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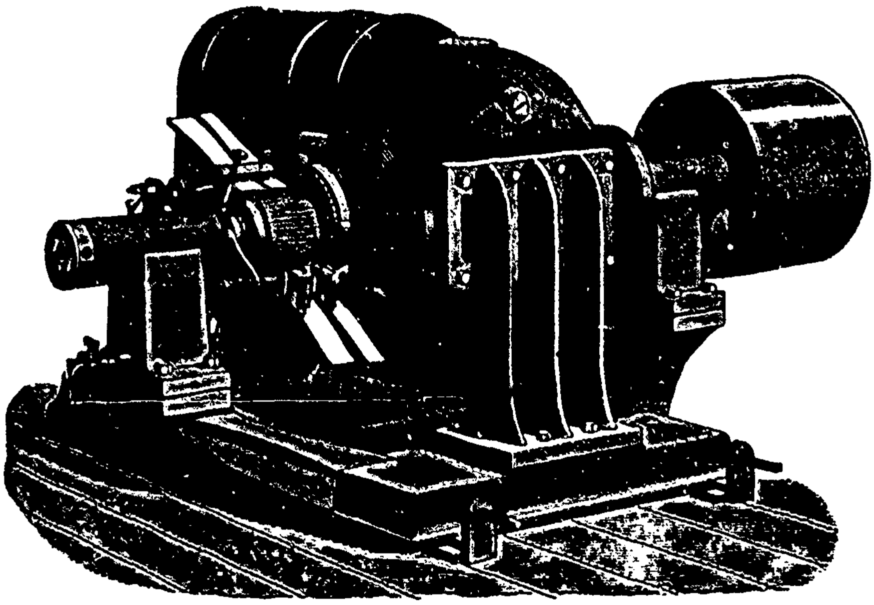

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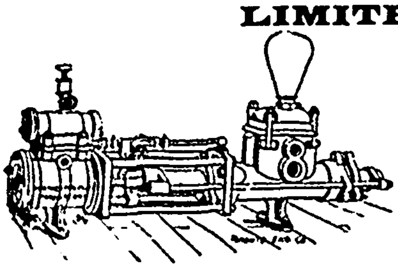

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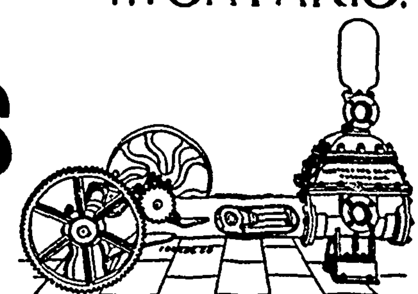

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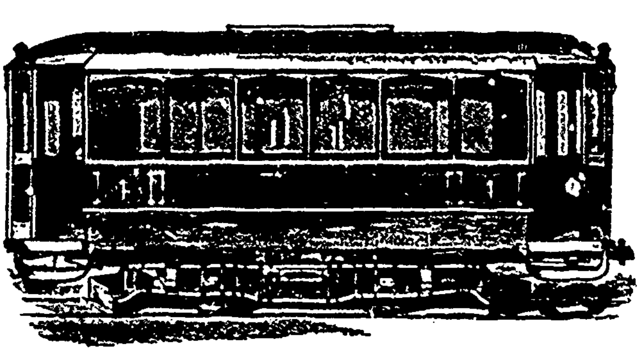

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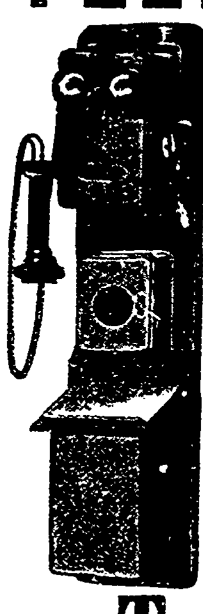

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CANADIAN

ELECTRICAL NEWS

AND

STEAM ENGINEERING JOURNAL.

VOL. III. | JULY, 1893 | No. 7.

THE LATE JOHN A. WILLS.

IT becomes our painful duty to chronicle the unexpected death on the 16th of June, of Mr. John A. Wills, Chief Engineer at the Toronto Custom House. Mr. Wills, who was in his 48th year, was possessed of a naturally strong physical organization, and until the last two years enjoyed the best of health. Of late he was a sufferer from Bright's disease, and early last spring passed through a severe illness which several times threatened to have a fatal ending. Greatly to the comfort of his family and many friends, what seemed to be a marked improvement in his condition suddenly manifested itself two or three weeks ago; his appetite returned, he gained strength rapidly and was able to go down town. But a few hours previous to his death he drove around town with a friend who was on a visit to Toronto. After returning from the drive he lay down to sleep—which proved to be the sleep of death—for he passed quietly away a few hours later without having regained consciousness.

THE LATE JOHN A. WILLS.

Mr. Wills was one of the best known and most popular men of the city, and his death came as a great surprise and grief to thousands of his fellow citizens.

The deceased was a native of Ottawa, in which locality his parents were among the first settlers. After graduating from college, he entered as an apprentice the machine shops of Messrs. E. & C. E. Gilbert, at Montreal, who at that time were the principal manufacturers in Canada of marine engines. On completing his apprenticeship he went to the New England States, where he spent several years, mostly at Fall River, Mass, where he met and married the estimable wife who survives him.

He returned to Canada, and received the appointment of Chief Engineer of the Dominion Parliament Buildings, which position he held for three or four years, when at his own request he was transferred to Toronto and assumed the duties of the position which he occupied at the time of his death and for seventeen years previously.

He always showed a desire to assist his brother engineers. He was the first Registrar of the Ontario Association of Stationary Engineers, and in May last was elected to the Presidency. He was also a member of the Canadian Association of Stationary Engineers, and Chairman for the present year of the Technical School Board. He likewise filled prominent positions in connection with the Masonic order, the A. O. U. W., and the Orange Society.

His cheerful, sympathetic disposition made for him a multitude of friends, to whom his sudden death is the subject of profound regret. A wife, seven sons and one daughter mourn the loss of a beloved husband and father.

The National Electric Tramway Company, of Victoria, B. C., has purchased the business of the Victoria Electric Light Company of that city for the sum of $20,000. The plant purchased embraces dynamos, 30 miles of wire and 3,700 lamps. The purchasers intend to largely increase the capacity of the lighting plant, and to employ water power for the generation of current for both lighting and tramway purposes.

THE CANADIAN ELECTRICAL ASSOCIATION.

SEVERAL meetings of the Committee on Statistics have lately been held. A form of schedule has been drafted, which embraces enquries for statistics which would show the extent of the electrical industries of Canada, and the conditions under which they are being conducted. Copies of this schedule will be immediately forwarded to every firm in the electrical business in Canada, with a request that the blanks be filled in with the information sought to be obtained, and which if secured should prove to be very useful. The deputation which a few months ago visited Ottawa to oppose the bill for the inspection of electric lighting, greatly felt the need of statistics such as those which the Association is about to attempt to secure. It is hoped that persons engaged in any department of electrical business to whom copies of this schedule may be sent, will promptly supply the information required.

TORONTO ELECTRIC LIGHT CO.

THE Toronto Electric Light Co., in addition to having recently doubled the size and capacity of their central station, have erected handsome new business offices facing on Esplanade street, into the possession of which they have just entered. The new office building, which by the way was erected from the design and under the supervision of the versatile general manager, Mr. J. J. Wright, includes a commodious business office and an office for the manager on the ground floor, a large board room, and sleeping accommodation for officials of the company whose duties at times prevent them from reaching home. Of course the latest equipments in the way of electric bells, speaking tubes, etc., are employed. The office on the ground floor are handsomely finished in quartered oak, having stained glass windows, and comfortable looking fireplaces of pressed brick. We congratulate the company and the general manager upon these indications of progressiveness and prosperity.

PERSONAL.

Mr. John Bain, who for twelve years has been in the employ of the R. G. McLean Co., of Toronto, has been appointed to take charge of the water power station of the Niagara Falls Park and River Electric Railroad. Mr. R. G. McLean, on behalf of Messrs. R. G. McLean & Co., and of the employees of that firm, presented Mr. Bain before leaving for Niagara with a gold-headed cane and diamond pin, as a token of esteem. Mr. Bain is a member of the C. A. S. E., and is held in the highest respect by all his acquaintances, whose best wishes will go with him to his new position.

There are already a number of applicants in the field for the position made vacant by the recent death of Mr. John A. Wills. The salary is $1500 per year.

We have received from the Columbia Lamp Co., of St. Louis, a large size portrait framed in oak of Henry Goebel, who is claimed to be the original inventor of the incandescent lamp.

The Ottawa Electric Street Railway Company, at its annual meeting a few days ago decided to establish a car manufactory as a separate department, for which purpose a capital of $50,000 will be employed.

A QUESTION OF PRIORITY.

HAMILTON, June 15th, 1893.

Editor ELECTRICAL NEWS.

DEAR SIR,—In a recent article in the *Electrical Review* of New York, the writer, Mr. Allen R. Foote, claims to have been the "first in the field" in suggesting that an arc light be known by its amperage and voltage only, and not by candle power. Now, while we do not make any claim to priority in the matter at all, we beg to state that the contract made between this city and our company calls for lights of 10 amperes at 55 volts, and says nothing about candle power at all, and we have no doubt the same will be found to be the case in several other places where arc lights are being supplied on city contracts. We claim, then, that Mr. Foote's suggestion was nothing new under the sun in 1890, as our contract has now been running nigh on to four years.

Yours very truly,

THE HAMILTON ELECTRIC LIGHT & POWER CO.

D. Thomson, General Manager.

QUALITY OF ARC LIGHT CARBONS.

Editor CANADIAN ELECTRICAL NEWS.

SIR,—I note in a recent number of The *Electrical Review*, of New York, a short article on the "Development of Arc Light Carbons," in which the writer is made to say that, "A carbon manufacturer five years ago would make a poor showing if tested in comparison with one of the present day." I am in a position to say that just the opposite is the case. I had oppertunity not very long ago to see tested some Wallace diamond carbons (so called) that were manufactured away back in the early period of the electric lighting industry, and which burned better, lasted longer, were more evenly coated, and fully 50% better in efficiency than most of the carbons in use at the present day. True the price of them was about 10 cents a piece, but to say that they were of poor quality or not equal to those now manufactured is incorrect as any one who has had the handling of arc lights from the start to the present day can amply testify.

Yours truly,

CENTRAL STATION MANAGER.

MOONLIGHT SCHEDULE FOR JULY.

Day of Month.	Light.	Extinguish.	No. of Hours.
	H.M.	H.M.	H.M.
1......	P. M. 8.00	P. M. 10.40	2.40
2......	" 8.00	" 11 10	3.10
3	" 8.00	" 11.30	3.30
4......	" 8 00	" 11.50	3.50
5......	" 8.00	A. M. 12.20	4.20
6......	" 8.00	" 12.50	4.50
7	" 8.00	" 1.10	5.10
8	" 8.00	" 1.40	5.40
9......	" 8.00	" 2.20	6.20
10......	" 8.00	" 3.10	7.10
11......	" 8.00	" 3.40	7.40
12......	" 8.00	" 3.40	7.40
13	" 8.00	" 3.40	7.40
14......	" 8.00	" 3.40	7.40
15......	" 8.30	" 3.40	7.10
16......	" 9.00	" 3.40	6.40
17......	" 9.20	" 3.50	6.30
18	" 9.40	" 3.50	6.10
19......	" 10.00	" 3.50	5.50
20......	" 10.20	" 3.50	5.30
21......	" 10.40	" 3.50	5.10
22	" 11.00	" 3.50	4.50
23	" 11.20	" 3.50	4.30
24......	" 11.50	.....	4.00
25......	....	" 3.50	
26......	A. M. 12.20	" 3.50	3.30
27	" 1.20	" 3.50	2.30
28	No light.	No light.	....
29.	No light.	No light.	
30......	P. M. 7.50	P. M. 9.50	2.00
31......	" 7.50	" 10.00	2.10
		Total,	143.50

A company is said to have been formed for the purpose of cleaning and repairing incandescent lamps, the bulbs of which have become blackened and the filament impaired by use. The process, as described, consists of cutting a hole in the glass and by mechanical or chemical means cleaning the interior of the bulb, re-flashing the carbon, exhausting the bulb and resealing it.

THE ELECTRIC HEATER. †

By THOMAS AHEARN.

THE increasing interest manifested in electric heating apparatus during the past year throughout the United States and Canada is highly satisfactory and, without a full knowledge of what interesting application of heating devices may have been made in the United States, I will endeavor in this paper to outline what we have accomplished in Canada, and more particularly in the city of Ottawa.

The ideas relating to the limited field of electic heating are fast disappearing, and the notion that an electric light or railway plant, unless operated by water-power, cannot profitly introduce electric heat, is but an instance of history repeating itself, as witness the introduction of the telephone, incandescent light, etc.

When friction is overcome, heat is produced, whether the friction be the resistance of any portion of an electric circuit or of a purely mechanical character, as, for example, the application of the ordinary car brake; the resultant equivalent in each case appears as heat, so that if one or five horse-power of electrical energy be absorbed in an electric heater the full amount is converted into heat.

A mechanical example of this conservation of force may be demonstrated by rubbing the right hand on the coat sleeve of one's left arm. If the rubbing is brisk and continued, an unpleasant heating of the hand will result; the force expended in the muscular effort of rubbing results in an exact equivalent of heating of the hand, and the coat sleeve rubbed. This result is practically analagous to the heat developed in the heating wire of an electric heater. The resistance (or friction) offered, as in the rubbing of the coat sleeve, results in the developing an exact equivalent of heat.

The operation of the electric heater may also be compared to that of an incandescent lamp, in which, as is well known, good conductors of electricity are carried to the terminals of the lamp filament, and the latter purposely made a poor conductor, in order that the resistance offered by the filament and overcome by the current may produce a sufficiently high degree of heat to give the desired light. Although light alone is the object sought, it is but an accompaniment of the incandescence of the filament. In the electric heater, heat alone is desired, and heat alone is present.

The size and length of the lamp filament and wire of the heater are both determined in very much the same manner, excepting that in the case of the heater, the calculation for amount of wire does not subject the heater wire to such a degree of heat as in the case of the incandescent lamp. The size and length of wire employed in a serviceable electric heater should be such that the heat developed will not be sufficient to destroy it by oxidation of fusion. This is greatly assisted by the design and other conditions of manufacture, and in the case of my cylindrical 500 volt upright car stove, the inlet of cooler air at the bottom, and its rush through the heated cylinder, results in a vigorous circulation of the air through the space to be warmed, and this displacement of hot air by cooler air constantly relieves the heater wire within the stove.

Instead of making heaters on the plan of the rheostat, I have found that for marked results, and more particularly for the air draught, it is desirable to conserve the heat within the heater up to a certain degree, above which the construction of the heater should not permit the wire to reach.

I have also concluded that iron wire is most desirable, and among many of the points in its favor is that its resistance increases with the heat. The benefit of this quality is felt when the electromotive force is increased, as frequently happens for short intervals in nearly all classes of circuits.

By the method of construction and the use of good non-conductors of heat, as insulation and packing, the heat developed in small water heaters and large water furnaces is directed to the copper water-containing vessels around which the heating wire is wound; the heat is quickly transferred from the wire to the copper vessel, which can never reach a very high degree of heat. The air draught in my other heater operates in very much the same manner as the presence of the water in the liquid heater.

It is an interesting fact that the good conductors of heat are also the good conductors of electricity, and the poor for one is also poor for the other. This conductive quality, which is com-

† Paper read before the Chicago Electric Club.

mon to both forms of force, is very suggestive of a close relationship, which doubtless future investigation will determine. With the good conductors, such as copper, the current may be imagined as gliding freely through the atoms of the copper; while in the case of the comparatively poorer conductor—iron—the atoms may be pictured to throw themselves, like barriers, across the track of the current, this friction (or as we electrically term it, resistance) resulting in the development of heat. The mutual convertibility of the various natural forces is evinced from the combustion of coal in a power house, the dynamo converting the energy supplied by the coal into the convenient form of electricity, which is transmitted along wires to electric heaters placed at different points in the circuit, where we again have heat as at the starting point, the heater in turn giving up its heat to the surrounding air. It is evident thus, that from electricity heat may be obtained. It is also true that from heat we can obtain electricity as in the ordinary thermoelectric pile—the application of heat to the junction of the dissmilar metals of the pile will be demonstrated by the movement of the needle of the galvanometer.

I will now proceed to a brief description of some of the electric heating installations which have been in successful operation during the past winter.

In July of last year I had erected in the car shop of our local electric railway a baker's oven eight feet square, which was built of brick in the usual way, excepting that within the oven, and set in the foundation, were placed two of my 20 ampere, 50 volt cylindrical stoves, the interior of the oven being whitened and lighted with incandescent lamps; a small window looking into the oven, and provided with three panes of plate glass, separated from each other by air spaces, being provided for the purpose of observing the process of baking, cooking, etc. The oven was also equipped with a clock and a pyrometer, which latter instrument recorded the degree of heat within the oven. The pyrometer indicating 400 degrees Fahrenheit, a neighboring baker tried a few pans of buns. The process of baking was watched with much interest, and from the puffing up of the dough to the pretty brown finish could be seen through the window of the oven which, as before stated, is provided with incandescent lamps. A short time after a full dinner of one of our leading hotels was cooked, including a 21 pound roast of beef, several turkeys, ducks, lamb, etc. This electric dinner was served to the regular guests of the hotel, together with a distinguished company of invited guests. The cooking of the meats was pronounced perfect, and the time occupied in cooking was 30 minutes less than is usually required to do the same work in the hotel range.

It may be interesting to state that this oven has been in full blast since it was started, and the current has been applied constantly night and day without trouble of any kind, and it is now used in drying out repaired electrical parts of railway equipments.

At the Central Canada Fair, held in this city in September of last year, a baker's oven the same as described was erected in the main building, attended by a staff of bakers. The oven was provided on one side, with a window, through which our delighted ruralists gazed in wonder. The oven proved the great card of the show, and the presence of a special policeman was required to keep the crowd moving. The baker started in selling a small bag of buns at five cents on the first day, but the law of demand justified him in increasing the price to 25 cents on the last day of the exhibition, when the supply was not sufficient although 14 pans were turned out every 14 minutes. In the same building the Women's Christian Temperance Union Dining Hall was made somewhat more attractive than in former years by the use of large electric water heaters, which supplied a dozen smaller heaters placed conveniently, and in which were made tea and coffee. The outfit was kept in continuous operation during the Fair, and although hard pressed by the crowds present, the supply was ample; no other means of heating water was employed. The success of this display will be best appreciated by the fact that the financial results were for the first time in many years of a satisfactory nature.

An ordinary hot water radiator connected with an electric furnace placed in a pit below the door, lighted by incandescent lamps and covered with an iron grating flush with the floor, attracted the attention of householders. The absence of a chimney and other accessories of a hot water coal furnace added to the fact that the closing of a switch only was necessary to obtain heat, which might be continued indefinitely without dirt, dust or labor, were doubtless the main reasons for the innumerable inquiries made as to the cost of operation, etc.

As no long continued test of this form of hot water house heating had ever been made, I concluded that only two installations of this description should be made during the winter just passed.

The first installation was made for the purpose of heating a gentleman's conservatory in this city. The furnace was placed in the basement, the controlling switches on the floor above, and all connected with the 50-volt lighting circuit. The total amount of pipe employed in the conservatory was 300 feet, the current absorbed being equal to three horse-power. The amount charged by the light company was based upon the cost of an equal amount of power from motor circuit. The operation of this plant has been a great success, having worked continuously and absolutely without attention since October last, the user being so much pleased with its success that the question of heating the entire premises electrically is now under consideration.

The second installation of the hot water system was made in R. A. McCormick's drug store, Sparks street, this city. The premises was piped throughout for hot water heating in November of last year, the electric furnace being placed in the basement. This 50 volt furnace was constructed in five independent heaters radially connected to a common supply pipe, each heater being independent of its neighbor, the five sections both mechanically and electrically being connected in multiple. Each of the sections was controlled by five 10 ampere switches, which were placed in a row in the store above, so that for all conditions of weather the heat could be regulated by turning off and on any of the five sections into which the furnace was divided. Another important consideration which suggested this design was that in the event of trouble with any one of the five sections comprising the complete furnace, it could be detached by closing the valves, and the particular section which might require examination could be removed without disturbing the other four-fifths. Despite the fact that the past winter was unusually severe in this usually cold climate, this outfit worked without a hitch and without attention of any kind, and provided at all times the heat desired.

For the usual Christmas display of the Chaudiere Electric Light Company, I designed an electric upright boiler which operated a one horse-power engine and the boiler being placed upon a large table in the company's office. The boiler was provided with steam gauge water glass, safety valve, etc. Being nickle plated throughout, it presented a very handsome appearance. The safety valve was set for 35 pounds pressure, which operated the engine. As heretofore steam engines have been employed in applying the power necessary to energize dynamos, the novelty of this outfit consisted in the fact that the electricity was developed by water power, which was converted into heat, making steam in the boiler, and which was then used in driving the steam engine.

The charge that is here made for current used in the numerous one gallon water heaters, which have been largely introduced by the Chaudiere Electric Light Company, is based upon the amount charged for the 16 candle-power lamp, which is $8 per annum (the user paying for lamp renewals). Motor rates are charged for larger installations. These water heaters are used in barber shops, drug stores, bar-rooms, etc., and absorb three times as much current as one 16 candle-power lamp—$3 \times 8 = \$24$. The company collects 50 cents per week for current supplied each heater, making $26 per annum, as against $24 if the same current was used for lighting. The charge is considered small by users, and the service is very satisfactory.

The business done during the past year in electric heating devices of various kinds has amounted to a very respectable sum, and will here, as it should elsewhere, increase from year to year.

The Merchants' Telephone Company has obtained unrestricted right of way in the city of Montreal. The Sherbrooke Telephone Association have made arrangements with the Merchants' Telephone Co., by which at an early date the subscribers to the Association will have communication by metallic circuit with Montreal.

THE TESTING OF DYNAMOS AND MOTORS.*

By Hazen Ritchie.

THE first and probably the most important series of tests which are made on any machine are those from which the characteristic curves are obtained. The characteristic curves give us practically everything we require to know about a machine, and from them we obtain all necessary data for making any necessary alterations and improvements.

The most important curve to be taken is the curve of magnetization in which the vertical ordinates represent the electromotive force in the armature and the horizontal absissae the ampere turns flowing round the fields.

In this test the speed should be kept constant, as no accurate corrections for variations can be made. The fields must be separately excited, preferably from a storage battery, as this gives a practically constant electromotive force.

The first point on the curve is obtained by measuring the voltage at the brushes when the fields are open circuited, and which is due to residual magnetism. The fields are then excited, weakly at first, and readings taken of voltage, amperes in the field and speed.

The fields are gradually strengthened, readings being taken at each change, until a great change in the feeding current is required to produce a small change in the voltage; great care being taken to keep the speed constant throughout.

To make this test of any value, only the most accurate instruments should be used. The best instruments for this purpose are a Thomson reflecting galvanometer combined with a high resistance of say 1 megohm or a condenser for measuring the electromotive force, and a Thomson quadrant electrometer shunted across a standard resistance of say 1 ohm, which is in circuit with the field, for measuring the current in the fields. Both these instruments should be calibrated with two or more standard cells checked against each other, both before and after the test.

The next tests in this series are the quarter, half and full load curves. These are taken in the same way, except that a quarter, half or full current is taken from the machine, the current being kept constant by means of an adjustable resistance.

Other curves which are of interest show the relation between the volts and amperes in the external circuit, the speed being kept constant, and the volts and amperes in the external circuit at various speeds.

The next test is the efficiency test. In generators this must be made in one of three ways: either by indicating the engine used for driving the machine and measuring the output; by measuring the power supplied by means of a transmission dynamometer, or by coupling two machines of the same type, one as a motor and one as a generator, and dividing the loss equally between them This is by far the most satisfactory method, all the readings being easily made; and, in testing large machines, by coupling back to line we need only use the power lost in the inefficiency of the machines. That is, we could test two 100 h.p. machines having an efficiency of 85% with a generator capable of giving only 30 h. p. This saving of power would be a large item in factories constructing large machines.

This last method of obtaining the efficiency has the great advantage that we are able very accurately to separate the mechanical losses due to friction of the moving parts from the purely electrical losses.

In all these tests corrections have to made, when machines are not directly connected, for loss in belt or gearing.

There is some question as to the correctness of dividing the loss equally between the machine running as a motor and that running as a generator Mr W M. Mordey, in a recent paper before the Institute of Electrical Engineers, said that this might be assumed to be correct, and as he was not contradicted I think we may consider it so.

The efficiency of a motor is obtained by measuring the electromotive force and current taken and the power given out; the power being measured either by a transmission dynamometer or an absorption dynamometer or brake, the latter being the preferable way. One of the simplest and best transmission dynamometers is that designed by Profs. Ayrton and Perry. This consists of a pulley fixed to shaft, a loose pulley and a pulley connected by springs to a plate rigidly connected to the shaft. The engine belt runs on the fixed pulley and the machine belt on the spring pulley. The extension of these springs causes, by means of a link motion, a bright bead at the end of a long arm to move towards the centre.

The distance of the bead from the centre being a measure of the power transmitted, by having adjustable links the leverage, and therefore the range, of the dynamometer can be varied at will. They have also designed a coupling on this principle for use on direct connected machinery. In several forms of transmission dynamometers the tension of the belt is measured by means of jockey pulleys held in position by spring balances and weights, and from this the power can be calculated.

Transmission dynamometers are unsatisfactory owing to the difficulty of taking accurate readings, and in the case of measuring the deflection of the belt by the complicated nature of the calculations.

The absorption dynamometer is usually some form of the Prony brake, which consists of two brake blocks placed round the pulley of the machine to be tested, and held together by bolts and thumb screws. A lever is fastened to the upper block, one end of which is secured to a Salter's balance which is made fast to the floor, the other carrying a counter weight. The brake is adjusted when the machine is at rest with the blocks slack, the counter weight being moved till the balance reads zero. The machine is started and the thumbscrews tightened until the required balance is obtained, the Salter's balance being adjusted by a nut at the end of the lever to keep the lever level. The horse power absorbed is found from the formula

$$H P = \frac{2 \pi r n P}{33,000}$$

when r = horizontal distance in feet from centre of balance to centre of shaft.

n = the number of revolutions per minute.

P = the Salter's balance reading in pounds.

It is important to note that neither the diameter of the pulley, nor the pressure of the friction blocks on the pulley, nor the coefficient of friction enter into the formula for obtaining the horse power.

Every reading taken during any test should be recorded, whether it appears to be correct or not, as very often important results are obtained from figures which at first sight appear to be contradictory and due to errors of observation. With each test the complete detail of the machine should be fyled, showing the number of turns on the armature and fields, the size of the wire and the copper resistance of the various windings both before and after the test, when the machine is cold and at the end of the run; together with the insulation resistance before and after the run, and the final rise of temperature.

*A paper read before the Montreal Electric Club.

PURELY VEGETABLE BOILER COMPOSITION.

MESSRS. J. C. Taylor & Co. Ltd., Bristol, England, manufacturers of boiler compounds solely for thirty-five years, have lately brought out a special and invaluable invention, called "Liquid Anti Scale," which is at the present time meeting with introduction in Great Britain, Canada, the United States, France, Germany, India and Australia.

This compound is claimed to be invaluable to all users of steam power, being an article which is free from all chemical matter. It not only proves powerful in removing, but effective in preventing the accumulation of scale, without injuring the boiler, also acting as a preservative to the plates and fittings. The advantages to be derived from the use of a guaranteed article, which this is, recommended it to proprietors of locomotive, marine and stationary boilers. The company are represented in Canada by Mr. L. Fuge, London, Ontario.

QUESTIONS AND ANSWERS.

In answer to the enqury of "Subscriber," Chatham, in the ELECTRICAL NEWS for June, the Toronto Radiator Mfg. Co., of Toronto, write that they are manufacturers of Kieley's patent standard steam trap, and will be pleased to send full particulars regarding the same to all enquirers.

The annual statement of the St. John, N. B., Gas and Electric Light Company shows a gratifying improvement in the financial position of the business as compared with former years. The income from all sources was $76,523, and the total expenses $55,205.

DYNAMO ROOM TALKS.

By Force Bain.

Let us take the little things first; success is usually reached through close attention to little things.

A voltmeter is an instrument for measuring the electromotive force or difference of potential between any two points in a circuit, just as the steam gauge measures the difference of potential or pressure between the inside and the outside of the boiler. Pressure is an element of power in electricity exactly as it is with steam; it is necessary, therefore, that we should know continuously and reliably the pressure of our dynamo plant as our steam boiler. The economic operation of an incandescent plant requires the pressure to be kept within at least two per cent. of the proper voltage. If the pressure is a few volts too low, the lamps are not efficient in producing light; if too high, the durability and life of the lamps are very much below the normal value. In an electric railway power station we should have a voltmeter always in circuit. In a properly designed plant of this kind the electric pressure at the station should rise proportionately as the load comes on, and we should be able at all times to know just how much this rise is. If it is not maintained at a constant degree with the proportionate increase of amperes to line, there is sure to follow serious consequences, such as the burning out of armatures in the motors. The voltage being low, more current is required by the armatures in the motors to do the work, and it is the current that overburdens the armatures. They heat and chafe in consequence, finally, and often quickly burn out.

There are a number of things that may happen to prevent this increase of voltage referred to. A stiff governor on the steam engine; low steam at the boiler; engine overloaded, with less than full dynamo capacity; slipping of a belt; series field coil of dynamo short circuited;—any one of these would cause trouble which you would not be able to detect without a good voltmeter.

An ammeter should be in circuit with every feeder and every main at the station. You cannot be too well informed on just what is going on in your circuit. Remember you are handling an agent which you cannot see, feel, hear or smell, and this is the only means of telling what you are doing.

Don't get ammeters or voltmeters for your plant until you are sure you know just what you want. There are instruments now on the market that are not any more reliable than the method used by an old farmer for weighing his pigs,—which was to balance a pig on a rail on one side and a stone on the other, and guess at the weight of the stone. I will describe the construction and peculiarities of the instruments you are familiar with, and then give you my idea of what you require.

In a plant where a number of instruments are to be used, it is not necessary to pay extravagant prices for instruments of great delicacy and theoretical precision; there are cheaper instruments which will answer every purpose. These instruments will indicate within one per cent., which is quite close enough, provided they may be depended on; and for this reason one fine, standard instrument—one voltmeter and one ammeter—should be kept for the purpose of checking and recalibrating those in regular use.

Do without an instrument rather than buy one which is unreliable and which does not possess the features described. There are a number of instruments in the market which depend upon the power of a coil to lift a heavy piece of iron and pointer against the varying force of gravity. These instruments are sluggish of action, so that small changes in the strength of the current or potential difference that is being measured is not instantly indicated. The needle and other moving portions being large and heavy, the moment of inertia is great, and this moving in a weak magnetic field, upon any change taking place in the current strength, the needle would simply oscillate over the scale. Many changes might take place in the current strength, the current or potential even remaining constant at each of its various values for a very decided time, before the needle had come to rest and allow any measurement to be taken. An instrument with the needle dancing around over the scale is not of much practical use. These solenoid instruments also indicate differently for the same values, depending upon whether the readings are taken on the rise or fall of potential or current.

Instruments employing permanent magnets are not reliable; the effect of each measurement varies the condition of the permanent magnet. A temper fracture, which is liable to exist undetected, causes the strength to be constantly changing and consequently variable readings for the same value of current. A spring is the most unreliable and inconstant of all mechanical devices. Temperature affects its value, it is easily misplaced, and its molecular structure is changed with every strain to which it is subjected.

Multiplying devices of all kinds should be abjured; they have no place in a properly constructed voltmeter or amperemeter. Select an instrument in which electro-magnets, or the action due to the currents flowing in diamagnetic conductors, are employed. The moving portion should be the very lightest weight possible, and there should be no complicated multiplying devices. The instrument should be tested to see that it is absolutely dead-beat. This is an important feature. A voltmeter should be wound with a wire having a very small heat coefficient, and it should be wound with a resistance having at least fifty times as many ohms as the highest number of volts on the scale. For instance, a 600 volt instrument should have a resistance of at least 30,000 ohms. An ammeter, on the contrary, should have as little resistance as possible.—*Electrical Industries.*

SPARKS.

The St. Charles Co., of Belleville, are reported to have orders for 140 electric cars, all of which are to be completed before the end of the year.

The Bell Telephone Company's exchange at Ancaster, Ont., was recently struck by lightning. All the wires were burned and considerable other damage done.

The Toronto Street Railway Company are about to erect a two-story brick motor house on the corner of Frederick and Esplanade streets, at a cost of $30,000.

The Goldie & McCulloch Co., of Galt, are placing in the new electric light station in Pembroke two new engines and boilers, with necessary shafting, pulleys, etc.

An action has been entered by Mr. Lacroix, Building Inspector of Montreal, against the Montreal Street Railway Company for erecting a power house without a permit.

Owing to increase of business and the consequent need of additional accommodation, the Royal Electric Co., of Montreal, Que., are said to be about to issue $250,000 worth of new stock.

Mr. J. A. Culverwell, formerly contract agent for the Edison General Electric Company, has been appointed general agent for the Automatic Telephone and Electric Company of Canada.

An examination of the water powers on the East River near Hopewell is being made by the New Glasgow, N. S., Electric Light Co. with a view of utilizing the same to drive its lighting and power plant.

The Stratford Gas Co. has under consideration the advisability of establishing a power circuit. In view of this the promoters of a street railway who have for some time possessed a charter, are talking of constructing an electric road.

The Coal Saving and Smoke Consuming Company, Ltd., with a capital of $50,000 is seeking incorporation at Montreal. The promoters are Chas. J. Arthur, Thos. H. Turton, Wm. Angus and Jas. B. Kerr, of Montreal, and Frederick Jones, of St. John, N. B.

The Merchants' Electric and General Service Company have elected the following officers.—Mr. G. A. Greene, president, Mr. John A. Goose, manager; and Senator A. W. Ogilvie, Messrs. S. H. Ewing, James Cooper, G. S. Brush, E. Hanson and S. Finley, directors.

The application of the Hamilton Radial Electric Railway Company for incorporation has been refused as the powers asked for are exceptional and cannot be granted to a street railway company. The directors of the company are considering the advisability of seeking incorporation as an ordinary railway.

The Northern Graphite Co., Ltd., are seeking incorporation. Their headquarters would be Montreal and the capital stock $95,000. The company is composed of John Fraser Torrance, Frank E. Caine, H. E. Stearns, D. T. Stearns, Wm. Starke and Geo. R. Starke, of Montreal, and James E. Caine, of Boston.

Courtland Bronson, of Hamilton, Ont., recently received a patent for an invention by which he claims he can make 20-year-old whiskey from raw whiskey by removing all impurities. He cools the whiskey to 70 degrees below zero and then passes an electric current through it. He has been supplied with money to carry on his experiments.

Mr. Charles F. Medbury has resigned his position of agent for the Montreal district of the Canadian General Electric Co. and accepted that of general sales agent for Messrs. Ahearn & Soper, of Ottawa, the Canadian agents of the Westinghouse Electric Co., of Pittsburgh. In this position he will look after the sales of Westinghouse apparatus throughout Canada. Mr. Medbury has had an extensive experience with the Thomson-Houston Electric Co. in the United States, as well as with the Canadian General Electric Co. in Canada, and is exceedingly well qualified for the position he is to fill.

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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 may 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 must 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 coming legitimately within the scope of this journal.

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

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KINGSTON, ASSOCIATION STATIONARY ENGINEERS.—Meets twice each month over No. 1 Fire Station. J. Devlin, President: W. Gilmour, P. O. Box 699, Secretary.

THE Chief Engineer of the Dominion canals states that tests of the applicability of electricity to the working of lock gates are being made at Beauharnois Canal, and should they prove satisfactory, electrical appliances will be adopted in connection with the Canadian canal at Sault Ste Marie, water power from the canal being used to generate the electricity. The result of the test at the Beauharnois canal will be known shortly, and will be looked for with much interest.

FALSE notions of economy still prevail to a very large extent, notwithstanding that vast improvements in business methods have come into vogue within recent years. These false notions, singular as it may appear, frequently exist side by side in manufacturing establishments with the most improved mechanical appliances, and not unfrequently serve to neutralize the benefits which would otherwise be derived from the employment of perfect mechanism. Of what use is it to buy the most perfect and economical engine at a high price and place in charge of it a man who has never got beyond his A B C's in engineering? No doubt his services can be got cheap, and on the surface there would appear to be a substantial saving in salary as compared with the amount which would be required to pay a skilled engineer. This apparent saving soon disappears, however, through the medium of the coal pile, repair bills and depreciation of plant. Often, too, the manufacturer of valuable money-saving devices is blamed because the result of their use in the hands of incompetent engineers is not what it would be under skilful management such as they were designed for. A great deal of loss and trouble results to the owners as well as the manufacturers of steam plant because, as a gentleman bluntly expressed it to the writer the other day, the practice so often prevails of placing a "mutton head" in charge of nicely adjusted mechanical apparatus.

THE recent decision in the U. S., sustaining what has become known as the Edison feeder patent, will without doubt cause considerable trouble to the different lighting and power companies doing business in that country provided it is pushed to a suit for injunction. Whether the General Electric Co. will push their claims in this direction remains to be seen; in the meantime there may arise another Goebel to dispute their right, and it would be well for all interested in this method of distribution, and particularly those who have been using it for a long time, to try and fix the time at which they commenced its use, and then refer to the patent records to see if this does not antedate the original patents. What effect this decision may have on this side of the line we are not in a position to say, nor can we say if a patent was ever issued or applied for in this country. We fail to see, however, how the company can prohibit the use of feeders, for most assuredly they could not begin to operate even a small part of the plant now distributing currents by means of feeders. They may impose a royalty, but to our mind the question with them resolves itself into one of policy, and we do not think they will adopt the stringent and arbitary conditions that they have thus far done in the lamp case. We note also that they have been allowed an injunction to prevent a street railway company from using a trolley, on claim of ownership of the foundation patent by right of purchase. It may be that their claim in this direction is a valid one, and presuming this to be the case, before they try to stop all who are using this method of collecting the current from the wires, they will act wisely if they at least grant the right to continue its use on the payment of a small royalty. How much better it would have been, and how much better off they would have been, had they pursued this course in the lamp case. We doubt if there would have been one of the many factories that they have closed by injunction that would not have willingly paid them a royalty on all the lamps they manufactured, and upheld reasonable prices throughout. This would have brought the lamp competition down to the "survival of the fittest". We should not be surprised to wake up some fine morning and find that somebody has injuncted somebody else for using a dynamo for any purpose whatever. Although this may be an overdrawn surmise, yet it may become a fact sooner or later if monoplies are allowed to flourish in our midst.

MUCH diversity of opinion exists as to the proper engine to employ for the operating of generators for street railway work, some preferring one type, others something quite different. But little argument should be necessary to convince the most skeptical that the cross connected slow or moderate speed is the ideal engine for this class of duty. The engine may be either horizontal or upright, and either high pressure on both sides or cross compound, or in the case of very large units, tandem or steeple compound on both sides. It should be compound only if there is sufficient water available for condensing purposes or if very high pressures can be carried; not otherwise, else when there is little or no load on there will be a steady drag of the low on the high pressure on account of the steam being cut off early in the stroke and the low pressure cylinder being unable to get sufficient to fill it. We have seen an engine of this kind, of high speed, show a vacuum of 15 to 20 lbs. in the low pressure cylinder when the engine was only doing about 25% of its rated capacity; this of course meant a considerable waste of coal. In this case it did not take long to unship the valve on the low pressure end and let the high pressure end do all the work. However, when the proper load was put on the engine, the valve was put back and the cylinder did good service with an initial pressure of 100 lbs. on the low pressure end. But to return to our subject, if those who contemplate using engines for street railway work will but remember that there are times when an engine being used for this purpose is suddenly required to jump from a few to hundreds of horse power in but a few seconds of time, and that this sudden load may come on at the very instant that the single side engine is on its centre, it may readily be seen why the second side with cranks connected to shaft at an angle of 90° with each other will help out and carry the sudden load without any appreciable effort, and with little or no fluctuation in the speed, particularly if the engine is provided with a good heavy wheel. We are aware that what are known as high speed engines will do the work perhaps equally as well, but they cannot be classed with low speed engines on the point of economy in steam consumption, not to speak of the expensive and frequent repairs required on them, which feature is almost entirely eliminated in the slow runners. Advocates of high speed engines claim as one of their points of superiority that with a number of units, should anything go wrong, one engine can be shut down and a spare one substituted for it for the time being, while with slow running engines if anything goes wrong it perhaps means the shutting down of the entire plant. But we think we are safe in saying that there is not one chance of such an engine breaking down to a dozen or twenty in the case of the smaller high speed engines, as any one who has had the running of the two kinds will know. While each style of engine has its admirers, we must enroll ourselves on the side of slow running cross connected engines for electrical work of all descriptions.

LEAD water pipes that are used on streets occupied by electric railways who use the rail for a ground and return, are found in various places to be seriously affected by the eating away of the outside of the pipe by electrolytic action. Electrical journals from time to time have recorded cases of this kind, some of the most recent being in the city of Hamilton, where the water department have been compelled to renew the service pipes in quite a few places, the worst affected seeming to be in close proximity to the power house. It would perhaps be quite a difficult matter to advance a proper theory for this result. It is perhaps caused by the pipe being laid in a particularly dry sandy soil, and by the return current in its effort to reach a good ground finding such ground by way of these lead pipes to the water mains in preference to forcing its way to a wet spot in the ground through dry sand or perhaps rock. That it should occur in the immediate vicinity of the power house is more difficult to account for, unless it be that the rail connections on the ground plate at that end offer a greater resistance to the passing of the current than does the intervening earth between the rails and these numerous water service pipes. In the case of Hamilton the water mains are several feet higher than the level of the bay and the streets all dip at a very great angle to the bay, forming thereby a water shed that must result in a somewhat dry sub-soil. That the pipes are eaten away as the result of the current going to ground through them there can be no doubt, and that this action is purely an oxidization of the metal through the electrolytic action is reasonably certain. To remedy the trouble we think will be quite a difficult matter, but as experiments in that direction will no doubt be the order of the day, we would suggest the following as worthy of consideration and trial: Wrap the pipe with a covering of tarred (pine tar) hemp about half an inch thick before burying it, give the outside of the pipe a thick coat (or two or three coats) of a good, hard, but elastic japan, which has been well dried in an oven; let the outside of the pipe be enamelled with an elastic enamel, the same as is now being used on the inside of some lead water pipes; surround the pipe by a square box some 3 or 4 inches in internal diameter, thereby allowing an air space as an insulator; last but not least, see that the rails are well grounded, bearing in mind the fact that a hole dug some 6 or 7 feet in the ground and a good sized piece of an old boiler stuck in with a number 4 galvanized iron connection to the rail is simply no ground at all in a sandy soil, and would not be much better in a pool of water. For the carrying of heavy currents such as are used in street railway work, a good ground should consist of at least 100 square feet of exposed metallic surface, preferably copper, covered on its two sides with at least one foot in thickness of fine gas coke and buried in decidedly moist earth, and connected to each rail by a No. 0000 copper wire well rivetted and sweated on. With such a ground every quarter of a mile, and good and sufficient bonds between the rails we predict that the eating away of lead water pipes would soon be a thing of the past.

THE Canadian Electrical Association has missed the only chance it has had since its inception to make its name immortal. This chance came when a motion was made at the first convention of the Association in the City of Hamilton in June, 1892, to establish a standard for the nominal candle power of arc lights, which motion was voted down, principally because the subject was considered too grave a one for the Association to grapple with. Time now proves the fallacy of this reasoning. Our readers will have noticed in the electrical journals of the United States that one of the many subjects that will be brought before the Electrical Congress to be held in Chicago will be one to establish a standard of current or watts for the different nominal candle powers as used at the present time in speaking of or contracting for arc lighting. From present appearances it seems as though one of the methods which will likely be proposed will be to standardize the different arcs as of so many watts capacity, and to drop the candle power appellation entirely. Doubtless this is a step in the right direction, and will solve the problem to all intents and purposes, but we do not see why they do not adopt a standard for the several sized arc lights and let the voltage take care of itself, which it undoubtedly will do. We are decidedly of the same opinion as the mover of the resolution in the convention (Mr. D. Thomson), that with the proper carbons and lamps producing a quiet, steady, non-fluttering, non-frying and non-flaming arc, with a fixed current, they will take the same voltage in every case; consequently a watt standard is not what is required, but a current standard only. We commend this to the consideration of the members of the Congress to be held very shortly in connection with the World's Fair in Chicago. At the same time we wish to record the fact that the Canadian Electrical Association was the first society in America—and for aught we know, in the world—to have the matter brought up for consideration. That some action was not taken which would have placed it on record as perhaps the first mover in this important matter is, to say the least, a deplorable mistake. Questions presented themselves to the minds of some of the members that were entirely reasonable and rational from their standpoint, but that, nevertheless, should have had little weight in deciding so momentous a question. One of the objections urged was that as the Canadian Government was about taking some action with that end in view, their standard, if established, and that of the Association would conflict. What argument could have been weaker? What would have prevented the Government from adopting the Association standard? We doubt if they could have improved upon it. Another objection urged was that such a standardization would create discord between cities and towns which were buying their lights from private companies, from the fact that some municipalities would insist that they be supplied arc lights of the candle power and current called for by the Association standard. It seems a useless waste of words to say that there could have been nothing so easy of adjustment. It would have been an easy matter to convince such towns and cities that at the time their contract was made, the lights they were then furnished were known as of a certain candle power, and that any new standard established could have no bearing towards annulling their contract or in compelling the company supplying the light to live up to the new standard. Of course when it came to making a new contract with the company, if the Association standard was called for, it would in very many cases entail but a small expenditure to have the dynamos re-wound for the new conditions. Nothing now remains for the Association but to await the decision of the Electrical Congress and follow in its wake. If they adopt a standard, and it seems reasonably sure that they will, the same hardships will be experienced by would-be suppliers of a 2000 c.p. arc light with 7½ amperes of current as would have been had the Association instead of the Congress adopted the standard, for be it understood that this standard will be used in Canada to as great an extent as would have been the one adopted by the C. E. A. That there should be some sort of a standard is unquestionably a fact, for at present we know of from 4 to 5½ ampere lights being called 1000 c.p., of 5 to 6½ being called 1200 c.p., and of from 7½ to 10 amperes being called 2000 c.p. This is very misleading to those whose knowledge of such things is limited. That the C. E. A. will profit in future by the lesson they are now about to learn we sincerely hope.

IT is understood to be the intention of the Canadian Association of Stationary Engineers to make an exhibit of models and inventions in the line of mechanical engineering, at the forthcoming Montreal Exhibition, which will be held simultaneously with the Convention of the Association.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

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

RESOLUTION OF CONDOLENCE.

At the last regular meeting of Toronto No. 1, the following resolution was adopted: Whereas, it has pleased our all wise Creator and Heavenly Father to remove from this earth our esteemed friend and worthy brother engineer, John A. Wills, therefore be it resolved, that while we bow in humble submission to the Divine will of our Heavenly Father, we do at the same time extend our sincere and heartfelt sympathy to the bereaved family in this their hour of sorrow, and we deplore the loss of so eminent an engineer. Be it further resolved, that a copy of these resolutions be sent to the sorrowing family, be spread on the records of this Association, and also that a copy be sent to the mechanical press for publication. And be it further resolved that our charter be draped for the space of three months.

On behalf of Toronto No. 1, C. A. S. E.

A. E. EDKINS,
W. BUTLER,
GEO. GILCHRIST.

Toronto No. 1, C. A. S. E., elected officers at last meeting for the ensuing year, as follows: President, Wilson Phillips; Vice President, W. Butler; Recording Secretary, Herbert Terry; Financial Secretary, Geo. Mooring; Treasurer, A. M. Wickens; Conductor, S. Thomson; Door Keeper, J. Thomson; Trustees, W. G. Blackgrove, Charles Heal, Wilson Phillips.

Toronto No. 1, C. A. S. E., have appointed a committee of five to devise some means of bringing the aims and objects of the Association to the notice of the manufacturers and to invite their co-operation.

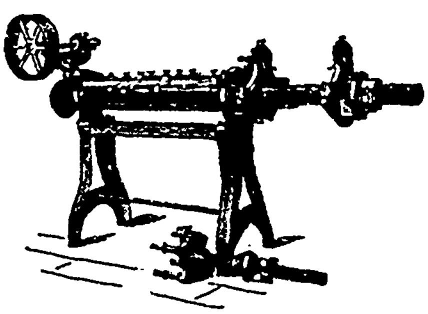
At the annual meeting of the Canadian Association of Stationary Engineers, held in Hamilton on June 11th, the following officers were elected:—President, W. Sweet (re-elected); vice-president, E. Johnson; recording secretary, William Norris; financial secretary, A. Nash; assistant permanent secretary, George Mackie; treasurer, W. Nash.

THE membership of Hamilton No. 2 numbers about 50, and the finances are in a flourishing condition. The Association is about to purchase an indicator for the use of the members.

THE ERIE KEY SEATING MACHINE.

The accompanying engraving represents the Erie Key Seating Machine, manufactured by the Button Machine Co., of Erie, Pa. They are furnished with two or three arbors, as desired, to cut any width of key seat up to 2½" wide. If the work is heavy and too large to be placed on machine it can be readily detached from stand and used as a portable machine, and fully meets all the requirements of a machine shop.

The arbors are made of steel and supplied with eccentric taper bushings to accommodate all bores within their range. Each arbor is hollow and has within a steel guide bar, movable up and down by means of a screw at each end. It is planed through its entire length the necessary size and shape to carry within a tool bar. This steel tool bar carries two tools of the



THE ERIE KEY SEATING MACHINE.

width desired for the key-seat. It is connected to the driving carriage by means of a removable pin, and is driven back and forth through the guide bar, cutting in both directions, and fed down the desired depth and tapers by the screws at the ends.

The driving apparatus consists of two parallel screws 2½ inches in diameter, ½ inch pitch threads. They are set six inches from center to center, and run in opposite directions; between them is an open-sided nut which slides from one to another within a carriage. The nut engages in one screw and travels the desired distance when it comes in contact with a cam which throws it out of gear, and by a spring it is pushed in gear with the other screw. The nut has on its top two ribs, one of which, by passing behind a guide, holds it in gear. The other serves to receive the pressure of the spring. By shifting the cams and springs, any desired length of stroke can be made. The travelling of the nut carries with it a carriage to which the cutting bar is attached. The screws are driven by cut gears running smoothly and giving a very strong motion to the cutter bar.

With an attachment for the purpose, seats can be cut in holes as small as 1 inch in diameter by one passage of the cutter.

Mr. John A. Burns, B. A. Sc., machanical engineer and manufacturers' agent, 686 Craig street, Montreal, has the sole agency for these machines in Canada.

TRADE NOTES.

Messrs. Patterson & Corbin, of St. Catharines, have been given the order for the cars required for the proposed electric street railway at Kingston.

The Waterous Engine Works Co., of Brantford, are just starting at Windsor for the Sandwich and Amherstburg railway, an addition to their plant, consisting of 43 feet of 5½" steel shafting, 9 heavy floor stands with extra strong ring oiling ball and socket pillow blocks; one solid pulley 45 x 24" face, and the following grip pulleys: 54 x 16, 84 x 12, 86 x 12, 54 x 22, 53 x 17; one 350 combined friction grip pulley 72 x 10½ face and grip coupling; two 300 h.p. grip couplings; one heavy tightener frame with screw adjusting for a 30 x 24½ pulley. They have also an order to ship next month for the Wingham Electric Light plant 5 pairs of grip gears connecting a shaft 84 feet long with 5 water wheels, with its ring oiling ball and socket boxes and floor stands and several grip pulleys.

SPARKS.

Mica deposits have been found in Burgess and Bastard townships, Leeds county, Ont.

W. C. Green has been offered a large sum of money for a mica mine near Arden Station.

The Arnprior Electric Light Co. will probably install a new engine next fall with which to operate their plant.

The Merchants' Telephone Company is about to commence operations in Montreal, and will advertise for poles.

Michael Keegan has been registered proprietor of the Keegan, Milne Co., manufacturers of electrical supplies, Montreal.

The Montreal Street Railway Company are erecting iron posts on Notre Dame, Windsor, Peel and other streets in Montreal.

The Kingston Electric Light and Power Co. will enlarge their lighting station and will put in two new boilers and a new engine.

The corporation of the town of Port Arthur intend applying to the Legislature for power to enable them to do street and commercial lighting.

The Kay Electrical Works, of Hamilton, have applied for a patent for a combined motor and dynamo which will furnish both light and power.

Tenders have recently been invited for the purchase of the Vancouver Electric Railway and Lighting Company, which is in the hands of a receiver.

The St. Henri Light and Power Company will apply for power to increase their capital stock to $1,000,000, and make other amendments to their charter.

The Thomson Electric Welding Co., of West Lynn, Mass., has nearly completed an electric loom. This will be the introduction of electricity into another branch of industry.

Mr. A. W. Congdon, formerly engineering representative of the Canadian General Electric Co for the Montreal district, has been appointed agent of the company for that district.

The town of Arnprior has granted for a term of twenty years to the Automatic Telephone and Electric Company, the privilege of erecting wires and poles on the streets of the town.

The citizens of Toronto Junction are talking of requesting Mr. A. Campbell to install in his new flour mill, a dynamo sufficiently large to supply electric light for commercial purposes.

In view of the intention of the Government to widen the approaches to the Ottawa bridge on the Hull side of the river, the Ottawa Electric Railway Company has decided not to enter at present into any agreement to establish an electric street railway in Hull.

A telephone line is to be constructed from Revelstoke to Kalso and Nelson, the centre of the Kootenay mining district, British Columbia.

The Toronto and Scarboro' Electric Railway Company propose to issue bonds covered by a mortage on the present and future assets of the company, for the prosecution of its undertakings.

There appears to be a greater demand for mica than any other material at present. Mr. James Stark, a dealer in minerals, has just returned from England and intends shipping 100 tons in a few days, and will continue to send large shipments until fall.

Messrs. E. Leonard & Sons, of London, engine and boiler manufacturers, have opened an office at 79 Bay street, Toronto, and have placed in charge Mr. Thos. Nopper, who has been in their employ for the past twelve years.

The county council of Welland has granted to Messrs. Dawson & Syme power to construct a street railway between St. Catharines and Port Dalhousie, and will request the Minister of Railways and Canals to give them permission to cross the canal bridge.

The town council of Toronto Junction has decided that the town shall retain its own electric light plant As the law will not allow corporations to do commercial lighting, the merchants are anxious to see how the council will deal with this phase of the question.

At the annual meeting of the electric light company of Amherst, N. S., the Board of Directors was re-elected. No dividend was declared, but though the business of the past has not fulfilled the expectations of the shareholders, the prospects for the future are brighter.

The following gentlemen have been re-elected the Board of Directors of the Chaudiere Electric Light and Power Company, of Ottawa: T. Ahearn, G. P. Brophy, J. W. McRae, Thos. Workman, W. Y. Soper, R. Hurdman, W. G. Hurdman, Wm. Scott and Wm. Hutchison.

Messrs. W. H. Wrighton, H Long and M. T. Ostrum, merchants, of Peterboro', Ont., are seeking by an injunction to restrain the construction of the proposed electric street railway on the business portion of George street. The road has been completed almost up to the point mentioned.

The Montreal Park and Island Railway Co., consisting of Sir Donald A. Smith, Hon. Louis Beaubier, Messrs. R. L. Gault, David Morrice, M. Perrault, D. Graham, Senator Thibeaudeau, and a number of New York capitalists, has been consolidated with the Corriveau-Williams Street Railway Co. and has taken over all the franchises held by the latter company.

An act of incorporation has been obtained by Alex. Fraser, Westmeath; Wm. Gibson, M. P., and Richard Fuller, of Hamilton; John Mather, of Ottawa, and W. H. Brouse, of Toronto, unber the name of the Keewatin Power Co., to furnish hydraulic and electric power from the Winnipeg river, and to establish factories, dwellings, etc. The capital stock is $1,000,000.

ELECTRIC INSTALLATIONS AND SOME RADICAL CHANGES IN GENERAL SYSTEMS OF WIRING.*

By Charles G. Armstrong.

It is not my intention this evening to enter into a general discussion of isolated electric installations but simply to point out common errors and suggest such remedies as would seem, in my judgment, to make a better plant. In planning a building it is true that the designing of the electric plant is generally left until the last. In my experience I have found it not an unusual thing to be called upon to design a plant, when upon receiving the plans I find that the architect has left room for the plumbers' pipes, has prepared excellent runways for drainage, has looked after his catch basins, has located his elevator pumps and given them plenty of room in the basement, has provided ample space for everything except the electric light plant. There are no raceways in the building, the space left for the dynamos and engines is totally inadequate, the boiler capacity is about half what it ought to be, no place for storage of coal, and yet the most important feature of the entire building is light. It becomes necess ry, of course, to at once make a claim for more space and provide raceways or some substitute therefor. Having obtained all the space possible the next item that confronts the designing engineer is how to lay out his plant.

There is a plant on State street that it was my duty to inspect and report upon a little while ago where I found an arc and incandescent dynamo running in a separate room about 50 feet from the switch-board. The plant really consisted of two separate plants connected to one switch-board; the only redeeming feature about it was that there was only about an hour a day when both dynamos were running at the same time. This plant showed an insulation resistance of ten ohms to ground on the arc circuit and one-twentieth of an ohm on the incandescent circuit.

In order that the proprietor and others casually inspecting the plant would have a good opinion of it, the highly ingenious electrician in charge had disconnected the ground wire so his plant always showed clear on the ground lamp. It is often very much easier to remove the evidence of a ground than to go to the trouble of removing the ground itself. It would undoubtedly be better to have electricians of less ingenuity and more honesty in cases of this kind.

One cause of a bad plant is lack of forethought on the part of the designer of the building, another is desire to diminish the first cost, and a third is often force of circumstances. A person may have an old building, and to put in an electric plant he may have to accept what he finds and make the best of it. For the first two faults there is no excuse, and even the latter can be remedied by a little study on the subject and a proper selection of dynamos and engines. There is a great need to-day of a small unit direct connected slow-speed dynamo to be used in such places as I have last mentioned, where plants are to be installed in old buildings and the space is very limited. Perhaps some of you will say, "if you specify such dynamos, I will furnish them," but from the fact that it would require from six months to a year to design and perfect these sizes I would not dare specify them.

Generally when a man has concluded to put in an electric plant he wants it as soon as he can get it, and although he takes six months or a year to make up his mind, he wants the plant put in at once. But if such dynamos were constructed and kept in stock as ordinary dynamos are, I have no doubt that you would find a good demand for them and they would be a matter of great convenience both to the designer and the owner of the plant.

I prefer to get dynamos as close together as possible. The only conditions to be considered are first, that they will not be reversed in polarity by proximity of like poles, and second, that the armature of any machine can be removed without disturbing the other. A modification of this condition could be made where space is very limited by running the smaller machines in tandem, but as a general rule I do not favor this arrangement.

On the matter of foundations for dynamos I hold decided views. I like to have a good foundation under the dynamos, and while this is not as absolutely essential as a good foundation under the engines, yet a concrete or brick foundation in which the best quality of Portland cement has been used is a very desirable thing. A strong wooden frame should be bolted to this foundation, and the bed plate of the dynamo would be bolted to the wooden frame. The wood should be previously soaked and thoroughly painted with insulating and water proof compound. This insulates the machines from ground. Some companies insist that their particular type of machine needs no foundation. I have handled almost every machine on the market and I have yet to find one that runs as well without a good foundation as it does with one.

Switch-boards are the next item of importance. The switch-board should be placed within six or eight feet of the commutator of the dynamo or as near that as possible; a greater distance is unnecessary and a closer proximity is not desirable. I believe that switch-boards should be made of marbleized slate or marble. I prefer marble and I use white marble in many cases, but between white and Tennessee marble, I prefer Tennessee from the fact that it is less easily strained. Slate is somewhat cheaper than marble, but it absorbs moisture, which is a thing to avoid in switch-boards. If marbleized slate is used it should be thoroughly painted on the back to prevent absorption. There is one precaution which should be taken, however, in all marble switchboards, that is in fastening instruments thereto. From the unyielding properties of either marble or slate it is advantageous to have a coil spring, and connections should be made after the manner shown in Fig. 1, otherwise the instruments will soon become loose by the jarring of the board. In no case should the wire connections to the instruments be so placed that it can jar loose, as there is great danger of arcing.

Where more than one dynamo are used, bus bars, I believe, are better than any other method of connection. If they are placed on the front of the board they must be polished and lacquered, and if fine effects are desired, they can be nickel plated. If placed on the back of the board, rough and unpolished copper bars can be used. Bus bars should be large, and of such capacity as not to heat perceptibly on the heaviest load. The object of this is to get a good connection. If they are made sufficiently large, connections can be tapped and screwed into them just as a bolt would screw into a nut. Where connections are made on the front of the board this method is not as desirable as the "stirrup," which is used pretty generally by first-class construction companies.

It should be the object of all designers of switch-boards to make the board as simple as possible. To avoid complications and yet have the board accomplish the purpose designed requires no little ingenuity on the part of the designer.

Electrical engineers and Philadelphia lawyers usually are not employed by owners to run plants. The salaries paid are so ridiculously small that in some cases the dynamo tenders are anything but what they should be in education or knowledge of the business. Often the engineer of the plant must also take care of the dynamos, although he admits that he knows nothing about them. The whole matter is a mystery to him except that he knows he must keep the brushes trimmed and perhaps polish off the commutator once in a while, and in order to perform his duty thoroughly he may perhaps use a file to do the polishing.

The great objection to connections being made on the rear of the board with bus bars, I find, is the liability of a great multiplicity of wires being run helter skelter across the back of the board, making the simplicity on the face of the board more than compensated for by the intricate connections on the back.

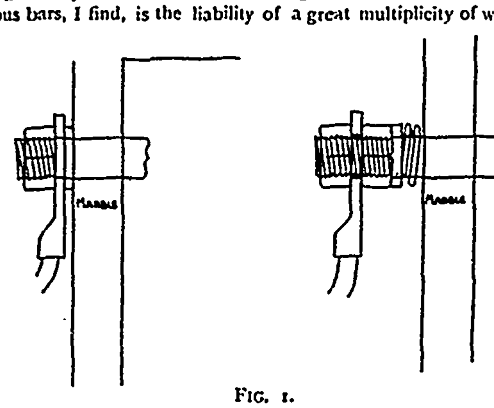


Fig. 1.

It often happens in very large buildings that the motor load amounts to quite a considerable part of the entire load. When such cases arise I believe in having a third bus bar on the board, which shall be used for motor connections. This applies only, of course, to such plants as have two or more dynamos. Where motor connections are used it is desirable to have an ampere meter to measure the amount of current used on the motors. This ampere meter should be "dead beat," and should have a range equal to all the motors in the installation. A careful attendant would know if his motors got into trouble or blow a fuse, and could also tell how the different loads were being handled throughout the building. This applies especially to cases where electric elevators are being operated from the same plant as the lights. As to other meters on this board I would prefer the non-polarized type, from the fact that they are less liable to get out of calibration. There is one slight disadvantage, perhaps, and that is if a machine should get to running as a motor an attendant might not as quickly understand it; but it is seldom, indeed, that it occurs, and where it does the operator ought to know that the belt is pulling the wrong way.

Dynamo switches should be made double throw, one connection being onto the bus bars in such a manner that any or all dynamos can be thrown on the motor circuit. By closing a switch the motor circuit is placed in multiple with the lighting circuit. By opening this switch and throwing down a dynamo switch any dynamo is connected to the motor circuit.

Recently I was called upon to solve a problem in connection with the Schiller theater in this city, where the owners expected to take current from the Chicago Edison company's mains. As you are well aware the rules of the Edison company prevent the operation of 110 volt motors upon their lines from the liability of throwing their lines out of balance. They require that motors operating on their lines should be 220 volts. We were not using the three wire system in the building, and it was necessary to construct a switch-board in such a way that 220 volts could be obtained on the motor circuit from our own plant as well as from the mains of the Chicago Edison company. In order to accomplish this the dynamo switches are arranged to throw any dynamo in series with the others by a simple movement of the switch. The motors throughout the building are used to operate ventilating fans, and therefore can be operated at 220 volts or 110 volts according to the amount of ventilation desired. In addition to this a small rheostat placed in the field of each motor allows us to get any variation of speed desired with scarcely any waste of current. I may say in this connection that the use of ventilating fans is becoming more and more appreciated by architects and owners, and this method of varying speed is a very advantageous and economical way of regulating ventilation. In this point the

* Read before the Chicago Electric Club, Feb. 20th, 1893.

switch-board is placed in the middle of the room, completely boxed, is very close to the commutator, and is convenient in operation.*

There is nothing more important in an installation, outside of dynamos, than wire. Use always the best wire. In making tests upon wire I do not believe in soaking it in chloroform, naphtha, sweet spirits of nitre, or any other absurd method. In the ordinary course of events wire is not subject to the influence of any of the substances named. The greatest enemy of wire is ammonia; an enemy which is most potent, and which is found in any and all plastering; it is an incidental product in the settling of mortar, which is more especially found in patent plastering.

One of the greatest outrages perpetrated on electric wires is the use by painters of an acid wash to neutralize the acid in the plaster. This wash is composed chiefly of sulphate of iron and sulphuric acid; it quickly penetrates the plastering, and by its action on the nitrates contained therein evolves ammonia, which attacks and honeycombs the rubber insulation of the wire.

Within the last few weeks it has become necessary to remove all of the wire in a large building in this city, owing to just such barbarous treatment as that described. The only protection against ammonia that I know of is a waxy covering which is used on the best grades of weather-proof wire. I generally specify wire which is covered with a braid saturated with some compound to strengthen and protect it. Other enemies of wire are rats and mice and roaches. My experience has been that the weather-proof compound already mentioned will prevent them eating the wire; they are fond of rubber, but do not like wax. In addition to its chemical properties wire should have the ability to stand rough usage and bending without perceptibly breaking its insulation.

The present method of running distributing wires in fire proof buildings is, first, placing directly beneath the plasting with cleats; second, enclosing in interior conduit tubes; third, and most desirable, is running wires from cut-out cabinets in moulding to the rooms, and then under the plastering in nterior conduit tubes to the outlets. This last method I have adopted almost exclusively. Fig. 2 shows one form of corridor moulding which I

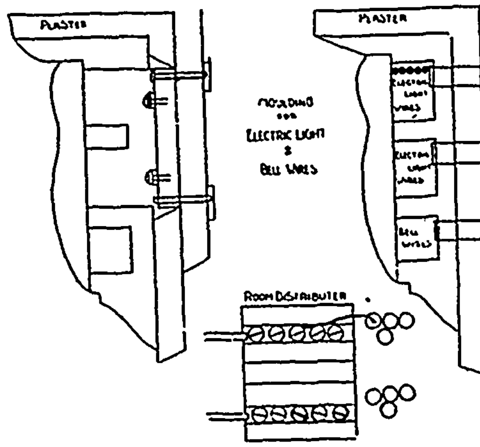


FIG. 2.

use. It has three compartments, one for each polarity of the light wires, and one for the bell wires. When leaving this moulding interior conduits carry the wires to the outlets. This is a better method than all interior conduits, as architects are every day limiting the thickness of plastering. Originally 1¼ inches of plastering was considered about right, now ½ inch is considered too much; in fact, many architects complain bitterly when asked to use enough plastering to cover ¼ inch tubing; but the greatest objection to running interior conduits clear back to the cut-out cabinets is that a large number of tubes are brought to one point and it is almost impossible to make the plastering adhere to them.

Many architects think that interior conduits should only be placed in the flooring. I object to this, because it is almost impossible to lay tubing in the flooring and to prevent them from being broken to pieces by the workmen. Theoretically it is a perfect way of wiring, practically it is anything but satisfactory in my estimation. I object to the indiscriminate use of interior conduit from the fact that a slight settling of the building will break and destroy the tubes in such a manner as to make them useless for the purpose for which they are intended. I do not wish to be understood as being opposed to interior conduit, as in 95 per cent. of my work I use it; but I believe in restricting its use to its proper place—using it in short runs between outlets, and then having some form of moulding to carry the wire back to the cut off cabinets. In office and hotel buildings this is especially applicable. The amount of conduit is reduced to a minimum and the liability of breakage from settling of the building is reduced in proportion.

For convenience of testing, I prefer an individual distributer, which consists of a horse shoe cut-out, having no fuses. This can be placed in the centre electrolier of the room from which a circuit will run to the outlets, or, where possible to do so, I use a block, which is placed in the moulding at the entrance to the room. All wires are run from the block to the outlets. In case of a ground in any line in this room, it requires but a moment to uncover this box and discover the line which is grounded.

All work described so far is in strict accordance with the rules of general wiring as pronounced by good authorities up to date. I wish now to digress somewhat from orthodox rules and suggest some changes which are more or less startling, depending upon the amount of thought that has been given the subject. When the matter was first presented to me it did not strike me favorably, but as I considered the question further I became convinced that the innovation would sooner or later be adopted.

There are three danger points in electric light plants: First, the switch-board; second, the cut-out cabinets, and third, the liability of ground on a circuit.

Grounds can be avoided by the use of good wire, by using insulators to carry all risers and feeders, and by distributing in moulding and interior conduit as described. I would consider that a model plant, in a modern office or hotel building, would consist of no less than three and not more than five dynamos, a slate switch-board properly mounted with instruments arranged tastefully thereon, the best quality of rubber covered, braided and slicked wire, mains and feeders run upon porcelain or glass insulators, cut-out cabinets made of slate or marble, something after the fashion of that shown in Fig. 3, with all connections on the face. Up to

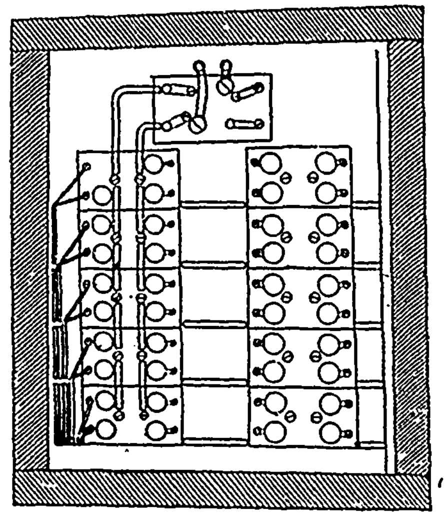


FIG. 3.

this point the plant would have been made according to the best and most approved system of wiring, but here I would make a departure, by bunching my distributing wires together, wires of opposite polarity being placed side by side in the same raceways, as shown in Fig. 4. This raceway would be lined with asbestos paper, with several coats of a good fire-proof paint, or made of fire-proof material throughout. Opposite each room I would place an individual distributor similar to that already shown. The greatest amount of current to be allowed on one circuit I would make eight amperes. I would so construct my fuse block that it would be impossible to place a fuse therein with a greater carrying capacity than eight amperes. No fixture could be used unless it be provided with an insulating joint, which must also carry the canopy It is quite a common thing to place a good insulating joint on a fixture with a canopy which grounds the fixture by shunting the joint.

Fig. 5 shows the common method of insulating (?) fixtures. Electric gas lighting work would not be accepted on my fixtures unless the same quality

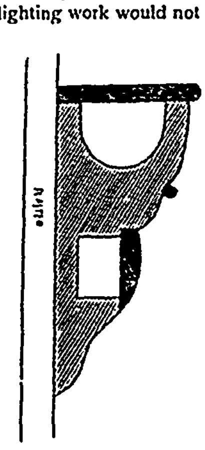


FIG. 4.

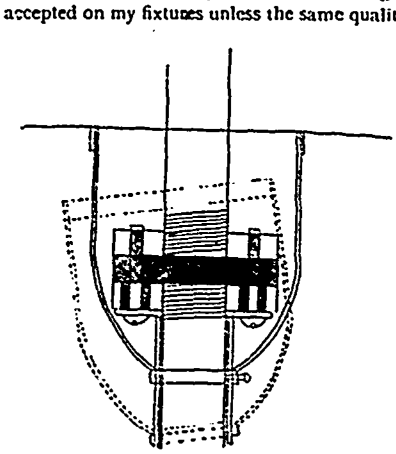


FIG. 5.

of wire was used as in the rest of the installation. No ground would be permitted in the gas lighting circuit. No drop cord smaller than No. 16 B & S could be used and no wire smaller than No. 14. These suggestions I am satisfied are in the line of better and cheaper construction. The reasons are: First, wires placed behind the cut-out box are generally arranged in such a manner as to make it almost impossible to trace them, which is in violation of the board rule that all wires should be accessible for repairs and renewal at any time; second, the bunching of wires is a cheaper and neater method of running than where opposite polarities are separated.

When electric lighting came into existence it had no precedent except that of telegraph work and rules, hence telegraph practice was followed. Wires

* At this point Mr. Armstrong displayed photographic views of switch-board, typical of the principal lighting system installed in Chicago, and incidentally described the most prominent and characteristic features of each.

were separated as far as possible; it was argued by many that wires of like polarity should be kept apart for fear there might be a difference of polarity between them, and in one case no longer ago than last summer an insurance inspector insisted that the wires of a loop running to a switch were of different polarity and liable to short circuit.

The safety valve of electric lighting is the fuse. The most dangerous current that we can have is known by some as the "sneak" current and is one that is so slight as not to affect the fuse and open the circuit. The indiscriminate mixing of polarities is especially to protect us against the "sneak" current. With the present system wires become bruised at a certain point, the insulation is injured, the breaking of a water pipe causes a ground, electrolysis takes place, the wire becomes oxidized and attenuated, and finally causes an arc, which may result in a fire. In the system which I am describing a short circuit would very quickly develop and the fuse would be blown, which would warn the electrician that something was wrong. Repeated blowing of fuses would cause an investigation, the trouble would be discovered and remedied. Danger from short circuiting would be comparatively nothing, for the faithful fuse, ever on duty, would give warning of danger. In fact, it would not require a great stretch of imagination to conceive of placing a false lining on the door of the cut-out cabinet in such a manner that the blowing of the fuse would indicate on an annunciator in the engine room where the fuse had blown, thus notifying the engineer in advance of the inevitable angry tenant.

As to the use of eight amperes on a circuit instead of eight lights, as is the present rule in Chicago, I believe there can be no serious objection made. "Lights" is an indefinite term and depends entirely upon the voltage employed for its value in current. The only object of limiting the amount of current on circuits is to reduce the liability to destroy sockets by short circuiting. Experience has convinced me that eight amperes properly protected by an eight ampere fuse will not destroy a socket by short circuiting. If the fuse is warm and other lights are on the circuit there is not the slightest danger of injuring it.

To conclude, I will say that the plant designed after the plan outlined would have an economical range in the dynamo capacity, and an economical loss in the wires, which, by the way, is a point that many do not seem to appreciate; in fact, one building is being wired to-day in Chicago with wires several times larger than needed, the owner probably following the logic of the man who drank the whole bottle of medicine with the remark that "if some of it was good more was better," or the son of the Orient who went to purchase a pair of shoes, found that whereas a pair of No. 6 would exactly fit him, that a pair of No. 12 would cost the same money, so he took the No. 12 shoes.

A plant should be designed with a very small loss at the average load; this loss will vary with the character of the building. Very few buildings operate any where near their full capacity at any one time, but if they should for a few minutes in the day require their full capacity the excessive cost of coal expended for that short time would nearly compensate for the interest on the copper, which is a fixed charge against the plant.

This method would reduce the cost of distributing to a minimum, danger of grounds would be almost entirely removed, and with improved fixture connections I doubt whether a better plant could be devised.

It is true that this plant would not coincide with the city inspection rules of Chicago to-day, but the history of our inspection department has been one of incessant warfare against bad work and in favor of better and safer installations. The gentlemen who compose Prof. Barrett's staff are progressive, active, and thoroughly alive to the interest of the electrical profession, and I am satisfied are willing to make any change or alteration in the present rules that would make our work better, safer and more in accordance with good engineering; and we all feel that they are working to accomplish this laudable object. When I say that these gentlemen are working I wish it understood that I mean it literally. When you consider that four inspectors are required to thoroughly inspect 498 isolated stations operating 646 arc lamps and 132,521 incandescents, and 21 central stations operating 9,300 arcs and 150,000 incandescen lamps, all of which are irregularly distributed over 174 square miles, you will understand that they have plenty to occupy their minds and time.

TRADE NOTES.

The Montreal Electric Company, 302 St., James St. have been appointed sole agents for the province of Quebec for the Crocker-Wheeler motors.

The Robb Engineering Co., Amherst, N. S., recently received orders for a 125 horse-power Monarch Economic boiler for the I. C. R. shops at Moncton, N. B.; 125 horse-power Robb Armstrong automatic engine for an electric station at Lethbridge, N. W. T.; and a 150 horse-power Monarch Economic boiler for a woollen factory at Preston, Ont.

Mr. John A. Burns, of Montreal, has secured the agency for that city for the Kay Electric Works, of Hamilton, Ont. The excellent workmanship and well known features of their machines need no recommendation on our part, and we have no doubt but that their interest will be well looked after by Mr. Burns, who has had an extensive experience in some of the largest engineering works in Canada and the United States, and is also a graduate of McGill University, Montreal.

There is a scheme on foot to build an electric railway line between Deschene mills and Aylmer, a distance of about three miles. Mr. R. H. Conroy, warden of the county of Ottawa, is the principal promoter of the movement.

THE CORLISS ENGINE.*

The valve that is used in the Corliss is by no means a new thing, and it is a fact that all of the principal valves in use to-day were conceived and tried in the early days of the steam engine, but the time was not ripe for their use. The slide, the gridiron, the rotary, piston, rocking, and poppet valves were all old enough when Corliss commenced first to work on the steam engine, although the minor details may not have been the same, but these are constantly changing. The Corliss engine is noted for its valve motion, not its valve. Corliss could have chosen the gridiron valve to put his ideas into practice upon, or any other, but the rocking valve answered best his purpose. The rocking valve is by no means an ideal valve, but it possesses some advantages. The best feature is that it can be extended clear across the cylinder and placed very near the cylinder, thus reducing the waste or clearance space between the valve face and the piston head, at the end of its stroke, and in addition by the use of a fair valve system, the steam and exhaust passages are short and direct. Its great length makes a very slight opening of the port represent a considerable area of opening, and the movement of the valve need not be very great to make a considerable area of opening of the valve. The valve is very quick in reaching a full opening, and if the motion given the valve is also very rapid, the port is opened extremely rapid. These are important points to the advantage of the Corliss engine valve—the small clearances and the quick opening; and as the valve motion is one that gives a particularly quick movement to the valve it is very quick in action.

The valve has this against it, that it is hard to keep tight. To do this it must fit its seat well, and no grit or substances must be allowed to cut this seat, for once a leak begins the cutting action of the steam makes the leak extend very rapidly. It is not an easy matter to remedy this leak after it has once commenced. The valve chambers must be re-bored, and unless the leak is stopped a considerable loss ensues. It is a fact, too that leakage past the steam valves exists more than is generally admitted, and represents a considerable loss even though the steam is used again for heating purposes. Men put up with leakage that they know exists in an engine and satisfy themselves by saying, it is'nt wasted, for it goes to heat the feed water or to do this heating, and all there is about it is that we use the engine as a reducing valve instead of using a separate reducing valve. It is a fact, usually that the legitimate exhaust from an engine is sufficient to do this work, and this being so all that leaks past the valve is pure loss. The Corliss valve may not show any more leakage than the Brown or Putnam under the same care, perhaps not so much as the two latter, but it is far from being a perfect valve in this respect. The old valves were much worse than those of the present day, for they were hung turning in bearings, while to-day they rest upon the seat, the valve being held against the seat by springs or the pressure of the steam. The insufficient warming up of the engine before starting up produces unequal expansion of the valve and its seat, and wear in spots follows and, of course, a leaky valve. The valve is not balanced and the friction item is an important one. This defect is one of varying magnitude, according as the valve allows steam to get underneath it or not. The plain slide valve, with the pressure squarely upon it, will sweep the steam from beneath it on a true seat. A Corliss or any rotating valve has not this tendency and instead is inclined to lift and allow steam to get beneath it and its seat, and this in a measure balances it. The friction of the valves is therefore greater in some Corliss engines than in others, and it is undoubtedly less when the engine is running than when starting up. A leaky Corliss valve is also in a measure balanced, so that whether the valve possesses excessive friction or not comes back to the practical consideration of the matter in its practical operation. It does not always show friction, but it is not like the piston and balanced slides of high-speed engines, which are under all conditions working with the least friction. Their great defect, then, lies in their tendency to leak, the wearing of the valve seat unequally at different cut-offs requiring a frequent use of the boring machine.

The fact that the valve extends clear across the cylinder makes so wide an opening for a full admission of steam unneces-

*Abstract of lecture delivered by Thomas Hawley, in the Lowell Course at Wells Memorial Institute, Boston, Mass.

sary. The ordinary Corliss engine has a single-ported steam valve, but some attempts have been make to give it double ports. The Trenton valve, Fig. 1, has a single port to the cylinder, but two passages through the valve so as to make a very slight movement of the valve give a full port opening, a quick port opening and, of course, a quick closure. The new Wright valve is a gridiron Corliss with a single port to the cylinder, and in some of the Reynolds-Corliss engines, instead of

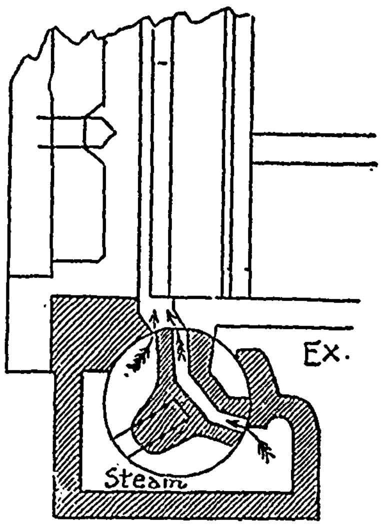


FIG. 1.

placing the valves on top and beneath the cylinder, place them in the heads, as in Fig. 2.

The object of this construction was to give a short travel and wide port opening at the high speed run, 100 revolutions per minute and least clearance. It is obvious, of course, that the chances of leakage are increased by thus multiplying the extent of edges exposed to the steam. The lap of the valve edges must be decreased, and in doing so we get back to one of the defects of the early Corliss engines, of insufficient lappage, causing more leakage.

It is quite clear, I think that a valve of itself must have defects, but its merits will depend very much upon the valve gear by which it is operated. On the continent of Europe a Corliss engine is any engine with a detachable cut-off gear, though the valves may be poppet or anything but what we know as the Corliss. This is, in a great measure, right; and, though many people will have a Corliss engine nothing but what it is, yet the great beauty of the Corliss engine is its valve motion, and it is its

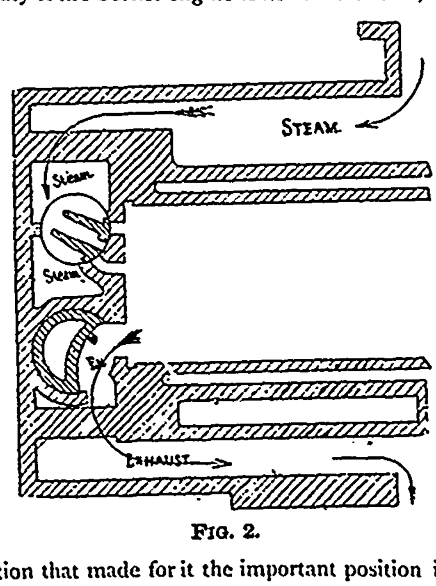


FIG. 2.

valve motion that made for it the important position it holds today as the best of steam engines. The motion is calculated to fill what is best of the different functions of the valve. It will open the steam valve rapidly, it will hold it wide open until the time it is to be closed, and it will remain closed, without movement, until again to be used. In short, it operates rapidly when in motion, and when not opening or closing is at rest. The same is true of the poppet valve of the Putnam engine, and in the Brown less so. This lingering or dwelling of the valve when opened or closed, is caused by the position of the wrist plate and connections. If we take a skeleton outline of the wrist plate and connections, as in Fig. 3, they are, in effect, like a number of levers, each independent, except that they derive their motion from a single shaft. The eccentric rocks these levers back and forth in a certain arc, and they rock the valve

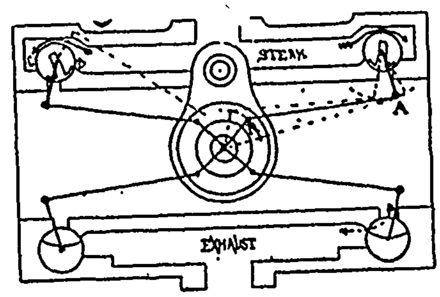


FIG. 3.

over a certain path to uncover and cover the ports. That is all there is to it except the trip gear.

Take one of these valves and connections, as in Fig. 4, you will observe that the opening movement of the valve comes when the wrist-plate connections are in such position that the full movement of the wrist plate is given to the valve, the skeleton "levers" being then in position, *a a*. If the opening of the valve should take place when the "levers" were in position, *b b* it will be seen that the wrist plate would have a considerable circular motion before moving the valve at all, hence the more the "levers," *a a*, are at right angles to each other, the more

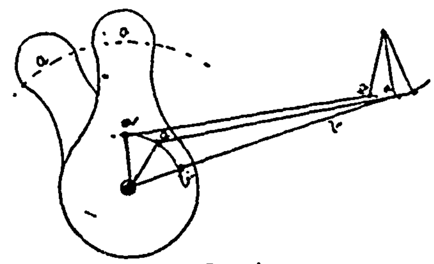


FIG. 4.

alike will the movement of wrist plate and valve be. This construction gives a rapidity of motion in opening and a dwell when open that is important, and in the case of the exhaust, particularly so, since that is positive in its motions, opening quickly, barely moving when open, closing quickly and hardly moving when closed.

The original Corliss had the wrist plate situated half way down the frame and long connection rods to the steam and exhaust valves. The dash pots were also horizontal, and attached to the frame, the dash pot rods running lengthwise of the engine. This construction has one advantage, that the influence of the heat of the cylinder was not noticed as now, the present construction making the valves act slightly different when hot than cold. The placing of the wrist plate on the side of the cylinder obviated the difficulty that was found in the spring of the long connections, and while with the old Corliss one of the valves opened toward the centre and the other away from the centre, the ordinary construction to-day makes them open one way.

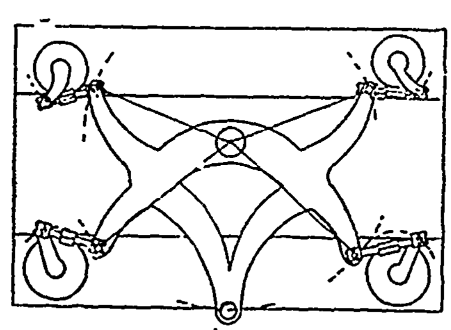


FIG. 5.

In the case of the ordinary Corliss the valve opens toward the centre of the cylinder, and in modifications opens away from the centre of the cylinder, so the steam does not have to pass over the valve to enter the cylinder. The tendency of the Corliss original shop is to increase the angularity of the connections so as to give an even quicker motion to the valve than was possible under the old arrangement. This has led to the adoption of a wrist plate like this, Fig. 5. It is a fact that the full pressure of steam may be realized in the cylinder of the engine, even though the port is not wide open. It follows, then, that any opening of the port after this point is reached is useless, but the valve must continue to move forward some or the trip could not have a chance to operate. The cut-off of the valve must not be considered as taking place until the valve has actually closed. The valve may be tripped and still slow in closing, showing a wire drawing of the steam. A sluggish dash pot will aggravate this trouble, and in any event there must be some time consumed in closing the valve. With the Corliss that time is very little. The action of the tripping is likely to give shocks to the governor, even though the dash pot prevents, in a measure, the oscillation.

The particular fault with the valve motion of this engine is that it does not permit of a sufficient degree of compression being given the engine without affecting the release. The exhaust valves are large enough, and open rapidly enough to make a quick, free exhaust, with very little back pressure. The time of release may be changed by lengthening the right and lefts, but to obtain more compression the right and lefts must be lengthened. This action makes the release later, and before you know it the release is at the end of the stroke, and no more can be done. To give the eccentric more angular advance will increase the compression, but at the sacrifice of the range of cut-off, and making the valve open slower. To obviate this difficulty of obtaining considerable compression without a release too late, some engineers place two eccentrics upon their engine, one for the steam and one for exhaust valves, and set their exhaust eccentric with sufficient angular advance to give the proper compression. Another scheme proposed is to make the exhaust ports nearer the centre of the cylinder, so that the piston will completely cover it in a portion of each return stroke. The covering of the port by the piston confines the steam and allows it to be compressed, the exhaust valves caring for the release. This gives a fixed compression. The weight of the dash-pot piston and connections is to cause wear to appear, causing the stuffing boxes of the valve stems to wear oval. In the Wright engine the wrist-plate is made in two parts, one portion being in engagement with the tripping gear so that the tripping comes at the wrist plate, which is more able to stand the shock than the valve stems.

In setting the valves of the Corliss engine it should be done first by the marks and then with the indicator. The first thing to do is to place the wrist plate in its central position. Upon the stud or pin supporting the wrist plate will be found a mark, and upon the wrist plate three marks, the central one of which should coincide with the mark upon the stud when the plate is in its central position. Upon removing the bonnets from the back end of the valves we will find upon the end of the valve a mark, and that mark coincides or is in line with the opening edge of the valve, and upon the valve seat are two marks that correspond with the edges of the port, showing its location and width. It might be well to verify these marks, but after that is

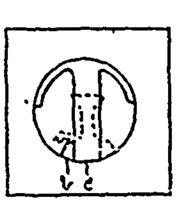


FIG. 6.

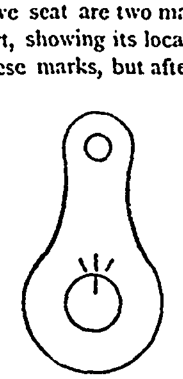


FIG. 7.

done, or assuming the marks are right, we can set the valve by these marks, two showing where the port is, and the one on the valve, the edge of the valve, *b c* on the valve seat show the location of the port as shown by the drawing, Fig. 6. With the wrist plate in its central position, the steam valves on each end should overlap equal distances, ¼ inch for an 18-inch cylinder and up to ½ inch for a 36 inch cylinder, and the exhaust port may be a little open, usually one-sixteenth of an inch for an 18-inch cylinder, and ⅛-inch for a 36-inch cylinder. The object is to get all alike and squared. If they do not appear alike, turn each of the right and left connections until they do. The valves are then squared. See next that the rocker arm rocks equal distances each side of a plumb line, and if not, cause it to do so by taking up between the rocker arm and eccentric. Next hook the carrier rod to the wrist plate, and by turning the engine over see if the wrist plate moves equal distances on each side of its central position. There being three marks upon the wrist plate this is easily seen, Fig. 7.

If the wrist plate does not move equal distances each side of a plumb line cause it to do so by taking up on the carrier-arm connections wherever it can be done, and if there are no means of taking up there it must be done at the eccentric rod, but only after the rocker arm has been squared. The point is to have the wrist plate vibrate evenly. Now, when this is done, and the wrist plate hooked in, turn the engine on the centre and set the eccentric in the direction the engine is to run so that the steam valve on the end which is to take steam will be open about one thirty-second to one sixteenth of an inch. It should be kept small as possible. If the valve had no lap or lead the eccentric would be set at 90° angular advance, and any advance from this position will cause the opening to be slower and diminish the range of cut off.

The next point is the governor. The long rods from governor transmit the motion of the governor to the cut off mechanism and adjust it to trip the steam valve. By changing the length of these rods the point at which the valve will be tripped for a certain position of the governor is altered. Block the governor in its highest position, and adjust the long rods so that the valve will trip before the steam port is opened, that it will trip before the lap is uncovered, or no more than touch the steam valve. This can be determined by working the valves with the bar in the wrist plate. Then drop the governor to its lowest point and see if valves do not trip at that point. If, when the average load is on as determined by the indicator, the cards are unequal in area, as will probably be the case, change the governor rods so that the end doing the most work will trip a little earlier, and the one doing the least work, a little later. If the card should be a little late all around, set the eccentric ahead a trifle. If it is then desired to change any particular point, shortening the right and left will give more lead, and decreasing it, less lead. By shortening the exhaust connections, the release will be earlier and the compression decreased, while lengthening these connections makes exhaust take place later and increases the compression.

THE REAL INVENTOR OF TELEGRAPHY.

SAYS a writer in the *Popular Science Monthly* for February, Weber was the first who established a permanent workable telegraph line, and thereby demonstrated the practical value of electric telegraph. Weber's house in this city was connected with the astronomical and magnetic observatories by a line three or four kilometers (over two miles) in length. The signals were made by the deviations of the needle of a galvanometer to the right and left, and were interpreted according to a conventional alphabet. The use of interrupted or reversed currents did not permit the transmission of more than one or two words a minute, but the speed was increased to seven or eight words by the use of induced currents. The following first notice of this telegraphic connection was published in one of the numbers of the *Gottingen Gelehrten Anzeigen* (or Gottingen Scientific Notes) for 1834: "We cannot omit to mention an important and, in its way, unique feature in close connection with the arrangements we have described [of the Physical Observatory], which we owe to our Professor Weber. He last year stretched a double connecting wire from the cabinet of physics over the houses of the city to the observatory; in this a grand galvanic chain is established, in which the current is carried through about nine thousand feet of wire. The wire of the chain is chiefly copper wire, known in the trade as No. 3. The certainty and exactness with which one can control, by means of the commutator, the direction of the current and the movement of the needle depending upon it were demonstrated last year by successful application to telegraphic signalizing of the whole words and short phrases. There is no doubt that it will be possible to establish immediate telegraphic communication between two stations at considerable distances from one another."

ELECTRIC RAILWAY DEPARTMENT.

TORONTO AND MIMICO ELECTRIC RAILWAY.

It is reported that negotiations are under way and will speedily be consummated for the purchase of the above road by the Toronto Street Railway Company. The present owners of the road appear to have had a by no means pleasant experience. They have for some time been engaged in litigation with the builders of the road, the Reliance Electric Mfg. Co., arising out of their claim that the plant installed for the purpose of operating the road is defective, and that to this cause was due the fact that the road ceased operations after having been running for a couple of months last year. Again the company has been involved in litigation with persons resident in the township of Etobicoke, with the object of securing payment of a bonus of $10,000 granted to the company by a vote of the ratepayers under a by-law of the municipality. The line, if properly operated, should prove a profitable one in the summer months at least, when thousands of the citizens are weekly visitors to High Park and the Humber.

ECONOMICAL OPERATION OF STREET RAILWAYS.

Mr. A. B. Johnson, in writing on this subject to *Electricity* of New York, says :—I think it can be reasonably claimed that any route where the travel will warrant the installation of a horse railroad, can be more economically operated by means of electricity, provided the water supply is ample, and the cost of the fuel is not exorbitant.

It is in just such cases, however, where the conditions for success are the most restricted, that a system of false economy is most apt to be practiced. Managers of small roads will argue that their business will not warrant the expense of employing a competent electrician, and in consequence, men are often found in charge of electrical plants and railway equipments whose knowledge is limited to the operation of replacing burnt out armatures, which under these conditions, is an operation of unnecessarily frequent occurrence. A case illustrating this, recently came under my notice, in which an armature, which had been running for over six months without a particle of attention or inspection, was suddenly burnt out.

This was replaced by three others, successively, which met with the same fate. On examination it was found that the armature brushing had worn down so much that the armature winding was rubbing on the lower pole piece of the motor.

The "electrician" of the company, after making this discovery, spent two days in patiently chipping out the lower pole piece, until sufficient clearance for the armature was obtained. This remedy had the effect of burning out the armature on the opposite motor, and the case was referred to the company, who installed the plant. This company supplied a new pole piece, two pairs of brushings, five armatures and the services of an expert.

The cost of this experiment, covering a period of five days, would have paid the salary of a competent electrician for more than six months. This is undoubtedly an unusual and, it is to be hoped, isolated case, but it serves to illustrate the folly of intrusting the care of electrical machinery to men who have no knowledge, either theoretical or practical, of its requirements.

The idea that electrical machinery is indestructible is fast losing ground with railway companies and it is now the rule to find competent men in charge of electrical equipments, but it is difficult to surmise why such an opinion has ever existed. In installations of almost every other class of machinery the greatest care is take and the most competent engineering ability is demanded, but in the case of electrical plants these ordinary precautions are frequently neglected, and while it would be hard to find a case where a steam plant is in charge of a man who knows nothing whatever about an engine, electrical equipments, which are infinitely more susceptible to injury, are often intrusted to men who have not the least knowledge of electricity.

The annual depreciation in the value of a plant is always an important item to which too little attention is apt to be paid, but the care which a railway plant receives will, to a great extent, determine the percentage of its yearly depreciation. It would seem that the expense of equipping a street railway is sufficient to make the saving of two or three cent. per annum on the investment an object of very careful consideration. This question of depreciation is sure to be an important one with this class of machinery, and every care should be taken to increase the life of such an equipment. The renewal of the plant is sometimes a matter of great expense to companies who have allowed their machinery to run down until it is useless, while the entire cost of keeping it in good order from day to day would be hardly felt in comparison.

There can be no doubt that the supervision of a competent man will save any railway company several times the amount of his salary, in averting accidents by intelligent foresight, and at the end of five years the value of the plant will be probably twice as much as in the case where it is permitted to take care of itself.

The Berne, Switzerland, compressed air tramway is at present exciting a good deal of interest. The peculiar feature of this system, which is known as Mekarski's, is, according to the *Street Railway Gazette*, that steam is mixed with the compressed air—in order to keep its temperature from falling too much when the pressure is lowered—and so reducing the air pressure to a point too low for use on the engines. The air is compressed in a central compressing station, and after passing through dryers is sent out in pipes to the so-called accumulator stations, where it is stored in tanks preparatory to delivery to the car. At these accumulator stations are also the boilers furnishing the steam to be mixed with the air. The motors are like a common steam motor, and the storage tanks are under the car floor.

The Ottawa Electric Street Railway Company are enlarging their power house and intend putting in larger motors in the place of the ones now in use. The company have extended their line to Rockliffe, but say that even with the lines now in operation they require additional power.

Messrs. C. and J. F. Beck and others have been granted incorporation as the Penetanguishene & Midland Electric Street Railway, Light and Power Co. The capital of the company is $75,000. Mr. Holgate, C. E., and his staff are engaged in surveying the road, and it is expected that construction will soon be commenced. The company intend to carry freight as well as passengers.

The Montreal Street Railway Company's new power house, of which mention was made in the last issue of the Electrical News, will contain an engine and dynamo room 160 feet by 85 feet, and a boiler room 100 feet by 80 feet, and will be built of brick and stone. Messrs. J. Laurie & Bro., of Montreal, are now engaged in the construction of the twelve generators which are to furnish the power, and which will be driven by six steam jacketted, compound condensing Corliss engines of 600 h. p. each. The high pressure cylinders will be 24 in. in diameter by 48 in. stroke; the low pressure cylinders 48 in. diameter by 48 in. stroke. The shafts will be of steel, 15 in. diameter in the centre and with 13 in. journals. The fly wheels are to be 22 feet in diameter, 44 in. face, with a weight of about 40 tons each. The cost of the engines will be $75,000, and the weight over 500 tons.

In reply to Mr. Cockburn's inquiry, Mr. Wood, Controller of Inland Revenue, has stated that the Government do not intend to introduce a bill for the inspection of electric light.

The Northwest Transportation Co. has let the contracts for lighting their boats. There will be one engine of the Armington & Sims pattern for each boat, and they will be furnished by Messrs. Nie & Lynch, of Hamilton, while Messrs. Ahearn & Soper will complete the work and furnish all material.

The Canadian General Electric Co., of Peterboro', have completed the fourth of the locomotives they have been building for the Vancouver Coal Co. The average speed will be about 8 miles per hour, the grading in the mine being very irregular. The current will be delivered at 3,000 volts, but will be reduced to 50 volts at the locomotive.

SPARKS.

The name of the Guelph Gas Company has been changed by an order-in-council to the Guelph Light and Power Company.

Messrs. McColl Bros. & Co., of Toronto, have formed a company and are being incorporated under the name of The McColl Oil Company, of Toronto.

Mr. T. Ahearn, of Ottawa, has returned from a trip through Mexico and Central and South America, where, he states, very little progress in electrical matters has been made, owing to political difficulties.

The St. Catharines Electric Street Railway Co. have relaid the track from Thorold to St. Catharines and intend to commence work shortly on the extension to Port Dalhousie. They have also built a large and handsome car stable.

Mr. J. W. McRae, president of the Ottawa Electric Street Railway Co., states that it is the intention of the company to put in a steam plant, so that in case of low water they can have steam to fall back on. During March last, when the water was low, they had considerable trouble. They with a number of others interested also propose to deepen the channel so as to obtain a greater head of water.

The Montreal Electric Club held its last meeting for the season on May 29th. An instructive paper was read by Mr. H. Ritchie on "Testing Dynamos and Motors," and the secretary-treasurer afterwards presented a report, showing the club to be in a flourishing condition financially and the membership to be increasing satisfactorily. The meeting then adjourned to meet at the call of the president next September.

SPARKS.

St. Cunegonde, Que., has been equipped with complete electric fire alarm and police signal systems by Mr. N. Simoneau, of Montreal, who was awarded the contract for the work.

In another part of this paper the city of Fredericton, N. B., invites tenders for electric street lighting. Mr. Chas. W. Beckwith, City Clerk, writes as follows "I may say that we have a company here to whom we pay about $2,000 for 62 gas lights, and as they also run an electric system (the only one in the city) they will not furnish us with electric street lights at any reasonable figure, preferring to keep us to the old gas lights. We are therefore seeking some advance, and if satisfactory tenders are received, are in a position to close a contract on terms advertised."

The gigantic undertaking of harnessing Niagara is rapidly nearing completion, and when finished will be one of the triumphs of the nineteenth century. The large tunnel through which the water will have to pass after being utilized to rotate the large turbines is nearing completion, and the total length of the tunnel is 7,000 feet; 19 feet wide and 21 feet high. The immense shaft in which the turbines will be situated is sunk to a depth of 200 feet. Turbines of enormous size and capable of producing 5,000 horse power each will be used, the largest ever constructed. Large dynamos will be vertically coupled directly to the main shaft, so that no power will be lost through the means of belting, and the electric current generated will be used to furnish power, heat and lighting. This large undertaking is engineered over by G. B. Burbank, of New Aqueduct fame, and Prof. Geo. Forbes, the great English electrician. On the Canadian side work is finished. In this case the water power is obtained from a cut leading from the river of about 100 feet in length, at the end of which the sluice gates are situated, thence a fall of eighty feet, the waste water passing through a tunnel situated below the Falls. In this case two turbines of 1,000 horse power each are used. The current furnished will be used to operate the electric railway, which is now built, running from Queenston along the brink of the river to the prettily situated village of Chippewa. On every pole used to suspend the wire between the Clifton House and Queen Victoria Park, there are situated six 16 candle power lamps, which will be lit up at night, making it one of the prettiest rides imaginable.

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