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CONVENTION NUMBER

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SEPTEMBER, 1895

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CANADIAN

ELECTRICAL NEWS

AND

STEAM ENGINEERING JOURNAL.

VOL. V. SEPTEMBER, 1895 No. 9.

ELECTRICAL OTTAWA.

A Description of Some of the Electrical Features of the Capital City.

IF in selecting a place for their next annual convention the members of the Canadian Electrical Association had been in search of a city combining great natural beauty with unceasing electrical development, they could not have made a more felicitous choice than that of the City of Ottawa.

The site of the Canadian capital is one of the most favored spots in the whole Dominion. Built on a commanding elevation on the right bank of the noble river from which it takes its name, the city spreads away to the south, east and west in regular and well built streets; while in the distance to the north, the Laurentian mountains form a beautiful and imposing background.

The great water power afforded by the Chaudiere and the Rideau Falls has long since made Ottawa the chief lumbering-mill centre of the Dominion, and in addition to this distinction its people are now predicting that in the near future it will be a great manufacturing and railway centre as well. With its present industrial activity this article does not propose to deal further, than to mention and briefly describe those features of special interest to the electrical world.

It is just ten years since Ottawa took the lead of Canadian cities by introducing a complete system of electric street lighting. Two years later, in 1887, when incandescent lighting was a luxury enjoyed elsewhere almost solely by the owners of isolated plants, a local company was already supplying the stores and dwellings of the citizens of Ottawa with incandescent light. It was not until 1889, however, that the boom in incandescent lighting really took place. Up to this time the United States Electric Light Company's multiple series system had been used but its many drawbacks prevented its general adoption for house lighting. In 1889 the introduction of the Westinghouse system of distribution gave a great impetus to the lighting industry, and its subsequent growth may be gauged by the fact that the present installation is equivalent to 50,000 16 c. p. lamps, or one lamp for each man, woman and child in Ottawa.

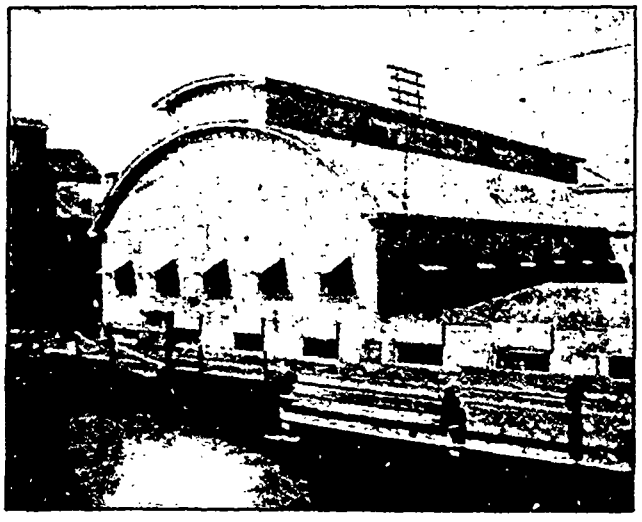
But the electrical feature which gives Ottawa special pre-eminence is undoubtedly its street railway system. In this field, as in that of electric lighting, Ottawa was also a pioneer. When the project was first mentioned grave doubts were expressed on all sides as to the possibility of operating an electric road in Ottawa during the severe winter season, but the promoters of the undertaking had the courage of their convictions, and the uninterrupted service which they have given their patrons shows that their confidence was not misplaced. The electric roads now in operation in all the principal cities and towns in Canada

VIEW OF CHAUDIERE FALLS, OTTAWA.

are to a great extent the result of Ottawa's foresight and enterprise.

The Ottawa electric railway has attracted so much attention that a short description of it will not be out of place. The power house is driven entirely by water and is situated close to the Chaudiere Falls. The plant comprises 1-700 h. p., and 2-400 h. p. multipolar, and 1-100 h. p. bipolar Westinghouse generator. The latter machine is driven by a separate water wheel and is used during the day time to excite the fields of the multipolar machines. At night it supplies current for running the mail cars, the workshop motor and for lighting and heating the power house and car sheds. The multipolar generators are driven by six 66 inch turbines which are all belted to the same counter-shaft and are provided with friction clutches so that any or all of the wheels may be run together or separately as the requirements demand. One of the greatest difficulties that had to be overcome at the power house was the regulation of the speed of the machinery. Several types of automatic regulators were

tried, but the variations of load were so great and occurred so frequently that the regulators were discarded after a very short trial and the present system of hand regulation adopted instead. A voltmeter operated by pressure wires from the centre of the city is placed on a small board at one end of the generator room and directly above the water wheels. The man in charge is seated in front of this voltmeter and convenient to a lever attached by an eccentric box to a friction pulley below. The gates are opened and closed and the speed thus controlled by



Street Railway Power House, Ottawa.

simply moving the lever backwards or forwards. The regulation of the speed by means of this arrangement alone was fairly satisfactory, but since the introduction last winter of a separately driven exciter, the variations in voltage, due to speed variations, have been as small, if not less than those of any closely regulated steam driven plant. The switchboard is situated at the opposite end of the generator room from the pressure indicator, and the entire equipment consists of Westinghouse apparatus, with the exception of a Weston total load ammeter, and a voltmeter of the same make. The generator panels are made up of a rheostat, triple-pole jaw switch, automatic circuit breaker and ammeter; and the feeder panels of a single pole jaw switch, automatic circuit breaker and the Wurts non-arcing lightning arrester. The well known "Tank lighting arrester" manufactured by the Westinghouse Co. has also been in use for a long time and no accident attributable to lightning has occurred since its introduction. Visitors to the power house are apt to think that the method employed of regulating speed by hand is a very crude arrangement. At first sight there seems to be some ground for this opinion, but when it is explained that the plant is never for a moment from under the eye of a watchful attendant and that it has run for more than four years without a single accident, the visitor will likely conclude that the managers are wise in continuing the present system.

The Street Railway Company's car sheds are situated on Albert street, between Lyon and Kent streets. The sheds are used both for the purposes of barns and repair shops. The offices of the company occupy the central portion of the sheds, fronting on Albert street, and are divided into the offices of General Manager, Secretary-Treasurer, Superintendent and Accountants' offices. In the rear of these offices come in the order mentioned the lavatories, conductors and motormen's rooms, winding room and machine shop. The remaining portion of the building is fitted up with pits, switches, transfer tables, etc., for the convenient handling and repair of cars.

The manufacturing establishment of the Ottawa Car Co., an outcome of the Street Railway Co., is quite close to the car sheds, and the excellence of their work is attested to by the fact that they have supplied numerous cars to nearly all the street railways in Canada.

In the winter the snow is removed from the street railway by the well-known Lewis and Fowler sweepers and the Walkaway snow plows. The sweepers clean the tracks and the plows following force the snow back to the sidewalk where men shovel it into large box sleighs; it is then hauled to the river and dumped on the ice. During the winter season street car trave is just as popular in Ottawa as in the summer. The cars are heated by the famous Ahearn heater and are always very comfortable. The same heater is also used to heat the power house, car sheds and offices of the company.

Of the many benefits conferred on the people of Ottawa by the street railway there is none that they appreciate more than the extension of the line to Rockliff Park, which is situated on the Ottawa river just below the city. The ride to Rockliff is a charming one, the scenery being varied by pine woods and rocky bluffs which overhang the river and from which the park derives its name. Every evening during the summer the company provides an open air band concert for their patrons and the park is visited daily by thousands of children for whom innocent amusements are provided.

The Ottawa Canoe Club, whose headquarters are on the river bank at Rockliff, have a novel arrangement for hoisting their canoes out of the river, an electric motor supplied with current from the street car circuit furnishes the motive power.

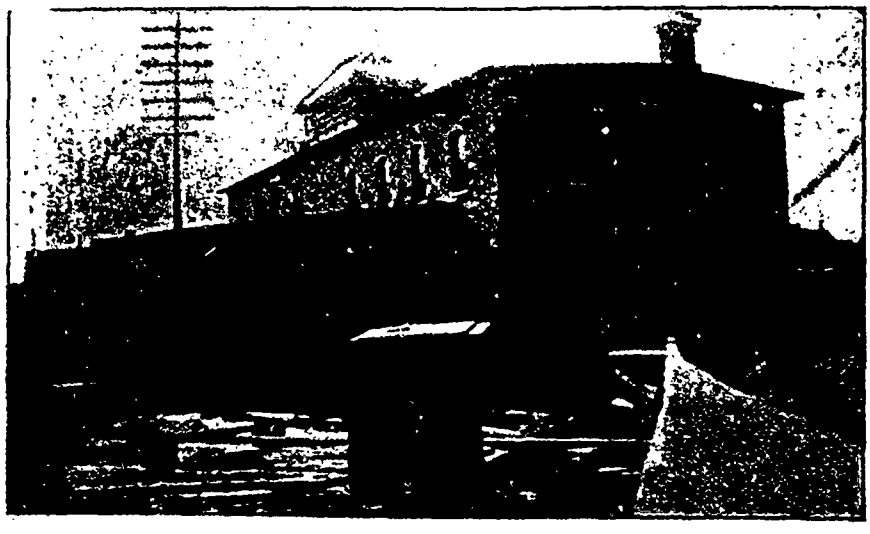
Next in importance and interest to the street railway, stands the electric lighting company. In 1885 street lighting was begun by the Ottawa Electric Light Co., and in 1887 the Chaudiere Electric Light & Power Co. commenced supplying incandescent lamps and motors. Four years later the Standard Electric Co. entered the same field as the C. E. L. & P. Co. Each of these companies carried on its business separately until a little more than a year ago when an amalgamated company was formed under the name of the Ottawa Electric Co. Before handing over the privileges enjoyed by each of the companies the City provided against any increase in the rates of supply and also for reduced rates when the earnings of the company exceeded a certain per cent on the capital stock. Some idea of the extensive nature of the lighting business in Ottawa may be had from a glance at the power houses now operated by the Ottawa Electric Co. The three companies had each their own water power stations, and one of them an auxiliary station driven by steam. The steam station is intended for use only in times of low water

Street Railway Car Sheds, Ottawa.

and during a portion of last winter when the river was unprecedentedly low it prevented the city from being plunged in almost total darkness. Two 600 h. p. compound condensing engines, fed by six boilers, comprise the driving plant at the steam power house, and the electrical plant consists of three alternators of 240 K. W. each and three 50 arc light machines. In building this power house the company provided for future extensions, and among other arrangements the chimney was made with ample draft capacity for double the present number of boilers; it stands on a cut stone base 24 ft. sq.; it is 120 feet high, is

hexagonal in shape, and 9 ft. in diameter at the bottom and 7 ft. at the top. Water for the boilers and condensing purposes is drawn direct from the river, and there is also a connection with the city mains to provide against emergencies. Hard coal and mill wood are used for fuel, the former almost exclusively when the engines are run for four hours or more at a time. Coal is received by rail and dumped direct from the cars into a shed situated alongside the railway track; while the wood supply is purchased at the neighboring saw mills.

The largest and most important of the water stations is known as power house No. 1. There are at present in this power house four 500 h. p. wheels in operation. The water wheels, crown wheels and pinions are in a building projecting from the power house proper, and much of the vibration usually felt in water driven stations is not transmitted to the dynamo room by reason of this isolation. Three-ply leather belts 50 inches wide and 120 feet long transmit the power from the main shafts to the countershafts in the power house proper. All pulleys on the countershaft are provided with friction clutches and the countershafts are so arranged that they may be driven from either one of two waterwheels. The dynamo capacity of this station is equal to 2000 k. w. in alternaters, and the continuous current machines for motor work to 250 h. p., to which is being added a multipolar machine of 250 h. p. capacity



Power House No. 1, Ottawa Electric Co.

Probably the most interesting feature of this power house will be the switchboard now in course of erection. It is built after the model of the well-known Westinghouse Company's Worlds Fair lighting plant board, modified to suit the requirements of the Ottawa Electric Co. It will consist of 35 panels, each 20" wide and 11 feet high, and will be divided into dynamo, feeder, and motor sections. The frame work is built of angle iron (1½" × 1½" × ¼") and stands on rubber cushions, to ensure steady working of the voltmeters and ammeters. The dynamos in all the other stations will be wired to this switchboard and distribution of the load among these other stations will be done by the switch board attendant. The circuits which formerly were regulated and operated from the power houses belonging to the different companies will all run direct to this board. Each circuit will be supplied with a Stilwell regulator so that its pressure may be varied considerably without changing the pressure of the dynamo at the other stations. A portion of this switchboard already in position presents a remarkably handsome appearance.

Although the arc lighting business has not increased with the same rapidity as the incandescent, still it has kept up a steady pace, and has now reached very large proportions. Ottawa is perhaps the most thoroughly lighted city in America. Some of the principal streets are not as brilliantly illuminated as the corresponding ones in other cities, but the general lighting of all the streets is more thorough and complete. The growth of the city and the consequent extension of its limits has much more than offset any damage which may have been done to arc lighting by the introduction of the incandescent.

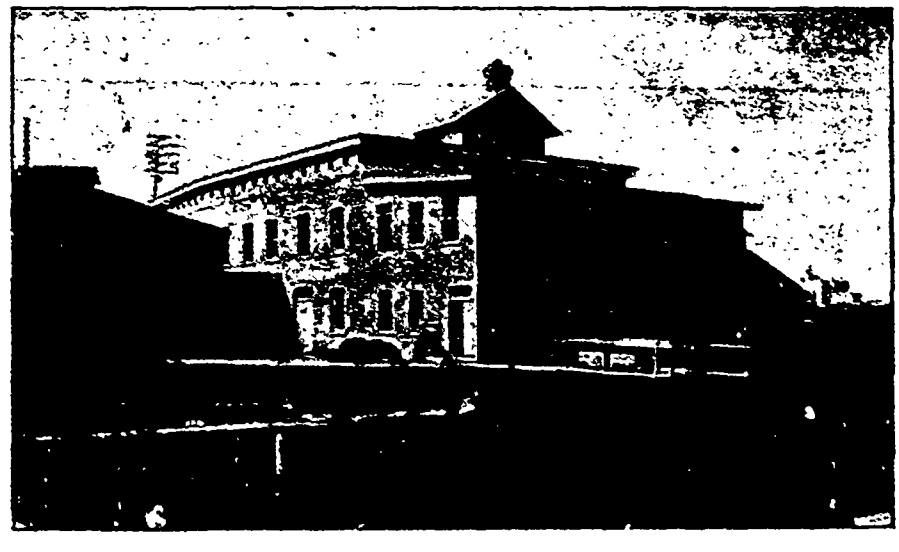
The Ottawa Electric Co.'s motor business is represented by a constant day load of about 300 h. p., distributed among mills, machine shops, printing offices, hotels, and stores. The most important motor installation is at Messrs. Martin & Warnock's Dominion Roller Mills about a mile and a half from the power house. The mill was formerly driven by a 100 h. p. steam engine, which has been replaced by a motor of similar capacity, and runs day and night all the year round except an occasional stop for repairs. For the better regulation of the voltage on the motor circuits, a separately driven exciter is at present being set up at power house No. 1 in a similar way to the installation at the railway power house.

The arc light station of the Ottawa Electric Co. is known as power house No. 2. The present building was erected about three years ago, and the premises adjoining, which were formerly the arc station, are now used by the company as a workshop. The arc station also is driven by water power, the arrangement of the machinery being similar to that at No. 1 power house, except that rope drives are used instead of belts between the main shafts and countershafts.

Power houses Nos. 4 and 5 are situated close to the arc station and supply current for incandescent light and motor work.

The total equipment of the Ottawa Electric Co. in dynamo capacity, including apparatus in course of installation, is as follows:

Arc lights, 2,000 c. p.	550
Incandescents, 16 c. p.	35,000
Motors	600 h. p.



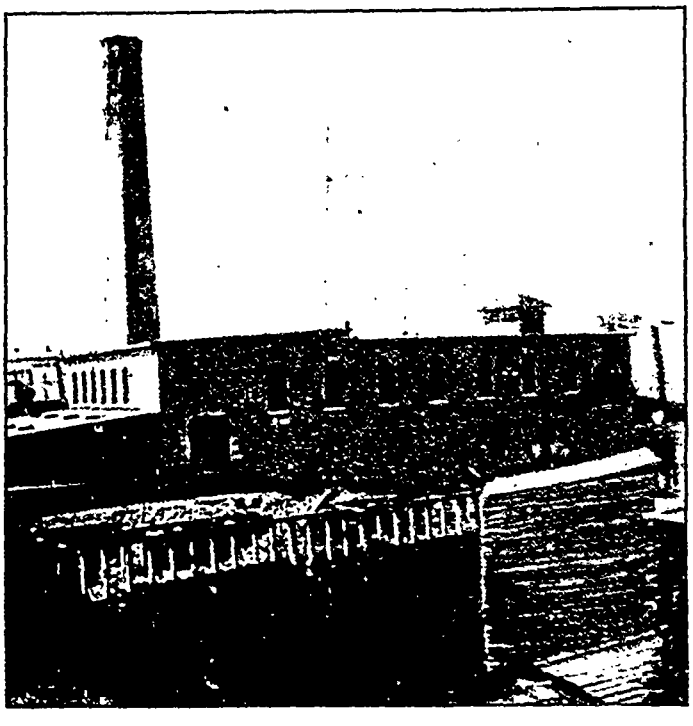
Power House No. 2, Ottawa Electric Co.

Chief among the many isolated plants worthy of mention in Ottawa and vicinity are those of Mr. J. R. Booth and the E. B. Eddy Co. Mr. Booth has a lighting station built on the very edge of the Chaudiere Falls, and his plant of arc and incandescent dynamos which are used in lighting his mammoth lum-

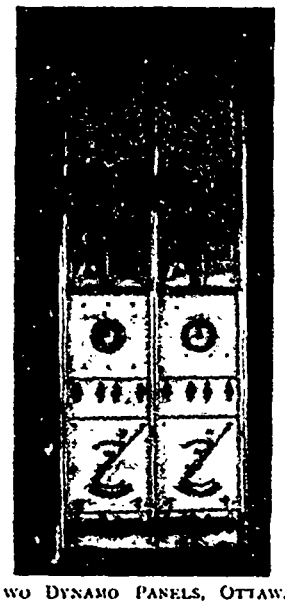
ber mills would meet the requirement of many a good-sized town. The Eddy Co. have also a large outfit, and among other interesting things in connection with the plant may be mentioned an electric welder for joining iron hoops for their patent butter tubs.

The Bell Telephone Company's business has grown with the city, and they have recently moved into their new four-storey building on Queen Street. The basement and lower floors are used for storage and office purposes, while the operating room is situated in the top storey. All wires enter the building through underground conduits which extend through the central portion of the city. Aerial cables connect with the underground cables at various places and carry the wires to still further distributing points on the poles. Metallic circuits are used altogether, the Telephone Company having presented "the earth" to the Street Railway.

The Ottawa Porcelain & Carbon Company, which is just commencing business, is another institution that owes its existence to the success that has attended the many electrical industries in this city. The company's works are situated close to the Canada Atlantic Railway depot, and with their tall kilns and chimneys present an appearance that is sure to attract the attention of the arriving tourist.



STEAM POWER HOUSE, OTTAWA ELECTRIC CO.



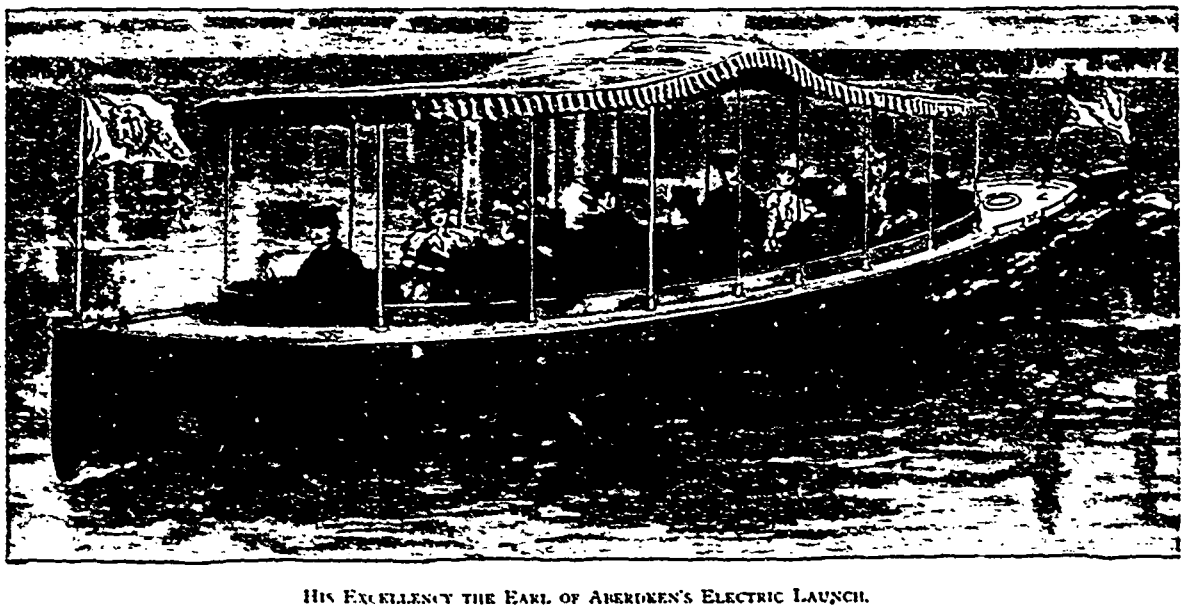
TWO DYNAMO PANELS, OTTAWA ELECTRIC CO.'S NEW SWITCH-BOARD.

LEGAL.

GREEN V. THE TORONTO RAILWAY COMPANY.—A car of the defendents' electric street railway was moving very quickly along a down grade on a street in a city where the plaintiff, who was in the employment of the city corporation, was engaged in his duty of sweeping the roadbed. The motorman did not sound the gong on the car, as was customary, and ran into the defendant, injuring him. Held by the Court of Chancery, that although the defendant had the right of way, the omission to sound the gong or give any warning of the approach of the car was actionable negligence.

The Brantford Electric & Power Company have applied for an injunction to restrain Messrs. Wood Bros. from using the canal water for their mill on the Power Company's water way.

Mr. Thomas Willson, the discoverer of the method of manufacturing acetylene gas, was in Ottawa recently, for the purpose of securing a Canadian patent on his invention. Mr. Willson states that he does not expect the new gas to come largely into use until electricity for the production of the calcium carbide can be cheapened. He further states that when the product is ready for popular use, it will be sold like coal; each house will have an apparatus in which by dropping pieces of carbide into water, gas will be made, which will be conveyed through the house in pipes, and be available for use in the same manner as ordinary gas is now.



HIS EXCELLENCY THE EARL OF ABERDEEN'S ELECTRIC LAUNCH.

CORRESPONDENCE

A QUESTION OF PRIORITY OF INVENTION.

CHICAGO, ILL., August 26th, 1895.

Editor CANADIAN ELECTRICAL NEWS.

DEAR SIR:—I read with great interest an article in your issue of August, 1895, page 125, concerning a new method of Mr. Thos. Ahearn, of Ottawa, for preventing variation of E. M. F. occasioned by sudden withdrawal or addition of load in connection with dynamos driven by water power.

The method is very good, but as I pointed out in other journals, Mr. Ahearn does not deserve the credit of being the first designer or inventor of this method.

In my paper: "Practical Notes on the Electrolytic Refining of Copper," read before the American Institute of Electrical Engineers, June 6th, 1892, I say: "A few words as to electric generators may not be out place. The author prefers separately excited machines for the reason that they cannot be reversed and other incidental advantages. When water is used as prime mover a good deal of trouble has been experienced in the regulation of the wheels. As a matter of fact, there is no water governor in existence which will regulate so perfectly as the governor of a modern automatic engine under varying loads. By running all the exciters from an independent prime mover (either water or steam) the strength of the fields of the generators will be uniform at all times whether there are fluctuations in the external circuit or not; the strength of the field of the generators which, with self-exciting machines, is subject to the fluctuations in the external circuit, and is a variable, becomes a constant. The author proposed this arrangement over three years ago for railway and power stations with the very best results."

It will readily be seen that what you please to term "The Ahearn Method" was suggested and tried by me as early as 1889. At the time I first suggested this method, I discussed with my patent attorney the question, whether it was a patentable invention or not, and he stated most positively that it was not. I simply mention this as a matter of record.

You will greatly oblige me by publishing this communication in the next issue of your paper.

Yours respectfully,

J. B. BADT.

GOUVERNEUR, N. Y., AUG. 20th, 1895.

Editor CANADIAN ELECTRICAL NEWS.

SIR:—I beg to call your attention to a note on page 125 of your August issue, in which Mr. Thos. Ahearn, of Ottawa, claims he has devised a method for preventing variation of E. M. F. occasioned by sudden withdrawal or addition of load in connection with self excited water driven dynamos, etc I installed an Edison three wire system some two years ago, consisting of six dynamos of different sizes driven by water, and connected just as you describe in your article, so that one dynamo (or any one) could excite the fields of all, or each be self-exciting, or the fields of the dynamos on one or other side could be excited by one of themselves.

My switchboard was so connected up that it was almost an impossibility for any one to make a mistake, no matter what switches they operated, as the dynamos, resistance boxes, ampere meters, volt meters and switches were all numbered in the most prominent places. A man standing in the centre of the board could see and operate every switch, field and main, and see every volt meter and ampere meter for the six dynamos.

I trust sir you will see that credit is given where credit is due in this matter.

Yours truly,

J. AUG. FARLINGER.

The following note has been received from Mr Ahearn, whose attention was directed to the above communications.

"I am not aware that I have made any claims in the matter of dynamo regulation, but at the same time what has been accomplished here is the result of independent work and experience, and so far as I am concerned I have had no knowledge of Prof. Badt's suggestion in the same direction. I have no desire to enter into a controversy over this matter. My only object in stating what has been accomplished here in the matter of regulating dynamos driven by water power, was to give the benefit of our experience to other water driven stations. I am not aware that any other station is using anything of this kind, and, as stated before, what has been done here has not been borrowed from Prof. Badt or any other person."

QUALIFICATIONS OF AN ELECTRICAL ENGINEER.

TORONTO, Aug. 26th, 1895.

Editor ELECTRICAL NEWS.

SIR,—In your August issue you published some of Mr. McLean's opinions on the subject of the qualifications of an electrical engineer. Mr. McLean will perhaps allow me to heartily endorse those opinions. It is precisely, because, as he says, "a young man who can handle a coil of wire and perform a few mechanical acts with an electrical plant, thinks himself a master of electrical engineering," that such a quantity of bad work is done in Canada. Any person with a little capital, who has run line wires, or served for a few months in a machine shop, goes manufacturing electrical machinery, and starts into business as an electrical engineer, or "expert," as some of these persons call themselves. The consequence is just what one might expect -dynamos that certainly furnish currents; and that shake themselves to pieces before long; armatures that burn out; instruments that are curiosities, and general wiring that is a derision. I know one "manufacturer," who, I believe is an electrical, mechanical, mining, hydraulic, and every other kind of engineer, besides architect and general scientist, who makes quite a decent living out of the repairs necessary on machinery of his own make. This speaks highly for his goods, equally highly for the public taste. Another "electrician," when it came to the fine point, couldn't calculate his wires, and these are the men who are responsible for the electricity of Canada. Lord Kelvin has said that and electrical engineer is nine-tenths a mechanical engineer; he did not say that a working mechanic possessing not even a good education is, by virtue of his trade, an electrician.

Mr. McLean is again right in saying that "much of the criticism levelled against mechanical engineers, who undertake to call themselves electrical experts, is due to the fact that these men are no more mechanical than they are electrical engineers." The public will, perhaps, some day discover to their cost, that the man who shovels coal and wipes up the engine is not a mechanical engineer, and the "expert," who juggles with the rheostat, and runs wires by guess work, is not a fully educated electrical engineer. When it is properly understood that in the States and in Europe, some years of scientific education and practical experience are necessary before a man may call himself an electrical engineer, or can be considered competent to take charge of electrical enterprises, then perhaps we shall find the "electrician" of to-day, relegated to his proper status as a kind of superior day laborer, who will not be permitted to express an opinion on electrical matters, or to sink the whole science of electricity to the level of a trade.

Electrical knowledge should be disseminated broadcast electrical men should co-operate and combine for the purpose of exchanging experience, linemen, dynamo tenders, lamp trimmers, should be encouraged to read, and everything done to specialize our profession, and to raise the general tone of men following it. There should be examinations for wiremen, tenders, superintendents and the like, and certificates given, and a sure means to all the above ends is to diligently peruse electrical papers, and to strengthen the Canadian Electrical Association by lending it vigorous help. The more specialized the electrical profession, the fewer quacks as described by Mr. McLean, we shall have in it to disgrace it.

Yours,

GEORGE WHITE-FRASER, E. E.

It is reported that the hackmen on the Canadian side of the Niagara river have determined to take legal action against the Niagara Falls Park and River Railway Co., with the object of compelling the company to cease operating their road on Sunday. The true inwardness of this action on the part of the hackmen is apparent on the surface. The electric road has been the means of lessening, to a large extent, the profitable business which Niagara hackmen formerly did. It is to be presumed that the present action has been taken by the men who have only entered the hack business in recent years, as those who were formerly engaged in it, at this point, might reasonably be supposed to have accumulated such vast fortunes as would make them indifferent whether any further business came their way or not.

MR. L. A. CARR,
Manager London Street Railway

MR. JAMES GUNN,
Superintendent Toronto Street Railway.

MR. ROSS MACKENZIE,
Manager Niagara Falls Park & River Railway.

MR. G. C. CUNNINGHAM,
Manager Montreal Street Railway

MR. A. J. NELLES,
Manager Hamilton, Grimsby and Beamsville Electric Railway

A GROUP OF CANADIAN ELECTRIC RAILWAY MANAGERS

THE CANADIAN ELECTRICAL ASSOCIATION CONVENTION.

As the present number of the ELECTRICAL NEWS goes to press, the finishing touches are being put to the arrangements for the annual convention of the Canadian Electrical Association, which will open at Ottawa on the 17th inst. The officers of the Association feel confident that this convention will prove to be the most pleasant and profitable, and in every particular the most successful of any which the Association has yet undertaken. The papers, as in former years, are instructive in character, and cover a variety of topics, some of which have not been touched upon at any of the previous conventions.

The illustrated article appearing on front page of this paper will, it is hoped, prove an object le son to those members of the Association who may not be familiar with the many interesting electrical features of the Capital City. Certainly there is no more interesting place in Canada, from an electrical point of view.

It may be permissible to emphasize what was said in the ELECTRICAL NEWS for August concerning the completeness of the arrangements which have been made by the local committee for the entertainment of visitors to this convention. Nothing has been left undone which would enhance the enjoyment of the occasion, and it only remains for the members and their lady friends to be on hand to participate in the pleasure and profit of the gathering.

The Canadian Pacific Railway is offering a return fare of $7.00 to the Montreal Exposition, on the 16th and 18th inst., good for return until the 23rd inst., and it is understood that members of the Association resident in the vicinity of Toronto, who may wish to attend the Ottawa convention, can purchase a return ticket for Montreal at the price mentioned, and have it marked "via Ottawa." This will lower the fare by more than $3.00 as compared with the rate previously arranged for by the Association, and should render it unnecessary for any member to deny himself the pleasure of attending the convention on the ground of expense.

Following is the program of the convention:—

HEADQUARTERS—RUSSELL HOUSE.

BUSINESS PROGRAM.

SEPTEMBER 17TH.

11:00 A. M. Formal opening of the Convention in the Railway Committee Room of the House of Parliament, when His Worship the Mayor will read an address of welcome.

At the conclusion of the address, members and ladies will be shown through the Senate, the House of Commons and Parliamentary Library.

2:30 P. M. Opening of First Session at Board of Trade Rooms, Elgin Street.
President's Address.
Reading Minutes of last Meeting.
Secretary-Treasurer's Report.
Reception of Reports of Committees on: Constitution, Statistics, Legislation.
General Business.
Presentation of Papers.
Discussion.

SEPTEMBER 18TH.

10:00 A. M. Consideration of Reports of Committees.
Election of Standing Committees for the ensuing year.
Selection of Place of next Meeting.
Election of Officers and Executive Committee.
General Business.
Presentation of Papers.
Discussion.

SEPTEMBER 19TH.

10:00 A. M. Presentation of Papers.
General Business.

LIST OF PAPERS.

"Some Notes on the Consolidation of Two Systems of Electric Supply,"
A. A. Dion, Ottawa.

"The Telegraph in Canada,"
Chas. P. Dwight, Toronto.

"Suggested Forms for Electric Light Accounting,"
D. R. Street, Ottawa.

"From the Coal Pile to the Meter,"
Jas. Milne, Toronto.

"Some Modern Alternating Current Apparatus,"
H. T. Hartman, Peterborough.

"Non-Interference Diplex Relay,"
"A Percentage Method for Circuit Measurements,"
D. H. Keeley, Ottawa.

"_____,"
J. J. Wright, Toronto.

SOCIAL FEATURES.

SEPTEMBER 17TH.

8.00 P. M. Members and ladies will be conveyed by special electric cars to view the Chaudiere Falls, the Lumber Mills, and Electric Power Houses. This is a sight which for novelty and interest can scarcely be duplicated outside of Ottawa.

SEPTEMBER 18TH.

8:00 P. M. Banquet to Members and Ladies at the Russell House.

SEPTEMBER 19TH.

Immediately after the adjournment, electric cars will be provided to carry members and ladies over the Street Railway Company's lines out to Rockliffe Park and return.

It is anticipated that arrangements will be consummated for members and ladies to run the water slides on a raft of square timber.

His Excellency Lord Aberdeen has placed his electric launch at the disposal of members and ladies.

RAILWAY AND HOTEL ARRANGEMENTS.

Arrangements have been made with all railways for a reduced rate of one and one-third fare for members and ladies accompanying them. To obtain this concession, members must purchase a first-class ticket, obtaining from ticket agent a Standard Certificate, which will entitle them to purchase at Ottawa a return ticket at one-third the usual fare. This concession is not obtainable prior to 14th Sept.

Special hotel rates have been arranged for as follows: Russell House, $2.00 per day; Grand Union, $2.00; Windsor, $1.50.

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.

TORONTO ASSOCIATION NO. 1.

AT a regular meeting of Toronto No. 1 C.A.S.E., held Aug. 9th, the following resolutions of condolence were passed:

"Whereas, it has pleased Almighty God to remove from our midst the beloved daughter of our esteemed Brother, Edward Dunn, be it therefore resolved, that we do extend to Bro. Dunn and his family our heartfelt sympathy in this their hour of bereavement, and commend them to our all Wise and Supreme Ruler, who doeth all things well, and be it furthermore resolved, that a copy of the above be placed on our minute book and the mechanical press be furnished with the same.

W. G. BLACKGROVE,
G. FOWLER,
T. EVERSFIELD, } Committee.

DELEGATES TO THE OTTAWA CONVENTION.

The following delegates and alternatives have been appointed to the annual convention at Ottawa, by their respective Associations:—

London No. 5—Bro. F. G. Mitchell; Bro. R. Simmie, alternate.

Toronto No. 1—Bros. Fox, Huggett and Wickens; Bros. Lewis, Bain and Eversfield, alternates.

Kincardine No. 12—Bro. Jos. H. Walker.

Hamilton No. 2—Bros. R. Mackie, C. Pettigrew and Wm. Norris.

Peterborough No. 14—Bro. A. C. McCallum.

Kingston No. 10—Bros. Sandford Donnelly, Pres., and Harvey Hoppins, vice-president: Frederick Simmons, alternate.

Brockville No. 15—Bro. W. F. Chapman; F. B. Andrews, alternate.

Wiarton No. 13—Bro. John F. Cody.

Montreal No. 1—Bros. T. Ryan, J. G. Robertson, Elph. Valiquett.

The secretaries of other associations from whom the names of delegates were requested have failed to respond, for which reason we are unable to publish the complete list.

CANADIAN ELECTRICAL NEWS AND STEAM ENGINEERING JOURNAL

PUBLISHED ON THE FIFTH OF EVERY MONTH BY

CHAS. H. MORTIMER,

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ADVERTISEMENTS.

Advertising rates sent promptly on application. Orders for advertising should reach the office of publication not later than the 25th day of the month immediately preceding date of issue. Changes in advertisements will be made whenever desired, without cost to the advertiser, but to insure proper compliance with the instructions of the advertiser, requests for change should reach the office as early as the 22nd day of the month.

SUBSCRIPTIONS.

The ELECTRICAL NEWS will be mailed to subscribers in the Dominion, or the United States, post free, for $1.00 per annum, 50 cents for six months. The price of subscription should be remitted by currency, in registered letter, or by postal order payable to C. H. Mortimer. Please do not send cheques on local banks unless 25 cents is added for cost of discount. Money sent in unregistered letters will be at senders' risk. Subscriptions from foreign countries embraced in the General Postal Union, $1 50 per annum Subscriptions are payable in advance. The paper will be discontinued at expiration of term paid for if so stipulated by the subscriber, but where no such understanding exists, will be continued until instructions to discontinue are received and all arrearages paid.

Subscribers may have the mailing address changed as often as desired. *When ordering change, always give the old as well as the new address.*

The Publisher should be notified of the failure of subscribers to receive their papers promptly and regularly.

EDITOR'S ANNOUNCEMENTS.

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

THE "CANADIAN ELECTRICAL NEWS" HAS BEEN APPOINTED THE OFFICIAL PAPER OF THE CANADIAN ELECTRICAL ASSOCIATION.

CANADIAN ELECTRICAL ASSOCIATION.

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TORONTO BRANCH NO. 1.—Meets 2nd and 4th Friday each month in Room D, Shaftesbury Hall. W Lewis, President; S. Thompson, Vice-President; T. Eversfield, Recording Secretary, University Crescent.

MONTREAL BRANCH NO. 1.—Meets 1st and 3rd Thursday each month, in Engineers' Hall, Craig street. President, John J. York, Board of Trade Building, first vice-president, J. Murphy; second vice-president, W. Ware; secretary, R. A. York; treasurer, Thos. Ryan.

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

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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. President, S. Donnelly; Vice-President, Henry Hopkins; Secretary, J. W. Tandvin.

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ONTARIO ASSOCIATION OF STATIONARY ENGINEERS.

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

WITH the aid of subscriptions received from outside sources, the members of the Montreal Association No. 1. C. A. S. E. have the nucleus of an engineering library. This is directly in line with the avowed object of the Association, which is declared to be first and foremost an organization for the purpose of improving by means of education the standard efficiency of engineers. If the Canadian Association of Stationary Engineers has come to stay, as no doubt it has, the officers of the various branch associations throughout the country could not do better than follow the example of their Montreal brethren in this particular.

THE question of the right of electric companies to operate their road on Sunday is likely to come to a test, and be decided at no distant date. In view of the present condition of the law on the subject, it is desirable that such a decision should be reached at as early a date as possible. It is certainly an anomalous state of affairs that street cars should be allowed to run on Sunday in Hamilton, while in Toronto, forty miles distant, they are prohibited from doing so. The matter is one which should be placed on a more consistent basis. The law should declare either that it is legal and proper that street railway lines should be operated on Sunday, or that it is illegal and improper that they should be so operated; this decision should apply everywhere throughout the Dominion. In answer to a deputation representing the Kingston Electric Railway Co., Mr. Harty, a member of the Ontario Government, made the sensible suggestion that the various street railway companies should get together and formulate and present to the government their views on the question of the operation of electric roads on Sunday, when the government would be in a position to consider the question intelligently and take some action in reference thereto.

THE recent mishap to the conduit pipe of the Toronto Water Works should tend to popularize the electric elevator, resulting as it did in stopping the operation of every hydraulic elevator in the city.

NOTWITHSTANDING the rapid increase in the use of the bicycle the receipts of the Toronto Street Railway Co. continue to grow. The total receipts for the month of August were $90,285.78, of which the city's percentage amounts to $7,222.86, as against $7,013.30 for the corresponding month of last year. This franchise is proving a very valuable one for both the company and the city.

AT the time of this issue the Toronto Industrial Exhibition is in progress, and the same success which has marked it ever since its inception still attends it. The remark so frequently made that it is the same old thing from year to year is not correct, neither is it reasonable to suppose that it can be very different. Still there is marked progress, and every year shows some advance in every department of industry which the exhibition covers. This year, as usual, a large number of our electrical firms make creditable exhibits, showing that the rapidly growing demand for appliances in this branch of science and industry can be fully met in our own country.

The Calumet Electric Railway Co., which was, we believe, the first to give trolley parties, now so popular, has introduced another new idea in the form of trolley funeral trains. A procession of this kind conveyed a funeral recently from West Pullman to Oakwoods cemetery. The forward part of the first car was appropriately draped, and formed the hearse, and the remainder of the train was occupied by the relatives and friends of the deceased. Mr. Farson, the general manager of the road, anticipates some difficulty in overcoming a not perhaps unnatural prejudice against such an innovation, but as our cities grow, and longer distances have to be traversed to the cemeteries, such a system must commend itself from the standpoint of both economy and convenience. Why, for instance, should not a funeral from Parkdale to the Necropolis proceed by trolley instead of with hearse and cabs? It would be a saving of both time and money.

AN Act came into force in New York State on the 1st of September which will tend to protect those who use the telephone for business purposes as fully as their interests are now guarded by the law relating to the telegraph. The Act makes it punishable by a fine not exceeding $1,000, or imprisonment for not more than six months, for any person to wrongfully obtain or attempt to obtain any knowledge of a telegraphic or telephonic message by connivance with a clerk, operator, messenger or other employee of a telegraph or telephone company. The same punishment may be meted out to the operator or other employee of the telegraph or telephone company who wilfully divulges to any one but the person for whom it was intended the contents or nature of any message or despatch intrusted to him for transmission or delivery. The same penalties attach to refusal or neglect of any employee to duly transmit or deliver such message, or the aiding or abetting of any unlawful business or traffic. Someone suggests that this law will settle the question whether a woman can keep a secret.

VOLT-METERS, or pressure indicators, are very important instruments in the operation of lights, and as they are liable to get out of adjustment from various causes, it would be well to have them frequently compared with a standard. A very slight cause may result in throwing a volt-meter out of adjustment. The writer knows of an instance where a small spider, having got into the case in some mysterious manner, left a thread across the space within which the needle swings, which made a difference of about 1 volt in the reading. A little dust will get in and clog the pivot; and more especially, the cheap instruments which are supplied with small plants, although quite good enough to run by, have not been, as a rule, carefully made, or calibrated, and so are quite seriously faulty sometimes. It is the same thing as with a watch. A Waterbury $2.50 will probably keep excellent time for several months, and then simply wear out, because the material, although worth the $2.50, was cheap. Keep your plant up to the mark; spend a little money on it, and the popularity of the light will repay the cost. Save a $5 bill in small ways, by neglecting to keep it up, and your customers will become dissatisfied and put your lights away.

A SUCCESSFUL test was made a few days ago of a new engine, built at the Grand Trunk shops in Montreal, embodying improvements which give greatly increased power with economy of fuel. There are two cylinders, one of 19 inches and the other of 29 inches, so arranged that the steam is used in the larger one after it has done duty in the smaller. The steam is thus used twice, and in such a way that very little of its force is lost. In the test the new engine drew forty-six loaded cars from Montreal to Brockville, a distance of 125 miles, with a consumption of 4½ tons of coal, an average of 1.66 pounds of coal per car per mile, on an up grade, which is considered by the railway officials a remarkable achievement. An ordinary engine hauling half the number of cars the same distance usually consumes at least five tons of coal. The engine, on the return trip, took fifty-six cars. On its second trip the engine drew 41 and 50 cars respectively. A number of prominent officials accompanied the engine on the trial trip. This compound principle, as applied to locomotives, is covered by patents secured through Sidney Stevens, of Brockville, travelling representative of the Rhode Island Locomotive Works, of Providence, R. I. It seems to promise a revolution in the construction of railway engines.

IT is of great importance to electric lighting stations that the pressure all over the system should be sensibly the same, and equal at all loads. It is, of course, practically impossible to so arrange the system of primary wires and transformers if alternating currents be used, and the mains and feeders if direct currents be used, as that there shall be exactly the same electrical pressure on the lamps, at every distributing point; but a careful laying out of such a system can always result in obtaining a very small, and comparatively negligible difference. The wiring of a town or building is really a very potent factor in the future operation of the lights, and is deserving of quite as careful calculation as any other feature; in fact, possibly more money is wasted, and more serious faults made, in the figuring of the mains, feeders, etc., than in almost any other way. This seems a rather bold statement, but a little consideration will shew its force. Consider a very simple case. Lamps placed around the circumference of a circle, with the generator at the center, and a main primary leading from the generator to two poinrs on the circle, at opposite ends of a diameter. The lamps are 110 volts, and the generator gives 125 volts, which allows a drop of 15 volts between generator and lamps. In this case, as the generator is equi-distant from the center of distribution, the mains in every direction may be the same size, to give the same resultant pressure at the lamps; but taking another case, which more closely represents conditions practically obtaining, shews the necessity for careful calculation. Take a square with the corners A, B, C, D; the generator situated at A, and the lamps in bunches at B, C and D. Assume the same number of lamps in each bunch. Then the distance from A to C is almost half as long again as A to B, or A to D. Everybody knows that the size of wire to carry a certain current, with a certain initial pressure, has to be greater as the distance increases, and less as the distance diminishes; so that the wire between A and C should be larger than the wire between A and B, or A and D. Now, we have above 15 volts that we can drop between the generator and the lamps. Suppose we find that number 0 wire will carry all the current required, and drop 15 volts over the distance A B; then it is evident that it will drop more than 15 volts between A and C, so that if we use 0 wire between A and C, our lamps at C will not get 110 volts, so that they will not be burning at proper candle power, and customers will kick. On the other hand if number 0 wire suffices to drop 15 volts between A and C, then it will not drop so much between A B or A D, and if we use No. 0 here, the lamps will have more than 110 volts—will burn quite brilliantly, but will burn out before their time, resulting in another kick. It is quite usual to run a pair of mains direct from the generator, along all the streets perhaps to a distance of three-fourths of a mile from the power house, and to tap transformers on to this wherever lights are required,

without any reference whatever to centers of distribution, or the many different pressures resulting at the lamps. Let us consider what this means. Take a line A, F, and divide it into equal parts at the points B, C, D, E; let each of these parts be 200 feet long. The generator, giving 125 volts is at A, and at each of the points B, C, D, E, F is situated a bunch of lamps, requiring say 10 amperes altogether, at 110 volts. So that the generator has to supply altogether 50 amperes. The usual mode of running this wire is as above described, to carry one size all the way from A to F, tapping off at intervals; and if any calculations at all are made, which is doubtful, they are made thus—What size of wire will carry 50 amperes over a distance of 1,000 feet (A to F) dropping 15 volts? The proper size on this basis is 35,000 circ. mils., or nearly No. 5 B & S gauge. Now, if this wire be run the results will be as follows—remembering that the wire has to carry 50 amperes between A, B; 40 between B, C; 30 between C, D; 20 between D, E, and 10 between E, F. At any moment, when all the lamps are burning and the generator voltage is the proper 125, (direct current is assumed, but the theory is just the same for alternating at a higher voltage), the pressure at the lamps at F will be 110, as it should; at E it will be 113; at D it will be 116; at C it will be 119, at B 122 volts. Thus the lamps everywhere but at F, will be burning at far too high pressure, and will burn out in a very short time. Some authorities state that every one per cent. too high voltage reduces the life of the lamp 15 per cent. The above is certainly a rather exceptional case, but in a modified form actually occurred within the writer's experience. Suppose that the wire had been calculated to carry the 50 amperes as far as D, dropping the 15 volts; then the lamps at D would have 110 volts; those at E and F would have too little; while those at B, C would have too much. E would have 108; F, 106; C, 112 and B, 114 volts. Here we have some not up to candle power, and the others burning out. There has been enough shewn to prove that the careful calculation of the wiring of a system is of the highest importance, and that slap-dash methods of guessing at wires are almost sure to be disastrous. It is too usual to conclude that No. 16 will be the proper size for inside wiring, irrespective of the outside pressure. A case came recently under the notice of the writer, where the contractor, out of the honest intention to give good square work for his money, increased the *size* of the wires all around, thinking that nobody could complain if he put up No. 6 where he had contracted for No. 8. His honesty, not to say his beautiful ignorance, resulted in burning out lamps in all directions. The fact is that hundreds of dollars are wasted by guessing at wires, and hundreds of lamps are burned out by excessive pressures. In quite a small village the wiring system is as capable of scientific calculation as in a large town; and experience and care can save money in this way as in every other. It would certainly pay electrical men to have their systems overhauled and put in order.

IN view of the approaching convention of the Canadian Electrical association at Ottawa, and of the American Street Railway Association at Montreal, the effort has been made to make the present number of the ELECTRICAL NEWS one of special character. A largely increased edition has been printed in order that copies may be placed in the hands of every delegate to these conventions, as well as of manufacturing and other concerns who should be interested in acquainting themselves of the progress which is taking place in the applications of steam and electricity. It is hoped that the readers of this number, whether casual or regular, will find the contents of both reading and advertisement pages of more than usual interest. If you are not a subscriber, remember that for only one dollar per year you may enjoy that privilege. If you are not an advertiser, it will pay you to become one.

NOTES ON AN INTERESTING STEAM PLANT AT MONTREAL.

A representative of the ELECTRICAL NEWS recently called on the superintendent and chief engineer of the Board of Trade building, Montreal, Mr. J. J York, and it was with much pleasure he saw the neatness and brightness in the power and boiler rooms.

In the pumping rooms are two Davidson steam pumps, 24 × 14 × 24 which run the three passenger elevators. These elevators carry 4,000 passengers daily during the summer months. The pumps pump the water over and over again and only 60 gallons per week are wasted. Two feed pumps (Davidson) are in use and one Otis feed water heater, which receives water from the city mains and delivers it to the boilers at 210° Fr. The only circulating hot water supply system used in the city is used here. It is so arranged that hot water may be had from any of the 170 hot water taps at once, while in other buildings you have to wait till the water arises from the basement. The temperature in the hot water tank is regulated by Power's temperature regulator.

The building is lighted by a private electric plant, supplying light to 1400 lights. The system is divided into ten sections, each connected to one switch board, and so arranged that, in case of an accident, light can be had by connecting to the Royal Electric Co.'s wires. The building is wired for 2% loss at 52 volts, and all wires are rubber covered cable laid in armored conduit.

In the power room are three engines and three generators. The engines are Robb-Armstrong, Class A. *10½ × 12 × 260.* The generators are Edison compound wound 30 k. w. A new switch board has just been built in the power room, having Weston volt metres and Edison ametres. New brass railings have just been put around the engines and generators giving them a nice appearance. A 10 h. p. Sprague motor drives a fan which supplies air to the boilers, where hard coal screenings are used for fuel. The motor is controlled by a damper regulator connected with the starting box, so that when steam is up and no air is required the motor and fan will be at rest, and when steam goes down, needing more air for the fires, a weight slowly descends automatically, at the same time pulling a cord attached to the handle of the starting box, which sets the motors and fan again in motion till the required steam is up. This automatic invention does not require any attention from the fireman. This invention originated in the fertile brain of Mr. York and is one he may well feel proud of.

In the boiler room are three boilers, 18 feet long by 5½ feet diameter. They are multitubar and have an average pressure of 90 lbs. Mr. York, after experiments with mixtures of hard and soft coal screenings, has decided to stick to hard coal screenings.

In the kitchen of the restaurant next to the power room is a 2½ h. p. Ball motor which drives a 30" Blackman fan which can change the atmosphere of the kitchen three times a minute. The kitchen is the best ventilated in the city. The power of the fan was clearly demonstrated to the reporter by Mr. York. He closed all the windows and doors with the exception of one, and then speeded the motor to its utmost capacity. The air was drawn so quickly out of the kitchen that the reporter found it almost impossible to close the open door against the rush of air from outside.

Mr. York is experimenting on an electric heater for a tea-broker of the city. He is making it of German silver insulated with mica and is pleased with results. He says he can heat two quarts of water in ten minutes and not burn out the heater. Mr. York, as President of the C. A. S. E. goes to Ottawa to the convention this month.

PERSONAL.

Dr. McMaster has been appointed principal of the Toronto Technical School Board, at a salary of $700 per year.

Mr. W. F. Clockenberg, electrician, of Niagara-on-the-Lake, was married recently at Toronto, to Miss Sherrin.

Mr. J. J. Wright, manager of the Toronto Electric Light Co. has also assumed the management of the Hamilton Electric Light & Power Co.

Mr. E. B. Merrill, late principal of the Toronto Technical School, has entered the employ of the Westinghouse Electric Manufacturing Co., Pittsburgh Pa.

Mr. E. L. Barr, brother to Mr. M. D. Barr, formerly manager of the Canadian Edison Co., has recently been appointed secretary of the Wallace Electric Co., of Chicago.

Messrs. John W. Mackay, president of the Postal Telegraph Co., and C. R. Hosmer, superintendent of the Canadian Pacific Telegraph Co., have recently returned from a trip to Alaska.

At the recent convention of the Association for the Advancement of Science, held at Springfield, Mass., Prof. Galbraith, principal of the School of Practical Science, Toronto, was elected secretary of the Mechanical Science and Engineering section.

LOCATION OF GROUNDS IN ARMATURES, FIELDS, ETC.*

By Clarence E. Gifford.

If the work can be performed in a very quiet room, two or three cells of battery, a telephone receiver and connecting wires, comprise the necessary apparatus. In some cases two "table binding posts" and a foot or two of No. 18 or No. 20 bright iron wire will be a convenient addition. Where noise will not permit of the use of a telephone, a dead-beat reflecting galvanometer, a milli-voltmeter, or some other form of delicate and rapid working visual indicator, must be used instead. If an armature is to be tested without removing it from the machine, connection with the battery may be made through the brushes, first making certain that the short-circuiting switch is open, if dealing with an arc machine. The points of connection with the battery need not be diametrically opposite, and may be made by the wires being firmly pressed against the commutator by an assistant, if more convenient.

Good electrical contact between metallic surfaces can better be secured by cleaning the same thoroughly with kerosene, which removes foreign matter, and is so fluid that it will in no way interfere with perfect contact, when moderate pressure is applied. Especially when making measurement of resistance of armature sections, it is even advisable to have the surface of the commutator quite wet with kerosene during the operation, as this avoids trouble from grease or dirt which might get on the surface from hand...g, subsequent to cleaning, and it also prevents the contact points becoming oxidized by any sparks which may occur at the moment of breaking contact. True, the oil is an insulator, but we use it in this case as a detergent simply.

Connection being made between battery and commutator, first determine whether the armature circuit is complete throughout. If the circuit is complete, a click will be heard in the telephone when the two terminals of the same are brought in contact with any two contiguous bars of the commutator, or when contact is broken. If an open circuit exists on either side of the circuit, of course no sound will be heard in the telephone when used on that side, except when connection is made or broken by it between the bars lying on opposite sides of the break. See Fig. 1.

Close any open circuit temporarily by bridging between the two bars with a drop of solder. Two or more breaks can evidently be located by suitably shifting the battery contacts and searching as before. Open circuits will, of course, when an armature continues in work, soon cause burns between the bars

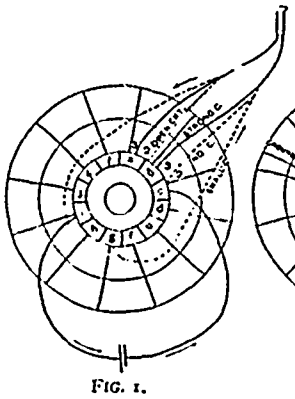


Fig. 1.

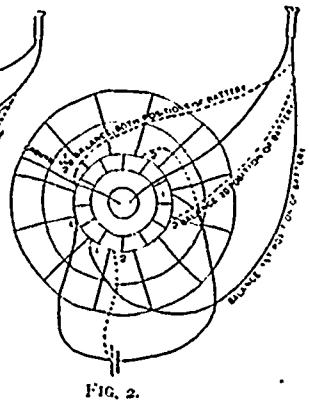


Fig. 2.

that will indicate unmistakably their location. Having closed any open circuits, and the battery being connected to two points of the commutator, appro...imately opposite each other, one terminal of the telephone is connected to the armature shaft, or frame of the machine, and the other terminal is drawn completely around over the surface of the commutator, while the telephone is held to the ear. If only one ground exists, two balancing points, or points giving the least noise in the telephone, will be found.

In an armature of ordinary construction, one of the points so found will be on the bar nearest the real ground, while the other balancing point bears what might be termed a "bridge relation" to the first, being at practically the same potential; the armature itself forming in reality a veritable Wheatstone bridge.

Now, shift the points of battery contact a few bars either way, and the true ground, if but one exists, will be indicated in precisely the same position as before, while the other balancing point will shift every time the battery contacts are shifted. See Fig. 2.

If two grounds exist, two balancing points will be found, as before, but both points will shift more or less when the battery contacts are shifted, provided the grounds lie on opposite sides of the same battery contact.

In the case of one ground, having determined its location approximately, fix it as closely as may be by making and breaking contact with the telephone terminal on each of the more quiet bars, separately, until by comparison, the two giving the faintest clicks are determined. If your hearing has served you correctly these two bars lie nearest the trouble, the fainter one being the nearer. Prove the non-existence of a second ground by placing

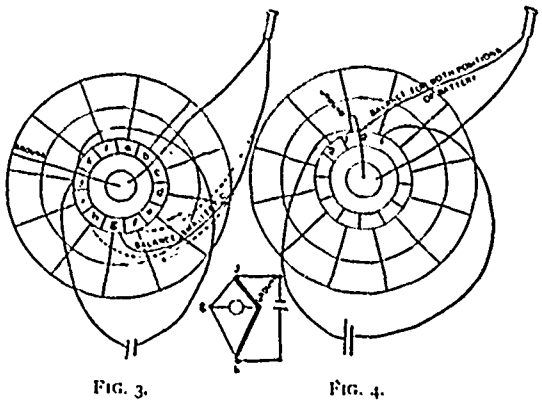


Fig. 3. Fig. 4.

one of the battery contacts on the first bar to the right of the apparently permanent balancing point just found, and then on the first bar to the left of said point, the other contact being nearly diametrically opposite. This balancing point should still remain unchanged if no other ground exists.

The next step is to connect the battery to these two bars just fixed upon as lying nearest the trouble. The armature still forms a "bridge," the portion included between the two contiguous bars to which the battery is now connected forming the one side, and the remainder of the armature, the other side. See Fig. 3.

One of the telephone terminals is now connected to the shaft as before, and the other terminal again drawn around the commutator. If the balancing point is found, say one-sixth to one-half, the long way round from one battery contact to the other (these contacts being on two contiguous bars), the trouble lies in the coil between those two bars, and the point of trouble divides the coil in the same ratio as the balancing point divides the remainder of the armature, the ground and the balancing point being respectively nearest the same battery contact. If the balancing point falls on the same bar as one of the battery contacts, the ground is located on that bar or on the lead between it and the armature, provided the balancing point is found to be upon the same bar when the battery contacts are both shifted one bar to the right or the left of their original position. See Fig. 4.

If the balancing point appears to be found within three or four bars from one of the contacts, the precaution should be taken to test its correctness by moving both battery contacts one bar toward the balancing point. If the trouble was between the battery contacts when in their previous position, this shifting of the contacts will now throw the balancing point clear around on to the contact which was, in the previous position, farthest away from the balancing point. If, on the contrary, the balancing point remains unmoved by this shifting of the battery contacts, it shows that this balancing point is the point nearest the real ground, and that the ear was deceived in its first supposed approximation, which, with due care, however, is not likely to occur.

If such error had been made, the new point, as indicated, together with first the bar on one side of it, and then on the other, must be tried as points of battery contact; or much better, make a new start with the contacts nearly at opposite sides of the commutator and proceed as before. A single 20,000 ohm ground on a one ohm armature should be located accurately in not over three minutes, in a quiet room. High resistance

*Abstract of a paper read before the American Institute of Electrical Engineers, Niagara Falls, June 26-30, 1895.

grounds require more battery and more care. Armatures of very low resistance also offer greater difficulty.

Where two grounds are found to exist, as indicated by the change of location of both balancing points, under the conditions before stated, when the battery contacts are shifted, the following mode of procedure will answer the purpose well, and is simple. Fix the battery contacts at any two points of the commutator nearly opposite each other, preferably at points to be determined by trial, that will cause the balancing points to fall nearly diametrically opposite to each other, and determine and mark the two balancing points, as then shown. Now place the battery contacts on the balancing points just found. If only one ground exists, the two balancing points and one battery contact will all be coincident in one point. If two grounds exist, both balancing points will be shifted from their former position. Open the armature circuit by unsoldering one of the ends of a coil connecting with the lead of the bar that is marked in the first part of this test, as one of the balancing points. Place one of the battery contacts on the armature shaft, and the other on the marked balancing point that is farthest from the point where the circuit has been opened. Next place one telephone terminal on the first bar to the right of the opened wire, and draw the other terminal from the same point, toward the right, over the surface of the commutator. The telephone will be absolutely silent until the moving terminal has just passed the ground nearest to it, and strikes the first bar beyond the same, when it will click. This ground lies in the coil between this first bar giving a click and the one passed just previously, or else in the said previous bar.

The other ground is obviously to be located in a similar manner, by placing one telephone terminal on the bar just to the left of the open wire, and from that point searching toward the left with the other terminal. Only in cases where one ground is of very low, and one of very high resistance, will any difficulty be experienced in locating both accurately before either is removed.

The coils thus indicated may have their terminals unsoldered, when it can be readily ascertained with each, whether the ground be in the coil or in the bar just preceding it.

If scientifically inclined, or if otherwise preferable, the circuit may be opened at a point somewhere midway between the two indicated coils instead of disconnecting those coils, and the exact location of each ground determined as follows: Take a piece of "broom wire" about eighteen inches long, new and clean, screw the ends firmly into two clean, brass table binding posts, and into the other holes of the same posts screw the battery terminals. Have an assistant press the corners of the bases of the binding posts into very firm contact with the two bars that lie at the ends of the indicated coil, observing the directions previously given for securing clean contact. Place one telephone terminal in contact with the shaft, and with the other find the balancing point on the wire. This point will indicate the relative position of the ground in the coil, or commutator bar, as the case may be. If more than two grounds were suspected, the two lying the farthest apart would be approximately located by the first part of the two-ground process, and if these coils were not disconnected before proceeding farther, it would be well to make two openings in the circuit, close to and lying between these outer grounds; then locate definitely these two extreme grounds, and proceed with the remaining section somewhat as with a complete armature, except that you would commence by connecting the battery to the terminals of this section, and would then bridge the telephone from the shaft to the different portions of the section, and would complete the process by applying the remainder of the two-ground test.

In dealing with a cross connected Gramme ring, an obvious change would be made in the points of application of the battery; and as many points of apparent trouble would be indicated as there were series of cross connections.

After location of these points it would be necessary to use the auxiliary wire loop, as before described, between these points, to determine which is nearest the trouble. This fact being determined, it would in case of a single ground (indicated by the permanency of the balancing point) become necessary to remove the cross-connections from two bars before proceeding further. The auxiliary wire loop would properly be used to complete the process.

The ordinary "closed coil" ring or drum armatures are types to which these methods are directly applicable.

The sections of open coil armatures would receive the same treatment as field coils.

Whenever necessary to deal with wet grounds in testing, it is better to make at least four tests, reversing the battery after each test, and taking the mean of the four determinations.

Field coils, also any wires of uniform cross-section, the extremities of which are accessible, and within a reasonable distance of each other, can of course be easily tested for grounds by soldering or firmly clamping a bare wire of suitable size between the extremities of the conductor to be tested, applying a battery to the junctions, and bridging with a telephone between the bare wire and the object upon which the conductor is grounded. This will give only the location of a single ground, or the "resultant" of two grounds. A "T.-H." rheostat should have the battery connected to the two extremities, and the point of apparent ground determined by bridging with a telephone between the frame and the several contact plates. Then apply the battery to the frame and point of apparent ground, connect one terminal of the telephone with each extremity successively, and search from it toward the center with the other terminal, as in the case of searching for two grounds in an armature.

In determining the location of grounds that are of very low resistance, a good induction coil similar to that used in the Blake transmitter may be used with advantage in connection with the telephone receiver. The receiver is placed in circuit with the secondary of the coil, and the "bridging" is done with the primary. With high resistance grounds the best results are obtained by using the receiver only.

MOONLIGHT SCHEDULE FOR SEPTEMBER.

Day of Month.	Light.	Extinguish.	No. of Hours.
	H.M.	H.M.	H.M.
1.....	A.M. 12.40	A. M. 4.30	3.50
2.....	" 1.40	" 4.30	2.50
3.....	" 2.30	" 4.30	2.00
4.....	No light.	No light.	....
5.....	No light.	No light.	....
6.....	No light.	No light.	....
7.....	P. M. 6.40	P. M. 8.40	2.00
8	" 6.40	" 9.20	2.40
9.....	" 6.40	" 9.40	3.00
10.....	" 6.40	" 10.20	3.40
11.....	" 6.40	" 11.00	4.20
12.....	" 6.40	" 12.00	5.20
13	" 6.30	A. M. 1.00	6.30
14	" 6.30	" 1.10	6.40
15.....	" 6.30	" 2.20	7.50
16.....	" 6.30	" 3.40	9.10
17.....	" 6.20	" 4.50	10.30
18.....	" 6.20	" 4.50	10.30
19.....	" 6.20	" 4.50	10.30
20	" 6.20	" 4.50	10.30
21.....	" 6.20	" 4.50	10.30
22.....	" 6.20	" 4.50	10.30
23.....	" 6.20	" 4.50	10.30
24.	" 8.00	" 5.00	9.00
25	" 9.10	" 5.00	7.50
26.	" 10.30	" 5.00	6.30
27.....	" 11.00	" 5.00	6.00
28.....	" 11.30	" 5.00	5.30
29.....	.....	" 5.00	4.20
30.....	A.M. 12.40	.....	
		Total,	172.30

Since the publication of the article relating to the Sault Ste. Marie Canal, which appeared in our August issue, we have been informed that half the motors required for operating the canal gates were supplied by Messrs. Ahearn & Soper, of Ottawa.

Referring to the article published in the ELECTRICAL NEWS for August, of the electrical apparatus employed in connection with the Sault Ste. Marie Canal, a communication has been received from Mr. J. B. Spence, Government Engineer, stating that he has visited the work since the publication of the article referred to, and by trial has found the valves and gates to open and close (with all caution) in from 45 to 50 seconds. The lock filled in barely 7 minutes, and discharged in barely 5 minutes, being in less time than the estimate made in Mr. Spence's report.

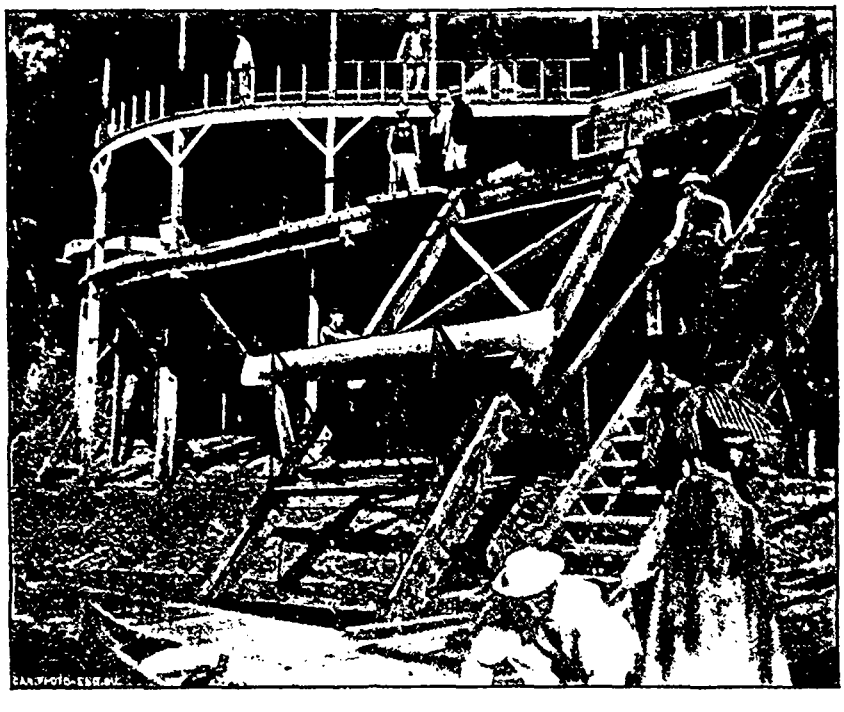
AN INGENIOUS ELECTRICAL DEVICE.

A NOVEL and interesting application of electric power has recently been made in Ottawa, Ont., in an elevator for boats, constructed by the Ottawa Canoe Club. This club has its headquarters in a prettily designed and well appointed boat-house, built on a ledge of rock and against a high bluff well known as "Rockcliffe," situated on the Ottawa River, a short distance from the city and easily reached by the electric railway.

The Ottawa River rises every spring to a height of 10 to 15 feet above the average summer level, consequently the club house had to be perched quite high up the hill. At this time the lower sills lie some eighteen feet above the water. Under these conditions the transfer of the skiffs and canoes between the boat-house and the water was a difficult, slow and laborious process, that offset to a large extent the many attractions of the place.

This season the Executive decided to overcome this difficulty by the installation of an elevator or "lift," operated by electricity, and Mr. A. A. Dion, of the Ottawa Electric Co., who is the Honorary Treasurer of the club, designed and had constructed under his immediate supervision the apparatus which is now used. Its operation is perfect. The boats are handled quickly and safely, and are less strained than they were when carried by hand. In fact, the lift is a complete success.

The apparatus consists mainly of a framed gangway 10 feet wide by 32 feet long, a skeleton car, an ordinary worm geared hoisting drum, and a 3 K. W. 500 volt Edison motor. The gangway, which is made of two heavy timbers, with lateral ties and braces, forms an inclined plane extending from the lower platform of the boat-house to the water, into which it dips at an angle of about 45 degrees. On the inner face of the side timbers of this gangway, rails of 2 inch angle iron are fastened. The car which runs upon this track consists of an oblong bed frame, from two sides of which arms made of 2 inch by ½ inch iron, looped, extend upwards at an angle of about 90 degrees from the bed-frame. Slings made of 3 inch rubber belting are suspended between the top corners of the bed-frame and the tops of the iron arms, forming two flexible, elastic supports about 9 feet apart, intended to receive the boat. This carriage is mounted on four independent 4 inch cast iron wheels with one inch flanges. There are also two wheels running under the rails to prevent the car leaving the track.



ELECTRIC ELEVATOR FOR BOATS.

The carriage is attached to the drum by a ¾ inch steel cable running over sheaves to the back of the building, where the hoisting apparatus is placed under the floor. The motor is belted to a countershaft, that is in turn belted to the shaft carrying the worm.

When a boat is to be raised or lowered, the motor is first started on a loose pulley. The drum is started to raise or lower the car by means of a belt shifting lever placed on the edge of the boat-house platform. The car stops automatically at the top and bottom of its allotted course, the lower stop being adjustable to suit the water level.

When the car is at the bottom, its highest part stands about one foot under water, so that a boat may be floated on and off. When at the top its highest part stands over and inside the edge of the platform, so that a boat may be lifted on and off easily. It will be understood that the boats are carried side on, or at right angles to the line of traction. The speed of the car is about 75 feet per minute. The construction and operation of the apparatus will be more clearly understood from the accompanying photograph, for which the writer is indebted to Mr. J. A. D. Halbrook, a talented amateur photographer and a member of the club.

The automatic stop device is an ingenious modification of the well known arrangement of a nut moving along a screw extending from the drum shaft, and is very positive in its action.

All the machine work was done by Mr. Geo. Low, and the carpenter work by Mr. A. Sparks.

FIRING STEAM BOILERS.

IF an engineer must hire the fireman, let him look first for a sober man; next see that he is neat, careful and reliable; next ascertain if he wants to learn something new each day. If the man is a "know-it-all" it will not do to take him into the fire room. No matter what his other qualifications may be, he will not prove a financial success. His introduction to the coal pile will mean a considerable hole in the owner's pocket book. The new fireman, if he understands his business, and especially if he has a new boiler, will start a slow fire. He will be easy on that boiler for a day or two; he will start the fire with wood, if possible, as that fuel can be regulated closer than any other form.

For a medium sized boiler, say 5x16 feet, he will be very lazy in getting up steam the first day. Probably three or four hours will be consumed in getting up the pressure. While this is being done he will have a good look at every seam and every rivet that is within his reach. He will take pains to let the air out of the boiler as soon as the pressure begins to start. This is easily done by leaving a gauge cock or two open, or by raising the safety valve if the lever variety is used.

After the new boiler has been gradually worked up to a pressure, he will let it stand an hour or two, then open the blow-off at surface, and give a chance for all the oil and light dirt to run out. After this the boiler may be put to work in earnest, and if the above directions be followed he will have very little trouble from leaky seams or tubes.—Tradesman.

BRITISH STREET RAILWAY STATISTICS.

An English paper gives the following statistics of the street railways of Great Britain: Altogether 37 civic authorities and 110 companies own tramways in the United Kingdom. On these tramways 30,528 horses, 564 locomotives, and 4,179 cars are used. The number of men employed is about 20,000. The total number of passengers carried during the year 1894 was 616,872,830. The gross receipts were £3,615,837, and the net profit £758,781, giving a return of 5¼ per cent., or an increase of 1 per cent. on the previous year.

The Condensed Mill Co., Truro, N. S., are putting in a 30 horse-power Robb Armstrong engine.

CANADIAN ELECTRICAL ASSOCIATION.

WE print by request of the Executive Committee the following copy of the constitution of the above Association, as recently revised by the Committee on Constitution, in order that members of the Association may be in a position to discuss intelligently its provisions at the approaching convention in Ottawa:

ARTICLE I.

NAME.—This organization shall be known as the Canadian Electrical Association.

ARTICLE II.

OBJECT.—The object of this Association shall be to foster and encourage the science of electricity and to promote the interests of those engaged in any electrical enterprise and for discussion and interchange of opinions among its members.

ARTICLE III.

MEMBERSHIP.—The Association shall consist of active, associate and honorary members. The term Active Members includes all members actually engaged in electrical business. The term Associate includes those interested or actively engaged in any electrical pursuit, and they shall be entitled to attend all meetings of the Association, except those of the Executive, and take part in all discussions, but shall not be entitled to vote or be eligible for office. Honorary members shall be elected by a two-thirds vote of the Association.

ARTICLE IV.

OFFICERS.—The officers shall consist of a President, 1st and 2nd Vice-Presidents, Secretary and Treasurer, and an Executive Committee, consisting of ten members, five of whom shall act on the Committee for two consecutive years. The President and Vice-Presidents shall be ex-officio members of the Committee. Five shall form a quorum. The office of Secretary and Treasurer may be held by one person.

ARTICLE V.

FEES.—The annual fee shall be for active members $3.00, associate members $2.00, payable in advance.

ARTICLE VI.

ELECTION OF OFFICERS.—All officers shall be elected by ballot at a general meeting of the Association. The ballot shall be taken in the following manner:—The Secretary shall read the list of active members alphabetically, and each member shall deposit with the Secretary a slip of paper on which he has recorded his vote, the Secretary checking off his name on the list of voters. Two scrutineers named by the Chairman shall assist the Secretary in counting the votes, and the Chairman shall declare elected the person receiving the majority of the votes cast. In case no one candidate receives such majority on first ballot, another ballot is to be taken, and so on until a clear majority is given in favor of some one candidate. Officers shall hold office until the close of the session, at which their successors are elected, such successors to be elected on the second day of the first general session after the expiry of ten months from day of previous election.

ARTICLE VII.

ELECTION OF EXECUTIVE COMMITTEE.—Members of the Executive Committee shall be elected by ballot in the following manner, the vote being taken immediately after the election of officers:—Ballot papers containing the names of the ten members of the Executive Committee, five of whom must be re-elected, shall be given the members. The Secretary shall read a list of those entitled to vote, and members, having first marked a cross opposite the names of the five persons selected for re-election, shall deposit the ballots with the Secretary, who, assisted by the two scrutineers named by the Chairman, shall count the vote, and the Chairman shall declare elected the five persons receiving the greatest number of votes. Members shall then proceed to elect the five other members of the Executive, the election being by ballot and the Secretary reading the names as before. Each active member of the Association shall have the right to vote for an active member of the Association, including the retiring members of the Executive, and the vote being counted in the usual way, the Chairman shall declare elected the five persons receiving the greatest number of votes.

ARTICLE VIII.

PLACE OF MEETING.—Place of next meeting shall be decided by ballot, taken in same manner as laid down for election of officers.

ARTICLE IX.

VACANCIES IN OFFICE.—Vacancies in office, caused by death or resignation, shall be filled by the Executive Committee to cover the term until the next general meeting of the Association, at which the officers are elected.

ARTICLE X.

NOTICE OF MOTION.—Permission to introduce any notice of amendment or amendments to this constitution must be granted by a majority of two-thirds of the active members present. Permission being granted, notice may be given and the proposed amendment moved at any subsequent sitting. After discussion the amendment must be submitted to a Committee of five, named by the Chairman. The report of said Committee cannot be considered on the same day on which it is introduced. A two-thirds vote of all active members present shall be necessary for its adoption.

ARTICLE XI.

Notice of substantive motions is required, and no motion shall be discussed at the sitting at which the notice has been given, but this rule does not apply to merely formal motions, such as motions to adjourn. All reports of standing Committees are to be discussed at a sitting subsequent to the one at which such reports have been received. This rule may be suspended by a vote of two-thirds of the members present.

ARTICLE XII.

All motions must be duly proposed and seconded, and shall, except those of a purely routine character, be in writing.

ARTICLE XIII.

No member shall speak more than once, or at a greater length than five minutes, upon any question until all others have had an opportunity of doing so, nor more than twice on any one question without permission of the Chairman, or a majority of the members entitled to vote. The mover of a substantive motion has the additional right to reply.

ARTICLE XIV.

Questions may be re-considered upon a motion to re-consider being made by a person who voted with the majority, provided such motion is carried unanimously. No discussion of the said question is allowed until the motion for re-consideration has been carried.

ARTICLE XV.

VOTING.—Every active member present must vote, but any person entering the room after the question has been put by the Chairman may not vote. The Chairman shall not vote except in the case of a tie. Voting by proxy shall not be allowed.

ARTICLE XVI.

Except where vote is by ballot the chairman will take the sense of the meeting by voice, or by asking members to stand, but on call of five members the Secretary shall read the list of persons entitled to vote, and record the yeas and nays.

ARTICLE XVII.

An appeal may be taken without debate against the ruling of the chair, a vote of two-thirds being required to reverse the decision.

ARTICLE XVIII.

The President shall nominate a Committee of three to strike the Standing Committees for the following year and define their respective duties, the report of the Committee being considered at a subsequent sitting to its introduction. The number of Standing Committees must be decided by the Association.

ARTICLE XIX.

The first person named on any Committee shall act as Chairman until Committee is called together, when they will elect their own Chairman, but the President, in his absence the 1st or 2nd Vice-President, shall be Chairman of the Executive Committee. In the event of the absence of ex-officio members, the Executive Committee shall proceed to elect a Chairman pro tem.

The general order of business at all sessions shall be as follows:

Reading Minutes of last meeting.
Report of Secretary-Treasurer.
Report of Standing Committees.
Election of Standing Committees for following year.
Selection of place of next meeting.
Approximate date of next meeting.
Election of Officers and Executive Committee

Time being allowed for general business and social affairs, at the discretion of Executive Committee or Chairman of meeting. Selection of next place of meeting and election of Officers and Executive Committee must be on second day of meeting. Order of business may be altered only by unanimous vote of members present.

ARTICLE XX.

Ten active members of the Association shall be a quorum for business.

ARTICLE XXI.

Todd's Parliamentary Practice shall be the governing law of the Association in all cases not provided for in its own rules

ARTICLE XXII.

DUTIES OF THE PRESIDENT. It shall be the duty of the President to preside at all meetings of the Association and to call meetings of the Executive Committee, and when requested by the Executive Committee, to call a special meeting of the Association.

ARTICLE XXIII.

DUTIES OF THE VICE-PRESIDENTS.—The 1st, or in his absence, the 2nd Vice-President, shall act in the absence of the President.

ARTICLE XXIV.

DUTIES OF THE SECRETARY.—The duties of the Secretary shall be to attend all meetings, take record of all proceedings, and shall perform such other duties as the Executive Committee shall direct.

ARTICLE XXV.

DUTIES OF THE TREASURER.—The duties of the Treasurer shall be to keep a correct account of all receipts and disbursements in connection with the Association. All checks for disbursements shall be signed by the Treasurer and countersigned by the President, after being approved by the Executive Committee.

ARTICLE XXVI.

THE DUTIES OF THE EXECUTIVE COMMITTEE.—The Executive Committee shall be the governing body of the Association, shall manage its affairs, pass upon all applications for membership, eligibility of representatives, subject to the constitution, and such special rules or regulations as may be adopted by the Association from time to time.

ARTICLE XXVII.

DUES.—Dues shall be payable annually on the 1st June, in advance. Members in arrears for dues, other than those for current year, shall not exercise the privileges of membership.

ARTICLE XXVIII.

The permanent office of the Association shall be in Toronto.

STEPPED GRATES.

There is one story which comes up to me very often, and it has the special merit of being true, writes Robert Grimshaw, in Power and Transmission. A certain firm drew up plans and specifications for a bridge to cost about a million and a half dollars. When they were done, a certain engineer pointed out where, by a slightly different construction, equal strength, durability, convenience of erection, slightliness, etc., might be had, with a saving of two per cent. "Oh, bother the two per cent," said the designers, "do you suppose that we are going to overhaul and re-make all our calculations and strain-sheets and drawings for a measly two per cent?" "Well," said the critic, considering that two per cent of a million and a half is thirty thousand dollars, I think you could very well overhaul the whole business"

This story is good for any latitude and in any business, and can be especially well applied or considered by large coal users.

What a lovely and useful thing the multiplication table is! Say fifty tons of coal at four dollars a ton, and three hundred working days in the year; and figure up only two per cent on that: $50+\$4\times300\times.02=\$1,200$.

How many coal users know or remember that, no matter how well their boilers are set and managed, they can not possibly get more than seventy-five per cent of the heating effect of the coal, and are not likely to get more than seventy-five per cent?

The manufacturer who gets six or seven pounds of dry steam at good pressure per pound of hard coal, is doing better than the average,—and that is not saying much. The little two per cents may be picked up by attention to details,—such for instance, as grates, ash-pits and dampers, and by finding out what combustion rate pays best.

Many manufacturers have tried all sorts of plain grates, and have even ventured into the field of "patent" grates, with rocker arms, fingers and so on; and those who have properly experimented with rocking grates, suitable to the conditions under which they are applied, have usually found a saving. But the stepped grate, although considerably used and well liked in Europe, where coal costs money (and money is nailed down fast,) is comparatively a stranger in the United States.

The grate should be from 36 to 42 inches long; and it is better, usually not to exceed 20 inches (or at most 24) in width, *i. e.* in the length of the plates forming the steps). When a wider grate is required, there should be two sets of steps side by side. Underneath the slanting part of the grate should be an ash hole, leading to a masonry ash pit, and a similar hole under the dead-plate or ash-plate at the lower or back end, leading to the same pit. The plates may be, if of wrought iron, only about one third inch to one half inch thick, and they may be so set that each is about three quarters inch to one inch below the other, between centers. As they are set flat, there is more risk of bellying than those bars in ordinary grates, which are set on edge, hence the precaution of having a length of 24, or better yet, only 20 inches. About 45 degrees is a good angle for the grate considered as a whole, but 35 degrees with the horizontal is usually better,—this depending on the kind of coal, some coal sliding more freely and requiring to be held back, and some needing a good deep angle to keep it from banking up instead of moving backwards and downwards. At the back and lower part there should be a slot controlled by a sliding plate, for ashes to drop through and for air to come up through should it be needed, and this may usually be kept open about an inch and a quarter, although it should be capable of opening six or eight inches to facilitate rapid cleaning, re-making of the fire, etc.

The stepped grate has usually the advantage of requiring but little attention on the part of the stoker. It generally works best when the principal combustion takes place on the lower half; and this part requires the most slicing and poking from the front and raking from the back. The thickness of the bed depends, of course, on the kind of fuel and on the draft; the proper amount may be learned in a few days stoking. Usually it is best to have the thickness rather more than twice as great on the upper part of the steps as on the lower, as, for instance, two inches below and four and a half to five above, for hard coal; usually thicker for soft.

The smaller the coal the better the stepped grate works; that is, it works with small coal better than with large; also it makes a greater saving with small coal over large than the ordinary grate will. It is is not at all suitable for lump and steamer coal, and *per contra*, it will burn stuff that other grates will utterly refuse to raise steam with;—for example, such trash as is found for a depth of a foot or so under a coal pile which has been standing for one or two years with constant changes, as on a shipping wharf,—this stuff consisting of from twenty to fifty per cent. of clay, sand, or other incombustible trash.

OBSTINATE THUMPING.

SOMETIMES an engine which usually runs well develops an obstinate pound or thump, which persists in spite of all the doctoring that can be done to the machine. In vain the engineer will go from the wrist pin to the cross head, and from eccentric to bearing. Even the fly wheel and the manner in which it is keyed upon the shaft will be investigated, to see if the thump is located therein. After all these things have been tried in vain, just give the engine a trifle more compression and note the result. Probably it will cure or make it worse. In the latter case change the valve again and give a little less compression than there was before. In nineteen cases out of twenty the change in compression will do the business. The philosophy of the business is this: The compression is too little or too great to allow the engine to run smoothly over the centre; and at that point the piston gives a "yank," which causes wrist pin and connection and sometimes the main bearing to vibrate to the extent of the lost motion, forming the thump or pound, which is so objectionable to the good engine runner.

BOILER FEEDWATERS, THEIR TREATMENT.*

By W. P. Jarvis.

WATER is a wonderful agent produced and given us by nature, and has its advantages and drawbacks; it is the greatest solvent of all natural or artificial liquids known to chemistry; it becomes impregnated with all different elements, in one form or other, in which it comes in contact, and absorbs free carbonic acid gas *from the air and ammonia from the air and earth.* Carbonic acid gas thus formed becomes the life of the water and enables it to take up the otherwise insoluble carbonates of lime, magnesia, etc., holding them in solution as bicarbonate of lime, magnesia, etc.; the colder the water and the heavier the pressure the more gas it contains; consequently the larger the body of water or the deeper the well, the more heavily impregnated it is with the salts of lime, magnesia, etc.

All natural waters are imbued with the salts of the following mineral bases: lime, magnesia, sodium, potassium, iron, silica and aluminum, combined with carbonate, hydrochloric and sulphuric acids, and sometimes medicinal waters with phosphoric acid, or all of them to a more or less extent, according to the nature *of the soil or the conditions in which the water percolates the soil.*

The calcium, commonly termed lime, is taken up in the forms of sulphate and bicarbonate; the magnesia as bicarbonate, sulphate, and chloride; the sodium and potassium as chloride, sulphate and carbonate; the iron as bicarbonate. Iron as well as copper is found in solution as a sulphate. The aluminum exists in the water as a sulphate or in suspension as an oxide; the silica as silicic acid. When we find a water containing sulphate of iron or copper in solution, we generally find free sulphuric acid also.

The salts of lime and magnesia, iron, silica, oxide, etc., are scale forming ingredients; the sulphate of lime forms a very hard compact incrustation, adhering very tenaciously to the hot metal, is very hard to break up, decompose or dissolve, and, like all sulphates, it is a very staple salt; it is conveyed into the boiler by the water as a sulphate, and as such enters the scale formation, and is not even soluble in its own acid, and it is impractical to dissolve it with hydrochloric acid except in laboratory work.

The only substances which can be successfully used in the boiler to break up and convert sulphate of lime into a form in which it can be readily washed out, are sugars properly blended, which, when used under the high heat, and the existing conditions of the steam boiler, convert this sulphate of lime into a complex mixture of saccharates and carbonate of lime, and this, in the presence of the tannin matters, is practically converted into tannates of lime.

Carbonates of lime and magnesia enter into the scale formation as such, forming a very compact incrustation, due to the great chemical affinity they have for hot metal, which is also the cause of the adhesive properties of sulphate of lime (gypsum). They can be readily and successively converted into a complex mixture of the tannates of lime and magnesia without any contamination to the steam or injurious effects to the steam receptacle or its connections.

Silica enters the scale formation as such, and also as silicate of magnesia. Sodium salts enter into the scale formation only in small quantities. Being very soluble they remain in solution until the water in the boiler becomes supersaturated, and unable to hold a greater quantity; these salts then cake on the hottest parts of the boiler, falling out of solution; this is very dangerous, having been the cause of the burning of a great many boilers in localities where the feed water is highly impregnated with soda salts. They cause internal corrosion, wasting away of the iron, eating through the joints and connections, and are the cause indirectly of one class of corrosion of which I will speak later under another head.

Chlorides of lime and magnesia, found in some feed waters, are very corrosive agents of iron. Being very unstable salts, they readily decompose with the high heat into oxides of lime and magnesia, entering the scale formation as such. The free chloride combines with the hydrogen of the water as a hydrochloric acid, and has a direct corrosive action on the iron. The action of sulphate magnesia is very similar to that of the chloride under the influence of high heat. The sulphates of iron and copper are direct corrosive agents to the iron and boiler connections, and will not enter the scale formation.

It is almost impossible to neutralize sulphates of iron, copper or magnesia in a practical manner. If you do it with soda, and convert the sulphuric acid into sulphate of soda, you get an excess of soda salts, which sets up galvanic action. If you use lime, converting the sulphuric acid into sulphate of lime, you get such large quantities of gypsum that in a short time your boilers will be so full of a hard incrustation that it will be impossible to run them. The only thing which has been half way successful in the handling of soluble sulphates and free sulphuric acid, is a mixture of sugars and starchy matters of a complex organic nature, which have offset the action of the acid by breaking up the acid radical, taking the sulphur and incorporating it with the aid of some of its oxygen into its own organic compositions.

Speaking of sodium and potassium salts, I would ask if it does not look unreasonable to endeavor to treat water for the prevention of the scaling deposits by the use of sodium and potassium salts, yet these salts are, in 99 cases out of a 100, the principal ingredient of the so-called boiler compounds and water purifiers, and it is these salts which cause most of the internal corrosion of steam boilers by their galvanic action.

Internal corrosion is the eating and wasting away of the threads, plates and joints, causing leakage and also causing the boilers and their connections to assume unsafe conditions. Where the corrosion is due to chlorine, free hydrochloric or hydrofluoric acids in the water, we find the pumps and feed pipes eaten through, the submerged parts of the boiler being free from such action on account of these acids readily passing off with the steam, and we get a similar action again in the steam-exposed surfaces of the boiler and the steam piping.

Free sulphuric acid has a very similar action, attacking the feed pipes a great deal more rapidly than the boiler itself; its corrosive action in the boiler is more uniform and not so much of a pitting and grooving nature; its action in the steam piping having almost entirely a grooving appearance. Where the deleterious action is due to the presence of an acid, it is called a direct corrosive action, and is generally found prominent in the feed pipes (colder pipes) and in the steam exposed surfaces. Where the corrosion takes place mostly in the submerged parts of the boiler, it is generally an indirect action, due to an excess of salts or too pure a water, coming under the head of galvanic action, termed by electricians electrolysis.

The boiler, as it is generating steam, is also generating a certain amount of galvanic current. The boiler is a galvanic battery in itself, the valves and their brass connections, composed of copper, babbitt, and other alloys, are negative, the iron being positive, forming the negative and positive poles, and under the high heat and other conditions existing in the steam boiler we have a galvanic battery; not only is copper negative to iron's positive, but the very molecules of the iron in the plates and tubes are negative and positive to each other; but electrolysis does not take place in the plate because the impurities, or we might say, foreign matter, such as silicon, oxygen and carbon compounds, are not and do not act as conductors between these negative and positive poles; the water in the natural condition, that is, its chemical affinities and solvent properties, being satisfied with lime and other natural salts, will not act as a conductor between these poles, consequently, having no conductor, the battery is not connected by water, but when using distilled water, rain water, or water with an excess of sodium salts, we then have a perfect conductor, the water assuming the position of a battery and of a battery solution, connecting our negative and positive poles, and inciting and generating a galvanic current. We then have a true galvanic battery existing, due to the general make-up and influence in the steam boiler. The purer the water, or the greater the excess of sodium salts, the stronger our galvanic current, the more pronounced our electrolysis.

You well understand that water contains a very corrosive radical in the nature of a hydrate; the hydrate radical is HO. Water is composed of two atoms of hydrogen and one of oxygen, which is a very strong chemical combination, not readily decomposed except with a soluble metallic base or red hot metal, but in this case, under the influence of the galvanic current, the positive metal, which is iron, exercises a chemical affinity over the water, chemically combining with its hydrate, forming ferric

* Read at the convention of the National Electrical Association, Chicago, July 17, 1895.

hydrate, taking up the oxygen and part of the hydrogen of the water, freeing part of the hydrogen, which goes off with the steam. This ferric hydrate gradually converts into corresponding oxides, due to the high heat and boiling of the solution, gradually converting into the black magnetic oxide of iron, so named owing to the galvanic action in its manufacture; its physical properties are that of a black gritty powder found at the bottom of the boiler when washed out, when electrolysis is going on. If you will take a boiler that is pitting from this cause, you generally find zigzag pits and grooves coated over with a baked film, and by tapping these with a hammer you find a reddish brown soft powder underneath, which is the more freshly formed ferric hydrate; that of a lighter shade is the partly converted oxides, and the few handsful of black gritty powder from the bottom of the boiler, which you can examine after rinsing the other oxides from your hand, you will find to be the black magnetic oxide of iron.

Speaking of electrolysis, which we, from our standpoint, term galvanic action, we believe it truly exists as such, and to prove it consider the large ocean-going vessels and think of the trouble they have from this cause and how and why they treat it. They use tons and tons of zinc to offset this very action, due partially to using too pure a water on account of the hot well system, and further by what salt water they are compelled to use. We all know zinc to be one of the most positive metals known in galvanic battery work; it is more positive than iron. The zinc put into the boiler assumes the position of the positive pole, consequently it is destroyed in place of the iron by the battery solution in the steam boiler. Its reaction and conversion into its oxide are similar to that of the iron, it being destroyed under the same influences.

Of all the deleterious actions which take place in steam boilers this is the easiest to handle, for you simply need to satisfy that water with some vegetable starch and saccharine matter, and in that way break up your conductor between the negative and positive poles, whether they be brass connections (negative) and the boiler plate and flues (positive) or the molecules of the iron of the boiler plate. It is impossible to set up a galvanic action without the water assuming the position of the battery and acting as the conductor. This same saccharine inert matter in conjunction with tannin extracts will cause these pits and grooves in the iron plate (where the case hardening protective surface of the plate and tube is broken and the raw steel or iron exposed) to heal over, assuming that same case hardening appearance as before. Do not understand me to say that you can fill up the little holes, as that cannot be done, the iron being gone, but the surface of these little zigzag holes and pits will heal over, serving as a protection against the water or the atmospheric oxidation.

Scaling ingredients are converted from crystallizable scale-forming carbonates and sulphates, having a great affinity for hot metal, into non-crystallizable tannates and saccharates of lime and magnesia, being a complex mixture of these with some carbonate, the sodium salts being readily handled in the same manner. This complex mixture of the saccharates, carbonates and partially converted tannates is of an inert nature, having the physical properties of a soft oozy mud, of the same specific gravity as the water, and no affinity for hot metals, neither has it the clay-like properties, but it will readily wash out with the water when cleaning the boiler.

In conclusion I might say a few words relative to the deleterious action of oil in steam boilers. Many of you to-day are running large condensing plants with your hot-well systems, and you are getting oil, with the condensation, into the boilers, possibly 5 to 15 drops per gallon. These oil separators are a good thing, and do, possibly, 50 or 60 per cent. of the work. You often hear of the tubes in a water-tube boiler buckling up and having to be taken out; you often hear of the bagging of the fire-sheet in tubular boilers. Why is this? The specific gravity of the oil is lighter than that of the water; the oil does not settle in its natural state. We explain it as follows: The oil coming into the boiler floats on the water; there is just a sufficient quantity of fresh water coming in to convey salts of lime, magnesia, etc., which are thrown out of solution, chemically combining with the animal oil as insoluble oleates, and mechanically combining with the mineral oils as a heavy mass, both these chemical and mechanical combinations being of a greater specific gravity than the water in the form of little globules, sinking to the bottom, the great chemical affinity and adhesive properties of this mixture causing them to adhere to the hot metal, and they, being a perfect non-conductor, retarding the transmission of the heat units to the water, concentrating heat in that part of the plate, causing the iron to melt, and the pressure in the boiler forces it down.

Sodium salts, so commonly found in water, or where it is used to counteract this action, saponifies the oil, causing the boilers to foam and carry over into the engines, and should not be used. This defect can be successfully handled with tannin extracts, the tannates forming complex organic compositions with the oils of an inert, light, powdery nature, having no chemical affinity or physical adhesive properties and readily washing out with the water at the opening of the boiler. To prove this go to the tannery and watch the tanner take the hides out of his vat after he is through with the tanning process, and when he lets the liquor run out of the vat you will find two or three scoop shovels full of an inert powder, which readily dries out and is termed pure tannin by the tanning experts. They claim that this is insoluble, and are in want of a solvent so that they can successfully use it for its tanning properties. We do not believe this to be the case, as the tannin in this mixture is, chemically speaking, part of the mixture, and the tannin is satisfied by the fatty matters contained in the hide. We aim to get this same reaction with the oil by pumping into the boiler a properly blended mixture of slippery elm, starches, sugars and tannin extracts.

We have found that we can successfully cope with most of the deleterious actions taking place in steam boilers with vegetable matters, and vegetable matters only, sometimes using from 5 to 10 per cent. of carbonate of soda to partially cut the starches and aid in the action of the sugars, but, correctly speaking, we are vegetarians on this subject, and do not believe that perfect results can be obtained from any other methods known to science.

THE CARE OF BOILERS.

THE boiler being the vital part of the steam plant, which again is the center of all motion and life in a mill or factory dependent on that form of power, all the skill and attention possible should be directed to their preservation in good order, and at the smallest possible expense consistent with good results. To this end all means proposed should receive the careful consideration of those interested, so that the best plan applicable may be chosen in each place. It is evident that the same method is not practicable under all circumstances, for while the general principles involved are in all cases the same, the working out of these principles necessarily varies. Thus all water derived from wells where the underlying rocks are anything except granite or sandstone, contains a greater or less proportion of solid matter, varying, according to one list in my possession, from as little as 6.7 grains per gallon to as much as 353.8 grains per gallon. In the same localities the water of the streams is likely to partake to a considerable extent of the characteristics of that in the wells. So it may be said that over the greater part of the country it is impossible to procure even comparatively pure water. Even that which falls as rain and snow in inhabited localities contains impurities washed from the air in its descent, although the proportion is so small as not to interfere with its use in boilers, provided it could be obtained in sufficient quantity; but this, from the nature of the case, is impracticable.

Of course not all the solid matter found in well water is of the kind which forms scale. Lime and magnesia are the principal ingredients of scale, with at times a combination of iron and some organic matter, a mixture of iron especially forming a peculiarly hard and obstinate scale. The question of greatest interest to a man in charge of steam boilers is: "How shall I get rid of the scale in my boilers?" The correct answer perhaps smacks of the Hibernian, but I believe it to be: "The best way to remove scale from boilers is not to let it in." After a dozen years of experience with water containing seventeen to twenty grains of solids per gallon, the greater part being of the incrusting kind, I am satisfied that with a little care and the use of moderately good exhaust steam heaters, no trouble need be had with scale in a boiler which is well taken care of.

One great trouble in this matter is that owners are unwilling to allow the firemen reasonable compensation for the extra time

required to properly do the work connected with keeping the boilers clean. Some only allow a quarter of a day's pay for the time necessary on Sunday to wash out and clean up generally. It is safe to say that the fireman, unless made of sterner stuff than the majority of the race, does not, on an average, put in much more time than he is paid for. Other owners allow full pay for the day, depending on the engineer and fireman to keep the plant up to the highest condition possible. In one such plant with return tubular boilers, which has been run for fifteen years, with the kind of water just mentioned, no trouble has been had with scale on the boilers for ten years at least; and the heaters are not of the most recent construction either

Very much depends on the care taken of the heaters as to their efficiency, for if they are allowed to become foul, the accumulation of slush is liable to pass on to the boiler, at least, if the heater is one of the closed variety. While it is a little more trouble to take care of an open heater, as they are generally provided with some kind of a filter which requires some attention to keep in good order, they are, I think, a little more efficient in heating the feed water, while the proportion of steam condensed in the process, being pure water, is also of some advantage. Where the plant is of sufficient size to warrant the expense, or where the water is so hard as to require it as a measure of safety, the addition of a live steam heater of proper size will almost prevent scaling. The water being raised to the temperature of that in the boiler, practically all the incrusting matter is dropped by the water, which is then frequently filtered through a layer of finely-ground coke or similar substance, and so enters the boiler practically pure.—F. Riddel, in American Miller.

SHAFTING, PULLEYS, ETC.

IN designing a mill or manufacturing plant, says C. R. Tompkins, M. E., one of the most important features, aside from the arrangement for good and sufficient power, is the line of shafting and the necessary pulleys for the purpose of transmitting the power to the several machines to be used. Now, it is just as important that good judgment be manifested in this part of the plant as in any other. The fact is that much needless expense is often caused in the first instance, besides a continual loss of power in the second, by an injudicious selection of the shafting.

A line of shafting unnecessarily heavy, with pulleys and couplings to match, not only involves a greater expense in the first place, whether it is purchased by the pound or foot, but the extra amount of friction on the journals caused by that weight is a factor that should also be taken into consideration. It is a well-known fact that the frictional resistance with all bodies in sliding contact is in direct proportion to the weight pressing them together, so that the weight of a line of shafting with heavy pulleys, no matter what the speed may be, will exert a constant frictional resistance in proportion to the weight.

While there can be no question as to the economy in all cases of using a lighter shaft at greater speed than was formerly the case, still it is not advisable under any condition to go to extremes in either case, for the reason that, with a little forethought and calculation in the first instance, we may avoid either.

As a rule, in all modern mills and factories, the tendency has been toward lighter shafting and pulleys of small diameter, with a corresponding higher speed, and there is no question but much more satisfactory results have been obtained. The shortest and most reliable rule that has been found to obtain the torsional strength of all sizes of shafting, is to multiply the cube of the diameter by 600, and this product by the number of revolutions per minute, and divide by 33,000 for the horse-power. The ultimate torsional strength of a shaft is not the power required to twist it off, but a power not quite sufficient to give it a permanent set.

Now, according to this rule, which has been verified in many cases, a shaft 3 inches in diameter at 200 revolutions per minute should not be required to safely transmit 32 horse-power while by the same rule a shaft of 2 inches diameter of the same quality of iron running at 300 revolutions will safely transmit 43 horse-power. Now, all other things being equal, it is evident that where not over 35 horse power is required, a 2 inch shaft at 300 revolutions per minute is the most economical. For example, the weight of a line of 3 inch shafting 40 ft. long, without couplings and pulleys, is 955 pounds, while a 2 inch shaft of the same length weighs 424 pounds, a difference in weight of 531 pounds. Now, the frictional resistance, as before stated, is in proportion to the weight, and without any lubrication it is estimated that it amounts to 25 per cent., but with a good lubrication this may be reduced, according to the best authorities, to 8 per cent.

Now, taking 8 per cent. as the average, we find that with a 3-inch shaft we have a constant frictional resistance of 76.40 pounds to contend with, while on the contrary, the frictional resistance upon a 2-inch shaft amounts to but 34 pounds. Here an important question arises which has been frequently discussed, and that is whether the speed has anything to do with the frictional resistance.

One authority says that "with hard substances and within the limits of abrasion, friction is as the pressure, without regard to surface, time or velocity." In another place the same author states as follows: "A regular velocity has no considerable influence on friction; if the velocity is increased the friction is greater, but this depends on the secondary or incidental causes as the generation of heat and the resistance of the air."

Now, without entering into a full discussion of this question, if we take the question of speed into consideration, the argument is still in favor of the lighter shaft. We found the frictional resistance in the 3-inch shaft without taking the speed into consideration to be 76.40 pounds. Now, if we multiply this by the speed, as some contend it should be, we have a total resistance of 15,280 pounds per minute to overcome, while with the 2-inch shaft by the same proposition we have 10,200 pounds per minute to overcome, showing a difference in frictional resistance in favor of the 2-inch shaft of 5,080 pounds per minute.

Now, as to the question of pulleys. In order to obtain say 900 revolutions from a pulley driven from a 3-inch shaft at 200 revolutions per minute, it will require a pulley 36 inches in diameter, while the same power and speed may be obtained from the 2-inch shaft at 300 revolutions from a pulley 24 inches in diameter.

Now, in the foregoing argument in favor of lighter shafting and higher speed, the torsional strength of the shaft has only been taken into consideration, and while the torsional strength of a shaft of a certain diameter may be amply sufficient to transmit the required power with perfect safety, still the lateral strength must also be considered. A shaft, no matter what the size may be, in order to fulfill all the conditions of practical use, must possess sufficient lateral strength to stand the pull of the belts, together with the sudden shocks which may be sustained when heavy machines are started suddenly, and for this reason, under peculiar conditions, it may be advisable to use a shaft a trifle larger than the rule calls for. But under ordinary conditions, if the distance between the boxes or hangers is in proportion to the size of the shaft, it will not be found necessary to vary much from the foregoing rule.

One of the most common faults in erecting a line of shafting is in too great a distance between the bearings, and it is often the case that a shaft abundantly heavy is rendered ineffective from this cause, and when a machine is started the shaft springs, so as to cause the belt to slip, unless the pulley happens to be close to the bearing.

While it is good practice in all cases where the conditions will admit to run all heavy pulleys as close to the bearing as possible, still it is not always practical to do so, consequently the size of the shaft and the distance between the bearings should be so calculated that there will be sufficient lateral strength to admit of placing the pulleys upon any part of the shaft between the bearings.

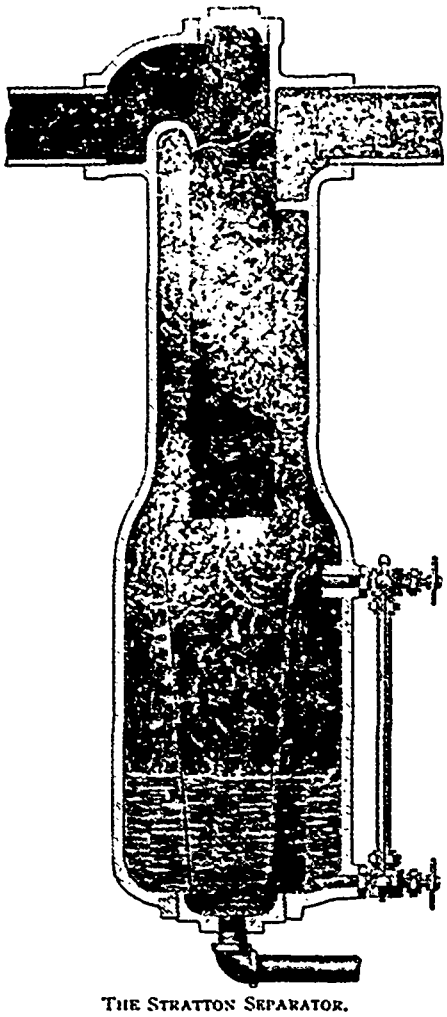
There is no question but as a general rule a shaft that possesses sufficient torsional strength to perform the work, with a moderate allowance for contingencies, will, if the bearings are placed at a proper distance apart, also possess sufficient lateral strength for all practical purposes.

In practical experience it has been found that the most reliable rule for this purpose is to take three times the diameter of the shaft in inches for the distance from center to center of the bearings in feet Thus a shaft of 2 inches in diameter should be 6 feet from center to center of its bearings. One of 2½ inches would call for 7 feet and 6 inches, while one of 3 inches may be 7 feet, and so on.

THE STRATTON SEPARATOR.

The following is a letter from Prof. R. C. Carpenter, of Sibley College, Ithaca, N. Y., reporting a test made of the Stratton Improved Separator this year:

"I send you with this letter a short summary of the test which we have made on the Stratton Separator. The results show that the separator is practically perfect, and removes all the moisture which can possibly be taken out by mechanical means. I think we will make another test in which we inject water into the steam pipe, thus increasing the percentage considerably of water in the steam supplied. This latter will not be of great practical interest, but will bring out, of course, the capacity of the separator for extraordinary conditions. If you have no objection I will publish a copy of this report in the next number of the Sibley Journal, and for that purpose would be pleased to have you loan us an electrotype showing vertical section.



THE STRATTON SEPARATOR.

"TEST OF STRATTON IMPROVED SEPARATOR.—For this test the steam pipe leading to the separator was surrounded for a portion of its length with a jacket which could be filled with water to any desired height, the purpose of the water jacket being to condense as great a per cent of the steam as possible. The discharge of steam from the separator was led to a surface condenser, where it was condensed and the amount carefully weighed. The drip of water discharged from the separator was led to a barrel standing on a pair of scales, and accurate weighings were made of the water taken out from the steam by the separator. A throttling calorimeter was placed in the steam pipe directly after the steam left the separator. Pressure gauges were placed either side of the separator. Observations were taken and the results reduced by Messrs. Collins, Hubbard and Thomas of the class of '94. The following is the general summary of the results: The steam supplied to the separator contained moisture, the percentage of which varied from a little over 5 to nearly 21. That discharged from the separator was in every case nearly dry, it containing in every instance less than 1 per cent. of moisture. The separator was worked up to its full capacity, and there was no appreciable reduction of pressure. The summary of the results of different runs is given in the appended table. During these runs the water was kept at a constant height in the separator:

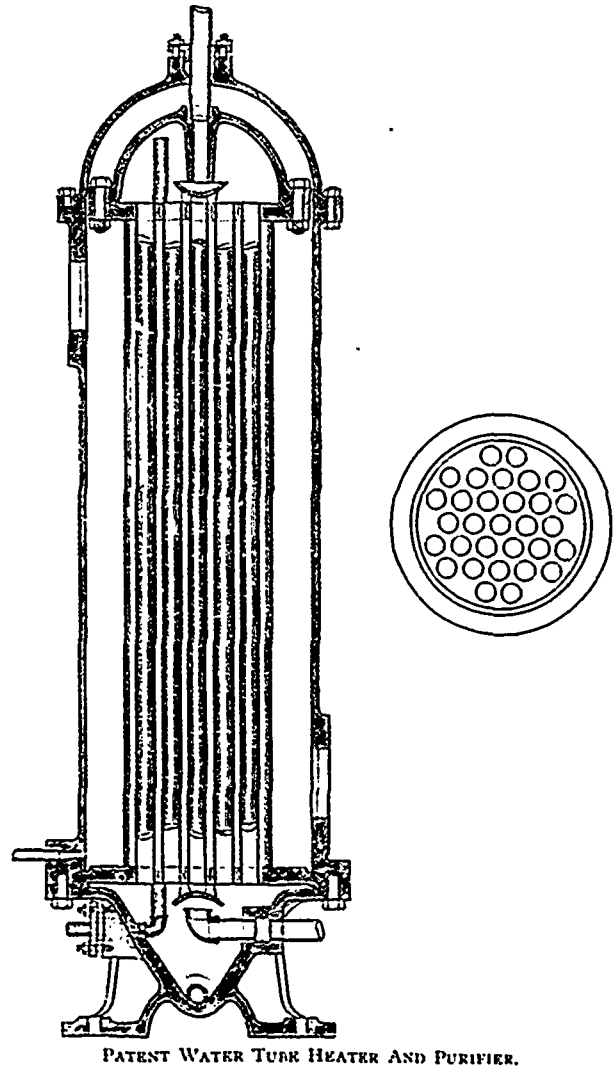
No. of Run.	Pressure of Steam.	Moisture in Steam Supplied Separator, Per cent.	Moisture in Steam Leaving Separator, Per cent.	Quality of Steam Leaving Separator. Per cent. of Dry Steam.
1.....	60	6.55	0.95	99.05
2.	61	17.2	0.94	99.06
3.....	62	15.31	0.9	99.1
4.	76	15.6	0.6	99.4
5.	61	20.9	0.8	99.2

The Goubert Manufacturing Company, New York city, who are sole manufacturers of the Stratton Improved Separator, are represented in Canada by Wm. T. Bonner, 415 Board of Trade Building, Montreal.

PATENT WATER TUBE HEATER AND PURIFIER.

WE herewith illustrate a patent water tube heater and purifier, manufactured by Laurie Bros., of Montreal. The manufacturers claim for these heaters that when applied as rated they will raise the temperature of feed water to from 210° to 212°, and that the impurities in the feed water that precipitate at boiling point will be deposited at the bottom of the heater, where provision is made for blowing it off.

As will be seen from the cut, the upper tube plate is entirely



PATENT WATER TUBE HEATER AND PURIFIER.

separate from shell or body of heater, thus providing for free expansion of tubes independent of any other materials used in construction. They are constructed entirely of cast iron and brass, making them almost indestructible.

The water entering at bottom (and being distributed by deflector) passes slowly up the tubes absorbing heat in its passage, to upper chambers, where it is still surrounded by exhaust steam till discharged.

The discharge pipe projects downward into chamber to avoid carrying scum from surface of water into boiler. A scum blow-off is provided, with discharge at bottom of heater as shown in cut.

ELECTRICITY FOR MINING.

AN important application of the three-phase system of long distance transmission of power has recently been installed and put in operation at the Silver Lake Mines, near Silverton, Col., where power is transmitted a distance of three miles through some of the roughest country in Colorado. It is attracting con-

FIG. 1.—THREE-PHASE GENERATOR FOR LONG-DISTANCE TRANSMISSION AT SILVERTON, COL.

siderable attention among mining men, as it is the first three-phase plant established in the Rocky Mountain region.

The success of direct current transmission has been thoroughly demonstrated by transmission plants operating, not only in Colorado, but elsewhere all over the world. The expense, however, inseparable from direct current transmission, precludes the utilization of that system in most places where the distance exceeds a certain limited number of feet. This will be readily understood when it is stated that if 100 H.P. can be transmitted by direct current one mile at 500 volts, 10% being allowed for loss in the line, the copper wire necessary will cost about $2,000, while for the same horse power transmitted by the same system for ten miles it will cost about $200,000. If, however, the three-phase current at 5,000 volts be employed to transmit the 100 H.P. ten miles, the cost will not be more than $2,000. In other words, a given horse power can be transmitted by the three-phase system at 5,000 volts, ten times further than a similar horse power by the direct current system at 500 volts for the same expenditure in copper. As, therefore, the question of dollars and cents is a most prominent factor in all transmission installations, the three-phase system, where long distance transmission is concerned, is the most practical system because the most economical, commercially speaking, and the installation at Silverton is a striking example of this fact.

The Silver Lake group of mines lies about four miles southeast of Silverton, and is situated at an altitude of 12,300 feet above the sea level. They are owned by Edward G. Stoiber. The ore mined carries both gold and silver, is of a comparatively low grade and requires concentration.

Previous to the installation of electricity, the mill, which is situated on the shores of the lake, near the mouth of the mine tunnel, was run by steam. Coal was brought to the steam engine by the zigzag path up the mountain shown in figure 3, and by the time it reached the furnace cost $8.75 a ton. This represented a monthly expenditure of almost a thousand dollars, and the expense proved a burden which went far to eat up the profits of the mine. Reform, therefore became imperative.

The plant is now operated by water power, which is brought from the Animas River, above Silverton, through a 3 x 4 foot flume, 9,750 feet in length, which carries 2,350 cubic feet of water per minute. Flume and trestle are shown in figure 4. One of the great advantages of electrical utilization is here demonstrated, for it was found less expensive to build this costly two mile flume, running from above Silverton to a spot where the necessary head could be utilized, and then to transmit the electricity back to the mine, rather than to continue to burn coal at the price which it brought at the mouth of the Silver Lake Mines.

The head of water obtained is about 180 feet; this develops on the water wheel shaft 640 H.P. The plant consists of two four foot double nozzle Pelton water wheels, with special buckets, belt connected to two 150 K.W. (200 H.P.) General Electric three phase generators.

The current from these machines is given out at 2,500 volts and is transmitted over a distance of a little more than three miles to the Silver Lake Mill and Mine.

The conductors are No. 3 B & S bare copper wires, one for each branch of the three-phase circuits. These are strung from the power house, shown in figure 2, up the mountain passes and through the rugged forbidding country shown in the illustrations. In one place where a chasm has to be spanned the wires leap from pole to pole a distance of 275 feet. They have been strung with especial care, as befitted the abnormal conditions. At each insulator the wire is run through a short piece of rubber tube, as an extra precaution against leakage. Lightning arresters are placed at each end of the line, and an additional safeguard against possible damage by lightning is provided in the shape of a barbed iron wire, which extends the entire distance of the line along the tops of the poles, and is grounded at every second pole. In this country, where the storms are frequent and the lightning disastrous in its effects, every precaution is taken to frustrate possible damage from atmospheric discharges. The most effective lightning arresters which have been found for this work are those which the General Electric Company itself manufactures.

In the winter time the snow lies thickly on the ground and all intercourse between the mine and civilization is almost cut off. Some idea of the difficulties of the road may be gathered by referring to figure 3, where the zigzag route up the mountain is shown.

Arriving at the mine, the current is supplied to a 100 H.P.

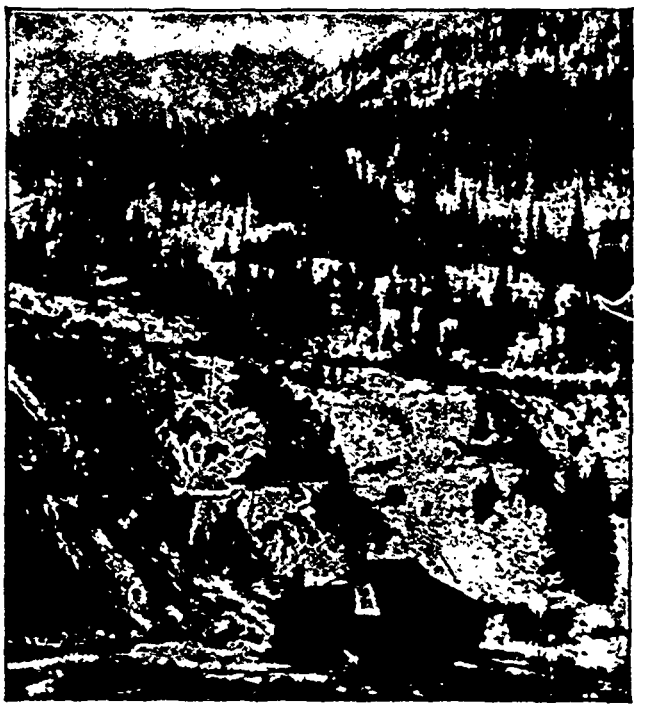


FIG 2.—POWER HOUSE AT THE END OF THE FLUME, SILVERTON, COL.

three-phase induction motor, run directly from the primary circuit. Another 100 H.P. motor, as well as one of 75 H.P., are located beneath the ground, and current is supplied to these at a pressure of 220 volts, the reduction in pressure being effected by step-down transformers. In addition, a 15 H.P. motor runs a pump, raising water from the lake to the mill, and one small 1 H.P. motor operates a blower and the lights for a bunk, office

and other buildings, both being connected to the secondaries.

The induction motor used is an excellent representation of the latest type of alternating current motor built by the General Electric Co. There are no commutators, collector rings or brushes; the field winding is conected to the circuit, but there is no connection between the armature and any external source of current. The three-phase currents rising and falling in the field windings induce corresponding currents in the armature winding, and the armature revolves. The field armature cores are so completely laminated that all loss from eddy currents is practically eliminated. The speed of the motor is at all loads practically constant. The starting resistance for preventing any excessive current in the armature winding, while gaining speed, is contained in the armature itself, and the handle shown in the cut serves to cut out the resistance when the motor is fully up to speed.

FIG 3.—ZIGZAG TRAIL UP THE MOUNTAIN, SILVERTON, COL.

The interest in this mine centres, of course, upon the economy induced by the electrical installation. The power used in the mill and the mines at the present time is more than three times as much as was used when generated by the steam engine previously employed. If, therefore, $1,000 a month or $12,000 per year would be economized by using the same power, an economy of not less than $36,000 a year is effected by the operation of the mine by electricity, and a greater power is available. This has allowed of the operation of machinery inside the mine for the first time.

Before such figures as these any question as to the economy of an electrical installation, when coal is anywhere near the price it is in this case, becomes irrational.

FIG. 4.—THE FLUME, SILVERTON, COL.

Joseph Brisbois, of Guelph, Ont., in the employ of the G. N. W. Telegraph Co. as repairer, was run over and killed by a Grand Trunk train recently.

EDITOR v. SUBSCRIBER.

DIE MUHLE, a paper printed in Berlin, Germany, indulges in some caustic comments concerning those subscribers who expect everything, and give nothing. It declares that a trade paper is expected to supply information very often outside of its sphere and field; that it must inform manufacturers of the particulars of its own business, even to the extent of showing them how to reduce expenses; must, in fact, be a general advertiser on all subjects within the commercial domain. If, says this paper, the editor should ask where he must get the information, the subscriber is apt to reply, "It is none of your business." The editor thereupon shows precisely what are the duties of the subscriber in relation to the journal he takes, and berates the reader for not supplying him with such facts as may come within his notice, and which, when developed, would probably prove to the mutual advantage of editor and subscriber. There is much force in this. Subscribers have it in their power to extend the usefulness of their trade paper by making suggestions and submitting facts; and he would, indeed, be an indifferent editor who refuses to consider them. Newspaperdom perhaps, puts it in the best possible light by saying that a man who subscribes for a trade paper does so, not only because he is alive to the interests of his trade in general, but because he expects to find in it—and generally does—information and suggestions of value in the conduct of his own business. Such a man reads his paper from end to end, advertisements and all, commenting as he goes along. Many things are jotted down on his memo pad, for everyday use, and for enquiring further into on his first visit to the market. And as it is necessary for a man to be wide awake nowadays in order to succeed in business, these are the men who subscribe to their trade journal, and are the advertisers' best patrons.—The Effective Advertiser.

IMPROVED CORLISS AUTOMATIC ENGINE.

THE accompanying illustration represents a Corliss automatic engine, as manufactured by Laurie Bros., of Montreal, for electrical purposes, with extra heavy fly wheel.

The general design is a modification of what is known as the girder frame engine. The cylinders, frame and pillow block are cast separate and bolted together. The guides (being circular) are bored and end of frame faced at one operation, thus securing perfect alignment with the cylinder. The frame at outer end of guides forms a complete circle, at which point a pedestal is placed, thus forming a very rigid arrangement. The steam cylinder has four valves, two for steam and two for exhaust, independent of each other in action, and placed so close to the bore of the cylinder as to leave the least possible amount of clearance. The steam valves are operated by means of bronze spindles or stems; the exhaust by steel spindles or stems. Either of the four valves may be removed by unscrewing the cap screws that hold the back end bonnet in place. The exhaust valves are located below the cylinder, thereby securing perfect drainage.

These engines are built from extra heavy patterns, and every possible precaution taken to prevent the possibility of accident or derangement.

MUCH INFORMATION IN A SMALL SPACE.

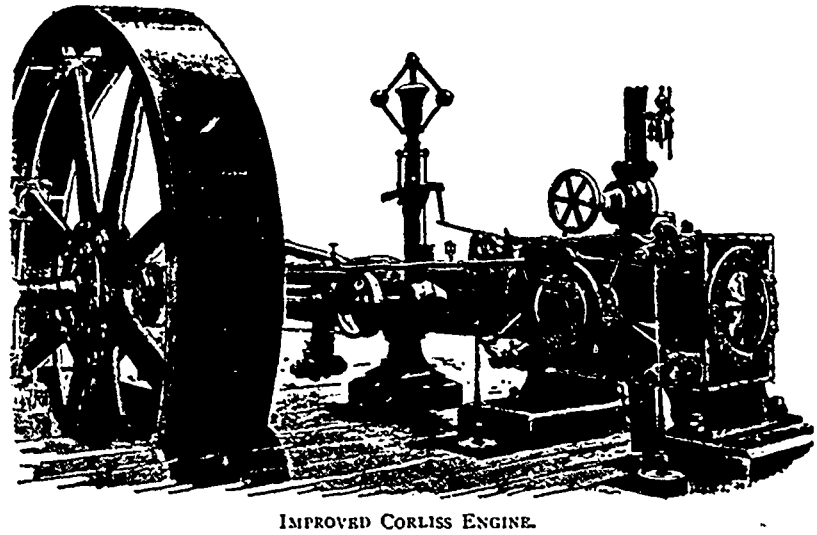
DROPPING a steel magnet, or vibrating it in other ways, diminishes its magnetism.

It is said that steel containing 12 per cent. of manganese cannot be magnetized.

Flames and currents of very hot air are good conductors of electricity. An electrified body placed near a flame soon loses its charge.

In charging a secondary battery, the charging electro-motive force should not exceed the electro-motive force of the battery more than 5 per cent.

Lightning has an electro-motive force of 3,500,000 volts and a current of 14,000,000 amperes. The duration of the discharge of lightning is 1-200,000 of a second.



IMPROVED CORLISS ENGINE.

The resistance of copper rises about 0.21 per cent. for each degree of Fahrenheit, or about 0.38 for each degree Centigrade.

A lightning rod is the seat of a continuous current so long as the earth at its base and the air at its apex are of different potentials.

The rate of transmission on Atlantic cables is eighteen words of five letters each per minute. With the "duplex" this rate of transmission is nearly doubled.

The effect of age and of strong currents on German silver is to render it brittle. A similar change takes place in an alloy of gold and silver.

A test for the porosity of porous cells consists in filling the cell with clean water and taking the per cent. of leakage. The correct amount of leakage is 15 per cent. in twenty-four hours.

If the air had been as good a conductor of electricity as copper, says Prof. Alfred Daniell, we would probably never have known anything about electricity, for our attention would never have been directed to any electrical phenomena.

A perfect vacuum is a perfect insulator. It is possible to exhaust a tube so perfectly that no electric machine can send a spark through the vacuous space, even when the space is only one centimeter.

For resistance coils, for moderately heavy currents, hoop iron, bent into zigzag shape, answers very well. One yard of hoop iron, ½-inch wide and 1-32 inch thick, measures about 1-100 of an ohm; consequently, one hundred yards will be required to measure an ohm.

Compression of air increases its dielectric strength. Cailletet found that dry air compressed to a pressure of forty or fifty atmospheres resisted the passage through it of a spark from a powerful induction coil, while the discharge points were only 0.05 centimeter apart.

An accumulator with seventeen plates, ten by twelve inches, is reckoned in horse power hours, equal to about 1 horse power hour. Taking this as a basis, it will require six cells for 1 horse power for six hours, or thirty cells for 5 horse power for the same length of time.

The voltage of a secondary battery must always be equal to or slightly in excess of the voltage of the lamp to be burned. For example, a twenty volt lamp will require ten secondary cells, but ten cells will support more than twenty lamps.

To obtain the length of wire on an electro magnet, add the thickness of the coils to the diameter of the core outside of the insulation, multiply by 3.14, again by the length, and again by the thickness of the coils, and divide by the diameter of the wire squared.

Blotting paper, saturated with a solution of iodide potassium, to which a little starch paste has been added, forms a chemical test paper for testing weak currents. When the paper (slightly damp) is placed between the terminals of a battery, a blue stain appears at the anode, or wire connected with the carbon or positive pole of the battery.—Boston Journal of Commerce.

PUBLICATIONS.

Mr. Street of the Ottawa Electric Company, is introducing a new meter ledger and system of keeping electric light meter accounts with customers, which appears to be much superior to the methods generally used. It effects a saving of time and book space. A customer's account, occupying from ¼ to ½ page, shows the meter readings, debits and credits for a number of years, so that the whole history of the account can be seen at a glance as well as the balance owing to the company at any time.

The publishers have favored us with a copy of the Stationary Engineer's Gazetter of Illinois, being a directory of chief engineers, and engineers in charge, owners of steam plant, etc., etc., within the boundaries of said State.

The September number of the Review of Reviews contains two articles which will be of special interest to electricians, as well as readable by all who watch the world's progress. One is "Nikola Tesla and the Electrical Outlook," the other "Industrial Niagara." Both are extremely interesting.

The Parry Sound Electric Light, Heat and Power Co. are applying for a charter. The company have been granted a five years franchise by the Town Council of Parry Sound, and have agreed to furnish incandescent street lamps of 50 c. p. at $17 per lamp per annum, and to supply lamps for residences at the following prices:—first five, 30 cents each; five additional, 25 cents each; all over ten, 20 cents each. For stores, first two 50 cents each; two additional, 40 cents each; all over six, 25 cents each, with special rates for churches and public halls.

The tender will probably be accepted of the St. Thomas Street Railway Company to light the streets of the city for eight years, from January 6th, 1896, with 90 electric arc lights, 2,000 candle-power, cedar poles on a moon light schedule of 305 nights a year, at 25 ½ cents per lamp per night. The annual cost of lighting under this scheme will be $7,200. The present cost of 31 electric lamps of 1,200 candle-power, and 98 gas lamps, is $5,226, and the cost of their continuance under a proposition from the gas company for a renewal of their contract would be $3,820.

An order has been placed by the Michigan Central Railway Company, with the General Electric Co., of the United States, for two powerful search lights, which will be used to illuminate Niagara Falls. These lights will each have a brilliancy of 100,000 candles, and will be operated with different colored lens. The power to generate the current will be taken from the Niagara river. The effect is expected to surpass anything of the kind to be seen in the world. The only similar attempt at illuminating water falls is that to be seen at the Rhine Schloss, Laufen, Germany.

SPARKS.

There are female locomotive engineers in Colorado and Kansas.

The project of a Pacific cable is likely to be much advanced by the visit of Mr. Hosmer of the C. P. R. telegraph, and Mr. John W. Mackay, the American millionaire, to the Pacific coast.

The telephone, it is said, is not making much progress in Russia. And no wonder! Fancy a man going to the 'phone and shouting, "Hollon, is that you, Divsostkivchsmartvoiczski?" "No, it s Zollemschouskaffirnocknstiffsgowoff, who's speaking?" "Sezimochockiertrjuaksmzyskischohemoff. I want to know if Xliferomanskeffiskillmajuwchzvastowskskweibierski is still stopping with Dvisostkivchsmartvoiczski."—The Katipo.

The first electric boat on the Rideau canal made the trip from Ottawa a few days ago, in charge of Mr. O. Higman, chief electrician of the inland revenue department of Canada. The Minosee, an Indian word signifying beautiful boat, is thirty-seven feet in length with a beam of seven feet, carrying fifty-two storage batteries, with a four horse-power motor, and when charged she will run about seventy-five miles. The wheels and rudder are attached to the same shaft and so arranged that one man can manage the motor and steer. Her average speed is eight miles an hour. She will accommodate thirty persons comfortably.

Messrs. Wm. Kennedy & Sons, Owen Sound, have an order from the Sault Ste. Marie Water, Light and Power Co. for eighteen water wheels of the latest "New American" type. The wheels are to be 57 inches in diameter and aggregate 5,868 h. p. They are to be used in driving the machinery of the large wood-pulp mill being erected by the above company at the Sault Ste. Marie, Ont.

ELECTRIC RAILWAY DEPARTMENT.

CANADIAN ELECTRIC RAILWAYS.

WHILST speaking needed words of caution to the Canadian Electrical Association at its annual convention in Toronto in 1893, President J. J. Wright took no optimistic view of electrical possibilities when he referred to the wonderful future ahead of the electric railway. The events of the past two years have furnished much evidence in this direction.

The CANADIAN ELECTRICAL NEWS placed itself in communication some time since with the managers of the various electrical railways in Canada, with the purpose of ascertaining what progress had been made in this direction. We have to thank a considerable number of these for the ready response made to our inquiries, and from the data thus secured we are able to present a fairly full statement of the extent of the electric railways of the Dominion.

Altogether there are about 30 street and suburban railways in Canada. The large majority of these are operated by electric power, though a few still hold to animal power.

Nearly $10,000,000 capital, or to give the exact figures, $9,905,000, is represented in the 12 railways of which we give statistics below. 255 miles of road is covered by these companies, who operate together 387 motors and 144 trailers.

To a large extent a uniform fare is charged by the different street railways of the country. Except in the case of suburban roads, where the fare must be regulated by the length and conditions of travel, five cents is the usual fare, or 6 tickets for 25 cents, 25 for $1.00, with 8 tickets for 25 cents at certain hours of the day, and children's tickets 10 for 25 cents.

The franchise of the different roads varies from 20 to 50 years. The Galt, Preston and Hespeler road, as also Hamilton, have a 20 years' franchise, with Toronto 30, and London, the highest, 50 years.

The most important railway from which an answer to our enquiries was not received at the time of writing, was Montreal, where there is about 70 miles of road, and which, since the adoption of electric power, has attained to remarkable success. The stock of the Montreal Street Railway is viewed in financial circles as one of the best investments on the market, and has been going up with leaps and bounds. No report is received from British Columbia, where there is a road of about 7½ miles length in Vancouver, and another of nearly double that length at Victoria. Aside from the Winnipeg Electric Street Railway, of which full particulars were received from the manager, Mr. G. H. Campbell, there is also a railway about 5 miles length operated by horse power. St. John, N. B, has quite a successful electric railway, and in Halifax and Yarmouth, N. S., there are two roads under operation. Of other roads that have failed to report may be named Belleville, Brantford, Kingston, Peterboro, Port Arthur, St. Catharines, St. Thomas, Waterloo and Quebec. With some of these animal power is still used, and with others, as Kingston, electric power has recently been brought into force. Approximating the mileage of these several roads at 187 miles, which is close to the figure, and adding this to the 255 mileage already noted, it may be said that there is 442 miles of street and suburban railways in Canada, or perhaps in round figures 500 miles.

Individualizing the reports received we take the leading cities first, and the statistics are as follows:

TORONTO.—Capital stock: $6,000,000. Officers: President, William McKenzie; superintendent, James Gunn; secretary, J. C. Grace; comptroller, J. M. Smith. Mileage, 81½. System in use: General Electric, Westinghouse, and Thomson-Houston. Motors, 166, trailers, 70. Power plant: two 1,600 h. p. engines with multipolar generators coupled direct, 800 K. W. each, working up to 2,000 amperes each at 560 volts; four 620 h. p. and one 430 h.p. engines, with 10 generators driven by belt, 200 K. W. each; output, 4,000 amperes at 560 volts. Capacity of total output, 7,000 amperes at 560 volts. Indicated horse power, 6,110. Period of franchise. 30 years from Sept. 1, 1891.

OTTAWA.—Capital stock authorized $1,000,000; paid up $814,800. Officers. J. W. McRae, president; W. Y. Soper, vice-president; T. Ahearn, managing director; James D. Fraser, secretary-treasurer; J. E. Hutchinson, superintendent. Mileage, 23. System in use: Westinghouse. 60 motors. Power plant: one 700 h. p. generator; two 400 h.p. generators; three 100 h.p. generators. Franchise: 30 years from 13th Aug., 1893.

HAMILTON.—Capital stock: $205,000. Officers: B. E. Charlton, president; E. Martin, Q. C., vice-president; J. B. Griffith, secretary-treasurer and manager. Mileage, 22. System in use: Westinghouse. 35 motors and 14 trailers. Power plant: 3 Wheelock, 260 h. p., and one Corliss 260 h. p. engine. Franchise, 20 years.

LONDON.—Capital stock: $250,000. Officers: H. A. Everett, president; E. W. Moore, vice-president; C E. A. Carr, manager and treasurer; S. R. Break, secretary; Charles Currie, assistant secretary; D. L. D. DeHart, superintendent. Mileage, 25. 60 motors and trailers. Franchise, 50 years.

WINNIPEG. Capital stock. $300,000. Officers: James Ross, president; W. Whyte, vice-president; William McKenzie, treasurer, F. Morton Morse, secretary; G. H Campbell, manager. Mileage, 16. System. Edison. 24 motors and 12 trailers. Power plant. one 900 h. p. Corliss engine (Laurie type), one Wheelock 250 h.p. engine, and three Edison generators. Franchise, 35 years.

WINDSOR, ONT. Capital stock: $500,000. Officers: John Coventry, M. D., president, Geo. M. Hendrie, vice-president; William J. Pulling, treasurer, James Anderson, secretary Mileage, 10. System in use. Westinghouse. 25 motors and trailer cars. Power plant. two Robt. Armstrong engines, 200 h. p. each, and one Brown-Corliss, 125 h. p. Franchise: 20 years from March, 1893.

SARNIA, ONT.—Capital stock: $50,000. Officers: J S. Symington, president, H. W. Mills, secretary and manager Mileage, 4. System, animal power. 9 cars and 21 horses. Franchise, 30 years.

NIAGARA FALLS, ONT. Niagara Falls, Wesley Park and Clifton Tramway Co. Capital stock $50,000. Animal power in use; about changing to electric. Mileage, 4 Plant: 8 cars, 20 horses. Franchise, 20 years.

NIAGARA FALLS, ONT.—Niagara Falls, Park and River Railway. Capital stock. $1,000,000. Officers. E. B. Osler, president; William Hendrie, vice-president, R. A. Smith, secretary-treasurer; W. Phillips, electrician, H. Rathery, superintendent; Ross Mackenzie, manager. Mileage, 13½; 12 miles double track. System in use: Canadian General Electric. 14 motors, one luggage van with motors, 16 trailers, and 10 observation cars with double trucks, motors, (41 in all). Power plant. one water power station with two 1,000 h.p. wheels, and three 250 h. p. dynamos; large steam station with two 150 h. p. engines, and two 125 h.p. dynamos. Franchise, 40 years. Charter admits of about 27 miles more line being constructed, viz.: to Fort Erie and Niagara-on-the-Lake, and also a railroad on the water's edge from the Falls to Queenston.

HAMILTON, ONT.—Hamilton, Grimsby and Beamsville Electric Railway. Capital stock, $200,000. *Officers:* C. J. Myles, president: T. W. Lister, vice-president; Adam Rutherford, sec.-treas.; A. J. Nelles, manager; C. K. Green, electrician. Mileage, 25. 7 motor cars, 1 trailer, 1 motor freight car, 3 trailer fruit cars. Power plant: 2 Inglis engines, 150 h. p. each, 3 boilers, 2 Westinghouse generators; Westinghouse electrical equipment.

GALT, ONT.—Galt, Preston and Hespeler Street Railway Co., Ltd. Capital stock, $100,000. Officers: Thomas Todd, president; R. G. Cox, vice-president; W. H. Lutz, sec.-treas.; W. A. Lee, manager. Mileage, 9. System: Westinghouse and Canadian General Electric. 5 motor and 3 trailers. Power plant: 2 Wheelock engines, 125 h. p. each; 2 generators—1 Westinghouse 85 K. W., 1 General Electric 100 K. W. Power house is located at Preston, being about the centre of the line. Franchise, 20 years. The company have further in the way of equipment a Baldwin steam motor, hauling capacity, 500 tons, with which freight is carried between Preston and Hespeler and the C. P. R. at Galt. The tracks connect with the C. P. R. and

are the same guage. There is also an electric freight car, equipped with 2 Canadian General Electric 1200 motors, and also a freight trailer for carrying less than car load lots. The tracks from Galt to Preston are on the highway, and between Preston and Hespeler a private right of way is held. The average freight amounts to about 600 tons per month, and passengers about 20,000 per month. Sidings are run into all the factory yards in Preston and Hespeler, so that freight can be loaded at their own doors. 30 passenger trains are run every day. The freight work is all done at night after 10 o'clock. This is the pioneer Canadian road, combining freight and passenger traffic, and has reached very marked success.

TORONTO JUNCTION, ONT.—Toronto Suburban Street Railway Co. Capital stock, $250,000. Officers: R. Wilson Smith, *president*; E. P. Heaton, *vice-president*; R. H. Fraser, secretary and manager. Mileage, 10. System: Edison, General Electric and Westinghouse. 5 motors and trailers. Power plant. 1 100 K. W. B. P. Edison generator, 1 150 h. p. engine. Franchise, 20 years.

THE COMING STREET RAILWAY CONVENTION.

THE convention of the American Street Railway Association, which assembles at Montreal in October, is exciting much attention from railway men, who look upon it as one of more than usual importance, on account of the questions which are likely to come before it. The association comprises not only the officials but also the electrical and mechanical experts of the leading railway companies of Canada and the United States, and therefore wields great influence, as well as containing the concentrated experience of a large number of able men. There are nearly 1,000 companies in existence, operating 13,000 miles of track, and representing a capital of something like $1,200,000,000, with a yearly earning capacity of from $125,000,000 to $140,000,000.

Referring to the questions likely to come before the convention, a writer in the St. Louis Globe Democrat says:—

Considerable speculation is being indulged in by the street railway men of this and other cities concerning the proposed action of the fourteenth annual meeting of the American Street Railway association, which is shortly to be held at Montreal. It was given out some time ago that the scope of the organization is to be enlarged and its character somewhat changed. At the last annual meeting formal steps were taken to bring about the change. The executive committee was instructed to elaborate plans. This, it is understood, has been done. The committee has not given out what kind of a report it is going to make. However, among some of the propositions to be presented is the establishing of a central bureau of information, which shall be charged with the duty of answering all questions propounded by members on problems affecting their interest. Questions of operating methods, of patents, of legislation, of franchise, etc., etc. The bureau is to be in charge of men well versed in law, patents, insurance and the like. To run a bureau of this kind, the promoters say, will require a great deal of money, that can only be obtained by subscription and by putting up of the dues. Opinion is divided as to the value of the bureau, in relation to its great cost to maintain. The large companies are, it is said, in favor of the scheme, and will insist on its establishment, while the small companies will object thereto for the reason of the large yearly assessment they will be called upon to pay. The annual dues at present are $25, when, under the new arrangements, the dues, it is expected, will be at least ten times that amount. This and the other equally radical changes contemplated is what has started the talk and the discussion in railway circles. Another change that will be made is holding of more executive sessions, and that, hereafter, the proceedings, aside from the reading and discussion of papers, will be secret. Heretofore the annual gatherings have been regarded more as a pleasure outing than a business assembly. The thoughtful ones are begining to see that more unity and a great deal more action is needed on account of the magnitude of the interests at stake, and the complications that are on the increase. There are many troubles and difficulties arising during the course of the year that bother many roads in different parts of the country. In other words, many roads are afflicted with the same annoyances at the same time. If all the troubles were referred to the bureau, much worry and expense would be avoided. This is the illustration given by the friends of the bureau. They say that the proposition for its establishment will be carried by a large majority, and that half of the benefits to be derived therefrom have not been told, and can only be known by those on the inside. They further state, that once started, its merits will be highly appreciated by all and voted a grand affair and acknowledged that it fills a long felt want.

THE BERLIN AND WATERLOO STREET RAILWAY.

THIS railway has been in operation for many years as a horse-car road. It is two and one-half miles in length, connecting the two thriving towns of Berlin and Waterloo, and has also a short spur line running to the Grand Trunk depot in Berlin.

The management has for some years been desirous of changing the road to be operated by electricity, but various obstacles have so far hindered the project. The road was originally built for light horse-car traffic; in the main part of both towns the old style of flat rails, weighing about 27 pounds per yard, were put down, while over the remainder of the line a 30 pound steel tee rail was laid. The road-bed was well graded and ballasted and is still in good condition. No very heavy grades are met with, the steepest being 4%, about 300 feet long, and the general being 2½%.

The closed cars in use were of a 12 foot body, and a number of 16 foot open cars were kept for summer use.

To change the road into an electric one, according to the most modern practice, would therefore have necessitated the discarding of all the old material and stock in fact, building and equipping an entirely new road. The company had for some time past not been making more than expenses, and the necessary funds for such a complete overhauling were not available.

In view of these circumstances, it was decided last winter, on the advice of the Company's consulting engineer, Mr. E. Carl Breithaupt, to utilize the old material in so far as possible and undertake the work of making the change.

The cars were in good condition. Three of the closed cars were altered and equipped as motor cars, a 4½ foot closed vestibule being built on at each end, thus making the car 21 feet over all. One of these was equipped with two Canadian General Electric "800" motors, using series parallel controllers, and the other two were each equipped with one 25 P Westinghouse motor. The two latter are used in the general service and the double motor car is kept as a spare and for special occasions, when one or two trailers can be used with it. Peckham trucks are employed throughout and give excellent satisfaction. The wheel base being 11 ft. 6 in. from centre to centre brings the main part of the car body, which carries the main part of the load, directly over it. The cars thus ride very easy and entirely without any rocking motion.

The road-bed was re-ballasted and re graded where necessary, but it required very little work, since the road bed was in good order and the ties were mostly sound and firmly imbedded. The old tracks were used throughout; at rail joints particular attention was given to secure a solid foundation and a rigid joint, and the track was double bonded throughout.

The track construction was the chief point of difficulty. It was feared by the management that the old rails would be too light for the heavier traffic, and to put down a new track using 52 pound rails would have involved too great an expenditure. As they are now used, the engineer expects that the old rails will serve for two or three years at least; at the end of that time it can reasonably be expected that the Company will be able to put down a new track. In the present work the bond wires were made somewhat larger than actually required, so that they can be cut off and used again. The only extra item of expense incurred in the complete reconstruction of the road-bed will therefore be the labor of bonding on the present track—a comparatively small item. The cost of operation will be somewhat increased, for a larger co efficient of traction must be allowed for with these rails, and the cost of track maintenance will also be slightly greater. In these respects this road will furnish some interesting data. It is Mr. Breithaupt's intention to make a series of experiments with special reference to track resistance.

Power is supplied from the electric station of the Berlin Gas Co., a 100 K. W. Edison bi-polar generator being used.

The new road has been in operation since May 18, and so far

the expectations as to increased traffic have been more than realized, and everything has worked well, though the system has already had some severe tests. On the occasion of the annual bicycle meet, July 1 and 2, the traffic was very heavy. A ten minute service was maintained and five thousand passengers were carried on the first day without any serious mishap.

The case furnishes a good example of what can be done in the way of improving street railway properties, which have depreciated somewhat, chiefly from the fact of their being out of date. Horse car traffic is at the present time too slow in any case, and particularly so in suburban and kindred work. It is not claimed that the Berlin and Waterloo road is a model one, embodying all the latest improvements in street railway work, but it has been put on a firm footing and is thoroughly well equipped; moreover, the work has been done cheaply and no money has been expended in utilizing old material, which will be wasted when this material is replaced.

THE COMING STREET RAILWAY CONVENTION AT MONTREAL.

We had hoped to be able to print in this number of the Electrical News the program of the convention of the American Street Railway Association to be held in Montreal from the 15th to the 18th of October. This cannot be done, however, owing to the arrangements being as yet incomplete, in consequence of which the program cannot be issued for perhaps a fortnight. A meeting of the Executive to further the arrangements was held in Montreal on the 5th inst., but nothing of importance was done. It is probable that a luncheon and drive will be given the visitors by the city council. Montreal can be depended upon to maintain on this occasion the enviable reputation it has gained for hospitality. We present herewith a portrait of the gentleman who will preside over the deliberations of the assembly.

Mr. Henry C. Payne, Milwaukee, Wis.
President American Street Railway Association.

SPARKS.

Arrangements are said to have been completed for the amalgamation of the St. Thomas Street Railway Co. and the Radial Electric Railway Co.

The Parry Sound Electric Light, Heat and Power Co. has commenced the construction of its plant. It is expected to be in operation by the 1st November.

Negotiations are in progress for an electric road between Renfrew and Portage du Fort. The distance is eight miles, and water power will generate the electricity.

The promoters of the Aylmer Electric Railway will be compelled to seek an extension of time for the construction of their road, as their charter will expire shortly.

Messrs. Howard, Leamy & Murphy, contractors for the section of the belt line railway extending from Hochelaga to Bout de L'Isle, expect to have the work completed in three months.

It is probable that the Hamilton and Dundas Railway will be changed into an electric road on the termination of the present lease in nine months time. It carries 250,000 passengers a year.

Electric power for manufacturing purposes is now being transmitted from the power house of the Cataract Company at Niagara Falls, to the aluminum works of the Pittsburg Reduction Company.

Mr. F. G. Mitchell will represent No. 5, London, at the convention of the Canadian Association of Stationary Engineers, Ottawa, 24th to 27th Sept., with Mr. Simmie, of the waterworks, as alternate.

The Knechtel Furniture Company, of Hanover, Ont., have purchased a water power at Maple Hill, and are said to be considering the question of transmitting electric power to manufactories at Hanover.

The prospect of the electric railway being built in Hull this year are not very good, through want of capital. It is expected, however, that the electric light service, for which the same contractor, Mr. Vaiu holds the franchise, will be completed.

The Village Council of Hintonburg are negotiating for the securing of the necessary right of way for the extension of the Ottawa Electric Railway Co.'s lines to that place, and as soon as these negotiations are successfully completed, the extension will be made.

It is reported that Scotch capitalists have sent a representative to Schomberg, Ont., to report as to the business prospects for a railroad, to be operated either by steam or electricity. The locality in question is one of the richest grain growing districts in Ontario.

The earnings of the Montreal street railway for August were $109,316.30. In the corresponding month of 1894 they were $90,202 66, showing an increase of $19,113 66. The largest receipts for any single day were on Saturday, the 17th, when they amounted to $4,404.04.

The Toronto Railway Company has issued £323,000 of first mortgage 4½ per cent. sterling bonds. Of this amount £250,000 was issued in Canada and the remainder in London. The subscription lists closed in Toronto August 2, when about £150,000 had been subscribed.

Chas. McLeod, a lineman employed by the Windsor, Sandwich & Amherstburg Street Railway, was badly injured by coming in contact with a loose wire, one end of which was lying on the trolley wire and the other touching the ground. The strength of the current he received was 500 volts. The doctor says he will recover.

A representative of the Canadian General Electric Co. has been in Kaslo, B. C., in connection with a project to supply the city with water by a somewhat novel plan. It is proposed to take water from the lake and force it into the mains by means of an electric pump, the power for which is generated by water on the river a short distance above the city.

Mr. E. Franklin Clements, of the Standard Telephone Co., of New York, is said to be endeavoring to obtain the consent of the Prince Edward Island Government to the construction of a transcontinental telephone system in that province. Mr. Clements is said to be also negotiating for the establishment of an electric street railway to be constructed by American capitalists in the City of Charlottetown.

The Lachine Rapids Hydraulic Company are proceeding with the construction of a dam 4,000 feet in length, for the purpose of generating electric power to be transmitted to the city of Montreal. It is expected that when the work is completed, the company will have 8,000 horse power at its disposal, and the contractors guarantee that the work will be completed, and that the company will be in a position to supply power by the 3rd of May, 1897.

It is proposed to form a company to supply Ashcroft, B. C., with water and electric light. Water is to be brought from the mountains to serve for household purposes and to furnish motive power for the electric plant.

Steps are being taken to incorporate a company to build an electric railway for both freight and passengers between Detroit and Port Huron. The road will run close to the river and lake St. Clair, through a territory not tributary to the Grand Trunk. Much of the right of way, it is said, has already been secured, and surveys made. The distance is 65 miles, and the cost of the road, power houses and equipments is put at six hundred thousand dollars.

The work of constructing the new electric railway at London, Ont., is being vigorously pushed forward. On one branch of the system a car has already been successfully operated, and an effort will be made to provide electric transit for the visitors to the approaching Western Fair. The construction of a substantial power station from which the system will be operated has been commenced. The line to Springbank has been completed and is in operation.

The Montreal and Toronto Street Railway Companies have recently inaugurated a new idea in the shape of excursion trains, which are handsomely fitted up, and are used for the purpose of conveying social parties and strangers visiting these cities, over the most interesting of the company's lines. This method of seeing the interesting features of cities has become popular in the United States, and it is believed will in time become equally so here. It has the advantage of being very inexpensive as compared with hiring carriages.

SPARKS.

The Aurora electric light plant has been sold by the Royal Electric Co., to the Metropolitan Lighting Co., who will introduce some radical changes.

R. S. Willison, who claims to have been injured last January by a motor car at Sherbourne and Carlton streets, has filed suit against the Toronto Railway Company for $2,000 damages.

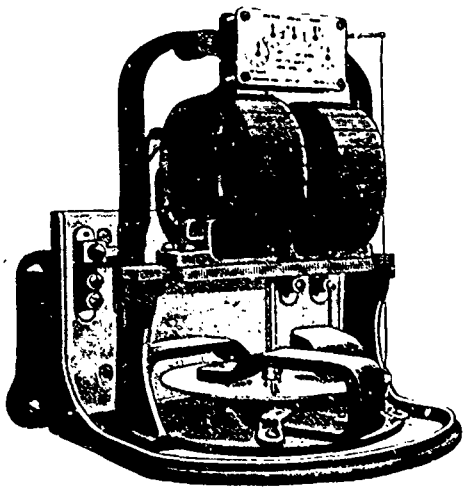
The work of erecting the trunk line for the Bell Telephone Company between Toronto and Montreal is progressing rapidly. It is within a few miles of completion between Toronto and Belleville, and is finished between Kingston and Mallorytown.

W. O. Ogilvie, the great miller, has presented the Winnipeg General Hospital with a pair of steam boilers with fittings, for the purpose of establishing an electric light plant in the hospital, and for other purposes for which steam is required.

The Royal Electric Company have contracted with the City Council of Charlottetown, P.E.I., to supply that city with 65 arc lights of 1,260 candle power each for $73 per lamp per annum. The company also agree to allow the corporation 50 cents per light when the lights are out.

The town of St. Marys recently advertised for tenders for electric light. The only tender received was that of Mr. H. L. Reesor, the present contractor. Mr. Reesor made two offers as follows: to supply 32 arc lights at $45 00 per light, and 24 incandescent lights at $87.00 per year; or to supply 13 arc lights of 1000 c. p. at $42.00 per light, and 55 incandescent lights of 30 c. p. at $15.00 per light per year. It was decided not to accept either of these offers, but to call a public meeting to discuss the best method of lighting the town.

CANADIAN GENERAL ELECTRIC CO.
(LIMITED)



METERS

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The only meter which measures both current and voltage and is perfectly accurate from one lamp to full load . . . . . .

Suited for Direct and Alternating Circuits, Arc Lighting, Railway and Stationary Motor Service.

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possess important advantages in mechanical construction, such as oil-insulation, separate switch and fuse boxes, and double secondary coils, which, together with Superior Electrical Design, have caused them to be recognized by the leading Central Station Managers as far in the lead of all others for . . . . . .

Durability which means saving in repairs and reliability of service.

Efficiency which means saving in power and plant capacity.

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TRADE NOTES.

E. S. Stephenson & Co., St. John, N. B., have ordered a 50 horse-power Monarch Economic boiler from the Robb Engineering Co.

The Dominion Coal Co. has placed an order with the Robb Engineering Co. for a 60 horse-power engine to run their machine shop at Glace Bay.

It is the intention of the Mica Boiler Covering Co., of 2 Bay street, Toronto, to remove their business to more extensive premises on Jordan street.

The Halifax Electric Railway Co. have ordered two 300 horse-power Robb-Armstrong engines, in addition to two of the same kind now under construction for them.

Messrs. Patterson & Corbin, of St. Catharines, are furnishing twenty-five cars for the London electric street railway, and four for the Montreal Park and Island railway.

The Canadian General Electric Co. are installing a direct connected engine and dynamo in the Ladies' College at Whitby. The engine is a 50 horse-power Robb-Armstrong.

The Dodge Wood Split Pulley Co., of Toronto, have been given the contract for supplying the split pulleys, and split friction clutch pulleys for the Ottawa Porcelain & Carbon Co.'s extensive new works at Ottawa.

The North Sydney Electric Co. have decided to enlarge their plant and have ordered two dynamos from the Canadian General Electric Co., and a 100 horse-power Robb-Armstrong engine and Monarch Economic boiler from the Robb Engineering Co.

The recently organized firm of Stilwell, Ralston & Co., at Hamilton, Ont., has been succeeded by Messrs. Stilwell & Co., who propose to manufacture incandescent lamps and other electric specialties. The advertisement of the new company appears in the present number.

The Dodge Wood Split Pulley Co., of Toronto, have supplied R. Thackeray, of Ottawa, with a very neatly designed rope drive for the transmission of the power required in the new extension just erected to his extensive planing mills. They have also supplied the required belt pulleys.

The Babcox & Wilcox Company report business as excellent, their orders for June alone exceeding 25,000 h. p. Of this amount they have orders for 6,000 h. p. of their water tube marine boilers from the Plant Steamship Company. All the boilers built by the Babcock & Wilcox Company at their Belleville shops are of wrought steel construction, having a capacity for 200 lbs. working pressure.

In the description published in the ELECTRICAL NEWS for August, of the fire-protection plant of the Gooderham & Worts Co., Ltd., Toronto, mention was omitted of the fact that the pumping engines were supplied by the Northey Manufacturing Co., Ltd., Toronto, and are of their latest type of compound condensing pumps of the "Underwriter" pattern. These pumps are to be finely finished, and will deliver ten or twelve fire streams of much greater efficiency than can be furnished by the ordinary city pressure.

The Royal Electric Company have in operation, in Machinery Hall, at the Toronto Industrial Exhibition, their S. K. C. two phase-alternating current system, and from their two-phase alternating dynamo, are supplying current at the same time for lighting incandescent lamps, arc lamps, and operating motors.

The Dodge Wood Split Pulley Co., of Toronto, have in hand two mammoth rope drives, for the E. B. Eddy Co., of Hull, Que., each drive to have a guaranteed capacity of 700 h. p. The drives are used in the transmission of power from new McCormack water wheels, being installed for the purpose of increasing the pulp grinding capacity of the company. The E. B. Eddy Co. are of the opinion that the rope drive is a long way ahead of any other means of transmission, especially for heavy work.

The Packard Lamp Co., Ltd., have recently issued a circular announcing that their new factory at St. Catharines is now in full operation, manufacturing lamps and transformers, and is equipped throughout with new and improved machinery, by means of which the product will in the future be of the most superior description. Mr. W. D. Packard has assumed the general managership of the company, with Mr. A. G. Powell as assistant. Prof. Thomas, of the Ohio University, who was chairman of the World's Fair Committee on incandescent lamps, has recently conducted a series of tests of Packard lamps, and concludes his report with the following statement: "Taking economy, maintenance of candle power, and freedom from blackening into account, the results obtained from these lamps are much superior to any heretofore published."

The Canadian Electric Repair Co., has recently been organized under very favorable auspices, and has begun business at No. 623 Lagauchetiere street, Montreal, with Mr. Geo. E. Matthews as manager. Mr. Matthews is well known in the electrical field, he having spent some 20 years in the mechanical and electrical business. He has had the advantage of being an early beginner with the Royal Electric Co., and succeeded in working himself up to be superintendent of the winding department, which position he held for eight years. He was also associated with Mr. David A. Starr, Montreal, for about eight months in a repair business. The above concern will undertake the rewinding of armature fields and transformers, also all other electrical and mechanical repairs required for electrical machinery and apparatus.

We take pleasure in announcing to our readers that the Boudreaux dynamo brush which has met with marked success in the United States and abroad, is now being introduced into Canada, the Boudreaux Dynamo Brush Co. having placed the agency for Canada with R. E. T. Pringle, of Montreal, who is now ready to fill all orders for brushes ranging in thickness from $\frac{1}{16}$ to $\frac{1}{2}$ inch, and in width from $\frac{1}{2}$ inch to 3 inches. The Boudreaux "Foliated" brush, it will be remembered, is made of anti-friction metal rolled into sheets $\frac{1}{200}$ inch thick, and folded and refolded until the desired thickness is attained. It differs essentially, therefore, not only in the material, but also in the manner of its application from the old "laminated" brushes. Besides its anti-friction properties, the Boudreaux brush also possesses in an eminent degree the non-sparking property, so that it preserves the commutator from wear, leaving it with a smooth and polished surface. It might be advantageous to consumers to make further enquiries regarding these brushes.

SPARKS.

The Treasurer of Montreal Association, No. 1, C. A. S. E., acknowledges through the press a large number of subscriptions to the Association's Mechanical Library.

Mr. Jeule Behm, an employee of the Montmorency Electric Power and Light Co., of Quebec, had his hands severely burned while working at a new switch board.

Several accidents have recently taken place in connection with the operation of the Oshawa Electric Railway, one being the burning out of the coils of the generator armature, and another the blowing out of the cylinder head of the engine at the power station.

At the annual meeting of stockholders of the New Brunswick Electric Telegraph Co., held on the 12th of August, the old board of directors was re-elected as follows.—C. W. Weldon, president; D. C. Dawson, secretary-treasurer; L. J. Almon, J. J. Tucker and D. M. Sutherland.

On the occasion of the civic holiday of the town of Galt, the Galt, Preston and Hespeler Electric Railway carried 1,300 passengers, and this number, it is said, would have been considerably increased had the weather not proved unfavorable during the early part of the day. Regular trips are now being made to Hespeler every half hour.

An invitation has been received to attend the observance of the twenty-fifth anniversary of the founding of the business of the American Electrical Works, Providence, R. I., and in connection therewith the 17th Annual Rhode Island Clam Dinner, tendered to the electrical fraternity at Haute Rieve, on Aug. 17th. *It was a matter of regret that we were unable to participate in the pleasur · of the occasion.*

The Town Council of Trenton, Ont., have awarded to the Brush Electric Co., of Cleveland, Ohio, a contract for lighting the town for the period of ten years. The company will, in addition to supplying incandescent light, also distribute power for manufacturing purposes throughout the town, having at its disposal one of the finest water powers in the Dominion, situated immediately north of the town, and capable of producing 12,000 H. P.

One of the largest shoe manufacturers in the city of Quebec has given in writing to the Montmorency Electric Power Co., his testimony to the advantage *which he has obtained by the use in his factory of electric motors*, as compared with the steam plant formerly employed. He states that apart from the fact that the motors are instantaneous in operation, smooth running, free from danger, occupy but little space and are less expensive to maintain, he has been enabled since putting them in to manufacture, with the same amount of machinery, from 200 to 300 pairs of boots more than formerly.

SPARKS.

A pair of 250 H. P. wrought steel boilers are being placed in the Bell Telephone Co.'s new building in Montreal, by the Babcock & Wilcox Co.

Charles McLeod, lineman of the Windsor, Sandwich & Amherstburg Electric Railway, was injured by coming in contact with a live wire on Aug. 22nd.

It is said to be the intention of the Kingston Electric Railway to secure permission of the City Council to construct a belt line on the eastern side of the city, similar to the one now in operation on the western side.

A test of the magnetic motor invented by Mr. Brintnell, of Toronto, described in a recent number of the ELECTRICAL NEWS, was recently made at the Hubbell Primary Battery Co.'s works at Ottawa. The test is said to have been so successful that it has been decided to commence immediately the manufacture of the machine.

Some of the leading citizens of the village of Cesaire have purchased a water power with the object of providing the municipality with electric light.

A satisfactory understanding has recently been reached at Ottawa, under which the Berlin and Waterloo Street Railway Co.'s cars will cross the Grand Trunk Railway on King street, Berlin.

Mr. H. Pim, the representative of the Canadian General Electric Co. at Vancouver, B. C., is engaged in promoting the installation of an electric light plant at Nelson, B. C. It is proposed to utilize the power from Kalso Creek.

It is reported that owing to what was considered to be an unreasonable demand on the part of some of the promoters of the Windsor-Selkirk Electric Railway, the conference which was to have taken place between the promoters of the road and St. Paul capitalists has been declared off for the present at least.

SPARKS.

The light committee of the Windsor Council have awarded to the Thompson Electric Co., a contract for dynamos, and to Leonard & Sons, a contract for engine and boiler.

The charter has been granted to a local company, with a capital stock of $2,000, to build and operate a telephone line in the counties of St. Maurice, Champlain, and Three Rivers, Que.

A lineman named Alfred Sarazin came in contact with a live wire while at the top of a telephone pole in Ottawa recently, and fell from the pole; fortunately a store awning intervened and broke the fall, thus saving his life.

Mr. D. H. Keely, superintendent of the Government Telegraph lines, is superintending the laying of the new telegraph cable for the Grosse Island quarantine service. The cable extends from the Quarantine Station to Isle Aux Reaux.

Mr. Fraser, Secretary of the Toronto Suburban Street Railway Co., has recently held conferences with the Reeves of the townships of Etobicoke, Markham and York, and with the warden of the County of York regarding the extension of the company's line to the village of Islington.

The New Westminster and Burrard Inlet Telephone Co., has purchased the interest of the local telephone company at Kamloops, B. C., and is about to rebuild and put in good order the system. The arrangements were carried out on behalf of the purchasers by Mr. H. W. Kent, Manager.

In view of the application of the Merchants' Telephone Co. to the Montreal City Council, for exemption from taxes, the Bell Telephone Co. have requested a similar concession, urging the fact that they have been giving a good service at a cost averaging only 11 cents per day to each subscriber, while the average number of calls for each subscriber is twelve, as a reason why their petition should receive consideration.

The control of the Dundas Telephone Co.'s business has recently passed into the hands of the Bell Telephone Co., and new officers have been elected as follows:—W. C. Scott, Toronto, president; W. J. Gilmour, Brockville, secretary; W. Gardener, Winchester, treasurer; directors, W. J. Gilmour, Brockville; S. S. Reveller, Winchester; J. E. McFarlane, Montreal; H. N. Horton, Montreal; W. Gardener, Winchester.

Messrs. French & Hardill, of Stratford, Ont., are said to have invented an improved steam engine, in which the utilization of the steam in the cylinder is effected on a new principle. The most novel feature of the invention is, that there are two piston rods working in opposite directions in the cylinder, the stroke commencing at the centre. A small model of this type of engine has been tested with a 3 H. P. dynamo with satisfactory results.