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CANADIAN
ELECTRICAL NEWS
AND
STEAM ENGINEERING JOURNAL

OLD SERIES, VOL. XV.—No. 4.
NEW SERIES, VOL. IV.—No. 6.

JUNE, 1894

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CANADIAN

ELECTRICAL NEWS

AND

STEAM ENGINEERING JOURNAL.

VOL. IV. JUNE, 1894 No. 6.

MR. ECKLEY B. COXE.

IN connection with the outline of proceedings of the approaching convention of the American Society of Mechanical Engineers in Montreal, which is printed elsewhere in this paper, we have the pleasure of presenting to our readers a portrait and sketch of the President of the Society, Mr. Eckley B. Coxe, of Drifton, Pa. For the data employed in this sketch we are largely indebted to an article by Mr. Wm. Kent, M.E., in Cassiers' Magazine.

The newly-elected presiden. of the American Society of Mechanical Engineers, Eckley Brinton Coxe, has been for many years one of the leading spirits in the engineering profession. In April, 1871, his name was the first signature to a circular issued by a committee consisting of R. P. Rothwell, Martin Coryell, and himself, calling a meeting of mining engineers, to be held at Wilkesbarre in May, to organize the American Institute of Mining Engineers. At this first meeting of the Institute he was elected one of its vice-presidents and in 1878 and again in 1879 he was elected president. Being a frequent contributor to the "Transactions of the Mining Engineers," and a constant attendant at its meetings, and being head of the well-known firm of Coxe Bros. & Co., the largest private corporation producing anthracite coal, his name and face are more familiar to the mining than to the mechanical branch of the profession, but since his work has been pre-eminently in the mechanical line, as in the invention and construction of machinery for mining, conveying, and separating of coal, and since the mechanical branch is indebted to him for the translating and editing of Part I. of Weisbach's Mechanics, the American Society of Mechanical Engineers has as much right to claim him and to elect him its president as had the older society.

Eckley Brinton Coxe was born in Philadelphia, June 4th, 1839. He graduated from the University of Pennsylvania in 1858. After completing a course in the scientific department of that institution, he was engaged six months in topographical geological work, in the anthracite coal region of Pennsylvania. In 1860 he went abroad to continue his studies. The next two years were spent at the Ecoles des Mines, in Paris, and then a year in the Bergakademie at Freiburg, Saxony. He subsequently spent two years in visiting and studying the practical operation of the mines of England and the Continent. With his brothers he inherited large coal estates in Pennsylvania, and his entire education had been directed with the special object of preparing him for their management. Consequently upon his return to the United States in 1865, Mr. Coxe, in company with his brother, under the firm name of Coxe Bros. & Co., began the business of mining anthracite coal in the Lehigh region. Since that time he has been engaged in the operation of his company's collieries.

In the operation of these mines he has won a high reputation as one of the most progressive, able and honorable representatives of the great coal mining industry.

In 1880 Mr. Cox was elected to the Senate of Pennsylvania.

Mr. Coxe is a member of other engineering and scientific bodies besides the two of which he has been chosen president, among them the American Society of Civil Engineers, the Engineers' Club, and the American Association for the Advancement of Science. He was one of the vice-presidents of the last named at its New York meeting in 1887.

THE LONG DISTANCE TELEPHONE.

A FEW weeks ago a business man in New York city telegraphed to the owner of a big poultry farm in a small town in Illinois to go to Chicago and "meet" him at a certain hour on the long-distance telephone line that now places New York on speaking terms with Chicago. The Illinois farmer kept the appointment, and the two conversed together over the wires for half an hour.

At the end of the conversation, the Illinois man emerged from the telephone booth, paid his $54 with entire satisfaction, and exclaimed with great glee, "'Great Scott' I've just sold a hundred thousand chickens!" This little episode "points a moral and adorns a tale." Such a text needs little expounding to a circle of business men, such as comprise the majority of the readers of this magazine. Take the first point.

Correspondent No. 1 telegraphs from New York to Chicago to correspondent No 2 at some provincial town in Illinois, to go to Chicago in order that he may talk to him. Point the second. They talk for half an hour at a cost of $54. If a personal meeting had had to be arranged, they would probably have talked for several hours before coming to a settlement, the time spent in traveling by one of them would have been from three to four days at a minimum and the actual expense about $100.

Point the third. A sale amounting to, say at least, $20,000, was effected with great promptness, and without the intervention of any middleman. Surely no better illustration of the business possibilities of the long-distance telephone could be desired. Engineering Magazine.

CUTTING MICA.

AT the glass house the mica is put into shape for shipment. The The blocks vary greatly in size. One from the Wiseman mine, near Spruce Pine, is reported to have been six feet long by three wide. Pieces a yard in diameter have been obtained at the Ray mine, in Yancey county, and similarly plates have been found in Siberia, but these are exceptional. The average block is a little larger than the page of a magazine, and is generally less than six inches in thickness. It separates very readily into sheets parallel to the base of the prism. It is estimated, says C. H. Henderson, in the Popular Science Monthly, that this cleavage may be carried so far that it would take three hundred thousand of the mica plates to make an inch. It is needless to say, however, that such a thickness is not suitable for service in stoves and furnaces. The mica is generally split into plates varying from about 1/8 to 1-64 of an inch in thickness. In preparing these plates for market, the first step is to cut them into suitable sizes. Women are frequently employed in this work, and do it as well as, if not better than the men. The cutter sits on a special bench which is provided with a huge pair of shears, one leg of which is firmly fixed to the bench itself, while the movable leg is within convenient grasp. It is requisite that the shears shall be sharp and true, for otherwise they will tear the mica.

The patterns according to which the mica is cut are arranged in a case near at hand. They are made of tin, wood, or pasteboard, according to the preference of the establishment. Generally they are simple rectangles, varying in size from about four square inches to eighty.

A telegraph line is in process of construction by the C. P. R. Telegraph Co., from Kingston to Ottawa, via the Rideau Canal route

MONTREAL JUNIOR ELECTRIC CLUB.

AT regular meetings of the above club held on the dates below mentioned, papers were read and discussed as follows:—

April 23rd.—Paper by S. W. Smith on "Direct Current Dynamo," part 1st.

April 30th.—Paper by R. H. Street and H. O. J. Overton on "Electric Light and Bell Circuits."

May 7th. Paper by Geo. Morris on "Steamboat Lighting by Electricity." (This paper was read before the Montreal Electric Club by R. W. Herring.)

May 14th. Paper by Wm. T. Sutton on "Storage Batteries," part 2nd.

ADVANTAGES OF DIRECT CONNECTED DIRECT CURRENT GENERATORS.*

BY W. N. STEWART.

MY remarks refer to electrical work over areas not exceeding three miles in any direction from the power house, in cities with 35,000 population, with streets lighted by arc lamps, and stores and residences with either arc or incandescent lamps, motive power being supplied as required, and the service extending over the 24 hours.

In a model, 500 H. P. plant, the essential machinery would be a 100 H. P. multipolar generator, directly connected to a compound engine running at 250 revolutions per minute; one 400 H. P. multipolar generator similarly connected and running at 170 revolutions; both engines being condensing when water is available. The generators to be built for 220 volts if used on a three wire system and 480 volts if used on a five wire system; the three wire for distances not over one mile, and five wire where they exceed one mile. Also 120 cells of storage battery, 30 amperes for 15 hours, for the three wire system, and 240 similar cells for the five wire system, these batteries to be used as an equalizer and regulator as well as to supply current. The usual switchboard and accessory apparatus would also be necessary. The wiring would consist of one circuit of mains and feeders to supply all customers with light or power, each consumer to have a meter connected to the outside wires. This plant could be operated by one engineer, one fireman, superintendent and the necessary lamp trimmers.

If the three wire system be used, a common grounded neutral wire could be used for both public and private lights, the arc lamps being connected in groups of two between the positive and neutral. If the five wire system obtains, they could be connected in groups of eight, each lamp having its automatic cut out. The necessary resistance should be in the line wire; iron wire being used in some cases, or copper wire not smaller than No. 8.

Apropos of the belief that resistance is waste of power, and therefore to be avoided. If the ordinary arc dynamo† give 78 per cent. efficiency and the constant potential machine 95 per cent., we have a difference of 17 per cent. in favor of the latter, and as the resistance for low tension arc lamps never exceeds 15 per cent. of the current, we have an advantage of 20 per cent. in favor of the system under consideration. Then we eliminate the friction of the belting which means a loss of 10 per cent., increased to 18 per cent. if a countershaft is used. Thus, in this case, 12 per cent. is gained, in the other 20 per cent.

The operation of such a station would commence by starting at 4 P. M. the small dynamo, the current from which would flow to the storage batteries. At dusk the large machine would be started, and the current would be divided between lights and the battery, until all the lights were burning, when the battery would act as a regulator. From 10 P. M. until 2 A. M. the current would be devoted principally to the charging of the batteries. This would mean an employe's working day of ten hours, the operation of the machines at full efficiency, and a battery working day of fourteen hours. Storage batteries are now extensively used in Europe and in some American stations with excellent results.

In our station we have one slow speed machine in operation at one time doing all the work, with an efficiency of 95 per cent., without loss in belting or shafting, and minimum repairs; ten hours daily run, current available day and night; low pressure wiring, hence no damage suits for personal injury; longer life and less blackening of incandescent lamps, the battery keeping the current uniform; less investment for real estate and buildings; less liability to breakdown; no burned out machine or armatures, less oil, fewer employes, no losses in transformers. The economy in such a station would be 40 per cent. over one run on the antiquated methods.

The high speed engine and belted dynamo are disappearing, and the direct connected slow speed combination is being adopted *because it pays to make the change*. The multipolar generator is almost perfection, its high initial efficiency is maintained for many years; it has an armature winding of solid copper bars; only about 20 per cent. of the current is used for the fields. Not less than $46,500 per annum economy is attained on the 17,500 incandescent lamp at the Chicago Auditorium, by the use of a direct connected plant, and equally favorable results are reported from other places. No reasons exist for managers retaining their obsolete apparatus and methods. In most places it would pay to sell the old dynamos and lamps, and adopt the direct connected combination and newer methods, which experience shows to be the most economical.

*Abstract of a paper read before the Northwestern Electrical Association, Milwaukee.

†Dynamos Electric Machinery: Prof. Sylvanus Thompson.

TELEPHONES.*

BY N. HOLLAND AND J. A. SHAW.

Before describing the construction of the telephone of to-day, we will consider what are the requirements of an instrument for transmitting speech and how they are met by inventors.

In transmitting speech electrically, the transmitter has to so control the current in the line that it will be able to reproduce at the distant end the three characteristics of a musical note, *pitch, loudness* and *quality*.

In the diaphragm at the distant end the pitch would correspond to the number of vibrations, or, as our alternating current friends would say, "the number of cycles passed through" in unit time. The loudness would depend upon the amount or amplitude of the fluctuations in each cycle; the quality depending on the form or nature of these fluctuations; and the necessary condition of a successful system of telephoning is the ability to reproduce these characteristics.

The first of these is very easy to reproduce, as of course, if we open and close the circuit sufficiently rapid we can get the period required.

It was on this principle that the much talked of Ries' instruments were made. His transmitter had a stretched skin diaphragm, with platinum points in the centre to make and break connections, and the receiver consisted of an electromagnet, which gave out sounds as it was magnetized and demagnetized. As the current was broken at every vibration caused by the sound in the transmitter, the sounds given out by the magnet were necessarily of the same pitch as those at the transmitter. Mr. Ries thought that the amplitude was also to some extent obtained by the varying length of contact in the transmitting instrument, but judging from the result of recent telephone investigation, it is highly probable that this was due, not to the duration, but to the varying degree of firmness of the contact.

The transmitters in commercial use to-day are constituted on two principles: 1st, By magnetic induction; and, By varying the resistance of the circuit. It was on the first of these principles that Graham Bell took out his now famous patent of 1877. When first brought out it was intended for both transmitting and receiving, but owing to the improvements in microphonic transmitters, it has now been used principally as a receiver. As it is this receiver (very little altered from the time it was put on the market) that is now used altogether, it would perhaps be excusable to give a short description of the way it is made, and how it performs its duties.

A laminated permanent magnet is used, as in this form it is less likely to lose its magnetism than if it were solid. On the end of this magnet is fixed a boxwood spool, having a soft iron core, wound with 1300 turns of 36 silk-covered wire, with a resistance of about 75 ohms. This magnet and spool is placed in a hard rubber shell, and has opposite to it, with its plane normal to the axis of the magnet, a thin ferrotype iron diaphragm about 2¾ inches in diameter, being held at the edges by the cover, cut in a convenient shape for the mouthpiece, which screws on, leaving it free to vibrate in the centre. Two receivers connected in series (no battery being required) constitutes the simplest form of telephone circuit.

The actions that take place in the instruments are as follows:—A person talking into the transmitting receiver throws its iron diaphragm into rapid vibrations. The diaphragm being close to the permanent magnet is magnetized by induction, and as it vibrates its magnetism is constantly changing, being strengthened as it approaches the magnet, and weakened as it recedes from it. This undulating magnetic field will in turn induce currents in alternate directions, in the coil of wire before mentioned. These currents traverse the whole length of the circuit; passing through the coil of the distant instrument. When the direction of the arriving current is such as to strengthen the power of the permanent magnet, it exerts a stronger attraction on the iron diaphragm, whereas, if it flows in the contrary direction, the permanent magnet is weakened, allowing the diaphragm to spring back. Thus any motions given to the diaphragm of the transmitting receiver are reproduced in the other. It follows from this, that words spoken at one end will be repeated at the other, though much enfeebled by the many transformations which take place.

There are numerous transmitters using the second principle of varying the resistance in the circuit, but nearly all of them are carbon in some form or other, and may be classed under three heads: Carbon Pencil, Granulated Carbon, and Platinum and Carbon. The Carbon Pencil is the most simple form of transmitter, though not much used on this side of the Atlantic. The Granulated Carbon is believed to be the best for long distance work. Perhaps the best form of this is the Hunning, which is much used for long distance transmission on this continent, notably between Detroit, New York, Chicago and Boston. The "Gower Bell" instruments are used between London and Paris; the latter end using the Carbon Pencil variety.

The third class, the "Platinum Carbon," gives the most perfect articulation, and it is under this head that the Blake transmitter comes—the transmitter which is in almost universal use on the continent. It is too well known to need description. Its action is due to the varying pressure between the platinum point and the carbon button, which, altering the resistance of the circuit, allows more or less current to flow. The diaphragm is to present enough surface for the sound waves to act on.

An induction coil is generally used with a microphone transmitter, the primary being in series with a cell of Leclanche Battery and the transmitter contacts, and the secondary being in circuit with the receiver and the line. The object of this is two-fold: 1st, The local circuit being short and of small resistance, the varying resistance at the carbon contacts is greater in proportion than if connected direct to line, and also as there are a great many more turns in the secondary than in the primary, the potential is increased. Having a good transmitter and receiver, it still becomes necessary to have some kind of signalling apparatus calling attention to the 'phone. For short distance, such as warehouse instruments, the ordinary battery and vibrating bell does very well, but as the distance becomes greater this would become impracticable, as it would require too much battery power; so that we now use a ringing set composed of a generator, having a permanent magnetic field and a Siemens armature of the H type. This armature is 2½ inches long and is wound with 2500 turns (500 ohms) of 36 silk-covered wire, wound equally on each side of the shaft. It has no commutator, so that the current is sent in alternations to the line. A polarized bell is used, the armature being kept polarized by the permanent magnet.

As both the ringing and the talking are done on the one line, a switching arrangement must be made so as to cut the different circuits to line; this is performed by means of the hook which holds the receiver. This hook also automatically disconnects the battery when not in use. We might also state that armature of the generator is short circuited, except when in the act of ringing up.

We will now call your attention to the way these circuits are "wired in" in the instrument itself. Referring to this diagram which is wired in shunt and is the way that the Bell Co. wire their instruments.

*Paper read before the Montreal Electric Club.

CONVENTION OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS IN MONTREAL.

THE American Society of Mechanical Engineers will meet in convention in Montreal from the 5th to the 9th inst. Tuesday will be spent in viewing the city. The first session will be held on the evening of the 6th inst. The meeting will take place in the Molson Hall of McGill University, where addresses of welcome will be presented by the Mayor of the city, Mr. Herbert Wallis, Chairman of the Local Committee, and the Chancellor and Faculty of the University.

Papers will be read and discussed on the following subjects :

"Notes on the Theory of Shaft Governors," by A. K. Mansfield.

"Heat by Units and the Specifications for Pumping Engines," by Albert F. Hall.

"A New Recording Pressure Guage for Extremely High Ranges of Pressure," by W. H. Bristol.

"A Note on Compressed Air," by Frank Richards.

"The Relation of the Drawing Office to the Shop in Manufacturing," by A. W. Robinson.

"The Theory of the Steam Jacket; Current Practice," by R. H. Thurston.

"Results of Experiments with a 50 Horse-power Single Non-Condensing Ball & Wood Engine to Determine the Influence of Compression on Water Consumption," by D. S. Jacobus.

"Cylinder Proportions for Compound Engines, Determined by their Free Expansion Losses," by Frank H. Ball.

"A New Method of Compound Steam Distribution," by F. M Rites.

"Cost of a Small Electric Railway Plant," by Jesse M. Smith.

"Power Losses in the Transmissive Machinery of Central Stations," by W. S. Aldrich.

"Rustless Coatings for Iron and Steel," by M. P. Wood.

"Corrosion of Steam Drums," by C. W. Hunt.

"First Stationary Steam Engines in America," by F. R. Hutton.

"Cost of an Indicated Horse-power," by DeCourcy May.

"A New Form of Canal Waste Weir," by John R. Freeman.

"Effect of Varying the Weight of the Regenerator in a Hot Air Engine," by G. W. Bissell.

"Mechanical Draught for Boilers," by W. R. Roney.

"The Saturation Curve as a Reference Line for Indicator Diagrams," by R. C. Carpenter.

"Results of Measurement of the Water Consumption of an Unjacketed 1,600 Horse-power Compound Harris Corliss Engine," by Messrs. Denton, Jacobus and Rice.

"Notes on the Corrosion of a Cast Steel Propeller Blade," by F. B. King.

A reception will be tendered in honor of the visitors on Wedesday evening by Sir Donald A. Smith, at his residence, 1157 Dorchester street; and a giaden party on Friday afternoon at Piedmont Hall, the residence of Mrs. J. H. R. Molson. On Wednesday afternoon the visitors will go by G. T. R. to Lachine and run the rapids, proceeding afterwards by steamer to the Isle au Herror, where luncheon will be served under the direction of the Harbor Commissioners. On Saturday the visitors will proceed by train to Ottawa and spend the day in seeing the points of interest at the Capital.

A TELEPHONE CABLE TEST.

THE following data, furnished to Electricity, New York, by Mr. C. W. Swoope, are said to be the record of a test such as is usually made both at the factory and after laying in conduit upon a section of a telephone cable, and may be of interest as an example of the usual mode of procedure. The test includes the measurement of insulation, resistance and capacity—conductivity being omitted—and the test here given was made upon a cable wound upon a reel and immersed in a tank of water for about fifteen hours before being tested.

Size of cable, fifty-one pairs of No. 18 B. & S. wire; four layers; wires insulated with dry paper; length 560 feet = 9.42 of a mile.

Insulation test made with 500 volts from Clark's Standard cells, galvanometer constant being 512,000 megohms = 1 deflection.

Deflection with conductors all bunched, 25 = 2,048 megohms.

Deflection of insulation, leads free = 0.

Deflections of every fifth wire singly in each layer :

1st layer,	2-2-2-2-2-2	deflections.
2d "	1-1-1-1-2-2	"
3d "	2-2-2-2	"
4th "	1-3	"

Average deflection, 2.

$\frac{512000}{2} = 256000$ = megs. per 560 feet, or 27126 megs. per mile.

Resistance test by Wheatstone's Bridge, several wires promiscuously chosen from each layer :

Outer layer	3.902	3.851	3.848	3.818 ohms—	3.854	average.
2d "	3.875	4.408	3.892	"	4.058	"
3d "	3.857	3.955		"	3.906	"
4th "	3.895			"	3.895	"

3.854×45 (wires in layer), $+ 4.058 \times 32$, $+ 3.906 \times 20$, $+ 3.895 \times 4$ is equal to the sum of the average resistances of all the wires in the cable, and divided by 102 (wires in cable) equals 3.930, equals the average ohms resistance of one wire. Subtracting the resistance of the leads (.347 ohms), we get 3.583 ohms at 3.5° C. = 3.749 ohms at 15.5° C or 35.515 ohms per mile at 15.5°.

Capacity test by 30 Standard Clark cells (30 volts) :

1st layer—Deflections : 196, 198, 208, 208, 204, 205, 202, 203, 200, 200, 200, 200, 200, 200, 200, 200. Average 201.5

2d layer Deflections. 185, 184, 185, 185, 196, 198, 188, 193, 194, 185, 186, 193, 193, 192, 192, 188. Average, 189.

3d layer Deflections : 190, 192, 194, 195, 191, 192, 190, 191, 194, 195, 190, 191. Average, 192.

4th layer Deflections 200, 194, 198, 198, 200, 200, 205, 206. Average, 200.

Deflections by pairs : 120-118 (1st layer), 100 100 (2d), 100-100 (3d), 128-128 (4th). Average, 112 less capacity of leads, 6 = 106. Standard deflection from condenser by .01 microfarad : 225-225-225-225 = 225 average less leads, 3 = 222.

The average capacity is obtained in the same manner as the average resistance and equals 195 less 10 for leads = 185, corrected average. The highest capacity of any one wire in cable = 208 less 10 = 198. The lowest capacity of any wire in cable = 185 less 10 = 175.

The capacity is found as follows. $K = \frac{D \times K_1}{D_1}$

when D = deflection produced by cable's charge,
D_1 = deflection produced by .01 microfarad in condenser,
K = capacity of cable,
K_1 = capacity of condenser.

Thus the average $K = \frac{185 \times .01}{222} = .0083$, or .0781 microfarads per mile ;

the highest $K = \frac{198 \times .01}{222} = .0089$, or .0838 microfarads per mile

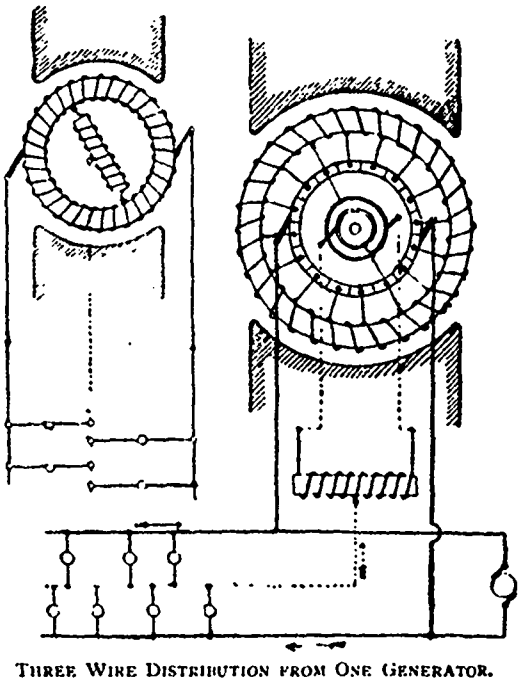
the lowest $K = \frac{175 \times .01}{222} = .0081$, or .0743 microfarads per mile.

THREE-WIRE DISTRIBUTION FROM A SINGLE DYNAMO.

THE Fires-Lille Electric Co., of France, says Electricite, has recently patented a device which allows of an electrical distribution on the three-wire system from a single dynamo. It consists in the adaptation to the dynamo of a strong self-induction coil. Fig. 1 shows the device, the two brushes being shown as bearing directly on the armature to simplify the explanation. These are connected to the two outside wires of the three-wire system.

A low resistance coil possessing considerable self-induction is connected to two opposite points on the armature and turns

FIG. 1. FIG. 2.



THREE WIRE DISTRIBUTION FROM ONE GENERATOR.

with it. The neutral is connected to the centre of this coil. In case of a difference of load between the two sides of the system, this wire and each half of the coil, the ohmic resistance which offers but little obstacle to the passage of continuous current, serve to conduct the current back to the machine and maintain the pressure constant. As a general thing, however, it will be necessary to have this coil separate from the machine. The two ends would then be connected to two rings connected to two diametrically opposite bars of the commutator. This device may also be used to regulate the current in three-wire central stations at some distance from the source of supply. To this end one or more dynamos with self-induction coils (Fig. 2) are connected to the principal conductors and operate as motors, the neutral wire of each sub-station being connected to the centre of the coil of each motor-regulator or equalizer, which can also operate as a generator. This device can also be applied to multipolar generators.

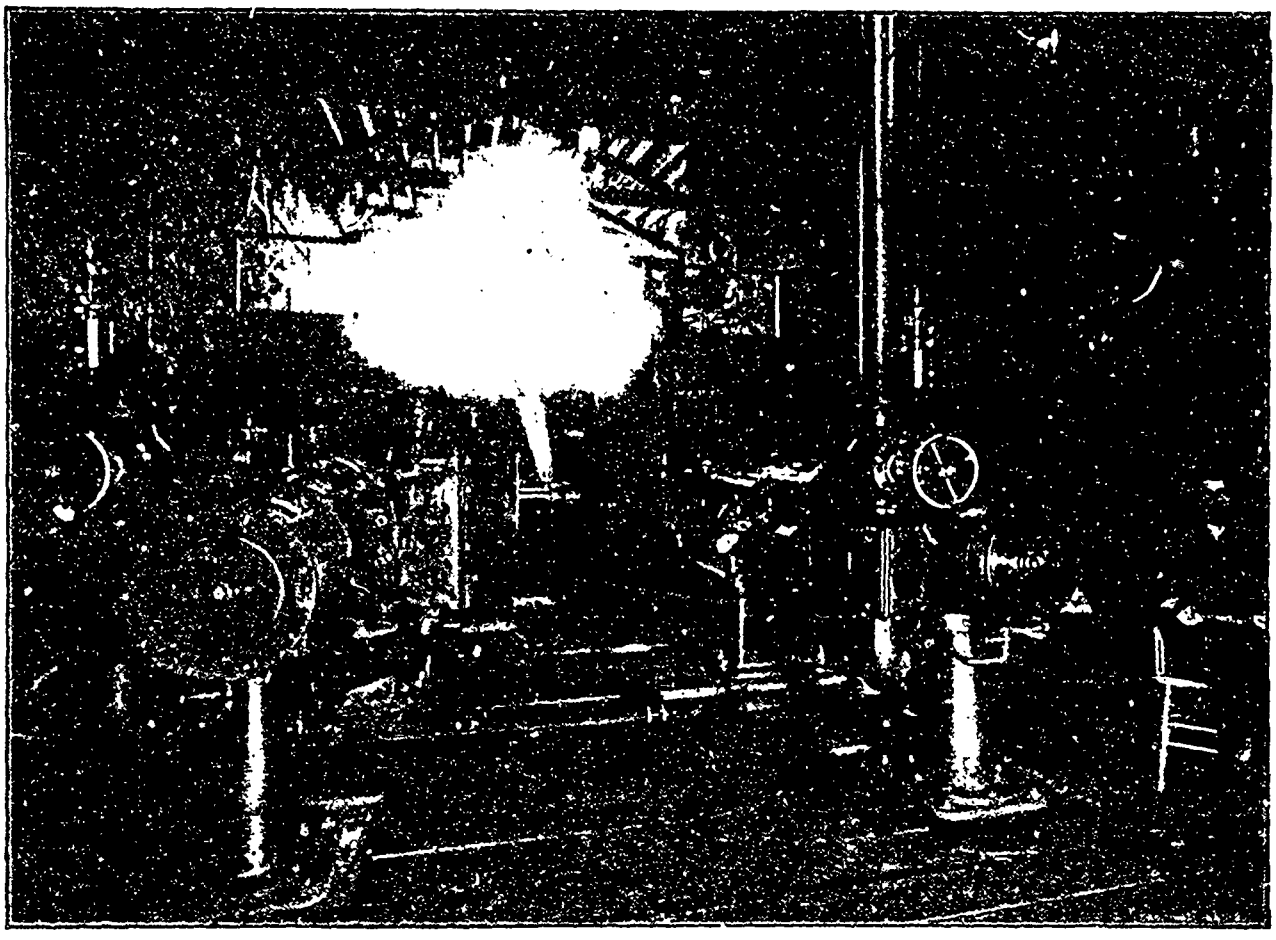
ELECTRIC LIGHTING IN ST. JOHN, N. B.

BY A. H. McC.

Probably no other city in Canada is so well lighted as is St. John, New Brunswick, certainly there is none better lighted. This is not an idea that finds a resting place in the minds of a few persons only, for strangers coming here from large centres of population are quite willing to acknowledge that the streets of this city are as well lighted as any they have seen. There are four electric lighting concerns in the city, namely, the Consolidated Electric Co., D. W. Clark & Sons' electrical works, a small station run by the city, and the Gas Company's electrical works.

Of the four the latter is the larger. Its building is situated on the corner of St. James and Wentworth streets. It is built of brick and is 100 feet square. The main building is 100 × 40 feet, and the boiler and coal bins 100 × 60. There is not an electric lighting station in Canada better equipped for its size. The electrician and superintendent is Mr. Frederick Mount. This company have six tubular boilers of 90 h. p. each. Four of these boilers are on one side of the chimney, and the remaining two are on the opposite side. The boiler room is 28 feet wide with 30 feet left for coal, which is deposited through hatches and falls down within a few feet of the furnaces. The coal bins will contain 600 tons. This concern's chimney is the largest in the city, being 120 feet high. The interior is round, 6 feet in diameter. They have two feed water heaters and two pumps each of sufficient capacity to feed all the engines in case one gives out. There are seven engines, 3 150 h. p. bi-compounds, and four simple engines. Only three of the latter are kept working, the remaining one being held in reserve. The larger compound engine was the first of its kind ever built in Canada. E. Leonard & Sons, of London, Ont., were the makers. The simple engines are from 70 to 90 h. p. Two of the high speed engines are belted direct to a countershaft, and are run connected in that manner, with both governors in use. An invention of Mr. Mount's has enabled him to run them in this manner. This invention is chiefly intended for use in connection with high speed engines, operated in pairs, having a shaft between or common to both engines, and separate governors on each engine. It is intended to enable the engineer to properly regulate or divide the load at will. Belted to this pair of engines are four arc dynamos of the Thomson-Houston system, one of 30 and three of 50 lights capacity, also one incandescent machine of 1200 lights capacity, with exciter. To the other compound is belted another incandescent light machine of 1200 lights capacity, with exciter. The three simple engines are belted to arc machines from 20 to 50 lights capacity. All the arc lights are 2,000 candle power. This company run about 300 commercial arc lights, and 2,400 incandescent lights. The latter are both commercial and domestic. The company contemplate taking out all the simple engines, and placing in their stead high speed automatic compounds, similar to those now in use. J. M. Robinson is president of this company and Geo. Ellis, secretary.

In 1890 the Eastern and the New Brunswick Electrical Co. were formed. They ran independently of each other until 1892, when they were amalgamated under the name and style of the Consolidated Electric Co. Their building is situated on the corner of Union and Smythe streets. It is of brick 100 × 40 feet. The cut which is furnished was taken when some new machinery was being placed in position. This company's steam plant consists of four Heine boilers of 100 h. p. each and one Manning vertical of 200 h. p. The engines which are at present in use consist of two 150 h. p. McIntosh & Seymour tandem, and two 250 cross compounds, one 100 h. p. Armington & Sims, and one 90 h. p. Leonard Ball simple. They have 1000 horse power square condenser supplied with water from the harbor a distance of 400 feet by a circulating pump, driven by a T. H. F. 40 railway motor, which supplies 1500 gallons a minute. New engines of greater h. p. will be placed in the building at an early date. The electrical plant consists of four No. 16 Edison dynamos of 125 volts, 3 Slattery alternators of 1,250 lights capacity, four No. 8 Wood arc dynamos and three 35 Brush lighters. There are 133 street arc lights of 2,000 candle power each, 3000 incandescent lights on the Edison system of 16 candle power each, 2,100 on the alternating system of 16 candle power, and 90 commercial arc lights. This company is composed of a number of Canadian capitalists, with W. C. Van Horne, of the C. P. R., and James Ross, of Montreal, at the head. Charles Jones is Manager, and A. R. Bliss, Electrician.



TWO 1RI COMPOUND ENGINES IN GAS COMPANY'S ELECTRIC WORKS, ST. JOHN, N.B., SHOWING CONNECTIONS.

The concern that is owned by the city is on Main street, north end. It is small and does not furnish over 40 arcs and about 100 incandescents. There is nothing particularly interesting about the plant. The other concern, of which we have already made mention is in the west end of the city (Carleton). It is also small, furnishing about 25 arcs and between 50 and 75 incandescents. It may be interesting to note that in 1893 the city was assessed $19,061 for street lighting, $300 more than in 1892.

The incandescent lighting plant recently installed by the Royal Electric Co. at Aurora, Ont., consists of a twenty-four K. W. alternator with exciter. From one dynamo are run incandescent lights for stores and a series circuit of twenty-three c. p. lamps and two alternating arc lamps for street lighting. The generating machinery is driven by a thirty-five H. P. Leonard Ball engine. The machinery is housed in a solid brick station, thirty by forty feet in size.

A NEW BATTERY PLANT.

Editor CANADIAN ELECTRICAL NEWS.

SIR,—Messrs H. Morgan & Co., the large dry goods firm of Montreal, have lately made a new departure in the Canadian practice amongst private lighting plants.

They have for some time past followed the usual custom of generating their electrical current for lighting purposes during the greater part of the day, previously they received all the current required for night purposes from the Royal Electric Co., through a small transformer. Their electrician,

CONSOLIDATED ELECTRIC COMPANY'S BUILDING, ST. JOHN, N. B.

Mr. McMurtrie, conceived the idea that this cost could be greatly discounted by means of a far better arrangement.

Throughout the day steam has always been used in this store for elevators and other purposes in addition to the necessary basement lighting, therefore to generate a trifle more current during that time would have no appreciable effect upon the coal bill and would need no increase whatever in the generating machinery or labor required. He therefore suggested that a small battery should be added to their present equipment that could be easily charged during the day time and would be sufficient to entirely dispense with the services of the local lighting company at night—thus crediting their monthly bill against simply the first cost of the battery.

This perhaps sounds very nice on paper, but Canadians have already learnt how very treacherous are many of the storage batteries that flood the market. Mr. McMurtrie was also well aware of this fact, but he wisely did not judge *all* batteries by *some batteries, neither did he* make any hasty conclusion before a complete investigation.

The various periodicals soon told him that Europe had been successfully handling batteries for some time past and that in the "old country" there are many similar installations to the one he was requiring, and further that their success was amply proven by the annual increase in their number and size. When companies are willing to spend $75,000 on batteries alone there surely must be a considerable commercial advantage in them?

The Crompton-Howell E. S Co., of London, England, have made several sales to that extent, and so Messrs. H. Morgan & Co., through their electrician, soon decided to put equal confidence in that company's goods and purchased, in the autumn of last year, a battery of sufficient capacity for their purpose.

This plant commenced its work during January last and has given complete satisfaction ever since that date. It easily carries all the night load that is required and it is recharged again by such machinery as is always running during the hours of the day.

There are other and special advantages also gained by this improvement, as it is now possible to switch on without running any special machinery; and this at seasons of special work, must always be a great convenience. Another important item is, that if a break-down unexpectedly occurs to their machinery the battery is at hand as a reserve and can carry no less than 200 amperes for a considerable period. Engineers of any experience are fully aware of the value there is in this factor of safety.

The characteristics of this type of battery are its high efficiency, its great durability, its low cost of maintenance, and its capability of standing such high discharge rates. It is perfectly safe and practicable to discharge these batteries at times within an hour and at a rate of 3½ times as great as the normal discharge rate. The result of this "step in the right direction" has been that the owners of many other similar plants in Montreal are considering like improvements and some have already erected batteries.

The advantages to be obtained from such plants vary more or less in each individual case, and it is extremely easy to form erroneous ideas of the size required for any one installation. It is therefore wise to always get advice on this matter while considering it. I might add that this plant is being charged from a Crompton straight current dynamo.

The Canadian agent for this battery company is Mr. John Forman, of 650 Craig street, Montreal.

Yours truly, C. W. SULLY.

THE BLAKE VS. KILLEY PUMPING ENGINE

Editor ELECTRICAL NEWS

SIR, In answer to Mr. Mackie's letter in your May issue re the Blake pumping engines, in which he says I must have been mistaken or misinformed, I would like to say that my information was from a blue print copy of the official paper. Mr Mackie received his information from a paper of that date. I leave the reader to judge which is the most likely to be correct, the newspaper or the exact copy of the record of test; also, if Mr Mackie would look a little closer at the figures he would see that 13.6 and not 15½ is allowed for refuse in the Blake test. Mr Mackie says the steam for heating the engine room was not considered during the Hamilton test. Hamilton is a pretty hot place in summer I have been there it must be a very cold place in winter if they require to steam heat their engine rooms.

Mr. Mackie further says that if the Hamilton test had been conducted in the same manner as the Toronto test, the Killey pumps would show 4,000,000 ft lbs higher duty than the Blake pump. This would be a duty of over 136,000,000 ft. lbs, a duty never heard of, except from Hamilton.

Again, sir, I am acquainted with men who assisted Mr. Galt in making the test at Toronto, and who will swear that during the Blake test every bit of coal used was shoveled right out of the pile just the same as while running at any other time, and was not hand picked.

The Blake test has been copied by mechanical papers from one end of the continent to the other, and very favorably commented upon. Toronto wants the best, irrespective of where it is made or of the cost. Perhaps Mr. Killey will pardon me if I use his words in this matter, and say that "Commercial appreciation is the best test in this matter," as well as between the high and low speed engines.

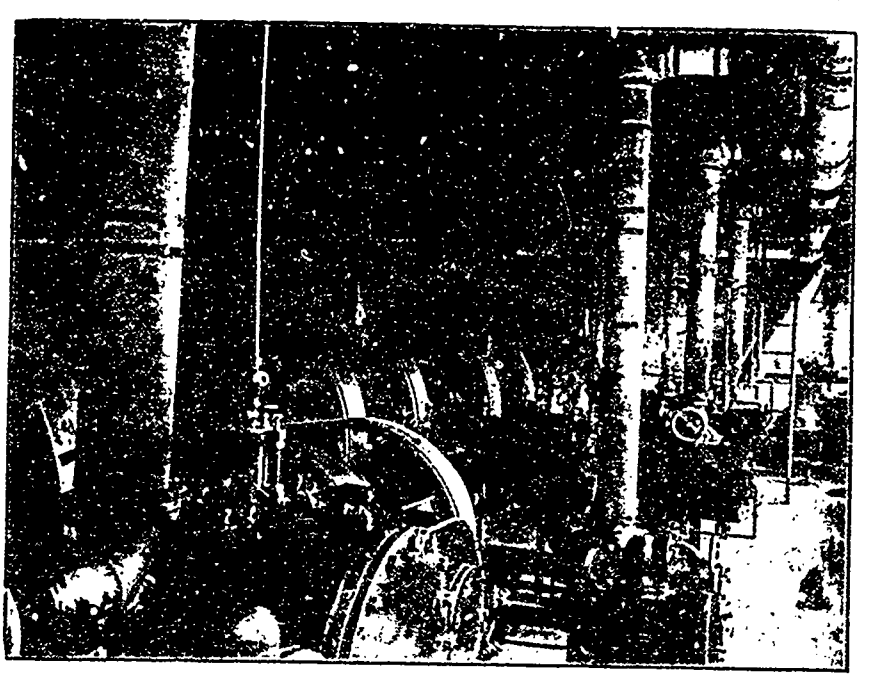
No, Mr. Mackie, put an automatic cut-off steam valve motion on your Killey pumps and I have no doubt mechanical men would consider them first class. However, if Hamilton is satisfied with Killey pumps, we in Toronto will try to be content with the Blake.

Yours truly, G. C. MOORING.

SPARKS.

The new incandescent station of the Royal Electric Co., to replace the one recently destroyed by fire, will be made fire proof.

The shore end of the Commercial Cable Company's new cable was successfully landed from the cable ship Faraday, at Canso, N. S., on the 9th of May. The work occupied about eight hours, and was superintended by Mr. Alex. Siemens, managing director of Messrs. Siemens Bros. & Co. and Messrs. Brittle and Jacob, chief cable engineer and chief electrician, respectively.



VIEW OF CONSOLIDATED ELECTRIC COMPANY'S PLANT, ST. JOHN, N. B.

The Street Railway Gazette, of Chicago, is apparently unacquainted with the geography of its own country when it locates the city of Port Huron in Ontario.

The Nictaux Electric Light & Power Co., has been organized with headquarters at Middleton, N. S. The promoters are, Dr. A. P. Reid, of Halifax, and Dr. S. N. Miller, of Middleton. The proposed capital is $50,000 in 50,000 shares of $1 each.

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

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NOTICE OF REMOVAL.

Subscribers and advertisers are asked to note that on the first of May the Branch Office of the CANADIAN ELECTRICAL NEWS in Montreal was removed to the New York Life Insurance Building.

A STORY is going the rounds to the effect that recently the permission of the Underwriters' Association was requested for the placing of a converter in the basement of a Methodist church in a Western Ontario town, and that the irreverent reply received from the Association's inspector was that no "conversions" must be allowed in a Methodist church.

THE past month has witnessed the closing down of manufacturing establishments in the United States and Canada for lack of fuel caused by the strike of workmen at the mines in the United States. It is a great hardship and injustice that thousands of workmen and their families should be deprived of their means of living by the action of persons with whom they are not in the remotest degree connected. Second alone to the hardship inflicted on the workmen is the inconvenience and loss imposed on manufacturing and railroad companies. One outcome of the experience of the past few weeks is likely to be increased attention to the endeavor to provide a satisfactory substitute for coal for steam producing purposes.

THE vexed question of the duty on rails for electric street railways, a question which arose in consequence of the ambiguous wording of the exemption clause in the old tariff, has been referred to before in these columns. The matter at last came before the courts at a sitting of the Exchequer Court, held in Toronto the latter part of April, to hear the case of the Toronto Street Railway Company, which was suing for the recovery of duties paid on rails imported for use in Toronto. The question at issue turns upon the interpretation of the word "railway" in the exemption clause of the statute, and as this clause in the new tariff is an exact repetition of the clause in the old tariff, the question is still of immediate interest and importance. It has more than one bearing upon projected electric railways and has been the cause of much uncertainty and annoyance. Judgment in the case of the Toronto Railway Company will settle whether an electric railway operating entirely within one municipality is properly exempt or not. But even if the rail for such a road are

dutiable, there has hitherto been a doubt whether a road connecting two municipalities would not come within the meaning of the word "railway" in the exemption clause; or even whether a future intention to connect two municipalities, such as would be implied by a corporate name for a road containing the names of two towns, would not be sufficient to entitle the rails for use in any part of the road to free entry. It is hoped that the judgment in the Toronto Railway case will cover all these points and definitely settle the whole matter. The judgment, which it is expected will be delivered sometime this month, will be looked for with more than ordinary interest.

IN view of the conviction which seems to have fastened itself on the minds of municipal councils in a number of Canadian towns and cities, that a great advantage would accrue from the municipality owning and operating its own electric light plant, it may not be out of place to re-print the following extract from a local paper regarding the experience of the town of Seaforth which has lately disposed of its lighting plant. The paper in question referring to the sale of the plant says: "Notwithstanding the loss the town has suffered in this matter, we believe the people decided wisely when they voted to part with it, as a private company can run a business of this kind much more efficiently and economically that the council can where the members are being changed from year to year."

IN an exhaustive discussion of the subject of the intrinsic value of street railway investments, conducted by Mr. Edward E. Higging in the Street Railway Journal, the author arrives at the following conclusions: 1. Well managed electric street railway systems of from 25 to 40 miles in length in the best American cities of from 50,000 to 100,000 inhabitants will probably develop a maximum earning power of from $5.00 to $6.00 gross per capita, with one or two exceptional cases rising above these figures; a large number will earn from $4.00 to $5.00 per capita; and few will be unable to earn $4.00 per capita. 2. Those properties which have been improperly constructed and equipped, particularly in the matter of roadbed, cannot probably be permanently operated at less than 75 per cent. of the passenger income, higher figures rather than lower being probable. Those properties which have postponed equipment until a comparatively recent period and which have been carefully and thoroughly built can usually be operated at from 65 to 70 per cent. of the passenger income. 3. Under the most favorable conditions of operation a maximum net earning power of about $2.00 per capita is possible, but more usual figures will range from $1.00 to $1.50 per capita. 4. $1.50 per capita is a return of 12 per cent. per annum on capital liabilities of $12.50 per capita, which represents about the average present cost of building and equipping in the most perfect manner electric railway systems of average length in cities of this class, where the cost of taking up and replacing pavement forms an important item of original investment. In general therefore it may be said that these properties are, intrinsically, investments returning from 10 to 15 per cent. on the actual value of tangible assets apart from franchises.

ELECTRICITY is charged with being the cause of many destructive fires. While beyond doubt it is saddled with a larger measure of blame in this particular than it deserves, it must be admitted that the accusation is in a measure well founded. Competition in electric wiring has become so keen, that prices are reduced to a point where it is impossible for first-class work to be done. As a result, we learn that in some Canadian cities, first-class wiremen are unable to secure employment, while the work which should be their's is being done by incompetents, who in many instances are without any qualifications whatever. The consequence is that buildings are being wired in the most ignorant and dangerous manner, and to those conversant with the facts, their destruction by fire at any time would occasion no surprise. Electricians need not be told that by the use of the best modern methods of insulation, the wiring of buildings can be done so that the fire hazard will not in the slightest degree be increased. Unless prompt action be taken, however, by reputable electrical companies, to put a stop to cheap work by unskilled workmen, the use of electricity in buildings will soon be regarded as so highly dangerous that it will largely be abandoned and the interests of all engaged in the business will sustain such injury as perhaps never can be repaired. All electrical manufacturing and supply concerns who wish for the continued growth of electric lighting should join hands with the underwriters in demanding that the standard of electric wiring shall be raised to the point of safety. This is a subject that might well receive attention at the hands of the Canadian Electrical Association, whose province it is to guard and promote the interests of every legitimate electrical industry. Electricity is being given a bad name, of which it is undeserving, and which, if its future is not to be compromised, it must be freed from as speedily as possible.

THE question of municipal versus private ownership of electric street lighting plants is one which is now being agitated in several places. In a matter of such importance it is of grave moment that the whole subject should in each case be thoroughly canvassed and investigated, before the city undertakes a new and onerous responsibility which, if the decision be a hasty one, based upon superficially plausible grounds, may easily result in a continual drain upon the pockets of the taxpayers, and a new discredit to the principle of municipal control of any department whose operations are of an industrial character. The proposition is that if a private company finds it to its profit to maintain a plant for furnishing street lights at a contract price, the city, by undertaking this service itself, must save to the taxpayers the profit which previously went to the shareholders of the company. But against this there is a strong and almost universal feeling that a civic corporation cannot carry on any business as economically and efficiently as is done by a private company. Without the slightest reflection upon the ability and integrity of the permanent civic officials, and apart from all questions of political influence or corruption, the lack of continuity of control inherent in our system of municipal government, and the control by men elected for other considerations than their especial fitness for the business in hand, place the civic corporation at such a disadvantage that in competition with it a private concern will earn a profit which is the wages of ability and fitness. That is the feeling that has grown up in the popular mind, and it is fair to assume that it is not without grounds in experience. Call it popular prejudice, and it still remains to be shown from what inadequate or obsolete causes the prejudice arose. Added to this feeling is the distrust, which has been too often justified, that attempts to make use of the department in the strife of municipal politics, will hamper the best efforts of faithful and capable permanent officials. The result is that to satisfy the taxpayer at the present time that any benefit will accrue to him from municipal ownership of the street lighting, the advocates of this plan must show that the gap between the cost and the contract price for lighting is much wider than can be spanned by a moderate profit on the capital invested. Whether by their fault or misfortune, civic corporations have a poor reputation for business management, and the burden of proving the contrary rests with them. The advocates of municipal ownership and operation must clearly prove that the lowest obtainable contract price for the lighting service yields an inordinate profit on the actual investment needed to give this service. If they cannot do so, they have no case.

THE city of Evansville, Ind., recently undertook an investigation of the relative cost of street lighting under public and private ownership. The report has been republished in the technical press and has been widely circulated. It contains in tabulated form, interesting and valuable statistics of municipal lighting of both public and private ownership, gathered from a large number of towns, and no doubt for this reason has been reprinted as an appendix to the report recently made on the same subject by the City Engineer of Toronto. But the body of the Evansville report does not commend itself either in tone or matter, as the thoughtful and well considered presentation of the subject which is required to furnish grounds for action in a matter of such importance. The city has been using a little less than 200 arc lamps burning all night on the moonlight schedule at a contract price of $158.30 per lamp per annum. The committee states its conclusions after "a careful investigation," and the first one is that "our city is now paying sixty per cent. more for her street lighting than she ought to do." If correct, this is a comment upon the business capacity of the city to make a fair

bargain, which is not calculated to inspire confidence in its fitness to be entrusted with the more difficult and responsible job of operating a plant economically. The second conclusion is that "fifty-five cities doing their own lighting pronounced the same a complete success,"—they naturally would—and that "we have ascertained" that their average cost is $57.88 per lamp per annum. "Ascertained" is a strong word to describe an unquestioning acceptation of statements of results, without investigation of how these statements were compiled. Without examining the system of book-keeping in each case there is no certainty that all items of cost are properly charged. The results are mere matters of opinion, nor is the average of 55 opinions which vary--as shown by the tabulated statistics—from $36.00 to $115.00 per lamp, of any value to start a business on. The third conclusion states the average cost of contract lights at $114.58 per lamp per annum. This is a matter of fact, being, as shown by their tables, the average of 22 facts varying from $80.00 to $160.00. They conclude fourthly that the city should have about double the number of lights it now has, and finally that the first cost of a plant with 350 lights would not exceed $75,000--which seems about right—and that "the annual cost of maintaining such a plant would not exceed $50.00 per lamp per annum." They give no reasons for this faith that is in them, but it is charitable to hope that some sort of estimate was made of running expenses, and that $50.00 is not merely a deduction from the averages they pin their faith to—averages of plants of all sorts and sizes scattered from Maine to California, and therefore no doubt peculiarly applicable to a 350 light plant at Evansville, Ind. They of course recommend a municipal plant, and any defects in the joints of their argument as above constructed are neatly plastered over by a statement that "Your committee has also ascertained"—what again!—"that municipal ownership of all plant, such as waterworks, street railways, lighting and others necessarily requiring franchises from the public, should, in the opinion of the best thinkers of the age, who have studied municipal government, be owned by the public, instead of by private corporations." From all of which it is perfectly plain why "your committee is of the opinion that a new contract for our street lighting could now be let for a much lower price than the present contract calls for, but we do not believe it to be for the best interests of the citizens of this city for her lighting to be done by private contract." We have devoted a good deal of space to the consideration of this report, as it has been given a wide publicity and we think it deserves to be held up to admiration as a model of how not to do it. What would a business man think if he were asked to embark on a business enterprise on the strength of such a futile prospectus as this report? If the taxpayers of Evansville are contented with statistical averages and platitudes about the best thinkers of the age, they deserve what they are likely to get if they operate a municipal plant controlled by the framers of this report. But we trust that in Canada this business problem will be treated in a business manner.

Mr. Keating's report to the Board of Works on the probable cost of an electric street lighting plant for Toronto was made to a meeting of the Board on May 28th. It presents the case for consideration in a clear, business-like form, and refers briefly in turn to the main points involved in such a scheme. He first touches upon the question of combining an electric plant with the present waterworks plant, and advises that in the case of Toronto this would not be economically feasible. He points out the caution which must be observed in accepting as correct, statements made of the operating cost of lighting plants owned by municipalities, owing to the doubt which must prevail, in absence of a detailed statement or an examination of their books, whether all proper charges have been included in the statement made, particularly a proper allowance for interest and depreciation. He instances points which would appear to make for the advantage of a new civic plant in competition with an older private company, viz:—The lower cost and better construction of electric appliances now than a few years ago, and the absence of any need for the city, after paying running expenses and an allowance for depreciation, to make a profit other than a low rate of interest on debentures, as compared with a dividend of about double such a rate required from a successful private company. He also alludes to the possibility of shortly obtaining power from Niagara Falls delivered in Toronto at a price to compete with steam. The plan he outlines for immediate lighting involves the addition of 300 arc lights, displacing the 1100 gas lights still remaining, making a total of 1300 arc lights—the station buildings to be large enough to ultimately contain a 1500 light plant, though at first a steam and electric plant for only 1300 lights is to be put in. On this basis a summarized estimate is given for buildings with station and street plant, totalling $310,200.00. Also a detailed estimate of annual operating expenses, including interest at 4 per cent., and depreciation at 6 per cent., reckoned on $310,200. The result shows an annual cost of $81.78 each for 1300 lamps, or $75.00 each for 1500 lamps, as against the present contract rate of $108.58 each for about 1000 lamps. The whole report is a straightforward statement, in sufficient detail to allow intelligent criticism. For instance, we miss from the annual operating expenses an allowance for contingencies not properly covered by the 6 per cent. depreciation, which might fairly be figured at 4 per cent. Last winter's sleet storm was an extraordinary contingency, but in different forms extraordinary contingencies are of practically annual occurrence. The present coal shortage is a case in point, and suits for damages will be always on hand. The report hardly shows a case favorable to city ownership, and it remains to be seen what the Electric Light Company can tender for the increased number of lights. The uncertainty about power from Niagara makes the present time unfavorable for determining on a large steam plant, when cheaper power may be available in less than a year.

R. C. BROWN GOES TO MONTREAL.

R. C. Brown, electrical engineer of the West End Street Railway of Boston, has resigned that office to accept a similar position with the Montreal, Canada, Electric Railway.

R. C. Brown.

Mr. Brown ever since 1889 has been in the West End's service, and by dint of effort and native ability raised himself to the position of electrical engineer. His first position of trust was as superintendent of motors and cars, quickly followed by the superintendency of electric power, which he has since held to the satisfaction both of the company and of his employes. The best wishes of his many friends follow Mr. Brown to his northern field, and a rousing ovation from 100 of his employes marked his departure.—Street Railway Review.

THE ELECTRICAL STUDENT'S A B C.

A is the Amp, that went into the Arc.
B is the Brush, sometimes seen with a spark.
C is the Copper, most handy for mains.
D is the Dynamo, driven without reins.
E is the Science we study and pass in.
F is the Field, with more iron than grass in.
G is the Galvo., which "shorts" can foretell.
H Hysteresis, heats iron like —— (anything).
I s Induction, much blessed and cursed, too.
J is the Joule, set in carbon and cu.
K is the Kathode, who lives in a bath.
L is the Line, cut by wires in its path.
M is the Motor, which torques as it works.
N Non-conductor, which carrying shirks.
O is the Ohm, found in wire as in brick.
P is the Pole, which to iron wood stick.
Q is the Quickbreak on a high-voltage circ.
R the Rheostat, which 'eats when at work.
S is the Switch, like the ones used with trams.
T is the Telephone; earns many bad —— (words).
U is the Unit, at fourpence a blessing.
V is the Volt, who is always most pressing.
W the Watt; E. C., when you know it.
X the Xpense. House installers should blow it.
Y is the Yoke, which in magnets is grey.
And the
Z inc has connection with bells every day.

J. H. C. B., in London Electrical Engineer.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

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

ORGANIZATION OF WIARTON ASSOCIATION NO. 13.

Editor ELECTRICAL NEWS.

SIR,—On the 17th of May I had the pleasure of instituting Wiarton Association No. 13, C. A. S. E. with the following Bros. as officers: President, Wm. Craddock; Vice-president, Chas. Shaw; Rec. Secretary, Ed. Dunham, (engineer electric light station); Fin. Secretary, R. L. Graham; Treasurer, I. Dunham; Conductor, A. Sheldon; Door Keeper, R. Murray; Trustees, A. McLaren, G. L. Kitchen and Wm. Smith. The other members present were, Wm. McKenzie, Robt. Burrows, E. Drinkwater and D. McDonald.

Upon my arrival, I was met at the train by Bro. Ed. Dunham, and visited several of the members. In the evening we met in a very pleasant room, adjoining the Mechanics' Institute, and nicely fitted up by the members, with writing desk, black-board and everything necessary for good work. The members are all enthusiastic and anxious to learn, and I predict a strong useful and healthy little lodge in Wiarton.

After the meeting we adjourned to the Arlington, where an hour was spent very pleasantly, but as all had to be at work early in the morning and your humble servant was obliged to catch an inconveniently early train, we dispersed all well pleased and hoping to meet again.

A. M. WICKENS.

A branch of the C. A. S. E. is about to be organized at Peterboro', Ont.

WE learn from Mr. L. Brandon, Secretary, that the recently organized association of stationary engineers at Winnipeg, is meeting with gratifying success, additions to the membership taking place at every meeting. Mr. James White, engineer of the Ogilive Milling Co., has been elected president in the place of Mr. H. E. Robertson resigned. A deputation has been appointed to wait on the Government to request that incorporation be granted to the society. It is the intention to have a series of papers read at future meetings. The first of these will be prepared by the secretary, Mr. Brandon, his subject being "Heat as Pertaining to Boilers."

A regular meeting of the Ontario Association of Engineers was held at London on the 28th ult. The yearly message of the president, who was not able to be present, was read by the registrar. It showed this to be the most prosperous year since the incorporation of the association. The total number of certificates in force up to date, including raised certificates, amounts to 562; new certificates issued during the year, 161. The expenses for the year have been $523.95, leaving a balance in the treasurer's hands of $157.15. The four members of the board whose terms expired were re-elected, also the officers of the board.

PERSONAL.

Mr. D. A. Starr, electrical engineer, Montreal, is at present on a protracted business trip to the island of Trinadad, W. I.

We are pleased to learn that Mr. J. A. Kammerer, who for several years has successfully filled the position of District Agent at Toronto for the Royal Electric Co., has recently been appointed General Sales Agent for the Company, with headquarters in Montreal, vice Mr. D. A. Starr, resigned.

Mr. G. C. Mooring, chief engineer of the Methodist Publishing House, and an active member of Toronto No. 1 C.A.S.E., will sail on the 8th inst. from New York for England. He will be accompanied by his father. It is their intention to spend five or six weeks in revisiting associations and friends from which they have been separated during a residence of twenty years in Canada. Some of the leading engineering establishments will also be visited in quest of information.

TRADE NOTES.

Mr. Samuel May, President of the Dodge Wood Split Pulley Co., Toronto, is at present on a visit to Europe in the interest of the export branch of the Company's business.

As will be seen by reference to our advertising columns, Messrs. La Flamme & Anderson have started in business as electrical and supply engineers in Montreal. These gentlemen are thoroughly practical men in their profession and we feel sure that any contracts placed with them will be promptly and satisfactorily executed,

Messrs. John Starr Son & Co., of Halifax, call attention in our advertisement pages to the "Star" Incandescent Lamp of which they are the manufacturers. They inform us that they are selling large quantities of these lamps all over Canada as well as in the West Indies, South America, etc., and that they are giving excellent satisfaction. They have recently gotten up new and improved bases for these, which, together with other improvements, gives them high efficiency. The lamps are packed in such a manner as to add to the convenience of handling, each lamp being done up in a corrugated package, with particulars stated on outside. The Company also state that their "Unique" telephone is in increasing demand.

The Dodge Wood Split Pulley Co., of Toronto, have recently received from Mr. James Stuart, Superintendent of the Manitoba Electric and Gas Light Co., Winnipeg, the following letter through their Winnipeg agents, and which speaks for itself:—"In reply to your inquiry re Brown Friction Clutch, which we got from you about two years ago, I beg to state that it has been running a 50 arc light dynamo, of the Thomson Houston type, made by the Royal Electric Co., Montreal, and the clutch and pulley has given us perfect satisfaction. We are running clutch pulleys of different makes, but for ease of handling and perfect running, without slip of any kind, none of them can equal the "Brown" we got from you. In adding to our plant in future we intend to use no other."

QUESTIONS AND ANSWERS.

If the subscriber who writes to us for information over the nom de plume of "Ignoramus," will forward to us his name and address, as a guarantee of good faith, we will be pleased to endeavor to answer his enquiries.

SPARKS.

It is said that Battersea and Kingston will be connected by electric railway.

The New Westminster & Burrard Inlet Telephone Co. has been incorporated.

Messrs. Mackay & Guest, Renfrew, will shortly put in a 1,000 light incandescent machine.

The Dominion Parliament has granted incorporation to the Dominion Gas & Electric Co., Winnipeg.

St. Catharines has direct telephone communication with Detroit, 256 miles, the longest circuit in Canada.

The Sarnia Gas & Electric Light Co., have given a contract to the Canadian General Electric Co. for a new lighting equipment.

Application is being made for the incorporation of the Ontario Engine & Machine Co., of Toronto, with a capital stock of $12,000.

The annual meeting of shareholders of the Standard Electric Co., of Ottawa, will take place at the company's office on the 6th inst.

The Northwest Electric Co., of Winnipeg, are said to have decided to increase the motive power at their lighting station in the near future.

At a recent meeting of the Smiths Falls Electric Light Company, it was decided to buy a new dynamo and an entire set of lamps for the streets.

Negotiations are said to be in progress for the amalgamation of the interests of the Nanaimo electric light works and the proposed street railway enterprise.

The Packard Lamp Co., of Montreal, are negotiating for a suitable site on which to erect a new and commodious factory to meet the requirements of their rapidly growing business.

A chimney in the rear of the C. P. R. Telegraph office at Winnipeg collapsed on May 10th, killing Howard Smith, a check-clerk, and fatally injuring Aubrey Tennant, a message boy.

At the annual meeting of the Light, Heat & Power Co., of Kingston, Mr. R. T. Walkem was elected president, Mr. L. H. Breck, vice-president, and Mr. B. W. Folger, managing director.

The town of North Bay offers an exclusive franchise for a term of ten years to anyone putting in a system of electric lighting, the cost of public and private lights to be limited to a certain sum.

The Bell Telephone Company's Exchange, at Winnipeg, was recently damaged by fire to the extent of $5,000, as the result, it is said, of a telephone wire becoming crossed by an electric light wire.

The City Engineer of Toronto has received a communication from the Great Western Electric Manufacturing Co., of Chicago, stating that they are desirous of establishing a manufactory in Toronto.

The New Brunswick Telephone Co. are constructing a line from the C. P. R. station at East Florenceville to the village of Centreville, and will probably extend the line from thence to Hartland and Woodstock

Mr Feodor Boas has obtained permission to erect poles, lay cables, etc., for the transmission of electric light and power at St. Hyacinthe, Que. He also contemplates engaging in the manufacture of electric plant and supplies.

There is said to be keen competition among the various electrical manufacturing companies for the supply of the necessary apparatus for an incandescent lighting system for the town of Orillia. Tenders closed on the 1st of June.

On the 6th of May, the power station and plant of the Nanaimo, B. C., Electric Light Co., was completely destroyed by fire. The company's loss amounts to about $50,000. We understand that a new plant will be installed as speedily as possible.

Messrs. Ross & Muir, who are at present erecting a flour mill at Mattawa, Ont., have expressed their willingness to install an electric arc and incandescent lighting plant at that place, if a sufficient amount of business is guaranteed to make the venture a profitable one.

In the item mentioning the incorporation of the "Packard Electric Co., Limited," at Montreal, which appeared in the May issue of the ELECTRICAL NEWS, the names of Messrs. F. E. Cavanagh and Charles C. Paige, were inadvertently omitted from the list of incorporators.

A bill introduced by Mr. Mulock has passed the Dominion Parliament providing for the placing of vestibules on electric street cars. This bill will no doubt be the means of raising the question of jurisdiction as between the Dominion and Provincial governments in relation to the control of electric railways.

The action of the Royal Electric Co. in appointing Mr. Fred. Thomson, who it will be remembered has a case pending against them in the courts, as their valuator for the adjustment of the loss sustained in connection with the recent fire on their premises, has excited a considerable amount of comment in electrical circles. Certainly no better testimonial of character could be given to Mr. Thomson than this.

Mr. E. O Champagne, City Boiler Inspector for Montreal, in his annual report for 1893, just issued, shows that during the year he made 1,410 inspections, condemned nine boilers, found 89 boilers imperfect, and issued 313 test certificates He also issued 413 certificates to persons in charge of engines and boilers, and 39 candidates failed to pass their examination. One accident had happened during the year, involving loss of life, and the owners of the insured boiler were condemned at the Coroner's inquest for negligence. Mr. Champagne advocates a return to the old system of compulsory inspection for all boilers.

Nowhere perhaps in Canada, has the introduction of the electric railway proved so injurous to the business of the hackman as at Ottawa, as the distance at which the railway depots are situated from the centre of the city made it almost necessary for persons arriving by train to engage the services of a hackman to convey them up town. Now the electric car stands alongside the station platform, and affords the traveller cheap and rapid transit wherever he may wish to go. It is rumored that a further inroad is to be made on the hackman's profits, by the extension of the street railway company's lines from Sussex street, through Rideau Hall grounds to the residence of the Governor General. The hackmen have petitioned the Governor General against the carrying out of the proposal. They claim that it would be an infringement on private rights to build a railway upon Government property.

SHAFTING. *

I need offer no apology for bringing a subject of this kind before an Association of Stationary Engineers, for wherever you find a stationary engine you will also find more or less shafting, and if any other excuse were required it will be found in the fact that questions on shafting are quite frequently found in the Question Box at our meetings.

It may be, however, that there are some present who think that as engineers they are not expected to have anything to do with shafting. They may argue something like this "Our employers expect too much from us, they look for us to wheel in coal, fire two or three boilers, wheel out the ashes, attend our engines and a score of other jobs, as well as find tools for the whole establishment, and it would be just as well not to know anything about shafting, or we would be expected to attend to that too." In answer to such I would say, that it is not often that a man loses his situation by being too well posted, and in this world of changes one never knows when he may be called on to make use of the knowledge he possesses.

It is of the greatest importance that all shafting should be properly proportioned and correctly put up, as it not uncommonly happens that great loss of power and much annoyance results from carelessness or ignorance, and a plant that is otherwise of the best, rendered unsatisfactory.

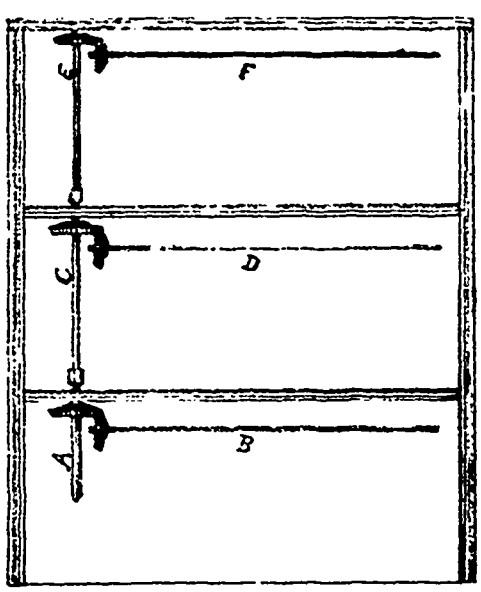
The first question the engineer has to decide is what size or strength of shaft he requires to do a certain amount of work, and in doing so he must bear in mind that a small increase in diameter will give a large increase in strength. It is not an uncommon thing to hear a man say that such a size ought to do the work, but to be on the safe side will put in a size larger, not knowing that he is adding a much larger factor of safety than he had any idea of. The strength of a shaft varies as the cube of its diameter varies Let us assume that 1" shaft will safely drive at a given speed four horse-power, a 2" shaft will drive as much more as the cube of its diameter in excess of the cube 1. The cube of 1" is $1 \times 1 \times 1 = 1$. The cube 2" is $2 \times 2 \times 2 = 8$. The cube of 3 is $3 \times 3 \times 3 = 27$ and the cube of 4 is $4 \times 4 \times 4 = 64$.

Now we assume that the 1" shaft drives 4 H. P., the 2" shaft drives as much more as the cube of its diameter is in excess of the cube 1; the cube of 2 is 8, therefore its power compared with the 1" shaft driving 4 H. P., is $2 \times 2 \times 2 = 8 \times 4 = 32$ H. P., and comparing the 3" shaft with the 1", the cube of 3" is 27 and the power of the 1" is 4 H.P.—$4 \times 27 = 108$ H.P. It must be borne in mind that these figures are comparative and are given to show the rapid increase of strength in a small increase of size, for if we were to use a 3" shaft instead of a 2" we would have 108 H. P. instead of 32 H. P.

Another fact we must not lose sight of is, that the power a shaft will drive is in direct proportion to its speed. If a shaft drives 4 H. P. at 200 revolutions per minute, at 200 revolutions it will drive 8, and at 300 it will drive 12 H. P. The higher the speed of the shaft the smaller the diameter of the shaft to drive a given H. P. Then there is another important consideration in selecting a proper size for a shaft—as they are inclined to bend and also to twist we must take into account the weight of the pulleys and the distance they are from the bearings and whether the strain of the belts is down or the reverse. The bending of a shaft as well as the torsion contributes towards its liability to break, but the bending is the most likely to cause it. The bending also causes a considerable loss in power as well as a the liability of belts running to one side of the pulleys. It follows therefore a shaft loaded with pulleys must have a greater number of bearings and the pulleys placed as near the bearings as possible.

To put up a larger line of shafting than is necessary, is objectionable for two reasons, 1st it costs more to put it up, and 2nd it costs more to run it after it is up. The extra weight of the long shaft as well as the larger circumference which has to move through a greater distance will add materially to the friction. There is one other fact I would notice before leaving this part of the subject, and that is, that the second and third lines may be smaller than the main driver. The reason of this obvious, for the first line has not only its own machinery to drive but also the second and third lines with the machinery driven from them.

To make this clear, I have prepared a diagram which I believe will make it plain to everyone. We will call it a mill or factory, and we assume that



the machinery in it requires 100 H. P. to drive. The machinery on the first floor requires 45 H. P., that on the second, 30 H. P., and on the third, 25 H. P. Now the shaft A and B are practically one shaft, being coupled together by the gear; so are C and D, and E and F; but while practically one shaft, A has to transmit 100 H. P., while B only transmits 45 H. P., therefore B may be smaller than A. B having absorbed 45 H. P., it follows that C has only to transmit 55 H. P., therefore C may be smaller than A. The machinery on the first and second floors has now absorbed 75 H. P., leaving only 25 H. P. for the third floor, therefore the shaft E and F may be smaller than C.

The same argument will hold good with the shafts B, D, and F. If the machinery which they drive was equally distributed from end to end, then the ends furthest from the motive power might be smaller because they would have less power to transmit, but in practice the disadvantage would be greater than any gain that would be derived from so doing.

I will now give one or two rules to determine the size required to drive a given H. P.

To find the power a shaft will transmit, cube the diameter and multiply by the number of revolutions per minute, and by two, if it is the first line from the engine, and by three if it is the second, and divide by 100.

The crank shaft being the first or prime mover, what power will a 2" shaft transmit as a second mover running at 300 revolutions per minute? $2 \times 2 \times 2 = 8 \times 300 = 2400 \times 2 = 4.800 \div 100 = 48$ H. P. If steel add 30 per cent. If this shaft was to be used as a second line then it would be: $\times 2 \times 2 = 8 \times 300 = 2400 \times 3 = 7.200 \div 100 = 72$ H. P. Where the power required is known and number of revolutions is given and the size of shaft is wanted, proceed as follows: What diameter of shaft is required as a prime mover to transmit 75 H. P. at 175 revolutions? $75 \times 100 = 7.500 \div 175 = 42.86 \div 2 = 21.43$. The cube root of 21.43 is 2.75. (2.7776) the diameter required.

The same problem with the shaft used as a second line, would be: $75 \times 100 = 7.500 \div 175 = 42.86 \div 3 = 14.28$. The cube root of 14.28 is 2.42 (2.4261) the diameter required.

Having got the size we want, the next thing is to get it put up, and it is right here where many failures and mistakes are made. There is perhaps no part of the plan which should be more carefully looked after than the proper lining of the shafting because it is a never-ending source of annoyance if out of line. The rules governing the putting up of shafting are few and very simple:

1st, Be sure that your shaft is exactly at right angles with the engine pulley; and, see that it is dead level; and 3rd, be sure that it is as straight as a line can make it. The same rules should be observed with intermediate and counter-shafts, they must be parallel with main shaft All shafts carrying pulleys must be level; a shaft driven with gear from a horizontal shaft must be at right angles with it but may be run at any angle from the horizontal, and the same if driven from a perpendicular—in this case the driven shaft must be level, but may be run in any direction. If the building is likely to settle the adjustable hanger should be used, but where there is no danger of settling, stationary bearings should be used, especially for dynamos and all heavy machinery which ought to be a rigid as possible.

I do not think it advisable to give any rule for the distance at which bearings should be set, as circumstances vary in almost every case, but would state that for a a 3" shaft the distance should never be more than 15 feet, and for a 2"shaft not more than 11 or 12 feet. These distances in both cases are for shafts without pulleys.

We have stated that second and third lines of shafting may be smaller than the first, but this applies only where they run at the same or at higher speed, and does not apply where the speed is reduced for the purpose of driving heavy and slow speed machinery or lifting heavy weights. Let us try to make it plain. Let us assume we have a weight of 33,000 lbs. to lift and a one H. P. engine to lift it with; we can raise the weight one foot high in one minute, but if our weight is ten times as heavy, or 330,000 lbs., it is evident that to lift this with the same engine it can only be done by a sacrifice of time, or in other words a reduction of speed (bear in mind that to lift a weight greater than the motive power can only be done at a sacrifice of time). Now what are we going to do? Our weight is 330,000 lbs., and our engine is only 1-10th the power required to lift it. It is evident we must construct a system of reducing gear. We will assume that we require three reductions—the first reduction will be from the engine to the first shaft, and so on until we reach the third or last shaft which supports the weight. Now the nearer we get to the weight the stronger must the shafting be, and the same with the gear, because as each shaft is reduced in speed it is capable of transmitting less power, and therefore must be increased in size.

Precisely the same principle is clearly shown in the use of the lever—a man can lift a heavy weight with a lever, but it is always at a sacrifice of time or speed. It is also well understood that the end of the lever on which the man rests may be very much smaller than the end which rests on the fulcrum, because on it rests the whole weight.

* Paper read before Toronto No. 1, C. A. S. E. by Bro. Geo. Gilchrist.

MOONLIGHT SCHEDULE FOR JUNE.

Day of Month.	Light.	Extinguish.	No. of Hours.
	H.M.	H.M.	
1.....	P. M. 7.50	A. M. 3.40	7.50
2.....	" 7.50	" 3.40	7.50
3.....	" 7.50	" 3.40	7.50
4.....	" 7 50	" 3.40	7.50
5.....	" 7.50	" 3.40	7.50
6.....	" 8.50	" 3.40	6.50
7.....	" 9.40	" 3.40	6.00
8.....	" 10.20	" 3.40	5.20
9.....	" 11.00	" 3.40	4.40
10.....	" 11.20	" 3.40	4.20
11.....	" 11.50	.....	}
12.....	.....	" 3.40	} 3.50
13.....	A. M. 12.20	" 3.40	3.20
14.....	" 1.00	" 3.40	2.40
15.....	" 1.20	" 3.40	2.20
16.....	" 1.50	" 3.40	1.50
17.....	No light.	No light.	....
18.....	No light.	No light.	....
19.....	No light.	No light.	....
20.....	P. M. 8.00	P. M. 10.10	2.10
21.....	" 8.00	" 10.50	2.50
22.....	" 8.00	" 11.20	3.20
23.....	" 8.00	" 12.00	4.00
24.....	" 8.00	A. M. 1.00	5.00
25.....	" 8.00	" 1.20	5.20
26.....	" 8.00	" 1.40	5.40
27.....	" 8.00	" 2.10	6.10
28.....	" 8.00	" 2.40	6.40
29.....	" 8.00	" 3.20	7.20
30.....	" 8.00	" 3.40	7.40
		Total,	136.30

RELATIVE ADVANTAGES OF TOOTHED AND SMOOTH CORE ARMATURES.*

By Alton D. Adams.

THE merits of different methods of construction in the manufacture of dynamo electric machinery, as in other lines, must evidently be decided by their comparative costs, all else being equal. Although questions concerning the relative merits of toothed and smooth core armatures have long been discussed, very little seems to have been written, to show whether actual saving in cost may be effected by one construction over the other, when employed to produce the same results.

The practice of dynamo builders in this country, and abroad, embodies both types, and the history of the art records many changes from each to the other. In view of the above, the inquiry, whether in the light of present facts any saving can be effected by the use of toothed core armatures, seems of interest.

The limits of this paper do not permit consideration of this question in connection with all classes of electrical machinery, and its bearing on direct current constant pressure machines only will be taken up.

The principal disadvantages of toothed, compared with smooth core armatures, are greater first cost, large change of lead, excessive sparking when used with too short air gaps, and the production of heat in pole pieces; their advantages are, that inductors are positively driven, large solid inductors, protected from eddy currents, and that a reduction may be made in the length and consequent magnetic resistance of the air gap.

Change of lead may be fixed within any desired limits, and sparking abated by such proportions of air gap and teeth, as give them sufficient magnetic resistance.

Heat in pole pieces may be reduced by their lamination, by the use of very narrow teeth and slots, by forms of teeth that present a nearly continuous surface of iron to the pole pieces, and still more, by the use of openings in core discs which do not cut through their outside surface, or a continuous magnetic sheath outside the teeth.

For any given form of tooth, the heating of pole pieces is less, the longer the air gap.

The mechanical strength of armature teeth, as usually employed, is far in excess of that required to hold inductors in position, even under conditions of short circuit, and driving pins inserted in the core, at proper intervals, are much cheaper and take up less valuable room on the armature circumference.

Either teeth or substantial driving pins are, of course, preferable mechanically to the slender bits of hard fibre which have been much used, and frequently give way under the heavy strains to which large generators are subject.

When large wires or copper rods are used as inductors, their protection from eddy currents is an important matter, but proper stranding of inductors reduces the eddy loss in them, when used on smooth cores, to a very small amount, and has the further important advantage that inductors may be bent into the proper shape at armature ends, and the joints, necessary when rods are used, avoided.

The chief possible advantage, then, to be gained by the use of toothed armatures, is through a reduction in the length of the air gap, and the consequent reduction in the ampere turns required on field magnet, weight of copper, or energy in winding, and the length and weight of iron core. To make this advantage available, it must be practical to use air gaps shorter than are required for insulation, winding and clearance.

As is well understood, the armature winding of a dynamo or motor, in operation, has a magnetizing action which is measured in ampere turns for a bipolar machine, by one quarter the product of all the inductors of the armature, into the total armature current. The ampere turns on the armature evidently tend to set up a flow of magnetism, having a complete circuit through the armature core, twice across each air gap, and through the iron of pole pieces.

About half the ampere turns furnished by the inductors under pole pieces, evidently act against the field ampere turns in each air gap at the polar tips, and the ratio between the armature and field ampere turns at this point, necessary to give sparkless reversal there, must determine whether the required magnetic resistance be greater or less than that of an air gap long enough for insulation, winding, and clearance with a smooth core armature.

As an armature coil in an operating dynamo or motor passes under the brush, the current flowing in it must stop, and one in the opposite direction be set up; and if this action is to be accomplished without sparking, a sufficient electromotive force must be provided in the coil while in direct contact with the brush. In the ordinary dynamo or motor, magnetism forced across the path of the coil, by the field ampere turns expended in air gap, must provide this reversing electromotive force.

The data of a number of smooth core armature machines of different make, show ratios of field to armature ampere turns in air gap, of from about one and one-half to one, to two and one-half to one, and the writer's experience is that a ratio of two to one will give sparkless operation at full load, with brushes set just outside pole corners.

It is a matter of common experience that the ratio between field and armature ampere turns in the air gap may be so reduced, even in machines with smooth core armatures, as to require excessive change of lead to secure even approximate freedom from sparking.

If it be desired therefore to build machines having an expenditure of field ampere turns in the air gap not much greater than those of the armature, we need not resort to toothed cores.

Take, for example, the case of a 260 ampere dynamo, with 120 inductors on its armature in one layer; an air gap induction of 25,000 lines per square inch, and 80 per cent. of inductors under the pole pieces.

An air gap of .45 inch between the armature and each pole piece will be sufficient for insulation, winding and clearance, and the field ampere turns expended in each air gap will therefore be 3,500, while the armature ampere turns, active under each pole tip, will be 3,100.

A considerable change of lead and sparking can be readily predicted for this machine.

In some types of small machines, the room required for insulation, winding and clearance, makes the air gap longer than necessary for sparkless operation, and in such machines the utility of teeth seems to depend on their cost compared with the saving to be effected by their use.

As the ampere turns, furnished by the inductors under any pole piece, grow less in a machine of given capacity when the number of poles is increased, very short air gaps may be used, if the number of poles is sufficiently large.

As an increase in the number of poles usually makes a machine of given capacity more expensive, however, the question at once comes up, to what extent the number of poles may be increased without a greater expenditure than the saving of iron and copper to be effected.

In large multipolar machines of four or six poles, such as are commonly used, the length of air gap required for sparkless operation, is considerable, and those who have watched the development of these machines with toothed core armatures during the last four or five years, have seen the air gaps gradually widen until machines of this character are not hard to find in which the copper inductors between the teeth could be taken out, wound outside the teeth, and still leave room enough for good clearance.

Additional mechanical security, of course, furnishes a considerable argument for the use of teeth in large slow speed machines.

A number of devices have been suggested from time to time, to enable toothed core armatures to be used with short air gaps, and the consequent saving in iron and copper effected. No machines with these devices, however, have yet stood the test of time and competition with those of ordinary type, and have yet to prove their ability to produce results, as at present attained at a less cost.

The seeming opportunity to save material by the use of toothed armatures is very attractive, and we cannot but hope it may some day be practical; in the light of present knowledge, however, there seems little to be gained by their use in medium or large bipolar machines.

*A paper read at the Phila. Meeting, Am. Inst. Elec. Engrs., May 16, 1894.

SPLIT PULLEYS.

HAS it ever occurred to you, says J. A. Allen in the Iron Trade Review, that there are some methods coming into vogue that are cheaper in the long run to use than to be without? Among these is the split pulley. It costs money, and big money, too, at times to cut a keyway in a shaft when a new pulley is to be located. Have you ever used a good split pulley? If not, do so. A short time since I fitted out a whole shop with pulleys and shafting, and used nothing but split wooden pulleys. Hold? Well, not at first. Each pulley was tightened as well as we could do the work at the start and then watched. At the first indication of a slip the wrench was put on again and that settled the matter for all time. I had those pulleys driving every conceivable kind of ironworking tool, from a light drill to a heavy hammer, and never had the slightest indication of trouble. Then, when new tools were bought and old ones had to be shifted, ten minutes sufficed to take down the pulley. But when I did that job, I didn't know as much as I do now. I allowed builders to sell me tight and loose pulleys on the countershafting, so that for every machine having a four-inch belt I had to buy a nine-inch split pulley. If I had the job to do again I would specify clutches. Of course the clutch would cost more than the extra paid for the double width split, and the additional loose pulley, but not so very much. And then I would save weight on my main line; and room also.

TRADE PAPERS AS AN ADVERTISING MEDIUM.

THERE are scores of business men, says the Journal of Building, who, when told that the circulation of a trade paper is 3,000 to 4,000, are inclined to ridicule its claims as an advertising medium, not knowing that a single edition of a trade paper, a circulation of 1,000 copies, reaches more persons whom they wish to reach than the issue of a daily paper of 100,000 copies. Those who may be surprised at this statement and imagine that the figures are incorrect may easily convince themselves of their error by referring to the commercial agency reports. To reach the consumer of general merchandise the daily papers are a valuable medium: to reach those particularly interested in trade, the trade papers alone cover the field.

ELECTRIC RAILWAY DEPARTMENT.

DESTRUCTIVE EFFECTS OF ELECTRICAL CURRENTS ON SUBTERRANEAN METAL PIPES.

In a paper on the above subject read before the American Institute of Electrical Engineers, Mr. Isaiah H. Farnham describes some experiments made in Boston, with the effect of discovering means to avoid damaging effects by electric currents employed for street railway purposes upon underground pipes. The facts elicited by these and other experiments have led Mr. Farnham to the following conclusions:

1. All single trolley railways employing the rails as a portion of the circuit, cause electrolytic action and consequent corrosion of pipes in their immediate vicinity, unless special provision is made to prevent it.

2. A fraction of a volt difference of potential between pipes and the damp earth surrounding them is sufficient to induce the action.

3. Bonding of rails, or providing a metallic return conductor equal in sectional area and conductivity to the outgoing wires, is insufficient to wholly prevent damage to pipes.

4. Insulating sufficiently to prevent the trouble is impracticable.

5. Breaking the metallic continuity of pipes at sufficiently frequent intervals, is impracticable.

6. It is advisable to connect the positive pole of the dynamo to the trolley lines.

7. A large conductor extending from the grounded side of the dynamo, entirely through the danger territory and connected at every few hundred feet to such pipes as are in danger, will usually ensure their protection.

8. It is better to use a separate conductor for each set of pipes to be protected.

9. Connection only at the power station, to water or to gas pipes, will not ensure their safety.

10. Connection between the pipes and rail, or rail return wires, outside of the danger district, should be carefully avoided.

11. Frequent voltage measurements between pipes and earth should be obtained, and such changes in return conductors made as the measurements indicate.

THE ELECTRIC LOCOMOTIVE.

There is special reason why the mechanical engineer may be expected to increase his efforts in connection with the steam locomotive, says the Railway World, for he is likely soon to feel the stimulus of wholesome competition. Already the electrical engineer has his visions of a high speed locomotive and is preparing to challenge the position of the steam locomotive. So far has he already progressed that many mechanical engineers—and among them may be found the locomotive superintendents of not a few important railways—are keeping in view the possibility of radical changes in their department, and, while perfecting their own machines, keep, as it were, an eye to windward. Moreover, there is no objection to the material increase of speed on the grounds of safety, for in England especially the permanent way is well-nigh perfect, and fully capable of permitting almost any speed obtainable. Altogether, there is no reason to expect that development toward higher speed has reached a limit, while there are many considerations which point to rapid improvements in this direction.

SPARKS.

The extension of the Toronto and Scarboro Railway to Victoria Park has been completed.

The Montreal Street Railway Co. are said to have made a net profit during the six winter months, of $59,000.

The Standard Light & Power Co. is said to have decided upon the construction of an electric railway, from the city of Montreal to Lachine.

Eight thousand passengers were carried over the Kingston Electric Railway on the Queen's birthday.

An action for $10,000 damages has been brought against the town of Port Arthur, by a person named Burk, who lost his hand by an accident on the Port Arthur Railway, of which the town of Port Arthur is the owner.

A considerable amount of new machinery, including a 200 H. P. Robb-Armstrong engine, has lately been added to the plant of the Sandwich, Windsor & Amherstburg Railway.

It is proposed to utilize power from the cable station at Canso, N. S., for the operation of an electric railway from Hazel Hill to Canso, a distance of three miles, and from Milton to Liverpool, a distance of six miles.

Mr. John Patterson, the principal promoter of the Hamilton Radial Electric Railway, is said to have succeeded in making the necessary financial arrangements for the carrying out of the undertaking.

The city council of Toronto will contract with the Toronto Railway Co. to water, four times a day, the track allowance, covering a distance of forty miles, at a cost of $26.00 a day.

Mr. McKenzie, of the Toronto Railway Co., who is at present in the Northwest, is reported to be negotiating on behalf of the Dominion Lighting Co. for the purchase of the Manitoba Gas and Electric Company's property and the Street railway controlled by Mr. Austin.

The courts of Montreal have given judgment against the Montreal Street Railway Co. for $5,325, in favor of Mrs. J. H. Hamelin. The plaintiff's husband was run over by one of the company's horse cars, and died from the result of the amputation of one of his legs which had been injured in the accident.

Messrs. A. H. Edwards and James Fowler, of Carleton Place, are among the promoters of a company which is endeavoring to secure aid from the municipalities for the construction of an electric railway from Perth to Lanark, Ont.

The Niagara Falls Park & River Railway Co. have paid $10,000 to the Victoria Park Commissioners for the privilege of constructing an incline railway at an angle of fifty degrees from the top of the bank at the southwest corner of the Clifton House to the Maid of the Mist Landing. It is said to be the intention to charge a twenty-five cent. fare.

The Town Council of Oshawa have given the right of way for an electric railway to Capt. Carter, of Deseronto. The railway will be built in three sections, and will run from the Grand Trunk depot through the town, with switches to the leading manufacturing concerns. A bonus of $1,500 on sections one and two, and of $2,000 on section three, is a condition of the agreement.

A company is said to have been formed with the object of constructing an electric railway at Nanaimo, B. C., with an extension to the adjoining town of Wellington. The road will be about ten miles in length, and it is said to be the intention of the promoters to make the construction and equipment of first-class character. The road is expected to be in operation by the 1st of September.

It is reported to be the intention of Mr. F. W. Colcleugh, of Selkirk, to commence immediately the construction of an electric railway from Winnipeg to Selkirk, for which he holds the charter. It is probable that the construction of the road will be done by contract with the Winnipeg Street Railway Co., but should this not prove to be the case, it is said that Duluth capital will be forthcoming to complete the undertaking.

Application is being made for the incorporation of "La Compagnie de Tramways Electriques de Quebec," for the construction of an electric street railway in the city of Quebec and through the suburbs of St. Valier, St. Sauveur, Jacques Cartier, St. Roch, etc. The promotors of the company, are Messrs. J. B. Laliberte, J. U. Gregory, B. Leonard, P. Dumoulin, J. F. Guay and F. M. W. Pampalon. The capital stock is to be $200,000.

The construction of the Hamilton, Beamsville & Grimsby Electric Railway is being pushed forward in a most active manner. Thirteen miles of track have been completed, leaving only four miles at the Grimsby end of the line to be finished. The power station is well-nigh completed, and the cars for the equipment of the road about ready for shipment. The company are unfortunately still experiencing difficulty with one or two of the municipalities regarding the right of way.

The City Council of Hull has granted the application for a charter by Mr. D. Viau, on behalf of a local company, for the construction of an electric railway in that city. The period of the charter is thirty-five years. It provides for exemption from taxes for fifteen years, for the commencement of the work within two years, and for the expenditure of $15,000 thereon the first year, and $5,000 a year for the succeeding ten years. The corporation has the right to purchase the road and equipment at a price to be fixed by arbitration, after the expiration of twenty years.

In reply to an inquiry, Sir Adolphe Caron stated in the House of Commons recently that the contract made with the Ottawa Street Railway Co. for carrying the mails from the railway stations to the post office had proved to be in every way preferable to the former system by mail carts. The contract is for a period of four years from 1st November, 1893, at the price of $4,000 per year, which is slightly more than $100.00 above the cost of the old method. It is understood that the Government has under consideration proposals from the Montreal and Toronto Street Railway Companies for a like service in those cities.

It is reported to be the intention of the Toronto Railway Co. to extend their Mimico line to Burlington, and there make connection with a branch of the Hamilton Radial Electric Railway, thus providing through electric transit between Toronto and Hamilton. It is said to be the intention to equip the line for passenger and freight traffic, and in the case of the former, to give a half-hour service with a speed of twenty miles an hour, and about half the price charged by the G. T. R. The opinion is expressed in some quarters that the C. P. R. Co. are at the back of this project, with the object of obtaining, free of charge, right of way between Hamilton and Toronto.

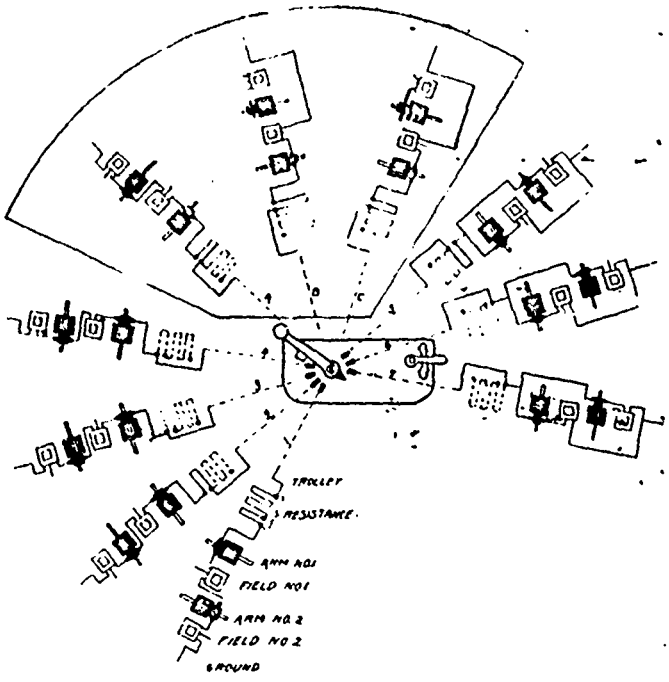
Section 210 of a bylaw of the city of Montreal for the regulation of the street railway reads as follows:—"The company shall not carry more passengers than the cars can conveniently accommodate, and the number of passengers each car can accommodate shall be previously fixed and determined by the City Surveyor, and indicated upon a card posted inside and outside of each car." The City Surveyor has decided that an ordinary horse car can hold from twenty-four to thirty-four passengers, open cars from thirty-five to fifty, and motor cars from thirty-six to thirty-nine. He lately instructed the clerk of the Recorder's Court to take legal proceedings against the Street Railway Co. for overcrowding their cars, but the case was dismissed.

Mr. Thos. Todd, president of the Galt & Preston Street Railway Co., stated at a recent meeting of the directors, that the contract for dynamos, motor cars, overhead work, bolting rails, etc., had been awarded to Messrs. Ahearn & Soper, of Ottawa, at the sum of $15,925, and the contract for engines and boilers to the Goldie & McCulloch Co., of Galt, at $6,000. He stated further that the rails, ties, posts and spikes and three trailer cars had been purchased by the Directors, and that the only remaining contracts to be let are the erection of a power house and the bridge over the Speed, tenders for which are already in. The road is expected to be in running order by the 1st of July. The cost of the road, including equipment, it is said will not exceed $75,000.

The construction of an electric railway, connecting the towns of St. Stephen N. B., and Calais, Me., has been commenced by Mr. C. A. Richardson, President of the Worcester, Mass., Construction Company. The road will be seven miles in length, extending from the steamboat landing at Calais through the principal streets of the town, and crossing to St. Stephens by means of the two bridges across the St. Croix. The road will be equipped with ten cars, each car being capable of accommodating fifty passengers. The company propose, also, to supply electric light and power. The power station is to be of brick, thirty-five by forty feet in size, with a chimney seventy feet in height. The car sheds will be thirty-five by fifty feet in size, built of wood. A one hundred and fifty h. p. Ball engine will furnish the motive power to the generating machines, which will be of the Westinghouse type. The officers of the company, which has a paid up capital stock of $100,000, are as follows: Mr. I. C. Libby, of Waterville, Me., treasurer; Mr. H. A. Goodenough, of Brighton, Mass., president; Mr. Curran, a lawyer of Calais, Me., secretary; Messrs Pike and Hill, of Calais, and Mr. Richardson, directors.

AN AID IN EDUCATING MOTORMEN.

THE proper handling of the controller is the most important point in a motorman's education, and it is almost impossible to train a man to handle the controller properly unless he understands the principles of what is going on and the connections that are being made as the handle is thrown from point to point.



Educating a large number of motormen who have had no previous knowledge of electricity is a difficult task at its best, and anything to simplify matters ought to be gladly adopted. The accompanying illustration is from a blue print which is supplied to every motorman on the Calumet system of this city. On the same sheet are a few instructions and a brief explanation of the connections. The idea of the diagram, as will be seen, is to give the connections for each controller point in the same relative positions as those taken by the controller handle in making the corresponding connections. This particular diagram is for the General Electric type "K" controller wired to W. P. motors and using the field loop method of control. Of course the idea is applicable to any controller. With plain rheostat control such diagrams would not be worth the while, but where the connections are as numerous and varied as on series-parallel controllers, anything that will simplify matters to the befuddled mind of the motorman during the learning period, should be adopted. The department on the Calumet system is under the charge of H. P. Rustling, who is doing much to save repairs by a thorough education of the men under him.

ALLGEMEINE ELEKTRICITÄTS GESELLSCHAFT.

WE learn from our Montreal correspondent that Messrs Munderloh & Co., Montreal, have secured the sole agency for the Dominion of Canada, for the Allgemeine Electricitats-Gesellschafts (General Electric Company of Berlin, Germany.) The well known quality of the goods of this firm throughout Europe and the United States should secure Messrs Munderloh & Co. a portion of the trade in this country.

The exhibit of the Company at the World's Fair was highly praised by many of the leading American electricians and engineers, it being one of the largest and finest in the Electricity Building.

The introduction of electric street railways on the continent of Europe is due chiefly to the Allgemeine Elektricitats-Gesellschaft, who have carried out by far the greatest number of trolley systems in towns. Where sharp curves occur a special arrangement of the overhead wiring is provided for obtaining the greatest possible smoothness in running; this is effected by a suitably shaped instrument, facilitating the speedy fixing and removal of the span-wires between the curves. The Allgemeine Elektricitats-Gesellschoft were the contractors for the transmission of power from Lauffen to Frankfort.

Mr. John A. Burns has been appointed manager of the electrical and mechanical department of Messrs Munderloh & Co., and inquiries for goods for which he has the agency should be addressed to Munderloh & Co.

The City Engineer, of Hamilton, is considering the advisability of manufacturing electric light for the pumping-house at Burlington Beach, on the premises as is done at the pumping station at Toronto.

USEFUL HINTS.

Never open the shunt circuit of a generator (or mortor) while it is charged, as the inductive discharge from its fine winding is liable to strain the insulation and sometimes destroy it. In the case of a motor, and the winding remaining intact, the motor will race and the abnormal flow of current may burn out the armature.

A GOOD SOLDERING FLUID.—In order that all joints should be perfectly secure it is necessary to solder them, and in this work nothing but an acid solution much recommended is easily made and simple, as given below. After the joint is complete, the acid should be washed off before applying the tape:—Saturated solution of zinc, 5 parts, alcohol, 4 parts; glycerine, 1 part.

The best economy yet reported for a triple expansion engine is 12.73 pounds of feed water per hour per horse power. This has been satisfactorily shown by a Sulzer Corliss engine in Germany with cylinders 19.65 in. 26.4 in. and 47.35 in. by 55.2 in. stroke at 65.5 revolutions per minute. 145 pounds boiler pressure and about 24 expansions with all cylinders and receivers jacketed with live steam as boiler pressure.—Power and Transmission.

In piping up a boiler the stop valve in the main supply pipe should be so placed that water cannot collect about the valve. This is liable to occur where a globe valve is used and placed in the horizontal main in an upright position, or in the vertical main. In either of these cases a drip should be provided, but a much better plan is to place the valve in a horizontal position, or else use an angle valve. Where water can collect trouble is sure to come, from water-hammer breaking connections.

In case an armature should get wet while in transit or from other causes, it should be thoroughly dried out before being run, and this says the American Mechanic can readily be done in several ways. Where ovens are handy, as in factories, they are used for this purpose, and a slow steady heating will do the work, taking care not to have it too hot. In central stations, where there is no oven, they very often turn a current from another machine through the armature, having a meter in circuit so as to avoid too much current of the armature. This will probably be found the best way in most cases and thoroughly dries the armature, as the current passes through it very thoroughly.

Twenty centuries before the birth of Watt a mechanic of Alexandria described machines whose motive power was steam, and even anticipated our modern turbine wheel by a machine he named "Neopile." When Fulton launched the Clermont he was simply repeating what was done in the harbor of Barcelona as far back as 1543. We have no parental claim on electric discovery, for in the twelfth century the scientific priests of Etruria drew lightning from the clouds, antedating Franklin, and by the means of an iron rod on the shores of the Adriatic Sea the signal service electrician of ancient days released the electric spark by means of the coming storm.

SPARKS.

A local paper claims that the town of Seaforth now has the best equipped telephone office west of Toronto.

Messrs. Laurie Bros., engine builders, Montreal, are applying for incorporation under the name of The Laurie Engine Co. with a capital of $250,000. The enlargement of their works is contemplated.

The Toronto Railway Co., have given assurance to the City Engineer of Toronto, that they are willing to lay all the electric return wires necessary to prevent the possibility of underground water mains and other pipes being damaged by electrolytic action.

Mr. Frederic Nicholls, manager of the Canadian General Electric Co., when asked by a representative of THE ELECTRICAL NEWS the other day regarding business conditions, expressed himself as being agreeably surprised to find that there is no falling off in the electrical business, while in other lines of wholesale business there has been a shrinkage of 25 to 30 per cent. The opinion obtains that as soon as the business depression at present prevailing begins to clear away, there will be witnessed a period of great activity in electrical business in this country, more particularly in the line of electric railway extension.

SPARKS.

Messrs F. H. Sleeper & Co. have commenced the manufacture of electrical machinery at Coaticook, Que.

The Town Council of Tilbury Centre, Ont., are reported to have decided upon the purchase of an electric light plant.

Messrs. Geo. H. Harper & Co. are erecting poles and stringing wire for electric light and power for commercial purposes at Dundas, Ont.

It is reported that some citizens of St. John, N. B., are endeavoring to form a company to install an electric lighting plant at St. George, N. B.

The City Council of Calgary will shortly submit to the ratepayers a by-law authorizing the expenditure of $30,000 for the purchase of an electric light plant.

A Mr. Cone has recently visited the town of Parry Sound, with the view of forming an Electric Light Co., and also establishing a machine shop for the manufacture of electrical apparatus.

Incorporation has been granted the Woodstock and Canterbury Telephone Co., of New Brunswick, to build and operate a telephone line between Woodstock and Canterbury.

Permission is being sought by the Standard Electric Power Co. to run electric cars through Cote St. Antoine and Notre Dame de Grace, and to enter the city of Montreal by way of Dorchester street.

Suits have been entered against the Montreal Street Railway Co. by the Bell and Federal Telephone companies for compensation for the use of their poles and to restrain the defendants from using the poles in the future.

It is said that in view of the fact that only one company has tendered for the contract for street lighting at London, Ont., it is in contemplation to organize a joint stock company of local business men to tender for the franchise.

The Water and Light Committee of the Goderich Town Council, recommend consideration by the Council of the application of the Wingham Electric Light Co. for permission to install an incandescent electric lighting plant.

The Plate Glass & Boiler Insurance Co., of London, Ont., are reported to be about to institute open meetings at which lectures on economy in engineering will be delivered for the benefit of operative engineers, and owners of steam plant.

The following students of electricity at the Toronto Technical School were granted certificates of proficiency at the recent examinations: J. W. Lawson, S. S. Clarke, J. R. Jeffrey, J. R. Patterson, A. Coulter, H. C. Champ, J. Preston, B. Kirk, A. L. Torgis, Geo. Adams, I. D Adams, W. Hahn, Geo. Trimming, H. F. Hutchison.

The Royal Electric Co., of Montreal, must be regarded as having been unfortunate of late. Following close upon the destruction of their incandescent lighting station, came the explosion of a boiler in their east end lighting station, wrecking the boiler house, but fortunately doing little damage to the machinery. It is still more fortunate that no injury was done to any of the employees at the station, or to the crowd of people who were at the time congregated in Sohmer Park, which immediately adjoins the lighting station. As the result of the accident, the electric lights throughout the city were temporarily extinguished, but in a very little time seven circuits were put on from the Wellington street Station.