek, for at the time they were placed on the market there was practically no reliable meter to compete with it for straight currents, and station managers were only too glad to accept anything in the metering line, as the flat rate or contract policy which was in vogue was the ruination of a good many companies. The only point in favor of the Edison chemical meter is, that if properly operated it will return exceedingly accurate results. For laboratory work they are splendid, but if used to any extent they are extremely

*Paper read before the Montreal Electric Club.

expensive to operate and very cumbersome. The latest style of Edison chemical meter is a decided improvement on the old style, but even now they leave a great deal to be desired. The plates for all size meters are of uniform size—about 1 + 2 × 5-16. The German silver shunt, instead of being so proportioned as to shunt the 1-975 of the total amount consumed through each size of meter (or having the same ratio), has a different ratio for each size—that is to say, if in a 6ft. meter the shunt shunts the 1-975 part of the current consumed through the cell, in a 12ft meter the shunt will only shunt the 1-1950 part through the cell, by making this important change the plates and cells are all of one size. The result is reached by multiplying the loss by a different constant for each size. The successful operation of this meter depends upon a good many conditions. The water for the solution must be the purest water obtainable, it should be distilled, and the next best thing is melted ice. The salts must be chemically pure. Great care must be taken to get the positive plate in the positive clip. This is found out by using a piece of paper soaked in potassium iodide and in passing a current through it. If a brown mark is left it is the positive, if no mark is left on the paper it is the negative. Allowance must be made for oxidation also.

The Aron clock meter, although little known in this country, is used quite extensively on the other side, and consists of two distinct clocks—one is of the ordinary kind of every day clock which oscillates regularly, and the other has a permanent magnet at the extremity of its pendulum, a coil of wire in series with the working circuit surrounding it, which carries the circuit to be measured. The effect of this coil either retards or accelerates the movement of the pendulum according to the direction of the current. If there is no current passing through the coil the two clocks run in unison, but immediately one is retarded or accelerated the difference in speed is registered in electrical units by a differential speed, counting mechanism. This meter may be used for registering alternating currents by substituting a coil of fine wire in place of the magnet. These clocks have to be wound up every two weeks, and are found to give very good results.

The Oulton and Edmonston meter is upon the same principle as the Aron, and consists of two tortion pendulums instead of two gravity pendulums, which are actuated by the twisting of a fine wire; one pendulum carries permanent magnets, and underneath are two copper rods carrying the current to be measured; the effect of the current is the same as in the Aron meter. The superiority of this meter over the Aron is, that having tortion pendulums, it will run much slower and therefore does not need to be wound up so often.

The very latest style of alternating current meter is due to the ingenuity of Messrs. Wright and S. Z. Ferranti, and consists of two vertical electro magnets, the pole pieces of which are drawn out into peculiar curved horns, so to speak. Around the horns are wrapped at intervals thin copper bands. Between the horns or pole pieces is placed a light copper wheel attached to a spindle, to which are attached light mica vanes to cause the necessary drag. The current passes through the electro magnets and causes lines of force to traverse from one horn to another. The passage of these magnetic lines of force, however, through the copper bands, tends to induce momentary currents in them, and these momentary currents tend to obstruct the passage of the magnetic lines of force which do not all traverse the pole-pieces at its tip by puff out, so to speak, at every band of copper, and induce currents in the copper wheel which causes it to be repelled and continuously rotated. The wheel actuates the usual counting gear. Of course this meter will only register alternating currents.

The Fr bes meter is based upon the heating effect of the current, therefore the meter can be made without any appreciable self-induction, and can be used for both straight and alternating currents. It consists of two concentric copper rings bridged across by a number of fine wires. The current enters one ring and leaves by the other, passing through all of the wires in parallel, the resistance offered by the wire being about 1-100 of an ohm. A number of air fans are placed over the fine wires inclined at an angle of 45° to the horizontal. As soon as the wires become heated by the passing current the surrounding air is heated, so that a continual upward current of air is maintained during the whole time that the current is flowing—the strength of the air current varying of course with the extent to which the wires are heated. The steel pinion supporting the fans is geared into a train of wheels which records the number of revolutions in the usual manner. It will be readily apparent that since the force which causes the rotation is so feeble, the slightest friction would be inadmissable, and the whole of the moving parts must be extremely light and delicate. Beautiful as the principle is, it is feared that it would be difficult to develop it into a practical meter. Like a great many other meters which have appeared from time to time, in theory they work like a charm, but in practice they fail to come up to expectations.

ELECTRIC MOTORS.

AN ELEMENTARY EXPLANATION AT THE REQUEST OF SEVERAL OF OUR READERS.

It will probably be more easily understood if we assume to have a permanent magnet for the fields of our motor, which has the horseshoe form, and the armature for the present will be a straight-bar magnet whose polarity we can reverse at will. These are shown in Fig. 1. We know from experiments with a horseshoe magnet and a compass that the north pole of the needle will follow the south pole of the magnet, while the south pole of the needle will be repelled by the south pole of the magnet, and this is our starting point. Starting with our pivoted-bar magnet (which we will call the armature) in the position shown we can readily see that the north pole of the armature will be attracted by the south pole of the magnet, while the other poles are similarly attracted, and as the similar poles repel, all the forces act to turn the armature as shown by the arrow.

When the armature has turned so as to lie at right angles to this position, as shown by the dotted lines, we see that it will move no further with its polarity as it is in the position to be attracted most strongly, and there are no repelling forces at work. This gives the shortest path to the lines of magnetic force which are supposed to flow from the north pole of the magnets back to south pole and so continue, and as the shortest magnetic path is always the earliest travelled, this is in its strongest position, as fewer of the lines are scattered in the air. If, now, our armature is a permanent magnet, it will remain here and refuse to turn except with outside force, and for that reason we must have it so that we can make it changeable, and in practice electro-magnets are used in places where this is necessary.

Considering that we can change the polarity of the armature at will, we will now reverse it, and as the momentum has carried it slightly past the center, we find that the poles are now repellant and tend to make a half revolution until they have their poles arranged as before, north to south and south to north. From this we can readily see that if we reverse the polarity of the armature twice every revolution, just as it passes the center of the pole piece, we can get a continuous rotary motion, although it will be readily seen in this case the power will be far from uniform, as there are two points of maximum strength and two of minimum, the former when the armature is just midway between the poles as in the first position and the latter when as shown by dotted lines. By making an armature with numerous poles, as in a coarse-toothed gear, and having each tooth wound with wire from a battery to form poles, we might get a uniform pull as there would be part of them at maximum and part at minimum strength all the time. But we will now abandon this idea, and go into the electric motor as it really is. We have used the magnets as their action is familiar to all, but in every-day practice we employ a different theory and process.

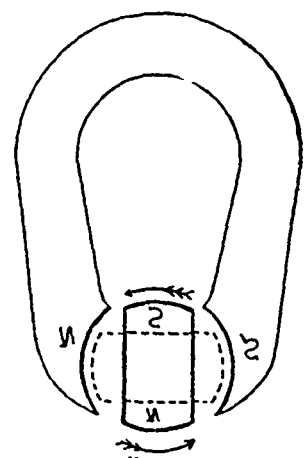


Fig. 1.

It is well known that by winding a soft iron bar with insulated wire and passing current through it we make a magnet much stronger than any steel or permanent magnet. This we call an electro magnet, and by simply reversing the direction of the current passing through it we reverse its polarity, so we have it under entire control.

We make our field magnets of soft iron or soft steel, and wind them as before stated in order to get a very strong magnet, and for the armature we use soft iron (formed of thin sheets or disks of iron separated by paper, called laminations), and have our winding outside of this. But instead of relying upon the magnetism of the core and the attractions of the field as generally supposed and as our first illustration would show, we merely use the iron core to help the lines of force across the space between the pole spaces and to concentrate them instead of having them scattered in space. It is found that a loop of wire having a current passing through it will tend to set itself at right angles to the lines of magnetic force when placed in their path as it is in the case of the armature between the pole pieces. It is upon this law, that the action of motors is based, as the polar armature is not nearly as efficient in action as the other.

The law is, that any loop of wire carrying a current will set itself so as to enclose the greatest number of magnetic lines, and this is at right angles to the lines of force. The direction which the loop will take in moving to enclose the greatest number of lines depends upon the direction of the current through it, and this gives us control of the motor by making it revolve in the direction we wish, according to the direction we send current through it.

The different loops on the armature are brought out to separate copper bars, insulated from each other, and altogether forming a cylinder or commutator, as it is called, on which the brushes conveying the current rest. As the segments pass under the brushes the coils connected with them receive current and tend to set themselves at right angles as before stated, and when they have reached this they pass from under the brushes and the next coil receives the current and proceeds in the same manner.

This, in simple language, is the operation of the electric motor of to-day, and it was deemed best to use the magnetic illustration at first as most people are familiar with that, but the other is not so far different from it except in making a more powerful motor than is possible by depending solely upon the magnetic attraction of metals.

In another paper we may go into more detail in this matter, and give more attention to the regulation of motors and to that bugbear of the student—counter-electro-motive force.—American Mechanic.

MONTREAL JUNIOR ELECTRIC CLUB.

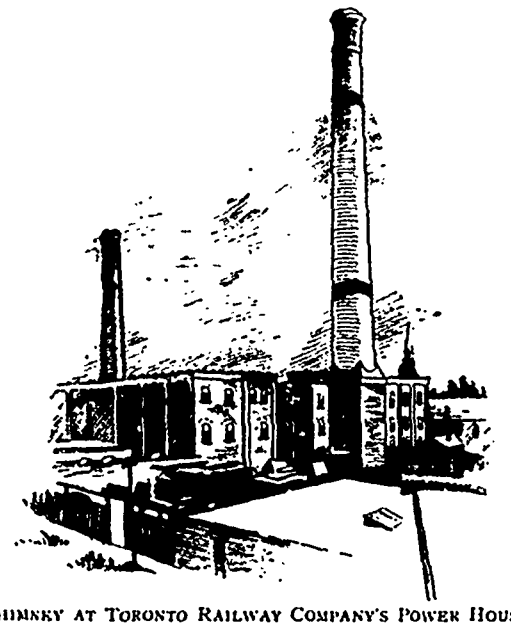
The Montreal Junior Electric Club, whose meetings have been discontinued during the summer months, will hold their first meeting on Sept. 3rd inst., at No. 6 Richmond Avenue, when arrangements are to be made for their work during the coming winter. The Club will hold a regular meeting every Monday evening at 8 p.m., until further notice. Any person wishing to become a member of this club may do so by sending in their application to Mr. E. W. Sayer, No. 6 Richmond Ave., Montreal.

EVERY PAST CONVENTION OF THE CANADIAN ELECTRICAL ASSOCIATION HAS BEEN A SUCCESS. THE COMING ONE IN MONTREAL PROMISES TO BE NO EXCEPTION TO THE RULE.

ELECTRIC RAILWAY DEPARTMENT.

NEW CHIMNEY AT TORONTO RAILWAY COMPANY'S POWER HOUSE.

We present to our readers herewith an illustration of what is claimed to be the tallest chimney in Canada, its height being 250 feet. It has recently been completed at the power house of the Toronto Railway Company, under superintendence of Mr. James Hill, and was commenced during the early part of last March. Excavations were made to a depth of 18 feet, at which point solid rock was struck. The concrete foundation, 40 feet square, is built on the rock, and was tapered up until it stood 24



CHIMNEY AT TORONTO RAILWAY COMPANY'S POWER HOUSE.

feet square at the surface of the ground, where the chimney proper was begun. For the first 50 feet the chimney is square, the top which is 18 feet 3 inches in diameter, being capped with cast iron. The inside diameter is 12 feet. A ladder made of U-shaped irons is provided as a means of ascending, the ends of the irons being anchored in brick. The smoke from 10,000 horse-power of boilers can easily be carried by this chimney. An excellent view of the City of Toronto is afforded from its pinnacle.

THE ALDERMAN'S DREAM.

THE alderman dreamed that he was dead and with great fear and trembling he stood before the pearly gates, and knocked ever so timidly.

"Come into the ante-room," said a voice.

The alderman obeyed with the same alacrity he had always shown when on earth he was called into the ante-room to participate in a star chamber session. Then he saw an immense pair of scales and the clerk of the court dressed in white, with a pen interrogation pointed behind his ear. He trembled, for he realized that his time had come for weighing in, and, as he carried no weights in his pockets, he might be found wanting.

"Where do you come from?" thundered a voice, now no longer mild.

"From London, Ontario," replied the quaking alderman, as he thanked his lucky star that it was not Hamilton, for in that case he would not have stood any show at all.

"What was your course on the electric railway question?"

The alderman's conscience smote him, yet he managed to reply, "I wanted cheap fares."

"Is that all?"

Was that all! The alderman was going to laugh outright, but he remembered where he was. "No," he replied. "I wanted a percentage."

The clerk's pen was working like lightning. "What else?"

"Mileage," answered the alderman, unabashed and beginning to feel at home.

The man with the pen was looking black and putting down marks equally sombre. "What else do you want, pray?" He was sarcastic now.

"The company to supply the paving material."

"Go on."

"And to supply all labor."

"Yes."

"And pave or repave whenever the city said so."

"Anything else."

"Well yes. I wanted the line to run past some promising real estate that I owned. Of course it meant crossing several railroad tracks, but then you knew it would have increased the value of my property."

"Nothing else, I suppose!" asked the white-robed scribe as he prepared to cast up accounts.

"Hold on," cried the alderman, as his bosom swelled with conscious pride, "we wanted the company to employ only home labor, and work their men only ten hours a day."

"Did you do that because of your love for the working men, or for votes?"

The alderman was candid. He knew it was a not time for levity. "Votes," he replied as he hung his head.

"Look here, alderman," spoke up the book-keeper, "you want neither heaven nor earth. First elevator to the left going down. Next!"

And the alderman woke to find the council in full session.—London, Ont., Advertiser.

RAIL WELDING.

EVERY street railway man, says the Street Railway Gazette, will feel an interest in the experiments now being tried in electrical rail welding. Aside from the supposed advantages which it will give as against electrolysis, it will have inherent advantages of no mean import. Could we have a continuous rail the item charged to depreciation on the books of the company would certainly be divided by half. The comfort of the passengers would be increased twofold, and the traffic would on this account be largely increased. Greater speeds would be possible with the same factor of safety and a lower factor of expense. The first company to realize all these benefits to their fullest extent will undoubtedly be the Nassau Street Railway Company of South Brooklyn, whose operations in the rail welding line were illustrated and described in a recent issue of the Gazette. It is contemplated to weld something over 30 miles of track—all in Kings County, and over the whole of which one may ride for a single fare. The Nassau Company evidently means business, as it is sparing no expense to make their roadbed the best that can be made. Among other extraordinary expenses that they are putting themselves to is the rail welding, which we understand costs them $3 per weld for the welding alone. Now, at $3 per weld the extra expense for this alone will amount to over $10,000 per mile. However, if the welded rail proves a success this will be money well invested, and will pay for itself over and over again in a few years in the lessened wear and tear of rolling stock and track.

SPARKS.

It is estimated that the Winnipeg Electric Street Railway carried 393,000 passengers during Exhibition week.

The employees of the Montreal Street Railway Company held their annual picnic at Sohmer Park on Thursday and Friday, the 29th and 30th of last month.

Mr. Wm. Hossack has been elected president of the Quebec Street Railway in place of the late Mr. St. Michel, and Mr. Gaspard Lemoine succeeds Mr. Hossack as vice-president.

The Montreal Street Railway Company have recently placed on their lines special smoking cars for the accommodation of smokers. They are said to be well patronized and appreciated.

It is reported that the Canadian Pacific Railway proposes to use electricity for moving its trains over the Rocky Mountain division of the line. The method is to be tried first at Kicking Horse Pass.

The City and Suburban Street Railway Co. has agreed to accept a bonus of $5,000 from the Town Council of Weston, Ont., for the extension of their line from Toronto Junction to that town. A by-law will be submitted to the ratepayers at an early date authorizing the Council to grant the bonus.

The City Council of Guelph, Ont., has granted a 30 years' franchise to Mr. George Sleeman for the construction of an electric railway along the streets of that city. The necessary legislation will be obtained as soon as possible, and work will be commenced early next spring. It is probable that the line may be extended to connect with the Galt and Preston electric railway.

The Belt Line Railway Company, of Montreal, are making preparations to proceed with their projected line. The route for the eastern section of the island is already surveyed, which will be the first to be constructed. The line will start at Hochelaga, follow the shores of the island to Sault au Recollet, and then make a cut across the island to the C. P. R. tracks at Hochelaga. The elevated railway through the city will be built the last of all.

It has been reported during the past month that the Grand Trunk belt line around the city of Toronto would shortly be converted into an electric road, and that arrangements were being made for the change. It is learned from Mr. Edmund Wragge, the local manager, that the company has been considering the question but no decision has as yet been arrived at, owing to the great difficulty in adopting the electric system on account of the numerous trains between the Union Station and the Don.

The Toronto Railway Company have lately put in operation three electric street sprinklers, consisting of tanks holding from 2,800 to 3,000 gallons of water, and which will sprinkle without refilling, about ten miles of track. Only one track is sprinkled at a time; thus the sprinkler does not require to be shut off when passing a car on the opposite track. The city supplies water to the sprinklers free of charge. The tanks are filled in about five minutes time, from large hydrants specially placed for the purpose at the ends of the street railway lines. The width of roadway sprinkled is about 16 and one half feet. Eighty miles of track per day are sprinkled; each route being sprinkled four times per day.

TRADE NOTES.

The London Machine Tool Company recently made a ten-ton fly-wheel for the new water works pumps at Springbank.

Messrs. Wm. Kennedy & Sons, of Owen Sound, have shipped $10,000 worth of machinery and castings for the lock-gates at Sault Ste. Marie.

We learn that it is the intention of a well-known American company to establish in Canada, shortly, a factory for the manufacture of accumulators.

The Canadian General Electric Co. have recently received from the Toronto Railway Co. a contract for 1,200 h. p. generator. The machine will weigh about 50 tons.

The Bertram Engine Works Company have recently erected in the power house of the Toronto Railway Company a large engine of 1,000 horse power, valued at $25,000.

The extensive manufactory of the Siemens-Halske Co., at Chicago, was burned during the past month. The company have secured other premises and will as soon as possible resume business on a larger scale than before.

Messrs. John Starr, Son & Co., of Halifax, Nova Scotia, have issued a new catalogue of convenient size giving illustrations and full particulars of their "Unique" telephones, accompanied by a number of testimonial letters from users of these instruments.

In the last number of the ELECTRICAL NEWS the statement was made that the town of Carleton Place had withdrawn its offer of a bonus of $20,000 to Messrs. T. W. Ness & Co., of Montreal. It has since been learned that Messrs. Ness & Co., in view of the financial difficulties which they have recently encountered, requested the town authorities not to submit the bonus by-law to a vote of the ratepayers at present.

An Ottawa paper describes as a "poem in car architecture" a new car just completed by the Ottawa Car Co. for the Toronto and Scarboro Electric Railway. It is of novel design, painted in enamel white with peacock feathers at the corners and gold stars for a border line on the panels. The monogram T. & S. R. is worked upon each vestibule. The interior is of elegant finish and the name of the car "Lalla Rookh" is significant of its beauty as a whole.

As will be seen by reference to our advertising columns, a new electric concern has been started at 146 York Street, Toronto, trading under the name of The Jones & Moore Electric Co. They purpose carrying a complete line of electric supplies and machinery, including dynamos, motors, transformers, etc. Particular attention will be paid to the repairing of all kinds of electric apparatus, and all work will be in charge of competent and experienced men. The company have secured the agency for McDonough's electric damper and pressure regulator for steam boilers, something entirely new in this line, and they have letters from recent purchasers stating that a saving of from 9 to 14 per cent. has been effected in their fuel bill, in addition to maintaining a steady and uniform pressure, so desirable to all steam users and especially electric plants. The members of this firm have had several years experience in the electric business, and we anticipate a prosperous future for the company under their management.

It is currently reported that Mr. Thomas S. Bell, civil and hydraulic engineer, has been engaged by local capitalists of Hamilton, Ont., to report on the possibility of utilizing the water power at Chedoke Falls for electric lighting purposes.

SPARKS.

The Valley Telephone Co. have decided to extend their line to Digby, N. S.

A new telephone line has been put in operation between Brockville and Athens, Ont.

The Crossen Car Mfg. Co., of Cobourg, Ont., are building new work shops, at a cost of about $20,000.

The ratepayers of Bracebridge, Ont., have carried a by-law authorizing the Council to purchase an electric light plant.

The Light Heat and Power Co., of Newmarket, Ont., are said to contemplate the purchase of an incandescent lighting plant.

The contract with the Hamilton Light and Power Company for lighting the streets by electricity has been renewed for another year.

The town council of Newmarket, Ont., is asking for tenders for electric street lighting for a term of five years. 21 arc or 100 incandescent lights are required.

The annual general meeting of shareholders of the Great North Western Telegraph Company will be held at the company's offices in Toronto on Wednesday, the 26th inst.

The Buckingham, Que., council, with one dissenting member, has decided to submit a by-law to the ratepayers to raise the necessary money to purchase an electric light plant.

The electric light plant at Port Arthur, Ont., owned by the Port Arthur, Water, Light and Power Co. was destroyed by fire a fortnight ago. Steps have been taken to install a new plant.

The Canadian General Electric Company have secured a contract to furnish the Toronto Railway Company with a 1,400 h. p. electric power generator. This will be a mammoth machine, and will weigh not less than 50 tons.

The electric railway between St. Stephen, N. B., and Calais, Me., is nearing completion. The wires have been strung and the greater part of the track is laid. When completed the promoters claim it will be one of the best equipped roads in Canada.

At Haute Rieve, on Saturday, August 25th, was held the 16th annual Rhode Island clam dinner tendered to the electrical fraternity by the American Electrical Works. As on former occasions there was a large attendance and much enjoyment.

At the annual meeting of the New Brunswick Electric Telegraph Company held at Rothesay, N. B., recently, the following directors were elected: C. W. Weldon, president; D. C. Dawson, secretary; T. J. Almon, J. J. Tucker and D. M. Sutherland.

The Vancouver and Westminster Tramway Company is being offered for sale by tender by the Montreal Safe Deposit Company. Their lines extend throughout the City of New Westminster, B. C., and between that city and the city of Vancouver. The date limit is the 24th of November.

The council of the village of Hintonburg, Ont., will shortly submit a proposition to the Ottawa Railway Company for the extension of their line to the village. As the right of way is yet to be secured and the question must also be voted on by the ratepayers, it is not probable, should an agreement be reached, that the work of construction will be commenced this year.

A company has been formed at Rat Portage, Ont., to develop the Assiniboine water power at that place for manufacturing and electrical purposes. The scheme is well advanced, and an offer to furnish the city of Winnipeg with 5,000 horse-power will be submitted to the council at an early meeting. The electric power will be transmitted to the city by a heavily insulated wire. The distance is about 150 miles.

Messrs. W. R. Brock, president; F. A. Nicholls, general manager; George A. Cox, R. Jaffray, H. P. Dwight and Hugh Ryan, of Toronto, composing the Board of Directors of the Canadian General Electric Company recently made a visit of inspection to the company's works at London. They were shown over the premises by the local manager, Mr. C. B. Hunt, and expressed themselves as well pleased with the appearance of the works.

The Canadian General Electric Company are reported to have issued a writ to recover payment for an arc and incandescent lighting plant sold a year or two ago to a syndicate of citizens of Port Dover. It is said to be the intention of the owners of the plant when the case reaches the courts, to set up as their defence that they were induced to purchase the plant on representations made to them by the sales agent that a certain water power situated about two miles from the village could be utilized to operate the plant at a trifling expense for power. Subsequently the purchasers employed experts to examine the water power and they have reported that it is insufficient for the purpose. The case will probably turn upon whether any guarantee was given in writing to the purchasers that the water power in question was available and adequate to operate the plant. In the absence of such a guarantee the objection to making payment is likely to be set aside.