ELECTRICAL AGE

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OHIO ELECTRIC LIGHT ASSOCIATION.

The Ohio Electric Light Association will hold its annual meeting at Piqua, Ohio, on October 8.

ELECTRICAL SOCIETIES.

That there is a popular demand for knowledge on electrical subjects is evidenced by the large number of societies, clubs, classes, etc., that are maintained in this section for the propagation of such knowledge. These societies are well membered, and, as they are increasing in number, the truth is self-evident that thoughtful-minded people are eager for more knowledge on electrical matters. The various societies are naturally graded according to the degree of knowledge possessed by their members. There are what might be called "Kindergarden" classes, where the rudiments of the science are taught; then come the more advanced societies, where the practice of electrics is discussed, and, finally, comes the principal electrical society, where theory and practice both are taught—the American Institute of Electrical Engineers. Among the many worthy institutions of this class that may be mentioned, in addition to the one named, are the New York Electrical Society, the Franklin Electric Club, the Henry Electrical Club, the Brooklyn Electrical Society, the Brooklyn Institute of Arts and Sciences, besides several "classes" which are doing excellent work.

THE BUILDING OF ELECTRIC LINES.

We conclude in this issue the article by Wm. F. Taylor on "Telegraph Line Construction." This is one of the ablest papers ever produced on this subject, and is full of valuable information on this important branch of electrical work. It contains matter of value to the telephone, electric light and electric power interests, as well as to the telegraph, and the author, who is the superintendent of telegraph on one of the greatest railroads in the country, has so combined theory and practice in his work of line building as to produce the best attainable results. Electric lines, for any electrical service, constitute a very important part of the system and, while in former years they were rather looked upon in the light of necessary evils, cheaply erected and neglected afterwards, they are now vastly better built and taken care of. Those directly concerned have found out by costly experience that it pays to build lines in the best manner possible, and Mr. Taylor's paper emphasizes the importance and necessity of using the best materials and erecting the lines in a substantial manner in order to get the best results.

PHASING TRANSFORMERS.

The study of alternating currents and their application to motors has occupied the best minds of the day. The development of the science which treats especially of two and three phase currents, of power generators to produce them and motors to consume them, has taken but a short period of time. The world today is ripe for all practical achievements in that direction. Mr. Chas. S. Bradley read a paper on the subject before the American Institute of Electrical Engineers, September 25, and it was listened to with marked attention and interest. He is following up the subject closely, and his work in that respect has been eminently practical. The complexities which arise and confuse all but those thoroughly initiated need hardly be mentioned. At the conclusion of the discussion, through Mr. Bradley's kindness, refreshments were served, and the engineers forgot for a time self-induction and hysteresis in practically demonstrating each other's capacity. It is needless to say that the meeting was a success.

PHASING TRANSFORMERS.*

BY CHARLES S. BRADLEY.

On account of the large number of single-phase plants in existence which were built for lighting, and with no thought at the time of running motors from these systems, it has seemed to the electrical engineer very necessary to produce a single-phase motor. Many talented men have labored and studied upon this subject, and, so far, the results have not been at all satisfactory.

During the last few years the rapid progress of the polyphase motor has been the only success. The evolution of electrical art seems to be toward the production of apparatus which shall make all systems mutually convertible; so that we may be able to convert the phases produced into a greater or lesser number; starting with a generator of three phases, we shall be able to produce from it two or one. Again, generating two phases, we shall be able to convert it into three phases or one. Again, starting with a single-phase generator, we shall be able to convert it into two or three phases.

The polyphase motor is so good as to need but very little if any improvement, but this is so familiar to the Institute that I need not go into details. I think the time is not far distant when we shall be able to fill out with the alternating currents any engineering problem that may be required of us. We will be able to take old plants and modify them to do any work which may be necessary. One of the important links to round out the art seems to be the phasing transformer, so that we can take a single-phase alternating current and convert it into polyphase of any desired number.

I have chosen for my work the conversion of single-phase to three-phase, because the three-phase motors which we have been able to construct give us very much less trouble than the two-phase. In a series of experiments I have found that the two-phase motor would run at a number of speeds, especially when supplied with current from a phasing transformer. I supposed the trouble arose from harmonics, but of this I am not certain. The tri-phase motor never has given us any of this trouble. These experiments, however, were carried out before the transformers had been refined; and, now that we are getting more perfect results, I think it is very probable that we could return to the two-phase motor and get much better results than when first tried. The following is a description of an arrangement of condensers and cores to produce polyphase and single-phase alternating currents. Many different arrangements of condensers and inductances have been tried, and all have failed to keep their phases at a working relation, except the one I am about to describe.

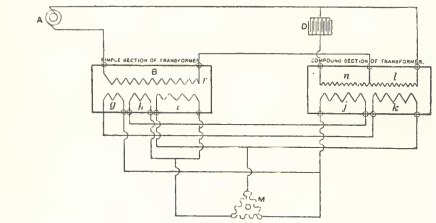
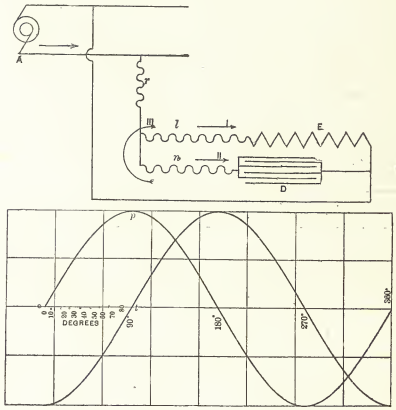


FIG. 1.

A diagram of the phasing transformer and connections, with the generator and motor, will be found in Fig. 1, A being the generator, B the simple section of the transformer, D the condenser, and M the motor; *r*, primary of the simple section of the transformer; *n* and *l*, primary of the compound section; *g*, *h*, and *i*, secondaries of the simplest section of the transformer, and *j* and *k*, secondaries of the compound section. The primary of the simple section of the transformer is in series with the compound section and condenser. By the proper adjustment of capacity and inductance, the magnetic flux in the core of the compound section is approximately 90 degrees in phase behind the simple section; then, in order to get three phases from two, I resort to resultants in the secondaries: *g* and *k* constitute one phase, *h* and *j* a second, and *i* the third. The



FIGS. 2 AND 3.

essence of this invention rests in the arrangement of the compound section of the transformer and condenser. There are, undoubtedly, several ways of explaining the theories involved in this device, and most people would prefer the mathematical description, but, as I did not hit upon the invention by that method, I shall follow in the explanation the same method of reasoning as I used to arrive at the result. In order to explain the theory involved in this, refer to Fig. 2, in which A is the generator, E, the inductance, D, a condenser or capacity; *l* and *n* represent the leads to the inductance E, and to the capacity D. If the generator is generating an electromotive force in the direction of the arrow, Fig. 2, a current will flow through the lead *l* and the inductance E, as represented by the arrow prime, and through *n* into E, in the direction of the arrow second, as indicated by the curves in Fig. 3; that is, during the rise of the electromotive force through the machine from the point, *o*, to the top of the wave at *p*, the current will flow in parallel into or through the induc-

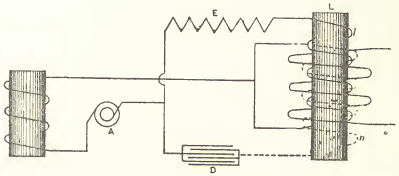


FIG. 4.

tance E, and the capacity D, Fig. 2 As soon as the wave of the electromotive force commences to decline from the point *p*, the condenser will begin to discharge and the current flowing from it will be in the direction of the arrow third, Fig. 2. Also, at the same time, the inductance will discharge its energy by a current in the direction of arrow third, so that the current represented by arrow third will cross the zero line at point *t*, Fig. 3, or is delayed by a time equal to 90 degrees. Thus we see that the current represented by arrow third will be lagging in its time

* A paper presented at the Ninety-ninth meeting of the American Institute of Electrical Engineers, New York and Chicago, September 25, 1895.

period considerably behind that in the lead *r*, represented by curve *o–p*. Now, if we wind the lead *l* and the lead *n* upon an iron core, as shown in Fig 4 in opposite directions and of the same number of turns, and have the inductance E bear a proper relation to the capacity D, so that the currents represented by arrow prime and arrow second shall be equal, no magnetic flux will be produced in

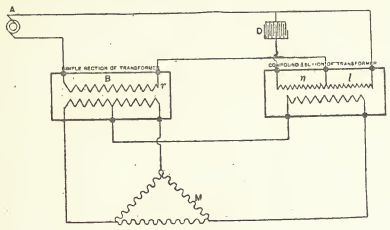


FIG. 5.

the core during the rise of the potential of the machine from *o* to *p* on the curve, but during the fall of the electromotive force of the machine, and during the discharge of the inductance and condenser which is represented by arrow third, Fig. 2, the currents flowing through *n* and *l* will be in series and flowing in the same direction; consequently, the magnetic flux will be approximately 90 degrees later than it would be if charged directly from the machine. I have represented in Fig. 2 a section of lead by *r*, and it will now be clearly seen that the current in the lead *r* will have a phase difference from the combined or resultant phases in the leads *l* and *n*. Furthermore, a current in the lead *r* will be in lead of the electromotive force of the machine, because the inductance and the condenser, previously described, cut off the flow of the current before the machine has reached the zero point, and when the lead *r* is placed upon an iron core, as shown in Fig. 4, it has a tendency to lag, which counterbalances the lead and leaves the main line current somewhere near in phase with the E.M F. of the generator.

Please refer now to Fig 4, where the leads *l* and *n* are wound in opposite directions, and completely interlaced upon the iron core L, the generator, inductance and capacity being indicated by the same symbols as in previous

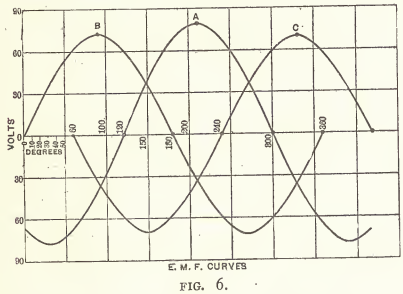


FIG. 6.

figures. The lead *r* is here wound upon the second iron core, which constitutes the primary of the simple section of the transformer as shown at B, Fig. 1. In reducing to practice and applying the transformer to an induction motor, we find that the inductance, E, can be dispensed with, as the apparent inductance produced by the motor furnishes all the lag necessary; and, it will be noted, that in Fig 1 the extra inductance which we used in our first experiments is left out of the combination. The lead from the simple section of the transformer, it will be noted, goes to the centre of the compound section. This diagram does not represent the true condition of the compound section, for the winding *n* and *l* are together, or, as before mentioned, interlaced upon the core. The magnetic flux in the two sections of the transformer are approximately 90 degrees apart. The secondaries are therefore wound each partially upon the two cores, so that the three resultant phases may be produced from two, this being in accordance with Mr. Fred. S. Hunting's invention for changing two phases to three.

Mr. Scott's invention for changing two phases to three may also be used, and is shown in Fig. 5. Making the resultants in this manner by means of the secondary windings contributes also to steadiness of phasing, If desired, two secondaries having a proper two-phase relation may be used on the motor.

The experimental work, in which I have been greatly assisted by Messrs. Hulse and Chapman, has occupied a long time and has passed through a great many stages. The results represent a great deal of patience, and we have chased the phases from zero to 180 degrees, back and forth, until there is a well worn path between these two points; but finally we have a set of beautiful results, and the electromotive force curves will be found in Fig. 6,

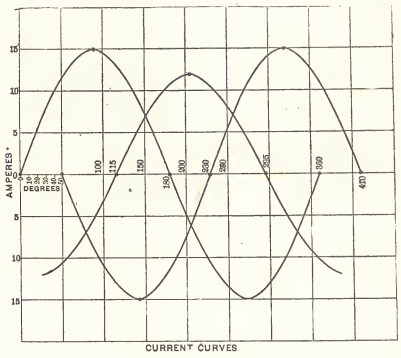


FIG. 7.

taken from the transformer, in connection with a half horsepower motor, running at full load, and Fig. 7 gives the current curves of the same. This motor gives powerful starting torque, and it gives me pleasure to show it to you here in operation. (*To be continued.*)

ENGINE INSURANCE.

Considerable difference of opinion exists as to the advantages of engine insurance. That there are advantages to the insurer is almost universally acknowledged, at all events in the textile manufacturing districts, although all would by no means agree as regards the nature of such advantages. Some insure mainly for the sake of the examinations and reports made by the insurance company's officials. The value of periodical inspection by competent, independent engineers is apparent, when it is considered that a large number of land engines are in charge of men without much special mechanical training. In the case of those large mills or works where there are trained engineers in charge of all the machinery, the owners naturally depend on their own men to a greater extent, but even in such cases it is useful to have independent reports. The compensation, too, received for breakdowns is not to be despised.

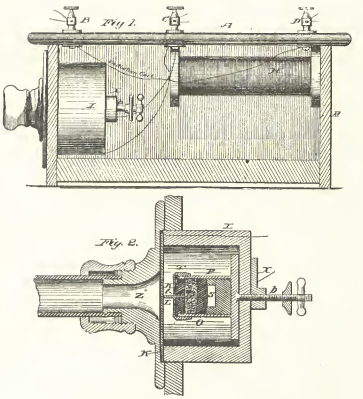
Occasionally it is urged that there is no need for insurance when an engine is of ample strength and very carefully looked after, while immunity from breakdowns in the past is also adduced as a reason for expecting similar fortune in the future. The experience of insurance companies, however, shows that the fortunate owner of such an engine owes as much to chance as to his own foresight. Engines insurance is fertile of surprises, and it is impossible entirely to prevent accidents.—H. B. Spencer in Cassier's Magazine for October.

THE GILLETT GRANULATED CARBON TRANSMITTER.

Like nearly all useful improvements the introduction of the telephone to public service was a hard struggle which came near financially ruining the promoters, and I, for one, rejoice that they have been amply rewarded for their perseverance, as it was no easy matter to convince the public of the merits of the telephone.

Steadily has improvement been going on in the telephone field, although hampered by a gigantic monopoly, until distance is almost annihilated. Soon will our neighbors of foreign birth be able to talk with their friends at their firesides in the old countries; what a pleasant thought to many is the possibility of hearing "Mother's voice" once more—all for a trifling sum.

The telephone, although not perfect as yet, seems a very simple affair, yet it greatly taxes the inventive mind. There yet seems to be something that is not understood, but which should be grasped. The maker of a telephone must possess a knowledge of several scientific laws—vibration, deflection, acoustics and electric influence.



GILLETT'S GRANULATED TELEPHONE.

The first patent taken out in the United States for granular substance used for telephonic transmission was by Webster Gillett, of Ypsilanti, Mich. The application was filed November 27, 1878, and the patent (No. 214,248) granted April 15, 1879.

In February, 1878, Mr. Gillett and Mr. C. C. Reid, superintendent of telegraph of the Michigan Central Railroad, conducted a series of experiments with the use of granulated carbon, over the railroad company's lines. The transmitter was placed directly in the line at Jackson, Mich., and the talking was distinctly heard both at Detroit and New Buffalo, the distance being over 200 miles. These tests furnish indisputable evidence that long-distance telephony was possible and practicable at that date.

In 1880 Mr. Gillett placed a pair of his telephones on the lines of the American Union Telegraph Company, one in New York and the other in Philadelphia, using a grounded circuit, and conversation was carried on at considerable length. The American Union Telegraph Company acquired a controlling interest in the Gillett patent, which interest was transferred to the Western Union Telegraph Company at the time of the amalgamation of the two companies. Litigation resulted, in which Mr. Gillett got, or is to get, six cents damages, and the first granulated carbon patent thus passed into the hands of the Bell monopoly. Not satisfied with that, the Bell Company has ever since been scratching around under the covers of the patent office and courts to find the dog to set upon the public.

In 1883 the Long Distance Telephone Company was organized, using what is known as the multiple telephone transmitter, which has several variable-resistance contacts actuated by a single diaphragm, and having an independent battery and induction coil for each contact; the secondary wires of the coils being connected in multiple arc.

In 1883 conversation was successfully carried on over the Postal Telegraph Company's lines from 49 Broadway, New York, to the Stock Yards in Chicago, a distance of 1000 miles, and the first business transacted in this country by telephone was an order transmitted at that time by Mr. Jerome Gillett for three car loads of hogs.

This instrument was patented by Mr. Webster Gillett and owned by the Long Distance Telephone Company before the Bell Company's instruments were talking 100 miles.

In 1884 Mr. Gillett, with others, went to England and France and did the first long-distance talking in those countries, first from London to Derby, a distance of about 140 miles, over a No. 11 iron wire, with ground return, and afterwards from London to Carlisle, nearly 300 miles, over a metallic circuit of No. 9 iron wire. In Paris he conversed over an underground copper metallic circuit 116 miles long, and from Paris to Nancy, a distance of 228 miles, seven miles of which was No. 11 iron wire, underground. This latter test was a competitive one conducted by the government. The various governments represented in this competition were Belgium, with two instruments, Austria with one, Italy one, Sweden one, Germany two, America one (the Gillett), and France three. The award of merit was given to Adair, of France, and Gillett, of America.

The next test was across the English channel over a cable laid down in 1853, which was said to be in a leaky condition. The transmission was perfect and the ticking of a watch was distinctly heard over the line, which ran from Dover to Calais. The circuit included seven miles underground on the French side; 21 miles of channel cable and nine miles of overhead line on the English side.

From these tests long distance telephony sprang up; they were all made in the summer of 1884, when the Bell monopoly was scarcely working its wires 100 miles. From these tests, also, the telephone service between London and Paris originated.

Mr. Gillett, in 1883, by a series of tests over lines from New York to Meadville, Pa., a distance of 509 miles, successfully demonstrated the practicability of long distance telephony, and there is no record of any practically talking long-distance instrument prior to this time, yet Hunning and the Bell Company get all the credit for the first long-distance work, in spite of the fact that Gillett's granulated carbon patent was taken out in this country some years before Hunning's.

Mr. Gillett's experience in electrical work dates back to 1859, when he was associated with the late George B. Hicks, the co-inventor of the Milliken telegraph repeater. He was afterwards (in 1862) associated with Prof. Elisha Gray, and later with Dr. Hill, the inventor of the gravity battery.

The accompanying illustrations are reproduced from Mr. Gillett's patent. Fig. 1 shows the transmitter and induction coil connections, and Fig. 2 the details of construction of the transmitter.

The artist—Hurrah! Bully! I've had a nightmare!

His wife—Well, what of it?

The artist—What of it? Think of the suggestions it gave me for my next art poster!

"Yes," said the business man to the clergyman, "I've lost a good deal of time in my life."

"By frittering it away, I suppose."

"No; by being punctual to my appointments."—*Boston Courier.*

—"G. D. Poor, Electrician," is the announcement on a sign in a western town.

CARBON BRUSHES FOR HEAVY CURRENTS.*

BY G. E. HARTMANS.

To those engineers who have the misfortune to be in charge of machines whose most brilliant feature lies at the toes of the brushes, the following account of experiments may present some interest.

Having first introduced one of the machines referred to as a 10-pole shunt with drum armature designed to give 500 amperes and 230 volts at 120 revolutions, with a commutator of diameter three feet and width seven inches, I will proceed to enumerate the various combinations of copper and carbon which we used as brushes and the results in each case.

(1). Our first excursion was made with three pairs of ordinary copper stencil brushes filed to a bevel of rather more than one section, *i.e.*, ½-inch, and it was soon apparent that something cheaper than commutator sections must be forthcoming to satisfy the sparky appetite.

(2). We then decided to try the effect of a carbon tip dovetailed into a copper carrier (fig. 1) placed in front of and touching the toe of each brush as shown, the total width of copper and carbon forming the bevel remaining the same as before. This was a decided improvement, but only for a short time, as the wear of the copper brush and flexibility of the arrangement caused a gap (fig. 2) between the copper and carbon, and the sparks returned to their former diet—to wit, the commutator. In addition the carbon tips got hot and their contact with the copper carrier deteriorated.

(3). We were then at some trouble to design a suitable holder for each carbon, insuring their nice adjustment and good contact, and arrived at the ornamental result shown by fig. 3. One or two runs with these brushes gave us some encouragement, but we were deceived in thinking our troubles were ended, for first one flat and then half-a-dozen made their appearance, and the weight of the carbon and holder, which was necessarily rather rigid, jolting over the sore places was too much for even a copper skin. So we were obliged to return to No. (2), whilst the commutators were refreshed with an emery bob.

(4). The next bait for the sparks was a set of carbons

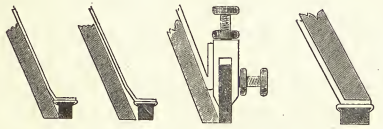


FIG. 1. FIG. 2. FIG. 3. FIG. 4.

served up as shown by fig. 4, carefully bedded and mounted in clean copper clips, the brush being placed on the top for the necessary rigidity and copper section. The total section of carbon being three square inches, the width slightly exceeding one section. Here, as before, the first few runs were most reassuring, the comparatively small section of carbon carrying 450 amperes in a manner far exceeding our expectations, due, no doubt, to the cooling action in passing over such a large commutator surface. The sparking was practically nil, and the face of the commutator absolutely unmarked. On running with the full load 500–550, the carbons required careful watching and frequent applications of vaseline, as they showed a tendency to become red hot, not all over, but suddenly in patches, and the contact between the copper and carbon became impaired as before through the continual heating. We therefore confined ourselves to a load of 450–480, using a small unit to relieve the larger ones.

(5). The same arrangement, but with double the width of carbon (fig. 5) was also tried, the result being that our position was rather safer at 500 than with the narrow carbons, and with these brushes we continued to run for more than a month, renewing the carbons occasionally as they became too much wasted. The commutators remained in perfect condition. The necessity for being prepared to overload again directed our attention to the brushes, and another effort was made in the way of a compromise (fig. 6) between all copper and all carbon.

(6). Two pairs of copper brushes as in (1) and one pair of carbon brushes as in (4), the latter set rather less than a section in front of the former, are now in use.

This arrangement gives far better results at loads of 500–560 than any of the previous trials. No marking of the

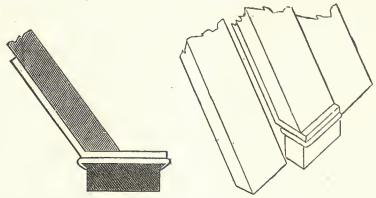


FIG. 5. FIG. 6.

commutator taking place under the carbons, whilst it is hardly perceptible under the copper brushes after nearly a month's running. It was found that the tension on the carbons should exceed that on the copper brushes sufficiently to enable them to take their full share of the current as nearly as possible.

I understand the last arrangement is no novelty on the continent, being in use at Hamburg and other central stations. My chief assistant, Mr. T. W. Bloxam, suggested this arrangement to me, and after giving it a trial we are able to consider our efforts quite successful.

* London *Electrical Review*.

A REMINISCENCE.*

BY A. E. SINK.

In the year 1874, while Mr. Edison was making his first experiments with the now famous and indispensable quadruplex, eight of the fastest telegraphers of the night force of the Western Union main office in New York were notified to appear in the office of the electrician, Mr. Geo. B. Prescott, on the following day, to make a practical test of the apparatus.

The design was to connect—at Boston or elsewhere—two wires, to form a loop, each "leg" of which was equipped with a full quadruplex set in the electrician's office, so that the operation of the invention at both ends of the wire could be observed by the inventor and others interested.

Some of the chosen eight saw that this arrangement would give them an opportunity, rarely found, to note the writhings of their victims at the other end of the wire and prepared to do their best should they be fortunate enough to be selected for *sending*.

At that time the now familiar polarized and neutral relays, rheostats, condensers, etc., were mysteries known only to a few; and it is safe to say that not one of the eight men knew what they were to try, but they could *telegraph* and that was sufficient.

At the appointed hour the eight operators marched into the electrician's office and confronted the "Wizard," who had then only just started in his career and was but little known to the public.

He shook hands with all and said:

"Well, boys, I'm not ready to put you at work as expected, but I will show you how I work the quadruplex whem I am alone."

He turned to a Wheatstone transmitter, through which ran an endless perforated strip containing three or four hundred words of matter.

"You see," he said, "when I wish to try the quadruplex

* From the *Telegraph Age* of September 16, 1895.

alone I start this strip through the transmitter, which sends automatically into one side of the quad. As the strip is pasted together at the ends it will run for an indefinite time, repeating the transmission over and over again."

"By the way," he added, with a merry twinkle, "suppose we all sit down and copy from the automatic sending to see which can hold out longest?"

Nobody objected, and all prepared for the contest. Each man was proud of his ability as a receiver. Some of them had reached the highest known speeds in regular work, and each felt quite confident that he would win the honor and be the last to give up.

Some of them felt dubious about Mr. Edison. Many stories were then current among telegraphers of his remarkable work in receiving while he was press-report operator in the West, but there was a determination to make the "Wizard" do the greatest telegraphing of his life.

Mr. Edison sat near the transmitter with his left hand near the speed-regulator, and the contest began with a comfortable speed of 25 words per minute. This was soon increased to 30 by Mr. Edison's manipulation, and when it had slowly risen to about 35 words there were signs of warming-up and uneasiness about the table.

At 38 to 40 words pencils were held with tighter grasp and moved within shorter range, and the uniformity of the writing was less pronounced, as the contestants struggled to keep up with the constantly accelerated stream of dots and dashes.

One after another of the proud eight fell out as the limit of their endurance was reached, in the neighborhood of 50 words per minute. All but one of them finally succumbed, and he was in the last stage of despair, his copy having been brought down from a beautiful round hand to a succession of straight lines, terminating in an up or down stroke as an apology for a letter "d," "y" or "g," but there was no sign of breakdown on Mr. Edison's part.

When the last of the picked eight had finally collapsed all gathered around Edison. To their astonishment he was coolly printing out each letter, and was one or two hundred words behind the strip. Marvellous! How could he do this? The boys stood around him amazed at this exhibition of skill, which was far beyond anything they had ever heard of.

Not till long after the incident did it dawn upon their minds that the "Wizard" had been listening to the story that came from the perforated strip for many weeks and was familiar with every word of it.

It was a pleasant event, however, and benefited all who participated in it, as it stimulated them to exceptional effort and revealed to them the limit of their powers of receiving and legibly recording perfect Morse.

Then again there was a feeling that their time had not been altogether thrown away, as would have been the case but for the timely suggestion of the celebrated inventor.

AFTER THE TELEPHONE MONOPOLY.

The following letter speaks for itself:

Chicago, Ill., September 24, 1895.

Editor Electrical Age:—Referring to an accusation through a Boston paper to the effect that the movement to present the illegal combination between the Bell Company and Western Union, Western Electric, American Telephone and Telegraph Co. and the licensees of the Bell Company has for its effect the disturbance of the stock of the Bell Company, the writer desires to say that this is an absolute falsehood, without any possible basis. The writer does not care what the price of Bell stock is.

The Bell Company and the parties to this most monstrous compact have through specific arrangement in writing agreed to and invoked the laws and flaunted its patent papers in nearly every court in the land to sustain a monopoly.

The writer's motive was inspired principally by a belief that this contract, in writing, specifically violated not only the federal laws but the statutes of nearly every state; that in conformity with this contract, in spirit and will, a monopoly was being maintained unlawfully; that this unlawful monopoly was oppressive in more than one way to the writer and those with whom he had interests; that the rate-cutting in vogue where competition was started was in pursuance of clause 5, taken together with clause 2 of Article 2 of the agreement, to stifle competition, and his position in the telephone business required his individual action.

Data is being prepared to properly present in the form of a petition; and as the Bell Company seems to love law so well, possibly it may have misinterperted its meaning as affecting them.

Very truly,

J. E. Keelyn.

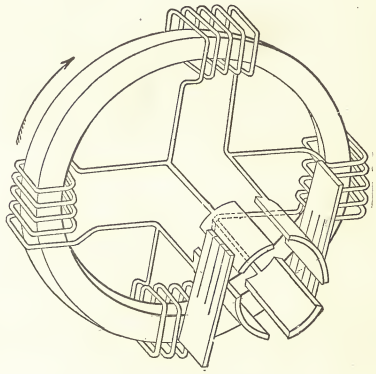
PRINCIPLES OF DYNAMO DESIGN.

BY

Alton Hamson E.E.

(*Continued from Page* 162.)

The winding of armatures is to many a department of design that has often lacked the proper consideration. The illustration shows the method of winding a ring armature; the turns are simply threaded in and out of the ring. The active inductors are equal to the number of turns on the ring, so that the point of difference between a Gramme and drum would lie in the function of the turns around the core; in a drum each turn consisting of two inductors; in a ring, consisting of merely one. The flow of current in each is identical; the armature being wound with a size



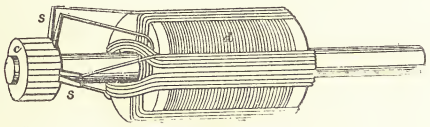
GRAMME WINDING.

equal to one-half of that which would be required for the total current, because of the two halves being in multiple. The process of threading or winding the turns around the iron core is the first of a host of preliminary processes. The laminæ of the armature are first firmly bolted together, and frequently each sheet of iron is insulated from the other. The statement has been made that the iron oxide is a sufficient protection against eddy or Foucault currents, yet many makers prefer to make assurance doubly sure by following out the old method. The burrs which exist on the edges of the plates at times are carefully removed by filing, or by the emery wheel, and then the core is carefully taped or bound in canvas—although any reliable insulating paint is considered by many as quite sufficient. While this may be so in some cases, the weight of opinions leans strongly to the abolition of the practice. After the insulating process has been carried through the winding is begun, which in the case of a Gramme is of but little difficulty to the winder. Clamps are used to separate coil from coil

until the last spacing between the first and the next to the last coil is about to be filled.

This brief introduction is the actual process and part of the winder's work in the shop. In calculating the number of turns in the case of a Gramme, they should be exactly divisible into equal parts by the number of sections decided upon in that particular case. The ring offers one of the simplest cases in practice, as it consists of a series of separate coils wound around the core, with the beginning of one core connected with the end of the next, so as to form a continuous series of windings with the extremities jutting forth to be connected to the commutator segments. If the number of turns to a section becomes too great sparking may result, because there is a certain maximum E. M. F. to each coil and a difference of potential between commutator bars, which must not be exceeded, otherwise arcing at the brush may occur. The old shuttle wound type of armature, invented by Siemens, has always been looked upon as the primitive form of the drum. In magnetos used for testing purposes the same style is adhered to and used. The present type was developed by simply trying to cover the iron with more wire and by the necessity for lamination in the core. The circular disks are bolted together by a nut, which presses them up against a shoulder on the shaft, both the first and last plates being thick enough to withstand the strain. The Edison Company of former years used the style of winding as seen in the illustration almost exclusively, until lately. The star-shaped appearance of the turns is characteristic of this winding. Many turns used to be connected in multiple in each section, so as to avoid the use of thick conductors. The winding is so carried on as to bring the line of commutation to a horizontal instead of a vertical position. This is frequently the practice, especially when the armature lies close to the floor, and where in such a case it would be very inconvenient for the dynamo tender to get his head so far down. The Edison armature and Siemens' were parallel types. In the Siemens, an advance or retrogression is also made in winding, depending entirely upon the point of view of the observer.

One of the objects of any winder, or style of winding, should be economy and compactness. If the turns are kept down to the least possible length, and carefully placed alongside each other, these two essentials will be observed and will add to the life of the armature and its successful operation. The ratio of space taken up by the wire on a drum armature is generally conceded to be about one-third of its length. If a small-sized wire is used and many connected in parallel, this difficulty is mitigated in so far as the better utilization of the space is concerned. A Gramme armature wastes, in the same sense as inside



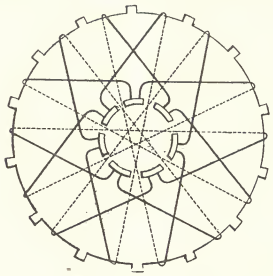
DRUM ARMATURE WINDING.

turns, one-half of its winding. It is a question as to whether the particular advantages of each particular shape do not remove this consideration entirely.

It is, however, evident that the amount of wire lost at the ends is greatly determined by the proportions existing between the length and diameter of the armature core. These are merely geometrical considerations and would lead to the opinion established by many others, who have considered the same question, namely, that the armature core taking the shortest possible turn will be one with a diameter equal to its length; in other words, the greatest possible cross-section with the least possible length of turn.

Both Gramme and ring are therefore subjected to this severe criticism. The core of a Gramme ring is not so easily manipulated as the drum, because one of the objects of design is to properly economize—which in such a case is only done by having the inner side of the turn the least percentage of the entire length of the turn and yet include the greatest possible cross-section of the core. The least it can be is one-half of the entire turn, and its greatest dimension depends upon the depth of the core as compared with the length, if the ends as waste wire be also considered. Therefore, if the thickness of the ring be greater than the length, the wire is being wasted. This does not occur in practice, however; so it may be left unconsidered.

The ratio of core thickness to length varies from 1:4 to 1:2, and is governed greatly by the diameter of the armature as a whole. If a slow-speed machine is desired, it



EDISON STAR WINDING.

may be obtained by the use of an armature of great diameter and strong field. The smooth core armatures are less bothered by sparking at the commutator than toothed armatures, because the air gap in the toothless type is of a less changeable nature than that of the toothed; and this because the loss of permeability due to the saturation of the teeth makes them approach air in their magnetic properties, thus leading us, by this reasoning, to a field in which the teeth are without effect and an armature with an abnormal gap space. There is no doubt, however, of the superiority of a toothed armature in saving of copper on the field. The General Electric generators used toothed armatures and never experience either sparking or heating of any great importance. For slow speed, however, either as motor or dynamo, and great torque, a Gramme armature undoubtedly leads the rest, in both its efficacy and general excellence.

(*To be Continued.*)

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

At the regular monthly meeting of council held at the rooms of the Institute, Sept. 25, the following associate members were elected:

Austin, Sydney B., Sidney, N. Y.

Blaxter, Geo. H., vice-president and general manager, Allegheny County Light Company, Pittsburgh, Pa.

Boyer, Elmer E., the General Electric Company, Lynn, Mass.

Burt, Byron T., manager and secretary and treasurer Charleston Light and Power Company, Charleston, S. C.

Carhart, Henry S., Professor of Physics, University of Michigan, Ann Arbor, Mich.

Cornell, John B., superintendent of construction, with Chas. L. Cornell, Hamilton, O.

Coster, Maurice, Westinghouse Electric and Manufacturing Company, Chicago, Ill.

Crawford, David Francis, Pennsylvania Company, Fort Wayne, Ind.

Dawson, Philip, 39 Victoria Street, Westminster, London, England.

Degen, Lewis, General Electric Company, Rio de Janeiro, Brazil.

Dunlap, Will Knox, Westinghouse Electric and Manufacturing Company, Pittsburgh, Pa.

Frenyear, Thomas C., general manager, Cayadutta, Electric Railway Company, Gloversville, N. Y.

Hakonson, Carl Harold, General Electric Company, Schenectady, N. Y.

Harrison, Russell B., president and electrical engineer Terre Haute Electrical Railway Company, Terre Haute, Ind.

Harvey, Robert R., Wilkesbarre, Pa.

Hewitt, Chas. E., Hanover. N. H.

Huntley, Chas. R., Buffalo General Electric Company, Buffalo, N. Y.

Irvine, D. W., Chambersburg, Pa.

Ker, W. Wallace, Jersey City, N. J.

Lincoln, Paul M., Cataract Construction Company, Niagara Falls, N Y.

Mann, Robert Bruce, Milwaukee, Wis.

Merrill, Josiah L., General Electric Company, Schenectady, N. Y.

Merz, Chas. H., Lincoln, England.

Mitchell, James, General Electric Company, Rio de Janeiro, Brazil.

Morley, Edgar L., superintendent, Hatzel & Buehler, New York city.

Parry, Evan, 52 Glengarry Road, East Dulwich, London, S. E.

Pinkerton, Andrew, electrical engineer, the Apollo Iron and Steel Company, Apollo, Pa.

Powell, Percy Howard, Hempstead, N. Y.

Robinson, Dwight Parker, with Stone & Webster, Boston Mass.

Rushmore, David B., Plainfield, N. J.

Skirrow, John F., assistant manager, Postal Telegraph Cable Company, New York city.

Stott, Henry G., Buffalo General Electric Company, Buffalo, N. Y.

Wiese, Gustav Adolph, city electrician, Alameda, Cal.

Wilson, Chester P., superintendent 33d and Market streets power station, Philadelphia Traction Company, Philadelphia, Pa.

Prof. F. A. C Perrine, of Stanford University, Palo Alto, Cal., was appointed local secretary for San Francisco and vicinity.

In order to provide a more central location for the meetings of western members at Chicago, the report of the committee appointed at the Niagara Falls meeting to consider this question was taken up, and the use of the rooms of the Western Society of Engineers in the Monadnock building was authorized for the present season, as recommended by the committee. Through the courtesy of the Armour Institute, meetings requiring the use of apparatus will be held there as heretofore.

The meeting of the Institute in the evening was held at the Hoffman House, a paper by Mr. C. S. Bradley on "Phasing Transformers" being read by the author, and the working of the described apparatus shown.

THE BALTIMORE TUNNEL.

The lead-covered primaries for the tunnel lighting plant are carried on posts set on the side of the cut, to the southern portal, where they drop to the tunnel and are carried upon porcelain knobs fastened to wooden blocks bolted to the masonry. At the points of support the cables are armored with wire to prevent abrasion. The secondaries are carried in cleats, also fastened to wooden blocks, similarly attached, and placed on either side of the tunnel about eight feet from the ground and fifteen feet apart. They are, however, staggered, and thus occur alternately at every seven and a half feet throughout the tunnel. Each block carries a lamp at its lower end, and is there cut out so that the lamp socket may be protected from moisture and dripping water from the tunnel walls. The lamps used are 32 candle-power, 52-volt Edison standard incandescent lamps.

The Metropolitan Traction Company of New York has declared a quarterly dividend of 1¼%, payable Oct. 15.

CONSTRUCTION AND MAINTENANCE OF TELEGRAPH LINES.

BY W. F. TAYLOR.

(*Concluded from Page 149.*)

This would suggest that a hole be bored in each pole a few feet above the ground, having poured into it at certain intervals a quantity of oil, until the pole becomes thoroughly saturated.

I have been impressed with the tendency to the use of unduly high poles. I think you will agree with me after mature consideration that the shortest pole possible should be used under all circumstances, and especially on our heavy trunk lines. The reason for this is apparent. The single pole with a number of cross-arms and wires suspended high in the air presents the features of a pyramid resting on its apex rather than its base. This at once sets forth a weakness of construction.

The length of poles should of course be determined by the number of wires, distances apart vertically, and headway required under the wires.

The height of lowest wires running parallel to the tracks need not be much over ten feet, and at public road crossings twenty-two to twenty-four feet.

The principal strain upon telegraph poles is not in the direction of the wires which they support, but transversly; if this be true, the single pole line does not possess the requirements of a structnre calculated to withstand the severe strains to which it is subjected without being well and thoroughly guyed and anchored; such being the case, it would be worth our while to carefully study the advantages of double-pole construction.

I am not prepared to suggest standard specifications for two-pole line construction, as the matter is in an experimental stage in this country. The books illustrate various forms and styles of double-pole line construction. In European countries the most common is perhaps the "A" pole, which consists of two poles slightly scarfed at the top and fitted together as an isosceles triangle. This form presents the features of a cone with its apex at the top, and resting on its base, which would indicate a strength far greater than the single pole as now in common use.

The first cost in building the double-pole line may be slightly in excess of the single-pole line; some difficulty may be experienced in constructing double-pole lines along deep fills, in digging holes to the proper depth, etc., but I am inclined to think all these difficulties would soon be overcome by experienced men.

The telegraph line should be thoroughly inspected once a year to ascertain its physical condition, especially with respect to the condition of poles at the "wind and water" line.

The line and slant of poles from a tangent to a curve should change uniformly with the curvature. At each end of curves above three degrees two or three poles should be head and side-guyed or well braced, and every tenth pole on long tangents must be head guyed.

Cross arms should be of the best quality of well-seasoned Norway pine, white pine or spruce, straight grained, free from knots or other imperfections, and should be covered with two coats of paint made from the following formula:

French Ochre.....39 lbs.	Raw Linseed Oil, 54 lbs.
Lamp Black..... 1 "	Japan..... 6 "

They should be of the following dimensions: 3"×4" the length being determined by the number of pins required, as given later on.

Cross-arms carrying four wires or less should be fastened to pole by two ½-inch lag screws, 6 inches long, with washers; cross-arms carrying 6 or more wires should be supported by two galvanized iron braces ¼ inch thick, 1¼ inches wide, and 28 inches long.

Cross-arms carrying more than four wires and supported with braces should be fastened to the pole by one galvanized iron bolt ⅝-inch in diameter with corresponding details. The holes for the first pin on each side of the pole

should be 22 inches between centres, and those for the end pins four inches from end of cross-arms, the intermediate holes being 16 inches between centres.

The depth of gains for cross-arms should not be less than 1 inch, nor more than 1½ inches. The following illustration may be in point showing the relation between the area of the gain and area of a circle representing the diameter of an 8" pole at top.

Gain 1 in. deep.....area 3.6254 sq. in.
Circle area of..... " 50 2656 " "
21
Per cent. of cut..... ——
7.100

Gain 1½ in. deep ... .area 6 530 sq. in.
Per cent. of cut..... 13.

Gain 2 in deep.....area 9 8272 sq. in.
55
Per cent. of cut.....19——
100

Gain 3 in. deep..... ....area 17.211 sq in.
24
Per cent. of cut.....34——
100

Pins should be of the best quality, sound, clear split locust free from knots and sap, and should be boiled in paraffine oil; they should be nailed in the cross-arm with six-penny galvanized wire nails, driven in straight from the middle of the side of the cross-arm.

Whether we use iron, steel, or copper wire in building our lines there is one important factor which should be observed, namely, the sag.

This is a feature of line construction considered of great importance in other countries, but in this country it has been virtually ignored.

It is claimed that the percentage of "breaks" in the case of tightly strung wires has been no greater than in the case of wire erected with specified sag.

Considering the matter more carefully we will say that the form which a wire suspended between two poles assumes is approximately the curve called the catenary. The properties of this curve have been studied carefully by engineers. It is the curve which characterizes the construction of suspension bridges, notably the Brooklyn Bridge. One of the properties of the catenary curve is that the less the sag in the wire the greater the strain. For at least ordinary conditions the following will serve us in illustrating the value of this sag: "Take one-half the distance between the poles and square it; then divide it by twice the sag—all represented by feet; then multiply this quotient by the weight of a foot of wire." Following this rule, and supposing that the poles are 30 to the mile and that the wire is of the kind known as No. 8 wire, we have this conclusion, namely:

When the sag is two feet, that is to say, when the lowest point in the curve is two feet lower than a straight line drawn between the poles where the wire is attached, the strain in the wire is about 140 pounds. When the sag is one foot, the strain is about 280 pounds; when the sag is six inches, the strain in the wire is about 560 pounds; when the sag is 3 inches, the strain in the wire is about 1,120 pounds, and so on. If, as stated above, the wire is drawn up so that the sag is six inches, the actual strain in the wire is nearly half the tensile strength, and it is very close to the limit of elasticity. You probably all know that the limit of elasticity is about one-half the tensile strength. I believe that bridge builders allow a factor of safety of six.

Applying this rule to the telegraph wire we should not strain the wire in construction over 200 pounds; but, according to present practice, it is perhaps strained nearly double, or, in other words, the factor of safety is very small.

The expansion and contraction of material under the influence of heat and cold is, of course, a well-known physical phenomenon. Let us suppose that a telegraph wire is put up on a warm summer day, with the temperature 90° Fahrenheit. The wire is put up so that there is a sag of two feet between the poles; the poles being thirty to the mile. What will take place with the wire when the temperature becomes 10 degrees below zero, or a fall in temperature of 100 degrees. Apply the coefficient of expansion for wire under these conditions. We are surprised to find that the wire is shortened by the contraction about one and one-half inches, and that this shortening introduces a strain into the metal of about 550 pounds, and that the wire which originally had a sag of two feet has now a sag of six or seven inches; the total strain in the wire being nearly 700 pounds under these conditions; that is to say, if the wire is put up on a warm day, at a temperature of 90 degrees, and only drawn up so that the strain in the wire is 140 pounds, which corresponds to two feet sag, and the temperature becomes 10 degrees below zero, or a fall in temperature of 100 degrees, the strain in the metal exceeds the elastic limit of the metal and, in fact, is more than half the actual tensile strength of the wire.

With the above suggestions we can readily see that the sag in the wire is an important factor.

I am indebted to Dr. C. B. Dudley, of the Pennsylvania Railroad, and Hopkin's book, entitled "Telephone Lines and their Properties," for valuable assistance

I desire to call your attention to the question of soldered joints, and will simply recite the results of a test which we made some time ago. We tested a series of joints made with No. 8 iron wire and also tested one piece of solid wire.

The joints were made in the usual way by our linemen, but were unsoldered. The tensile strength of the wire was 1170 pounds. The unsoldered joints stood an average of 660 pounds; all failing by the slipping of the joints which unwound. The soldered joints stood an average of 1210 pounds, or, in other words, were stronger than the solid wire. These tests would indicate that unsoldered joints are perhaps the weakest point in the wire.

For the purpose of trying to determine the cause of wires breaking during the prevalence of sleet storms across the meadows in New Jersey, some time ago, I measured the strain of a number of wires with a wire dynamometer which was made for the occasion, and found that at a temperature of 65 degrees the strain in the iron wire was about 150 pounds in each span, the length of which was 150 feet; copper wire in the same span had a normal strain of from 200 to 250 pounds. The breaking strain of No 8 B. & S. steel and iron wire when new is about 1,000 pounds, while that of copper is about 570 pounds.

The majority of No. 8 wire tested had been in service about seven years, and find the breaking strain now to average about 575 pounds.

The contraction that would have taken place in this wire with a drop in temperature of 65 degrees (that is to zero) would have been nearly $\frac{7}{10}$ of an inch, which would have, according to further tests made, introduced an additional strain of about 175 pounds, making the total strain that would exist with the temperature at zero about 325 pounds, a little over one-half the actual breaking strain of the wire.

Another question which naturally arises in our minds is, what kind of wire should we use. All wire, whether steel, iron, or copper, deteriorates more or less rapidly, depending upon its surroundings. Both iron and steel deteriorate very rapidly when exposed to gaseous vapors, while under similar conditions copper wire takes on a coating of some substance and does not appear to deteriorate as rapidly as the other named metals; but our experience with copper wire is, we might say, as yet, limited, and therefore, are not in a position to determine its actual life.

Some time ago I placed a section of copper wire in an unusually exposed place, where it constantly received the smoke from the engines passing to and from the round-house. After the wire had been up a year a small piece was taken out and the coating removed; the wire when first put up measured .085 of an inch in diameter, after the coating was removed it measured .081 of an inch, showing the wire to be actually .004 of an inch smaller than when first put up.

While I do not wish to make any criticism in regard to the general use of copper wire for telegraphic purposes, yet I believe the future will develop some important facts which are not now apparent.

From an electrical standpoint copper is not necessary as a conductor for the length of a majority of railroad circuits. Copper wire does not possess the strength of either iron or steel wire.

The ordinary telegraph circuit on railroad lines is worked with about .025 of an ampere of current.

My observation leads me to believe that the simplex circuit can be worked reasonably well if the conductor consists of practically nothing more than a streak of rust. This of course is not admissible from the standpoint of mechanical structures.

The matter of using iron or steel wire has been the subject of more or less discussion among some people, and without going into the subject in detail let me say that careful inspection has developed the fact that in many instances an order for iron wire has been filled with a certain grade of steel; this fact could only be determined by chemical analysis; therefore, in order to more nearly secure the grade of metal desired, we have found it desirable to require manufacturers to comply with the following specifications in furnishing either iron or steel wire:

"All iron or steel wire must be bought subject to the following requirements:

1. Any sample taken at random must be so well galvanized that when plunged into a saturated solution of sulphate of copper and allowed to stand for two minutes, it will not, when taken out, show any copper-colored spots on the sides of the wire.

2. Any sample of wire taken at random must be capable of standing, without rupture, not less than twelve twists between vise jaws six inches apart.

3. The product of the weight per mile in pounds, into resistance per mile in ohms, must never exceed the number 5,200."

Mr. Charles Selden thought that railroad people did not give the subject of line construction the attention it should have. They often lose sight of the advisability of properly constructing and maintaining telegraph lines. If they were educated to understand that the telegraph was a necessity, they would give more money for its maintenance.

Mr. R. B. Gemmell gave a description of the method of line construction on his road—the Atchison, Topeka and Santa Fé. Along the prairies the lines are built on the south side of the track, so as to avoid the danger of poles falling on the track during storms, the prevailing winds in that country being from north and west.

Mr. J. W. Lattig spoke of the advantages of steel insulator pins, copper wire, and of the length and life of poles.

Mr Thos. D. Lockwood, in referring to the use of iron poles, stated that they were not safe nowadays on account of leakage of electric light and electric railway currents. Linemen were liable to receive severe shocks, which would cause them to fall off the poles.

He stated that we could get along very well in this country without the use of any of the pole preservative methods so long as timber was plenty. No preservative process was of any value if only the but is treated. If the entire pole were treated—from top to bottom—the life of the pole might be thus lengthened. He favored charring the buts of poles to a short distance above the weather line.

As between long and short poles he favored the latter.

Regarding the usual method of building lines in such situations as on bridges and in exposed places he thought it was bad practice. Experience had taught him that it was advantageous to break the symmetry of such construction. The line shoul be built zig-zag, and the poles set at different distances apart. The regularity should be broken in order to avoid the rhythm of vibration. The vibrations caused by the wind in one part of a line so built would be offset or counteracted by the vibrations in other parts. Such a line will stand up under such circumstances when a symmetrically built line would fall.

THE MONTREAL CONVENTION.

The Delaware and Hudson Railroad Company will probably run a special train to Montreal for the many delegates and supplymen who wish to go that way. There are a great many applications for accommodations on the train that leaves the Grand Central station, New York, at 7 o'clock on the night of October 14, which goes over the Delaware and Hudson road. A great many travellers prefer this route because it is the shortest and quickest, and is one of the best equipped lines in the country. The road passes along the Adirondacks and Lake Champlain, and the scenery along its entire line is charming. Those who wish to make the trip by daylight can leave New York at 9.30 in the morning, arriving in Montreal at 9.50 P. M. The night train arrives in Montreal at 8 A. M, thus giving passengers a full night's rest.

For variety and beauty of scenery the Delaware and Hudson cannot be excelled, and it is not surprising that those who have been over this line prefer to go that way again.

The convention rate will be a fare and one-third—full fare to Montreal and one-third the regular fare back. These reduced rates are obtained on the certificate plan, which is explained below.

For further particulars regarding the Delaware and Hudson route our readers are referred to the map and advertising matter on other pages in this issue.

The following are the rules governing the purchase of railroad tickets on the certificate plan, which entitles the purchaser to a return ticket at one-third the regular rates:

First.—Each person must purchase (not more than *three* days prior to the date of the meeting), a first-class ticket (either unlimited or limited,) to Montreal, for which he must pay the regular tariff fare, and upon request, the ticket agent will issue a certificate of such purchase, properly filled up and signed by the said ticket agent.

Second.—Where the journey is made over more than one line it may be necessary for the passenger to purchase separate local tickets, and procure certicates thereof for each of the lines over which he travels in going to Montreal, as some lines do not honor the certificates of any other line. The passenger should ascertain from the ticket agent what portion (if not all) of his journey can be covered by the certificate procurable of him, and purchase his ticket and secure a certificate filled in accordingly. In case a ticket on the certificate cannot be procured at the starting-point, the person should purchase to the nearest point where such a ticket can be obtained, and there repurchase through to Montreal, requesting a certificate properly filled out by the agent at the point where the purchase is made.

Third.—Tickets for the return journey will be sold by the ticket agent at Montreal at one-third the highest limited fare, to those *only* who hold certificates signed by the ticket agent at the point where through tickets to Montreal were purchased, and countersigned by the Clerk of the Convention, certifying that the holder has been attending the convention. Mr. Stonewall Jackson, Local Secretary, Montreal, has kindly consented to serve as clerk of the meeting for this exclusive purpose.

Fourth.—It is absolutely necessary that a certificate be procured, as it indicates that full fare has been paid for the going journey, and that the person is therefore entitled to the excursion train returning. It will also determine the route by which the ticket for the return journey should be sold, and without it *no reduction will be made*, as the rule of the association is: "No refund of fare will be made because of the failure of the person to obtain a certificate."

Fifth.—Tickets for the return journey will be furnished only on certificates procured not more than *three days* before the meeting assembles, nor later than *two days* after the commencement of the meeting, and will be available for continuous passage only; no stop-over privileges being allowed on tickets sold at less than full fare. Certificates will not be honored unless presented within *one day* after the date of the adjournment of the convention. The certificates are *not transferable*, and the signature affixed at the starting-point compared with the signature to

the receipt, will enable the ticket agent to detect any attempted transfer. In order to guard against the misuse or transfer of either a certificate, or ticket procured through it, the association has been obliged to guarantee the redemption at full fare of any return ticket afterwards found to have been transferred or misused.

N. B.—Please read *carefully* the above instructions, and be particular to have the certificates properly filled out and certified by the railroad agent from whom you purchase your going ticket or tickets. *Tickets and certificates should be obtained at least THIRTY MINUTES before the departure of trains.*

A certificate is void if altered; if not presented within prescribed dates; if not signed by the clerk of the meeting; or if blank spaces on the *going* side are not filled out, signed and stamped by the agent of the line, at the point from which the passenger started.

PERSONAL.

Mr. R. Leo Van der Naillen has been obliged to resign his position as Western Manager of the Boudreaux Dynamo Brush Co., and returns to California on account of the ill health of his wife. All who have had occasion to come in touch with him during his stay in Chicago will certainly regret his departure.

E. Leon Hartpence, formerly with the Phillips Insulated Wire Company, and later with Holmes, Booth & Haydens, is now with the Bishop Gutta Percha Co., 420 East 25th street, New York City. Mr. Hartpence is well known and very popular in the trade.

THE BROOKLYN ELECTRICAL SOCIETY.

The opening meeting of the season of this society was held at the Edison Assembly Rooms, 300 Pearl street, Brooklyn, on the evening of October 1. Mr. C. J. Field, M.E., the well-known electrical engineer, delivered a lecture on "Electric Railroads and their Construction."

NEW YORK ELECTRICAL SOCIETY.

A well-attended meeting of the New York Electrical Society was held at Columbia College on the evening of September 27. Mr. T. C. Martin, editor of the *Electrical Engineer*, delivered a very interesting lecture entitled, "Niagara on Tap." The lecture was illustrated with many lantern slides, made from photographs, showing the progress of the great engineering work from the beginning up to the present time.

RELATION AND COMPARISON.

The history of this universe has been traced through vast periods of time. We have presumed upon the present in delineating the past and have thus constructed a series of wonderful tableaux whose far-reaching span no man can accurately measure. Age is only a relative expression —by comparison—youth and age can change places. The oldest things we know of—the fixed stars—or the mysterious gleams, coming from the most distant regions of space, have an established history that cannot be gainsaid. Above, below, and on all sides an immensity extends that thought cannot pierce. Were experience our guide in the measurement of things, then it would be most difficult to understand their limits, not their eternal persistence.

All effects that have ever occurred, all causes that were ever known, are to each other as they must always be, parts of an endless chain, from which nothing can ever be absolved.

There is to many minds a gap existing which separates a living force from the material it acts upon. Yet it would be impossible to imagine the presence of the body unattended by these very forces.

The particles would separate and become unrecognizable, because our only means of distinguishing between substances is by these forces, which act and react continually in the economy of nature.

Thus it is seen that what we view are only relative aspects, the mutual dependence of one upon another, and from all these intimate relationships springs the bewildering complexities of every-day life.

Electrical Class in Jersey City.—Mr Joseph Mason Naylor will open an electrical class at People's Palace, Jersey City, early this month. The course will be of an elementary character, and will be completed by practical instruction in electro-plating. The tuition fees will be low.

During the recent conclave in Boston of the Knights Templar, the parade was handled by telephone. The New England Telegraph and Telephone Company established eight pole stations with operators, and at each pole was a member of the grand marshal's staff. The movement of the vast body of men was in this way conducted in most harmonious manner.

New York Notes.

Office of the Electrical Age,
World Building, New York,
September 30, 1895.

The Edison Electric Illuminating Company of New York has declared a quarterly dividend of 1½ per cent. payable November 1.

Mr. E. W. Little, vice-president and general manager of the Interior Conduit and Insulation Co, 527 W. 34th street, will attend the Montreal convention and have a complete exhibit of his company's comprehensive system of electric railway underground conduits.

A. T. Howard & Co., 96 and 98 Maiden lane, are doing a good business in their B S Insulating Compounds, and black ozokerite for insulating purposes. These goods are giving the best of satisfaction, and are excellent insulators. The members of the firm are A. T. Howard and S. Cochrane, Jr.

Stanley & Patterson, 32 Frankfort street, are maintaining a lively trade. The Wilmington pigeon-hole desk lamp is the newest thing in their line. It can be pushed in, out of the way, on roller-top desks. The mere act of pushing it in cuts off the current and out goes the light, and vice versa, pulling it out turns on the light.

Mr. J. Goldmark, 29 Chambers Street, is now selling the famous all-glass Beacon lamp. This lamp, it will be remembered, figured very conspicuously and successfully in the great Edison lamp injunction suit two years ago. The all-glass Beacon lamp is a favorite and is growing more so every day, and is selling fast.

Mr. J. Jones, of J. Jones & Son, 67 Cortlandt street, is making a business tour of the Eastern States and is sending in orders at a lively rate from electrical supply houses. Their wire winder, which was illustrated and described in The Electrical Age two or three weeks ago, is selling fast. They are manufacturing and are able to quote figures that command orders for 6 × 8 battery coppers, Leclanche zincs, alarm clock outfits, medical battery outfits, baby switches, engineers' lamp handles, wood base switches, switch lugs, fire-alarm boxes, wall brackets, McCreary portables, iron crowfeet, etc. Their factory is conveniently situated near the Brooklyn Bridge, and, having a telephone connection, they are able to promptly fill orders.

The Municipal Signal Co., of Boston, on September 18, gave an exhibition of its apparatus. A box was rigged up on the northwest corner of Thirty-first street and Sixth

Avenue and the necessary apparatus was placed in the West Thirtieth Street station-house. Commissioner Andrews, Superintendent Brennan of the police telegraph, and Albert Stickney of the signal system were present. Commissioner Andrews, from the box at Thirty-first street, called up the patrol wagon, used the telephone with which the box was supplied, and pronounced the system an excellent one. By this system the patrol wagon may be called, a policeman can talk through a telephone which is in the box, and if necessary patrolmen can report while on duty, and the time at which they do so is registered on a dial in the station-house. A citizen may also connect with the station-house at any time.

Possible Contracts.

Long Branch, N. J.—Plans are completed and a syndicate formed to erect a hotel on the site of the old West End at Long Branch, to cost $700,000.

Chester, Pa.—Councilman S. Greenwood, of Chester, is preparing the plans for the erection of a $50,000 city hall.

Philadelphia, Pa.—It is rumored that the Ladies Home Journal Publishing Company intends to erect a handsome building on Walnut street, next June or July.

New York City.—Charles H. Heyman & Company have leased the five-story building at 133 West 42d street. The building will be remodeled. Work will be begun at once.

Philadelphia, Pa.—Green's Hotel, 8th and Chestnut streets, is to be extended through to Jayne street.

Brooklyn, N. Y.—T. Larsen will erect six four-story brick apartment houses on State street. Cost, $48,000.

Estate of C. Moll will erect four four-story brick apartment houses, corner Hamburg avenue and Grove street. Cost, $24,000.

Philadelphia, Pa.—John R. Wiggins will erect a six-story store building at 326 Market street, for the Edmund Wright estate. Cost, $40,000.

New York City.—The real estate corporation of which Samuel D. Babcock is president, and George P. Slade, treasurer, has purchased of Nathan Strauss the old Presbyterian Church property, on the north side of 14th street east of 6th avenue, upon which a fire-proof steel frame building for store purposes will be erected.

New York City.—D. Denham Spence, 559 West 185th street, will build a four-story brick dwelling at 613 West 181st street, to cost $8,000. Architect, S. Gifford Slocum, 124 West 23d street.

Sophia Dunkirk will build a five-story brick and stone tenement, 25x60, at 200 East 46th street, to cost $8,500. Architect, John C. Friend.

Cleveland, O.—It is proposed to erect a court-house for Cumberland county, to cost $200,000. County-Commissioners W. W. Wilson, John Dunlap, D. T. Smith, Auditor E. P. McCorkle. Contract for the work has not as yet been awarded.

South Bend, Ind.—The Board of County Commissioners of St. Joseph county propose to erect a court house, and will let the contract October 30th. Cost of structure, $300,000. Robert Myler is auditor.

New York City.—The Wm. F. Wells estate, of Newport, has filed plans for the erection of a fourteen-story building, at the southwest corner of Broadway and 12th street. Cost of building, $300,000.

Philadelphia, Pa.—Lit Bros., 731 Market street, will erect a new five-story structure, costing not less than $18,000.

Bids are asked for the construction of a building for Lawrence McSleavoy, at 24th and Callowhill streets; three stories.

New Haven, Conn.—The Exchange building is to be remodeled after plans prepared by L. W. Robinson. Cost of improvements, $40,000. The elevator shaft will be extended and will be fitted with an elevator of the latest design.

Washington, Pa.—The school board is contemplating the adoption of electrical apparatus in the new school building.

Boston, Mass.—A syndicate composed of F. S. Moseley & Company, E. H. Eldredge & Company, and J. Murray Howe and Bradley have completed plans for building a large fire-proof storage warehouse in Back Bay District, to be lighted by electricity.

Lyndonville, Vt.—Salmon Stern and others are interested in the establishment of an electric-light plant.

Pittsfield, Mass.—The Pittsfield Electric Company will extend its electric service.

Dublin, Ga.—James B. Sanders, mayor, can give information concerning construction of an electric-light plant, with a capacity of 100 arc and about 3,000 incandescent lights.

Street Railway Notes.

Suffolk, Va.—It is proposed to build an electric road between Suffolk and Smithfield. A Smithfield business man has offered to donate a site for a power house.

Milford, Mass.—A conference has been held between the Milford & Hopedale Street Railway Co. and the New Milford & Framingham Co., at 53 State Street, Boston, and as a result the franchise, rails, etc., of the former company were purchased by the new company, contract covering everything belonging to the Hopedale Co. except the cars and buildings. It is now expected that work will be commenced on the new road at once.

Urbana, Ohio.—W. H. Hanford & Company have been granted a franchise to build the interurban electric railway between Urbana and Springfield.

Terre Haute, Ind.—The Terre Haute and Brazil Electric Railway Company has been granted right of way to construct an electric road.

Brooklyn—The report of the Atlantic Avenue Railroad Company, of Brooklyn, for the year ending June 30, shows the following results: Gross earnings, $854,208, a decrease of $43,327, as compared with 1894; operating expenses, $744,558, an increase of $139,972; net earnings, $109,650, a decrease of $183,299; other income, 90,778; total income, $200,428; fixed charges, $292,137, leaving a deficit of $91,700. Last year there was a surplus of $115,226.

Bellows Falls, Vt.—F. L. Houghston, and others, of Brattleboro, are interested in the construction of an electric road from Bellows Falls to Saxton's River.

Coloma, Mich.—A syndicate has secured a franchise to build an electric line from Coloma to Paw Paw Lake.

An electric line is also proposed from Coloma Lake, and another to Union City.

Lima, Ohio.—A company has been organized to build an electric railway to parallel the Cincinnati, Hamilton and Dayton road.

Telephone Notes.

Olivet, Ia.—George W. Williams, of Olivet, has secured the right of way of the county commissioners to construct 100 miles of telephone lines.

Louisiana, Mo —The Louisiana Telephone Co. is making arrangements to extend its system through all the towns along the line of the Chicago and Alton Railroad, to Mexico, Audrian County.

TELEPHONE PATENTS ISSUED SEPTEMBER 24, 1895.

Self-Acting Commutator for Telephones. Salomon Berditschewsky dit Apostoloff and Moise Freudenberg, Paris, France. (No. 546,725.)

Telephone System. William W. Dean, St. Louis, Mo. (No. 546,731.)

Combined District Telegraph and Telephone System. Edgar E. Salisbury and Albert E. Dean, Tacoma, Wash. (No. 546,904.)

Telephone. George A. Tower, Maurice Hunter and Joseph P. Eastwood, Richmond, Va. (No. 546,965.)

Telephone Attachment. Louis J. Gerson, Philadelphia, Pa. (No. 546,972.)

New Corporations.

Mishawaka, Ind.—Citizens' Electric Company has been incorporated with J. A. Roper, president; M. V. Buger, treasurer; to supply electric light and power over five miles of circuit. Capital stock, $25,000.

Council Bluffs, Iowa.—Electric Gold Extraction Company, incorporated by Robert McKnight, G. M. Taylor and J. R. McKinney, to extract gold from ore and quartz by the use of electricity. Capital stock, $1,000,000.

Brooklyn, N. Y.—The Albert Edwards Car Fender Co., of Brooklyn, N. Y., has been organized with a capital of $100,000. Directors: Alice Edwards, Albert Edwards, Walter J. Thorn and others, of Brooklyn.

Knoxville, Tenn.—The Tennessee Electric Light and Power Company has been incorporated with W. S. Shields, secretary; W. A. Park, James Jennings, C. C. Howell, president, and H. L. McClung, and are endeavoring to obtain the municipal lighting contract. A $30,000 machinery plant is proposed.

Williamsport, Pa.—Citizens' Electric Company has been incorporated with Grant Sweet, treasurer. Capital stock, $2,000.

Newton, Ia.—The Newton Electric Co., incorporated. Capital stock, $25,000; President, B. E. Sunny; Treasurer, James S. Cummins; Secretary, H. M. Vaughan.

Troy, N. Y.—Troy Telegraph and Stock Co ,incorporated to maintain a line or lines of telegraph and telephone from Troy to New York. Capital stock, $2,000. Directors: Thomas Hogan, of New York City; Peter J. Turner, Patrick E. Purcell, Patrick J. Delaney and Wm. Miller, of Troy; Ely Galaise, Jr., of Cohoes, and Charles G. Teeling, of Green Island.

Newburyport, Mass.—It is understood that a company for the manufacture of street cars has been organized at Newburyport, in which W. B. Ferguson, of the Milford and Framingham Street Railway Co., Milford, Mass , is identified. Capital stock, $25,000. Buildings will be erected.

Bethel, Vt.—The Bethel Electric Lighting and Power Co. has organized with a capital stock of $15,000; W. H. Creamer, treasurer and general manager; Mr. Stafford, president; R. M. Chase, George H. Almon, directors.

Saco, Me.—Louis McCarty Insulating Company has been incorporated with Thomas Allen, president; Louis McCarty, treasurer, Boston, Mass. Capital stock, $200,000.

Winton, Pa.—The Archbald Electric Street-Railway Company, incorporated by James Kane as president, to build a road between Archbald Borough, Jermyn and Winton. Capital stock, $30,000.

Cleveland, Ohio.—The Warwick Electric Manufacturing Company has been incorporated by P. B. Warwick, D. H. Ridgeway, G. F. Ridgeway, M. Phalen and G. N. Cunningham. Capital stock, $30,000.

Trade Notes.

The Proctor-Raymond Co., 444 Niagara street, Buffalo, N. Y., has purchased the entire business, consisting of machinery, stock, name, good-will and patent rights of the Proctor-Raymond Elec. Co., formerly of Rochester, N. Y., and will continue to manufacture the justly celebrated Eclipse iron-box bell and the Rex wood-box bells; also annunciators, push-buttons, floor-treads, spark-coils, etc.

The Manhattan Electrical Supply Co., 32 Cortlandt street, New York, has issued the third edition of its pamphlet, descriptive of electric telephones and electrical supplies.

The alternating current motors made by the Phillips Electric Motor Co., 62 Railroad Avenue, Paterson, N. J., are rapidly making a name for themselves. They are giving the best of satisfaction in practice. The Chicago Telephone Co., Chicago, Ill., is using one of these machines with satisfactory results, and has given an order for a 2½ H. P. alternating current motor, to operate on a 110-volt circuit.

The Boudreaux Dynamo Brush Co. reports a steady increase of business all over the country. The Robinson Engineering Co., of Baltimore, has secured the sole agency for Maryland, Virginia and the District of Columbia.

The repair crew had it "in" for the new man. "Say! Bill," said one of them, "how many pounds of wire does it take to string up a horse by the tail to——," and, as Bill went down into his pocket and brought out the "Practical Application of Dynamo Electrical Machinery," they knew the fun was all over with. The table on wire and other valuable points ought to put this book into the pockets of every man connected in an any way with the subject of electricity. It is published by Laird & Lee, Chicago. See advertisement on another page.

The Sheffield Car Company, of Three Rivers, Mich., has just issued its foreign catalogue of light cars for all purposes. The catalogue is printed in English, French, German and Spanish. Anyone in foreign countries can obtain a copy free on application. The foreign trade of this company is large and constantly increasing.

Elliott Brothers, of London, stand in the foremost ranks as scientific and electrical instrument makers, and during their long, successful career, have constructed apparatus for governments, cable companies, telegraph companies, colleges, universities and other users of high class instruments throughout the world. The 1895 edition of their handsomely illustrated catalogue can be obtained promptly by sending 15 cents for postage to Mr. James G. Biddle, American agent, No. 525 Drexel Building, Philadelphia.

SACRAMENTO'S CELEBRATION.

On September 9 the citizens of Sacramento, Cal., celebrated the introduction into the city of electricity generated at the Folsom plant of the Folsom Water-Power Company, which is located twenty-two miles away. At night the city was brilliant with electric lights and electrical decorations, and the parade was unsurpassingly beautiful by the aid of thousands of electric lamps of all colors.

The "National" float was conspicuous for the large American flag, composed of appropriately colored electric lights. The "electric kite," showing Franklin in the act of flying his historical kite, attracted a great deal of attention.

One float had in its centre a small electric fountain, and on another a huge electric hammer was in operation.

Other electrical features of the procession, shown on floats, were an electric furnace in operation, an electric star and an electric locomotive. A May-pole 150 feet high with strings of vari-colored electric lamps for streamers attracted great attention, and the powerful search-light on the dome of the capitol threw a flood of light upon the streets and surrounding buildings.

The Sacramento *Bee* of September 10 gives a very full and well illustrated account of the great celebration.

The current from the Folsom plant was turned on on July 12 last, and has been delivered continuously ever since, operating the entire street-railway system of the city. The current is also used for lighting and power purposes.

CONVENTION OF ELECTRICAL WORKERS.

The National Brotherhood of Electrical Workers will hold a convention in Washington, D. C., on November 11 to 17, inclusive. A large number of delegates from the various Unions throughout the United States are expected to be in attendance. Many interesting papers on practical electricity will be read during the meeting. A very unique feature of the occasion will be the arranging of their convention hall as an exact counterpart of the United States Senate Chamber. Several prominent manufacturers of electrical apparatus have signified their intention to hold exhibits during the convention. An interesting programme has been arranged and it is the intention of the local Union, No. 26, to make this the greatest meeting in the history of the Brotherhood.

THE TENNESSEE CENTENNIAL EXPOSITION.

Electricity will form a very large part of the Tennessee Centennial Exposition, which will be held in Nashville from September 1, 1896, to November 30, 1896. There will be an Electricity Building larger than the one at Atlanta; an elaborate electric fountain in a large lake, and an electric crown of incandescent lights revolving and spelling the words, "Tennessee Centennial Exposition, 1896," on top of the highest edifice, and all the lighting will be done by electricity. Specific plans for the Electricity Building have not yet been adopted; the exact dimensions will be determined within a month.

Mr. Leland Rankin is chief of the Bureau of Promotion and Publicity.

—The magnetizing power of a current is proportional to the strength of the current, expressed in amperes, and to the number of convolutions of wire around the magnet core. If a current of one ampere flows ten times around the core, its magnetizing power will be the same as that of a current of ten amperes flowing once around the iron. Hence the magnetizing power of a current is proportional to the ampere-turns.

ELECTRICAL MECHANICAL CLOCK.

To those who were acquainted with Louis H Spellier, either personally or through his writings on electric clocks, it will be of interest to know that his latest achievement has been passed through the patent office.

Through some very ingenious movements Mr. Spellier every few minutes winds up the main spring that has been spent in propelling the clock-works. The main feature about this spring being that, even for very large clocks, it is very short, and the spring being wound up so often, not only takes little power but remains almost at an even tension, thus affording far better regulation and less wear and tear on the clock gears.

To show the simplicity of the device for winding this spring we will follow it for one cycle; say, for instance, the clock is running and the power of the spring is partly spent. A point on the drum, which carries the spring, makes electric contact, which energizes three magnets successively, winding the spring and carrying a weight past its highest point, which in dropping puts full tension on the spring. and the clock is again ready for another few minutes' run, etc. Another great advantage of this self-winding clock of Mr. Spellier is compactness; it occupies very little more space than an ordinary eight-day clock of any pattern or make, doing away with complicated gearing. This simplicity adds largely to its value commercially.

THE EDWARDS CAR FENDER.

The Albert Edwards Car-Fender Company, 26 Court street, Brooklyn, N. Y., was duly incorporated at Albany on September 11. Mr. Albert Edwards is the president; C. A. McLaughlin, vice-president; H. J. Powell, secretary; E J. Rusten, treasurer. The company is forging ahead and filling orders from the South Orange and Maplewood Street-Railway Company, Orange, N. J, and from various other street railway companies in Maine, Texas, Chicago, Asbury Park, N. J., Boston, Philadelphia, La Crosse, Wis.; St. Louis and San Francisco.

THE MONTREAL CONVENTION.

Delaware and Hudson Rail Road System,
Office of General Passenger Agent,
Albany, N. Y., Sept. 12, 1895.

To Delegates and others attending the Convention of the American Street-Railway Association:

Your attention is respectfully called to the fact that the Delaware and Hudson Railroad is in every way the Shortest, Quickest, and Best line between New York and Montreal. It is twenty miles shorter than the Central Vermont and ninety miles shorter than the New York Central line via Utica.

The road, power and equipment are maintained at the very highest standard. Every mile of the journey is attractive. The line passes through Saratoga and skirts the western shore of Lake Champlain for its entire length, in full view of the Adirondack and Green Mountain ranges. Through sleeping-cars leave Grand Central station, New York, at 7.00 P. M., and arrive in Montreal at 8.00 A. M. Day train leaves Grand Central station 9.30 A. M., connecting at Albany with Montreal express, and arriving in Montreal 9.50 P. M. Returning, day train will leave Montreal 9.10 A. M., and arrive in New York at 8.45 P M. Sleeping-car train will leave Montreal 6 20 P. M., and arrive in New York 6.45 A. M.

As the through cars of all lines leave Grand Central station, New York, on the same trains delegates should insist that their tickets read via Delaware & Hudson.

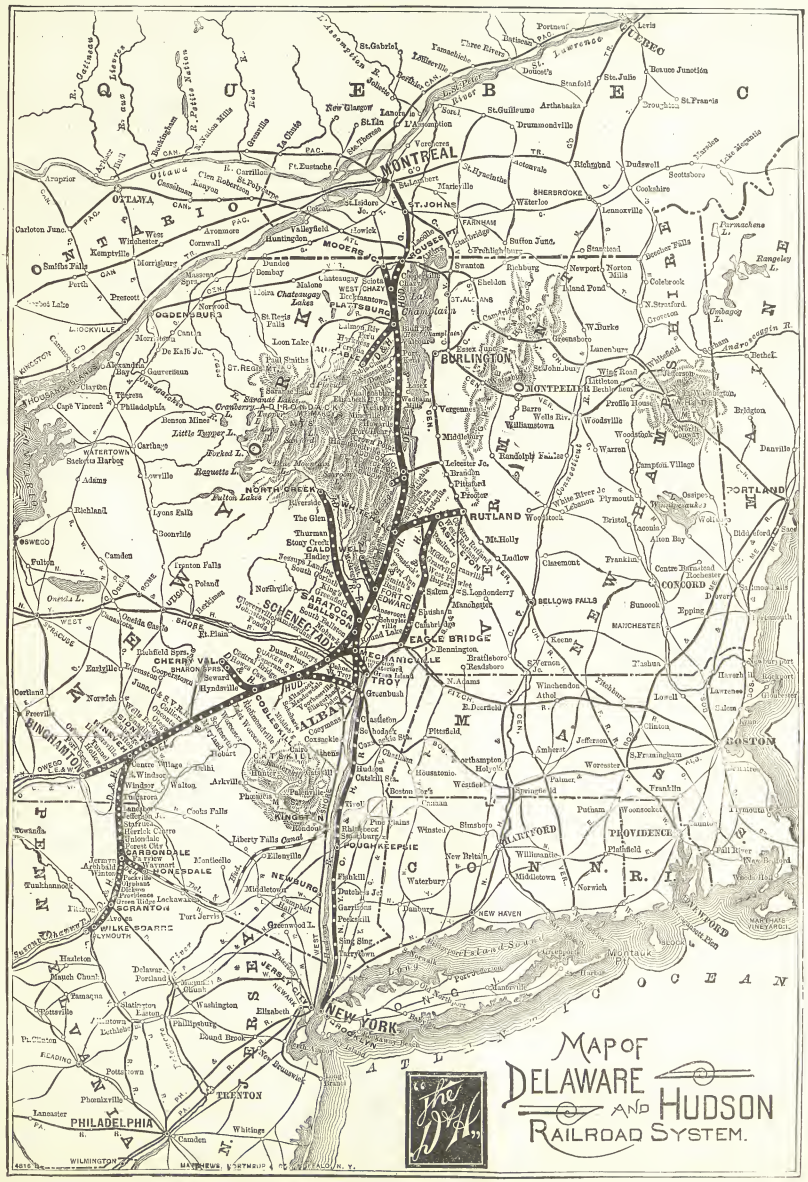
It is the Shortest, Quickest and Best Route.

Rates made for this convention are one fare and a third for the round-trip on the certificate plan, the purchaser taking a certificate from the ticket agent, which, when

properly countersigned at Montreal, will entitle the holder to a return trip at one-third fare. J. W. BURDICK,
General Passenger Agent.

New York ticket office and bureau of information, 21 Cortlandt street. Tickets via Delaware & Hudson are also on sale at all principal ticket offices.

"It may be questioned whether there is a railway journey in the world which gives in one day a variety and splendor of landscape to equal that which is enjoyed by the traveller taking the morning express by this (D. & H.) line between Montreal and New York."—*Prof. J. Clark Murray* of *McGill University*, in the *Scottish Review.*



THE MONTREAL CONVENTION.—MAP OF THE DELAWARE & HUDSON RAILROAD SYSTEM.