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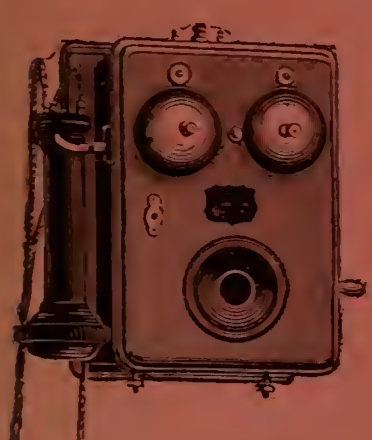

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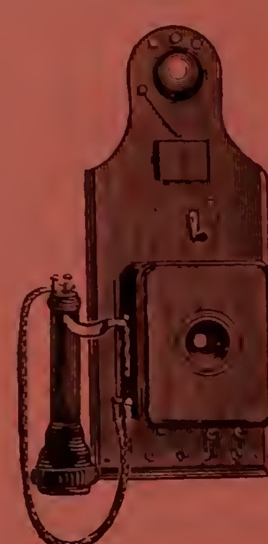

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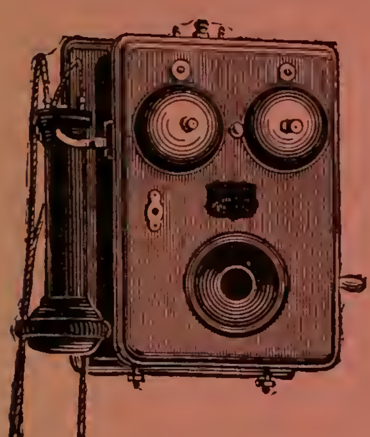

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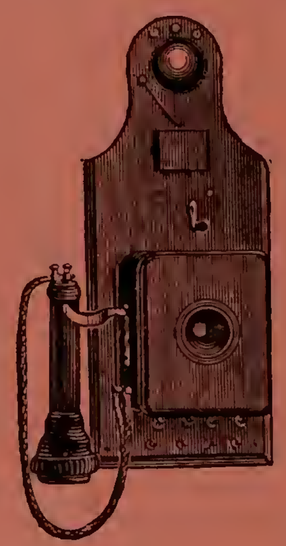

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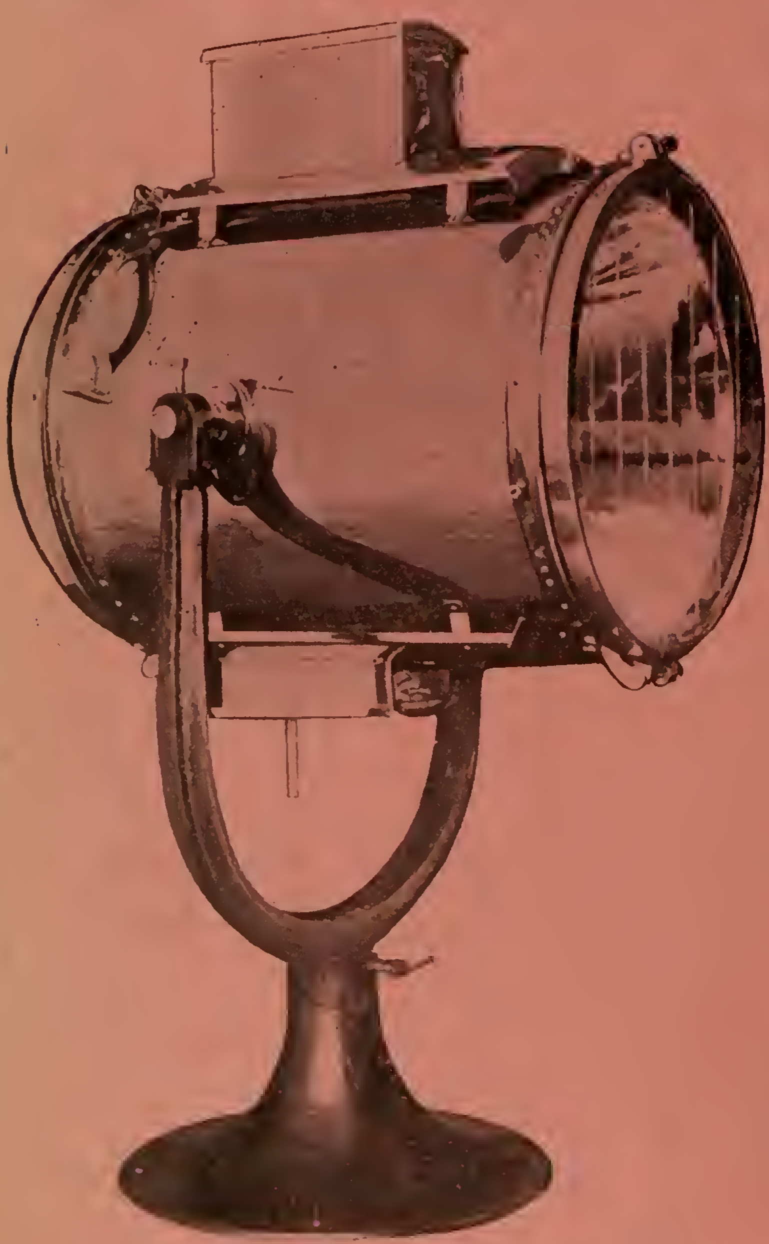

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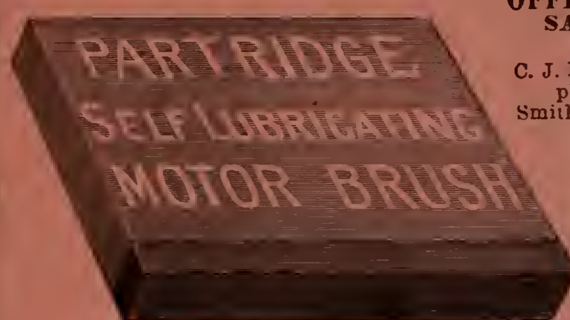

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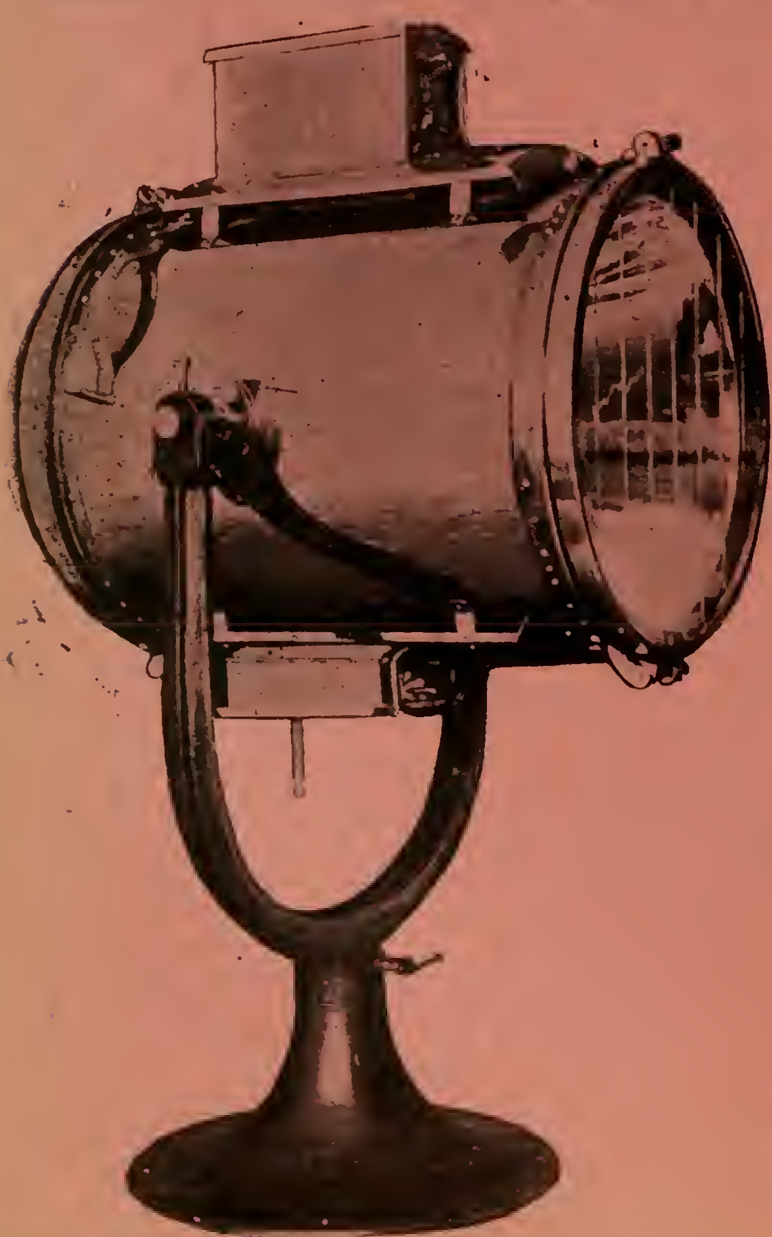

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DR. DUNCAN'S ADDRESS.

Dr. Duncan's utterances before the Niagara Falls meeting of the American Institute of Electrical Engineers, last week, regarding the substitution of electric for steam power on steam railroads will have the effect of opening the eyes of railroad officials very wide, and they may create consternation in some quarters, but they are the words of one of authority. Railroad men cannot ignore the writing on the wall; if they do, it will be their own loss. Dr Duncan makes no prophecies; he simply shows what electricity is doing in railroad work, and what it can do. This paper is one of the most interesting and valuable of its kind ever produced, and there is no question that it will bring railroad men to a full realization of the new power that threatens the demoralization of their invested interests. As Dr. Duncan says, they cannot now afford to ignore electric power as one of the most potential industrial factors of the age. It will be to their own interest to make friends with it and adopt it into their families. We print the first portion of Dr. Duncan's address elsewhere in this issue, and exceedingly interesting reading it is.

THE MODERN HEROES.

Huxley has passed away. The great scientist rests within the bosom of the earth. No beacon light ever burned more brightly, or shed more lustrous rays than the torch he has enkindled. Unique in his originality; persistent in his investigations; courageous in his untiring attacks upon those things adverse to his convictions, we view in him a rare type of man, one at whose loss the world bows its head in sorrow. Tyndall, Helmholtz and Huxley are dead. What adventurous spirit will dare to take their place? Nobility of birth counts for naught; mere excellence of speech cannot prevail. Some new Ulysses is even now climbing the dangerous heights: let us crown him with laurel when he arrives and trumpet his fame throughout the world. The curtain of time is slowly falling and hiding from our sight the most cherished and familiar forms. The inevitable is approaching; let us welcome it, that others, better than ourselves, can lead the march of progress and enlightenment.

THE STORAGE OF LIGHT ENERGY.

It is strange that no attempts have ever been made to store energy except as direct chemical reactions or the potential force residing in a body of water raised above the common level. Many substances exist that are more or less attacked by light waves. One of the best known is nitrate of silver in the presence of organic material. Another is bichromate of potash. It is evident that the energy of the light wave is quite sufficient to cause a very complete molecular change in either case. These facts are produced to show the direct effect of ether waves on certain combinations of material. Although it is very true that the only use of such a phenomenon is to apply it to photography, it at least acts as an indication of future possibilities. Were experiments made to determine the sensitiveness of other compositions to light it is very likely that a list of materials would be produced which would be affected either by individual waves or groups of them. This reaction might be made use of for the storage of light energy as chemical reactions and then transformed again when necessary into light.

TURNING ON THE NIAGARA CURRENT.

Word comes from Niagara Falls that the first delivery of electric power generated at the Niagara Power Company's plant was made on July 1. The first customer was the Pittsburgh Reduction Company, whose aluminum producing plant is located about a mile from the power station. It is stated that four thousand horse-power was delivered to the Reduction Company. This marks an important era in the generation of power in this country, and no doubt before many more years have passed by, most of the water courses of any consequence will be in like manner harnessed to do man's work.

THE SUBSTITUTION OF ELECTRICITY FOR STEAM IN RAILWAY PRACTICE.*

BY LOUIS DUNCAN.

In an address delivered before this Institute in June, 1892, Mr. Frank J. Sprague spoke of the coming development of electricity as applied to railways, and outlined his views as to the direction of this development. In the last three years great extensions have been made in electrical transportation, and it seems well to review briefly the amount of these extensions and their direction. In this paper I shall consider electric traction as it stands at present, not the possibilities of the future.

In the last seven years electricity has largely taken the place of horses for tramway work, and it is now beginning to replace cables, although the latter have been recently installed at great expense. At first the lines were confined

DR. LOUIS DUNCAN.

to the limits of towns and cities, but they have been extended first into the suburbs, and then to the neighboring towns, and the extensions have brought them in competition with the steam roads. The reports of the earnings of the railroad companies in the United States show that, after paying fixed charges, only a small amount of the net profit remains to be applied to dividends on the stock. Any general decrease in the earnings, even if it is only a small percentage of the total amount, will wipe out the narrow margin that is now applied to dividends, and the absorption by the electric lines of the local travel formerly conducted by the steam lines promises to do this. At first the managers of the larger steam roads ignored the growth of their electrical rivals, but the time has come when they can no longer ignore the decrease in the receipts from their local passenger travel, and they are beginning to face the difficulty and to carefully study the situation.

In this paper I will briefly take up the following questions:

1st. Given a railroad system at present operated by steam; will it pay to change entirely to electricity, or to make a partial substitution, and how should the change be made?

2d. If entirely new lines are to be built, is it likely that it will pay to equip them electrically; how should they be equipped?

3d. I will describe the equipment of the B. & O. Tunnel plant and draw from it what morals I can.

In order that it should pay a railroad to make a change in its motive power, the effect of the change must be either to increase the receipts or decrease the expenses by an amount equal to the interest on the cost of the change. There should theoretically be such a gain; practically, the amount would be greater in order to justify the change, to take into account those elements not capable of exact calculation, and also the fact that an increase in the fixed charges of a road is a more serious matter than the mere amount of it; for although the average for a number of years might show a gain by the substitution of electricity, in a bad year the increased fixed charge might cause difficulty.

There are two very distinct sides to the question of transportation, the passenger side and the freight side, and their requirements for good service are very different. First, taking up the question of passenger travel, the receipts of a road are increased by running trains at short intervals and at high speeds, and this is a condition peculiarly favorable to electricity. On an electric line short trains equally distributed over the track give a greater station efficiency, and the lowest cost of equipment of both station and line. The cost of train service is somewhat greater, but is compensated by the saving in the other items.

The cost of hauling a given number of passengers between given points by steam is greatly increased when the number of trains is increased, the efficiency is less, and the cost of equipment and of train service is greater. Wellington states that doubling the number of engines for a given traffic increases the cost of transportation about 50 per cent.

On the other hand, if you take up the question of freight traffic, the conditions of greatest economy are reached when trains of a maximum weight are hauled by a single locomotive. The tendency in late years has been in the direction of increasing the size of the locomotive, the capacity of the cars and the length of the trains. These changes have necessitated more solid and expensive road beds, heavier rails, and general strengthening of bridges. The outlay has been enormous, but the decreased cost per ton mile for freight transportation has shown the wisdom of the change. On one of the larger roads which publishes careful yearly statistics, I find that the cost of transportation per ton mile in 1870 was 1.15 cents, and in 1890, .56 cents; on another road it was 1.9 cents in 1864, and .447 in 1893. Number of tons per train mile on the first road in 1870 was 103, while in 1890 it was 226. In attempting to carry on traffic of this kind by electrical locomotives operated from a central station we find that we are at a great disadvantage because of the irregular service necessitated by the freight traffic and the unequal distribution of the load along the line. Suppose, for instance, that there were two stations supplying the lines and that the traffic was uniformly distributed along it; then the capacity of each station would be one-half of the total required capacity. Suppose, however, that the entire traffic was concentrated in one train, then each station would have to have a capacity equal to the total power required for hauling the entire traffic, as the train would be first supplied from one station, and then from the other. The line also would have to have a capacity suitable for handling the total traffic. If a number of heavy trains were used, and the traffic was irregular and liable to be congested at one point as in the case of freight service, then again the capacity of the station would have to be greater than that required to supply one-half of the normal traffic. If we were decided to transmit the current to a longer distance and to supply all the track from one station, using transformer devices along the line, then the capacity of the station itself would only be that required for the normal traffic of the line, but the transformer devices would have to be sufficient to handle the maximum traffic of the section

* Inaugural address read before the General Meeting of the American Institute of Electrical Engineers, Niagara Falls, N. Y., June 25, 1895.

which they supplied and would have to be given a capacity greatly in excess of the average load in order to supply this energy. We must distinctly bear in mind, in considering the application of electricity to steam roads, any departure from a uniform distribution of load along the line will increase both the cost of equipment and the cost of operation.

In looking over the reports of the same road from which I have given freight statistics, I find that in 1870 the receipts per passenger mile were 2.09 cents, while the expenses were .59 cents. In 1890 the receipts were 1.9 cents, while the expenses were 1.47 cents. During this period passengers per train mile have decreased from 79 to 59. Comparing these figures with those given for freight transportation, we find that the two types of traffic have gone in opposite directions in the period which we have been considering. The amount of freight transported per train mile has more than doubled, and the expenses have decreased more than one-half. The passengers per train mile on the other hand have decreased, and the expenses have changed only a slight amount, notwithstanding the greater economies that have been put in force in the interval. Passenger traffic has come in the direction in which electricity is the most economical for transportation; freight traffic, on the other hand, has gone in the direction where electricity becomes most costly. It might be argued that some new scheme for freight transportation by electricity might be used, but it would be difficult to devise any system more economical than that at present in use, and the great amount of through traffic on freight lines precludes the possibility of devising any system which differs radically from that at present in use. For instance, taking the figures from the records of the Pennsylvania Railroad for 1893, I find that the freight mileage of foreign cars on the Pennsylvania road east of Pittsburgh is in round numbers $370,000,000, while the freight mileage of home cars is $436,000,000, making almost 46 per cent. of the total mileage made by foreign cars. It would seem then impossible to change the present system of freight traffic without disorganizing the service and decreasing the freight revenue of the road. The importance of freight traffic is shown by the fact that the earnings from freight on all the roads in the United States is between two and one-half (2½) and three (3) times as great as that for passenger traffic. The New York Central Railroad Company in 1892 received from their freight traffic $26,000,000, and from their passenger traffic $13,000 000. On the lines of the Pennsylvania Railroad, east of Pittsburgh, the freight receipts were $47,000,000, as against $17,000,000 for passenger receipts.

Suppose, then, the question comes up before the managers of a road as to whether they are to equip their lines to be operated entirely by electricity. It seems to me, as matters now stand, it will not pay trunk lines to change the method of operation for freight traffic, and the question to be considered would be the operating of the lines partly by steam and partly by electricity. Let us consider if it is possible to run the passenger service wholly or partly by electricity. Considering a two-track road doing a through as well as a local business, I think we can decide that unless the case be an exceptional one, it will not pay to equip the main line electrically. It is necessary that the through express service be continued, and that the freight service be continued, and an attempt to operate the local trains with the through trains could not be successful if there was any considerable amount of through traffic. With a four-track road the condition of affairs is somewhat different. If the road operates between cities acting as terminal points for all passenger traffic, as with some of the lines between Boston and New York, then by equipping all four tracks it would be possible to run express service at short intervals on two of the tracks, and on the other two tracks to run freight and local trains. At present it would not pay to use electric locomotives operated from a central station for the freight service, but the local service could be operated electrically, and as the speed of the local trains would be approximately equal to that of the freight, there need be no serious interference with the traffic. We would then have express passenger service working under favorable conditions, that is, with a number of trains evenly distributed; a local service operated under similar favorable conditions and with no interruption to the freight traffic. If the road, however, is to transport a considerable number of freight cars, as, for example, the New York Central or the Pennsylvania Railroad, then the condition of affairs for express service would not be so favorable and the question of the equipment of the tracks for express service would have to be carefully considered. As far as the branch lines go, whether it would pay to partially or wholly substitute electricity for steam, depends upon the local conditions. A long branch with a small amount of local traffic would not pay to equip, but on a short branch with considerable passenger traffic and comparatively little freight traffic such equipment would pay. I find that in 1892 the total number of through passengers carried by the New York Central road was 234,650, while the number of local passengers was 21,978,979. It will be seen that the through traffic is but a small percentage of the total number of passengers and that the question of preserving the local traffic is of great importance. Now the greater part of this local traffic will in the next few years be taken by the electric roads paralleling the steam road, unless some effort is made either to control the electric roads or to give an equally good service between adjacent towns. This latter is possible, using the ordinary steam tracks only, when the distances between towns are small and the amount of freight or through traffic is also small.

There are certain kinds of local traffic which the steam roads must, to a large extent, lose, and which in the nature of things they cannot regain. In large cities having a considerable suburban traffic the trolley roads, forming as they do a network of lines within the city and extending in every direction into the suburbs, offer advantages with which the steam roads cannot compete. In Philadelphia, one of the large steam lines lost so much traffic that it has attempted to regain it by reducing prices and increasing the number of trains. In this effort it has partly succeeded, but at the cost of greater expense and decreased receipts. To counterbalance this loss at central points railroads may hope, by the introduction of electricity, to increase their earnings along the lines and on their branches.

As to the nature of the equipment that will be required, it would depend on the work to be done and the branch that is to be equipped. In some cases it might be well to use single electric cars running on the steam tracks between towns and on the local tram lines in the towns. As the speed would be very different in the town and on the railroad line, and as the voltage could also be different, it would be well in this case to use a number of motors on the car, and to use a series parallel controller, the motors being in series for the town traffic. For instance, suppose we wish to run at a maximum speed of forty miles per hour between two towns, and it is economical to use 1,000 volts on the line, we could use two motors on the car, run them in parallel on the main line at a speed of forty miles per hour, while in town, with a voltage of 500 we could run them in series at a speed of 10 miles per hour. I can hardly imagine a case where the three-wire system could be economically used for such service on the steam lines.

The condition of affairs in electric transportation is, at present, curious. The trolley companies by extending their lines are working from tramway transportation to through transportation. They are attacking the problem by development from small motors to larger ones The railroad companies, starting with the large units, are coming down in the direction of the present trolley systems, as in the cases of the Nantasket Beach road, of the N. Y., N. H. and H. Co. Perhaps in the future they will meet and some standard electrical system will be adopted for the present steam road. I think, then, that in the case taken up, the policy of the road will be to equip with a trolley those branches for which the conditions are favorable; run comparatively large motor cars capable of drawing one or two ordinary passenger or freight cars as trailers, using the present steam service for their freight traffic when necessary. This will allow the necessary through travel; will give the required local service between towns and will not interfere with the freight traffic.

As for the systems to be used for such services I believe that at the present moment the continuous current overhead trolley system is the only one that can be selected with a certainty of successful operation. It gives a minimum complication in the way of conveying the current to the cars; it allows a considerable range of speed with a comparatively high efficiency, and our experience with it is such that successful operation could be at once guaranteed. By using different voltages in the towns and on the line, both high and low speeds can be obtained. If the line to be operated is to be very long, it might be best to use rotary transformers at different sub-stations along it, the line being supplied by continuous currents from the sub-stations. In fact, the three systems that are at present possible are, first, the ordinary direct current system; second, a system in which direct currents are used on the line and rotary transformers supplied by alternating currents are placed along it, and third, a two or three-phase system supplying rotary field motors on the cars. In the latter case, it would be well to employ different periods in the towns and on the lines.

(*To be Continued.*)

COMPOUNDING DYNAMOS FOR ARMATURE REACTION.*

BY ELIHU THOMSON.

The opinion which seems to prevail amongst engineers is that by taking advantage of the best principles of design, the output of our machines is not limited by armature reaction, but rather by heating, or the capacity to diffuse that heat which is sure to be produced during operation.

The writer's views are in accord with the general sentiment indicated by the discussion of the paper in question, excepting that he conceives that it may on occasion become desirable to possess a structure, either generator or motor, in which a load which would inevitably overheat the machine if continuous, may be borne without destructive results for short periods only. The development of engineering work may in fact demand, occasionally, machines which would be regarded as emergency machines, to be operated with the highest possible loads for short periods. It is sometimes desirable that a dynamo be adapted to driving at different speeds while maintaining the same potential at the terminals, as in the case of direct driven dynamos coupled with engines of different makes and speeds. Such an adaptation would require a change in the armature turns, or in the field excitation, the former demanding a reconstruction amounting to the production of a special type, while the latter, change of field strength, might involve such a weakened field at the higher speeds as would be incompatible with proper commutation. In such cases means and methods for securing proper commutation and neutralizing reaction may become quite useful. The subject itself has been worked upon by the writer as far back as 1879. At first a peculiar disposition of the field coils and pole-pieces was selected, unfavorable to armatnre reactions, and later in a patent applied for by the writer in the year 1885, the series coil of a compound-wound machine was so disposed as to add, under load, a magneto-motive force to the field in the region of armature opposition, and as a consequence to diminish somewhat the magneto-motive force of the field where the reaction of the armature was positive or assisting.

In the present paper, however, the writer desires to bring to the attention of the Institute a different type of dynamo, worked upon by him some three or more years ago, in which there is no series-winding whatever, though the machine is in effect compounded, or over-compounded at will.

It is expressly to be understood at the outset that the present paper is not intended to advocate the disposition described as a desirable commercial structure, or even as one which will be likely to come into practical use on any scale. On the contrary, it is believed to be open to objections which would take it out of competition with ordinary types in which the compounding effect is secured by the series coil or load circuit wound as usual as a part of the field energizing conductor.

The machine is, however, interesting as bringing out forcibly the capability of the armature current to neutralize its own effects in a proper structure and maintain, or even increase, the potential at the brushes under heavy loads. In fact, the current in the armature in the type of machine herein treated, is made to react under load to magnetize a portion of the field structure which at no load is neutral or nearly so. The reaction may thus be made to give rise to a magnetic flux sufficient or more than sufficient to compensate for its effect in diminishing the flux of the other or excited portion. The result is accomplished by dividing each field pole into a portion which is left unwound and a portion which is wound and excited in shunt or separately.

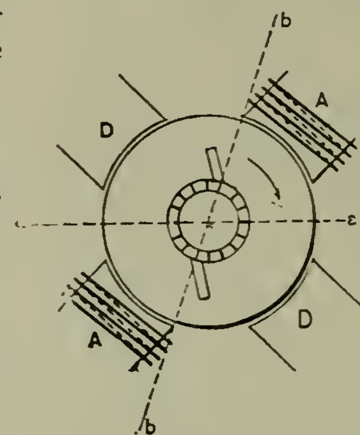


FIG. 1.

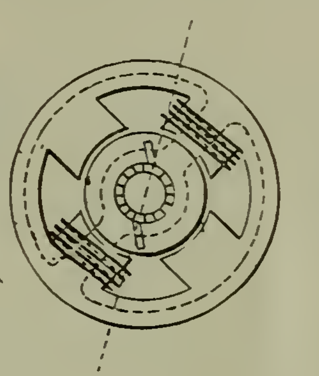


FIG. 2.

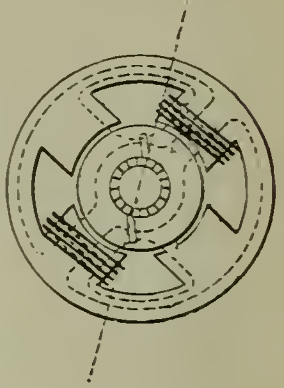


FIG. 3.

At no load only, the wound polar portions act to generate the open circuit E. M. F. As the load is put on, the unwound or dead poles become active in consequence of a magnetic flux developed in them by the armature currents themselves, that is, in consequence of the M. M. F. generated by the current in the winding of the armature itself. The disposition of the poles in a bipolar structure would be represented by Fig. 1, where A A are the excited poles, or wound field cores, under the fringe of which commutation is effected, while D D are the "dead" poles or sections of polar surface unenergized at no load. A dotted line *a a* may pass through the neutral or non-polar portion of the armature iron, threaded by all field lines on one side, while the lines *b b* may indicate the diameter of commutation on which the brushes rest. In such a structure by choosing the position and spread of the "dead" poles in relation to that of the wound or excited polar portions, and adjusting the M. M. F. of the initial field relatively to the turns on the armature and the speed of driving, the effect of compounding or over-compounding may easily be obtained. The "dead poles" may be made adjustable in position, so as to vary the effective M. M. F. of the armature upon them, and various changes in relations of the parts are conceivable.

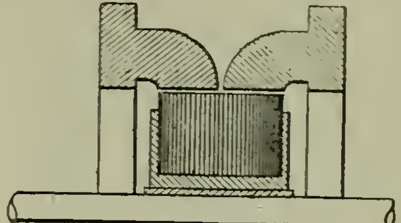


FIG. 4.

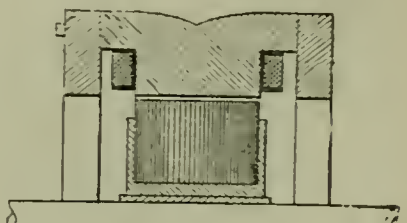


FIG. 5.

In Figs. 2 and 3 an attempt has been made to represent the magnetic flux under no load and under load respectively. In Fig. 2 the flux in the air-gap between the excited poles A A and the armature may be cousidered as of uniform density except at the edges, while in Fig. 3 it is, under the same poles, somewhat diminished towards the diameter of commutation. In Fig. 2 the dead poles are without flux across the air-gap, while in Fig. 3 the density increases from one edge to the other in the direction of rotation.

* Paper presented at the Twelfth General Meeting of the American Institute of Electrical Engineers, Niagara Falls, N. Y., June 26, 1895.

The dynamo constructed in accordance with the principle under discussion is multipolar, having four wound poles and four dead poles alternating in position around the armature. The latter is of standard iron projection type, being in fact identical in construction and dimensions with the armatures used about three years ago in regular four pole dynamos of the marine type of the Thomson Houston Electric Co.

The principal data of the armature construction are as follows :

Diameter over all	17	inches
Length (laminations)	8	"
Radial depth of laminations	4	"
No. of projections	87	"
Width of slots	.34	inch.
Depth of slots	.75	"

The armature is series drum-wound and has two conductors in each slot. The commutator has 87 segments. The new field system was constructed of two rings of cast open hearth steel having heavy lugs, four in number, projecting laterally from each ring on one side, and forming the dead poles when assembled in the machine. Separate castings for carrying the field coils and constituting the active poles were made, wound and bolted between the two-ring castings of the field. The arrangement will be understood at a glance from an inspection of

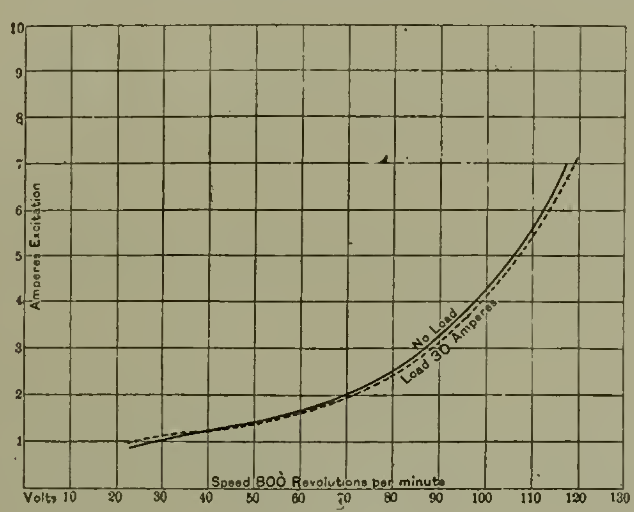


FIG. 6.

Figs. 4 and 5. Fig. 4 is a section of the field in a plane passing through the dead poles and the axis of the armature, and Fig. 5 is a similar section through the active or wound poles. The wound cores have a section of 3½ in. × 8 in. and are of steel. The field was bored to 17¼ in., thus giving a clearance of ⅛ in. around the armature. The excited or wound poles covered each about 5 inches, the dead poles each 5½ in., leaving spaces between wound and dead poles of about 1½ in. The face of each dead pole is 5½ by 8 in.

The coils on the active poles can be connected in shunt to the armature terminals with a variable rheostat in the branch, or separately excited as desired. It was found that for the purposes of test that the latter arrangement was most satisfactory, as the exciting current could then be adjusted to any given value and would remain undisturbed by variations in the potential difference between the brushes or terminals of the machine.

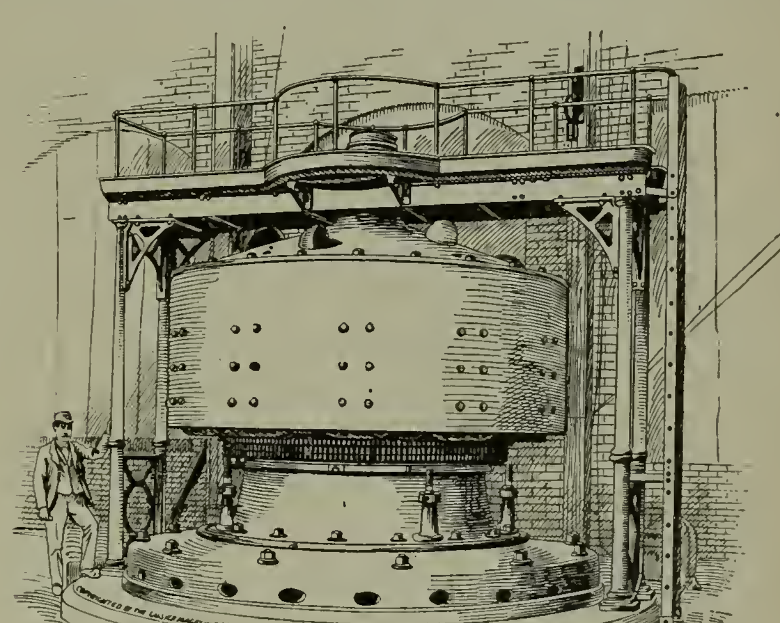
Fig. 6 shows the relation of volts at the terminals to varying exciting current at no load (full line) and at 30 amperes load (dotted line) with a speed of 800 revolutions per minute. It will be noted that the load has caused an increase of voltage particularly at the relatively higher excitations. The normal current of full load for the armature as constructed and used in the regular multipolar field was 140 amperes, and it was found that as the load was increased steadily during a run, the potential was not only maintained but increased with each increment of load, thus showing an over-compounding effect. This effect was less marked when the initial excitation was weak ; as when less than three amperes traversed the field coils. The over-compounding under load was, of course, still more increased when the field coils were connected in shunt to the armature. Thus, at a little over 750 revolutions per minute with an exciting current of four amperes, the open circuit volts were 84, rising to 104 when a load of 130 amperes was put on with an increase of the exciting current to 4.8 amperes.

(*To be Continued.*)

HANDLING ELECTRICITY AT NIAGARA.

The electric currents delivered by the big 5,000 horse-power generators are conveyed through heavily insulated cables to a switchboard. There, by means of suitable switching devices, the engineer in charge of the station may, at will, connect any one of the generators, or any combination of the generators, to the external circuits which convey the currents from the power house to the consumers. These external circuits, known as feeder or supply circuits, passing from the switchboard, are supported upon iron brackets in a brick-lined subway within the power house. Insulated, lead-covered cables are used, and these, leaving the subway, are continued through a bridge connecting the power house with a transformer on the east bank of the power canal. The cables conveying current, intended for the use of tenants of the power company and other consumers of power within a radius of two or three miles of the power house, pass directly through the transformer house and enter a conduit leading to the works of those tenants who are, at present, the principal users of the power.

Current intended for transmission to considerable distances, as, for example, to Buffalo, will pass from the switchboard through similar lead-covered cables in the power-house subway and the bridge to the transformer



5,000 H. P. GENERATOR, NIAGARA FALLS.

house. There it will enter the "step-up" transformers, and from these current at high potential (E. G. 20,000 volts) will be delivered to the long-distance transmitting circuits. It has not yet been determined whether these long-distance circuits shall be overhead or underground. At the distant end of the circuits "stepdown" transformers will be employed to reduce the potential of the currents to an amount suitable for local distribution.

The kind and amount of apparatus which it will be necessary to install upon the premises of the users of power depends upon the kind of service required. In the case of large motors, the current delivered by the local distributing circuits at Niagara may be supplied to the machines without reduction of potential by transformers. In the case of smaller motors, and in the case of commutating machines used to supply direct current, step-down transformers will ordinarily be employed.—L. B. Stillwell in the Niagara Power number of *Cassier's Magazine.*

In the Blake or other single contact microphone transmitter the volume of current produced in the secondary circuit is usually between .0001 ampère and .0007 ampère.

LOSSES OF EFFICIENCY.

BY F. M. F. CAZIN, OF HOBOKEN, N. J.

To expose naked facts and figures is looked upon as rebellious against sacred interests, as it is inimical to deception and incompetent superficiality.

Were I to state, without producing unimpeachable proof, that the already well-described power-transmission plant at Bodie, Cal., does not give more than 21 5 per cent. efficiency of the water-power used, instead of 64.62 per cent. as claimed, a storm of indignation and contradiction would be called forth on the part of those who claim to know about such matters. The description of this plant states that the efficiency of the electric motor was 71.8 per cent. and that of the dynamo 90 per cent. of the power of the falling water—the electrical engineer in charge even claiming an efficiency of 93.883 per cent. His tests, however, related exclusively to the loss of electrical energy between dynamo and motor, leaving out of consideration entirely the question of mechanical labor applied to the conversion of mechanical energy into electrical energy.

The point at issue is whether $\frac{1}{g}$ Kg. m. of mechanical power is producing one watt, or, at what loss of power the conversion takes place.

Mr. Thomas H. Leggett, of Bodie, Cal., in his paper entitled "A Twelve-Mile Transmission of Power by Electricity," describes not the transmission of power by electricity, but the transmission of mechanical power from falling water by hydraulic and electrical apparatus.

The power originates in the falling water and is delivered to working machinery by the electric motor. The maximum amount of work performed by the water falling from a stated elevation in a current of stated section is a known quantity, as is also the mechanical work performed by the electric motor. There is a discrepancy between these two quantities, and this discrepancy represents the loss of efficiency. How much is there of it? To what extent do the hydraulic and electrical apparatus each share in this discrepancy?

These are the questions I propose to discuss and thus prove the falsity of the various claims. I shall confine myself to the facts contained in the paper itself, and no other facts will be assumed except those which are accepted by science at the present time as incontestable.

The paper* states the following facts and conditions:

(1) In relation to hydraulic apparatus—

Head utilized ....355 feet.
Pressure gauged ....152 lbs.
Transverse section of each jet..........1 1/3 inch.
Number of jets applied (2 on each of 4 wheels).8
Diameter of wheels... ....1.75 ft.
Revolutions of wheels under load.... 860 to 870
Energy on wheel shaft has not been measured.
Efficiency, as rated by manufacturer, 60
H. P. ....240 H. P.

(2) In relation to electrical apparatus:

Constant potential generator...........120 K.W.
Maximum mechanical work performed
by motor.......................101.5 H.P.

This mill load represents 75 per cent. to 80 per cent. of the capacity of the electrical apparatus (twentieth line, page 2).

In the metric system the equation for maximum labor performable by water-jets is as follows:

Water-power = (f . v . 2/2g) (1/76.04) Horse-Power.†

It is therefore necessary to establish the values for . f v as they appear by the items given by Mr. Leggett.

f must be expressed in a unit of area, which as the base of a column of 1 m. in length, gives a volume of 1 litre or of 0.001 of one cubic metre weighing, when of water, 1 kilogram, and such value, f, thus expressed, must represent the total section of jets ejected.

A nozzle-tip of 1 1/3" diameter has in the stated unit of expression a section as 0.9008; and eight of such tips are equal to an area f = 8 . 0.9 = 7.2. This value f multiplied by velocity of ejection, should give the precise water-quantity ejected per second unto the wheels.

Were this ejected water-quantity known, then there would be no doubt about the maximum of labor performable by the water-wheels. As this quantity is not stated in Mr. Leggett's report, the exclusively reliable source for calculating true velocity of jets, and consequent effective head is wanting, and these values must be determined from what other items are available.

Under a head of 355 feet. . 0.3048 ms = 108.2 ms., the jet would develop a velocity of

$$v = \sqrt{108.2 \cdot 2 \cdot 9.81} = 46.08 \text{ ms.},$$

and by $f \cdot v = 7.2 \cdot 46.08 = 331.776$ kgs., the water-power from the surveyed head would, if all effective, amount to

$$P = \frac{331.776 \text{ kgms.} \cdot 108.2,}{76.04} \text{ as } 100\% \text{ to } 472.09 \text{ H. P.}$$

But the pressure-gauge indicated a head of only lbs. 152 . 2.306 . 0.3048 . = 106.836 ms, and the thereby indicated velocity of jet is as:

$$v = \sqrt{106.836 \cdot 2 \cdot 9.81} = 45.78 \text{ ms.},$$

and by $f \cdot v = 7.2 \cdot 45.78 = 329.616$ kgm., the water-power, as indicated by pressure is as

$$P = \frac{329.616 \cdot 106.836,}{76.04} \text{ or as } (98.09\%) = 463.11 \text{ H. P.}$$

The pressure indicated at the foot of the stand-pipe signifies a loss of only 1.91% of efficiency, attributable to resistance in and by the stand-pipe. This loss appears as considerably higher, whenever at any point in the circular stand-pipe the diameter thereof is less than $d \cdot \sqrt[4]{\text{head}^1}$, "d" signifying the diameter of a circle that is equal in area to the sum of transverse sections of jets applied, and "head¹" signifying the elevation between the outflow and the point in the stand-pipe, which is under consideration. The width of the stand-pipe being 22", and the requirement by the standard rule calling for 18" only, the smallness of the loss of efficiency in the stand-pipe is thus accounted for.

But it is a matter of general and uncontested experience that the water quantity ejected, and represented by f . v, does in fact demonstrate a lower value for velocity, v, than it would appear by v, evolved from $v^2/2g$ for head as indicated by pressure.

As the water-wheel can not be charged with the force of water which does not touch the wheel, and as the maximum labor performable by a water-wheel is in consequence conditioned by the quantity of water that actually touches the wheel, the value for effective head in the equation for maximum labor performable by the wheel must necessarily be the value expressed by $v^2/2g$, in which v is the same value as it is in f v, representing the quantity of water ejected per second. In fact there are two different values for v in these two items, whenever head is measured either by survey or evolved from pressure measured by gauge. Therefore ejected quantity of water is exclusively the proper source from which v and the consequent $v^2/2g$ or head must be derived.

In the case under hand the ejected quantity of water is not stated, and therefore it has to be assumed on the basis of well established precedents. Thereby it appears that, as against indication by pressure, actual ejection amounts to from 92 per cent. to 95 per cent. only.

* Transactions American Institute of Mining Engineers, February, 1894.
† See author's "Solids Falling in a Medium." I., p. 8.

It is proper, therefore, not to charge the four Pelton wheels with a higher maximum performance than

$$\frac{0.92 + 0.95}{2} \cdot 463.11 \text{ H. P.} = 433 \text{ H. P.} = 91.72 \text{ per cent.},$$

But the manufacturers rated the efficiency of their water-wheels under the stated conditions as 60 H. P. each,

as 240 H. P. = 50.84 per cent.

The four 21″ Pelton water-wheels are set up to drive one Westinghouse 120 KW. constant-potential 12-pole dynamo.

As 1 g kilogram-metre = 1 watt, and 120,000 (76.04. 9.81) = 160 H. P., the work intended for the four water-wheels was, as against 472.09 H. P. in the falling water,

160 472 = 160 H. P. = 33.89 per cent.

But the work actually done by the dynamo did not amount to 120 KW, because all the work expected from the motor amounted to 101.5 H. P., which, with a loss of nearly 25 per cent., as allowed between dynamo and motor, gave 135.33 H. P., or 135.33/472.09 = 28.96 per cent. of the original power in the falling water.

And the motor turned over in reconverted mechanical work 101.5 H. P. or 101.5/472.09 = 21.5 per cent.

(*To be continued*).

IMPROVED ELECTRIC MOTOR.

After five years' fighting in the patent office a patent was issued on June 4 last, to Mr. Frederick Pearce, of 79 John street, New York, on an electric motor.

Mr. Pearce's specific invention consists of a device for making and breaking the circuit, which device dispens s with the necessity for a commutator.

Commutators are troublesome at the best, and the substitution of a means that will avoid the use of a commutator altogether is certainly a step in the right direction.

Mr. Pearce accomplishes this highly desirable end by providing a spring vibrating arm connected at one end to the frame of the motor, and set at right angles to the armature shaft. This vibrating arm is operated by a square or many-sided hard steel block, fixed upon the armature shaft. The free end of the vibrating arm carries one contact point, and an insulating block connected to the frame of the motor carries the other contact point. The contact points are closed and opened alternately by the action of the square

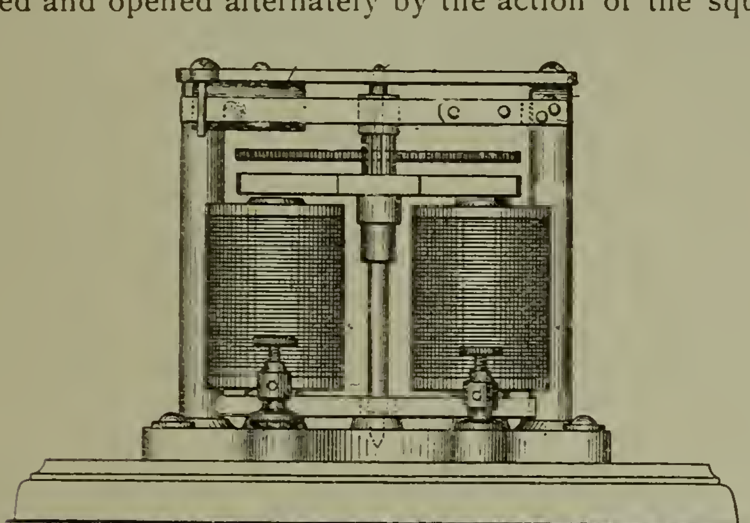


FIG. 1.

metal block, fixed to the rotating armature shaft, thus closing and opening the electric circuit. The contacts and breaks are so timed with reference to the relative positions of the armature and magnet poles that continuous motion is imparted to the armature and shaft—the circuit being closed as the arms of the armature *approach* the magnet cores and come within the magnetic influence, and then opened immediately after the arms pass the centre of magnetic influence. This operation is repeated during one rotation as many times as there are pairs of magnets and armature arms.

Reference to the accompanying illustrations will give a clear idea of the construction and operation of Mr. Pearce's invention.

Fig. 1 gives a front view of the motor; fig. 2 is a plan view, showing the details of the mechanism, and the small illustration shown in the left-hand upper corner of fig. 2 shows the vibrating arm, with its own and the opposite contact point.

This invention is more particularly adapted to small motors for light work, such as running show stands in store windows, and for similar devices.

Mr. Pearce's patent claim reads: "The combination

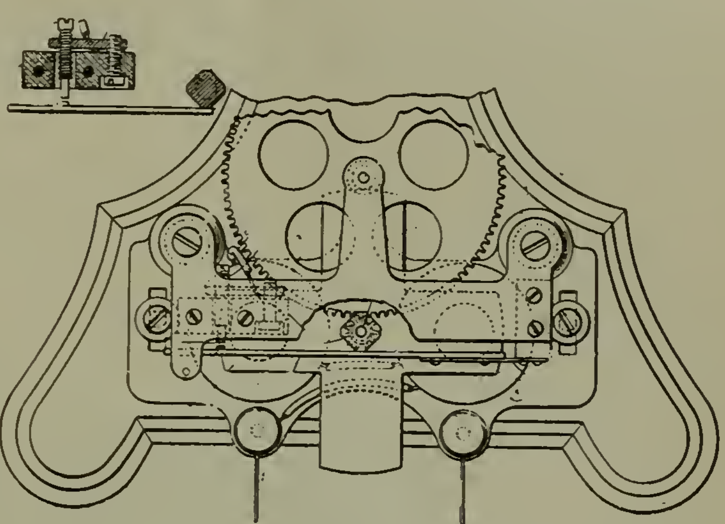


FIG. 2.

with the electro-magnets, armatures and rotating shaft, of a circuit-breaking arm and contact points. A spring fastened to one end of the arm and to a rigid support and a block on the armature shaft for vibrating the circuit breaking arm. substantially as specified."

This invention has been infringed with impunity while Mr. Pearce has all these years been trying to get his rights. His application was filed December 3, 1890.

ELECTRIC POWER IN MILLS AND FACTORIES.*

BY F. B. CROCKER, V. M. BENEDIKT AND A. F. ORMSBEE.

First Cost.—Practically the only objection which can be urged against the electric system is the fact that the first cost of installation is greater than with ordinary belting and shafting, but even this is questionable since the authors know of cases in which the estimated total cost of installing the necessary belting and shafting was actually greater than the equivalent electric motor outfit. The electric system would be cheaper, for example, in the case of very long or scattered buildings or those containing many stories or rooms, in any of which cases the belting and shafting required would be very complicated and expensive. The use of belting and shafting requires a much stronger and more expensive roof or ceiling than the electric system.

Saving of Power.—It might seem that the electric system would actually consume more power than the ordinary plan, since it involves two transformations of energy. In most cases, however, if the power has to be distributed to a number of machines, particularly if they are located at any distance from the engine, the loss of power is less with electric transmission. This is explained by the high efficiency of the dynamo and motor compared with the low efficiency of belt transmission as ordinarily practiced, involving as it often does very imperfect alignment and lubrication of the shafting. Perhaps the greatest saving, however, of the electric system is due to the fact that the consumption of energy entirely ceases when the tool stops. This stoppage in the case of the busiest tools amounts to at least 25 per cent. of the nominal working hours throughout the year and with large or special tools,

*Abstract of paper read at the Twelfth General Meeting of the American Institute of Electrical Engineers, Niagara Falls, N. Y., June 26, 1895.

which are not used so steadily, the stoppage is often as high as 50 to 75 per cent., since there are many whole days when they are not used at all.

Idleness due to strikes as well as to slack times must also be considered and would usually amount to quite a large percentage in ten years, for example. This assumes, of course, that a portion of the shop is running, which is usually the case even under such conditions. In short, with the mechanical system there is an enormous amount of shafting, idle pulleys and belting, which runs for long periods of time doing little or no useful work, but consuming considerable power.

Wherever electric motors can be substituted for a number of small engines scattered about, the saving in power is very great, not only because of the low efficiency of small steam engines, but also by the avoidance of condensation in long steam pipes.

Increased Output.—This is, perhaps, the most important advantage gained by the electric system, since after all the cost of power is a very small item, being, according to Mr. Richmond, only about one per cent. of the wages paid in average machine shop practice.

This increased output is secured by the greater convenience and promptness in starting and stopping, as well as in regulating the speed of the machinery. The workman can, for example, temporarily increase the speed when the conditions are favorable, thereby saving considerable time.

Flexibility.—The great convenience of moving the tools and placing them in any desired position is another great advantage of the new system. The great adaptability of this system is particularly well shown in the case of a factory which was almost completely destroyed by fire; nevertheless, a few uninjured tools in a remote end of the building were operated successfully by means of electric motors within two days after the fire.

Speed Regulation —The ordinary type o' motor used in factories is the plain shunt-wound machine fed with constant potential current. The motor is started and varied in speed by means of a rheostat in the armature circuit. This simple arrangement answers very well in most cases, but for variable speed between wide limits a series-wound motor controlled by a rheostat as in electric railway practice may be preferable. In other cases some special method of regulation such as the Leonard system, or the "boost and retard" plan may be adopted.

ALUMINUM ALLOYS.

Alloys of aluminum and gold, although interesting, are of little practical use except for decorative purposes. With 6 per cent. of gold the alloy is as white as pure aluminum, but more brittle, and with 10 per cent the product has a light violet brown color, is harder than aluminum, and works well at high temperatures only. A 15-per cent. gold alloy is almost white, with a violet shade, very soft, and a fine grained metal. An alloy of 50 per cent. gold is soft and spongy and possesses a beautiful violet color, while with 78 per cent. of gold it is very brittle and of a pinkish violet color. With 90 per cent. of gold the color is a pale violet, and with 94 per cent. it approaches a pink. Alloys containing small percentages of aluminum leave a bright violet color on the cupel under the blowpipe. An alloy of 50 per cent. gold. 45 per cent. copper, and 5 per cent. aluminum takes the color and polish of 14-carat gold, but easily tarnishes.

Alloys of aluminum with 4 to 8 per cent. of silver are harder than pure aluminum, are not brittle, and take a fine polish. The color is similar to that of fine silver.

An alloy of 50 per cent. nickel and 50 per cent. aluminum is of a dull gray color, very porous and too brittle to use. The following alloys of copper, nickel and aluminum are very strong, hard and fine grained: With 66 per cent. of copper, 24 per cent. of nickel, and 10 per cent. of aluminum an alloy is formed which takes a fine polish and has the color of 10-carat gold. With 55 per cent. of copper, 33 per cent of nickel and 12 per cent. of aluminum the color is a beautiful golden brown; and with 72½ per cent. of copper, 21¼ per cent. of nickel and 6¼ per cent. of aluminum the color becomes richer and deeper.

In melting aluminum the temperature should be kept even and not much above the melting point of the metal, which should be fed into the crucible in small pieces. The most useful flux is a little tallow. A crucible mainly of siliceous material must not be used, as the aluminum attacks the silicon.

In alloying, the aluminum is put into the crucible after the other metals have become liquid.

Aluminum may be cleaned and its mat restored by dipping for 1¼ minutes in a solution of 3 ounces of caustic potash or soda in a quart of water, than washing well, and dipping in a solution of three parts nitric and three parts sulphuric acid, by volume.

F. Andrews, after numerous experiments upon alloys of aluminum, has found that one composed of from 92 to 96 per cent. of the latter metal and 4 to 8 per cent of nickel is particularly valuable, since it possesses greater hardness than the pure metal without being brittle. It is well adapted to the manufacture of small articles of jewelry. The alloys of aluminum, copper and nickel are remarkable for their beautiful color, the ease with which they may be polished, and their hardness. In order to restore their metallic aspect, it suffices to immerse them for a few seconds in a 10 per cent. solution of caustic soda, wash them and then immerse them in a mixture composed of three par s of nitric acid and two of sulphuric.

The following is proposed by B. J. Roman as a solder for use with aluminum or aluminum alloys; Silver, nickel, aluminum, tin and zinc, are mixed in the following proportions: silver, 2 per per cent; nickel, 5 per cent; aluminum, 9 per cent.; tin, 34 per cent.; zinc, 50 per cent. No flux is necessary, and an ordinary soldering iron or tool may be used, though one of aluminum is said to be preferable.—*Aluminum World.*

GENERAL MEETING OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The twelfth general meeting of this society was held at the Cataract House, Niagara Falls, N. Y., on June 25, 26, 27 and 28, and was largely attended.

Some of the papers read, in full or in part, appear elsewhere in this issue, and others will be published in later issues.

On Tuesday afternoon (June 25), the members took carriages and visited the power house of the Niagara Falls Power Co., the Pittsburgh Reduction Co., the Carborundum Works, and the plant of the Niagara Falls and Buffalo Electric Light and Power Co.

On Wednesday afternoon the party walked across the upper Suspension Bridge and took a special train on the Niagara Falls Park & River Ry., stopping at Queenstown, the Whirlpool, Table Rock, Chippawa, etc.,

Thursday afternoon was devoted to individual trips to the Observation Tower, the Buttery Elevator, Prospect Park and other points of interest.

The History of Magnets.—To completely understand the behavior of a magnet we must not only know its present condition, but we must know how it got to that condition. In other words, we must know its past history, upon which so much depends in giving a knowledge of the magnet. For instance, a piece of steel once magnetized is not in the same condition as if it had never been in a magnetic field.

Heat anneals hard-drawn copper wire and reduces its tensile strength. This fact is important to remember in making solder joints in such wire.

A conductor cutting lines of force at the rate of 100,000,000, per second, will have induced in it an electromotive force of one volt.

SULZER-VOGT ELECTRIC ELEVATOR.

On account of their economy of space and maintenance, and other desirable features, electric elevators are rapidly growing in favor.

The machine illustrated herewith is made in the West—Louisville, Ky.—and applicable to freight and passenger service.

They are operated on the worm-gear principle, and all the parts—winding drum, gearing, motor and controlling apparatus are mounted on one heavy cast-iron bed-plate. The worm and worm-shaft are turned from one solid steel forging, and the anti-friction bronze worm-gear is enclosed with the worm, in a cast-iron case and run in oil to insure perfect lubrication and smooth running.

Both the brake lever and switch are operated by the cable in the hatchway or lever device on the car. Their movements are so timed that the instant the current is switched on the brake is released, and the moment the current is cut off the brake is applied.

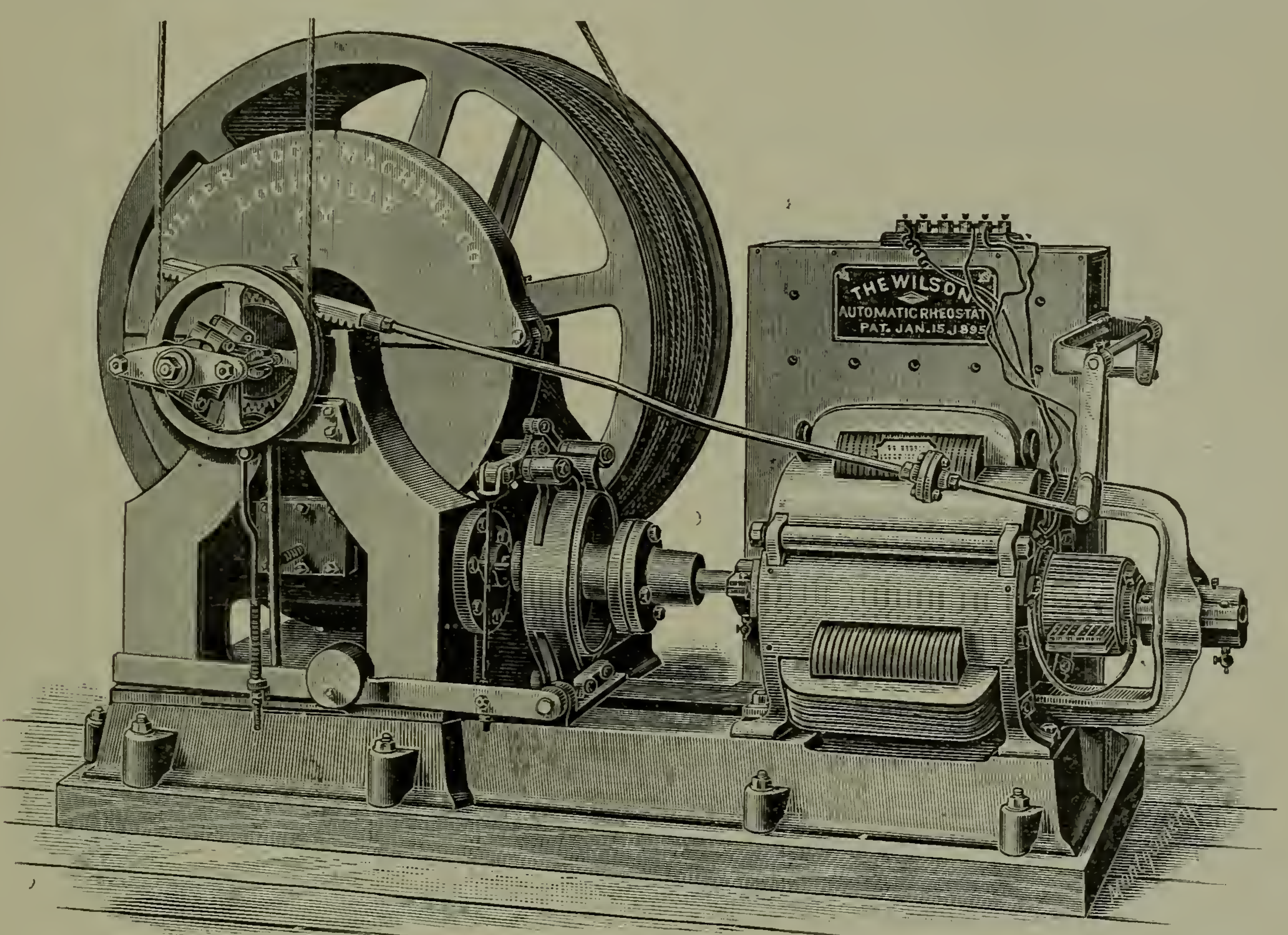
The motor is of the multipolar type, slow speed, long self-oiling bearings and with self-adjusting carbon brushes. It has a large margin of power and is self-regulating.

These elevators are provided with efficient safety appliances, and the controlling device is claimed by the manufacturers, the Sulzer-Vogt Machine Co., to be unequalled for simplicity, ease of inspection and freedom from repairs. Control is effected by the simple motion, up or down, of the hand rope. All the switches of the company's patent rheostat are of the double-pole, quick make-and-break type, and avoid the formatiom of destructive arcs.

The electrical parts of the machines are mounted on a polished marble slab, enclosed in an iron box, and insulated from other parts of the apparatus.

The advantages claimed for these elevators are ease, smoothness and promptness of starting and stopping; smooth running; uniform speed under all loads; fewness of parts; minimum attention and cost of maintenance, and economy of space.

Several large well-known concerns in the West are using these elevators.



SULZER-VOGT ELECTRIC ELEVATOR.

EFFICIENCY OF THE INCANDESCENT LAMP.

The difficulty with the incandescent lamp has been such as to narrow down all fields of investigation to one point, that is, the production of a filament capable of standing a higher temperature without the usual shortening of life that always ensues when such is attempted.

Refractory materials of all kinds have been used and numberless experiments have all resulted in the same failures. It would require about five volts' greater pressure to double, and not more then ten volts to triple the light developed by a sixteen candle-power lamp. What composition the filaments of later lamps will be is very difficult to say, but, whatever they are made of, the watt consumption per candle should be cut down to one-half of its present rate. It is possible to take any three-watt lamp and by applying greater pressure make it, while it lasts, a two-watt lamp. The effect of too great a pressure is well known—shortening the life, blackening the globe and making it generally useless.

With the present cost of the lamp, some isolated plants prefer to run at an abnormal candle-power. This always results in heavy bills for lamps. It is very likely that the next few years will witness some radical change in filament construction. An inoxidizable filament which could be raised to any high pitch of incandescence within reasonable limits would fill the bill to perfection.

The efficiency, which at present is not more than two to three per cent. at the most, can therefore be remedied only in one way, and that is the use of a material capable of withstanding a temperature bordering upon fusion. The statement that all things have been tried goes for naught. There is still room for untiring workers.

The efficiency of a dynamo is determined by comparing its power (amperes × volts = watts) with the mechanical power expended in moving the dynamo. For instance, if a dynamo absorbs 100 horse-power from the engine and returns 90 electrical horse-power, its commercial efficiency is 90 per cent.

THE NANTASKET BEACH ELECTRIC RAILROAD.

On June 25 motor car No. 2500 on the electrical branch of the New York, New Haven and Hartford Railroad pulled and pushed between 450 and 500 tons in a haulage trial. The test gave great satisfaction to the officers of the road, and was conducted for about two hours between the Old Colony House Station and Nantasket.

The opinion was expressed by several of those directly interested that the motors could easily handle twice and even three times the tonnage hauled.

Motor No. 2500 is a car equipped with four electric motors. It hauled a train of heavily loaded freight cars and started off with its load with great ease. The train ran at a speed of 25 miles an hour or more, with plenty of power to spare. Five more loaded cars were coupled to the train, increasing the load to over 450 tons, but the motor car handled its load apparently with the same ease as before.

It is stated that the officials of the road are satisfied that the electrical equipment is alike practical for passenger and freight service.

One of two tracks will be reserved for the electrical service, which was put into regular operation on Sunday last.

Electrician Wells, of the railroad company, is now engaged in instructing firemen of the Plymouth division in their new duties as motormen. The electric trains will be run by picked employés.

FOREIGN NOTES OF INTEREST.

Sweden has increased the duty on incandescent lamps about 40 per cent.

An electrical exhibition will be held in Carlsruhe next September.

Electrically propelled omnibuses will be put into service in a few weeks between Liverpool street and Hammersmith, London.

A new process of extracting gold from its ore has been devised by Mr. C. Lorsen. He electrolyzes a solution of bromide of potassium and thereby obtains an alkaline solution which contains hypobromide and bromate, which is capable of dissolving gold. The ore is treated with an excess of this solution by rotating cylinders. The solution is then filtered, the gold precipitated by passage over a mixture of iron and coal, and the solution, which now contains bromide of potassium mainly, is once more electrolyzed, and again used for extraction.

Experiments made by Herr Dammeyer in the sugar mills at Ottleben in refining by means of electricity seem to have resulted satisfactorily, according to the *Elektrotechnische Zeitschrift*. The analysis of the resulting product when electricity was used, with an admixture of 2 per cent. of lime, was: sugar, 89 per cent; other organic substances, 3.67 per cent.; salts, 2.65 per cent.; water, 4.98 per cent. Another experiment, without electricity being employed, and with an admixture of 3 per cent. of lime, gave: sugar, 86.8 per cent.; other organic substances, 4.31 per cent.; salts, 3.31 per cent.; water, 5.58 per cent. In the electric process there was also a gain in by-products, and crystallization took place quicker.

Lightning's Destructive Work.—On June 26, during a violent thunder-storm, the depot of the street railway in Hull, England, was struck by lightning and destroyed by the resulting fire.

At an agricultural show at Darlington, England, two persons were killed and three injured by lightning.

On June 27 a ship carpenter, named Donovan, was killed by a stroke of lightning in Brooklyn, N. Y. During the same storm an ash-cart driver was knocked from his perch by a lightning bolt and severely hurt. Several chickens and goats were killed in the same locality by the lightning.

NO MORE CABLE CARS IN PHILADELPHIA.

A few days more will witness the ending of the cable system as a means of passenger transportation in Philadelphia. Within a week every remaining cable car on the Market street main line, the last link in the cable system, will be displaced by the trolleys. The passing of the cable cars marks a step in the progress of street railway facilities in Philadelphia. When the system was introduced it was looked upon as a solution of the problem of rapid transit, and on the strength of this opinion the Philadelphia Traction Company invested a fabulous sum, estimated to be in the neighborhood of eight million dollars, in equipping the Market street, Columbia avenue, and Seventh and Ninth street lines.

But while they were an improvement over the jogging horse cars, they by no means proved satisfactory, and it is with no regret that the cable system has followed the horse-car lines in giving place to the trolleys. The cost of construction of the cable lines was enormous in comparison with the equipment of the trolley lines, the cost of operation was greater, and the service rendered was less efficient. As a consequence the cable cars have been forced out of service by the system, which has demonstrated its superiority.—*Philadelphia Record.*

ELECTRIC GOLD DREDGING PLANT.

An interesting account was given recently by Mr. Robert Hay, of the application of water-power in producing electricity for use in gold dredging in Shotover River, New Zealand. The water is obtained at a creek 1½ miles distant from the dredging ground, and brought by a race cut in the side of the hill, or, in places where the ground is not suitable, in a timber flume to a pressure-tank at a level of 524 feet above the pipe at the generator-house. From this tank to the Pelton wheel the water is carried in rolled-steel pipes, constructed in lengths 19 feet, six inches, bolted together by wrought-iron flanges riveted to the pipes. The prime mover of the generating plant is a four-foot Pelton reaction water-wheel, upon the buckets of which the water, from a nozzle 1½ inch in diameter, impinges at a pressure of 228 pounds per square inch. This wheel drives two series-wound dynamos working at a normal speed of 700 revolutions per minute, each developing a current of 40 amperes, at an E.M.F. of 650 volts, or nearly 70 horse-power. The dynamos are coupled in series. The conductors, of a length of two miles, are of No. 4 S.W.G. bare copper wire, and are supported upon insulators carried by cross-arms upon old 40-pound rails. The current is conducted to two motors in the dredge, one for driving a centrifugal pump and the other for operating the buckets, winches and revolving cylinder. These two machines are duplicates of the dynamos, and are coupled in series, so that when the bucket motor is switched off, the pump motor absorbs the surplus power by increasing the speed of the pump, and causing it to throw more water. The dredge is constructed for the most part of steel, and is capable, when operating at a depth of 20 feet, of an output of 90 cubic yards per hour. The dredgings are delivered through a revolving screen, for separating the stones and coarser material, upon baize tables set at an inclination of one in twelve. Two 10-ampere arc lamps light the dredge at night, and are joined in multiple series with the motors, with suitable arrangements for their control. The cost of the installation and the weekly working expenses are £7,000 and £35 respectively.

The Origin of the "Characteristic" Curve.—The application of the curve to exhibit the working of a dynamo is due to M. Deprez and to Dr. Hopkinson. In 1879, Dr. Hopkinson pointed out the advantages in the use of the curve. In 1881, Deprez, who had developed the method and applied it to many useful purposes, suggested the term "characteristic" curve, which proposal met with general adoption.

A NEW NON-INFRINGING TELEPHONE.

A public exhibition is being given in the Bullitt Building, Philadelphia. of a non-infringing telephone system, consisting of the Gould-Smith metallic circuit switchboard, of the Eastern Electrical Mfg. Co., and the M. and B. Standard Exchange Telephone.

These companies will put their appliances in the telephone field as a competitor of the Bell Company without any fear of legal interference.

The fundamental principles of operation are entirely opposite to those in use at present, and are productive of the most satisfactory results in quick work, accuracy and secrecy, and the system embraces many novel features.

A subscriber in calling up the main office, by a few turns of the crank of the magneto bell generates a current which automatically opens his own line at the central office and displays a visual signal to the operator at the board. This proves at once the completeness of his circuit, as the bell, in case of trouble, would continue to respond to the current produced by the generator.

This one convenience alone is a most admirable feature of the new system, as it overcomes all the perplexing doubts in a subscriber's mind, who can get no response from the main office in cases of wire trouble, while in this way he notifies himself at once if his circuit is or is not in complete working order.

At the switchboard in the central office the subscriber's call is indicated to the operator by a plunger, which is thrust outward by the release of a spring governed by a magneto coil placed in circuit at the back of the board and controlled by the current generated by the subscriber who calls.

When the required connection is made it is utterly impossible for the operator or any other person to cut in circuit as a listener, or in anywise interrupt the conversation, secrecy being thereby assured.

A most ingenious and novel device to prevent the possibility of neglecting or forgetting to "call off" is the attachment of the Gould receding book, which disappears into the box the instant the receiver is released, and cannot be used again to hang the receiver on until the subscriber rings off, which act immediately causes its reappearance. The value of this as a safeguard against unnecessary loss of time is apparent.

The switchboard is a most compact and complete arrangement, and permits the most rapid manipulation of 100 subscribers by a single operator without moving from the chair. It is so constructed that 50 subscribers can talk to the other 50 through the same board simultaneously—an advantage over the present method which is a revelation to all who understand telephone switchboards.

This switchboard is also exempt from being burnt out by powerful currents from electric light, trolley wires. or by lightning. The crossing of the 'phone wire will effect the instant breaking of the circuit in the terminal office, as was practically demonstrated by cutting in a current of 110 volts to illustrate the correctness of the claim.

The long distance or toll line switch is so constructed that neither cords, plugs nor pegs are used, but every connection is made by a system of sliding contacts which cannot in any way be broken.

The transmitter is constructed on the make-and-break principle, which has been all along contended by the Bell Company as being unworkable. The perfection to which this system has been brought is quite remarkable, producing the clearest articulation and conveying a whisper with distinctness that cannot be excelled.

This transmitter cannot get out of adjustment, as the contact with the diaphragm is made by a light sphere of carbon which is attracted to it by gravity and repelled by the sound waves produced by the speaker.

Harry M. Shaw, 126 Liberty street, New York, has added a very attractive saleslady to his force. She is amply able to take care of all orders from customers, and no doubt will attract business. Large orders for Paiste switches, sockets, etc., are coming in daily.

GOOD FISHING IN BOSTON.

The Thomson-Brown Electric Co., Boston, Mass., has just bought a large, handsome yacht, fitted out with all conveniences and comforts, and on Tuesday, Wednesday and Thursday each week entertains its customers on a fishing trip. Big fish stories will be all the go now.

THE WESTON COMPANY'S NEW PLANT.

The Weston Electrical Instrument Company, Newark, N. J., the well-known manufacturers of Weston instruments, will build a large plant in Waverly, N. J. The company has bought 48 acres of land, on which will be erected the factory and cottages for the employés. The company, it is stated, will engage in a new line of work besides the manufacture of standard ammeters and voltmeters, and the plant will be one of the most complete of the kind in the country.

THE BICYCLE AS AN EDUCATING AGENT.

The bicycle is, in fact, the agent of health and of a wider civilization. It will give stronger bodies to the rising generation than their fathers have had, and it will bring the city and the country into closer relations than have existed since the days of the stage-coach. What the summer boarder has been doing for the abandoned farms and deserted villages of New England, the wheelman is doing for ths regions surrounding our great cities. He is distributing through them modern ideas and modern ways of living, and is fructifying them with gentle distillations of city wealth. Above all, he is teaching their people that a sure way to prosperity lies before them in the beautifying of the country in which they live, and in the preservation of all its attractive natural features.—Editorial in the July *Century*.

A WORK OF ART FOR TOURISTS.

This year's edition of "Health and Pleasure on 'America's Greatest Railroad'" is the most elegant production of the kind we have ever seen. In every particular it is a work of art, and it is deeply entertaining and instructive. It has no less than 504 pages, and is profusely illustrated with high-class half-tone engravings. There is a fine map of the New York Central's system and its main connections, and a very complete one of the Adirondack region, through which a branch line of the New York Central passes to the north. This latter road is a very popular one among tourists to these famous mountains. There is also a very complete map of the lake region in New York State, and a birds'-eye view map of the St. Lawrence River and Thousand Islands, embracing the region from Buffalo to the Saugenay River, a distance of 800 miles.

The book is descriptive of summer resorts and excursion routes, embracing more than one thousand towns by the New York Central and Hudson River Railroad.

The passenger department of this famous railroad is entitled to a great deal of credit for the enterprise and taste exemplified in this elegant work. A great deal of pleasure is derived in the perusal of its pages, every one of which has at least one elegant half-tone engraving illustrating a town, a city, or some special point of interest along the line. Those who have travelled over this road know that the comforts and pleasure afforded cannot be exaggerated by beautiful pictures. The pictures in this book are really charming, and create a great desire to visit the various places so illustrated.

Ten 2 cent stamps will secure a copy of this valuable book from George H. Daniels, general passenger agent of the New York Central Railroad, New York.

Very high insulation in telephone circuits is a disadvantage, so far as clearness of transmission is concerned.

Financial.

Among the securities listed on the New York Stock Exchange on June 27, were the following:

Edison Electric Illuminating Company of Brooklyn's additional issue of first mortgage 5 per cent. gold bonds, $350,000, to be listed on July 1, making total amount listed at that date $850,000; also to be listed on the same date additional capital stock, $750,000, making a total of capital stock listed of $3,750,000.

Edison Electric Illuminating Company of New York, first consolidated mortgage 5 per cent. gold bonds, $1,897,000. The committee on stock list is empowered to list like bonds up to $2,188,000, when officially notified that said bonds have been issued in exchange for Manhattan or Harlem bonds.

Lexington Avenue and Pavonia Ferry Railroad Company's first mortgage 5 per cent. guaranteed gold bonds, $5,000,000.

Columbus and Ninth Avenue Railroad Company's first mortgage 5 per cent. guaranteed gold bonds, $3 000,000.

St. Paul City Railway Company's cable consolidated mortgage 5 per cent. gold bonds, $3.618,000.

Minneapolis Street Railway Company's first consolidated mortgage 5 per cent. gold bonds, $4,050,000.

Twin City Rapid Transit Company's 7 per cent. cumulative preferred stock, $1,135 200, and common stock, $15,010,000.

Telephone Notes.

E. B. Young. J. M. Edmonson and T. J. Ramson have been elected directors of the recently organized telephone company in Eufaula, Ala.

The Hamburg & Portland Telephone Company has just been organized in Hamburg, Ark. The incorporators are J. D. Pugh. Chas. M. Woodward. J H. Pryor, T. R. Pugh, and T. B. Savage. The company will construct a telephone line to Portland, a distance of 25 miles.

S. B. Kinard, Jackson, Ga., will build a telephone system in that place.

The Phoenix Construction Company, Indianapolis, Ind., has absorbed the Mankato Telephone and Telegraph Company, Mankato, Minn.

The *Chicago Tribune* says: "The Bell Telephone Company has taken the necessary legal steps to secure possession of the remainder of the earth."

The Schuylkill Telephone Company, Ashland, Pa., has been incorporated by William A. Marr and others. Capital stock, $25.000.

The Newark Mutual Telephone Company, Newark, N. J., by Ernest J. Ford, of Jersey City; P. J. Atkinson, of New York City, and Samuel I. Boyd, of Brooklyn, N. Y. Capital stock, $300,000.

The Magic City Telephone Co., Barberton. Ohio, by W. S. Holloway, John McNamara, F. G. McCauley, George A. Shaw and others.

The Framingham Telephone Co., Framingham, Mass, has been incorporated to furnish a telephone service in Framingham and Natick, with a capital stock of $15,000.

The St. Clair Telephone Co, Appleton, Mo., has been incorporated by C. E. Robinson and J. M. Burns.

The Oberlin Telephone Co., Oberlin, Ohio, has been incorporated with a capital stock of $10,000.

Fredonia Telephone Co., Fredonia, Kan., has been incorporated by Chas. L. Morton, F. W. Severson, A. C. Flack, G. S. Paulen and Atwood Cady. Capital stock, $5,000.

Street Railway Notes.

The Buffalo, Gardenville and Ebenezer Railway Co., Albany, N. Y., has been incorporated with a capital stock of $40,000.

A company is to be formed in Cumminsville, Ohio, to construct an electric street railroad from Cumminsville to Mt Airy. The company is to be composed of citizens of Green and Colerain Townships and property owners along the proposed line and vicinity. The capital stock will be $100,000.

A stock company has been formed in Towson, Md., by Geo. A. Meeter, Dr. W. Crim, S. J. Carr, of the Carr-Lowery Glass Co.; William F. Porter, of Johns & Porter, and others, for the purpose of building an electric railway to connect Mt. Winans, Westport, Landsdown and Meeter's Park with Baltimore. Capital stock, $75,000.

The Topeka Electric Railway Company, Topeka, Kan., has been incorporated to build an electric road between Topeka and Rossville.

The Michigan City and La Porte Street Railway Company, La Porte, Ind., has been incorporated by H. B. Tuthill and others. Capital stock, $10,000.

The North Trumbull Rapid Transit Co., North Trumbull, Ohio, has been organized in Trumbull County, for the purpose of building an electric road for both freight and passenger traffic from Kinsman to Mesopotamia, where it will connect with a projected line to Cleveland.

D. C. Rice, J. L. Girton, and others, Winchester, Tenn., are making arrangements to build an electric road from the Tennessee River to the property of the Tennessee and Alabama Land, Mining and Railway Company.

New Corporations.

The Electric Protection Co., Dallas, Tex. Capital stock. $50,0000; incorporators, Charles Goldstein, Henry Hirsh, and Wm. H. Garretson.

The Charleston Electric Company, Charleston, Ill., has been incorporated by Richard Cadle and others, with a capital stock of $5,000.

Washington & Tyler Electric Light and Power Company, Washington, Pa., by Arthur Kennedy, Francis J. Torrence, of Allegheny, Thomas Hutchinson, of Pittsburgh, John N. Mordock and John W. Vester, of Washington. Capital stock, $10,000.

The Union Electric Company, Charleroi, Pa., has made application for a charter to supply light, heat and power, by means of electricity, to the public. John A. Irwin, James S. Carr, Harry W. Gleffer, Henry S. Stewart and others are the incorporators.

North American Light and Power Company, Beatrice, Neb., by Frank A. Paddock and Ex-Senator A. S. Paddock, of Omaha. Capital stock, $1,000,000.

Consumers' Light and Power Company, Spokane, Wash., by W. R. Newport, A. D. Hopper, J. W. Binkey, M. J. Waller, and others. Capital stock, $250,000.

The People's Light, Heat and Power Company, Denver, Col., by William H. Brevoort, Chas. F. Lacombe and Samuel E. Campbell. Capital stock, $100,000.

The American Construction and Improvement Company, Camden, N. J., with a capital stock of $100,000, to construct and repair railroads, gas and electric works, etc.

The C. J. Field Company, New York, N. Y., by Cornelius J. Fields, of Brooklyn, Frank Bourne, of Mount Vernon and John W. Gilmore, of New York City. Capital stock, $4,000.

The Stadacona Water, Light and Power Company, Montreal, Can., by Louis H. Tachie, Joseph O. C Mignault, Ernest Belanger, and others. Capital stock, $200,000.

The Electric Protection Co , Dallas, Texas, by Charles Goldstein, Henry Hirsh, and Wm. H. Garretson, to supply electric devices for the protection of vaults, etc. Capital stock, $50,000.

Bullard Electric Co., Chicago, Ill., by Charles W. Bullard, Albert S. Bullard, Carl F. Kammeyer, with a capital stock of $25,000.

Possible Contracts.

A Boston company is building a factory in Columbus City, Ala., for the manufacture of electrical apparatus.

Address F. W. Wood, Canton, Sparrow's Point & North Point Electric Railway Co., Baltimore, Md , concerning a new power house which that company intends to build.

The Southern Railway Co. will build a new station in Atlanta, Ga.

Bruce & Morgan, Atlanta, Ga., are preparing plans for a temporary 225-room hotel, for use during the exposition in that city.

A new city hall will probably be built in Brunswick, Mo. The mayor of that place can give further particulars.

C. W. Bulger, Galveston, Tex., is the architect of the new Y. M C. A. building to be erected in that city. Contracts have not yet been let.

The Baltimore Traction Co., Baltimore, Md., will make an extension to its lines. The City and Suburban Railway, of the same city, contemplates opening its lines from Catonsville to Bonne Brae Cemetery. Address President Nelson Perin for further particulars.

A municipal electric light plant will be established in Fremont, Neb.

Worthington, Minn., will build an electric light plant of its own, an appropriation of $15,000 having been voted for the purpose.

F. Lockfield, Waco, Texas, has been granted a franchise to build an electric plant which is to be in operation by October 1, next.

Trade Notes.

McLeod, Ward & Co., Thames Building, New York, have issued an illustrated circular descriptive of the Van Houton Rotary Ventilating Fans. These fans are very artistic in design; copper and nickel-plated and with hand-painted blades. They are very attractive and easily kept clean. They come in different styles, adapted for use in all places. This firm also deals in Lundell direct-current fans, Meston A. C. fans and Dayton Electric Ceiling fans.

WOVEN WIRE BRUSHES.

The Belknap Motor Co., of Portland, Maine, are the patentees and manufacturers of the best woven wire commutator brush on the market.

National Electric Light and Street Railway Associations.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

President, C. H WILMERDING Chicago, Ill.; 1st Vice-President, FREDERIC NICHOLLS, Toronto, Canada; 2d Vice-President, E. F. PECK, Brooklyn, N. Y.

Members of Executive Committee: E. H. DAVIS, Williamsport, Pa , (one year); W. R. GARDINER, Pittsfield, Mass.; GEORGE A. REDMAN, Rochester, N Y.; J. J. BURLEIGH, Camden, N. J Next meeting, New York, May or June, 1896.

AMERICAN STREET RAILWAY ASSOCIATION.

Next meeting, Montreal, Que., October, 16, 17 and 18, 1895.

President, JOEL HURT, Atlanta, Ga.; Vice-President, W WORTH BEAN, St., Joseph, Mich ; 2d Vice-President, JOHN M. CUNNINGHAM, Boston, Mass.; 3d Vice-President, Russell B. Harrison, Terre Haute Ind., Secretary and Treasurer, WILLIAM J. RICHARDSON, Brooklyn, N. Y.; Executive Committee, HENRY C. PAYNE, Milwaukee, Wis ; W. H. JACKSON, Nashville, Tenn.; D. G. HAMILTON, St. Louis, Mo., C.C. CUNNINGHAM, Montreal, Canada; J. N. PARTRIDGE, Brooklyn, N. Y.

NEW YORK STATE STREET RAILWAY ASSOCIATION.

Next meeting, Albany, N. Y., third Tuesday in September, 1895

President, G. TRACY ROGERS, Binghamton; First Vice-President, JOHN H. MOFFITT, Syracuse; Second Vice-President, W. W. COLE, Elmira ; Secretary and Treasurer, WILLIAM J. RICHARDSON; Brooklyn ; Executive Committee, D. B. HASBROUCK, New York; JOHN N. BECKLEY, Rochester; DANIEL F. LEWIS, Brooklyn.

OHIO STATE TRAMWAY ASSOCIATION.

Next meeting, fourth Wednesday in September, 1895.

President, ALBION E. LANG, Toledo; Vice-President, W. J. KELLY, Columbus; Secretary and Treasurer, J. B. HANNA, Cleveland; Chairman Executive Committee, W. A. LYNCH, Canton.

MASSACHUSETTS STATE STREET RAILWAY ASSOCIATION.

President, T. H. CUNNINGHAM, Boston; Secretary and Treasurer, A. S. BUTLER, Lawrence; Executive Committee, SAMUEL WINSLOW, ALFRED A. GLAZIER, Boston; P. F. SULLIVAN, Lowell; E. C. FOSTER, Revere; HORACE B. ROGERS, Brockton; A. E. SMITH, Springfield; PRENTISS CUMMINGS, Boston.

THE TEXAS STREET RAILWAY ASSOCIATION.

President, W. H. SINCLAIR, Galveston; vice-president, C. A. MCKINNEY, Houston; Secretary and Treasurer, C. L. WAKEFIELD, Dallas. Directory: The officers and W. H. WEISS, San Antonio and GEORGE B. HENDRICKS, Fort Worth.

Next meeting, Galveston, third Wednesday in March, 1896.

PENNSYLVANIA STATE STREET RAILWAY ASSOCIATION.

Next meeting, first Wednesday in September, 1895.

President, JOHN A. RIGG, Reading ; First Vice-President, ROBERT E. WRIGHT; Secretary, S. P. LIGHT, Lebanon; Treasurer, W. H. LANIUS, York.

THE MAINE STREET RAILWAY ASSOCIATION.

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MICHIGAN STATE STREET RAILWAY ASSOCIATION.

President, W. L. JENKS, Port Huron; Vice-President, W. WORTH BEAN, St. Joseph ; Secretary and Treasurer, B. S. HANCHETT, JR., Grand Rapids; Executive Committee, the OFFICERS and DAVID H. JEROME, Saginaw, and STRATHERN HENDRIE, Detroit.

THE STREET RAILWAY ASSOCIATION OF THE STATE OF NEW JERSEY.

President, THOS. C. BARR, Newark, Vice-President, W. S. SCULL, Camden ; Secretary and Treasurer, CHARLES Y. BAMFORD, Trenton; Executive Committee, OFFICERS and C. B. THURSTON, Jersey City; H. ROMAINE, Paterson S. B. DOD, Hoboken.

Electrical and Street Railway Patents.

Issued June 25, 1895.

541,459. Combined Insulator and Fuse-Holder. Charles F. Scott and Harry F. Davis, Pittsburgh, Pa, assignors to the Westinghouse Electric and Manufacturing Company, same place. Filed July 16, 1894.

541,460. Electric-Arc Lamp. Albert W. Smith, Washington, D. C. Filed Apr. 25, 1895.

541,465. Electrolytical Process and Apparatus. Claud T. J. Vautin, London, England. Filed June 26, 1894. Patented in England July 12, 1893, No. 13,568.

541,466. Automatic Life-Guard for Cars. Clara M. Beebe, Elmira, N. Y. Filed Oct. 6, 1894.

541,467. Method of Preventing Electrolysis of Pipes Under Ground. Harold P. Brown, New York, N. Y. Filed Dec. 10, 1894.

541,468. Car-Fender. Robert Bustin, St. John, Canada, assignor of five-sixths to Robert Keltie Jones, same place, and Wesley Vanwart and John R. McConnell, Fredericton, Canada. Filed Apr. 17, 1895.

541,471. Electromagnet. Fred. B. Corey, Boston, Mass. Filed Apr. 15, 1895.

541,473. Fuse-Block. Harry P. Davis and Charles F. Scott, Pittsburgh, Pa., assignors to the Westinghouse Electric and Manufacturing Company, same place. Filed Oct. 23, 1893.

541,491. Repairing Incandescent Lamps. Joseph Möhrle, Munich, Germany. Filed Jan. 25, 1895. Patented in Germany Oct. 3, 1890, No. 58,802; in England Oct. 18, 1890, No. 16,613; in France Oct. 20, 1890, No. 208,976, and Feb. 17, 1882, No. 225,731; in Belgium June 2, 1891, No. 95,085; in Sweden Nov. 3, 1891, No. 4,011; in Switzerland Nov. 4, 1891, No. 4,243; in Spain Nov. 23, 1891, No. 2,479 and No. 12,647; in Denmark Feb. 3, 1892, No. 588 91; in Austria-Hungary Mar. 1, 1892, No. 51,994 and No. 4,471, and in Italy Mar. 31, 1892, No. 31,114.

541,497. Electric-Elevator Apparatus. Francis B. Perkins, Boston, Mass., assignor to the National Company, Chicago, Ill. Filed Dec. 15, 1892.

541,500. Electrical Controller for Motors. Oscar H. Pieper and Alphonse F. Pieper, San Jose, Cal. Filed Apr. 30, 1894.

541,541. Carbon Electrode for Electric-Arc Lamps. Salomon Heimann, New York, N. Y., assignor to Leopold Katzenstein, same place. Filed Oct 5, 1894.

541,542. Automatic-Working Rheostat for Starting Electric Motors. Frank E. Herdman, Winnetka, Ill. Filed Nov. 24, 1894.

541,543. Automatic-Working Rheostat for Starting Electric Motors. Frank E. Herdman, Winnetka, Ill. Filed Nov. 24, 1894.

541,544. Electric Motor. Frank E. Herdman, Winnetka, Ill. Filed Nov. 27, 1894.

541,545. Electric Brake-Controller. Frank E. Herdman, Winnetka, Ill. Filed Dec. 18, 1884.

541,577. Car-Fender and Snow-Cleaner. Charles A Smith, Philadelphia, Pa., assignor of two-thirds to Benjamin W. Grist and Wm. Schoderer, same place. Filed Nov. 21, 1894.

541,603. Electric-Arc Light. Edgar A. Edwards, Cincinnati, Ohio. Filed Sept. 19, 1894.

541,604. Alternating-Current Motor. Rudolf Eickemeyer, Yonkers, N. Y. Filed Sept. 23, 1891.

541,608. Electric Switch. William P. Hancock, Everett, Mass Filed Feb. 7, 1895.

541,615. Transmission of Power by Alternating Currents. Fred. S. Hunting, Fort Wayne, Ind. Filed Jan. 19, 1895.

541,641. Electric Motor. William J. Still, Toronto, Canada, assignor to Charles Riordon, same place. Filed Aug. 9, 1894.

541,719. Burglar-Alarm. Charles M. Clark, New York, N. Y. Filed Apr. 12, 1895.

541,723. Electric Gas-Lighter. John L. Creveling, New York, N. Y. Filed Jan. 21, 1895.

541,724. Thermo-Controlled Electrical Heater. Levitt E. Custer, Dayton, Ohio. Filed Dec. 22, 1894.

541,726. Car-Fender. Frank W. Darling, Hampton, Va. Filed Jan. 30, 1895.

541,730. Conduit Electric Railway. Edward Ebi, Cedar Rapids, Iowa. Filed July 5, 1894.

541,770. Car-Fender. Isaac Macowsky, New York, N. Y. Filed Jan. 3, 1895.

541,771. Car-Fender. George W. Mahan, Cold Spring Harbor, N. Y. Filed Mar. 15, 1895.

541,796. Trolley-Finder. James P. Taylor, Fort Worth, Texas. Filed Mar. 12, 1895.

541,798. Device for Removing Resistances in Starting Electric Elevators. George H. Whittingham, Baltimore, Md., assignor to the Automatic Switch Company, of Baltimore City, Maryland. Filed May 24, 1894. Renewed Feb. 18, 1895.

ELECTRICAL AGE

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NEW YORK, JULY 13, 1895.

CONTENTS.

WANTED, A RELIABLE BRAKE.

During the past few days a series of trolley-car accidents of like nature have occurred in different parts of the country, which emphasize the importance of utilizing reliable and powerful brakes on electric cars. On July 8 a car was derailed in Buffalo, N. Y., after having descended a steep grade at frightful speed—the brakes having failed to work. Several Italian laborers were injured. In East Liverpool, Ohio, on the same day, a trolley car became unmanageable on a hill and descended with great rapidity. The combination of a sharp curve at the foot of the hill and the high velocity of the car resulted in disaster to the vehicle. It was overturned and one man was killed. In the latter case the wheels of the car slid down the rails, owing to the wet condition of the track. Slipping wheels is very common in wet weather, even on the level, and it is surprising that cars can be stopped at all on hills under such conditions. Many accidents are directly traceable to this fact, and it would seem that an invention that would positively avoid this danger would find ready adoption on all large electric roads. There are some excellent brakes on the market, but they do not prevent the slipping of the wheels.

THE LIGHTNING FLASH.

One of the oldest yet most awe-inspiring of natural phenomena is the blinding flash and deep reverberation of the lightning discharge. It has played its part in developing religious convictions and in exercising a powerful influence upon the history of the earlier races. It will forever cause the bravest amongst us to hesitate when its rapid gleam appears upon the horizon. The great force of lightning discharges is familiar to all. Flashes of thousands of feet in length represent stored energy of a tremendous tension. The common opinion that prevails calls the discharge as commonly witnessed *a lightning discharge.* This is not so, because a disruptive discharge under such circumstances is a *succession of discharges,* which pass back and forth with such violence and rapidity that to the senses they appear to be but one. Millions of alternate flows per second, and a pressure correspondingly large, constitutes the most marvellous of observed phenomena—the lightning flash.

DEATH BY ELECTRIC SHOCK AND ARTIFICIAL RESPIRATION.

The cause of death in electric shocks has not yet been positively determined, and upon the solution of this important question depends largely the solution of another equally important matter, and that is, whether it is always possible to restore life by artificial respiration after a heavy shock. Dr. A. M. Bleile, of the Ohio State University, read a paper on this subject at the Niagara Falls meeting of the American Institute of Electrical Engineers, in which he described in detail a series of experiments made by himself to determine the real facts in such a case. The results of his work, however, were of a negative character; he did not definitely settle the question. He did, however, add considerable to existing knowledge on the subject, and no doubt persistent efforts on the part of himself and others will finally determine the true cause of death in electric shock. Dr. Bleile thinks that death is caused by the current producing a contraction of the arteries through an influence on the nervous system, and that this constriction of the arteries throws in such a mechanical impediment to the flow of the blood as the heart is unable to overcome. He thinks artificial respiration may be of value in cases of simple stunning, but no rational means of resuscitation have been suggested for cases where the shocks have been heavy.

LOSSES OF EFFICIENCY.

BY F. M. F. CAZIN, OF HOBOKEN, N. J.

(*Continued from page 7.*)

[CORRECTION.—The sixth line from the bottom of the first column, page 6, in the last issue of THE ELECTRICAL AGE should read: Water-power $= \left(f.\ v.\ \frac{v^2}{2g}\right) . \left(\frac{1}{76.04}\right)$ H. P.]

In the foregoing figures there is shown a scaling down of values for efficiency as follows:

Power in the falling water	472.09	H. P.	100%
Power by pressure at foot of stand-pipe	463.11	"	98.09%
Power by quantity of water, that under the stated pressure would be actually ejected, and as represented by f. v	433.00	"	91.72 "
Power of the four wheels by manufacturer's rating	240.00	"	50.84 "
Power theoretically required by the 120-K W. dynamo, when running at full capacity	160.00	"	33.89 "
Power (mechanical) received by dynamo, as conceded	135.33	"	28.96 "
Power (mechanical) delivered	101.50	"	21.50 "

It is certainly not an indiscreet question to inquire where the loss of 100 per cent.—21.50 per cent., or of about 78 50 per cent. of efficiency really occurs, whether this loss be experienced mainly in the hydraulic or in the electric apparatus, or what share either apparatus bears in such loss.

All figures given as relating to electric apparatus account for electric power as produced in the conversion from mechanical power. What amount of mechanical power is consumed by converting it into electric power remains an absolute mystery. The question is not even discussed, not even mentioned, except in the statement that the work performed by the water-wheel shaft has not been tested.

The electrician claims that only 135.33 H. P. of mechanical work is applied to the dynamo, and all his accounts are based on this assumption, it being neatly shown where parts of the electric energy are lost, leaving 101.5 H. P. of reconverted mechanical power to the credit of electric transmission, but only 21.5 per cent of the available power in the fall of water.

If the assumptions of the electrician were correct, that he receives from the hydraulic apparatus no more than 135.33 H. P., then there is no choice left to the manufacturer of hydraulic apparatus but to admit that either the four water-wheels develop an efficiency of only 135.33/433 (31.25 per cent.), or that four wheels were kept running, while two wheels with an efficiency of 62.5 per cent., such as constitute half the plant, would furnish all the power required by the dynamo.

It is true that a third possibility does exist in theory. There is no statement in the report about quantity of water actually ejected. Cannot all the jets have only half the section of what nozzles of 1.3. inch diameter would naturally make them? There is for each couple of 1.33 inch nozzles a regulating throttle-valve in a five-inch pipe, the sum of the two nozzle apertures being less than a two-inch circle. Can these valves not close the five-inch pipe until there is permanently left no more opening than what would allow the two jets controlled by it to have only half of their section full, or, cannot two nozzles be fed by a stream that is only sufficient to fill the aperture of one?

These questions indicate a theoretical possibility but not a practical one. The consequences of such action would in practice convince the dullest of observers of the fact that it is, of all power-reducing actions, the last of all to resort to, the successive closing of single nozzles being the only rational method for such reduction.

The writer made an inquiry on the point as to whether the reduction in numbers of nozzles had been tried, in the way of ascertaining whether a reduced number of 1.33-inch jets would provide for the required power, but no information has been obtained that could throw any light on the question.

If the manufacturers of the water-wheels have sanctioned the practice of throttling off the water from the nozzles without making a clear statement to that effect, and this against all technically justified practice, then they must have become less watchful of their interests than they have been for many years past. As the matter now stands the Pelton water-wheels at Bodie, Cal., represent an efficiency of 31.25 per cent., until the electrician admits that he receives more power than he admits.

And yet the real efficiency of the Pelton water-wheels is not an unknown quantity, although it cannot be said that the exaggerated claims of their manufacturers have in any way contributed towards settling the question in this regard. Amongst the many testimonials that are circulated in support of these claims I select one, on account of its origin and of its similarity with others in respect to errors committed and methods used. It is headed: "Pelton Water-Wheels in the Naval Service," and quotes part of a report by a member of the faculty of the United States Naval Academy at Annapolis, Md., to the secretary of the navy. The report proposes and recommends to transmit by means of steam-pumps, pipes and Pelton wheels, power to sundry working apparatus used on war ships. In support of this recommendation the report refers to a dozen of Prony brake-tests, as made at the Naval Academy of the Pelton wheel. The records given are in part those of observation and in part the result of assumption and calculation based thereon. The correctness of the observations as stated cannot be doubted, and is not doubted, but sundry false assumptions and the use made thereof, will be controverted by what the records themselves reveal.

The different items, as given, are as follows:

Serial number of test No 8		
Running pressure observed	pounds	100
Diameter of the one jet used	inches	¾
Water ejected per minute	cub.ft.	20.61
Theoretical h. p. possible	h. p.	8.957
H. P. as indicated by the brake test	h p.	7.756
Revolutions under load, indicating the developed power under the method of calculating brake-tests		775

From these records the following facts are evolved:

20.61 cubic feet per minute are converted into kilograms per second by: (20.61 . 28 316)/60 = 9.722 litres or kilograms.

The section of an aperture of circular form and of a diameter of ¾ inches is expressed on the basis of a unit of 10 square centimetres by 0 285.

Hence the jet velocity, as evolved from the quantity of water actually ejected, is by (f . v)/f = 9.722/0.285 = 34.11 metres.

And the effective head, evolved from this value for velocity by $v^2/2g$ is as $34.112^2/19.6 = 59.36$ ms.

And the highest theoretical horse-power that can possibly be derived from the water that comes into contact with the wheel, and by which the efficiency of the wheel as such alone can be measured, is:

$$\frac{\text{water-weight ejected . head}}{76.04} = \frac{9.722 . 59.36}{76.04} = 7.589 \text{ h. p.}$$

Efficiency by

$$\frac{\text{H.P. developed under test}}{\text{Theoretical h. p possible}} = \frac{7.756}{7.589} = 102.25\%$$

As this is an impossible result, and as there is absolutely no cause for doubting the accuracy of observations or statement of facts made in the report, the question solely and exclusively arising in the premises relates to the method first of drawing conclusions from the facts, as observed, and second, of making interpretation of what the brake-test indicates. These questions may be more specifically expressed as follows :

(1) Is the Trautwine equation for water-power, as it is evidently used at Annapolis and elsewhere, in the determination of wheel efficiencies, correct in itself and its results, and is it applicable to the determination of wheel efficiencies?

(2) Does the Prony brake-test indicate by efficiency in h p. developed =

$$\frac{\text{lbs. on brake . revolutions p m . circumference of brake}}{\text{33,000 lbs.}}$$

actual labor performed in foot pounds?

(*To be Continued.*)

THE SUBSTITUTION OF ELECTRICITY FOR STEAM IN RAILWAY PRACTICE.

DR. LOUIS DUNCAN.

(*Concluded from Page 4.*)

The second case which I wish to consider is that of roads built for an entirely new electrical equipment, such, for instance, as the elevated roads in Chicago, and the underground rapid transit road in New York, or the proposed Washington-Baltimore Boulevard Line. In most of these cases the traffic is almost entirely a passenger traffic, and the conditions are especially favorable for the operation of electricity. Taking first the case of the New York underground road, there will probably be required about 150 trains for local service, each train having five ordinary cars and a motor car. For the express service there would be about 25 trains of, say, four ordinary cars with a motor car. For this it would probably be best to use the direct-current three-wire system, one of the cars on the train being equipped with motors and acting as a locomotive. With four motors on a car the system would be efficient at all practical speeds, and if desired a large part of the energy could be thrown back on the line when the cars are being stopped. In the case of the local trains a simple calculation will show that a very small part of the total energy expended is used in overcoming the track resistance, while a very considerable part is employed in accelerating the train and afterward wasted by braking. I have calculated the amount of energy which can be practically saved under the conditions of local and express traffic on the New York underground road and find that with motors of ordinary efficiency about 45% can be returned. If storage batteries are used in connection with the central stations, the batteries being located along the line, a uniform load can be thrown on the stations, and their capacity may be reduced to almost one-half as compared with a system in which the energy is not returned, thus greatly decreasing the expense of installation and of operation. As it is possible at present to obtain batteries with a rapid discharge rate at very reasonable prices, and with a guarantee for repairs that place them well within the limit of commercial calculations; a system of this kind offers some advantages over any other system that could be applied to the operation of the underground road. An alternating current would hardly be economical for this work, as it precludes the possibility of returning the energy to the line, and as the variable speed required makes it uneconomical as compared with the direct current system using, say, four motors with series parallel control. In the case above cited, shunt motors would be used, and it would be possible to get a contact with the line that could not under any circumstance be broken. The case of the elevated roads is very similar to the one I have cited, except that in existing structures shorter trains could be used, and the cost of equipment for a given number of cars would be somewhat greater.

Baltimore has been the pioneer in almost every branch of transportation. In ocean service, the record of the Baltimore clipper is a tradition of our maritime supremacy. The Baltimore and Ohio Railroad was the pioneer steam road. An electric road from Baltimore to Hampden, built in 1885, gives us a right to boast of our pioneer work in electrical tramways. The immense locomotive for the Baltimore Belt Line Tunnel is the first instance of the direct displacement of steam by electricity, and the line over which it is to be operated is the first through steam line to be equipped electrically. The Baltimore and Columbia Railway Co. owns in Washington the Eckington and Soldiers' Home Railroad, and the Belt Line Railroads, and has franchises for extensive additions to their present mileage. In Baltimore they are constructing a road in the city, and beyond it to Ellicott City, and they have also purchased a steam line running from Baltimore to Catonsville. They have rights of way from the terminus of their Baltimore lines to the lines they own and are preparing to build in the District of Columbia. The problem offered is not a simple one, but it is one of the most attractive that can be presented to electrical engineers. Speeds of sixty miles per hour are to be used for the cars outside of the city limits, and within the city limits ordinary speed is to be employed. In fact there is presented almost every problem which must be solved if electricity is to displace steam in the future with the same rapidity that it has done in the past. Many high speed electric roads have been projected, a number of them occupying considerable space in the newspapers, but I think this road will be the first to solve the detailed problem of interurban rapid transit.

The last subject which I wish to take up is the electric plant for the Belt Line Tunnel of the B. & O. Railroad. In this case there is no question of economy in the employment of the electrical locomotives, as the plant adds considerably to the cost of operating the road. The Belt Line Tunnel runs beneath the city of Baltimore for a distance of one and one-quarter miles, then to the outskirts of town through open cuts and short tunnels. There is a grade of .8 of one per cent. over almost the entire length of the tunnel proper, while one-half mile beyond it there is a grade of one and one half per cent. Being in the middle of the town it would have been difficult to have provided a satisfactory ventilating plant, even supposing that ventilating plants had been successful in other localities, which is not the case. The managers of the B. & O. Railroad Co. wished to provide a satisfactory service, and considered a number of plans for drawing their trains through the tunnel without the annoyance due to smoke and gases. After careful consideration they concluded that electricity was the most satisfactory means to accomplish this, and the General Electric Co. was confident enough of the ability to successfully equip the road to make a contract with the B. & O. Co. to haul its trains over the Belt Line, the contract being dependent upon the successful operation of the plant. The total length of the line equipped is about three miles, the extension beyond the tunnel being for the purpose of assisting the freight locomotives to haul their trains up the one and one-half per cent. grade on the line beyond the tunnel. There are to be three locomotives, and it is calculated that the traffic can ordinarily be handled by two of them. The steam-engines are not to be taken off the trains, but hauled through the tunnel by the electric locomotive, which switches off at the terminus of the line. To operate these machines the station has been erected which contains 3,000 h. p. of electric generators, and an overhead line has been equipped to transmit current to the locomotive. With respect to the station itself there is little that is novel. There are four 750-H. P. Allis-Corliss engines directly coupled to generators of the same capacity, the generators having a voltage of 600 at no load, and 700 at full load. Foundations have been partly erected for a fifth unit, in case it is found necessary. The building also contains the lighting plant, having a capacity for 400 arc lights and 4,000 16-c. p. incandescent lights. Provision has also been made for an extension to this lighting plant when the stations for the belt line are erected. There are two incandescent machines, and one of them will be used to supply the 1,000 32-c. p. lamps which have been installed in the tunnel. Perhaps the most novel feature of the plant is the overhead structure which is employed. The conditions to be met were peculiarly difficult, and the ordinary under running trolley was considered impracticable. The tunnel is very low in places, and the management of the road decided that the conductors could not be placed over the cars but should be placed in the middle of the tunnel between the tracks. Outside of the tunnel the conductor is still between the tracks, but is elevated to a height of 22 feet, while inside the tunnel it is only 17 feet from the top of the rail. The conductor* consists of an iron trough made of two Z bars rivetted to a cover plate 12 inches wide, leaving a slot one inch wide between the Z bars. In the tunnel this trough is supported from transverse channel bars secured to expansion bolts, which are fastened from the top of the tunnel. There is a double insulation; one porcelain insulator being between the channel bars, and another between the channel bars and the expansion bolt. Outside the tunnel the trough is supported as follows: At distances of 150 feet light iron columns with cross trusses are erected, and between these trusses are hung catenaries supplied with a number of suspension bolts. Transverse channels similar to those used in the tunnel are fastened to these bolts and the trough is fastened to the channels. The Z bars are made in lengths of thirty feet, the opposite bars breaking the joints with one another; the lengths being rivetted together and then bounded with "Chicago" rail bonds. Suspended on the same transverse beams as the trough are three copper cables of 1,000,000 c. m. area, which serve as feed wires, which are connected at intervals with a trough, there being of course one trough for each track. For the return circuit the tracks are bonded as in ordinary railroad work, there being cross-bars and, at intervals, connections with a copper cable of 1,000,000 c. m. area buried in a wooden trough between the tracks. The contact arrangement that is to be used consists of a brass shoe, travelling in the trough and connected with a locomotive with a flexible sawbuck arrangement, which has a very considerable range in every direction. The current is transmitted to the motors by a copper cable, and in case of the shoe sticking in the trough, a safety pin is arranged to break with any desired strain. Where switches are used there is a tongue worked by the lever which operates the track-switch, and which serves to direct the shoe. This structure, although exceedingly massive and expensive, promises to give an excellent contact at all times, and it requires no care from the motorman.

The locomotives are the most massive in the history of either steam or electrical transportation, and the weight, which amounts to 95 tons, is on eight driving wheels, so that the full tractive power of the locomotive will be developed. On each axle there is sleeved a six-pole motor, there being considerable play between the axle and the sleeve, which latter is spring-supported from the frame. In this way any heavy blow due to irregularity in the track is taken through the springs and the wear both of the track and locomotive is reduced. On the armature shaft are projecting arms, which move between lugs cast on the wheels, thus allowing the necessary relative motion between the axle and armature.

The situation in the Baltimore Belt Line is this: The station is completed and is being operated daily. One of the locomotives is on the ground, set up and ready to run; the overhead work is finished, with the exception of a short length which was interfered with by a temporary bridge over a cut. The latter has been removed and the plant should be ready to run this week.

If this equipment proves successful it will open a limited but important field for the introduction of large electric locomotives. There are in the United States a number of tunnels whose operation is anything but satisfactory at present, which can be equipped as the Baltimore tunnel is equipped. Several of them have the additional advantage that they are near the switching yards of the roads, and the same plant could be used for hauling trains through the tunnels and for switching; and not only would the economy of the station be increased, but the substitution of electric for steam switching engines would result in a very considerable saving.

This is the last of the subjects that I proposed to consider. In this paper I have not indulged in prophesy, nor have I imagined any apparatus or equipment which cannot be bought in the open market. But to me it seems that the present is a crisis in the history of railroading. Up to the present the steam roads have ignored the competition of electric roads or they have fought them. Today they cannot afford to do either. In a few years electric roads will have absorbed practically all of the local traffic and will begin to cut into through transportation. The steam roads cannot afford this; their only safety is to make of electricity an ally instead of an enemy, and this before it is too late.

The conclusions that I finally reach are these:

First. The tendency of passenger transportation on the steam lines has been in the direction of the greatest electrical economy, while the tendency of the freight transportation has been in the direction of the least electrical economy.

Second. It will not pay any through line with considerable traffic, having two tracks, to equip their main tracks electrically.

Third. With four-track roads it will pay to equip all of the tracks electrically, unless a considerable portion of the business is through passenger traffic.

Fourth. It will pay all the larger roads either to equip a number of their branch lines electrically, or to control competing electric lines.

Fifth. In order to remain on a dividend-paying basis it is imperative that most of the two-track lines either build additional tracks or control the electric roads that parallel them.

Sixth. Believing that ultimately all of the traffic will be done by electricity, it is imperative that the managers of steam roads keep constantly in touch with electrical progress.

* See page 346, The Electrical Age, June 22, 1895.

THE CAUSE OF DEATH IN ELECTRIC SHOCK.*

A. M. BLEILE, M. D.

The statements made in regard to the cause of death by electricity are so at variance with one another that it is unnecessary to review them here. Among other plausible reasons it has been stated that the current has a direct disintegrating effect on the brain and nerve tissues and that herein is to be found the cause of the fatality. The disintegrating effects of the current on the brain and nerve tissue said to follow are not to be seen macroscopically, and the microscopic examination of these organs so far as made by us failed to reveal any change in their structure. It would appear therefore that death in electric shock is entirely due to the fact that the current produces a contraction of the arteries through an influence on the nervous system, and that this constriction of the arteries throws in such a mechanical impediment to the flow of the blood as the heart is unable to overcome, and that, where drugs are given to counteract this effect, much larger doses of electricity than the ordinary can be borne. While artificial respiration may be of value in simple stunning, when larger doses have been taken, no rational means of resuscitation have as yet been suggested.

OBITUARY.

JOSEPH BARKER STEARNS.

The Hon. Joseph B. Stearns, well known among telegraph people as the inventor of the duplex system of telegraphy, on July 4, died at his home in Camden, Me., at the age of 64 years.

Mr. Stearns was born in Weld, Franklin Co., Me., on February 28, 1831. He learned telegraphy, and in 1855, was appointed superintendent of the Boston Fire Alarm

* Abstract of paper presented at the Twelfth General Meeting of the American Institute of Electrical Engineers, Niagara Falls, N. Y., June 27, 1895.

System. He was president of the Franklin Telegraph Company from 1869 to 1871, during which period he brought out his duplex patent, which made his name famous in the electrical woild. He afterwards went to England and there introduced his duplex system. The particular device with which his name is so intimately associated is known as the "differential" duplex.

From 1882 to 1883 he was vice-president of the Mexican and South Ameiican Cable Company.

PRINCIPLES OF DYNAMO DESIGN.

BY

Newton Harrison E.E.

(*Continued from Page* 353.)

The different types of armatures which have been designed for the purpose of accomplishing certain ends are in existence today as an illustration of the general tendency of the times. The discussion was not that concerning the applicability of certain types to certain cases, but the advantage of either the drum or Gramme over each other in all cases. The issue hung upon a decision regarding the relative amounts of wire wasted, as the expression went, as inside wire in the Gramme or end wire on the drum. Such discussions are unnecessary, although it may be stated that the balance of favor today is towards the use of the Gramme. In either case there always exists, to an extent dependent upon the design of the machine, sufficient armature reaction to cause trouble when unduly loaded. During the generation of E.M.F. by any machine the conditions in the field are not constant.

This lack of reliability is eradicable by the pursuance of certain useful rules regulating the proportioning of the magneto-motive forces of both field and armature. The shifting of the brushes is a fault that may be greatly modified and reduced, and so effectively that a minimum of care will be all that is required during its active operation. The field apparently rotates through an angle proportional to the resultant of the two magneto-motive forces acting upon it, and it is necessary in order to follow those points from which the E.M.F. can be drawn off with least sparking that the brushes be inclined continually, each time to a new position, with every decided increase of current; thus removing the possibility for the time of a perfectly reliable and strictly automatic method of commutation. This shifting of the neutral point is to a certain extent overcome by having a means at command of regulating the strength of field with each variation of current in the armature. The E.M.F. originally generated is cut down by two distinct causes: First, the drop of potential or gradually increasing loss of pressure with every increase of current in the armature; and secondly, the gradual exhaustion or weakening of the field due to the negative influence of the armature current upon it. The removal of these influences is practically impossible, but they may be reduced within certain limits to such an extent as to greatly assist the general behavior of the machine and increase its efficiency.

The steadiness of the E.M.F. in shunt dynamos is of great importance. The usefulness of a plant is increased and its expense decreased almost in proportion to the evenness of pressure supplied by the dynamo. Lamps and motors connected to such a circuit vary, the one in candle-power and the other in speed, unless this condition be observed.

Therefore uniformity of field is of considerable importance in the design of either the dynamo or its antithesis, the motor. This, as will be now perceived, is greatly governed by the magnitude of the disturbance caused by the armature current. Hence one salient object should be held in view above all things, and that is the condition of the field with respect to the number of turns upon it. A great many opinions have been advanced regarding the proper proportioning of the ampere-turns for the production of this effect.

While generalizations are useful in so far as they afford the means by which a choice can be decided upon, no definite figures are at once deducible. It is said that armature and field ampere-turns must always bear a certain relation to each other in order that a sparkless machine will result. While this is true to a large extent in machines running at a moderate saturation, it is not necessarily so in machines whose field cores are highly saturated and armature core of low saturation. A slight increase in field strength in this case would, if the permeability were already very low, mean an over-proportionate increase in ampere-turns, and therefore a decided refutation of the theory just advanced when the field and armature ampere-turns are compared. Probably the expression is of greater value when used as a statement concerning the least proportion allowed between the armature and field ampere-turns to prevent sparking.

According to Ryan the armature ampere-

$$\text{turns} = \frac{\left\{\begin{array}{c}\text{the number of conduc-}\\ \text{tors on the surface of}\\ \text{the armature}\end{array}\right\} \times \left\{\begin{array}{c}\text{strength of cur-}\\ \text{rent in the arma-}\\ \text{ture conductors}\end{array}\right\}}{\text{number of poles.}}$$

It is best to so proportion these windings that the field ampere-turns are always in excess of the armature ampere-turns, otherwise the lines of force between the pole faces will be in an unstable condition.

Sparking.—The sparking that occurs is very frequently due to the weakness of magnetization at the pole corners. The action of the armature current upon the field issuing from these pole corners cuts it down and tends to bring it to zero. Therefore to prevent such a condition of affairs the excess of ampere-turns should always be with the field. By this means sparking, which would otherwise occur, is greatly reduced and a constant potential is better maintained. As a rule, the best proportion of the air gap to secure such results should be such "that the ampere-turns required to set up the magnetization through the armature without current, and the production of the highest E.M.F. that the machine will be called upon to give, shall be a little more than the armature ampere-turns when it furnishes its normal current. Then, as long as the brushes are kept under the pole faces, the non-sparking point will be wherever the brushes are placed."

(*To be Continued.*)

ELECTRIC FOUNTAIN AT THE COTTON STATES EXPOSITION.

The management of the Cotton States and International Exposition is jubilant over the brilliant results achieved by Mr. Luther Stieringer, consulting electrical engineer, in the design for an electric fountain. The design is that of a twin-fountain, rising from an island in the centre of the grand basin, immediately in front of the Machinery Hall. The island, which forms the groundwork for base of the fountain and covers the operating chamber, is one hundred feet long and fifty feet wide. There are nineteen orifices, each with seven to ten jets. The electric lights, used under each orifice to project the beam of light through the water, are of two hundred and fifty thousand candle-power each in the beam.

The four forms of water used are the solid stream, the geyser, the spray and the fog bank. The highest jets will rise something over one hundred feet from the basin of the lake. The fog bank is to be produced by steam, condensed by means of spray. The four forms will be used alternately in various ways with fine effect. The streams and geysers will be interspersed with circular pipes throwing jets in the form of wheat-sheaves.

Mr. Stieringer thinks that this will surpass the World's Fair fountain in brilliancy of effect.

ELECTRICAL INDUSTRIES OF NEWARK, N. J.

Over two years ago The Electrical Age devoted an entire edition to a description of the electrical industries of Newark, N. J. Since that time important changes and developments have taken place, and we now take the opportunity of calling the attention of the trade to the most important of these advances. It is needless to say that Newark is rapidly becoming an electric manufacturing centre, and all of those concerns engaged in this industry are thriving and kept continually busy. Some of the best known establishments in the country are located in Newark, as will be noted below.

GOULD & EBERHARDT.

This concern is well known to the electrical trade as machine-tool builders. Their works are at No. 95 to 111 New Jersey Railroad avenue, Newark, and among the large number of machines made by them may be mentioned gear cutters, shapers, drill presses, stamping and cutting presses of various kinds, circular shears, etc., etc.

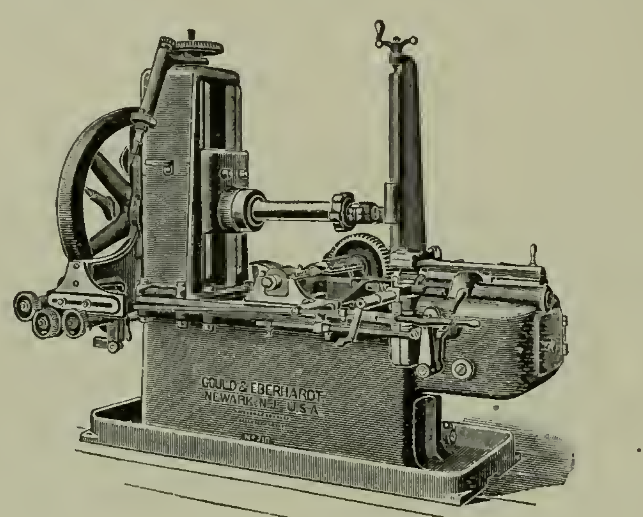
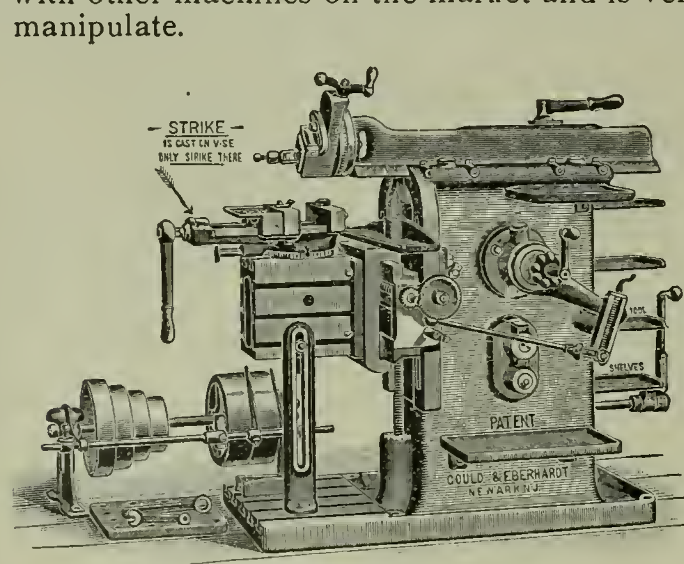


FIG. I.

The new type entirely automatic gear cutter is shown in one of the accompanying illustrations (Fig. 1). This machine is especially adapted for cutting motor gears as used on street railways, as well as other classes of heavy work which must be turned out accurate, in large quantities and in short time.

This machine is built very rigid, has few parts compared with other machines on the market and is very simple to manipulate.



DOUBLE TRIPLE QUICK STROKE
(TRADE MARK)

FIG. 2.

There is only one belt used to drive the entire machine, doing away with the trouble experienced in keeping belts in order, etc. Again, when more than one belt is required to drive the machine, and one should happen to break, part of the machine will continue to run with the chances of spoiling the work, which is not the case with the machine here described.

The cutter speeds and feeds have a wide range, and are changed with gearing, proper indexes being furnished with the machine.

As steel gears are coming more and more into use, the machine is provided with a suitable oil pan and pump to supply a lubricant to the cutter when being used on steel.

The Eberhardt Patent Shaper is shown in Fig. 2. This machine possesses many original features not found on any other shaper on the market. It has great strength and power, very rigid, has exceptionally large wearing surfaces, and has a double triple-quick stroke, giving on short work double the number of strokes per minute over any other.

It has a new extension base with support to work table, which gives additional rigidity and prevents springing when taking heavy cuts.

The power press shown in Fig. 3 has a new and simple arrangement for quickly altering the position of the

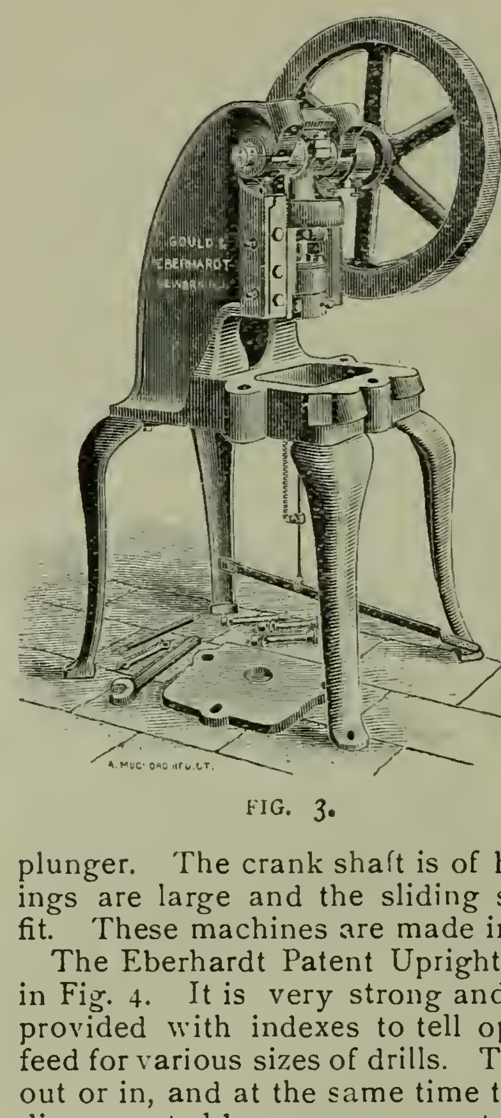


FIG. 3.

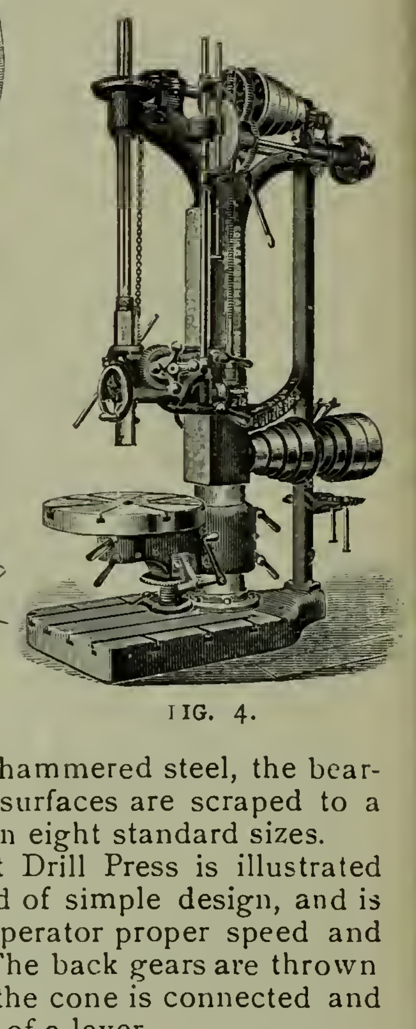


FIG. 4.

plunger. The crank shaft is of hammered steel, the bearings are large and the sliding surfaces are scraped to a fit. These machines are made in eight standard sizes.

The Eberhardt Patent Upright Drill Press is illustrated in Fig. 4. It is very strong and of simple design, and is provided with indexes to tell operator proper speed and feed for various sizes of drills. The back gears are thrown out or in, and at the same time the cone is connected and disconnected by one movement of a lever.

The feed is entirely independent of the drill spindle, and changing the speed of the latter does not affect the feed arrangement.

The spindle is provided with means for compensating all wear that may take place in the barrel.

This drill press at will can be made to feed either up or down, separately through the head, the entire length of planed surface on column, or independently through the rack or barrel.

All changes are made from front of machine, allowing the workman to remain in one position.

G. ZIMMERMAN.

G. Zimmerman, 191 Market street, manufactures burglar alarms and annunciators, and does all kinds of wiring, making electric light work a specialty. He began business 11 years ago on Broad street, and moved to his present quarters in May 1889.

In 1880 Mr. Zimmerman invented a burglar alarm annunciator which has some valuable features. He has since then installed several hundred of them, ranging from 8 to 150 drops. Only one single spool magnet is used on the drop. The annunciator is so arranged as to light or extinguish the gas jets and at the same time ring the usual alarm. It can also be used to connect or disconnect any circuit in the building, as desired.

Mr. Zimmerman's annunciator is reliable in its action and is a very serviceable device.

THE NEWARK ELECTRIC LIGHT AND POWER COMPANY.

The Newark Electric Light and Power Co., 36 and 38 Mechanic street, Newark, N. J,, is making some important changes in its plant, which is located at Nos. 90–104 River street. The station fronts on the dock and is adjacent to the Pennsylvania R. R.

This station is a large one and is run on the Westinghouse incandescent and Brush arc systems. After the changes are completed the plant will include thirteen 125-light and fourteen 65-light Brush arc dynamos.

This company, it will be remembered, moved to the present location from 25–33 Mechanic street after gradually enlarging the River-street plant for the past four years, to meet the steadily increasing demands upon it.

In the station there are at present 120 K.W. Westinghouse multipolar machines with a total capacity of 12,500 incandescent lamps; two Westinghouse 250 H. P., 500-volts generators, and two 150 H. P., 110-volts generators. These latter generators supply current for commercial purposes, for power, fans, etc.

The company is now operating 2,200 arc lamps in commercial and city lighting.

The boiler plant consists of Morrin's Climax boilers, with a total capacity of 4,700 H. P. This includes two 600 H. P. boilers now being installed, which, with the 3,500 H. P. in use for the past four years, will bring the total capacity up to the figure above mentioned.

STATION OF THE NEWARK ELECTRIC LIGHT AND POWER CO., NEWARK, N. J.

The engine plant consists of one Watts-Campbell cross-compound Corliss engine of 1,500 H. P.; two McIntosh & Seymour engines of 550 H. P. each, one of medium speed and the other a tandem compound; three cross compound, high-speed Ball engines of 300 H. P. each, and three Westinghouse cross-compound, high-speed engines of 300 H.P. each. The company has just closed a contract for one Armington & Sims cross-compound 400 H. P. medium-speed engine, to be furnished by E. P. Hampson & Co., of New York.

The property of the Newark Electric Light and Power Company covers an area of 250 feet square. Water is taken from the Passaic river when the tide is low and the water is practically fresh. It is then filtered and stored in the tanks shown at the right in our illustration.

The officers of the Newark Electric Light and Power Co. are: President, J. D. Harrison; Vice-President and Manager, Philip N. Jackson; Treasurer, Samuel S. Dennis; Secretary, Abram C. Denman. Dudley Farrand is the assistant secretary and constructing engineer, and John J. Gaffney, superintendent and electrician.

BAKER & CO.

The accompanying illustation shows the large works of Baker & Co., of Newark, N. J., the well-known gold, silver and platinum refiners.

Baker & Co. control a large share of the platinum business in connection with the electric lamp and other electrical industries, and their goods are reliably standard.

Among the various uses in electrical manufacturing to which platinum is applied are for the leading-in wires of incandescent lamps, electric gas lighting, contact points, electric protecting fuses, electric ignition fuses, electric heaters, electrodes, electro plating and electrical experimenting in general.

In addition to these are made a great variety of articles of platinum for surgeons, chemists, laboratory work, etc., etc.

Our other illustration (Fig. 2) shows the platinum electrodes used in copper tests for electrolytic separation. The electrolytic treatment, or assay of certain ores, is to determine the amount of copper the ore contains. The current in passing from the negative to the positive electrode carries with it the copper in the solution, the copper being deposited on the positive electrode.

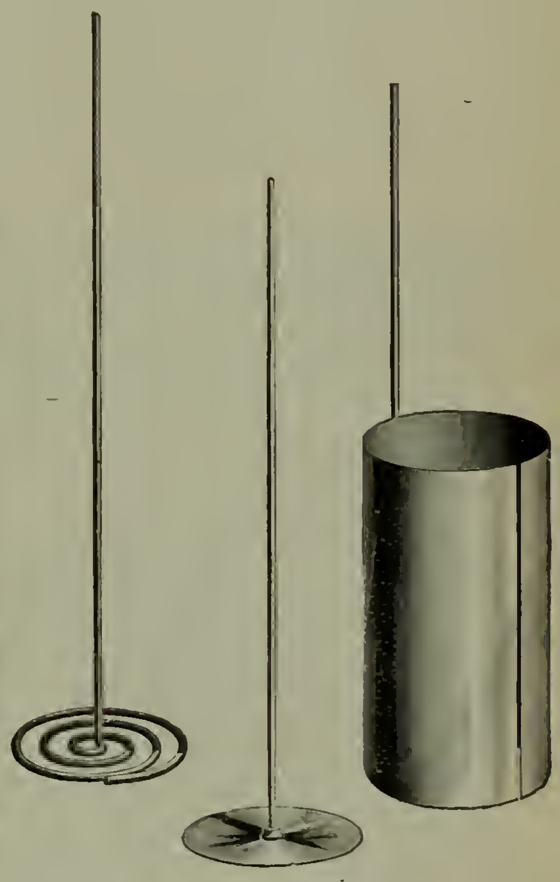


FIG. 2.—BAKER & CO.

The electrodes are of the standard forms and range in weight from 10 to 30 grammes. Special designs of electrodes and all other apparatus are made from drawings, of any shape or size.

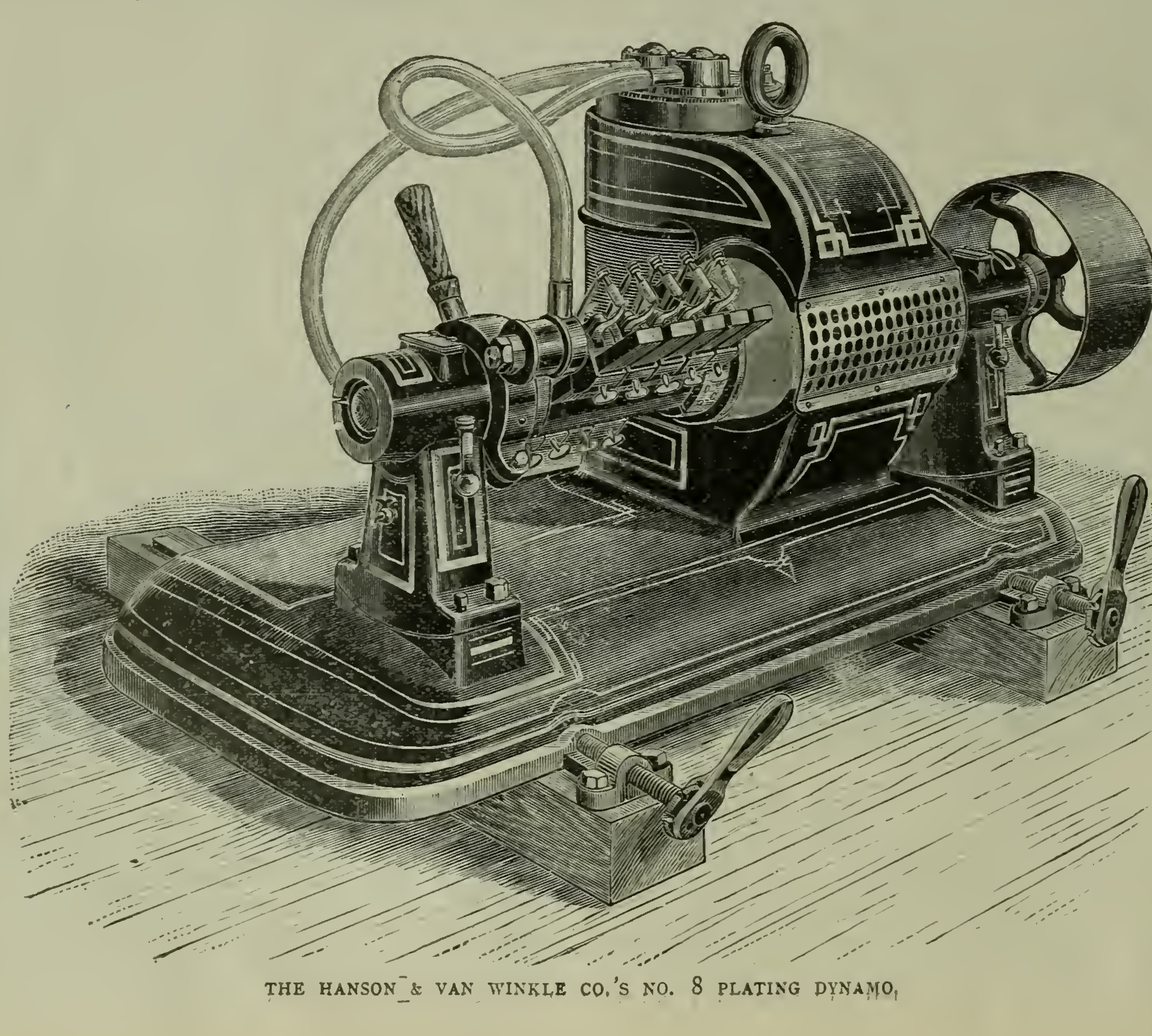
WORKS OF BAKER & CO., NEWARK, N. J.

THE HANSON & VAN WINKLE CO.

The electro-plating industry has become in late years one of the most important, and improvements in the electrical apparatus have kept pace with those in other electrical machines.

One of the leading houses in this branch of electric practice is The Hanson & Van Winkle Co., of Newark, N. J. This company is one of the largest manufacturers and dealers in the country of electro-plating outfits, chemicals, polishers' supplies, etc., and enjoys a high reputation in the trade at large.

The plating dynamo manufactured by The Hanson & Van Winkle Co. is well known for its efficiency and excel-



THE HANSON & VAN WINKLE CO.'S NO. 8 PLATING DYNAMO.

lence of construction. The accompanying illustration shows one of their No. 8 dynamos.

The field magnets are of wrought iron ; the magnetic circuit is very short ; the commutator segments are of tempered copper, and the machine in its entirety is as near perfection in its design and construction as it is possible to make it. The No. 8 dynamo has a capacity of 4,000 gallons of nickel solution and 7,000 of copper, and occupies a floor space of 58x37 inches.

Fig. 2 shows the improved H. & V. W. switchboard or rheostat, used in regulating the quantity of current. By the use of this switch the output from a plating room using two or more tanks can be doubled, providing the dynamo has sufficient generating capacity. These devices are made n several sizes.

Fig. 3 illustrates a combination outfit for jewelers, silverware dealers, repairers and small manufacturers. The operator sits in front of the machine on a bicycle saddle and runs the dynamo with the pedal movement. There is no cost attending the idleness of this machine, as in the

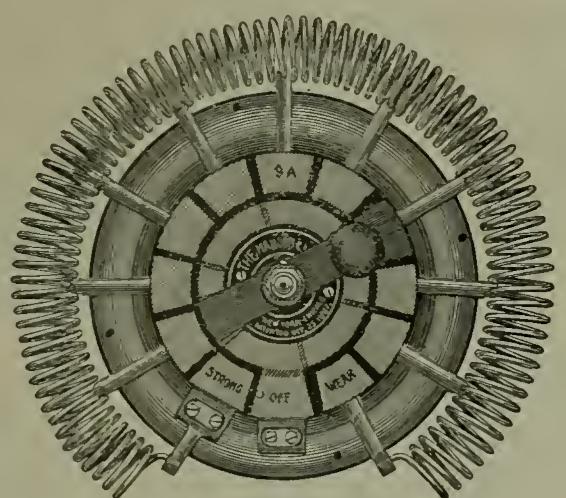


FIG 2.—SWITCH-BOARD.

case of a battery or steam operated dynamo, and for small work its use is invaluable. The merits of the machine are self-evident, and it is not surprising that it is meeting with great favor.

FIG. 3.—SMALL PLATING OUTFIT.

The facilities of the Hanson & Van Winkle Co. for the production of the various machines and large line of goods dealt in are unsurpassed, and the rapid developments made in the science of electro-plating is due in no small measure to the enterprise of this house.

The company maintains branches in New York, Chicago and Birmingham, England.

STUCKY & HECK ELECTRICAL MFG. CO.

Stucky & Heck Electrical Mfg. Co., electrical and mechanical engineers and draughtsmen, 35 N. J. Railroad avenue, Newark, N. J., lately moved into the three-story brick building at the above address, their business having grown to such large proportions. Their new works are very conveniently located, being opposite the Market street railroad station.

They are manufacturing the apparatus for the Muskowitz system of lighting railroad cars for the National Electric Car Lighting Co., and have been very successful in

SECTION OF MAIN FLOOR, DYNAMO, COMMUTATOR AND ARMATURE DEPARTMENT, STUCKY & HECK ELEC. MFG. CO.

carrying out the plan of the last-named company. On June 26 the system was tested and the lighting of the car was successfully accomplished.

QUARTER SECTION OF 2D FLOOR, WINDING ROOM, STUCKY & HECK ELEC. MFG. CO.

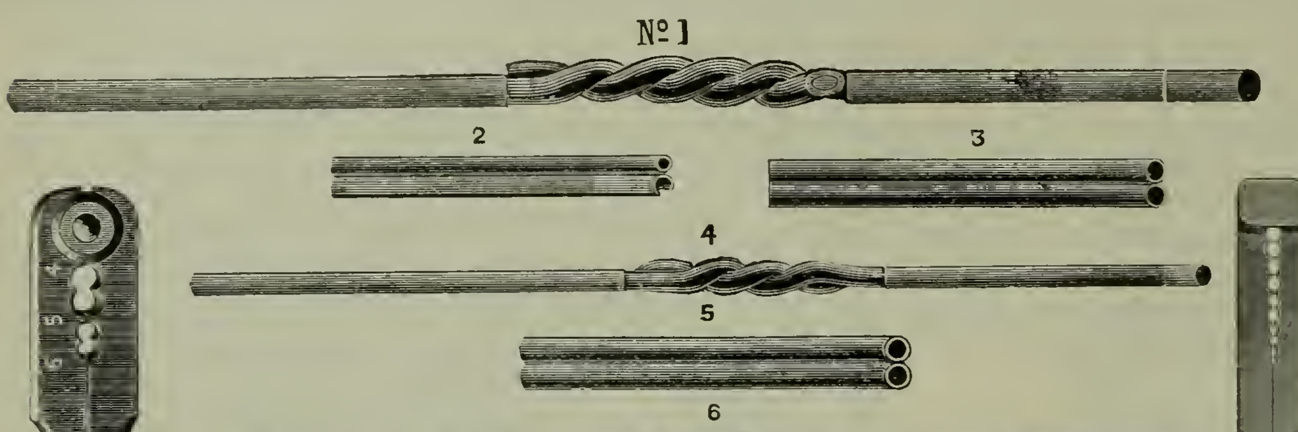
The Stucky & Heck Co. make a specialty of reconstructing and repairing armatures, lighting dynamos, power generators and motors, and of manufacturing commutators for railway motors and electric light dynamos.

They also entirely reconstruct machines of this class, also transformers. They have had an experience of 17 years in this class of work and are well qualified to undertake contracts of this kind. In their new shops they have every facility to turn out the best work expeditiously.

McINTIRE CONNECTORS AND TERMINALS.

The extensive use of copper wire for telegraph, telephone, electric light and electric power purposes created a necessity for a reliable and substantial joint. The McIntire "Connector" was born of that necessity and at once met with great favor, which it has ever since continued to maintain.

This connector has the full endorsement of the best electrical experts in the world, and the fact that it is rapidly increasing in use is the clearest evidence of its merit. It forms a perfect metallic contact, more enduring than the wire itself. A joint thus made is weather-proof and does



McINTYRE CONNECTORS, ETC.

not corrode, and is stronger than one made by the ordinary method of twisting the two ends of the wire around each other.

Joints made with the McIntire "Connector" save from 50 to 100 per cent. in wire in making the joints, and 50 to 100 per cent. in time and labor. Such a joint has no extra resistance whatever, compared with that of the wire itself, and is as durable as the wire.

From an æsthetic point of view the McIntire Connector commends itself. The joint is little larger than the wire, and is always neat in appearance, which cannot be said of the best of the old style joints.

The saving effected by the use of these connectors more than pays for their first cost, and when the mechanical advantages are considered the gain derived in their use is manifestly great.

Our illustration shows connectors and joints of various sizes, also the tools for making the joints.

The C. McIntire Company make connectors for hard-drawn copper wire, transposition and combination connectors, special splicing clamps for hard-drawn copper wire, connectors for electric light wires both for overhead and underground work, special sleeves, ells and ties for underground construction feed-wire connectors, terminals for solid and stranded wires for dynamo and motor work, fuse wire (tested), fuse links and strips.

The terminals and connectors are made of the best lake copper, of the highest conductivity and purity.

The office and works of the C. McIntire Company are at 13 and 15 Franklin street, Newark, N. J.

NEWARK, N. J., NOTES.

F. W. Crane, 179 Market street, does a general electric wiring business, including electric light and electric motor work, and installs electric fittings of all kinds on houses, offices, etc.

T. F. Dorris, 15 & 15½ Mechanic street, carries on a business of repairing dynamo and motor armatures and commutators. Mr. Dorris is an old central-station man and a mechanic of the highest degree. He is familiar with every detail of electrical work, and has built up a fine reputation for skilful workmanship.

O. A. Kessner, Mechanic street, carries on a business of repairing and reconstructing dynamos, motors and commutators, and rewinds armatures. He also makes new armatures. He employs at his factory in Vailsburg, N. J., skilled workmen and turns out the best quality of work. Mr. Kessner himself has had very extensive experience, having started with the Weston Dynamo Co., of Newark, in 1877. He was afterwards connected with the old United States Company, and later became electrician for The Hanson & Van Winkle Co., of Newark. He opened his present establishment in Mechanic street in 1890, and has done an excellent trade since that time. He does work for some of the most prominent lighting and power companies.

In addition to the houses previously named there are many others in Newark which our representative was not able to call on in the limited time at his disposal. Among them may be mentioned the following: The Wachtel Electric Mfg. Co., Hamilton and N. J. Railroad avenue, manufacturers of dynamos, motors and fan motors; T. Staehle, electric wireman and contractor, No. 2 Belmont street; Ash Automatic Electric Switch Co., 763 Broad street; the following-named manufacturers and dealers in electrical apparatus and supplies — Armature Bell Co., 216 High street; Automatic Electric Specialty Co., 31 Clinton street; H. G. Avery, 165 Halsey street; Duranoid Mfg. Co., 20 Prospect street; Fibrone Terraloid Co., 91 Oliver street; A. S. Swan, 729 Broad Street; A. H. Velders, 228 Orange street; and the Woodside Metal Co., 260 Oraton street; Wharton & Williams, electrical engineers and contractors; the Globe Metal Works, Platinum, and A. Bosch, jr., 50 Stratford street; E. W. Wilcox, 219 Market street and H. C. Dowden, 24 Abingdon street.

PEARCE'S SPRING MOTOR.

The accompanying illustrations show a novel motor recently brought out by Mr. Frederick Pearce, of 79 John street, New York. The machine is designed to operate a phonograph, and on one winding will run the latter instrument through two tunes. When it runs down it is easily rewound, and there are no batteries to take care of, it being entirely mechanical in its operation.

The motor is noiseless in its action and well made. By means of a regulator the instrument can be made to run at any desired speed, in order to reproduce the natural tone in the phonographic reproduction.

Fig. 1 shows the application of the Spring Motor to the phonograph, and Fig. 2 shows the motor without any connecting attachments.

In the matter of speed regulation it will be seen, by reference to the figures, that the upper end of the ball-governor shaft is supported between a pair of accurately turned jaws. By means of the thumb-screw these jaws are brought closer together or more widely separated according as we desire to slacken or increase the speed of the machine.

This method of speed regulation is very sensitive, and the phonograph can in this way be regulated with the utmost degree of fineness. The power is transmitted from the governor shaft to that of the phonograph by a small flat belt, the belt making two 90° angles on account of the plane of the axes of the two shafts differing to that extent.

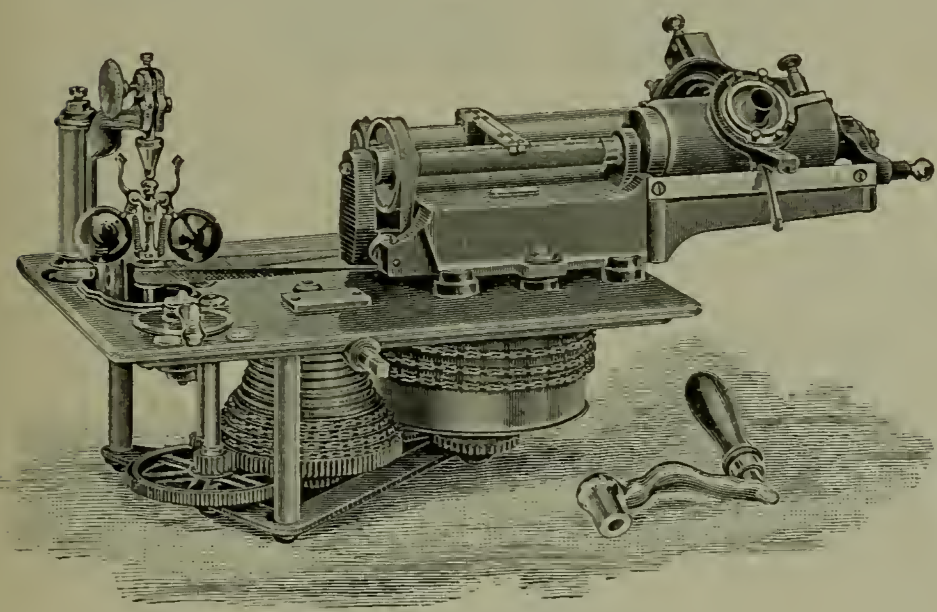


FIG. 1.

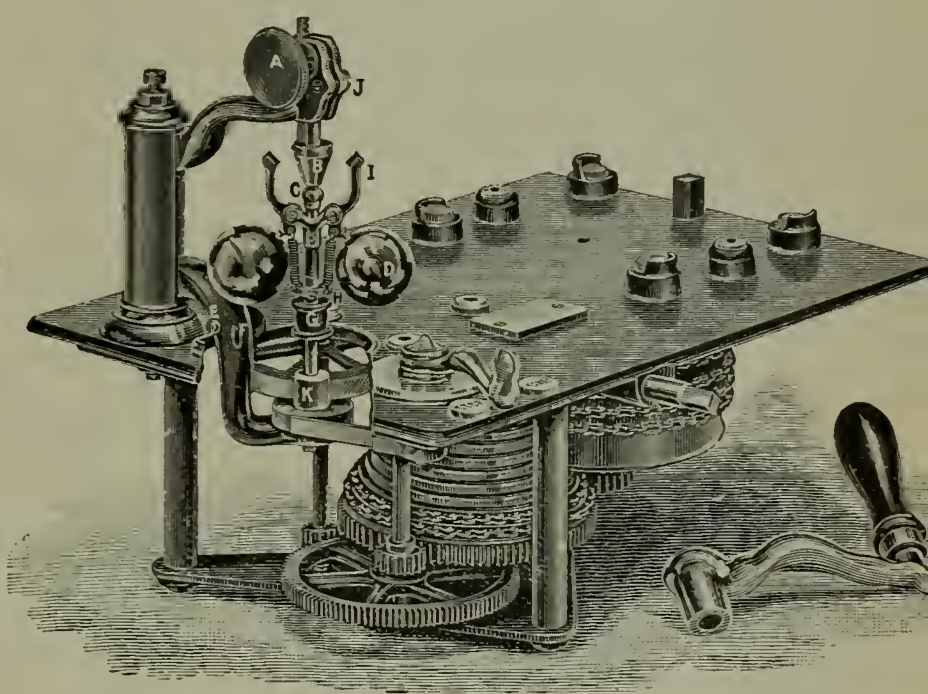


FIG. 2.

A small switch at the left of the motor-base starts and stops the motor. The winding, it will be noticed, is done at the side of the machine, where a freedom of motion can best be secured.

In Fig. 2 the surface plate is broken away in order to show the working parts of the motor.

The feature of this motor that shows itself most prominently is the simplicity of construction. Simplicity and few parts means the same in any machine, namely, less liability to get out of order, and ease to take care of.

This motor can be adapted to nickel-in-the-slot machines, and it requires little power to wind it. It is entirely automatic in its speed, which it maintains constant to the end of the spring tension.

ANOTHER NEW ELECTRICAL JOURNAL.

Within a month the West has produced two new electrical papers of the same name—*Electrical Journal*. Their homes are widely separated, however, and whether there is any relationship between the two or whether the selection of the same title is a coincident remains to be revealed.

The newer *Electrical Journal* hails from San Francisco; is edited by F. A. C. Perrine and Geo. P. Low, and will be published as a review of the industrial applications of Electricity, Gas and Power.

It is published monthly, and while the first number presents a good appearance its limited advertising is mainly local. It is about the size of The Electrical Age, and in many respects markedly resembles its namesake in Chicago.

ELECTRICAL EXHIBITS AT THE COTTON STATES' EXPOSITION.

Exhibitors are already at work in the Electrical Building at the Cotton States and International Exposition.

The Bell Telephone Company has a force of men preparing their exhibit. This company will occupy over 1,000 square feet and their display will be very fine. It will comprise a complete central station, operating telephones in all parts of the grounds, connected with the main system of Atlanta, and with the long distance system throughout the state. Their space will be fitted up in a very handsome manner and at heavy expense, and everything will be shown that illustrates the growth and progress of the telephone business.

The General Electric Company have engaged experts to design their display, and it will be most elaborate. Their space also will occupy considerably over 1,000 square feet, and they may possibly require more. The design of their exhibit will be original and unique, and will create a decided sensation.

The Westinghouse Electric and Manufacturing Company have also secured one of the large central spaces and will fill it with a varied and interesting exhibit, and there will be the usual rivalry between these two great companies as to which shall have the most interesting and instructive display.

The Brush Electric Company and Fort Wayne Electric Corporation were also among the first to take a large amount of space, and they will not be behind any other company in the size and beauty of their exhibits.

THE CAR-BUYER'S HELPER.

We have received a copy of "The Car-Buyer's Helper," issued by the Brownell Car Co., of St. Louis, Mo. The object of the book is to enable the reader to learn for himself "how a good car differs from a poor one, and how to get it." The book is artistically gotten-up, and is well printed and illustrated.

New Trolley Line between Jersey City and Newark.—A new electric railroad was opened for business between Newark and Jersey City, N. J., on July 1. The new line runs from the Cortlandt street ferry, Jersey City, along the old turnpike across the Hackensack Meadows, through Harrison to Newark. It forms a part of the system of the Consolidated Traction Company.

New Books.

The Telephone Systems of the Continent of Europe. By A. R. Bennett. 436 pages, with 169 illustrations. Longmans, Green & Co., New York. Price $4.50.

This work represents a vast amount of labor and time in its compilation and will be a valuable addition to every electrical library as a work of reference.

As its title indicates it is a big subject to handle, but the author has done some excellent and patient work.

Every continental state is represented, and every detail of the telephone system and operation in each is given.

The general scope of the work may be understood by giving the subject headings of chapter VIII, which is devoted exclusively to France. These subjects are as follows:

History and Present Position; Services Rendered to the Public; Tariffs; Way-Leaves (rights of way); Switching Arrangements; Hours of Service; Subscribers' Instruments; Outside Work (local); Outside Work (trunk); Payment of Workmen; Payment of Operators; Statistics.

There are 26 chapters to the work, each chapter being devoted to one country.

In five of these states no public telephone service exists. These are Bosnia-Herzegovina, Greece, Montenegro, Servia and Turkey. In the four first-named countries the telephone is used exclusively for military purposes, but the Turks have a prejudice against the instrument and resist all efforts to introduce it. Many of the other European countries have carried the telephone system to a high state of development, and excellent illustrations are given showing the instruments in use, the methods of building lines, etc., etc.

THE ROYAL ARC ELECTRIC CO., U. S. A.

The creditors of said company are hereby notified that I have deposited my report as receiver of said company, together with a list of creditors of said company who have proved their claims before me, with the Sergeant-at-arms of the Court of Chancery, at the chambers of said Court, in the Prudential Building, Broad street, Newark, New Jersey, and that said Court on this day has made an order that all parties interested therein must present their objections, if any, thereto on or before the 23d day of July, instant, at 10 o'clock in the forenoon of that day, when the matter of confirming the same will be heard

And notice is hereby further given that I will ask the Court on the 23d day of July, instant, to be allowed the sum of two hundred dollars as compensation for my services as such receiver.

Foster M. Voorhees,
Receiver.

Dated at Elizabeth, N. J., July 2, 1895.

The Partz Battery —The attention of railroad telegraph superintendents, electricians on steam roads and others using batteries, is directed to the advertisement of The S. S. White Dental Company, on Page V. The Partz battery there described is one of the most successful ever produced, and it would be time well spent to look into its merits.

New York Notes.

Office of the Electrical Age,
World Building, New York,
July 8, 1895.

W. E. Cooke, general sales agent of the Peckham Motor Truck and Wheel Co., on July 4, sailed for London, in the interest of his company. He has a good deal of ground to cover in a short space of time. There are nearly 50 Peckham trucks in use on the continent, and the Peckham Co. has orders for more.

The Lakon Company, 136 Liberty street, is the successor to The Hornberger Electric Mfg. Co. Mr. E. B. Latham is the eastern manager. John C. Boss is president and treasurer, and O. M. Ash, electrician of the new company. W. T. H.

Street Railway Notes.

John B. Maloney and others, of Detroit, are interested in a company to operate an electric railroad between Detroit and Dearborn. The capital of the new company is $50,000.

The Philadelphia Electric Traction Co. has decided to increase its capital stock from $7,620,000 to $8,750,000. There will be an issue of 22,600 shares of a par value of $50 per share.

The Kansas City and Independence Rapid Transit Railway Co., Kansas City, Mo., contemplates extending its lines in Independence.

Possible Contracts.

Charles Keighley & Son, Vineland, N. J., are seeking a franchise to light that place by electricity.

There is talk of building an electric light plant in Hawkinsville, Ga. The Mayor of that place can give further particulars.

The Baltimore, Columbia & Maryland R. R. Co. will probably build two power houses. Thos. M. Lanahan is president of the company.

A. McDowell, Scotland Neck, N. C., can give particulars regarding a company now being organized there to build an electric light plant.

Telephone Notes.

Several farmers in the neighborhood of Salisbury, Md., have received consent from the county commissioners to erect telephone lines from their farms to connect with the town lines. Among these enterprising farmers are W. H. Jackson. Messrs. Sampson and Truit, Major Humphreys and S. E. Gordy.

The Laurens Telephone Co., Laurens, S. C., has been organized to build a telephone system in that place. The directors are J. F. Traynham, B. F. Posey, J. H. Sullivan, E H. Wilkins, W. R. Richie and O. B. Simmons; President, J. H. Traynham; Vice-President, B. F. Posey, and Secretary and Treasurer, W. R. Richie.

The Western Electric Telephone Co., Britt, Iowa, has been incorporated by J. T. Carr, Charles Webster and T. A Potter, to operate telephone exchanges in Cerro Gordo, Hancock, Kossuth, and other counties. Capital stock, $100,000.

The Southern Electric Construction Co., Richmond, Va., has been incorporated with J. M. Cullingworth, president; C. B. Wingo, vice-president; G. S. Maxwell, secretary and treasurer, for the purpose of constructing and equipping telephone plants and exchanges, electric light plants, and do a general electric business. Capital stock, $25,000.

Boone County Telephone Co., Boone, Iowa, has been incorporated by A. A. During, Charles. E. Wells, R. G.

Schaaf, J. L. Stevens and W. H. Crooks. Capital stock, $10,000.

The Home Telephone Co., Sioux City, Iowa, has been incorporated by P. H. Johnson, A. H. Hazen, A. F. Pall, E. W. Lohr, and others. Capital stock, $70,000.

TELEPHONE PATENTS ISSUED JULY 2, 1895.

TELEPHONE SYSTEM.—Angus S. Hibbard, Chicago, Ill. (No. 542,052.)

ANNUNCIATOR CIRCUIT FOR TELEPHONE SWITCHBOARDS.—Charles E. Scribner, Chicago, Ill. (No. 542,066.)

MAGNETO-ELECTRIC TELEPHONY.—Edward S. Halsey, South Evanston, Ill. (No. 542,191.)

New Corporations.

The Fairmont (W. Va.) Suburban Railway Co. has been organized with an authorized capital of $200,000. Incorporators: M. A. Clayton, W. T. Horton, C. L. Skinner and others.

The Chaplin Company, Kittery, Me., with E. D. Chaplin, president; H. L. White, of Somerville, treasurer; for the purpose of manufacturing electrical and chemical inventions. Capital stock, $75,000.

Indianapolis, Anderson & Marion Railway Company, Indianapolis, Ind., by Noah J. Clodfelter and others.

The Fort Pitt Street Passenger Railway Company, Pittsburgh, Pa., by Joshua Rhodes and others. Capital stock, $50,000.

The Philadelphia, Reading & Pottsville Telegraph Company, Reading, Pa., has elected Joseph S. Harris, president; W. A. Church, treasurer; W. R. Taylor, secretary.

The West Brokerage Co., San Antonio, Texas, has been incorporated by J. R. Ramson, J. M. Ryan, and Paul Richards, to construct telegraph line, with a capital stock of $10,000.

The Amplified Electric Co. has been incorporated in East St. Louis, Ill.

The Inter-Ocean Electric Railway Co., Chicago, Ill., by Henry E. Beasle and others, with a capital stock of $2,000,000.

The South Freeport and Cedarville Electric Railway, Freeport, Ill., by A. Bergman, Henry Lichtenberger, and A. Baumgarthner, with a capital stock of $100,000.

The Pontiac Transit Co., Pontiac, Ill., by C. C. Strawn, I. F. Funk, and L. S. Strawn, to construct a street railway. Capital stock, $100,000.

Greenwich and Schuylerville Electric Railroad Co., Schuylerville, N. Y., by Watson M. Sprague, Robert Hamilton, of Greenwich; Martin Schenck, Reeves Smith, of Troy; James E. Kelly, of Schuylerville and A. M. Crandall, of Middle Falls, to construct a surface road six miles in length from Greenwich to Schuylerville.

The Union Electric Co., Charleroi, Pa., with a capital stock of $1,000.

The Consumers' Light and Power Co., Spokane, Wash., with a capital stock of $250,000, by S. Openheimer, W. R. Newport, A. B. Hopper, H. A. W. Binket.

The Spokane Terminal Railway Co., Spokane, Wash., by A. Openheimer, W. R. Newport, A. B. Hopper, H. A. W. Binket. Capital stock, $1,000,000.

The Electric Wire-Hanging Insulator Co., Chicago, Ill., by Edgar O. Baker, M. A. Roberston, and Henry W. Rice. Capital stock, $20,000.

National Electric Light and Street Railway Associations.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

President, C. H. WILMERDING, Chicago, Ill.; 1st Vice-President, FREDERIC NICHOLLS, Toronto, Canada; 2d Vice-President, E. F. PECK, Brooklyn, N. Y.

Members of Executive Committee: E. H. DAVIS, Williamsport, Pa., (one year); W. R. GARDINER, Pittsfield, Mass.; GEORGE A. REDMAN, Rochester, N. Y.; J. J. BURLEIGH, Camden, N. J. Next meeting, New York, May or June, 1896.

AMERICAN STREET RAILWAY ASSOCIATION.

Next meeting, Montreal, Que., October, 16, 17 and 18, 1895.

President, JOEL HURT, Atlanta, Ga.; Vice-President, W. WORTH BEAN, St., Joseph, Mich.; 2d Vice-President, JOHN M. CUNNINGHAM, Boston, Mass.; 3d Vice-President, Russell B. Harrison, Terre Haute, Ind., Secretary and Treasurer, WILLIAM J. RICHARDSON, Brooklyn, N. Y.; Executive Committee, HENRY C. PAYNE, Milwaukee, Wis.; W. H. JACKSON, Nashville, Tenn.; D. G. HAMILTON, St. Louis, Mo., C. C. CUNNINGHAM, Montreal, Canada; J. N. PARTRIDGE, Brooklyn, N. Y.

NEW YORK STATE STREET RAILWAY ASSOCIATION.

Next meeting, Albany, N. Y., third Tuesday in September, 1895.

President, G. TRACY ROGERS, Binghamton; First Vice-President, JOHN H. MOFFITT, Syracuse; Second Vice-President, W. W. COLE, Elmira; Secretary and Treasurer, WILLIAM J. RICHARDSON; Brooklyn; Executive Committee, D. B. HASBROUCK, New York; JOHN N. BECKLEY, Rochester; DANIEL F. LEWIS, Brooklyn.

OHIO STATE TRAMWAY ASSOCIATION.

Next meeting, fourth Wednesday in September, 1895.

President, ALBION E. LANG, Toledo; Vice-President, W. J. KELLY, Columbus; Secretary and Treasurer, J. B. HANNA, Cleveland; Chairman Executive Committee, W. A. LYNCH, Canton.

MASSACHUSETTS STATE STREET RAILWAY ASSOCIATION.

President, T. H. CUNNINGHAM, Boston; Secretary and Treasurer, A. S. BUTLER, Lawrence; Executive Committee, SAMUEL WINSLOW, ALFRED A. GLAZIER, Boston; P. F. SULLIVAN, Lowell; E. C. FOSTER, Revere; HORACE B. ROGERS, Brockton; A. E. SMITH, Springfield; PRENTISS CUMMINGS, Boston.

THE TEXAS STREET RAILWAY ASSOCIATION.

President, W. H. SINCLAIR, Galveston; vice-president, C. A. MCKINNEY, Houston; Secretary and Treasurer, C. L. WAKEFIELD, Dallas. Directory: The officers and W. H. WEISS, San Antonio and GEORGE B. HENDRICKS, Fort Worth.

Next meeting, Galveston, third Wednesday in March, 1896.

PENNSYLVANIA STATE STREET RAILWAY ASSOCIATION.

Next meeting, first Wednesday in September, 1895.

President, JOHN A. RIGG, Reading; First Vice-President, ROBERT E. WRIGHT; Secretary, S. P. LIGHT, Lebanon; Treasurer, W. H. LANIUS, York.

THE MAINE STREET RAILWAY ASSOCIATION.

President, W. R. WOOD, Portland; Secretary and Treasurer, E. A. NEWMAN Portland; Executive Committee, W. R. WOOD, Portland; GEORGE E. MACOMBER, Augusta; F. M. LAUGHTON, Bangor; FRANK W. DANA, Lewiston; AMOS F. GERALD, Fairfield.

MICHIGAN STATE STREET RAILWAY ASSOCIATION.

President, W. L. JENKS, Port Huron; Vice-President, W. WORTH BEAN, St. Joseph; Secretary and Treasurer, B. S. HANCHETT, JR., Grand Rapids; Executive Committee, the OFFICERS and DAVID H. JEROME, Saginaw, and STRATHERN HENDRIE, Detroit.

THE STREET RAILWAY ASSOCIATION OF THE STATE OF NEW JERSEY.

President, THOS. C. BARR, Newark, Vice-President, W. S. SCULL, Camden; Secretary and Treasurer, CHARLES Y. BAMFORD, Trenton; Executive Committee, OFFICERS and C. B. THURSTON, Jersey City; H. ROMAINE, Paterson S. B. DOD, Hoboken.

CASSIER'S NIAGARA ISSUE.

The Niagara power number of *Cassier's Magazine* is one of the finest productions of this class of literature that we have ever seen. It gives a detailed description of the great enterprise from beginning to end—the work of each department of the undertaking being described by a specialist. The issue is a triumph of the printers' and engravers' art. It will be of great value to the engineer, and will, no doubt, find a place in every technical library as a work of reference. A vast amount of time, labor and money is represented in this remarkable issue.

The Fourth of July in Providence.—The American Electrical Works, Providence, R. I., celebrated the glorious fourth by sending to its friends a neat little sky rocket enclosing a miniature American flag, wrapped in a sheet of paper containing some appropriate verses and other matter.

WOVEN WIRE BRUSHES.

The Belknap Motor Co., of Portland, Maine, are the patentees and manufacturers of the best woven wire commutator brush on the market.

Electrical and Street Railway Patents.

Issued July 2, 1895.

541,838. Rail-bond. Patrick Cunningham, New Bedford, Mass., assignor of one-half to John W. Cornell, same place. Filed Apr. 1, 1895.

541,854. Dynamo-Electric Machine. Thomas H. Hicks, Detroit, Mich. Filed Aug. 29, 1894.

541,871. Storage-Heater for Street-Cars. James F. McElroy, Albany, N. Y., assignor to the Consolidated Car-Heating Company, same place. Filed Mar. 13, 1893.

541,914. Fender for Street-Cars. George Berkley, Newark, N. J. Filed Aug. 16, 1894.

541,919. Commutator-Brush. Herman B. Collins, Fulton, N. Y. Filed Jan. 26, 1895.

541,921. Manufacture of Electrical Conductors. Louis W. Downes, Providence, R. I. Filed Apr 2, 1895.

541,923. Phonograph. Thomas A. Edison, Llewellyn Park, N. J. Filed Nov. 21, 1890.

541,924. Phonograph. Thomas A. Edison, Llewellyn Park, N. J. Filed Dec. 3, 1890.

541,928. Snow-Plow for Street-Railways. John H. Graham, Boston, Mass. Filed Jan. 7, 1895.

541,929. Incandescent Electric Lamp. Robert Greer, Westbrook, Me. Filed Nov. 10, 1894.

541,949. Block-Signal for Railways. William G. Roome, Jersey City, N. J. Filed Apr. 28, 1892.

541,967. Automatic Telegraphy. Patrick B. Delany, South Orange, N. J. Filed Apr. 3, 1895.

541,969. Trolley-Wire Clip. Fred W. Haeusgen, Buffalo, N. Y. Filed Oct. 9, 1894.

541,994. Duplex and Diplex Telegraphy. Minor M. Davis, Brooklyn, N. Y. Filed Apr. 18, 1895.

541,998. Electric-Wire Joint. Alfred Gartner, Newark, N. J., assignor to Charles H. McIntire, same place. Filed May 24, 1895.

542,002. Trolley-Restoring Attachment. William D. McDaniel, Philadelphia, Pa., assignor of one-half to Luther S. Green, same place. Filed Oct. 29, 1894.

542,030. Automatic Safety Device for Electric Circuits. Lewis G. Rowand, Camden, N. J., assignor to the Universal Fire Alarm Company, same place. Filed Feb. 6, 1895.

542,036. Electric Locomotive. Thomas E. Adams, Cleveland, Ohio. Filed Oct 3, 1894.

542,037. Attachment for Street-Cars. John W. Barnes, Rockland, Me., assignor of one half to Stephen Chase, George Smith, Max Antin, and Alfred Murrey, same place, and Charles Stimpson, Thomaston, Me. Filed Mar. 18, 1895.

542,047. Street-Car Fender. Peter R. Foley and Michael F. X. Foley, Philadelphia, Pa. Filed Oct. 23, 1894.

542,052. Telephone System. Angus S. Hibbard, Chicago, Ill. Filed Feb. 21, 1895.

542,057. Electrolytic Process and Apparatus. Léon P. Hulin, Modane, France. Filed Dec. 19, 1894. Patented in France, May 5, 1894, No. 238,301, and in Belgium May 5, 1894, No. 109,791.

542,066. Annunciator Circuit for Telephone Switch-boards. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Nov. 12, 1894.

542,105. Conduit Electric Railway. Leonidas C. Pressley, San Francisco, Cal. Filed Feb. 13, 1895.

542,191. Magneto Electric Telephony. Edward S. Halsey, South Evanston, assignor of one-half to William J. Phelps, Chicago, Ill. Filed Apr. 20, 1894.

542,210. Safety Device for Handling Electric-Arc Lamps. Edward P. Snowden, St. Joseph, Mo. Filed March 22, 1895.

ELECTRICAL AGE

VOL. XVI., No. 3. .NEW YORK, JULY 20, 1895. WHOLE No. 427

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CONTENTS.

ELECTRICAL CONVENTIONS IN CANADA.

Electricity's march is one of continual conquest, but so far it has not yet succeeded in breaking down the insulation of the frontier line between the United States and Canada. The American Street Railway Association will hold its convention this year in Montreal, but the bothersome customs regulations confront intending exhibitors. According to the announcement of Secretary Partridge, which is given elsewhere in this issue, the usual regulations will be somewhat relaxed on this occasion in order to afford the greatest facility for the entry and display of exhibits. The daily press rant and preach about the annexation of Canada to the United States, but there the matter ends. Would it not be surprising, therefore, if the peaceful, but all conquering agent—electricity—accomplished the results so much desired by these vociferous newspapers? The National Electric Light Association held its convention in Montreal, in 1891, and never was there seen in that country such a display of electrical apparatus and applications of the same; another convention, although of a different character, but essentially electric, to be held next October, will make our Canadian friends open their eyes and ask themselves why they are so near and yet so far from their great neighbor.

SCIENTIFIC TRUTHS.

The ideal journal is the one that tells the truth. Sometimes the truth hits hard and demoralizes the plans of those who labor to hide it in order to gain their own ends. But such false positions cannot long be maintained; truth will conquer sooner or later. A trade journal lives mainly on its advertising patronage, and, of course, should assist its patrons in every way possible to reach customers At the same time it should zealously protect the interests of both its patrons and its readers, and if any pitfalls beset them it is its duty to reveal to them the real truth. Therefore a trade journal, to be true to itself and to its patrons, should reserve the inalienable right to tell the truth in its columns for the protection of both advertiser and reader. All classes of readers of THE ELECTRICAL AGE well know that it fills these conditions to the highest degree, and is fearless in telling facts as they are found. In this issue we conclude Mr. Cazin's article, entitled "Efficiency Losses," which was commenced in our issue of July 6, and continued in the July 13 number. The object of this article is to establish the true facts regarding the efficiency of the power transmission plant at Bodie, Cal., as described by Thomas H. Leggett, E. M., in a paper read before the American Institute of Mining Engineers. In this paper Mr. Leggett accepts the usual claims made by the manufacturers as to efficiencies of apparatus, without any attempt to verify their accuracy. With the light shed upon the subject by the criticism now before our readers, it seems strange that a body of professional engineers should allow itself to be used as the medium to advertise apparatus without challenging any of the claims put forth. Indeed, the attempt of one member to bring the facts before the Institute in the usual form of discussion was met with decided opposition at the hands of the secretary, who refused to accept the manuscript and incorporate its contents in the transactions. This refusal was based on a trivial objection to the author's style of English, and on the further ground, based on the subject-matter, that "anything in your reasoning which involves the adoption of 120 Kilo-Watts as an element in your calculations is quite useless." The true motive for this action is, therefore, obvious. But, as we have already stated and proved, Truth is mighty and will prevail. Those interested in this particular case now have the true facts placed before them, and now understand the actual state of affairs in contradistinction with the claims made by the manufacturers, but hitherto unchallenged.

PROPERTIES OF FUSE METALS WHEN SUBJECTED TO SHORT CIRCUITS.*

BY WALTER E. HARRINGTON.

In the Transactions of the Institute, May, 1893, page 251, is a paper by Charles P. Matthews "On the Behavior of Fuse Metals in Direct and Alternate Circuits." The paper deals quite exhaustively with the law established by Preece, Prof. Forbes and others, bearing on the relation between the diameter of fuse metals and the minimum currents required to fuse the metals, when sufficient time elapses for the fusion to occur.

The law as enunciated is $C = a\ d^{\frac{3}{2}}$ wherein

C = Current in amperes,
d = Diameter of wire in inches,
a = Constant depending on the metal.

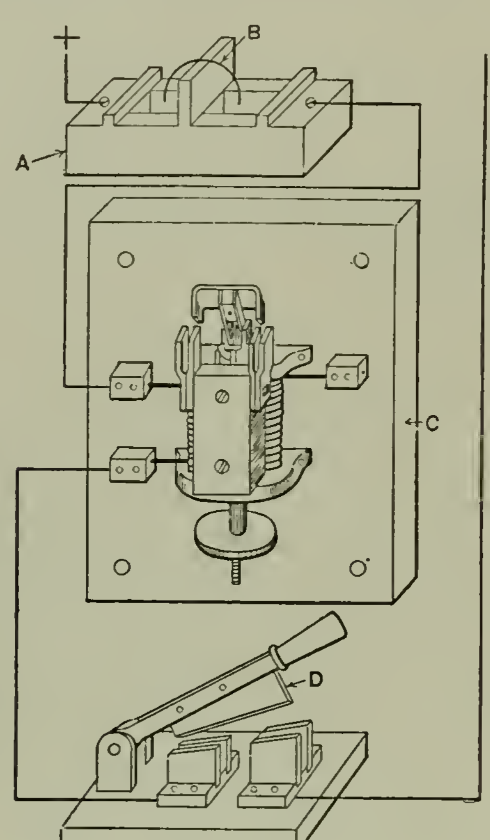


FIG. I.

The law is not rigorously true but can be depended upon very closely, particularly in the smaller diameters. In the larger diameters the law certainly does not hold true, as has been shown by different observers.

To be true and express the real relation, the constant a should be expressed as a function of d; and as far as my observation has led me, I think a is a linear function of d. It is not the purpose of the writer to elaborate on the various factors entering into the causes underlying the variability of fuse metals. The ground has been pretty thoroughly covered.

On page 261 of Mr. Matthews' paper is briefly mentioned that fuse metals rarely fuse in practice, under the conditions that the law as obtained demand.

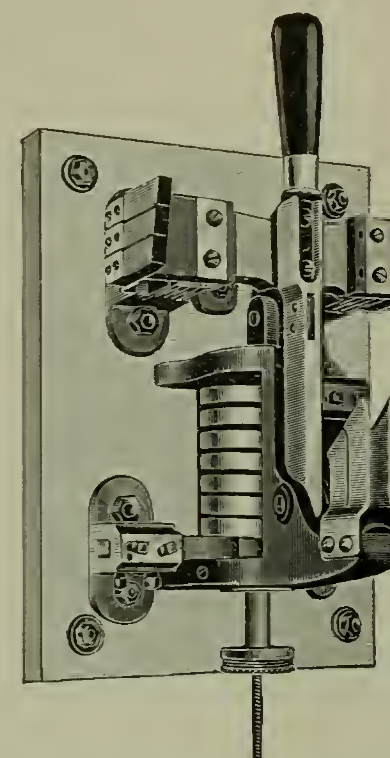
Mr. Preece on short-circuit tests made by him writes in a very vague manner covering the results as obtained.

In the course of his professional work the writer has had occasion frequently to desire to know what current would flow through fuse metals on 500-volt short circuit work. There being absolutely no literature on the subject and the data being obtained only by experiment, led to the following series of tests:

The tests were conducted in the power station of the Camden Horse R. R. Co., Camden, N. J, during August, 1894.

The testing room was about 30 feet away from the 'bus bars of the main station switchboard No. 2 B. and S. gauge copper wires led from the 'bus bars to the testing table. At the switchboard the two leads were connected, one to the ground 'bus bar direct, the other through a 100-ampere knife-blade switch to the trolley side of a Westinghouse magnetic circuit breaker, whose range of adjustment was from 250 amperes to 500 amperes in 50-ampere steps. In the testing room the wires were arranged diagrammatically, as shown in Fig. 1.

A, was a special fuse block whose terminals were protected by oil, leaving 3″ of fuse in the atmosphere.



C.-S. MAGNETIC CIRCUIT BREAKER CLOSED.

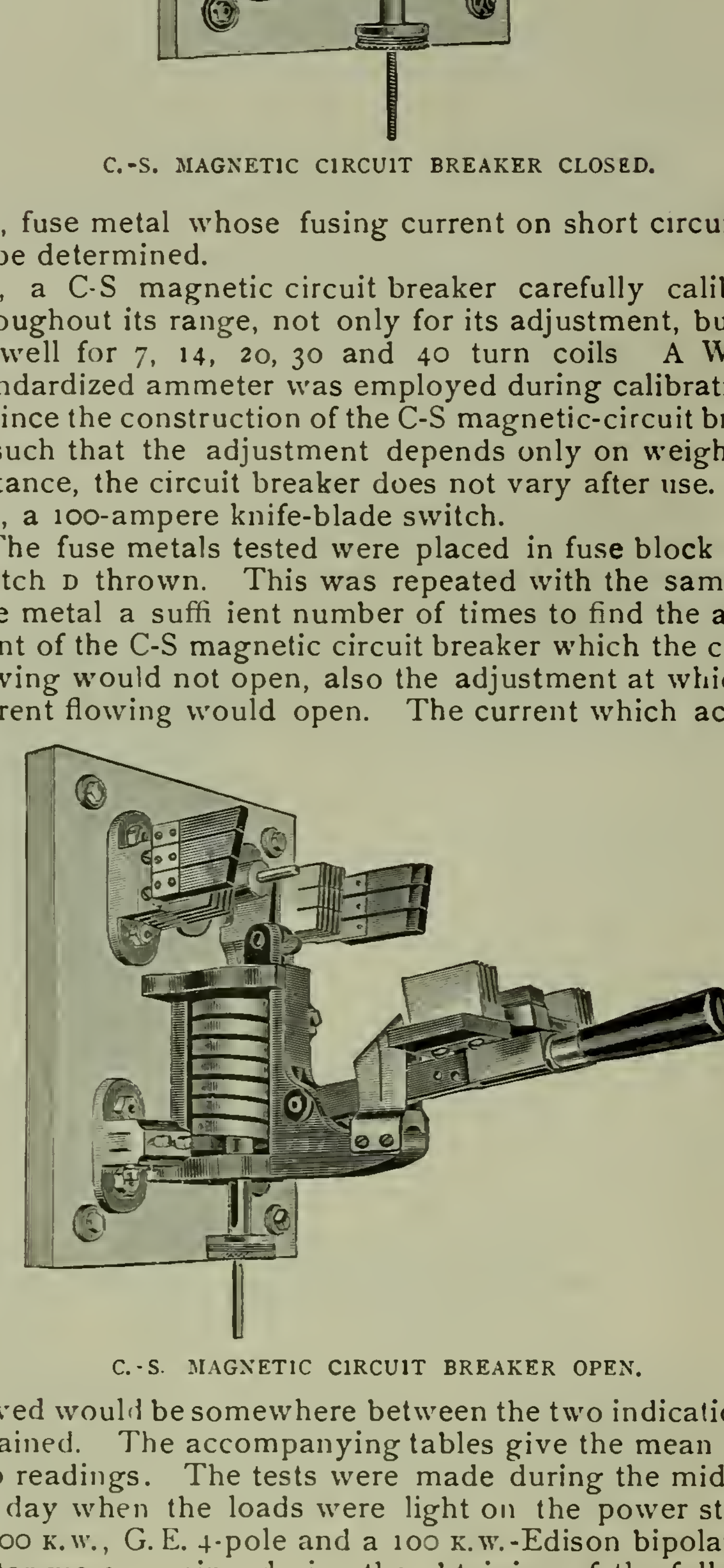
B, fuse metal whose fusing current on short circuit was to be determined.

C, a C-S magnetic circuit breaker carefully calibrated throughout its range, not only for its adjustment, but also as well for 7, 14, 20, 30 and 40 turn coils A Weston standardized ammeter was employed during calibration.

Since the construction of the C-S magnetic-circuit breaker is such that the adjustment depends only on weight and distance, the circuit breaker does not vary after use.

D, a 100-ampere knife-blade switch.

The fuse metals tested were placed in fuse block A and switch D thrown. This was repeated with the same size fuse metal a suffi ient number of times to find the adjustment of the C-S magnetic circuit breaker which the current flowing would not open, also the adjustment at which the current flowing would open. The current which actually



C.-S. MAGNETIC CIRCUIT BREAKER OPEN.

flowed would be somewhere between the two indications as obtained. The accompanying tables give the mean of the two readings. The tests were made during the middle of the day when the loads were light on the power station. A 200 K.W., G. E. 4-pole and a 100 K.W.-Edison bipolar generator were running during the obtaining of the following data.

The sizes of fuse wires employed was such that the cur-

* A paper presented at the Twelfth Annual General Meeting of the American Institute of Electrical Engineers, Niagara Falls, N. Y., June 25, 1895.

rent flowing through them would not exceed 500 amperes, this being determined by the adjustment of the Westinghouse magnetic circuit breaker referred to before.

(*To be Continued.*)

COMPOUNDING DYNAMOS FOR ARMATURE REACTION.*

BY ELIHU THOMSON.

(*Concluded from Page 5*)

It was noticed that on any considerable increase of load being made, the potential rose in some cases as much as 5 or 6 volts above the point at which it would remain; or which it would reach after a short interval. Similarly it was found that the sudden taking off of load caused a temporary fall below the stable voltage under the new or diminished load conditions. This curious effect was traced to the difference of time between that needed to build up or cut down the flux in the dead poles, as compared with that required to cut down or build up the excited poles, which, being wound with wire, were naturally more sluggish under the conditions of use. Currents would be induced in the coils under each change of flux, which change itself would thereby be rendered more gradual. The dead poles being unwound could respond more rapidly. Any increase of load would of course tend to break down the wound poles and to increase the flux in the dead or unwound poles, and the taking off of load would have the opposite effect.

Fig. 7 shows a compounding curve obtained under a constant excitation of four amperes at a speed of 790 revolutions, the load being varied from 0 up to more than thrice the full load. It will be noticed that the potential at first increases and only breaks down under extremes of

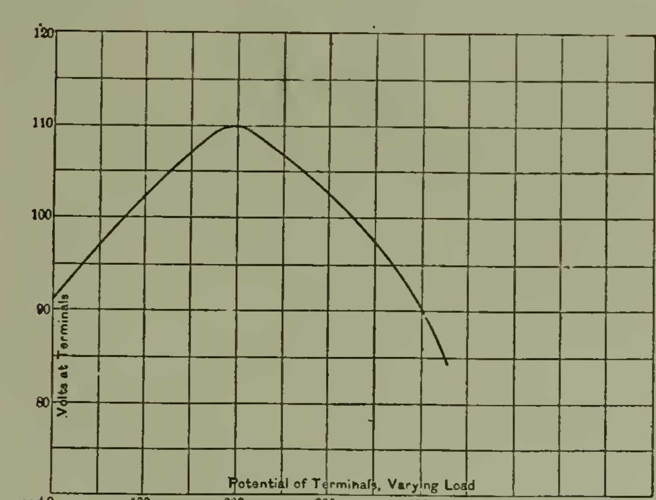


FIG. 7.

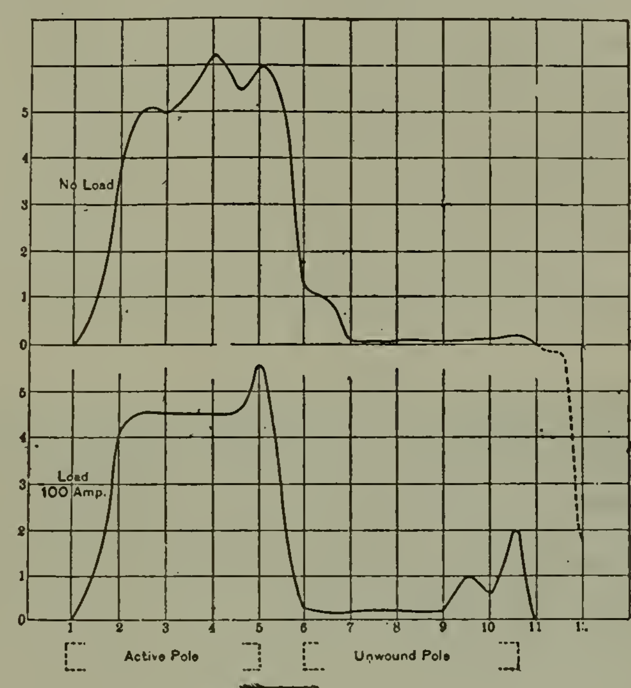
load. The final breaking down is doubtless due to saturation of the forward portions of the dead poles, together with the armature core projections. Part of the drop was undoubtedly due to resistance at the brushes, which were of carbon and by no means fitted to conduct off such heavy currents. Taking this drop and the drop over the armature conductor itself, it is not surprising that at the high loads the potential should fall off.

A horizontal plotting of the potentials generated in the armature coils under no load obtained by the two-brush method of Dr. S. P. Thompson, is given in Fig. 8, the relative positions of the wound and "dead poles" being marked in dotted lines, and the arrow indicating the direction of movement of the armature relatively thereto.

Fig. 9 gives the same plotting under a load of 100 amperes, and accentuates the effect of the armature reaction in magnetizing the dead poles. The curves are only approximate indications, owing to the fact that the number of points at which readings were taken was less than was desirable, and because in some cases it was difficult to maintain all conditions unchanged, particularly with the very heavy loads.

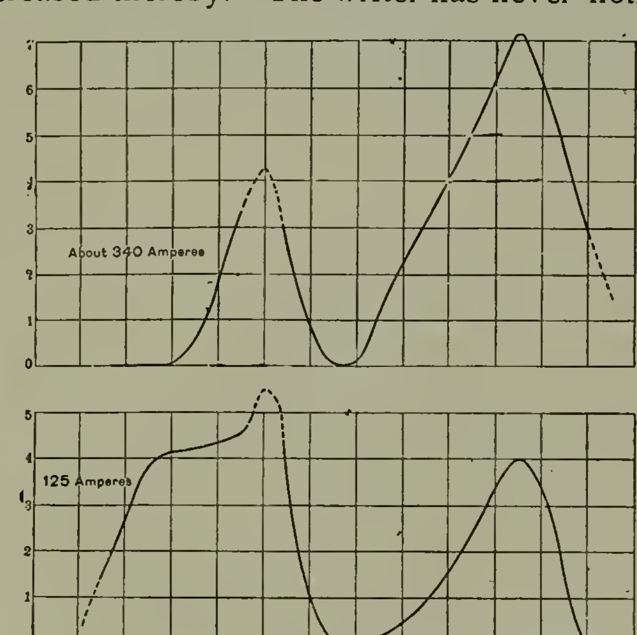
Figs 10 and 11 show a similar plotting for abnormal or extreme loads. The former shows how completely the wound pole has been broken down by armature reaction, and how the unwound poles have now become the chief working field poles, or rather how the armature winding itself has furnished the field for its own cutting. A calculation of the flux density at the forward edge of the unwound pole shows that the magnetization has risen to saturation. The other parts of the pole are shown to be still susceptible of increase of flux, but their relation to the armature is far less favorable for its generation.

The machine described is probably chiefly interesting from a theoretical aspect. Still it shows clearly that so far as the effect of the series field on compound wound machines is concerned, the electrical engineer has other resources at his command giving similar results. It cannot be doubted also that the design of armature and field



FIGS. 8 AND 9.

might be considerably improved with special regard for the particular feature of compounding. A feature of the machine which developed itself when carbon brushes were used, was that even at heavy loads the brushes could be set back from their maximum position, or true diameter of commutation in this case, and that the movement was attended with little, if any increase of spark, while the potential steadily went down. It was thus easily possible to adjust the potential by a backward movement of the brushes in the space between the unwound and wound poles, while the slight sparking under the carbon brushes was not increased thereby. The writer has never noticed this



FIGS. 10 AND 11.

effect in so pronounced a degree in any other structures, but thinks that it may not be peculiar to this machine.

A further interesting consideration is the effect of dispensing with the wound poles altogether, and either neglecting to employ any reversing or commutating field while maintaining the brushes near the forward edge of the field-poles which now remain, namely, the unwound poles, or employing commutating arrangements similar to those used by Mr. Sayers, that is, returning the leads through slots in the armature under the strong induction of the forward edge of the pole as the armature leaves it. In such a case it would appear from theoretical considerations that the machine should, if it possessed any permanent magnetism, excite itself as a series dynamo entirely without any winding on the field and solely by the action of the armature winding itself. This fact was, I believe, first pointed out by Drs. J. and E. Hopkinson.

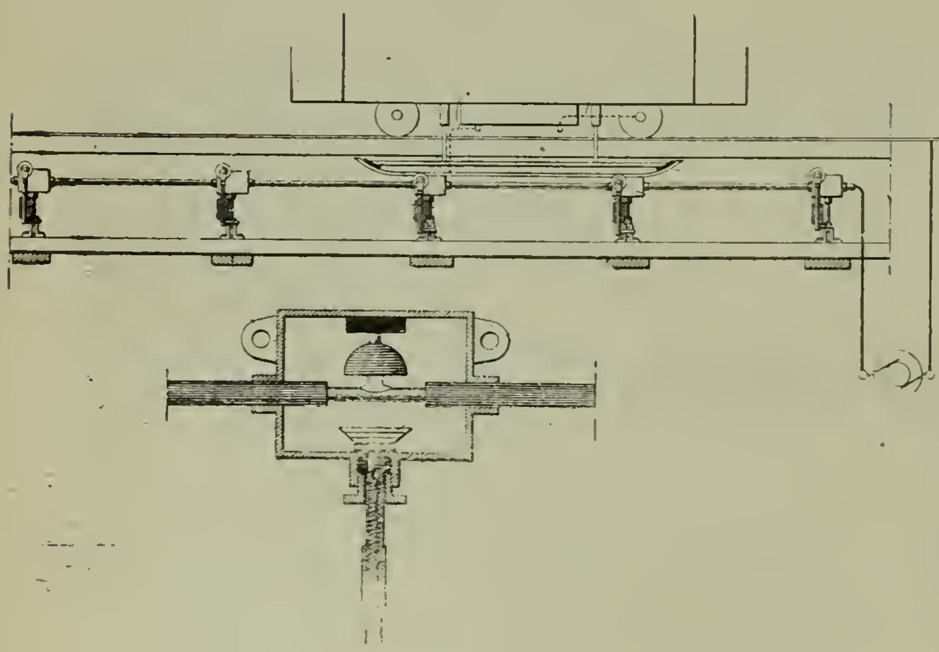
In conclusion it may be stated that tests of the machine used to generate single-phase and three-phase alternating currents in its armature winding were made by dispensing with the commutator and substituting rings and connections common in such cases. The results indicated a substantially similar effect of compounding, but to a less degree, owing no doubt to the fact that the phase of the electromotive force generated by the wound pole flux would not coincide with that due to reaction on the dead poles, since the position of the poles with relation to any portion of the moving wire is different at the same instant.

THE WIDMAYER CONDUIT ELECTRIC RAILWAY.

On May 28, 1895, a patent was issued to Frank B. Widmayer, of 404 West 27th Street, New York City, on a conduit electric railway, which possesses some very meritorious features.

In his invention Mr. Widmayer seeks to avoid the weak point of most all underground conduit systems, that is, leakage through the flooding of the conduit, or moisture.

By reference to the accompanying illustrations, Mr. Widmayer's method of accomplishing this desirable result will be best understood.



FIGS. 1 AND 2.

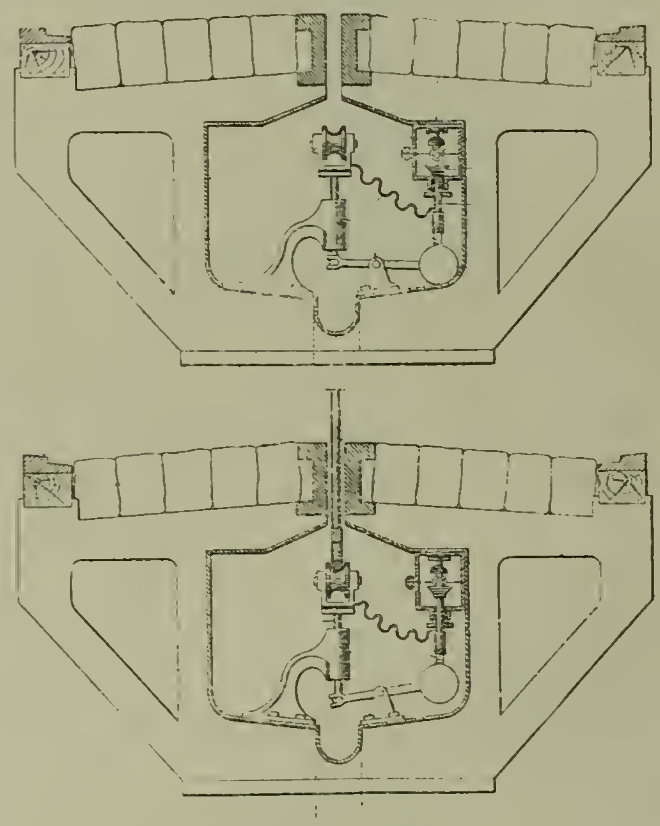
Fig. 1 gives a longitudinal plan of a section of the conduit and car connection; Fig. 2 shows the contact-box, and Figs. 3 and 4, cross-sectional views of the conduit, showing, respectively, broken and closed contacts.

The car is provided with a contact-shoe, which is of such length that it forms a connection with each contact-box before it, breaking the connection with the one immediately preceding. In this way the connection with the electrical conductor is continuous and uninterrupted, and there is no sparking at the point of electrical contact. As the shoe advances with the car it depresses the contact wheel, which is situated at one end of a lever, the other end of which raises the plunger within the contact-box, thus making contact with the conductor. Fig. 4 shows this position of the parts. Under these conditions the current passes from the conductor, through the plunger in the box, through the flexible connection with the contact wheel, thence through the shoe to the motors, and to return rail.

As the car passes off these contact points, or boxes, the counter-balance pulls the plunger away from the conductor and, at the same time, raises the contact wheel within the conduit, and places it in the proper position to be operated by the shoe of the next car, when the same operation is repeated.

It will be understood, therefore, from what has preceded, that connection is made between the car and the conductor through the successive operation of the contact mechanisms in the boxes, and before the contact in one box is broken that in the box ahead is established, thus preserving practically a continuous connection between car and conductor.

The details of the contact box are shown clearly in Fig. 2. This box is water-tight, and the portion of the cable enclosed therein is bared of its insulation in order to provide a metallic contact surface for the plunger, which normally is kept depressed from the conductor. The conductor, it is noticed, is supported within the box by an insulator, and every precaution is taken throughout the system to maintain the highest possible degree of insulation.



FIGS. 3 AND 4.

Since the entire main conductor is insulated and the contact boxes are water-tight, and since never more than two of the boxes can be used by one car, the conduit may be flooded with water without rendering the system inoperative.

Mr. Widmayer's system is simple and apparently efficient, and offers a more practical solution of the difficult problem than do most systems of this class.

THE ATLANTA EXPOSITION.

The first machinery received at the Cotton States and International Exposition for installation is the General Electric Co.'s 250 K. W. alternator for incandescent lighting and power. It weighs 37,000 pounds.

The electric light wiring, internal and external, has been commenced. The General Electric and Westinghouse Companies have received orders for all the incandescent lamps and fixtures to be used, and the Safety Insulated Wire and Cable Co., of New York, will supply the underground cables.

Work on the electric fountain is well under way.

Arc Light Carbons.—The formation of the crater on the upper carbon of an arc light is due in part to the checking of the current and consequent accumulation of energy above by the high resistance of the arc, causing increased consumption of carbon; and the exterior carbon surface being denser and harder than the interior, and also radiating heat more rapidly, is consumed more slowly. The formation of the point on the lower carbon is due to the accumulation of fused particles of silica carried down.

THE BALTIMORE AND OHIO TUNNEL PLANT.

The recent opening of the Baltimore and Ohio Railroad tunnel in Baltimore, with its electric power equipment, is one of the most important and interesting events of recent times in electrical and engineering circle. THE ELECTRICAL AGE has recently published considerable matter regarding this interesting system, and we are now able to add more valuable information to what has gone before, and at the same time give some illustrations of different parts of the plant and system.

The length of the tunnel is 7,339 ft., and the maximum dimensions, after lining, are twenty-seven feet wide by twenty-two feet high. Its cost, ready for the track, is set down at $225 a lineal foot.

The power house stands upon the west side of Howard street, east of the tracks leading to the southern portal, two blocks south of the Camden station of the Baltimore and Ohio Railway. It is a one-story building rising thirty feet from floor to eaves, with walls of brick one foot five inches thick. The roof of slate is supported on iron trusses, and the building is practically fireproof. It is divided into two parts, the engine room occupying the north portion, being separated from the boiler room by a brick wall. The entire length of the building is 322 ft., 1 in. long; the dimensions of the engine room 223 ft., 10 ins. in length by 57 ft., 9 ins. wide, and of the boiler house 98 ft., 3 ins. by 69 ft. wide.

The boiler house is a spacious and lofty room, having twelve boilers (250 H. P.) arranged in six batteries, three of which are placed on each side of the centre passage. It is lighted from the roof. The boilers are of the Root water tube type, from the shops of the Abendroth & Root Manufacturing Company. Each boiler is twelve tubes wide and eleven tubes high, with six fourteen and a half inch drums and a thirty-inch steam drum. Space is left for an additional boiler on the west side of the room.

A system of mechanical draft is employed, and the flues run over the rear of the boilers and taper from two feet, nine inches square at the end to five feet square at the junction with the fan chamber, nine feet in diameter, in which two fans of the Sturtevant pressure pattern revolve at 240 revolutions per minute. This chamber is at the base of the iron stack, which is seven feet in diameter and fifty-one feet high from the floor. Each fan is belt-driven by a ten horse power vertical engine, set up on the floor of the boiler room, and one is of sufficient capacity to secure the necessary draft.

The boiler room is further equipped with a C. W. Hunt coal crusher and conveyor, which brings the coal to the boiler and carries away the ashes from the ash pits, with Deane duplex feed-water pumps, and a 3,000 H. P. Webster feed-water heater.

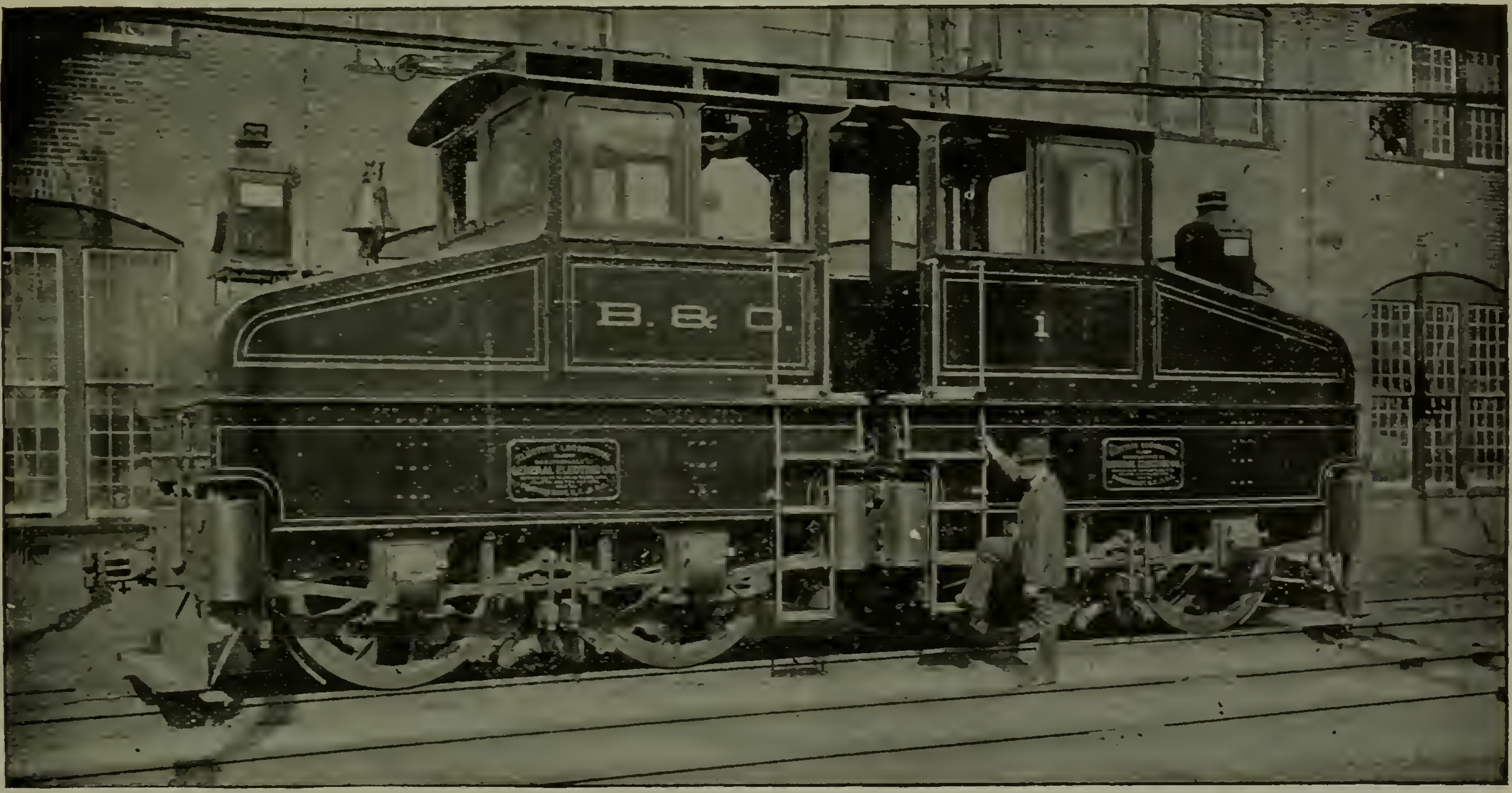
The steam system is duplicate throughout, and was laid out in the engineering department of the General Electric Company.

A twenty-four inch separator is furnished to each power engine, and one of similar size for each pair of lighting engines. The Holly drip system is used in the engine room, and is connected with the separators at the engines, the valves and expansion joints, wherever there is the slightest pocket in which water could lodge, returning it to the boilers with only a slight drop in the temperature. The steam piping is protected by Keasbey & Mattison magnesia covering.

The engines are horizontal, tandem compound Reynolds-Corliss machines, from the shops of E. P. Allis & Company, and have 24 and 40 × 42 in. cylinders.

Directly coupled to them are 500 K. W. General Electric multipolar generators, adapted to run with the engine at 110 revolutions per minute. The armatures of these generators are "overhung" on the outer end of the shaft. The arrangement, in this respect, differs from the regular practice of railway generators. The armatures differ from standard practice in being wound for 700 volts potential and are of the iron-clad type, *i. e.*, the windings are embedded in slots cut into the outer periphery of the laminated armature body. The armatures are of the latest barrel-wound type, and present a very massive appearance. The fields are of steel, according to the well-known General Electric design, and run remarkably cool. The machine compounds from 600 volts no load to 700 volts full load. The performance of both the generator and engine under the severe fluctuations to which this character of work is subject shows that the apparatus must have been carefully designed, with reference to the peculiar conditions to which it was to be subjected.

From the railway generators the current is brought over cables, of 1,000,000 C. M. cross section, to a switchboard of white marble, erected on a platform raised at the south end of the engine room. This switchboard consists of four standard "K" generator panels, each equipped with



THE 96 TON ELECTRIC LOCOMOTIVE.

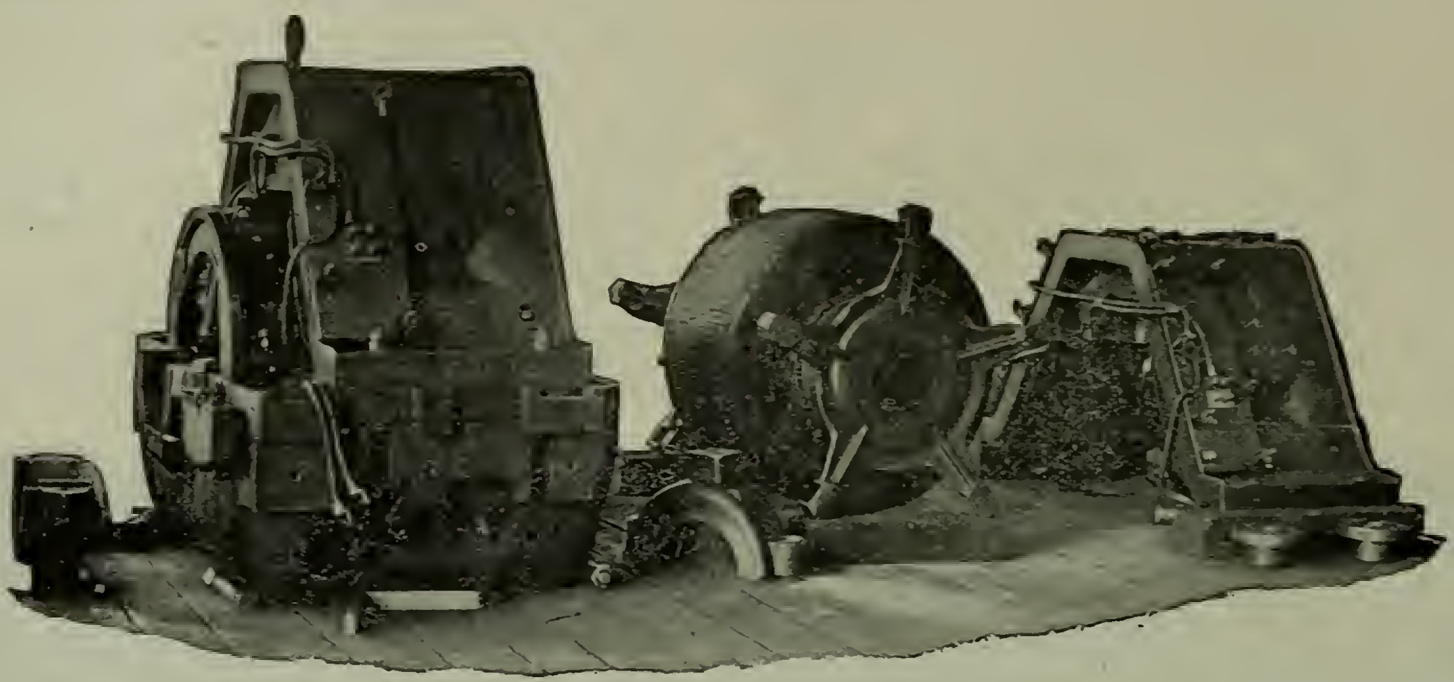
all the necessary instruments for controlling and measuring the current from one generator. The machines are protected from accident arising from short circuit by automatic breakers, one of which is fixed to the upper part of each panel.

The northern section of the engine room contains the lighting plant, consisting of eight fifty-light Thomson-Houston arc generators, and two alternators for the incandescent-lamp service in the tunnel. The arc-light machines are belted to two cross-compound Armington & Sims 250 H. P. engines, 16½ × 23 × 19 ins. Two other engines, of similar make and capacity, drive the two alternators, and space has been left for an additional engine and alternator. Each alternating generator has a capacity of 2,000 sixteen candle-power lamps, and as the tunnel is lighted by 1,000 thirty-two candle-power lamps, one alternator will suffice for the present illumination of the tunnel. Facing the lighting plant, on the east side of the room, is the lighting switchboard, also of polished white marble. It consists of one standard, twenty-circuit, arc-lamp plug board to which only sixteen circuits are at present connected; three alternating generator panels, one of which is left blank, and one feeder panel. The arc lamps used in the illumination of the power house are of the Thomson-1893 type. In addition, it is lighted by clusters of three incandescent lamps each, fixed to the walls. The approaches and stations are lighted by Thomson-Houston standard arc lamps.

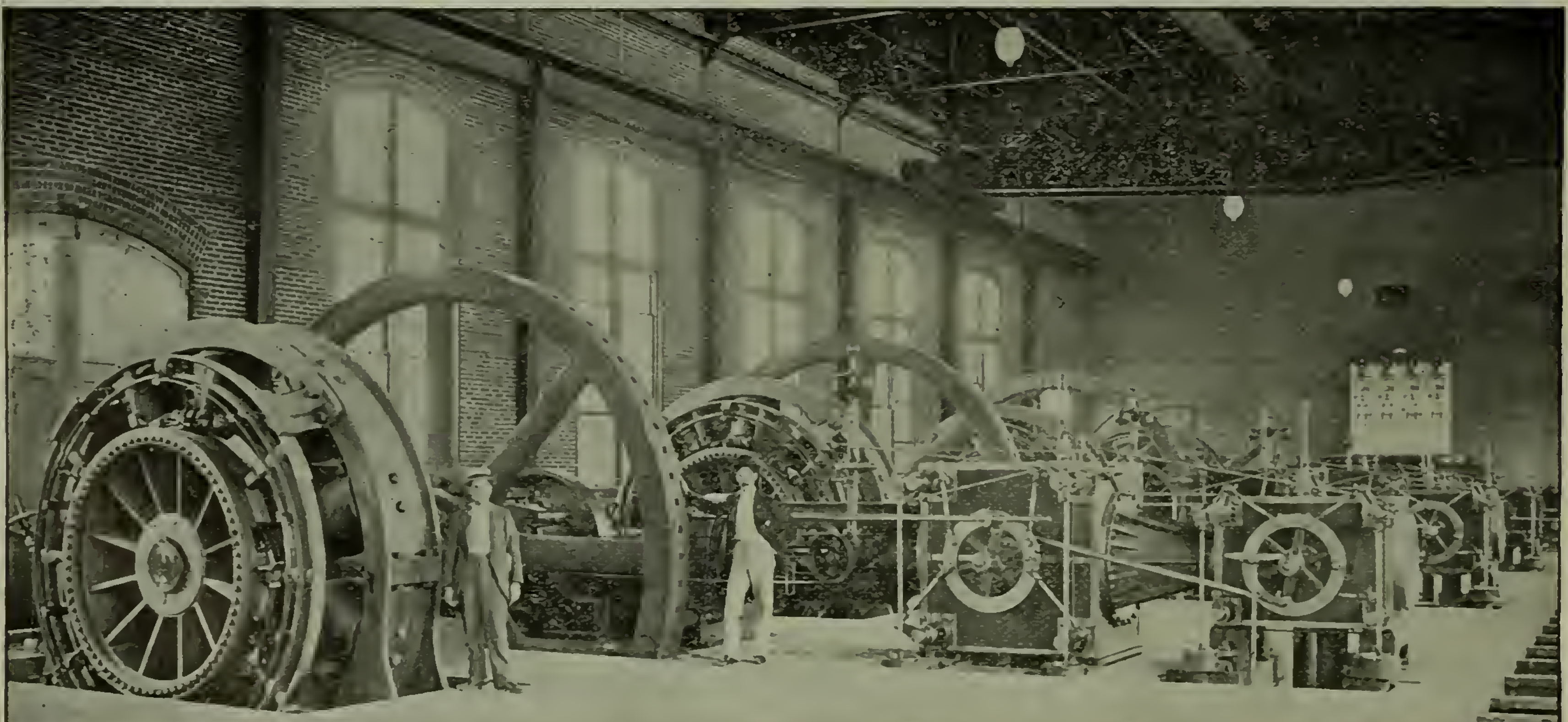
From the positive bus on the railway switchboard, eight cables of stranded copper, each of 500,000 C. M. cross section, or a total cross section of 4,000,000 C. M., pass to the overhead structure immediately outside the power house, where connection is made to three feeder cables, of 1,000,000 C. M cross section each, and to the overhead conductor itself, which has an equivalent of 1,000,000 C. M. cross section. The negative bus is similarly connected to the rails, which are double bonded with No. 0000 wire, and also to the return cables laid in a wooden box between the tracks. Perfect contact between bonds and web is obtained by using a hollow rivet on each end of each bond and expanding it, when inserted in the rail, by means of a conical steel pin.

The distance over which the electrical locomotives will operate is about 15,000 ft., passing through two tunnels, 7,339 ft. and 265 ft. long, respectively, and over 7,396 ft. of track in the open from Hamburg street to Huntington avenue.

The operation of the freight trains will begin at the main tracks south of the Camden station, where they will be switched into the cut. The electric locomotive will then couple on behind, without stopping the train, and push it through as far as the Mt. Royal Avenue portal, a



THE MOTOR UNASSEMBLED.



THE POWER PLANT.

distance of 8,146 ft., the steam locomotive doing no work. After passing out of the tunnel, both steam and electric locomotives pull and push together up the heavier grade as far as Huntington avenue, the average speed over the entire distance being about fifteen miles an hour. At Huntington avenue the electric locomotive will uncouple and run into its siding.

The passenger trains will be pulled through from the Lombard Street station near the south end of the tunnel to the Bolton street station at the north end.

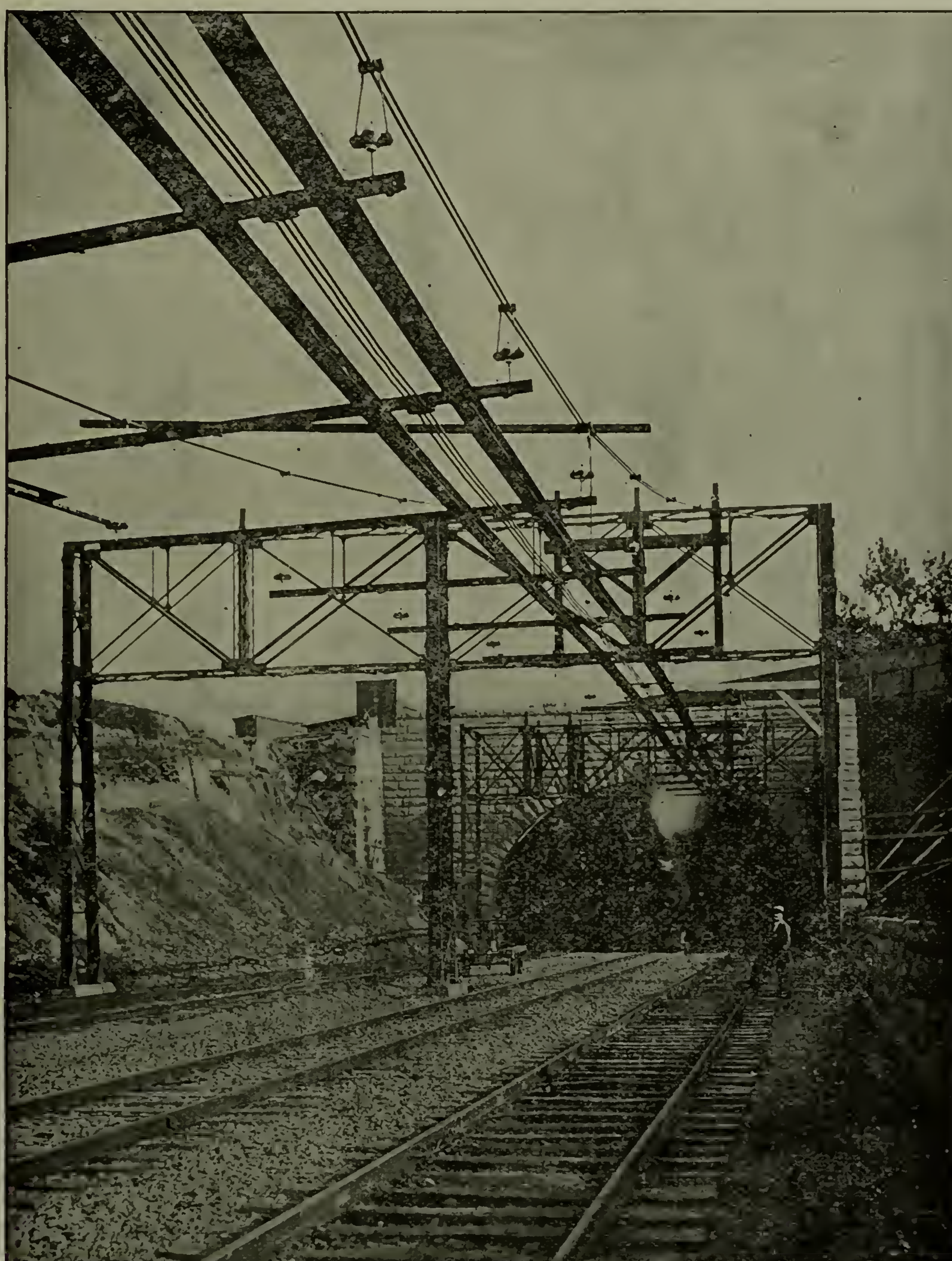
The dimensions of the electric locomotive were printed in the last issue of the Electrical Age as part of Dr. Duncan's inaugural address before the general meeting of the American Institute of Electrical Engineers, at Niagara Falls, last month.

The gearless motors are four in number, two to each truck, flexibly supported and transmitting their power to the wheels through flexible connections. They are of pyramidal shape, and the largest railway motors in the world. Each has six poles and six sets of carbon brushes, the brushes being connected to a yoke revolving through 360 degs. to facilitate accessibility to them. It is possible to remove four brushes without disabling the motor. The field spools are encased in sheet-iron cases and fitted over the pole-pieces bolted to the field-frame. The armatures are built of sheet-iron laminations, and are series-drum wound.

The motor is designed to allow of ready removal of the field frame for inspection or repair.

Each motor is rated at 360-H. P. and takes a normal current of 900 amperes.

The controlling devices and measuring instruments, etc., occupy the interior of the cab. The controller is erected in one-half of the cab, and is of the series parallel type. The reversing lever projects through the upper plate of the controller cover. The resistances are placed around the frame beneath the floor of the cab.



NORTH EXIT FROM TUNNEL.

The locomotive is equipped with a 1,200 to 3,500 automatic circuit breaker and one 2,000 ampere magnetic cut-out, a 5,000 ampere illuminated dial Weston ammeter and one illuminated dial Weston voltmeter. The compressed air for the whistle and brakes is supplied by an oscillating cylinder electric air pump, the air tanks being placed at each end of the complete locomotive. The interior of the cab is illuminated by clusters of incandescent lights.

The method of securing contact with the overhead conductor was also described fully in Dr. Duncan's paper, to which we refer the reader.

THE UTILIZATION OF THE TIDE.

BY NEWTON HARRISON.

The amount of power consumed for purposes of manufacture has always been the cause that prompted men to look for cheaper and more available sources of energy. The amount used is probably not one per cent. of that which is being wasted daily. Among the most familiar of all natural forces is that of the tide. It is capable of doing much of the work that does not require a perfect regularity and evenness of power. In the Bay of Fundy, for example, the tide rises fifty feet; and at other points in different localities there is also a phenomenal rise. Not only does the simple elevation of the water occur, but when the passage is constricted its inward or outward flow results in a speed like that of a running river. At Hell Gate, New York, the tide might easily be mistaken for the impetuous flow of a fresh water stream.

Such facts tending to prove that the effect of tides results in the development of many horse-power that is being continually wasted, the method to be employed for the utilization of the tide would, if practical, lead to a cheapness of production that might be unequalled from other sources. It would not be a difficult matter to at least experiment, if only for the purpose of showing the possibility of its application. To digress for an instant, let it be remembered that one horse-power represents 33,000 foot lbs. per minute. In order to develop its equivalent, 33,000 lbs. may be either raised or lowered one foot per minute and the same unit horse-power results. Or the distance may be decreased so that 66000 lbs. moved one-half foot will serve the same purpose. If therefore large rafts be constructed of 10, 20 or even 1,000 tons weight, the output in horse-power upon such a basis would be, if the 1,000 ton raft be considered :

$$\frac{1{,}000 \times 2{,}000 \times \text{feet per minute}}{33{,}000.}$$

By considering the rise of the tide as anything from 10 to 3 feet per 6 hours, a table can be constructed as follows:

feet per 6 hours	= feet per minute
10	.02778
5	.01388
3	.00833

and calculation made accordingly. If, for instance, the 1,000 ton raft experience a 10 feet tide, the table gives the feet per minute as .02778; then

$$\frac{1{,}000 \times 2{,}000 \times .02778}{33{,}000.} = 1.7 \text{ H. P.}$$

Rafts used for the above purpose can be made of wood and piled up with old, worthless iron and odds and ends to any extent compatible with its power of flotation. A walking beam with the shorter end of the lever attached to the raft and the longer end to a train of gears would complete as unique an equipment as could be found anywhere. The expense of operation would be practically nothing, and the production of power would last indefinitely without any further cost.

A ten-foot tide would develop 100 H. P. by raising 60,000 tons in six hours, and continue it for 6 hours more or a total of 12 hours upon ebb, thus providing a constant source of energy for 24 hours of the day by its second period of rise and fall.

PERSONAL.

Mr. J. W. Marsh, secretary and general manager of the Standard Underground Cable Company, Pittsburgh, Pa., was in the city last week.

LOSSES OF EFFICIENCY.

BY F. M. F. CAZIN, OF HOBOKEN, N. J.

(*Concluded from page* 17.)

Both of these questions may be met with an absolute denial, which is justified for the following reasons :

1. Mr. Trautwine is not in favor of making ample use of mathematics in practical engineering.* As a consequence, he has accepted on precedents an equation for evolving water-power that gives erroneous results, whichever way it may be turned or applied. It is based on two values to be taken by observation, namely, for *head* either by survey or pressure-gauge, and for quantity of water ejected to be weighed or measured. If the maximum power that may be evolved from water falling from a stated elevation is to be evolved, then his equation gives too small a result, because the water that would fall from this *head* in an unimpeded fall is more than the ejected water in any case; and if the maximum labor performable by the water actually ejected is the desired value, then the equation gives too high a result, because the head, by survey or pressure, is in all cases more than the effective head evolved from velocity of ejection.

There is only one correct way in either case, namely, in the one to evolve quantity of water ejected from the actual head and the transverse section of jets, or, in the other, to evolve effective head from the quantity of water actually ejected.

Two values that are contradictory to one another can not be used side by side in the same equation, and in Trautwine's values for *head* and *water-quantity* there are two different values for velocity, rendering the one or the other incorrect and both contradictory to one another.

This fact is well illustrated by the figures, as they are evolved above. Using the Trautwine equation the Annapolis professor calculated a theoretical h.p possible of 8.957 h.p.; but it was shown that, with the water-quantity ejected, no higher theoretical h.p. could be possibly effected than 7.589 h.p.; therefore the Trautwine result calls for an effect of

$$\frac{8\ 957}{7.589} = 118.\%, \text{ or for an impossibility.}$$

2. The effect of friction depends on weight and not upon either length of contact-faces nor on velocity of relative movement. Therefore, the effect of the brake expresses no positive labor performed in foot-pounds. The brake effect may express a comparative value for labor performed; and for testing such comparative values it was introduced and adopted.* This limitation in its proper use, however, has been forgotten, and, in using the brake, even the fundamental rule on which alone its value for even exclusively comparative tests rests has also been forgotten; therefore, to properly compare results they must all have been obtained under normal speed for highest efficiency as expressed by $\frac{v\ .\ 60}{2\ .\ \text{diam.}\ .\ 3.1416}$, and tests made under speeds that are disproportionate to normal speed offer no values for direct comparison.

The only possible method for using the Prony brake for positive labor measurement consists in the use of correcting coefficients that must be obtained by comparison with labor actually performed, such as water or mercury, or any other liquid of intermediate density, raised by a dipping wheel. Such comparison must not only be made for each individual brake but must be repeated for each test—the given conditions being changeable.

The test with a dipping-wheel raising a liquid on curves, and receiving at its circumference and discharging near centre with a permanent level for either action, is a simpler and a surer estimate of labor and efficiency.

* See the preface to Trautwine's Engineers' Pocket-Book.

The claim of 86.59 per cent. of efficiency made by the manufacturers of the Pelton wheel on the basis of the Annapolis tests, therefore, is without any basis in fact. An impossibility is claimed and the claim in consequence is futile; and the assertion by the Annapolis tester that the Peltons are at least 15 per cent., and in some cases 35 per cent. more efficient than other makes of water-wheels falls as a result.*

Tests of percussion water-wheels, the buckets of which divide the jets in the central plane of rotation demonstrate, with the dipping-wheel efficiencies, that they vary between 50 per cent. and 70 per cent. of maximum labor performable by the water actually ejected. The variations can be accounted for in each case by the more or less perfect compliance with the fundamental condition of reversing the direction of flow by contact with the receding bucket-faces; that is, by completely reversing such flow in continuous curves.

These tests make it safe to accept the rating that the makers of the Peltons have given to their wheels (in the Bodie case, 240/433 = 55.42 per cent).† an efficiency that might be increased to 60 per cent. by running the wheels at normal speed, as can be proved by the following:

The velocity pertaining to jets evolving a maximum labor performance of 433 H. P. from an aperture of ejection with a total as 7.2 units of 10 square centimetres is by

$$433 \text{ H. P.} = \frac{7.2 \times v^3}{19.62 \times 76.04}$$

and by

$$v^3 = \sqrt[3]{\frac{44.76 \times 3.28 \times 60}{1.75 \times 3.1416}} = 1{,}602$$

revolutions as the maximum speed of the 21-inch wheel when running without load. The normal speed under adequate load, therefore, would be as 1,602/2 = 801 revolutions per minute. The wheels run 870 revolutions, and in consequence perform only 801/870 or 92 per cent. of their maximum efficiency, which appears to be (100 . 55.42) /92 = 60 per cent. of the maximum labor performable by the water ejected.

On the basis above stated 240 H. P. are required to produce 132 H. P. in electric energy and for transmitting electrically to a distance of 12 miles a mechanical labor performance of 101.5 H. P., the absorption of energy in electrical apparatus being as follows:

In the conversion of mechanical power into electrical power 240—132 = 108 H. P...	=	45 %
In transmitting electric power to a distance of 12 miles and in reconverting electric power into mechanical power 132—101.5 = 30.5........................	=	12.7 "
Leaving an efficiency for electric power-transmission of........		42.3 "
		100%

*M. E. Cooley of the Michigan University at Ann Arbor certifies under May 23, 1891, to the efficiency shown of 1.9 H.P., under conditions, which properly calculated allowed a maximum or theoretical H.P. of only 1.994 H.P. The result claimed is equivalent to 95.29 per cent. of efficiency, which is almost as evidently an impossibility as the Annapol s efficiency of 102.24 per cent. In both cases the cause of error is in the false interpretation put on the indications obtained in testing with the Prony-Brake; resulting in overestimating efficiency the same as the false assumption which has resulted in overestimation of theoretical effect.

† By neglecting this condition and by testing one wheel under speed that is nearly normal, and another wheel under speed that is abnormal or below normal, test-results are presented snpporting claims of superiority that are essentially false and deceptive.

NOTE.—The preceding issue of THE ELECTRICAL AGE contains on page 10, under the head, "Electric Gold Dredging Plant," the statement that a four-foot Pelton wheel, driven by one 1½-inch jet under 228 pounds pressure drives two dynamos, each producing a current of 40 amperes under 650 volts, the equivalent of 69.7 H. P.

The water power, as specified, is the equivalent of 134.74 H. P., or of 128 H. P. if five per cent. are lost in quantity ejected as against indicated quantity. The efficiency against maximum work performable then is in the stated case as 69.7/128 54.45 per cent.

This efficiency coincides remarkably with the rating given by the manufacturers themselves in the Bodie case, which, with 60 H. P. is equivalent, as shown, to 55.42 per cent.

If these figures are incorrect it is in the highest interest of both the manufacturing firms concerned not to ignore but to controvert the figures by facts.

The actual performance by either hydraulic or electrical apparatus in transmitting mechanical power is the question at issue. The report quoted gives no straight answer to this question. The plant at Bodie furnishes an opportunity for the final solution of questions that are of much interest to both science and industry, but the data furnished by Mr. Legget do not solve them.

PRINCIPLES OF DYNAMO DESIGN.

BY

Newton Harrison E.E.

(*Continued from Page* 19.)

The Armature—The speed of the armature has always given rise to discussions that owe their origin to an inexact knowledge of the fact that, although a high speed is desirable, it is better determined by the purpose of the machine than by any arbitrary conclusion. The rate at which power is expended always determines the speed of rotation. A belt possessing a certain torque must, in order that it may deliver a given horse-power, move with a known rate of speed. This can be measured either in feet per minute, as is most usual, or in angular velocity. As in either case the product represents the output in horse-power, it is better and more convenient to adopt the term feet per minute. If the force that is acting to produce rotation be measured by the belt pull and speed in feet per minute, the product will be units of horse-power when divided by 33,000. Thus a speed of 3,000 feet a minute of the belt associated with a pull of 50 lbs. would give as horse power:

$$\text{H.P.} = \frac{3{,}000 \times 50}{33{,}000} = \frac{150{,}000 \text{ ft. lbs.}}{33{,}000} = 4.55$$

The speed of the belt, or peripheral speed of armature more exactly speaking, is determined by practice and veiy iarely exceeds its limits. The armature has a peripheral speed of 3,000 feet a minute as an average maximum, and varies from this down to 2,000 feet per minute, in each case determined from the circumstances and governed by its purpose.

This would require, as a primary assumption, a knowledge of the horse-power to be developed or applied. If a dynamo, the power is applied, and the losses as usually considered will tend to reduce the active pull by a certain calculable percentage. If, therfore, these losses for the present be left out of consideration, the pull can be immediately deduced from the two constituent elements, the horse-power and peripheral speed. Thus, if at 3,000 feet per minute the horse-power delivered by the belt be 100, then the pull will be:

$$\frac{100 \times 33{,}000}{3{,}000} = 1{,}100 \text{ lbs.}$$

The angular velocity, termed radians per second, is a more scientific mode of expression than the more common method. A radian is indicated by the Greek letter ω, so that if π = revolutions per second.

$$\omega = 2 \pi n.$$

[A radian being that angle whose arc equals the radius.]

As the speed of machines depends greatly upon their size, or horse-power, a proper judgment may be formed by an examination of speed data from any manufacturer. For drum armatures the

H. P.	Revolutions per Minute.
½	2,000
1	1,700
5	1,500
25	1,000

above table is a fair average. If it be remembered that the Gramme armature, as well as drum, follow the same rule for peripheral speed, the revolutions per minute will be found to be merely incidental to that primary consideration.

Torque.—The drag upon the armature is, like other phenomena, explained by the reactive influence of one force upon another. This particular type of reaction, however, differs from those usually experienced in ordinary ways in this respect, that it is not due to mechanical friction, except to a very slight extent. The law deduced by Lenz regarding the reaction experienced by a moving conductor in a magnetic field, becomes of importance as a means of understanding the elements concerned in this power consuming tendency.

The movement of a loop of wire across lines of force requires an expenditure of energy only when the extremities of the loop are connected so that a current flows; otherwise but a negligible amount of power is spent, such as would be incurred by the movement of any other body of equal weight. Thus we may look to but two factors of immediate importance—current and strength of field. It has always seemed curious to those newly in charge of a plant that there should be so sudden a necessity for more power the instant the main switch is closed to supply lights. And, furthermore, the complete absence of any new development that might be seen and criticised, either as greatly increased friction or any other evident change, always occasions deep surprise.

The energy of the coal appearing as the expansive force of steam is expended in overcoming the drag of the conductors in the magnetic field. The physical explanation of this fact, and all others of allied nature, is not difficult in the light of past suggestions. It is merely an attraction or repulsion between the lines of force of the field and the lines of force created by the flow of current in the armature conductors.

So that we may regard reactions of this description as being essentially due to attraction and repulsion, though they are but the secondary effects of current flows. An armature giving forth current may, therefore, be looked upon as an electro magnet whose magnetic field is produced by rotation and which exercises an adverse influence upon the field that produced it.

By the last formula for torque the entire pull upon armature was taken into consideration, but, as the drag upon the individual conductors will be limited by mechanical considerations, it is most interesting to know how nearly these limits have been approached. So that the

$$\text{lbs. pull per conductor} = \frac{\text{Entire Torque}}{\text{No. of Conductors.}}$$

If absolute measurements are desired the pull may be calculated in the smaller units, or dynes, by taking into consideration the current, intensity of field, and length of conductor.

$$\text{Dynes pull} = \frac{C \times c \times H}{10}$$

where C = current in amperes of
c = centimeters length of conductor
H = intensity of field in air gap.

The formula may be modified to suit the English system by the following arrangement:

$$\text{lbs. pull} = \frac{C \times l \times S}{11{,}303{,}000}$$

C = current in armature conductor
l = length of conductor in inches
S = total intensity of field in air gap.

As an example of the above kind let us assume

C = 100 in ½ armature
l = 10″ per inductor
S = 40,000 per square inch.

$$\text{drag on each conductor} = \frac{100 \times 10 \times 40{,}000}{11{,}303{,}000} = 3.53 \text{ lbs.}$$

By this means a predetermination of the torque of a dynamo or motor may be made. In the case of railroad motion this is of great importance for the proposed starting torque.

It is sometimes of importance to know not only the torque as a whole, but the increase or decrease on each conductor with a definite change in current, so that if 10 or 20 amperes be increased to 11 or 21 amperes, we will be enabled to calculate the greater torque resulting in either case. The pull per conductor, or the pull per inch of conductor, for every ampere of current will give rise to the possibility of determining the limits to which an overload can be carried without risk, although it is well known that such limits are far beyond those due to purely electrical causes, such as heating of the conductors from such an excess of current. To calculate the torque per inch of conductor per ampere it is simply necessary to divide the pull by the length in inches and by the current in amperes of each conductor.

Therefore in the last example as the data was as follows:

l = 10 inches
c = 100 amperes
T = 3.53 lbs.

the pull per ampere inch equals

$$\frac{3.53}{10 \times 100} = .0035 \text{ lbs.}$$

There are several interesting features about the losses in an armature. The fact that the hysteresis reduces with the load, and the heat of the conductors increases with the current, means that with an increase of torque there is an increased development of heat in one part and a decreased production in the other.

This may be represented by the following formula, according to Thompson:

$$\frac{T}{\text{heat waste}} = \frac{E i}{2 \pi n i^2 r} = \frac{E}{2 \pi i r}$$

where r = internal resistance
E = total E.M.F.
n = revs. per second
i = current.

If the field does not change, so that the active number of lines of force remain the same, it is very evident that one factor remains constant. The other factor, the current, being varied will cause a corresponding change of torque, so that the statement is allowable that if the magnetic field is constant the torque is proportional to the current. A curve may be drawn showing this relationship which, if used properly, will be of great assistance in the design of motors.

The losses which occur in an armature and which are necessarily subtracted from the theoretical torque are placed under the heading of

Frictional losses
Hysteresis
Eddy currents.

Frictional losses are of course greatly due to losses at

Bearings
Air friction of armature
Brush friction at commutator.

These losses may be allowed for and deducted from the ideal output. Hysteresis losses are sometimes less than one per cent. and rarely over two per cent. in properly designed armatures.

(*To be Continued.*)

CONVENTION OF THE AMERICAN STREET RAILWAY ASSOCIATION.

The fourteenth annual meeting of the American Street Railway Association will be held in Montreal, Que., on October 15, 1895, continuing for four days.

The Victoria Rink, at the rear of the Windsor Hotel, has been secured for the exhibition of supplies and manufactures of every nature used in street railway business. It is the intention to make this exhibition the most interesting of any yet seen, and a cordial invitation is extended by the association to all manufacturers and producers of street railway supplies to exhibit their machinery and wares.

An arrangement has been made with Mr. M Davis, Customs Broker, Montreal, for a reduction in Custom House charges on goods to be exhibited, as follows:

Warehouse and bond entry, $1.00; export bond entry, $1.00; making and producing consular certificates, $1.00

When goods to be returned are of the value of $50.00 or more, a consular certificate would have to be taken out, which costs $2.50; goods under the value of $50.00 require no consular certificate. The fee for the consular certificate is paid to the American Consul and goes to his government, so that no reduction can be made in this. The fees, therefore, to be paid for goods under the value of $50.00 would be $2.00; and $3.50 would be added to that when a consular certificate is required.

Shippers should mark goods with their own name, and "Care of M. Davis, Montreal, for exhibition purposes," prepaying the freight and sending invoices marked "certified correct," and signed. On arrival, Mr. Davis will make warehouse bond entry and have goods delivered at the Victoria Rink.

When the exhibition is over the owners of the goods will have to repack them, using preferably the same cases that the goods came in, and they will be returned under the export bond. They must be careful not to make more packages of the goods in sending them out than they had in bringing them in, and it is a distinct advantage to have them in the same cases, so that the marks on these cases may be identified. Consigners must pay all freight and cartage.

Exhibition space will be allotted on August 1, the charge for space being at the rate of 15 cents a square foot, no less than 50 square feet nor more than 1,000 square feet being rented to one exhibitor, unless by special arrangement. Electric power will be furnished to those who desire it at the rate of 45 cents per rated K.W. of machine actually using current. The minimum charge will be $15.00.

Copies of the rules and regulations governing the exhibition can be obtained of Mr. John N. Partridge, secretary-treasurer, pro tem of the association, 166 Montague street, Brooklyn, N. Y. Stonewall Jackson, No. 17 St. Sacrament street, Montreal, is the local secretary.

New Books.

DOMESTIC ELECTRICAL WORK is the name of a neat book just published by David Williams, New York. The author of the work is William A Wittbecker.

Domestic Electrical Work gives concise and practical instructions for plumbers, tinners, hardware dealers and others, on how to wire buildings for bells, alarms, annunciators and for gas-lighting from batteries. It is well written and cannot fail to accomplish the purpose for which it is produced. The text is illustrated with 22 clear diagrams, and any one without any previous knowledge of even the abc's of electricity can, by following the plain directions given, wire a building for bells, etc., with little trouble. While the book is not intended primarily for those who have more or less knowledge of electrical matters, it no doubt will be useful to all. The simplest problems sometimes confound the wise.

The price of this useful book is 25 cents for paper, and 50 cents for cloth cover.

Orders for this or any other book on electrical subjects received by the Electrical Age Publishing Co., World Building, New York. Send for a copy of our book catalogue.

We are in receipt of a copy of the fourth edition of Mr. M. J. Francisco's book entitled "MUNICIPAL OWNERSHIP; ITS FALLACY." The work is revised, and brings the subject up to date. It includes legal and editorial opinions and tables, and cost of lights as furnished by private companies and municipal plants.

"Theories are good in their places," says Mr. Francisco, "but actual results obtained by practical application and experience are the only reliable data upon which to base any statement relating to the cost of street lighting."

"In every case," he continues, "the records show, where all the facts are given, that it is for the best interests of the citizens and taxpayers to contract with an electric light company for lighting the streets of any city."

Mr. Francisco supports these facts by able argument.

RUMOR DENIED.

Chicago and other daily papers a few days ago printed a report that the Postal Telegraph-Cable Company's lines had been sold to the Standard Telephone Company for $15,000,000. The object of this deal, according to the report, was to establish a long-distance telephone system to compete with the Bell Company. The truth of the report, however, is denied absolutely by the officials of the Postal Company. They state that there is no foundation whatever for the rumor, as far as that company is concerned.

THE REPLOGLE GOVERNOR WORKS.

The Selle Gear Company, of Akron, Ohio, will hereafter manufacture and sell the Replogle electric water-wheel governor under the name of the Replogle Governor Works. Mr. Mark A Replogle will act as chief engineer of the concern and will have charge of all expert work.

New York Notes.

OFFICE OF THE ELECTRICAL AGE,
WORLD BUILDING, NEW YORK,
JULY 15, 1895.

Postmaster Sullivan, of Brooklyn, has organized a mail-collection system on the Fifth Avenue trolley line. Eight collections will be made daily by ten collectors.

The Edison Electric Illuminating Company of Brooklyn reports gross earnings for June of $33,023, an increase of $9,019 as compared with the same month of last year, and net $7,989, an increase of $1,807.

J. A. Hanna, of the Philadelphia office of the McGuire Manufacturing Co., of Chicago, has been appointed Eastern Agent of that company, with headquarters at 1302 Havemeyer Building, city.

The Solar Electric Company, 65-67 Duane Street, will begin next week to run their factory night and day, with double shifts, in order to keep up with the demand for switches and arc lamps. The company has large orders for these goods.

A few days ago an old trailer on the Steinway electric road, Long Island City, collapsed while loaded with passengers. No one was seriously hurt, but the Board of State Railroad Commissioners has ordered the discontinuance of the use of old trailers until an investigation is made as to the condition of the company's rolling stock.

W. T. H.

STREET RAILWAY STATISTICS.

Recent street-railway statistics show that in New York State there are 1,583 miles of track, of which 1,020 are operated on the trolley system. Pennsylvania comes next with 1,422 miles, of which 1,304 are electric. Idaho has only three miles of track.

The aggregate value of the street railway securities in New York State is $329,308,168, an average of $207,100 per mile of track. The average per mile in New Jersey is $129,400 and in Illinois $128,500.

Dividing the country into five groups of states the figures given below will be of general interest.

States	Roads	Miles of Track: Horse	Electric	Total	No. cars	Total capital
New England	104	168	1,392	1,560	5,519	$97,324,300
Eastern	305	567	3,189	4,102	16,001	597,512,578
Central	278	555	3,578	4,519	16,936	396,208,525
Southern	111	214	743	1,176	1,930	56,734,625
Western	178	410	1,461	2,231	4,359	152,359,683
Totals	976	1,914	10,363	13,588	44,745	$1,300,139,711

Street Railway Notes.

The Susquehanna Electric Light, Heat and Power Co., Susquehanna, Pa., is figuring on the cost of a trolley road between that city and Lanesboro, a distance of three miles, and it is expected to have the same under construction soon. Further particulars can be obtained from A. W. Cook, the secretary.

The Birmingham Railway and Electric Co., Birmingham, Ala., will, it is reported, extend its trolley road to North Birmingham.

The Little Saw Mill Run Street Railway Co., Pittsburgh, Pa., has been incorporated and granted a charter to run from Pittsburgh to Castle Shannon. Capital stock, $36,000.

The Washington, Sandy Springs and Baltimore Electric Railway Co. has been organized in Washington, D. C., by James B. Colegrove, Allen Freas and others. Capital, $1,500,000. The company will build an electric road from Takoma Park, one of Washington's suburbs, to Baltimore.

Telephone Notes.

The Citizens' Telephone Co., of Trinidad, Col., has been granted a charter for the construction of a new line in that place. This company is organized by citizens of Trinidad solely in the interest of cheaper rates. Correspondence is solicited for the construction of the entire plant, implements, etc.

The Conway Telephone Co., Conway, Ia., has been incorporated by Arthur Haynie and Miles H. Simmons. Capital stock, $5,000.

Astoria Telephone Company, Astoria, Ill., has been incorporated by J. A. Windhurst, J. N. Todd, A. J Baxter, H. J. Farwell and T. W. Emerson. Capital stock, $2,500.

The Douglass County Telephone Co., Superior, Wis., has been incorporated by Pear Benson, P. G. Straton and Russell Baxter, to purchase, lease, or otherwise acquire and maintain and operate telephone and telegraph lines. Capital stock, $30,000.

The North Carolina State Telephone Company has been organized in Raleigh, N. C. Mr. L. H. Carr, of Durham, N. C., is president. It is stated that the new company's lines will connect Wilmington, Winston, Raleigh, Goldsboro, Durham, Greensboro and Charlotte.

The Interstate Telephone and Telegraph Co., Durham, N. C., has petitioned for a franchise in Wilmington.

The Aurora, Oakland and Terra Alta Telephone Co., Aurora, W. Va., is extending its lines in various directions.

TELEPHONE PATENTS ISSUED JULY 9, 1895.

TELEPHONE SWITCHBOARD. James F. Gilliland, Adrian, Mich. (No. 542,249.)

MULTIPLE SWITCHBOARD FOR TELEPHONE EXCHANGES. Milo G. Kellogg, Chicago, Ill. (No. 542,262.)

TELEPHONIC TRANSMITTER. Charles C. Hughes, Baltimore, Md. (No. 542,444.)

Possible Contracts.

The Mayor of Hawkinsville, Ga., can give information regarding the building of an electric light plant in that place.

The Baltimore, Columbia and Maryland R. R. Co., Baltimore, Md., contemplate the erection of two electric power houses.

The Easton Gas and Electric Light Co., Easton, Md., contemplates making some improvements in its plant.

J. W. Eckford, Aberdeen, Miss., can give information regarding the proposed electric light plant in that place.

It is stated that the Columbia Water-Power Co., Columbia, S. C., will establish a big water-power plant at the terminus of its canal, for the generation of electric power.

A new $50,000 plant is contemplated by the Chattanooga Light and Power Co., Chattanooga, Tenn.

Humboldt, Tenn., is to be lighted by electricity. Address the Mayor for further particulars.

Sealed proposals will be received at the Interior Department, Washington, Del., until July 22, for an electric light plant at the Government hospital for the insane, Washington, D. C. Address Wm. H. Sims, acting secretary.

New Corporations.

Cycle Electric Light Company, Chicago, Ill., by W. H. Crodus, John Zimmermann and John B Thompson. Capital stock, $100,000.

Alton Railway and Illuminating Company, Alton, Ill., by James F. Porter, Charles W. Illner, Henry R. Phinney. Capital stock, $250,000.

Willemette Electric Light and Power Company, Willemette, Ill., by John S. Loyer, John W. Meyer and Edward Webb. Capital stock, $15,000.

Plainfield Electric Light and Power Company, Plainfield, Ill., by Giles G. Foster, A. E. Notinger, U. S. G. Blakely, H. A. Perkins and T. A. Corbin. Capital stock, $1,500.

Chicago Western Electric Street Railway Company, Chicago, Ill., by Henry T. Beam, Maier Rosenthal and Harlan W. Cooley. Capital stock, $5,000,000.

Cosomelectric Company, Chicago, Ill., by Bassett Cadwallader, Charles O. Barnes and Nathan E. Jamieson. Capital stock, $7,000,000.

Electric Shower-Bath Company, Chicago, Ill., by Levy Beemer, Michael J. Lyons and William A. Cunningham. Capital stock, $30,000.

The Beacon Light Company, Portland, Me., by Isaac Weils, president; L. C. Whicher, treasurer; to manufacture machinery for vacuum pumps and incandescent lamps. Capital stock, $500,000.

The Wadsworth Electric Railway Company, by W. A. Ault, M. C. Lythle, O. B. Dibble, J. S. Oberholtzer, F. C. Lee and F. B. McCauley.

W. B. Cogswells, C. B. Tracy, G. Higgins, Syracuse, N. Y., are interested in the erection of a new electric railway between Syracuse and Manlius. Capital stock, $250,000.

Albany and Suburban Railway Company, Albany, N. Y., by R. F. Barnes, John S. Burke, George T. Cunningham, George B. Moore, Arthur Hilton, John Leggett, Albert J. Barnes and others, to construct a road to connect Greenwich, Castleton and Bath-on-the-Hudson with Albany. Capital stock, $200,000.

The Syracuse and Suburban Railroad Company, Syracuse, N. Y., has been incorporated by John J. King, William Cowie, Osgood V. Tracey, Francis W. Crodley, Edward Joy, Arthur Jenkins, Francis B. Gilland Giles, H. Stillwell, D. W. Gridley, A. Cady Palmer and John F. Gaynor. Capital stock, $250,000.

Union Electric Company, Charleroi, Pa., by John A. Irwin, James S. Carrnof, Harry W. Gleffer, Henry S. Stewart and James S. McKean. Capital stock, $1,000.

The Pocatello Electric Light and Power Co., Chicago, Ill., by Charles W. Spaulding, Daniel Swinehart and Francis W. Smith. Capital stock, $150,000.

The Santa Barbara Consolidated Electric Co., Santa Barbara, Cal., by A. Hope Doeg, S. J. Kesse, N. F. Ashton, B. S. Hayne, J. B. McMullen, P. C. Higgins and W. F. Reed, to maintain street railways, etc. Capital stock, $2,000,000.

The Pittsburgh, Sheridan & Carnegie Traction Company, Alleghany, Pa., by Harding Kimberland, President; Henry Wenke, Miller Elliott, Richard B. Scandrett and D. K. Ferrell, to built an electric line from Alleghany to Washington, Pa. Capital stock, $42,000.

The Sheboygan Power and Railway Co., Sheboygan, Wis., by George B. Mattoon, John M. Saeman and F. I. Saeman. Capital stock, $200,000.

Elliott Magnetic Electric Co., Chicago, Ill., by William R. Elliott, Issac Robbing and William R. Elliott, 6851 South Green St. Capital stock, $1,000,000.

The Hall Electric Power and Transportation Company, Des Moines, Iowa, by G. B Burbank, A. H. Hatch, R. H. Laird and L. C. Darcey Capital stock, $510,000,

The Oregon Electric Light and Power Co., Oregon, Ill., by Albert H. Knodle, William L. Taylor and H. L. Allen. Capital stock, $50,000.

Trade Notes.

Business with the Metropolitan Electric Company, 186–188 Fifth avenue, Chicago, in the fan-motor line, is on the increase. They are doing better in this line than ever before. Their Metropolitan Incandescent Lamp is giving excellent satisfaction and they are making large sales constantly.

The Charles Scott Spring Co., 1028 New Market street, Philadelphia, has just issued an illustrated catalogue of their springs for street railways.

Mr. Charles Wirt, electrical engineer, formerly at 56 Fifth avenue. Chicago, has removed to Ludlow, cor. 31st street, Philadelphia, Pa. Mr. Wirt is manufacturing his "non-sparking" dynamo brush, and will shortly bring out a new brush intended for motors and dynamos which will run with practically no attention. Queen & Co., Philadelphia, have secured the right to the Wirt Switchboard instruments and will hereafter manufacture the same.

J. L. Somoff, 11 Park Row, New York, manufacturer of miniature incandescent electric lamps, has issued an illus-

National Electric Light and Street Railway Associations.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

President, C. H. Wilmerding, Chicago, Ill.; 1st Vice-President, Frederic Nicholls, Toronto, Canada; 2d Vice-President, E. F. Peck, Brooklyn, N. Y.

Members of Executive Committee: E. H. Davis, Williamsport, Pa, (one year); W. R. Gardiner, Pittsfield, Mass.; George A. Redman, Rochester, N. Y.; J. J. Burleigh, Camden, N. J. Next meeting, New York, May or June, 1896.

AMERICAN STREET RAILWAY ASSOCIATION.

Next meeting, Montreal, Que., October, 16, 17 and 18, 1895.

President, Joel Hurt, Atlanta, Ga.; Vice-President, W. Worth Bean, St., Joseph, Mich.; 2d Vice-President, John M. Cunningham, Boston, Mass.; 3d Vice-President, Russell B. Harrison, Terre Haute, Ind., Secretary and Treasurer, William J. Richardson, Brooklyn, N. Y.; Executive Committee, Henry C. Payne, Milwaukee, Wis.; W. H. Jackson, Nashville, Tenn.; D. G. Hamilton, St. Louis, Mo., C. C. Cunningham, Montreal, Canada; J. N. Partridge, Brooklyn, N. Y.

NEW YORK STATE STREET RAILWAY ASSOCIATION.

Next meeting, Albany, N. Y., third Tuesday in September, 1895.

President, G. Tracy Rogers, Binghamton; First Vice-President, John H. Moffitt, Syracuse; Second Vice-President, W. W. Cole, Elmira; Secretary and Treasurer, William J. Richardson; Brooklyn; Executive Committee, D. B. Hasbrouck, New York; John N. Beckley, Rochester; Daniel F. Lewis, Brooklyn.

OHIO STATE TRAMWAY ASSOCIATION.

Next meeting, fourth Wednesday in September, 1895.

President, Albion E. Lang, Toledo; Vice-President, W. J. Kelly, Columbus; Secretary and Treasurer, J. B. Hanna, Cleveland; Chairman Executive Committee, W. A. Lynch, Canton.

MASSACHUSETTS STATE STREET RAILWAY ASSOCIATION.

President, T. H. Cunningham, Boston; Secretary and Treasurer, A. S. Butler, Lawrence; Executive Committee, Samuel Winslow, Alfred A. Glazier, Boston; P. F. Sullivan, Lowell; E. C. Foster, Revere; Horace B. Rogers, Brockton; A. E. Smith, Springfield; Prentiss Cummings, Boston.

THE TEXAS STREET RAILWAY ASSOCIATION.

President, W. H Sinclair, Galveston; vice-president, C. A. McKinney, Houston; Secretary and Treasurer, C. L. Wakefield, Dallas. Directory: The officers and W. H. Weiss, San Antonio and George B. Hendricks, Fort Worth.

Next meeting, Galveston, third Wednesday in March, 1896.

PENNSYLVANIA STATE STREET RAILWAY ASSOCIATION.

Next meeting, first Wednesday in September, 1895.

President, John A. Rigg, Reading; First Vice-President, Robert E. Wright; Secretary. S. P. Light, Lebanon; Treasurer, W. H. Lanius, York.

THE MAINE STREET RAILWAY ASSOCIATION.

President, W. R. Wood, Portland; Secretary and Treasurer, E. A. Newman, Portland; Executive Committee, W. R. Wood, Portland; George E. Macomber, Augusta; F. M. Laughton, Bangor; Frank W. Dana, Lewiston; Amos F. Gerald, Fairfield.

MICHIGAN STATE STREET RAILWAY ASSOCIATION.

President, W. L. Jenks, Port Huron; Vice-President, W. Worth Bean, St. Joseph; Secretary and Treasurer, B. S. Hanchett, Jr., Grand Rapids; Executive Committee, the Officers and David H. Jerome, Saginaw, and Strathern Hendrik, Detroit.

THE STREET RAILWAY ASSOCIATION OF THE STATE OF NEW JERSEY.

President, Thos. C. Barr, Newark, Vice-President. W. S. Scull, Camden; Secretary and Treasurer, Charles Y. Bamford, Trenton; Executive Committee, Officers and C. B. Thurston, Jersey City; H. Romaine, Paterson S. B. Dod, Hoboken.

trated catalogue of his well-known goods. Mr. Somoff makes lamps for decorative and scientific purposes, and for use in connection with medical diagnosis and surgical instruments. They range from ½ to 8 candle power; 2 to 60 volts and .3 to 2 amperes.

The Western Electric Heating Co., St. Paul and Chicago, has just issued a neat illustrated catalogue of apparatus for heating and cooking by electricity.

The National Conduit Manufacturing Co., Times' Building, New York, has opened an office at Room 807, Equitable Building, Baltimore, Md.

The Partridge Carbon Co., Sandusky, Ohio, manufacturers of the "Partridge Self Lubricating Brush," have among their regular patrons about three-fourths of the electric roads in the United States. A good thing is always appreciated.

Electrical and Street Railway Patents.

Issued July 9, 1895.

542,228. Trolley-Breaker. Henry P. Ball and Charles A. Lieb, New York, assignors to the General Electric Company, Schenectady, N. Y. Filed Aug. 8, 1894.

542,258. Electrical Measuring-Instrument. Frank Holden, Schenectady, N. Y., assignor, by mesne assignments, to the General Company, same place. Filed Jan. 22, 1895.

542,262. Multiple Switchboard for Telephone-Exchanges. Milo G. Kellogg, Chicago, Ill. Filed Dec. 21, 1889.

542,276. Car-Fender. Daniel O'Mahony, Jersey City, N. J. Filed Apr. 4, 1895.

542,279. Arc-Light Support. Barton Pickering, Dayton, Ohio. Filed Nov. 15, 1890.

542,295. Transformer for Alternating-Current Systems. Elihu Thomson, Swampscott, Mass., assignor to the General Electric Company, of New York. Filed Mar. 6, 1895.

542,303. Car-Guard or Fender. Burden, Troy, N. Y. Filed Apr. 8, 1895.

542,309. Electric-Brake. William B. Porter, Schenectady, N. Y., assignor to the General Electric Company, of New York. Filed Mar. 20, 1895.

542,406. Electric Alarm-Gauge. William H. Bradt, Troy, N. Y. Filed Feb. 23, 1894. Renewed May 8, 1895.

542,434. Underground Trolley. Leedham Binns, Philadelphia, Pa. Filed Apr. 11, 1894.

542,444. Telephonic Transmitter. Charles C. Hughes, Baltimore, Md. Filed Sept. 12, 1894.

542,459. Electric Battery and Application Thereof to Medicinal Purposes. Seth R. Beckwith, Orange, N. J. Filed Apr. 3, 1895.

542,462. Electric Insulating Material. James O. Brown, Chicago, Ill. Filed May 5, 1894.

542,471. Electric-Bath Apparatus. William E. Golden, Auburndale, Ohio. Filed Mar. 5, 1895.

542,480. Car-Fender. Joseph Leightham, Reading, Pa., assignor of one-half to William H. Slichter, same place. Filed Mar. 21, 1895.

542,481. Car-Fender. Joseph Leightham, Reading, Pa., assignor of one-half to William H. Slichter, same place. Filed Apr. 8, 1895.

542,487. Electric-Lighting System and Dynamo Therefor. Morris Moskowitz, Newark, N. J., assignor to the National Electric Car Lighting Company, of West Virginia. Filed May 11, 1895.

542,489. Cable-Grip. Elihu Nelson, New York, N. Y. Filed Mar. 20, 1894.

542,490. Electric-Arc Lamp. Samuel E. Nutting, Oak Park, assignor to George W. Furbeck and Joseph Kettlestrings, Chicago, Ill. Filed Sept. 8, 1894.

511,503. Automatic Electric Weighing Scale. Charles F. Wood, Richmond, Va. Filed Jan. 29, 1894.

542,505. Arc-Lamp. Albert C. Seibold, Mount Vernon, assignor of one-third to Edgar O. Clark and William Sowdon, New York, N. Y. Filed Jan. 7, 1895.

542,508. Medical Electrode. Andrew P. Van Tuyl, Jr., Brooklyn, N. Y., assignor to himself and Edward C. Park, same place. Filed May 15, 1895.

542,512. Electric Railway System. Robert B. Wilson, Cincinnati, Ohio, assignor of one-half to Jeremiah M. Wilson, Washington, D. C. Filed Jan. 2, 1894.

542,539. Apparatus for Removing Obstructions from Car-Tracks. Frank Shuman, Philadelphia, Pa. Filed Nov. 14, 1894.

542,543. Electrically-Controlled Motor. Geo. L. Thomas, Brooklyn, N. Y. Filed Apr. 25, 1895.

542,589. Electric Arc Lamp. Frank M. Hildebrandt, Edwin S. Hildebrandt, and Henry F. Hildebrandt, Baltimore, Md. Filed Dec. 27, 1893.

ELECTRICAL AGE

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NEWTON HARRISON, E. E., Scientific Editor.

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NEW YORK, JULY 27, 1895.

CONTENTS.

THE EASTERN TELEPHONE ASSOCIATION.

The details of the organization of the Eastern Telephone Association are not yet ready for publication. It is expected that they will be given out during the present week. In the meantime only hints as to what the plans contemplate is all that can be obtained. Those particularly interested are close-mouthed just now, and promise, when the time comes, that the public shall know what the Eastern Association intends to do. Among the details hinted at is that stock will be issued and each member of the association will subscribe $1,000. If this is correct it indicates that the association will be a strong one, and that the Bell Company will have a formidable enemy to face. Whatever the plans of the new association are, they are backed by a determination to fight the common enemy if need be. The association has good ground to fight on, and can be aggressive, if necessary.

HOW TO LOCATE GROUNDS IN ARMATURES, ETC.

The location of grounds in armatures, fields, etc., to many practical men presents apparently formidable difficulties, but it is in reality a simple operation. In a paper read by Mr. C. E. Gifford before the general meeting of the American Institute of Electrical Engineers, held at Niagara Falls last June, that gentleman described an easy and simple method of locating such faults, using for this purpose apparatus which is available in every electrical establishment. Two or three cells of battery, a telephone receiver and the necessary connecting wires comprise the outfit necessary. The details of the test operation were fully described and illustrated by Mr. Gifford, whose paper is reproduced elsewhere in this issue. The method is a simple one, and will undoubtedly find ready adoption.

REPORTING RACES FROM A BALLOON.

The races between the new yacht "Defender" and the "Vigilant," last Saturday and Monday, were reported for the New York *World* from a balloon sent up near Sandy Hook. Communication between *terra firma* and the aerial ship was maintained by telegraph through a small cable connecting the two points, and the progress of the race was telegraphed direct from the dizzy height. No difficulty excepting that caused by fog should prevent the accurate description of the coming international races, when a perfect bird's-eye view of the course can thus be obtained. This method of reporting the races obviates many difficulties heretofore experienced in similar work from shore stations, and removes all doubt as to which boat is which, when the competing yachts are far from land.

PHILADELPHIA'S ELECTRICAL INDUSTRIES.

We devote a portion of this issue to a description of some of Philadelphia's electrical houses, of which there are many. Some of the most prominent concerns of this character have their headquarters in the City of Brotherly Love, and a very large trade is carried on by them, but Philadelphians are so innately modest that we have undertaken to throw the searchlight of publicity upon them and bring them to the front, where they rightfully belong. When we undertook the task we labored under the impression that we could complete it by devoting the major part of one issue to the subject, but as our work advanced we realized that to do justice to the matter we would have to give much greater space. Therefore, what appears in this issue represents only a small fraction of the whole. We will continue the subject in next and subsequent issues.

LOCATION OF GROUNDS IN ARMATURES, FIELDS, ETC.

BY CLARENCE F. GIFFORD.

This paper presents no novel scientific principles. The methods herein described are but simple adaptations of the principle of the Wheatstone bridge.

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

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

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

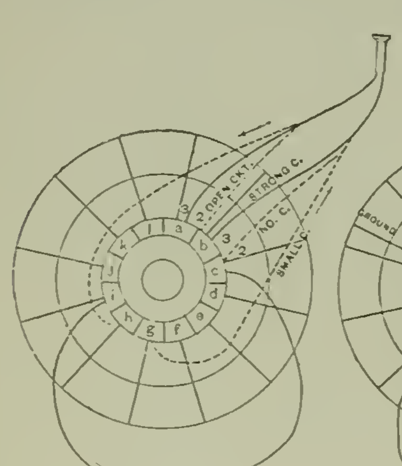


FIG. 1.

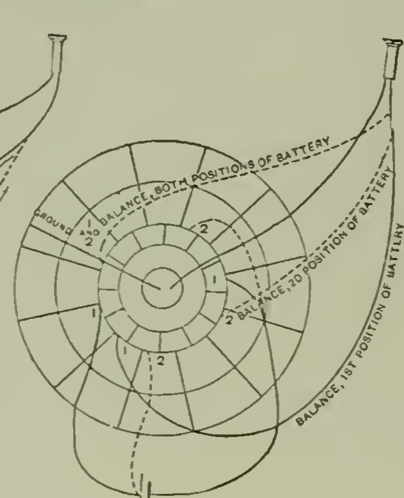


FIG. 2.

Close any open circuit temporarily by bridging between the two bars with a drop of solder. Two or more breaks can evidently be located by suitably shifting the battery contacts and searching as before. Open circuits will, of course, when an armature continues in work, soon cause burns between the bars that will indicate unmistakably their location. Having closed any open circuits, and the battery being connected to two points of the commutator appoximately opposite each other, one terminal of the telephone is connected to the armature shaft, or frame of the machine, and the other terminal is drawn completely around over the surface of the commutator, while the telephone is held to the ear. If only one ground exists, two balancing points or points giving the least noise in the telephone will be found.

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

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

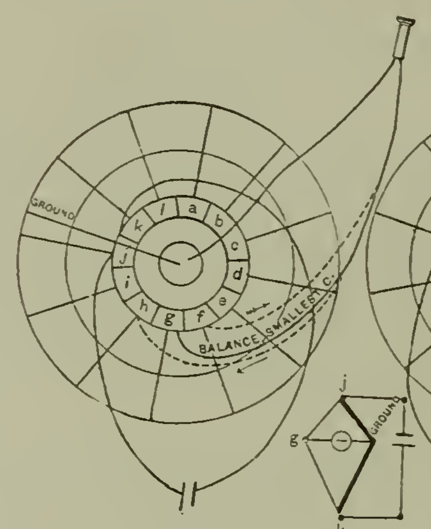


FIG. 3.

FIG. 4.

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

In the case of one ground, having determined its location approximately, fix it as close as may be by making and breaking contact with the telephone terminal on each of the more quiet bars, separately, until by comparison the two giving the faintest clicks are determined. If your hearing has served you correctly these two bars lie nearest the trouble, the fainter one being the nearer. Prove the non-existence of a second ground by placing one of the battery contacts on the first bar to the right of the apparently permanent balancing point just found, and then on the first bar to the left of said point, the other contact being nearly diametrically opposite. This balancing point should still remain unchanged if no other ground exists.

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

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

If the balancing point appears to be found within three

*A paper presented at the Twelfth General Meeting of the American Institute of Electrical Engineers, Niagara Falls, N. Y., June 25, 1895.

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

If such error has been made the new point, as indicated, together with first the bar on one side of it and then on the other, must be tried as points of battery contact; or, much better, make a new start with the contacts nearly at opposite sides of the commutator and proceed as before. A single 20,000-ohm ground on a one-ohm armature should be located accurately in not over three minutes, in a quiet room. Higher resistance grounds require more battery and more care. Armatures of very low resistance also offer greater difficulty.

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

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

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

If scientifically inclined, or if otherwise preferable, the circuit may be opened at a point somewhere midway between the two indicated coils instead of disconnecting those coils, and the exact location of each ground determined as follows: Take a piece of "broom wire" about 18 inches long, new and clean, screw the ends firmly into two clean, brass table binding posts, and into the other holes of the same posts screw the battery terminals. Have an assistant press the corners of the bases of the binding posts into very firm contact with the two bars that lie at the ends of the indicated coil, observing the directions previously given for securing clean contact. Place one telephone terminal in contact with the shaft, and with the other find the balancing point on the wire. This point will indicate the relative position of the ground in the coil, or commutator bar, as the case may be. If more than two grounds were suspected, the two lying the farthest apart would be approximately located by the first part of the two-ground process, and if these coils were not disconnected before proceeding farther, it would be well to make two openings in the circuit, close to and lying between these outer grounds; then locate definitely these two extreme grounds and proceed with the remaining section somewhat as with a complete armature, except that you would commence by connecting the battery to the terminals of this section and would then bridge the telephone from the shaft to the different portions of the section, and would complete the process by applying the remainder of the two-ground test.

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

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

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

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

Familiarity with any special forms of armature will doubtless suggest to the ingenious mind modifications of these methods suited to those forms, but it would be improper to attempt here to deal with specialties whose names are legion.

Where wet grounds exist it will always be better, when practicable, to dry them out before making the final test, as certain sections may show faults which will not be permanent. Wet grounds will of course give a click in the telephone when bridged from the commutator to the shaft when no battery is attached, owing to galvanic action of the water on the copper winding and the iron core.

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

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

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

Personal.—Mr. Wm. H. Pike, Jr., so long connected with The Brady Mfg. Co., Brooklyn, N. Y., being for the last two years their superintendent, has resigned and is now taking a much needed rest.

PHILADELPHIA'S ELECTRICAL INTERESTS.

OTTO FLEMMING.

This gentleman is well known to the electrical trade at large as one of the foremost manufacturing electricians. He makes a specialty of electro-medical apparatus, and his instruments are celebrated for excellence of workmanship and scientific construction.

Mr. Flemming's Du Bois-Reymond induction coil, of which Fig. 1 is an illustration, is well known among the electro-medical profession. This instrument gives slow or rapid interruptions as desired, and has a graduator for the control of the current.

The intensity of the current is regulated by the double helix in front, the primary current being augmented by gradually withdrawing the outer helix by means of the controlling screw on the right. For increasing the power of the secondary current, the motion of the outer helix is

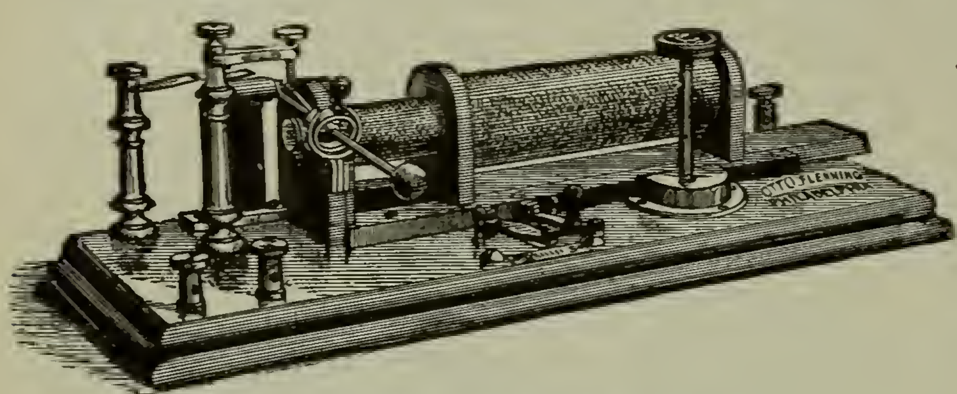


FIG. I.—DU BOIS-REYMOND INDUCTION COIL.

reversed, beginning with the outer helix at its extreme outward position and gradually feeding in.

A primary current is obtained by turning to the left the double switch shown at the front of the instrument; by turning the switch to the right, the position shown in the figure, gives secondary currents.

This instrument is covered by patents and Mr. Flemming will protect himself against infringers.

The accompanying large illustration (Fig. 2) is of Mr. Flemmings' Electro-Therapeutic-Gynæcological Cabinet, which was devised and is manufactured by himself.

This cabinet comprises 60 "Crosby" semi-dry cells of battery for galvanic and extra cells for faradic currents; the "Massey" current controller, for the purpose of varying the galvanic current at will, by rapidly increasing or decreasing the resistance in the circuit; the "Flemming" milliampere meter, for indicating the number of units of electricity passing through the entire circuit, including the patient; the single switch, for including or omitting the milliampere meter in the galvanic circuit; the "De-Watteville" current combiner, for combining the two currents (galvanic or faradic) simultaneously and also for selecting either one or the other; the commutator (or pole-changer) and the two terminal posts; the "Du Bois-Reymond" induction coil with slow and rapid interrupters and graduator; the water rheostat, for varying the faradic current by inserting a range of resistance into the circuit; the single switch, for omitting or including the water rheostat in the faradic circuit; the faradic double switch, for selecting either the primary or secondary induction currents and the single switch, for starting or stopping the electric action in the faradic apparatus.

Flemming's Electro-Therapeutic-Gynæcological Wall Cabinet is precisely the same as the foregoing as regards its equipment, the difference being in the design of the case, the batteries, of course, being placed in some convenient location outside of the case.

Mr. Flemming manufactures a simple ozone generator. It is operated by one cell of Grenet battery, and the ozone which is generated in the long glass cylinder is blown into the air through a nozzle by means of a small fan. The instrument comes in a neat wooden case and is well finished.

Among the specialties made by Otto Flemming are faradic batteries with rapid and slow interrupted induction currents; stationary office and cabinet batteries; galvanic cell batteries; cautery batteries; batteries combining both the faradic and galvanic currents; and Flemming's new universal batteries, combining cautery, galvanism and induction.

Mr. Flemming's offices are at No. 1009 Arch street, Philadelphia.

JAMES L. GARNETT.

James L. Garnett, 246 Arch street, the sole agent in Pennsylvania of the Electric Heat Alarm Co., of Boston, Mass., occupies a handsome store, in which is displayed the Electric Heat Alarm Co.'s apparatus in practical operation. The system attracts considerable attention and favor, and embraces automatic fire alarms, automatic journal bearing alarms, hotel call and fire alarm.

Mr. Garnett has lately put up in his salesrooms one of this company's improved street fire alarm non-interfering call boxes, and a complete city system of fire alarms and calls. In addition to his agency business Mr. Garnett contracts for and installs electric apparatus of all kinds, from the smallest instrument to a complete central station.

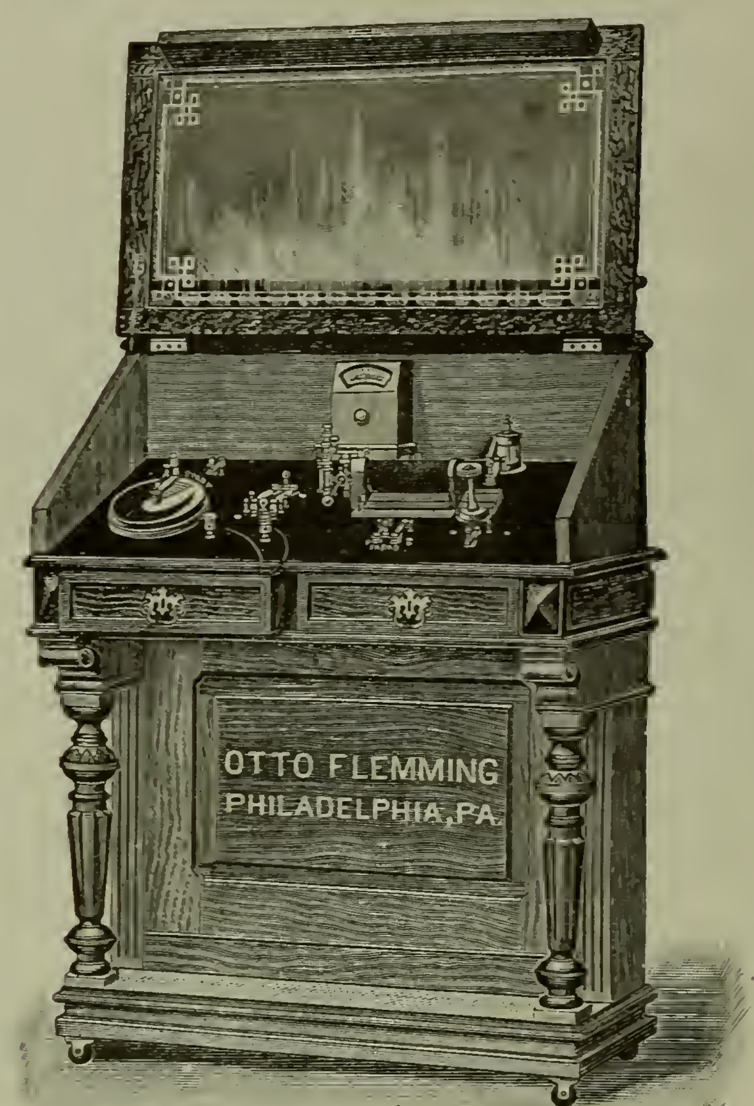


FIG. 2.—ELECTRO-THERAPEUTIC GYNÆCOLOGICAL CABINET.

He has the reputation in Philadelphia of being an expert electrician and engineer.

He has on exhibition in his salesrooms a sample of the latest type of the Hess storage battery, and has great faith in the future of this battery. Judging from the description of this battery it has superior merit.

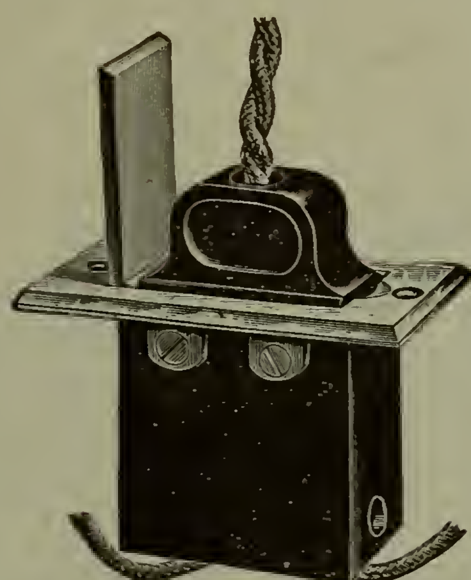
Mr. Garnett is still a young man, but has had an extensive experience in electrical matters, and a big fall business is assured him.

Transactions.—Volume IX, Transactions of the American Institute of Electrical Engineers is being delivered.

WM. T. PRINGLE & CO.

One of the oldest and best known firms of electrical engineers and machinists in Philadelphia is that of Wm. T. Pringle & Co., 1026 and 1028 Filbert street.

The firm is composed of Wm. T. Pringle and George Breckelman, both gentlemen having had a large experience in their particular line. They do a very large business in switches and switchboards, and there are many excellent examples of this class of work from their factory all over this section of the country. Their work is well known for



PRINGLE'S ATTACHMENT PLUG.

the high quality of materials used and excellence of workmanship and finish.

The firm, however, does not confine its labor to this particular line of work. All kinds of special work to order in light machinery and electrical apparatus is executed. The long experience of both members of the firm is a guarantee that all work entrusted to them will receive prompt and expert attention.

Wm. T. Pringle & Co. make Chapman's Patent Improved Attachment Plug, which has received great favor in the electric light trade. This plug has received the endorsement of leading electrical engineers.

It is a very neat device, and when in position is flush with the wall or floor, when the plug is out. As it can be finished to match the decorations of the room, there is nothing objectionable or unsightly about it, and it is substantially constructed and durable.

They are made with and without lid. The lid closes the opening when the plug is detached

A late improvement in the manufacture of these plugs is the use of porcelain bases, which is a preferable material. Some of the largest electrical houses in the country are handling this Attachment Plug.

BARNARD & HOOPES.

This firm was organized on the 1st of May, 1883, and although it is but a little more than two years of age it has attained a standing that very few reach in so short a space of time.

Barnard & Hoopes have their headquarters at 916 Arch street, where they carry on an electrical engineering and contracting business. They furnish estimates and prepare plans for complete electric light and power plants, and with their technical and practical training they do excellent work. They have drawn the plans and specifications for a 1,000-light plant for the State Normal School in Westchester, Pa., and also engineered the construction of the Amusement Palace, Atlantic City, N. J. They are now engaged on plans for the lighting plant for the Camden County Insane Asylum. Any one desiring the preparation of plans for electric light or power transmission plants, and consulting engineering services, certainly cannot place their interests in more reliable hands. The firm is very reasonable in its charges for such work. Both Messrs. Barnard and Hoopes have had college training and consequently possess all the necessary technical knowledge for the successful prosecution of such a business, and have had, besides, a long experience.

Barnard & Hoopes are the Eastern agents for the Card Electric Motor and Dynamo Company, of Cincinnati, Ohio.

A POPULAR SUPPLY HOUSE.

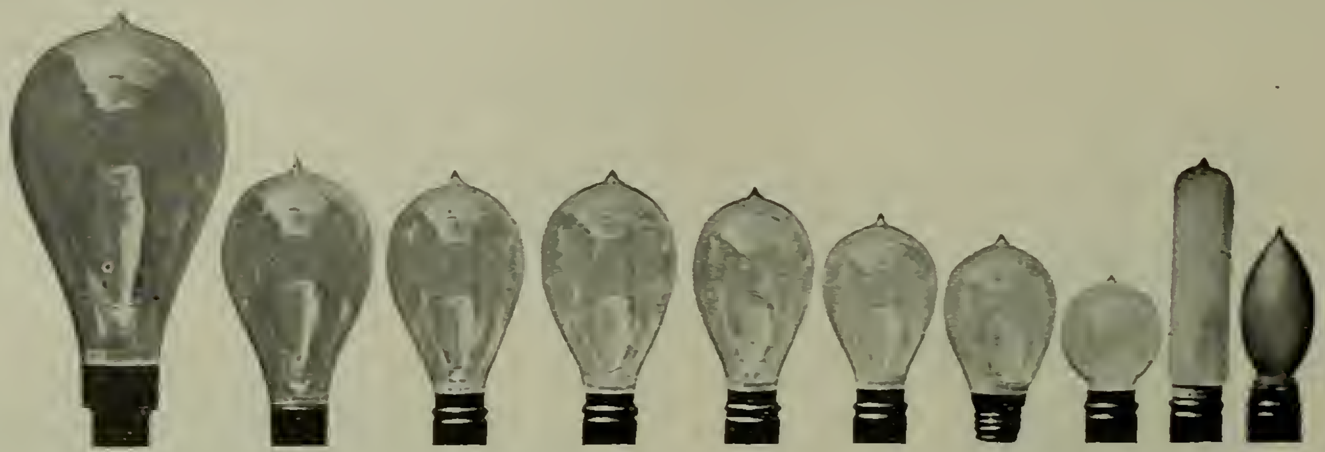
One of the best known electrical supply houses in Philadelphia is that of Vallee Bros & Co., 619 Arch street. Over ten years ago G. A. and Geo. W. Vallee started the business in a small way at No. 17 North 6th street, but the business soon became too great for such small limits and larger quarters were looked for. Two years ago the firm moved into their present location, which are large and excellently adapted for the purpose of a big and expanding trade. The salesrooms are nearly twice as large as those of any other Philadelphia electrical supply house, being about 30 feet in width and 156 feet long. They also occupy the basement with a large stock of goods, which is always kept on hand for ready shipment.

SALESROOMS OF VALLEE BROS. & CO., PHILADELPHIA.

In 1891 Mr. H. C. Roberts, a well-known and enterprising young electrician, became associated with the house as a partner, and to their combined energy and push the present prominent position of the firm in the trade is largely due. The business of Vallee Bros. at this time was entirely construction work, which they gave up and have devoted all their time since to supplies.

Vallee Bros. & Co. carry everything in the electrical line, from a push-button to a complete switchboard, fan motors and power motors, and they are the Philadelphia headquarters for Kerite wires, of which they always carry a large stock. In 1892 they took hold of the Buckeye lamp business, as sole agents in Philadelphia. Their record in this line is an excellent one, they having pushed these lamps and built up a large trade in them. They supplied all the lamps used on the new American line steamship "St. Louis," and they have a solid grip on the lamp trade in Philadelphia.

In addition to the goods above specified the firm handles



No. 1, "IMPERIAL."
No. 2, "BUNGHOLE."
No. 3, "CANDLE-FLAME."

Buckeye Incandescent Lamps.

all kinds of electric light, power and railway supplies, transformers, construction tools of all kinds, electrical plumbing goods, etc., etc.

The members of the firm are genial, whole-souled fellows, and to their personal good qualities no doubt is due the popularity of the house, and the good-will held towards it in the trade at large.

AN ENTERPRISING HOUSE.

The Central Electric Co., Wm. H. Shellenberg, manager, 9 North Thirteenth street, does a general electrical engineering, construction and supply business. They are licensed by the Philadelphia Fire Underwriters' Association to do wiring for incandescent electric lighting, and some of the best plants in Philadelphia were designed and wired by them. Mr. Shellenberg is well known and his long experience has won for him a reputation for painstaking and thoroughness in his work.

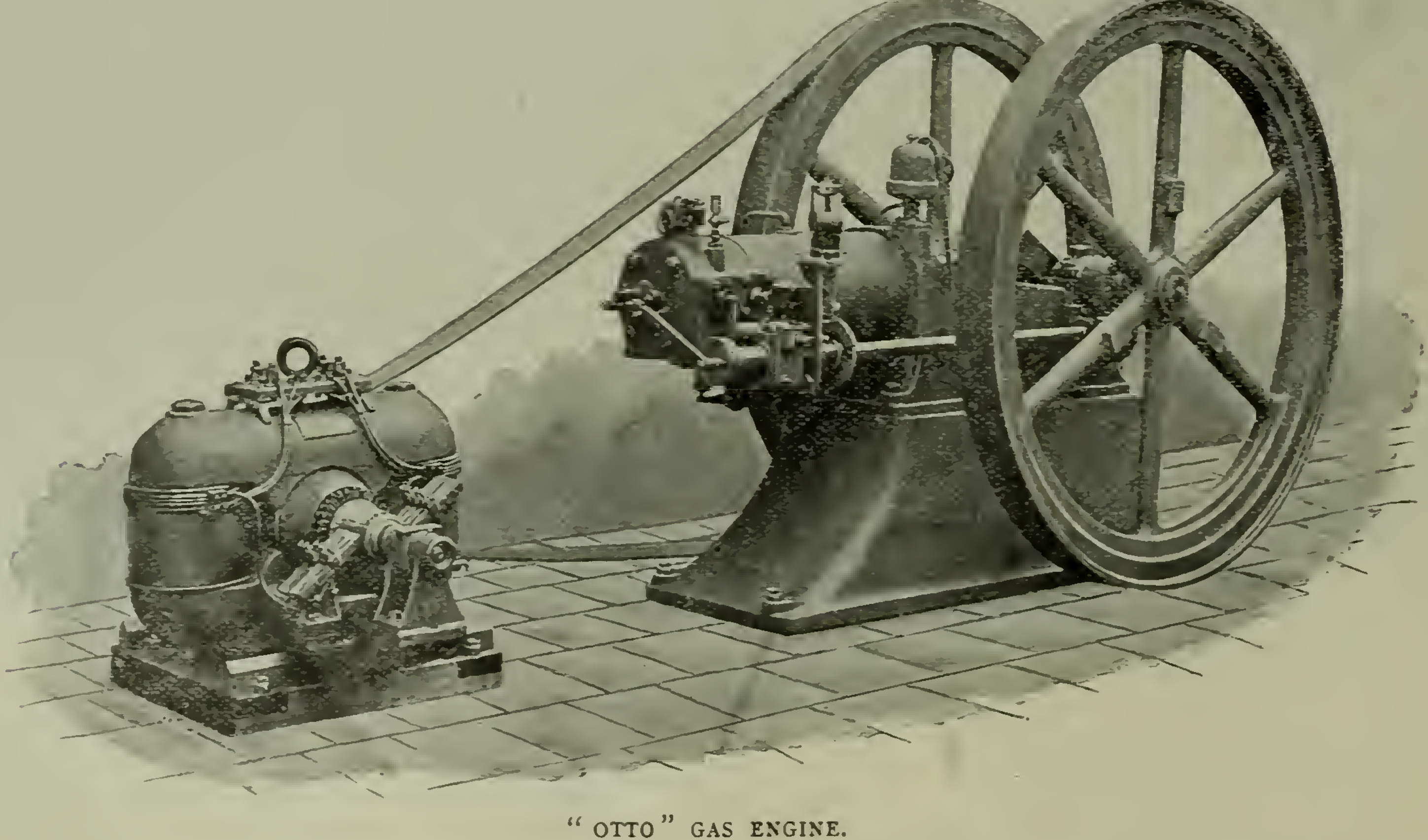
THE OTTO GAS ENGINE.

Of the many gas and gasoline engines on the market none is more widely known than the "Otto," which is made by the Otto Gas Engine Works, 33d and Walnut streets, Philadelphia.

The first "Otto" gas engine was brought out by Dr. N. Aug Otto in 1867, and received a gold medal at the Paris Exposition of that year. Since then 45,000 "Otto" gas and gasoline engines have been produced and sold, representing about 250,000 horse-power, and, during the same period the engine has been awarded over 200 gold and silver medals and diplomas at leading expositions all over the world.

The Otto Gas Engine Works have, through great expense and long experimentation, brought the engine to a high degree of perfection, and today it is said to be one of the most modern and reliable power machines in use.

A faint idea of the magnitude of this industry may be had from a glance at the accompanying illustration of the interior of the works. This view is of one floor of the erecting shop, and shows engines in various stages of completion. The capacity of the works is 1,200 engines per year.



"OTTO" GAS ENGINE.

The building is a substantially built one, of brick, the main section having four stories.

A description of the Otto gasoline engine, of which we also give an illustration, will be of interest to our readers in this connection.

The power in the "Otto" gasoline engine is obtained from the combustion of gasoline and air in the engine cylinder. The "Otto" gasoline engine does not use any vaporizers, carburetors or other dangerous apparatus purporting to carbonize the air, and which under certain conditions are known to fill with dangerous mixtures and to frequently explode. By avoiding this, the running of the engine is also not under the constant influences of changing temperatures of the weather, requiring at each change a different adjustment of admission valves.

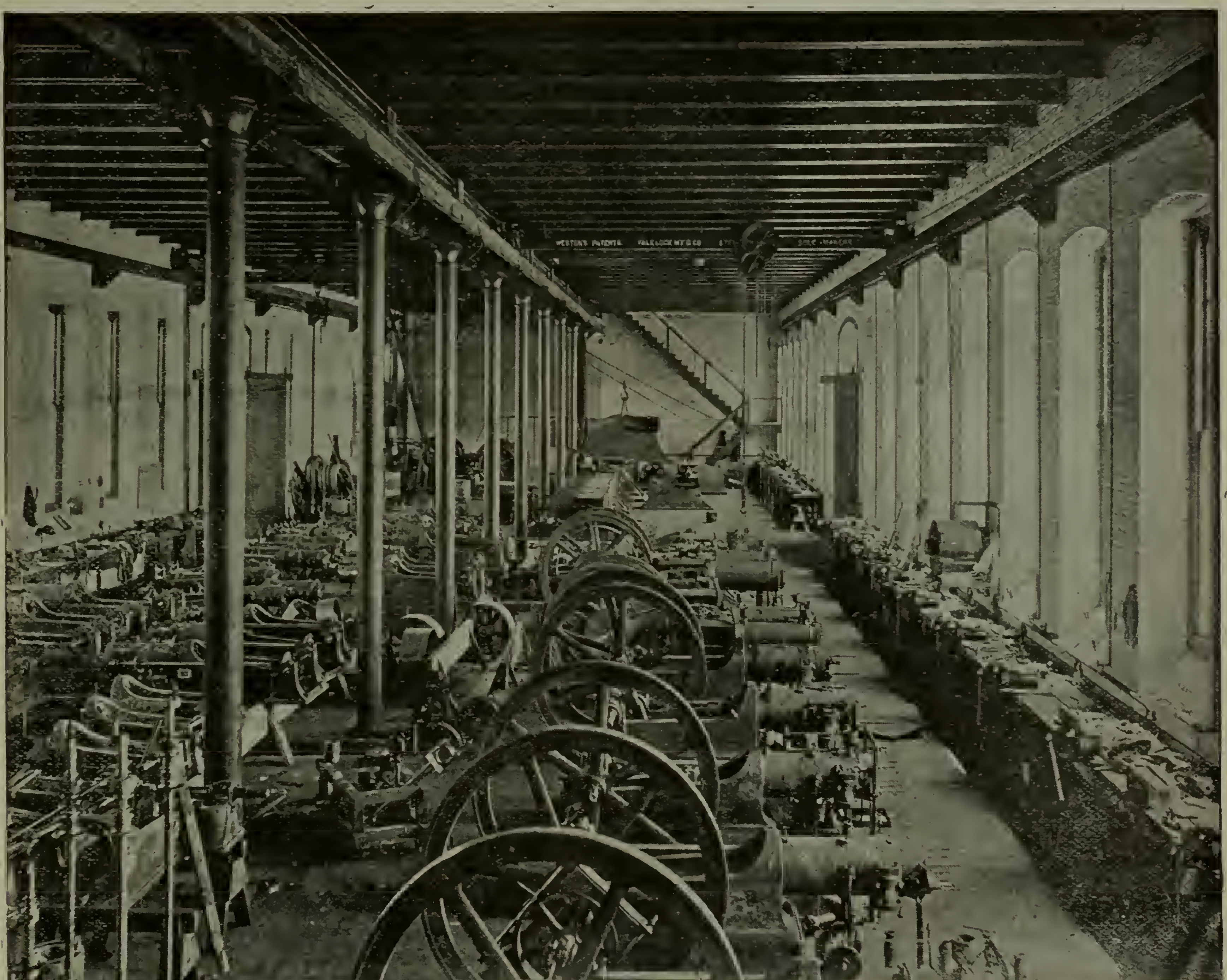
The "Otto" is a poppet valve engine. In it all air is excluded from contact with gasoline until it is admitted to the engine cylinder in fluid form. The gasoline is carried (from supply tank outside the building) in a galvanized iron pipe, with soldered joint to the engine, and provisions are made against any possible leak of gasoline between the engine and tank, or after it has reached the engine. A small valve admits the fuel to the cylinder and this valve is under the control of a governor, so that no more gasoline is taken at all times than is necessary to work the engine at uniform speed in proportion to a varying load. The gasoline is pumped from an underground tank, and upon being atomized within the engine cylinder by a current of air, is at once fired by an electric spark.

The engine is absolutely safe, and as regards the cost of operation, the quantity of 74° gasoline consumed for ten hours does not exceed, on the average, one gallon for each rated horse-power of any given size of engine. At 10 cents a gallon for gasoline, the hourly expense for horse-power would be one cent; for large engines, however, the cost of gasoline, and consequently of the power, is very much less.

The Otto company considers the electric igniter for both gas and gasoline engines preferable to the tube igniter, because it excludes not only all live flame near the engine but dispenses with handling of the gasoline inside of the building. By an automatic arrangement the batteries are cut out of circuit every time the engine is stopped, thus preventing any useless waste when the engine is idle.

"Otto" gas engines are applicable anywhere for power purposes, and are very successfully used in driving electric light dynamos. In this class of work they may be connected directly to the dynamo shaft, with good results as to steadiness of lights, but for engines of 20 h.-p. and over the use of countershafting is recommended. Hundreds of electric-light plants driven by "Otto" gas engines are in daily operation, and the cost of ten sixteen candle-power incandescent lamps in such plants is said to be one cent an hour, on the basis of gasoline at 10 cents per gallon.

The Otto Gas Engine Works were awarded two medals and three diplomas at the World's Fair, Chicago, for best designs, modern and improved devices and highest efficiency.



ERECTING SHOP, OTTO GAS ENGINE WORKS, PHILADELPHIA.

PHILADELPHIA MENTION.

Mr. F. D. Sweeten, 633 Arch Street, is manager of the Philadelphia office of the C. & C. Electric Company of New York. Mr. Sweeten does a large trade in portable fan motors, and his sales this season exceed those of any previous year. He is also doing a business in power motors.

The Brano Electric Co., 43 North Seventh Street, does electrical work of all kinds. They carry on a general engineering and construction business, and are licensed by the Philadelphia Fire Underwriters' Association for wiring for incandescent electric lighting. The company makes a specialty of repairing and its work in every department is characterized by care and thoroughness.

[Note.—The description of Philadelphia electrical interests will be continued in next issue.]

PRINCIPLES OF DYNAMO DESIGN.

BY

Newton Harrison, E.E.

(*Continued from Page* 38.)

The E.M.F. having been calculated by a formula that is based upon conditions existing in every dynamo, that is to say, a conductor cutting lines of force at a given rate per second, we are enabled to mould it into a somewhat different form for useful purposes. The original formula

$$E.M.F. = \frac{\text{inductors} \times \text{revs. per sec.} \times \text{lines of force}}{100{,}000{,}000}$$

will give a numerical value to the number of volts produced, with a fixed number of turns, lines of force, etc.; but it is frequently necessary to assume certain factors as being given and then calculate for the rest. Therefore the following changes will be of use whatever the assumption may be:

$$\text{No. of inductors} = \frac{E.M.F. \times 100{,}000{,}000}{\text{revs. per second} \times \text{lines of force.}}$$

$$\text{Lines of force} = \frac{E.M.F. \times 100{,}000{,}000}{\text{inductors} \times \text{revs. per second.}}$$

$$\text{Revs. per second} = \frac{E.M.F. \times 100{,}000{,}000}{\text{inductors} \times \text{lines of force.}}$$

By the above variations of the general formula the calculation of other quantities is made convenient. It is more than a matter of interest to know that where there is a definite loss of volts in the armature, due to either armature reaction, drop of potential or both, it becomes necessary to make some compensation for this loss by either increasing the

speed,
No. of inductors, or
lines of force.

The method usually employed is that of increasing the lines of force. This is successfully done by allowing the armature to directly affect its own field. This, then, renders the regulation entirely dependent upon the changes occurring within the armature. Should there be a sudden change of current in the armature, both the drop in pressure and change in field can be accounted for in exact terms. For drop in volts

$$E = C \times R$$

E = volts,
C = current,
R = resistance,

and for the change in field the effect of the ampere turns of the armature must be properly considered. These naturally react upon the armature, cutting down the field as its current or ampere turns increases, and by that means decreasing the output in volts.

It is not a difficult matter to show the direct effect of the armature resistance upon the volts produced. With the current = 200 amperes, and the resistance .01 of an ohm, the lost volts

$$\text{Drop} = .01 \times 200$$
$$= 2 \text{ volts.}$$

A relationship can be drawn up between all of the quantities concerned in the armature changes, showing that in a shunt machine

$$E = e \times r_a\left(\frac{1}{R} + \frac{1}{r_a} + \frac{1}{r}\right)$$

in which E = E.M.F.,
e = potential difference,
r_a = resistance of armature,
R = external resistance,
r_s = resistance of shunt.

The parenthesis shows that the sum of the conductivities by their variation, which may be caused by heating due to C^2R losses, may change the *E.M.F.* produced. This formula may be written in a simpler form, as follows:

$$\text{Potential difference} = \frac{E.M.F.}{\text{Resist. of armature} \times \text{conductivity of machine and circuit}};$$

therefore the P. D. changes with every rise or fall of resistance of armature or change in conductivity of machine and circuit included.

(*To be continued.*)

ASSIGNED.

The W. S. Hill Electric Co., 113 Oliver street, Boston, on July 20 assigned for $20,000 to Attorney F. A. Wyman. Mr. Wyman thinks that the company, which is doing a good business, will continue. The assignment was due to failure to meet certain notes that were deposited in banks to insure the payment of capital stock.

SEND-OFF FOR MR. GODFREY.

James W. Godfrey, general manager of the India Rubber and Gutta-Percha Insulating Co., 15 Cortlandt Street, sailed for Europe on Wednesday, July 24, on the steamer "New York." Mr. Godfrey goes to meet his family and will be absent from the land of the Stars and Stripes for some months. A large party of friends met at the pier to see him off, and they provided him with many good things calculated to make his voyage comfortable and pleasant. A dozen lady friends drove down in carriages to bid him "bon voyage," and they too contributed much in the way of little comforts for such a journey. Mr. Godfrey sailed with flying colors, and will no doubt greatly enjoy his vacation. He has labored hard for many years and has earned this rest. His host of friends wish him a pleasant time, and hope to see him return to his native land with his family enjoying the best of health.

New York Notes.

Office of the Electrical Age,
World Building, New York,
July 22, 1895.

The Electric and Mathematical Instrument Makers' Association will hold a picnic on Saturday, August 17, at Cosmopolitan Park and Casino, 170th street and Amsterdam avenue.

The Elson & Brewster Engineering Co., Thames Building, cor. Greenwich and Thames streets, manufacturers of standard electric wire mouldings, carries in stock always 100,000 of assorted sizes of these goods. Special mouldings are made to order. The standard mouldings are made to carry wires ranging from the smallest size office wire to the largest electric conductor. W. T. H.

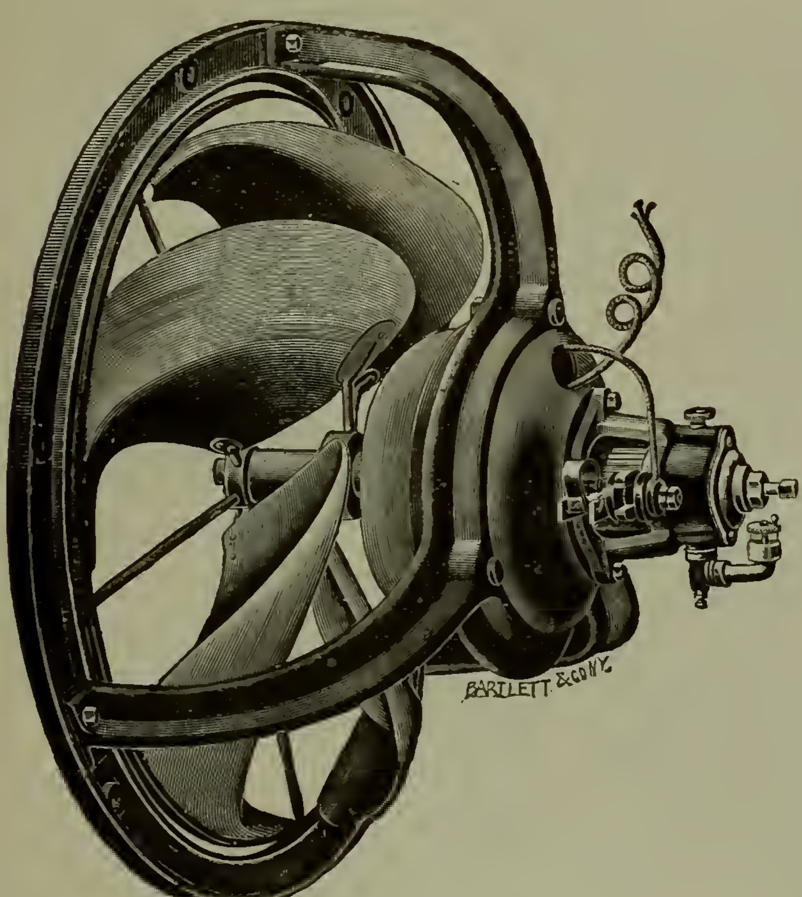
LUNDELL EXHAUST FAN OUTFIT.

The accompanying illustration shows an exhaust fan just prepared for the trade by the Interior Conduit and Insulation Company, 527 West 34th street, New York city, and it exemplifies the flexibility of application of the Lundell motor.

In the application of the Lundell motor to this class of service the shaft, which may be horizontal or vertical, is carried in two bearings in the motor frame itself, not supporting the shaft in any sense from the fan ring. This form of construction insures perfect alignment and practically noiseless running.

These outfits are made with horizontal shafts, unless otherwise ordered, and are invariably made so that the direction of the flow of air is from the motor toward the fan. With all standard horizontal shaft-fans an adjustable thrust bearing (shown in cut) is provided. All lubrication is effected by oil.

These combination outfits are made in eight standard sizes, the power of the motors varying from ¼ to 15 horse-



LUNDELL EXHAUST FAN.

power, and the diameter of the fans from 18 to 72 inches. The motors are wound for 115, 230 and 500-volt circuits. This new combination outfit is efficient.

The Lundell motors can be attached to any standard make of ventilating or exhaust fans.

TROLLEY ABSORBING THE ELEVATED ROAD BUSINESS IN BROOKLYN.

Gen. James Jourdan, president of the Kings County Elevated Railroad, Brooklyn, N. Y., has protested against the recent tax assessment on his road at $170,000 a mile.

Gen. Jourdan said that his road had been in a bad way since the trolley lines had come into operation, and that the company was absolutely unable to pay any taxes. Mr. Fred Uhlman, president of the Union Elevated Road, also entered a protest and said that his road had lost $126,000 during the year ending June 30, 1894, and $98,000 in the following six months.

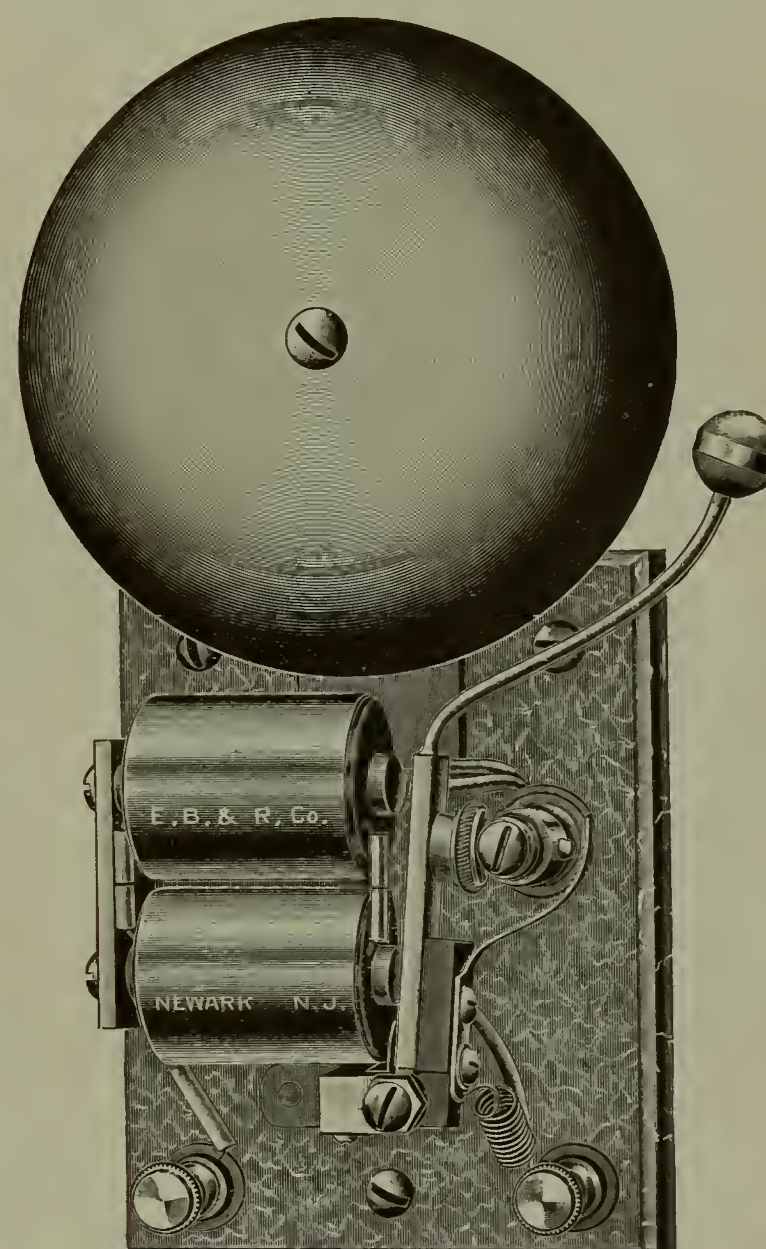
—The wiring in the new Pabst Building, Milwaukee, Wis., has been done over again. The old work was so defective and leaky that complete rewiring was imperative. This experience carries its own moral.

ELECTRIC BELL AND RESISTANCE CO.

This company undertook to devise a bell that could be used on currents carrying all the way from 50 to 500 volts, and succeeded in its efforts most admirably.

"Why not place bells on electric light and electric railway circuits?" was a very natural question to suggest itself, but while the proposition seemed plausible enough, the development of the practical bell for such circuits was attended with difficulties. These were all overcome, however, and now these bells are said to be perfection of their kind.

The Electric Bell and Resistance Co., of No. 46 Lawrence street, Newark, N. J., manufactures gongs, vibrating and single stroke, for signaling in factories, on railroads, mines, steamships, etc., for trolley car alarms, fire-alarms, elec-



STANDARD 110-VOLT BELL.

trically operated church chimes, tower-clock and fog-bells.

The accompanying illustration shows the standard 110-volt-bell. These bells are made in sizes of 2½ to 10 inches in diameter and work on circuits of 110, 240 and 500 volts, according to size. They are generally adapted for calls, signals and alarms for railroads, steamships, mines, factories, electric light stations, hospitals, schools, etc.

In order to overcome the difficulty of constructing the apparatus cheaply with a high non-inductive resistance, the company uses a patented insulated flexible carbon conductor, with which the magnets are wound, after the required number of ampere-turns are wound with the ordinary magnet wire. The bell magnets are wound on the outside with this flexible carbon, which interposes the necessary resistance, and the connections are such that there is no inductive spark at the armature contacts.

To get the best results these bells should be wired with the same care and precaution given to the wiring of lamp circuits.

When they are properly installed no further attention is required.

Among the advantages claimed for these bells may be mentioned the following: saving in space usually occupied by batteries; saving of from 30 to 50 per cent. of wire; raising the standard of insulation; less fire risk; no re-adjusting, and no trouble on account of imperfect contacts, etc.

These bells are mounted on marbleized slate bases and are handsomely finished.

NEW ACCUMULATOR.

A new storage battery, which seems to be an improvement in important respects over existing batteries of this class, can now be seen at 84 Pearl street, Brooklyn, N. Y.

A representative of THE ELECTRICAL AGE, on invitation, visited the place and found there a plant of 60 100-ampere-hour cells in process of formation. He was shown broken pieces of the plates used in the cell. The lead plate is rendered remarkably porous by mixing with the metal before moulding a granulated substance which looks like grains of flint. This stony-like substance causes the lead to mould full of minute air-holes and connecting cells, which permit the circulation of the liquid all through the substance of the plate, thus giving a large active surface.

The battery is of the Planté type, the active material being formed by electrolytic action. It is free, therefore, from all extraneous matter, as exemplified in the Fauré type of cell, which requires the mechanical application to the plates of the active material.

The plates of this new cell are thick and well put together, and being very porous and spongy before they are "formed" electrically, have the active material deposited in the many large and small cells and interstices throughout the body of the plates, instead of only on the outer surface.

The plates consist of one continuous mass of lead of a sponge-like formation, and not made so by the compression of a quantity of particles into partial contact with each other.

This battery is said to be the only one made where porous lead is used that has the plate made of one piece of lead, and by increasing the porosity of the plates a battery of extreme lightness is obtained. A battery of a given capacity can thus be made to weigh less than one-half as much as one of any other make and of like capacity, and at the same time its life is not thereby shortened.

From a legal standpoint this new cell is said to be entirely free from infringemeut of any other cell made.

By the method of manufacture these new cells, it is claimed, can be put upon the market at one-half the cost of any storage cell now in general use.

Further information can be obtained of J. Heron Crossman, No. 50 Exchange Place, New York.

Mr. J. Hart Robertson is the electrician, with headquarters at 84 Pearl street, where the factory is located.

MANAGER F. A. BROBST.

We have received from Manager Brobst, of The Hollenden, Cleveland, O., with his compliments, an elegantly framed large photograph showing the office of The Hollenden; also framed photographs of the exhibition room of the Electrical Light Convention held at that hotel last February, and of the exhibition room of the Brick Manufacturers' Convention. The two last-named pictures are in one fine frame.

Manager Brobst is one of the most enterprising and popular hotel men in the country, and has a special liking for electrical people. He has many friends in the electrical trade.

The electromotive force in volts per yard of active conductor in dynamo armatures varies with the intensity of the field and the speed.

OLD-TIME TELEGRAPHERS.

The fifteenth reunion of the Society of the United States Military Telegraph Corps and Old-Time Telegraphers' and Historical Association, will be held at the Broadway Central Hotel, New York, on September 11, 12 and 13.

The programme of the reunion is as follows:

September 11, 10 A. M.—Business Meeting of the Old Time Telegraphers and Historical Association.

September 11, 2 P. M.—Business Meeting of the United States Military Telegraph Corps.

September 11, 8 P.M.—Entertainment, especially arranged for this occasion, at Chickering Hall, Fifth avenue and 18th street.

September 12, 10 A. M.—Ocean Excursion to Long Branch.

" " 2 P. M.—Banquet at "Jæger's," after which return to New York.

September 13. — General Sight-Seeing.— "Go as you please."

An elegant card of invitation has been especially gotten up and the electrical fraternity of New York city and vicinity is invited to participate in the entertainments provided for this occasion.

The officers of the twin societies are as follows:

United States Military Telegraph Corps.

President,	W. R. Plum, Chicago.
Vice-President,	W. B. Wilson, Holmesburg, Pa.
Sec'y and Treas.,	J. E. Pettit, Chicago.

Old Time Telegraphers' and Historical Association.

President,	Edward C. Cockey, New York.
Vice-President,	R. J. Hutchinson, New York.

Sec'y, Treas. and Historian, Wm. J. Dealy, New York.
Executive Committee—John Brant, J. H. Emerick, J. F. Shorey, Jas. Brown, E. A. Leslie.

Edward C. Cockey is chairman of the Entertainment Committee, and Mrs. Edward C. Cockey is chairman of the Ladies' Committee.

The Committee of Arrangements consists of the following-named gentlemen: F. W. Jones, chairman; Edward C. Cockey, Wm. H. Baker, John Brant, John F. Shorey, M. W. Rayens, Wm. J. Dealy, M. H. Kerner, Chas. P. Bruch and J. B. Taltavall.

A royal good time is promised.

MAGNETIC CLUB'S MID-SUMMER MEETING.

The Magnetic Club, of New York, on July 18, held its eighth mid-summer meeting at the Boulevard Hotel, College Point, L. I., a large number of members and guests availing of the opportunity of an enjoyable outing.

Through the courtesy of the Western Union Telegraph Company and Superintendent W. C. Humstone, the Western Union's cable steamer, "Western Union," was placed at the disposal of the club, and during the afternoon two trips were made to College Point, a large party being carried each time.

At College Point a game of base-ball was played and afterwards various races were run, some of the younger members showing remarkable speed and agility.

The dinner was served in the evening, about 150 persons participating. After dinner, music and recitations kept the party in good humor until 10:30, when the "Western Union" was again boarded for the homeward trip. The ride home was a delightful one, and, taking it all in all, this meeting was the most successful and enjoyable of all its predecessors. President E. C. Cockey was at the helm on shore, and personally greeted every one present with a hearty hand-shake and expression of good cheer. The whole affair was devoid of formality, which made it all the more enjoyable.

Many prominent electrical people were present, including Gen. Fowler and W. H. Baker, vice-president of the Postal Telegraph Company, H. L. Shippy, of John A. Roebling's Sons, J. R. Kempster, (who was elected a member on this occasion amid vociferous applause) J. E. Wright, and T. J. Smith, of the E. S. Greeley & Co.

ELECTRIC LIGHT PLANT ON THE STEAMER "BAY STATE."

The accompanying illustration shows the electric light plant recently installed by the Belknap Motor Co., Portland, Me., on the steamer "Bay State," of the Boston and Portland line.

There are two multipolar, slow-speed Belknap dynamos each directly connected to an "Ideal" engine, made by the Harrisburg Foundry and Machine Works, Harrisburg, Pa. Each dynamo has a capacity of 400 lights, but is capable of carrying the entire load, amounting to 540 lights.

The plant is in duplicate, as a safety precaution against accident to either unit.

The dynamos were designed by Mr. W. H. Chapman, the Belknap Company's electrician, and are very compact and symmetrical in appliance.

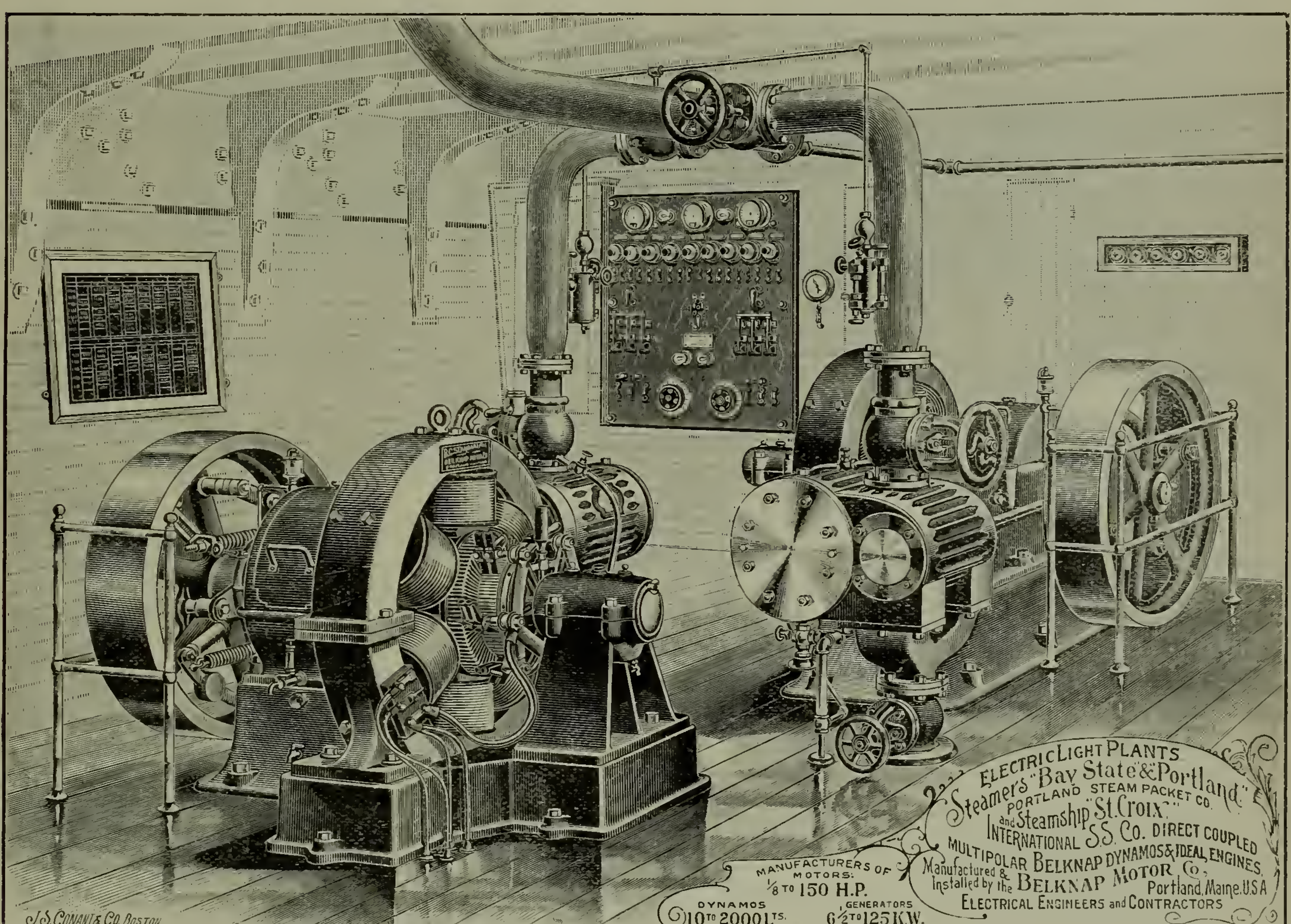
The wiring is done in an excellent manner. There are 8 circuits, leading to 16 distributing boxes containing switches, and located in different parts of the boat. Each switch controls 6 lights. These distributing boxes have glass fronts, secured with lock and key, and are under the control of the steward of the vessel. There are pilot lights at the main and fore rigging and at the bows of the boat.

The eight main circuits are controlled by the switchboard shown in our illustration.

The fixtures throughout the boat are of the latest design. Those in the saloon and rooms have opalescent globes and shades, which give a very beautiful, soft light. The dining saloon lights are fitted with ground glass globes, which give this part of the boat a very cheery and pleasing effect. The freight deck lights are protected with guarded fixtures.

This plant does great credit to the Belknap Motor Co., and it has given such satisfaction that the company has secured orders for the installation of two direct-coupled machines on the steamer "Portland," of the same line; also a similar plant for the steamship "St. Croix" of the International Steamship Company.

At night the "Bay State" presents a brilliant appearance with her electric lights. She is one of the finest boats in Eastern waters.



THE NANTASKET BEACH ROAD.

Judge John M. Hall, vice-president of the New York, New Haven & Hartford R. R. Co., is reported to have said that if the Nantasket Beach Railroad electric power experiment proves entirely satisfactory, other branches of the road will be similarly equipped before long. The Nantasket Beach electric trains have so far given very satisfactory results and have run well under the exessive excursion demands and at a high rate of speed.

BLOCK SIGNALS ON THE NEW YORK CENTRAL.

The passenger department of the New York Central and Hudson River R. R. Co. has just issued a little book, No. 17 of the "Four Track Series," which describes and elaborately illustrates the Block Signal system on that road. It is stated that the New York Central is the best signalled and consequently the best protected railroad line in the world. The descriptive matter is from the pen of John P. O'Donnell, a distinguished English civil engineer, who is an expert on block signals, and makes interesting and instructive reading. A copy of this work can be had for three 2-cent stamps of G. H. Daniels, General Passenger Agent of the New York Central and Hudson River R. R. Co., Grand Central Station, New York City.

Possible Contracts.

The Charleston, W. Va., street railway, water-works, gas plant and electric light plant have been purchased by New York capitalists, who will expend $50,000 in immediate improvements.

The North Mount Vernon Surface Railroad Company, Mount Vernon, N. Y., has voted to increase its capital stock from $20,000 to $250,000 for the purpose of extending its line to Tuckahoe, Bronxville and White Plains.

Hawkinsville, Ga , proposes to build an electric light plant of its own. Address the Mayor for further particulars.

The Easton Gas and Electric Light Company, Easton, Md., will make extensive improvements to its plant.

The State University, Raleigh, N. C., will put in an electric light plant,

Regarding the proposed electric light plant in Madisonville, Ky , Mr. I. Bailey can give further particulars.

An electric light plant is to be installed in Stephenville, Texas, by James Beech.

Alden & Kimsey, Wagnerville, N. C., will probably install an electric light plant in their new flour mill.

W. E. Sudlow, Florence, S. C., will erect an electric light plant in Georgetown, that state.

The Mayor of Bolivar, Mo., can give particulars regarding the proposed erection of an electric light plant in that place.

It is reported that the Pennsylvania Railroad Co. will build an electric light plant in Baltimore, Md., for the purpose of lighting its tunnel in that city; also for the production of electric power for the ventilation of the tunnel.

Jones, Pollard & Co., Baltimore, Md., have secured the contract for building the Catonsville extension of the City and Suburban electric railroad, Baltimore, Md.

The Hillsboro Street Railroad, Hillsboro, Texas, is to be converted from horse to electric power.

The station of the American Gas Engine Electric Company, Chicago, Ill., will, when completed, contain 400 H. P. in gas engines, bolted directly to dynamos. The largest gas engine in the plant will be of 200 H. P. and of the tandem type.

New Corporations.

The Georgia Railway Company, Atlanta, Ga., by August H. Denning, Thomas Barnes, James H. Gilbert and others. Capital stock, $2,800,000.

The Reed City Electric Company, Reed City, Mich., by Charles A. Kimmel, Laure Thomas and others. Capital stock, $10,000.

The Dan River Power and Manufacturing Company, Danville, Va. Thomas B. Fitzgerald, president; William P. Bethell, vice president; Roger A. James, secretary and treasurer; and directors, Thomas B. Fitzgerald, W. P. Bethell, R. A. James, J. H. Schoofield and James E. Schoofield. The company has the right to erect electric plants and lease water and electric power.

The Southern Electric Service Company, Norfolk, Va., by William R. Brown, Mr. Hobbs, of Rockland County, N. Y., and several others from New York state. Capital stock, $175,000.

The Philadelphia Lancaster and Harrisburg Railway Company has applied for a charter at Harrisburg. The incorporators are John J. Patterson, J. Hay Brown, John D. Skiles, J. Gus Zook, Michael Reilly, Dr. M. L. Herr, Dr Henry Yeagley and others. Capital stock, $6,000,000.

The Lancaster, Ephratas and Reading Railroad, Harrisburg, Pa., has applied for a charter. Capital stock, $70,000.

The Lititz and Manheim Railway Company has applied for a charter at Harrisburg, Pa. Capital stock $50,000.

The Washington, Sandy Springs and Baltimore Electric Railway Co., Annapolis, Md., by James B. Colegrove, Wm. P. Sliney, E. Ray Keys and S. F. Colegrove. Capital stock, $1,500.

Telephone Notes.

W. N Shaw, H. F. Fisher and P. B. Morris are directors in the new telephone company now being organized in Houston, Texas.

Mr. J. M. Foust proposes to establish a telephone exchange in Mt. Vernon Springs, N.C.

The Henderson-Harrison Telephone Co. has been organized in Henderson, Ky. The capital stock of the new company is $15 000, and the incorporators are Montgomery Merritt, W. J. Johnson, O. W. Rash, S. K. Snead, Jas. E. Rankin, Chas. E. Dallam, all of Henderson, and H. K. Cole, of Louisville, Ky.

W. P. Roberts, of Lynchburg, Va., has awarded the contract for the construction of the telephone system of the newly organized company in that city.

The Chesapeake and Potomac Telephone Co. is now preparing plans for the enlargement of its Baltimore building.

TELEPHONE PATENTS ISSUED JULY 16, 1895.

Telephone Relay or Repeater. Chester H. Arnold, Boston, Mass. (No. 542,618.)

Telephone Repeating Circuit and Apparatus. Chester H. Arnold, Boston, Mass. (No. 542,619.)

Telephone Relay Apparatus. Wilton L. Richards, Malden, Mass. (No. 542,657.)

Telephone Repeating Circuit and Apparatus Wilton L. Richards, Malden, Mass. (No. 522,658.)

Coin Controlled Telephone. Charles B. Hopkins and Thomas H. Elsom, Spokane, Wash (No. 542,679.)

Microphone. Henri Carbonelle, Brussels, Belgium. (No. 542,822.)

Telephonic Relay or Repeating System. Charles H. Arnold, Boston, Mass. (No. 542,913.)

Trade Notes.

Mr. Oluf Tyberg. M. E., a well-known practical and theoretical engineer and designer of many automatic and other labor saving machines, has acquired an interest in The Brady Mfg. Co. and accepted the position of superintendent of that concern, at 83 Washington street, Brooklyn, N. Y.

The Paris house of the Boudreaux Dynamo Brush Co., received last week the following letter from the French Navy Dept.:—"Dear Sir: I have the honor to inform you that in consequence of the satisfactory results obtained with your foliated brushes in the port of Brest, I have authorized by dispatch on this date, the use of it in our five ports and the establishments of Indre and Gueriguy.

..................Signed.
By order of the Minister,
The Director of Material.

WOVEN WIRE BRUSHES.

The Belknap Motor Co., of Portland, Maine, are the patentees and manufacturers of the best woven wire commutator brush on the market.

ELECTRICAL and STREET RAILWAY PATENTS

Issued July 16, 1895.

542,617. Running Gear for Electric Railways. Bion J. Arnold, Chicago, Ill., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Apr. 13, 1891.

542,618. Telephone Relay or Repeater. Chester H. Arnold, Boston, Mass., assignor to the American Bell Telephone Company, same place. Filed March 16, 1895.

542,619. Telephonic Repeating Circuit and Apparatus. Chester H. Arnold, Boston, Mass., assignor to the American Bell Telephone Company, same place. Filed March 16, 1895.

542,625. Carbon for Electric Lamps. Henri F. Cabirau, Paris, France. Filed Apr. 11, 1895. Patented in France Sept. 18, 1894. No. 241,477.

542,640. Electric Governor. William W. Handy, Lake Roland, Md. Filed May 1, 1895.

542,657. Telephone Relay Apparatus. Wilton L. Richards, Malden, assignor to the American Bell Telephone Company, Boston, Mass. Filed Mar. 16, 1895.

542,658. Telephone Repeating-Circuit and Appliances. Wilton L. Richards, Malden, assignor to the American Bell Telephone Company, Boston, Mass. Filed Mar. 16, 1895.

542,662. Electric-Arc Lamp. Elihu Thomson, Swampscott, and Charles E. Harthan, Lynn, Mass., assignors to the General Electric Company, Schenectady, N. Y. Filed June 25, 1894.

542,663. Electric Measuring-Instrument. Elihu Thomson, Swampscott, Mass., assignor to the General Electric Company, of New York. Filed Apr. 25, 1895.

542,664. Electric Annunciator. Henry C. Thomson, Boston, Mass., assignor to the Electric Gas Lighting Company, Portland, Me. Filed Oct. 2, 1894.

542,667. Regulation of Continuous-Current Motors. Merle J. Wightman, Scranton, Pa., assignor to the General Electric Company, of New York. Filed Apr. 2, 1895.

542,670. Cable Railway. William M. Wood and James C. Miller, Elmira, N. Y., assignors of one-third to Charles F. Wright, Susquehanna, Pa. Filed May 29, 1894.

542,675. Insulating-Shield for Metallic Poles. William J. Braley, Fall River, Mass. Filed Apr. 17, 1895.

542,679. Coin-Controlled Telephone. Charles B. Hopkins and Thomas H. Elsom, Spokane, Wash. Filed Mar. 16, 1894.

542,697. Burglar-Alarm Circuit-Closer. Albion A. Vanderpool, Newark, N. J. Filed Nov. 8, 1894.

542,699. Railway-Signal. Frederick B. Wetherbee, Walpole, Mass. Filed May 3, 1895.

542,720. Car-Fender. Morris Weiss, New York, N. Y. Filed Apr. 27, 1895.

542,749. Car-Fender. Robert Bateson, Fall River, Mass. Filed May 3, 1895.

542,761. Electric Block-Signal for Railroads. Angus C. Gordon, Rochester, N. Y., assignor to the Gordon Railway Signal Company, same place. Filed May 13, 1895.

542,769. Electric Signal Apparatus. Thaddeus B. Keeler, Rahway, N. J., assignor to Arthur H. Johnson, same place. Filed Mar. 11, 1895.

542,771. Means for Generating Electricity from Car-Wheel Axles. Morris Moskowitz, Newark, N. J., assignor to The National Electric Car Lighting Company of West Virginia. Filed Feb. 27, 1895.

542,772. Make-and-Break Switch. Morris Moskowitz, Newark, N. J., assignor to The National Electric Car Lighting Company of West Virginia. Filed Apr. 23, 1895.

542,773. Polarized Compound Switch. Morris Moskowitz, Newark, N. J., assignor to The National Electric Car Lighting Company of West Virginia. Filed May 2, 1895.

542,774. Car-Fender. William E. Moulton, West Troy, N. Y., assignor of one-half to Joshua Mors and George Caswell, same place. Filed Oct. 6, 1894.

542,776. Street-Railway Car. Louis T. Pyott, Philadelphia, Pa., assignor of one-half to Daniel A. Waters and Wm. G. Vernon, same place. Filed Mar. 12, 1895.

542,778. Car-Fender. George B. Riggins, Brooklyn, N. Y. Filed May 24, 1895.

542,822. Microphone. Henri Carbonelle, Brussels, Belgium. Filed Oct. 9, 1894.

542,833. Annunciator. John W. Olson, Chicago, Ill. Filed Nov. 21, 1894.

542,836. Life-Guard for Street-Railway Cars. Michael Riley, London, Ohio. Filed Mar. 25, 1895.

542,838. Supporting Strap for Cars, &c. Martin L. Senderling, Jersey City, N. J. Filed Nov. 30, 1894.

542,841. Car-Fender. Joseph Brautigam, Brooklyn, N.Y, Filed April 17, 1895.

542,848. Electric Switch. George T. Eyanson, Philadelphia, Pa. Filed May 10, 1895.

542,877. Life-Saving Net for Cars. Lawrence Dulligan, Rochester, N. Y. Filed Sept. 16, 1893.

542,913. Telephonic Relay or Repeating System. Chester H. Arnold, Boston, Mass., assignor to the American Bell Telephone Company, same place. Filed Mar. 16, 1895.

542,916. Electrical System for Signaling between Trains. Alejandro Basanta y Baqué, Madrid, Spain. Filed Jan. 21, 1895.

542,918. Street-Car Fender. William Barker, Philadelphia, Pa. Filed June 11, 1894.

542,924. House-Wiring Fixture. Chas. F. Case, Akron, Ohio. Filed Apr. 20, 1895.

542,926. Electric Annunciator. Wm. J. Clarke, Trenton, Canada. Filed Feb. 5, 1895.

542,928. Signaling Apparatus. Lucien S. Crandall, Parish, N. Y. Filed Feb. 17, 1893.

542,945. Electric Meter. Henry A. Rowland, Baltimore, Md., assignor of one-half to Louis Duncan, same place. Filed Apr. 19, 1895.

542,953. Elements of Galvanic Batteries. Franz A. von Alimonda and Nino von Alimonda, Castello Alimonda, near Sagrada, Austria-Hungary. Filed Oct. 1894.

542,959. Electric Gas-Lighter. Harry G. Grier, Philadelphia, Pa. Filed May 31, 1895.

542,968. Regulator for Alternating Electric Circuits. Charles P. Steinmetz and Albert H. Armstrong, Schenectady, N. Y., assignors to the General Electric Company, same place. Filed Feb. 16, 1895.

542,977. Track-Sweeping Attachment for Street-Cars. William H. Penny, Danbury, Conn., assignor of one-half to Henry H. Turner, same place. Filed Sept. 21, 1894.

542,979. System of Electrical Distribution. Georg W. von Siemens, Berlin, Germany. Filed Apr. 26, 1893. Patented in Belgium Jan 28, 1888, No. 84,457; in Germany Dec. 13, 1888, No. 50,578; in France Dec. 28, 1888, No. 195 045; in Italy Dec. 28, 1888, No. 24,650; in Sweden Dec. 28, 1888, No. 3,023; in Austria-Hungary Dec. 28, 1888, No. 20,779 and No. 69,346; in England Mar. 1, 1889, No. 3,674, and in Switzerland Mar. 2, 1889, No. 528.

542,980. Switch-Actuating Apparatus. George T. Janvrin and Frank J. Conlon, Brooklyn, N. Y. Filed Dec. 12, 1894.

ELECTRICAL AGE

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NEW YORK, AUGUST 3, 1895.

CONTENTS.

ILLUMINATING NIAGARA FALLS BY ELECTRICITY.

It is proposed to illuminate Niagara Falls at night by the use of electric lights. The General Electric Company has for some time been conducting experiments at its Schenectady works to determine the best method of accomplishing this purpose, and it is now stated that two 48-inch lamps, each of 10,000 candle-power, will be used. These mighty falls illuminated by the aid of electricity will form one of the most sublime attractions in the world, and a sight that would be worth travelling many miles to see.

COLLAPSE OF THE CHICAGO-ST. LOUIS ELECTRIC RAILWAY SCHEME.

Those who pinned their faith to the scheme which had for its object the transportation of passengers, freight, etc., from Chicago to St. Louis at the rate of 100 miles an hour by the aid of electric power, have "got left," just as we expected they would. We do not mean that the 100-mile an hour train left them; they "got left" in their expectations of being immensely wealthy. The great enterprise, which had a foundation of wind and promises, has collapsed, and the citizens of the two once rival towns are still travelling back and forth by the old, slow-going steam locomotive method. What an interesting chapter could be shaped from all of the glittering promises made for this beautiful enterprise. Weren't they catchy, though?

DECISION IN THE DOUBLE-CARBON LAMP CASE.

Judge Showalter in the United States Circuit Court of Appeals, at Chicago, on July 24, rendered a decision in the two suits of the Brush Electric Company against the Western Electric Company, for infringement of the double-carbon lamp patent of Mr. C. F. Brush. The judge decided that the Western Electric Company's double-carbon lamp did not infringe the Brush lamp. Brush's patent (No. 219, 206) was issued September 2, 1879, and will therefore expire in a little more than one year. The lamps alleged to have been infringements were invented by Charles E. Scribner, and were manufactured under patents issued to him on January 7, 1890 (No. 418,758), and August 1, 1893 (Nos. 502,535 and 502,536). Prior to the suit just decided one was tried in Toledo, Ohio, on the first mentioned patent, and was decided in favor of the Brush Company; but this case was declared by Judge Showalter to not affect the one just decided. The court holds that no infringement was made in either suit, and ordered that the bill be dismissed for want of equity.

OLD-TIME TELEGRAPHERS.

The Old-Time Telegraphers Society will enjoy the hospitality of the New York electrical fraternity on September 11, 12 and 13, next. A great majority of those now engaged in the varied electrical pursuits were formerly connected with the telegraph service, in one capacity or another, when the telegraph was the only electrical industry. This was only fifteen years ago. In 1883 many of the most prominent electrical people of today were telegraph operators or otherwise engaged in the telegraph business, but being of bright minds they foresaw the wonderful things that were to be developed in the near future, so they cast loose from their old surroundings and sailed for the "promised land." Some fared well; some fared indifferently and some fared not at all, but through success or failure they have always cherished a love for their former vocation and its associations. Therefore we opine that the old and honored telegraphers will meet with a royal welcome at the hands of the New York fraternity next September. Everybody interested should take hold and help to make the meeting a great success. Not only are the Old-Timers to be honored; the United States Military Telegraph Corps forms an integral part of the Society and will also hold its annual meeting at the same time.

PROPERTIES OF FUSE METALS WHEN SUBJECTED TO SHORT CIRCUITS.

BY WALTER E. HARRINGTON.

(*Concluded from page 31.*)

In the following tables the first column gives the size of wire in B. & S. gauge; the second column gives the circular mils.

The third column gives the mean of determinations as given by the indications of the C-S magnetic circuit breaker.

The fourth column gives the constant B entering into the formula $C = B\,d^2$, where

C = current in amperes passing through the fuse metal on a short-circuit.

d = diameter of fuse metal in inches.

B = constant depending on metal and voltage of circuit short-circuit is made on.

The writer noticed that the values as obtained in the tests when compared with the circular mils of the wires tested showed a very close proportionality, showing that the fusing currents on short-circuits followed the law of the square times a constant.

TABLE I.

Copper.

B. & S. Size Gauge.	d^2 C. M.	S. C. Amps	B.
30	100	39	380,000
29	126	44	350,000
28	159	62	390,000
27	201	80	398,000
26	254	116	456,000
25	320	140	437,000
24	404	225	556,000
23	509	300	589,000
22	642	370	576,000

Table I is for copper. While the constants B vary, especially as the sizes of the wire become larger, this variation is probably due to possible changes of conditions, such as differences of diameter, length of fuse metal, loads on the generators at the time tests were made and heating ot the leading wires as the tests were being made. By averaging B the law for copper wires on 500 volt short-circuits could be stated to be:

$$C = 460{,}000\,d^2,$$

or, expressed directly in terms of circular mils, the current which will flow in copper wires on 500-volt short-circuit will be:

$$C = \frac{C.\ M.}{1.9},$$

where C = current in amperes,
$C.\ M.$ = circular mils.

TABLE II.

Aluminum Wire.

Size B. & S. Gauge.	C. M. d^2.	S. C. Amperes	B.
24	404	200	500,000
21	810	290	358,000
20	1021	325	318,000

For aluminum the law for 500-volt short-circuit currents would be:

$$C = 392{,}000\,d^2.$$

$$C = \frac{C.\ M.}{2.6}.$$

There was one very pronounced peculiarity in the action of aluminum during the short-circuits; the metal seemed to burn longer and pieces of metal would come down, after the explosion, still burning.

TABLE III.

Stock (Lead and Tin) Fuse Wire.

Size B. & S. Gauge.	Rating Fuse Wire Amperes.	C. M. d^2	S. C. Amperes.	B.
24	1	404	50	125,000
21	3	810	115	156,000
19	5	1252	130	106,000
17	7	2048	230	118,000
15	10	3256	290	86,000

For fuse metal (ordinary commercial lead and tin alloy), the law for 500-volt short-circuit currents would be:

$$C = 118{,}000\,d^2.$$

$$C = \frac{C.\ M.}{9}.$$

The dense, heavy, suffocating smoke attending the short-circuiting of lead and tin fuse metals was very pronounced and disagreeable.

Copper gave the best result as regard quantity of current per cross-section of metal. This is shown in the formula for copper

$$C = \frac{C.\ M.}{1.9};$$

where compared to the other metals the current per circular mil is a maximum, and that the amount of metal to

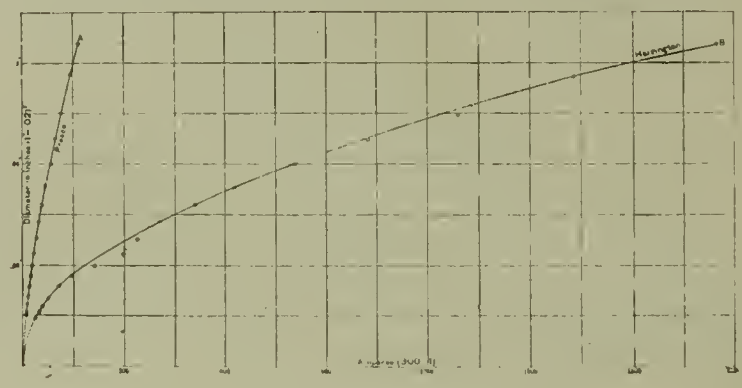


FIG. 2.

disintegrate for a given current would be a minimum. In all the tests the behavior of the copper short-circuits were noticeably short and attended with a loud explosive report, with but little comparative flash.

One phenomena was noticeable when a cold surface, such as glass, was placed in the immediate path of the discharge; a finely deposited surface of light copper would present itself. This was unquestionably a case of condensation of the copper gases. While it may be argued that the law as enunciated by the writer, covering 500-volt short-circuit currents through fuse metals may not be rigorously true, still it certainly is as true relatively as that of the law enunciated by Preece, covering the relation between minimum fusing currents and diameters of fuse metals.

In the use of the law for practical work, where fuses had to be employed for cases beyond the values as determined by test, the values as obtained by extrapolation in every instance fulfilled the requirements, demonstrating the practical correctness of the law.

A few cases are cited wherein a knowledge of the law wonld be of practical value. Take railway work, elevator work, in fact; any case of varying power transmission where, if fuse metals are employed, the size of the fuse metal is governed not so much by the normal safe carrying capacity of the apparatus to be protected as it is by the expected normal jumps of current the apparatus is designed for, and expected at times to carry. The standard 18 to 20-foot street railway equipments consisting of, say, two No. 3 or No. 14 Westinghouse motors, are usually protected by a piece of No. 14 B. & S. gauge copper wire, which will normally fuse under a minimum current of approximately 168 amperes—according to Preece's law—whereas under a 500-volt short-circuit, if not prevented by some foreign means, such as feeder magnetic, or generator magnetic circuit breakers, a flow of approximately 2,000 amperes will ensue. Take as another illustration the lead and the tin alloy fuses employed by the General Electric Company for their G. E. 800 equipments and rated to fuse on 100 amperes, will on a 500-volt short-circuit allow a flow 3,600 amperes for approximately .01 of a second, if not prevented by the opening of the power station magnetic circuit breaker. Further, with this latter type of fuse metal, the quantity of metal to disintegrate is so much greater that usually more harm is done owing to the vicious character of the gas as regards conductivity, this usually establishing other grounds.

At this point it is pertinent to refer to a phenomena accompanying the "blowing" of a fuse on a 500-volt short-circuit; that is, the destructive arcing following the disintegration of the fuse, maintained, of course, at the expense of the terminals. In the determination of the law $C = B\,d^2$, the after-arcing was eliminated by using a protected terminal fuse block.

In a paper entitled "The Destructive Arcing of 500-Volt Fuses," read before the American Street Railway Association at Atlanta, Ga., October, 1894, by the writer, this matter is elaborated upon. and in brief shows that the results due to arcing following the blowing of a fuse may, under short-circuit conditions, be far worse than even the results attendant upon the passage of such momentarily great currents.

Table IV.

Law.

B. S. Gauge Cop.	Circular Mils.	Preece. Regular Amperes Rating.	Harrington. Amperes Short Circuit.
30	100.5	11	39
29	126.7	12	44
28	159.7	14½	62
27	201.5	17	80
26	254.0	20	118
25	320.4	24	140
24	404.0	29	215
23	509.4	34	298
22	642.7	41	340
21	810.1	48	405
20	1021.5	56	510
19	1252.4	67	625
18	1624.3	82	812
17	2048.2	98	1024
16	2582.9	115	1291
15	3256.7	140	1625
14	4106.8	168	2053
13	5178.4	195	2589
12	6529.9	235	3264
11	8234.0	280	4167
10	10381.0	530	5190
9	13094.0	395	6547
8	16509.0	470	8000
7	20816.0	560	10000
6	26250.0	670	13000
5	33102.0	790	16000
4	41742.0	950	20000

In Table IV, column 1 gives the size in B. & S. gauge of the copper wires; column 2 gives the circular mils; column 3 gives the minimum fusing current as determined by Preece's law, $C = 10244\ d^{\frac{3}{2}}$, and column 4 gives the fusing currents on 500-volt short-circuits as determined by the law, $C = 470{,}000\ d^2$, enunciated by the writer. Fig. 2 graphically illustrates the pronounced disparity of the two laws, showing the curves of currents for diameters: Curve A for Preece's law, and curve B for the law as discovered by the writer. The natural conclusion arising from a knowledge of the above data is that fuse metals are under no circumstances to be considered in the light or nature of a protection.

—Long magnets have a greater attractive strength than short ones. The increased strength, however, is not due to the length of the magnet, but to greater length of the windings, and hence, the stronger magnetization.

PRINCIPLES OF DYNAMO DESIGN.

BY

Newton Harrison E.E.

(*Continued from Page* 50.)

If, however, the *E.M.F.* is increased as these resistances increase, the P. D. may be preserved unchanged. Another change in form may be made if

W = resistance of circuit and machine,

then as

$$E = e \times \frac{r_a}{W}$$

$$e = E \times \frac{W}{r_a}$$

showing that if the *E.M.F.* remains constant the P. D. depends upon the ratio between the entire resistance and the resistance of the armature. Thus it may be seen how much importance may be attached to the resistance of the armature. From a theoretical standpoint an ideal armature with no drop of potential, because of its lack of resistance, would give the most perfect regulation and consume no energy as heat. Returning to the original discussion, the armature current after being affected by the external resistance naturally varies in strength. If it be allowed to circulate around the magnet core, its effect upon that will be directly evident. The direction of its winding will be the same as that of the shunt winding; therefore, as the current from the armature increases, the ampere turns around the magnet core increases, and the lines of force proceeding from it affect the *E.M.F.* generated, building it up when the armature current increases, and letting it drop as the current strength declines. The proper range must be left in the condition of the magnetic circuit, otherwise its lack of sensitiveness in answering to the additional ampere turns will render it totally inefficient, and therefore useless. A super-saturation of the core will affect this condition; the permeability is then very low and it would require a great many ampere turns to sensibly increase the number of lines of force.

The critical number of turns required for the proper regulation will have a direct effect upon the *E.M.F.* generated when the armature is fully loaded. According to Thompson's deduction, these turns may be regulated by the formula

$$S = \frac{r_a + r_m}{n\,C\,q}$$

$$\text{where } q = \frac{4\pi}{\text{sum of } \frac{l}{\mu A}}$$

r_a = resist. armature,
r_m = resist. magnets,
S = critical turns,
π = speed sec.,
C = inductors,

where the magnetism is supposed to be unvarying except when influenced by the series coils through which the armature current passes.

There is also a value for what is called the "critical speed" which is dependent upon the series turns and internal resistance.

The reactive turns upon an armature are those included within a certain angle indicated in running machines by the angle of lead. If an armature have 100 turns and the angle of lead include 10 turns, then, because the turns that are reacting upon the field subtend twice that angle, the number of turns to be considered are 20.

If the armature carry 100 amperes, then the total ampere turns are 100 × 100 = 10,000, and the turns to be accounted for are 20 × 100 = 2,000 ampere turns of negative tendency. The magnetizing effects of the turns may be divided into two classes; those producing

cross magnetization
and demagnetization.

The turns are in a horizontal position that tend to cross-magnetize, while those whose effect is more destructive are in a vertical position. Unless the turns on the armature are very greatly in excess of those called for by even moderately good design the ratio between the two sets of tendencies is fairly large, from 1:20 to 1:10, depending upon the object of the machine.

It is necessary to remember that those turns which distort the field are not the demagnetizing turns because their action is of a directly opposite tendency, but that the distortion of field is caused by a magneto-motive force acting at right angles to the normal field and proceeding from the turns causing cross-magnetization.

This shifts the field around to a definite position, which is only varied by a change in the armature current, which when at a maximum is reacting in both the above-mentioned ways to its fullest extent. The worst development arising from the cross-magnetization is that due to the 'packing" of the lines of force at certain parts of the field; increasing the saturation at that part, destroying its uniformity and giving rise to difficulties which in machines with broad conductors or toothed armatures appear as excessive heat. The armatures are classified in a manner arising from their construction as

Ring armatures, Radial core armatures.
Drum " and Disk " "

Under these different headings a variety of composite types arise. Those receiving the most particular attention are the Drum, Ring and Radial core, whose use, however, is somewhat limited. Disk armatures are not in very great use at the present time.

The two types of compound winding called long shunt and short shunt do not differ so greatly from each other as to invite the necessity for a careful choice.

The long shunt gives connections in which the series coil and shunt coil are in series, one extremity of the shunt coil being one pole of the machine and the other pole comprising the junction of both shunt and series coil. The short shunt simply places the series coil in series with the outside circuit.

The critical turns required will be

$$S = \frac{r_a + r_m}{n_1} \times \frac{1}{c\,q}$$

and critical speed

$$n_1 = \frac{r_a + r_m}{S} \times \frac{1}{c\,q_1}$$

(*To be continued*).

SOLAR HEAT.

An idea can be formed of the quantity of heat developed by the sun by the citation of a few interesting facts in relation to it. As large as this earth is, it is but a speck in the infinite chasm of space. Its distance from the sun is measured in millions of miles, yet the amount of radiant heat received by it would suffice to melt in one year a layer of ice all over the earth's surface 35 yards thick. The earth, which is a type of planet that is slowly exhausting itself, sheds but an infinitesimal amount of heat in comparison. It is estimated to be but $\frac{1}{2,381,000,000}$ of the total heat of the sun. Faraday claims that the heat radiated from each acre in London is equal to the combustion of 60 sacks of coal. When it is remembered that radiant heat, like light, obeys the same law, that its intensity varies inversely as the square of the distance, the fearful heat of the sun and the tremendous temperature of its photosphere are items sufficient to make one marvel at their immensity.

The sun is not heated by combustion, such as is generally supposed, because the supply of meteorites required as fuel for this vast furnace would be almost immeasurable. Neither does it depend upon the impact experienced from aerolites in their sudden descent or the roaring waves of hydrogen, but upon its own gradually concentrating mass.

In spite of the great convulsions occuring within it its volume is diminishing and its bulk becoming smaller. Any gas of a given temperature may have its temperature increased by a rapid compression, or it may be correspondingly diminished by expansion. Thus an almost imperceptible shrinkage in size would mean to a body like the sun a raise in temperature of many thousands of degrees. The distance of the earth from the sun being 210 times the radius of the sun, the amount radiated per square foot at the sun is 45,000 times that received per square foot at the earth. From these figures the conclusion can be drawn that a temperature of 60° Fahr. at the earth corresponds to the enormous temperature of 2,700,000° Fahr. at the sun.

The corona of the sun during an eclipse, besides showing fiery waves 30,000 to 40,000 miles high, has shown peculiar streaming lights, described by astronomers as being of some impalpable material lighter than hydrogen.

Prof. Pupin, of Columbia College, has traced these effects to electrical causes, and has reproduced the corona in miniature.

The relation between cold and heat is no longer misunderstood; one is but the antithesis of the other; absolute zero denoting no molecular vibration, and an almost infinite range of temperatures beyond, with molecules vibrating at an inconceivable velocity, express the physical limits as defined by modern science. If common air were to transmit a wave with the velocity of light and its specific heat were .23 its temperature would be 400,000,000,000 000° Fahrenheit. Were a pound of luminiferous ether as well able to absorb heat as water, then the heat that would raise a pound of water to 100° Fahr. would raise the temperature of the ether but $\frac{1}{46,000,000,000}$ of a degree.

A LARGE SWITCHBOARD.

The Solar Electric Company, 65 and 67 Duane street, New York, have a contract for an immense switchboard to be installed in the Government Printing-office, Washington, D. C. It will be made of Tennessee marble, set in an iron frame, and will present a surface of nearly 1,700 square feet. It will be fitted up with special instruments, and all the bus-bar connections and clip-holders are to be made of solid copper. Several tons of copper will be used in the connections. The switches will range in capacity from 800 to 1,000 amperes, and the board will be used for the distribution of current throughout the building for power purposes. Crocker-Wheeler electric motors will be installed for the operation of all the printing-presses and other machinery in the building.

Removed.—Mr. Fred Brainard Corey, electrical expert and consulting engineer, Boston, Mass., has removed his office from 620 Atlantic Avenue to Room 33, Equitable Building, 150 Devonshire street. All matters pertaining to the application of electricity receive his attention.

Fatally Shocked.—John McGibney, a lineman employed by the Newark Electric Light and Power Co., Newark, N. J., was killed a few days ago by an electric shock. He was engaged in the work of stringing a new wire, which is supposed to have become crossed with a charged wire, and when he took hold of it he received the fatal shock. He received 3,000 volts.

PHILADELPHIA'S ELECTRICAL INTERESTS.

CONTINUED FROM PAGE 50.

THE S. S. WHITE DENTAL MFG. CO.

While the dynamo has superseded large primary battery plants, it is not so economical in places where few cells of battery are required. The primary battery will long hold its own in this field, and, with the constant improvements that are being made in its efficiency, its use will rather increase than diminish.

In these days of close calculation it is always more profitable to the consumer, in primary batteries as well as in all other articles of merchandise, to get the best. The best primary battery means that one which will give the greatest amount of electrical energy or current in proportion to the total cost. It is therefore of importance, in selecting a battery, to choose one that meets these conditions as fully as possible; and to find such a battery the only safe way is to purchase of a reliable dealer, whose guarantee as to efficiency is equal to an actual test demonstration. Batteries are divided into two classes—open circuit

FIG. I.

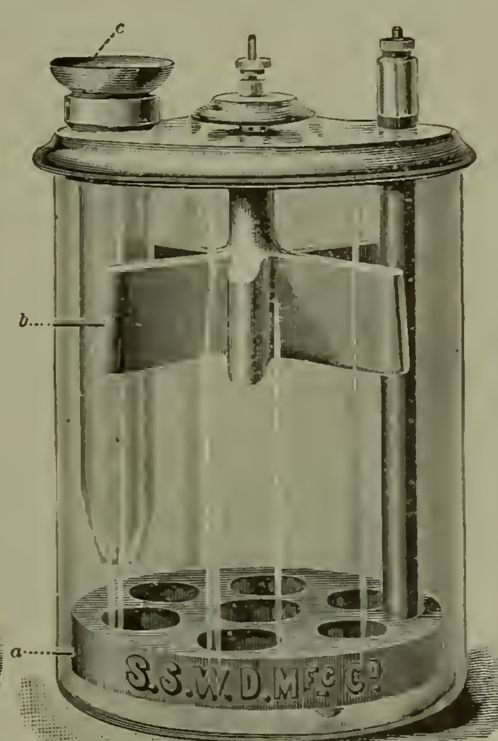


FIG. 2.

and closed circuit. The latter we will not discuss at this time, but confine ourselves to the consideration of an open circuit battery that is known all over the country as one of the best ever made; we refer to the Partz Acid Gravity Battery.

This excellent cell is manufactured by The S. S. White Dental Mfg. Co., Chestnut street, cor. 12th, Philadelphia. It is intended for all open-circuit work, and is claimed to have a higher voltage, and to be the strongest and longest-life battery in the world. It is unsurpassed for heavy electric-bell work, annunciators, open circuit electric signals, electric clocks, watchman's clocks, long distance and continuously used telephones, etc., etc. For railroad signal work this battery is eminently useful.

The Partz gravity battery was, after competitive tests, awarded medal and diploma at the World's Fair, Chicago, in 1893. It is rapidly extending in use, many large hotels throughout the country having adopted it. Architects, contractors and builders look upon the battery with much favor, and are adopting it wherever possible, and many electrical supply dealers keep it in stock as standard goods.

One hundred and twenty cells of the Partz battery have been in constant use for the past five years on fire alarm gongs in the Philadelphia Electrical Bureau. They have not failed once in that time, and the first zincs are still doing duty, with indications that they will last for a long time to come.

The Partz battery requires little attention, and when the current begins to show signs of weakness a spoonful of the sulpho chromic salts dropped into the gravity tube brings the current up to its full value.

Fig. 1 of the accompanying illustrations shows the Partz No. 3 cell. The jar is 6 inches by 8 inches, and the electromotive force of the cell is from 1.9 to 2 volts. On short circuit the No. 3 cell gives a current of from 1 to 2 amperes.

Fig. 2 shows the No. 4 cell. The jar is the same size as that of the No. 3 cell, and the E.M.F. is the same. The current on short circuit, however, is greater, ranging from 3 to 5 amperes. In the No. 4 cell the zinc is of the Star pattern, while in the No. 3 cell the zinc is enclosed in a porous cup.

The Partz sulpho-chromic salt, for use in making electropoin fluid for these batteries, is put up in air-tight jars, a jar containing two pounds of the salt, and can be shipped to any distant point.

THE BEN. FRANKLIN ELECTRICAL CO.

The dynamo, as an electrical machine, has probably received greater attention from electrical inventors in late years than any other one subject, with the result that it is today the most efficient power-transforming device in use.

A dynamo, in the ordinary sense of the term, is a comparatively large machine; one capable of feeding a greater or less number of electrical lamps, or doing other work in large units, and to this particular class of machine has the most attention been given. There are innumerable places, however, where a small dynamo, giving a small current, is desirable, and yet comparatively few persons have given this field any special attention.

The Ben Franklin Electrical Company, 727 Filbert Street, Philadelphia, Pa., however, perceiving the vast field offered here for the development of a first-class dynamo of small power, gave the subject their earnest attention, and finally produced the machine described and illustrated herewith.

The Eureka dynamo (Fig. 1) is designed to be operated by steam or other form of power, and when run to its prescribed limits gives a current with an E. M. F. of about 8 volts, and, if the circuit has low resistance, with a volume of about 12 amperes. It is an excellent plating machine, and is compactly and strongly constructed. The armature, which is of the Siemens drum type, is situated near the

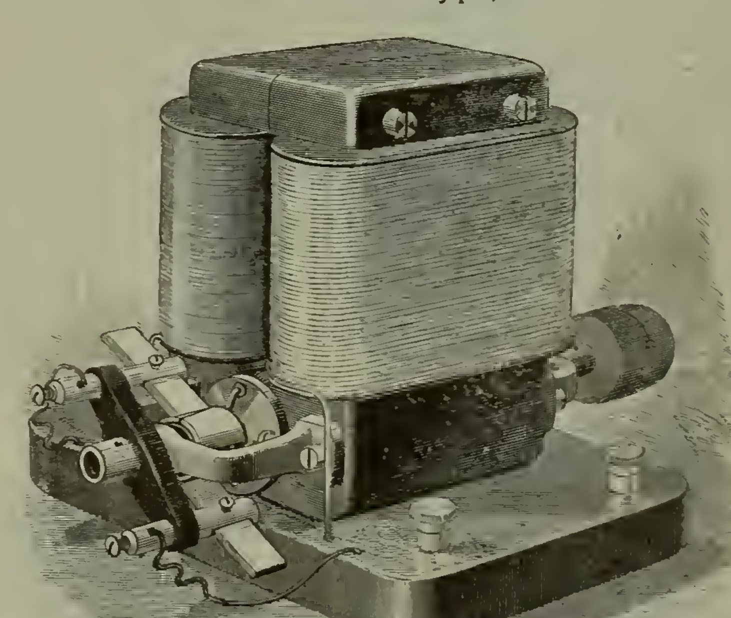


FIG. 1.

base of the machine, where the mechanical vibrations are the least, and the brushes and holder are substantially built. The machine is well made, and guaranteed to give good satisfaction in practical work. It can be arranged for hand power, in which case the power is transmitted by strong machine-cut gear wheels.

Such a machine is indispensable to every jeweller for gilding, silver or nickel-plating, or removing fire-coat after hard soldering. With hand-power gearing, etc., the machine weighs 38 pounds.

The "Wonder" dynamo, illustrated in Fig. 2, is the "Triple Alliance" for jewellers' service, and supplies to

FIG. 3.

the repair shop most of the advantages of the large manufactories of plated ware. The foot power is of the bicycle type. This machine combines electrical and mechanical features—a dynamo and a lathe. As a lathe, the workman has at his service a powerful polishing lathe for preparing and finishing work.

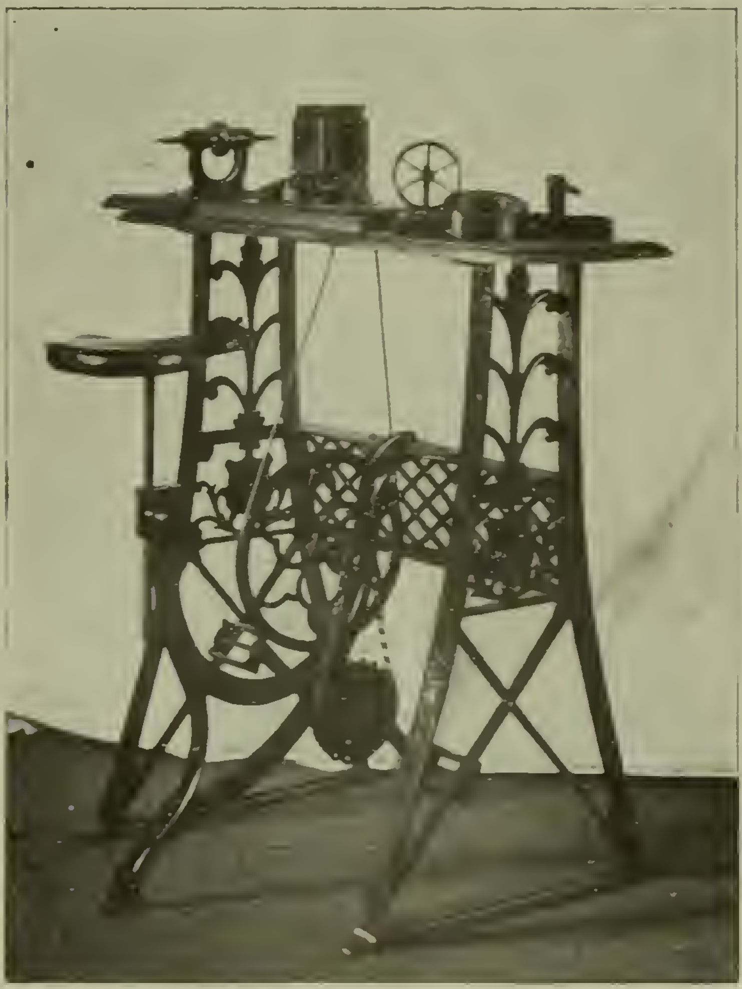


FIG. 2.

The polishing head is double-ended, and has lathe-cut taper screw for buffs at one end, while the opposite end is provided with screw-arbor for emery wheels and flat buffs, etc.

The dynamo can be slid into position on the bench or table in a few moments, and, as represented in the illustration, is connected with the power belt all ready for operation.

Fig. 3 shows the "Little Gem Dynamo," which is operated by hand power and furnishes current for small work in gilding, silver and nickel plating, or removing fire-coat after hard soldering. It is a valuable machine for jewelers.

The Ben. Franklin Company manufactures a watch demagnetizer, the combinations of which are claimed to be new and eminently effective. It is operated by any of the company's small dynamos, and can be used by any person of intelligence.

The Ben. Franklin Electrical Company also makes a line of efficient small motors, although the company manufactures motors of all powers. Their motors are very economical to operate. The best Norway iron is used in their construction, and the armature, which is of the Gramme type, is laminated and has a 16-bar commutator.

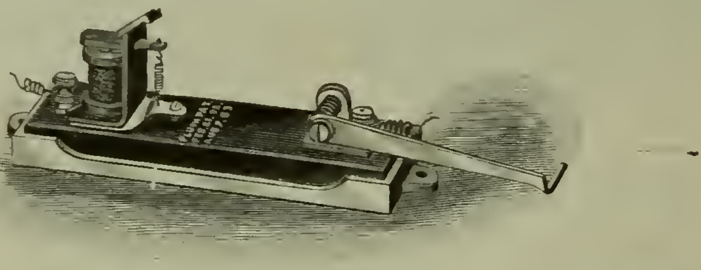
Referring to the subject of dynamos, it may be mentioned that the Ben. Franklin Company makes one and three horse-power dynamos for electric lighting, which are excellent machines. They also make an accumulator, having "patent stiffened" plates, which is claimed to have a greater capacity, in proportion to its weight, than any other accumulator made. It is as efficient as any cell made, and as durable.

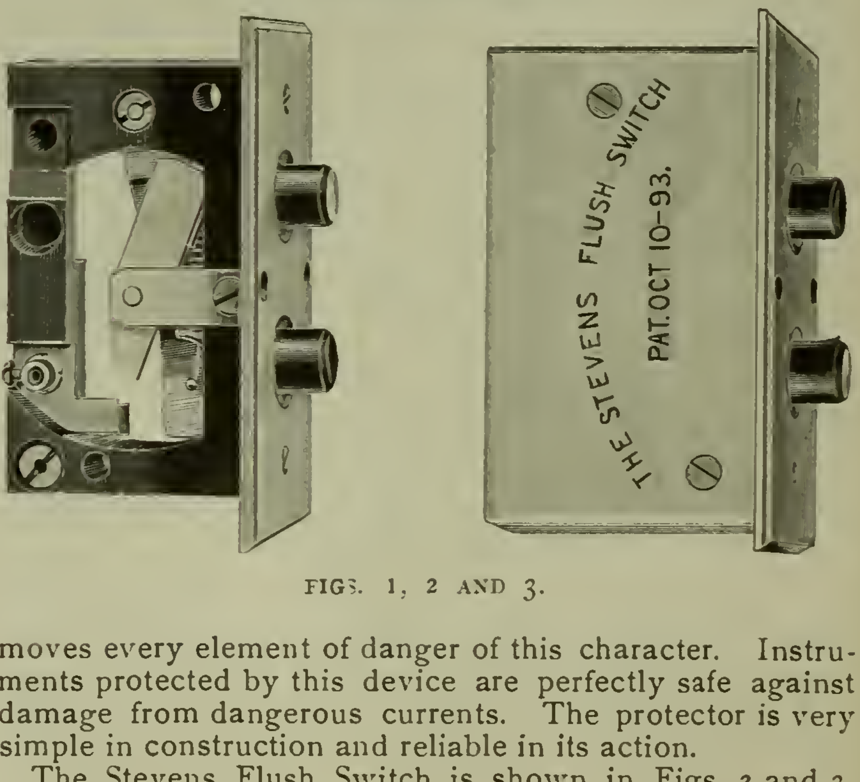
The company supplies, with each machine, complete instructions for using the same.

THE ELECTRIC PROTECTION CO.

This company, which has its headquarters at Nos. 1026 and 1028 Filbert street, Philadelphia, is the manufacturer of the celebrated Plush Protector and the Stevens Flush Switches.

The Plush Protector (Fig. 1) is designed for use on telephone and telegraph lines, and is operated by magnetism. When the circuit becomes charged with an excessive or dangerous current, the magnet is energized and releases the arm which opens the circuit. The break is sufficiently large to avoid arcing when the circuit is opened, and re-





FIGS. 1, 2 AND 3.

moves every element of danger of this character. Instruments protected by this device are perfectly safe against damage from dangerous currents. The protector is very simple in construction and reliable in its action.

The Stevens Flush Switch is shown in Figs. 2 and 3. The internal mechanism of this instrument is clearly displayed in Fig. 2. This switch is fire-proof and damp-proof, and the parts are few and simple in design.

There is no danger of the formation of an arc, as the break space is wide enough to avoid such a result.

A valuable feature of this switch is that it can be wired without removing the casing, thus saving time and annoyance. The buttons are made of mother-of-pearl, the base of vulcabeston and the case of porcelain.

The Stevens Flush Switch is made in various sizes and finely finished. The face-plate is made in polished brass, nickel, oxidized silver, mottled silver, bronze, copper, gold or bowre-barfe.

These switches are made in capacities ranging from 10 to 30 amperes, and are giving excellent satisfaction to users.

THE CUTTER ELECTRICAL AND MFG. CO.

Coincident with the introduction of heavy electric currents for electric lighting and railway purposes it became evident that some protection against abnormal currents must be devised. Such currents manifested themselves by

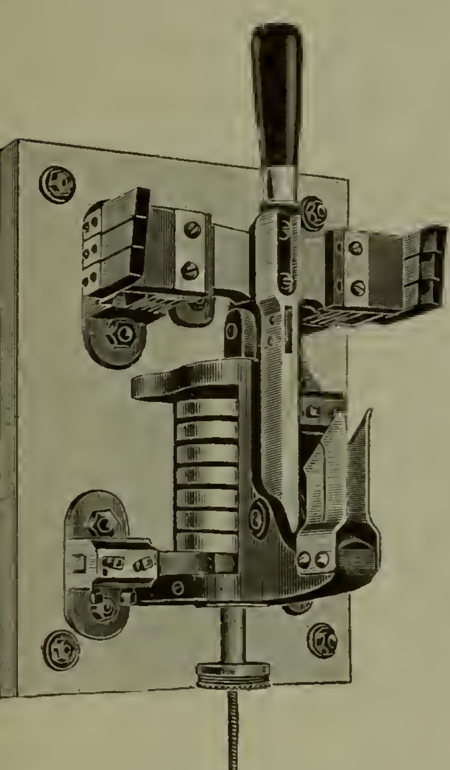


FIG. 1.

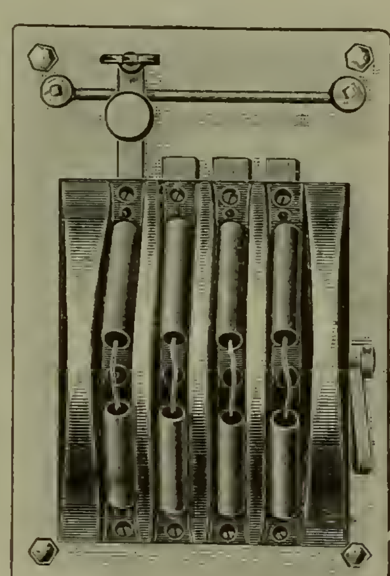


FIG. 3.

heating the conductors to a dangerous degree, if not actually fusing them.

To avoid the dangers of such results the fuse wire came into existence. Its function in an electric circuit is analogous to that of the safety valve on a steam boiler, and is

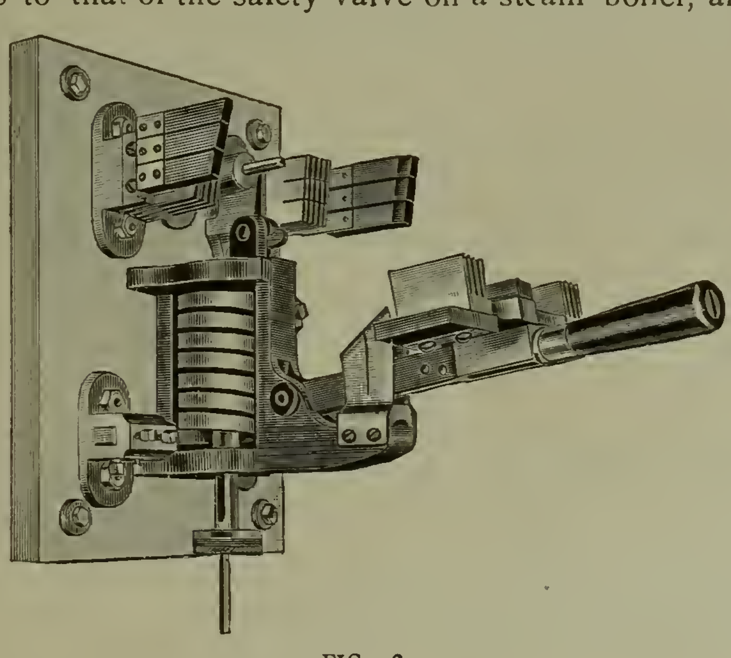


FIG. 2.

intended to fuse when the current passing through it becomes abnormally large. But experience has proved that fuse wire, while all right theoretically, does not always fulfil the purpose for which it is used, therefore something more reliable had to be devised. The result of this necessity bore fruit in the shape of the "magnetic circuit breaker."

The purpose of this instrument is to open the circuit electro-mechanically, when the current rises above the normal, and depends for its action upon the magnetic power of the current itself, and not upon the heating effect, as in the case of fuse wire.

In principle, the magnetic circuit breaker consists of an electro-magnet in combination with a throw-switch. When the current rises above the normal it instantly energizes the magnet to a point beyond which it is rated, and the in-

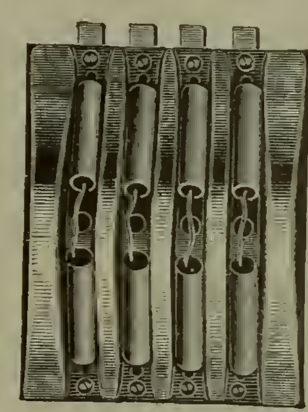


FIG. 4.

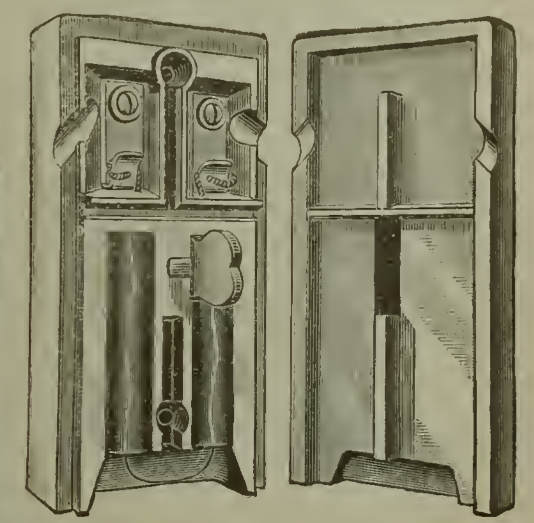


FIG. 6.

creased magnetic power causes the throw of the switch and the consequent opening of the circuit.

Among the most reliable magnetic circuit breakers ever put upon the market is that devised by Mr. W. E. Harrington, and manufactured by the Cutter Electrical and Mfg. Co., 1112 Sansom street, Philadelphia, Pa.

This device (Fig. 1 shows it open, and Fig. 2 closed) is designed on original lines and involves special features peculiar to itself.

The trouble with most magnetic circuit breakers is due to arcing at the switch, but in the Harrington device this is avoided by transferring the arcing away from the circuit breaker to a favorably located fuse or shunt block which contains a light copper fuse in shunt to the main break of the circuit breaker.

The time of opening the circuit becomes less and less as the conditions of the circuit protected approach nearer

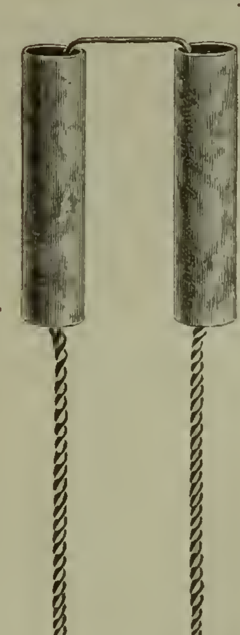


FIG. 5.

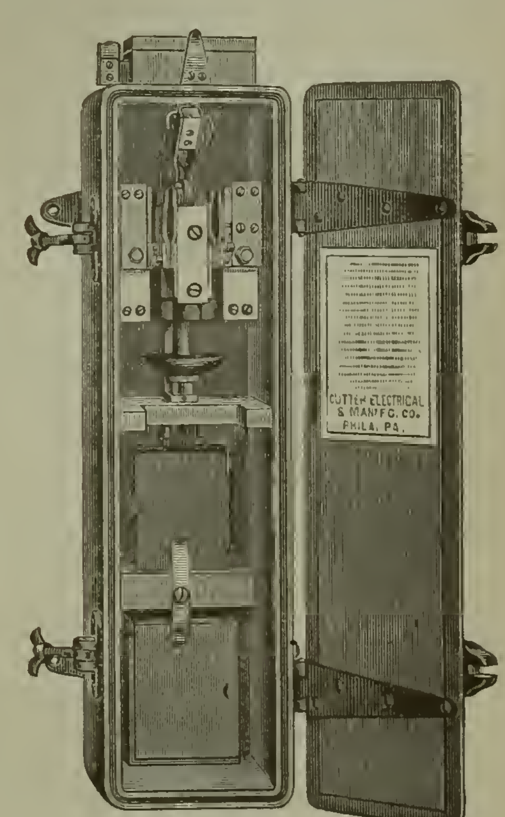


FIG. 7.

a short circuit. Under the latter condition circuit has been opened in 1/100 part of a second. It is always positive in opening and is constant in adjustment, the latter being due to the use of weights at fixed distances.

These circuit breakers are substantially constructed, and are rated at their actual carrying capacity.

The Standard Automatic Magnetic Circuit Breaker, as shown in Figs. 1 and 2, is designed for 500-volt direct current circuits.

The fuse or short block used in these magnetic circuit breakers is constructed on the removable magazine principle, one of the complete blocks being shown in Fig. 3, Fig 4 showing removable fuse-holder.

Fig. 5 gives an illustration of the primary portion of the protected terminal fuse.

In Fig. 6 is shown a single pole protected terminal fuse cut-out for 500-volt circuits. The case of this cut-out is made of porcelain, and the device is safe and compact. By its use the fire risk is reduced to a minimum.

The Cutter Company makes a magnetic circuit breaker for motor cars, two types of which are illustrated in Figs. 7 and 8. The Platform type (Fig. 7) is designed to be attached to the dashboard, and the Sill type (Fig. 8) to use on the platform sill. These instruments are automatic, non-arcing, and can always be depended upon to act, and it renders impossible the overload of the electric equipment. Those railway companies using this device are unstinted in their praise of the instrument.

The motor car circuit breaker is made in five sizes, based

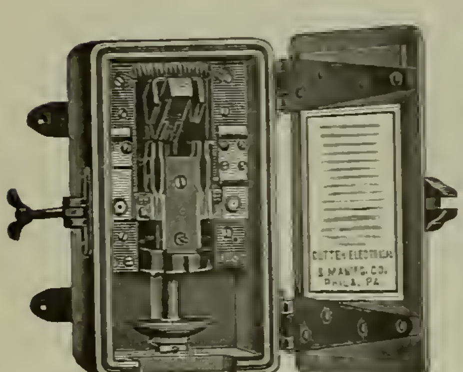


FIG. 8.

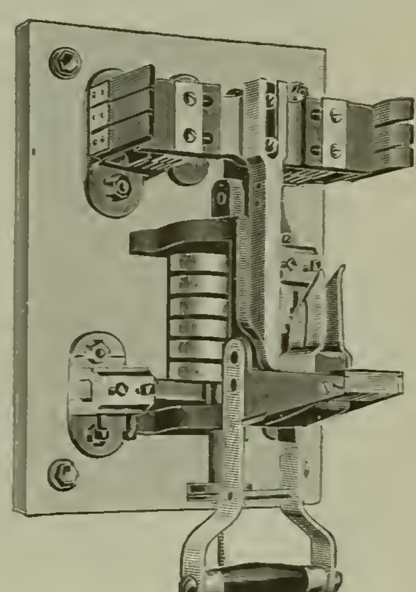


FIG. 9.

on amperage of current, ranging from 60 to 500 amperes.

An alternating current magnetic circuit breaker is shown in Fig. 9. It is of the switchboard type for 1,000 to 2,000 volts. In general construction it is similar to the direct-current breaker, provision being made for the proper lamination of the magnetic current. A fuse shunt is used in connection with this switch to avoid destructive arcing.

All of the above-named instruments are made in the best manner possible, only the best materials entering into their construction, and the Cutter Electrical and Manufacturing Company finds no trouble in selling them on their merits. Some of the largest electric railway companies in the United States are liberal users of these devices and speak in high praise of them.

CONSOLIDATION OF STREET RAILWAY INTERESTS IN PHILADELPHIA.

The plan to unite the Philadelphia People's and Electric Traction companies of Philadelphia was completed on July 23. It provides for the amalgamation of the People's and Electric companies, the consolidated concern then to lease the Philadelphia Traction Company at 4 per cent. on a par of $100, which is equivalent to an annual dividend of 8 per cent. on the company's capital stock. The new company will have a capital of $30,000,000, the limit permitted by law, and the shares will have a par value of $50 each, making 600,000 shares, to be held at the disposal of the different companies as follows: Philadelphia, 310,000; People's, 155,000; Electric, 135,000.

John Lowber Welsh, president of the People's Traction Company, will be the president of the new company. The new concern will issue bonds to the extent of $15,000,000, and will, it is said, be known as the Consolidated Traction Company of Philadelphia.

THE SAUQUOIT SILK MFG. CO.

When we pick up a piece of silk-insulated wire, as a rule little thought is given to the silk that is on it. It is there, to be sure; but who supplies it and how is it put on? How it is applied many of our readers already know, but we venture to say that few of them know where the silk comes from. Of course the silk-worm is the originating point; but who supplies the silk to the trade?

One of the oldest and largest manufacturers of silk yarns in the country is the Sauquoit Silk Manufacturing Company, Columbia Avenue and Randolph Street, Philadelphia. This concern is a very large one and operates factories in Philadelphia and Scranton in which no less than 2,000 hands are employed.

This company was the first to introduce silk yarns in the electrical line, and now furnishes the finest silk for insulating wires up to the coarsest sizes for braiding and cables. It does a very large business in the electrical trade and enjoys a reputation for the excellence and standard quality of its goods. Alexander D. Stelle is the president of the Sauquoit Silk Mfg. Co., and Mr. Richard Rossmassler, treasurer.

PHILADELPHIA MENTION.

Lewis Rice, over a year ago, removed to 1215 Filbert street from the Betz Building. He is manufacturers' agent for engineers' and electrical supplies, covering a wide range of the same. Among his electrical goods are found desk fans, dynamos, motors, wires and cables, shades and shade holders, insulating tape, sockets, lamps, switches, fuse wire, dynamo brushes, fan motors, exhaust fans, etc. He carries a full line of engineers' supplies and oils and is doing a very satisfactory trade. Mr. Rice makes a specialty of telephones, and his work in every department is the best testimonial that he knows his business well.

Hays & Swineford, No. 1022 Arch street, Philadelphia, electrical engineers and contractors, are licensed by the Philadelphia Board of Fire Underwriters and the Edison Company for construction work and wiring. They make a feature of electric and gas fixtures, bells and gas lighting, and give special attention to repairs. No job is too large or too small for them.

Messrs. Sheble & Patton, 1026 Filbert street, carry on quite an extensive trade as manufacturing electricians. They manufacture a large line of push-buttons, switches, etc.

G. A. Supplee & Co., 265–267 North Ninth street, Philadelphia, were established in 1888 as jobbers in fine tools, hardware and electrical supplies. They have a large shop, where they employ a number of men on repair and construction work. The firm repairs and reconstructs dynamos and motors for light and power work, and carries in stock dynamos and motors of various makes, electric light goods, etc.

The National Electric Company, 1223 Filbert Street, is placing a 25-number Worrell patent annunciator, to be used in connection with 25 telephones, in the store of Strowbridge & Chatham. This system is said to be the future method of telephonic communication for hotels, offices, stores, etc. It gives very satisfactory results in practical use. The system is patented in every country where patents are issued on inventions.

(To be continued.)

—The permeability of iron is symbolized by the Greek letter μ. The unit of permeability is that of air.

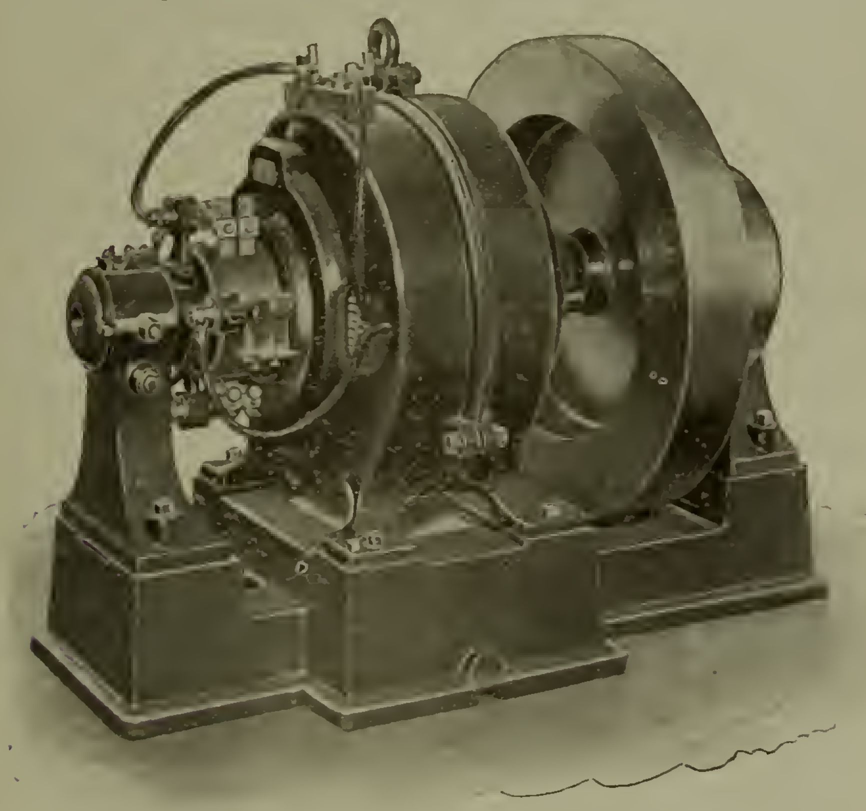
LUNDELL GENERATOR FOR GAS-ENGINE SERVICE.

The gas engine, as is well known, is rapidly growing in favor, for isolated electric lighting service, and great improvements have been made in the machine to meet the exacting requirements of electric lighting.

The manufacturers of electrical apparatus, appreciating the growing prominence of the gas engine, are willing to meet the manufacturers of these engines half way in the introduction of modifications with the object of effecting a perfect combination of the two classes of apparatus.

The Interior Conduit and Insulation Company of 527 W. 34th street, New York city, has just brought out a Lundell generator for operation in connection with a gas engine, of somewhat modified design to meet the conditions existing in such a combination.

The improvements in the gas engine are mainly in line of securing uniform speed, which is so essential in incandescent lighting.



LUNDELL GENERATOR FOR GAS ENGINE SERVICE.

In the Lundell machine referred to, however, whatever deficiencies may exist in the engine in this respect are overcome by a fly-wheel of heavy rim weight on the generator. This fly-wheel is provided in addition to the belt pulley, and in it is stored up sufficient energy to compensate for any slight irregularities in the speed of the gas engine; the electromotive force is thus maintained at a uniform value, and consequently the lights burn with steadiness.

In designing this generator extra care has been taken to furnish substantial pedestals, heavy shafting and modern self-aligning and self-oiling bearings.

The efficiency of the dynamo is from 86 per cent. for the small machine to 95 per cent. for the largest.

These generators are made in seven sizes, corresponding with gas engines ranging in power from 8 to 45.5 horsepower.

THE NORTHWESTERN ELECTRICAL ASSOCIATION.

The Northwestern Electrical Association held its sixth convention at the Leland Hotel, Chicago, on July 17, 18 and 19. First Vice-President George Grimm called the meeting to order, the president, Mr. H. C. Thom, having died since the last meeting.

Mr. Grimm delivered an address in which he feelingly spoke of the late president, and in the name of the association extended to the wife and children of the deceased sympathy and friendship.

He then referred to the subject of municipal control of electric lighting plants. The idea, he thought, mainly grew out of the disregard on the part of many lighting companies of their obligations to the community in which they operated. In many cases they enjoy a valuable franchise granted to them as gifts and conduct their business with the sole object of profit—the patron's interest being lost sight of. The municipal-ownership sentiment, he asserted, is the natural outgrowth of either unduly large profits extorted by such a policy as that referred to, or by the lack on the part of the managers of proper regard for the rights of the people. He invited his hearers, as individuals and as a body, to give the subject consideration. Public good will should be gained and held, he declared.

A paper on "Central Station Economies," by J. S. Stephens, was then read and discussed, and was followed by one by A. V. Abbott, entitled "Electrical Interference."

On Thursday W. D. Jameson read a paper on "Boiler Feed-waters; Their Treatment," and after some routine business Mr. George Cutter read a paper on "Electric Street Lighting." After the discussion of this paper the election of officers for the ensuing year was proceeded with and resulted as follows:

President, George Grimm; First Vice-President, Pliny Norcross; Second Vice-President, P. H. Korst; Secretary, Wm. Goltz; Treasurer, John Schuette—the two last-named gentlemen being re-elected.

At Friday's session twelve new members were added to the association roll. Papers on the following-named subjects were read and discussed: "Boilers and Suggestions for Boiler Specifications," by John C. McMynn; "Transformers," by Prof D. C. Jackson (read by T. R. Mercein)

The president then appointed an entertainment committee for the Milwaukee meeting in January next, composed of the following-named members: Herman Andrae, O. M. Rau, Walter C. Smith; and as committee on transportation, T. R. Mercein, assisted by the president and secretary. A programme committee was also appointed.

After passing a vote of thanks for the courtesies extended the association the convention adjourned to meet in Milwaukee in January, 1896.

There was a large attendance of western men, and many supply dealers in the West had excellent exhibits of their goods.

On the afternoon of the 18th the members visited the plants of the Metropolitan Elevated Electric Railway and the Chicago Edison Company.

On Thursday afternoon a special train conveyed the party on a trip along the drainage canal, and in the evening they attended theatre, and a drive and social entertainments on Friday terminated the successful meeting.

IN THE ADIRONDACK MOUNTAINS.

Persons contemplating a visit to the Adirondack mountains should by all means possess themselves of a copy of the delightful little book just issued by the New York Central, bearing the above title. It will not take long to read, for it contains only 64 pages, but every page bristles with information of just the practical kind one wants at such a time. You can take this book and in half an hour secure a good general idea of the Adirondack region—its grand divisions, characteristics of each, the location of the principal resorts and how to reach them.

Not the least valuable feature is a fine new relief map, printed in four colors, showing the correct location of all the principal mountains, lakes and streams; also all stage lines, wagon roads and carries, and on the back a complete list of hotels, cottages and camps—location, dates of opening and closing, rates, etc.

There is, probably, no other book published on the Adirondacks containing in such compact and readable shape so much useful information.

A copy will be sent free, postpaid, to any address in the world, on receipt of two 2-cent stamps, by George H. Daniels, General Passenger Agent, Grand Central Station, New York.

WHEN TO DEVELOP A WATER-POWER.

Persons owning desirable water-powers need not be afraid to develop them, if coal costs over $2.00 per ton at the site ; but in laying them out they should be governed by the minimum reliable flow of the stream, plus the amount that can be saved by night storage if it is only to be used for power by day, or for lighting by night, as such storage will double it. You may calculate on getting 80 per cent. net effect, with either of half a dozen of the best turbines, say the Geyelin, Hercules, Humphrey, Hunt, Leffel, Risdon, Swain or Victor, all of which have shown higher records than 80 per cent. With this effect you can get a horse-power net for each cubic foot of water per second on an eleven-foot fall. Do not, however, as the writer has seen done, plant a mill requiring 300 horse power on a stream which would furnish only 100-horse power for six months in the year, and have to haul coal from the railroad three or four miles distant to supply steam for the balance.

So much for the cost of water-power. For its value I return to the old rule. It is worth, in any place, if it should be needed at all, what it will cost to replace it by steam, and for this find the cost of coal per ton delivered at your boilers.

For triple-compound engines allow 1.50 pounds of coal of best quality per hour per horse-power, or, to be safe, say 1.75 pounds ; for double compound, 2 to 2½ pounds ; for single condensing, 2½ to 3 pounds ; or high pressure, 3 to 3½ pounds, according to size of engine.

To the cost of fuel add wages of engineer and fireman, cost of oil, and 12½ per cent. on the cost of the plant for sinking fund, for renewal, interest, insurance and taxes, repairs and supplies, and you get pretty close to the cost of a horse-power of steam as representing the only known measure of the value of a horse-power of water.—Samuel Webber, in *Cassier's Magazine* for August.

BROTHERHOOD OF ELECTRICAL WORKERS.

The Electrical Worker, the official journal of the National Brotherhood of Electrical Workers of America, is a prosperous looking journal. The July number is full of extremely interesting matter valuable to its readers. Considerable space is devoted to practical matters, in addition to society gossip.

The Electrical Worker is published in St. Louis. J. T. Kelly is the publisher and editor.

New York Notes.

Office of the Electrical Age,
World Building, New York,
July 29, 1895.

The American District Telegraph Company has declared a semi-annual dividend of one per cent. payable August 1.

Harry M. Shaw, 126 Liberty street, is in the market for two 30-arc lamp dynamos and 60 second-hand arc lamps ; one 150-ampere 6-pole, 110-volt dynamo, and six Wood 9½ ampere arc lamps of 2,000 c. p. each. Mr. Shaw finds it very easy to dispose of Partridge carbon brushes and is doing an excellent business in the same, also in Paiste switches, sockets, etc.

H. B. Coho & Co., electrical engineers, 203 Broadway, announce that they have taken the New York agency for the apparatus manufactured by the Eddy Electric Mfg. Co., Windsor, Conn. They will continue their business on the old lines, giving all their attention to electric plants. During the past year they have installed over 5,000 H. P. in motors and generators, and refer to their plants as evidence of the class of work done by this firm, which, as is well-known, is A1. W. T. H.

Street Railway Notes.

The annual report of President G. T. Rogers of the Binghamton Railroad Company, Binghamton, N. Y., shows a gratifying condition of things. The report is dated July 1 and shows an increase of 17 per cent. in gross earnings, as compared with last year, and a gain in net earnings from operation, including taxes, of 23 per cent. The percentage of operating expenses to earnings for the year was 57⅝ per cent. After paying interest on funded debt, amounting to $31,500, there remains a dividend upon the capital stock of over five per cent. The receipts during the year ending June 30, 1895, were $127,483,61 ; operating expenses, $73,716.48 ; taxes, 3,247.40 ; net earnings from operation, $50,519.73.

The Augusta Street Railway Co., Augusta, Ga., proposes to extend its electric lines to Lake Olmstead in the suburbs. D. B. Dyer can give further particulars.

David E. Evans & Co., Baltimore, Md., has been awarded the contract to convert the Waverly branch of the Baltimore Traction Company into the electrical system.

The Baltimore City Passenger Railway Co. has awarded the contract for the rebuilding of its South Eutaw street branch for the introduction of electric power.

The Columbia and Maryland Electric Railway Co. is receiving bids for the construction of its proposed double track road between Washington and Baltimore. For further particulars T. M. Lanahan, president of the company, should be addressed.

The Brunswick Street Railroad Co., Brunswick, Ga., proposes to extend its lines and introduce the electric system.

The Newington Tramway Co., Hartford, Conn , proposes to build an electric railway line between Hartford and New Britain.

The Lowell and Suburban Street Railway Co , Lowell, Mass., proposes to reconstruct and equip its lines with electric power.

Kalamazoo, Mich., gave herself over to rejoicing and revelry on June 22, in commemoration of the second anniversary of the electric railway system in that place. The day was observed as a holiday, and the Citizens' Street Railway Company gave an entertainment at Lake View Park, and distributed 1000 free tickets therefor. The 22d of June every year will probably be similarly observed.

ALL ABOUT BLOCK SIGNALS.

"Block Signals on the New York Central," the latest addition to, and number 17 of the popular "Four-Track Series" of "America's Greatest Railroad," is from the Press of the American Bank Note Company ; contains 64 pages, narrow octavo, beautifully printed on coated paper, and illustrated with graphic pictures of signal apparatus and its application to the traffic of a great railroad. The text is from the pen of a celebrated English expert on Block Signals, and the subject is treated in a way that cannot fail to interest the average traveller, as well as the technical engineer. It is believed that this, the latest of railway safety devices, has never before been so thoroughly and comprehensively described and illustrated as in this book.

A copy will be mailed to any address, free, postpaid, on receipt of three 2-cent stamps, by George H. Daniels, General Passenger Agent, Grand Central Station, New York.

By the use of two dynamos in parallel circuit, a gain of as much as 20 per cent. is frequently obtained. That is, the combined current is stronger than the two currents, flowing in separate circuits, added together.

Telephone Notes.

A police telephone system is to be established by the city of Jacksonville, Fla. For further particulars Mayor Bostwick should be addressed.

The East Tennessee Telephone Company is talking about establishing an exchange in Knoxville, Tenn.

The Texas Telegraph and Telephone Co. will establish an exchange in Houston, Texas. For further particulars, address B. Krain, Houston, Texas.

The Rockport Telephone Co , Rockport, Texas, is a newly organized concern which will establish an exchange in that place. Address C. W. Booth, secretary.

The Conway Telephone Co., Conway, Iowa, has been incorporated by Arthur Haynie and Miles H. Simons. Capital stock, $5,000.

The Iron River Electric Light, Power and Telephone Co., Iron River, Wis., has been incorporated by W. S. Carr, Byron Ripley, and O. H. Campbell. Capital stock, $20,000.

The Montpelier Telephone Co., Montpelier, Ind., has been incorporated with a capital stock of $2,000.

TELEPHONE PATENTS ISSUED JULY 23, 1895.

VILLAGE-TELEPHONE SYSTEM. Charles E. Scribner, Chicago, Ill. (No. 543,106.)

TELEPHONE EXCHANGE. Wada Y. Shibata, San Francisco, Cal. (No. 543,160.)

ART OF TELEPHONING. Arthur E. Paige, Philadelphia, Pa. (No. 543,190.)

TELEPHONE TRANSMITTER. Zorah E. Patrick, Chicago, Ill. (No. 543,313.)

TELEPHONE ATTACHMENT. Charles E. Bertels, Wilkesbarre, Pa. (No. 543,328)

TWO TO FIFTEEN DAYS' PLEASURE TOURS.

This is a beautiful little book of sixty-four pages, narrow octavo, printed in two colors, issued by the Passenger Department of the New York Central, from the press of the Matthews-Northrup Co. Complete Art Printing Works, Buffalo, New York

It describes a series of tours occupying from two to fifteen days, arranged for the purpose of meeting the wishes of all classes of travellers, including trips to the Thousand Islands, Montreal, Saratoga, Lake George, the Catskill Mountains, Niagara Falls, Chautauqua, Adirondack Mountains, Berkshire Hills, Richfield Springs and many other famous resorts. Information concerning these trips is given—distances, time, fares, connections and all other details—with much precision. It contains ten maps engraved expressly for this work, and is profusely illustrated with a large number of new and beautiful half-tone engravings. A glance over the pages of this little book will convince you that the attractions of the New York Central are equalled only by their merit, and afford a choice which will suit every taste and every purse.

"Two to Fifteen Days' Pleasure Tours" will be sent free, post-paid, to any address in the world, on receipt of two 2-cent stamps, by George H. Daniels, General Passenger Agent, New York Central & Hudson River Railroad, Grand Central Station, New York.

New Corporations.

The Fort Pitt Traction Company has been incorporated in Pittsburgh, by Joshua Rhodes and William B. Rhodes of Allegheny, C. L. Magee and Robert S. Frazier of Pittsburgh, and William C. O'Reilly of Crafton. Capital stock. $500,000.

The Geauga Central Transit Company, Middleburg, O., by P. W. Parmele, G. H. Ford, W. S. Williams, P. T. Thompson, and E R. Yeaman, to build an electric road from Middleburg to Russell Township. Capital stock, $10,000.

The Arcade Mutual Electric Light Company, Columbus, Ohio, by Oliver E. Connor, Louis H. E. Hummel, F. Seibert and M. L Robertson. Capital stock, $50,000.

The Transcontinental Railway Company has been incorporated in Chicago, Ill., to construct and operate an electric railway from Chicago to Jersey City. Capital stock, $200,000,000

The Mercantile Gas and Electric Company, San Jose, Cal., by J. B Klernana and E. C. Randall. Capital stock, $500,000.

Klamath Falls Light and Water Company, Klamath Falls, Ore., by Charl s S. Moore, George T. Baldwin and Harry V. Gates, to furnish electric light and power, telephone service and water for the town of Klamath Falls. Capital stock, $2,000.

The Blackstone Valley Street Railway Company, Worcester, Mass., by F. A. Lapham, of Worcester, J. H. Furguson, of Milbury, E. E. Howe, of Grafton, and others. Capital stock, $100,000.

The Portland Light and Power Company, Portland, Conn., by E. F. Bigelow, A. H. Hale, E. I. Bell, F. De Peyster, J. H. Peyton and others.

The Radnor Electric Light and Passenger Railway Company, Radnor, Pa., by Henry Douglas, of Philadelphia, president; Andrew J. Reilly, Albert Layton, David Pepper and Frank B. Schermerhorn. Capital stock, $30,000.

Mendota Light and Heat Company, Mendota, Ill., by John Goedtner, Anton Kuelgen, G. H. Madden, Newton Imus and T. C. Schultz. Capital stock, $2,000.

The Bullard Electric Company, Chicago, Ill., has been incorporated to manufacture electrical apparatus. Capital stock, $25,000.

The Electric Wire Hanging Insulator Company, Chicago, Ill., by Edgar O Baker and others. Capital stock, $200,-000.

The Brookhaven Manufacturing and Improvement Company, Brookhaven, Miss., has been granted a franchise to erect an electric light plant in that place.

The Lampasas Electric Light Co., Lampasas, Texas. Capital, $10,000. Incorporators, J. T. Donovan, E. A. Maxwell and W. L. Donovan.

The Mexia Lighting and Power Company, Mexia, Texas. Capital, $15,000. Incorporators, John W. Shoaf, Wm. L. Hall and Wm. L. Murphy.

The Fair Oaks and Orangevale Railway Co., Sacramento, Cal , by L. T. Hatfield, Capt. T. B. Hall, and others, for the purpose of building an electric railway between that city and Orangevale. Capital stock, $500,000.

The Citizens Electric Co., Plainfield, N. J., by Harry G. Runkle, Elias R. Pope, James C. Pope and others. Capital stock, $50,000.

The Scenic Railway Co., Cleveland, Ohio, by J. B. Hanna, George G. Mulhern, E. W. Radde and others. Capital stock, $15,000.

The Mechanical and Electrical Engineering Co has been organized in Friendship, N. Y.

The Kansas and Missouri Railway Co., Pittsburgh, Kan., by Samuel Barrett and Robert Bobbin and others, to construct an electric railway line in Crawford County. Capital stock, $25,000

The Little Falls and Litchfield Springs Railway, Richfield, N. Y. Capital stock, $200,000.

The Richfield Springs and Schuyler Lake Railway, at Richfield, N. Y. Capital stock, $20,000.

The Marble Falls Land and Power Co., Marble Falls, Texas. Capital $100,000. J. H. Barrett is one of the incorporators.

The St. Albans Street Railway, St. Albans, Vt., by Stewart Stranahan, A. S. Richardson, Alfred A. Hall, E. C. Smith, A. O. Brainerd, George W. Crampton and others. Capital stock, $25,000.

Possible Contracts.

C. B. Powers, South Framingham, Mass., can give information regarding the proposed trolley line to run between Milford and Holliston.

Philip R Zulanf, city clerk, Owensboro, Ky., can be addressed regarding the proposed electric light plant in that city.

The Chattanooga Light and Power Co, Chattanooga, Tenn., will build a new station to cost $50,000.

An electrical subway in Richmond, Va., is talked of. The mayor can give further particulars.

The Richmond Railway and Electric Co., Richmond, Va., is in the market for 1½ miles of double track and overhead equipment. A. Pizzini, Jr., Richmond, Va., can give further particulars.

The Brookhaven Mfg. and Improvement Co., Brookhaven, Miss., will erect an electric light plant.

A popular vote is to be taken on the question of electrically lighting Hermann, Mo. The town clerk can give further particulars.

The East Tennessee Telephone Co., Knoxville, Tenn., is reported to be considering the advisability of establishing an electric light plant in that place.

There is a probability that a fire-alarm system will be established in Selma, Ala. The mayor can give further information.

The Shelburne Falls, Mass., Board of Trade has taken up the subject of lighting that place by electricity. Vice-president Bowen can give further information.

Trade Notes.

W. W. and Oscar C. Turner have started an electrical supply business in Atlanta, Ga. They will also give attention to construction and repair work.

CORED "SHIP" CARBONS.

A. De Ronde & Co., 254 Front street, New York, sole agents in America for the Cored "Ship" Carbons, are meeting with excellent success with these celebrated goods.

These carbons are made of the very best materials, and have extremely long life. They give a very brilliant and steady light in consequence of the purity of the substances used in their manufacture. The Cored "Ship" Carbons are made by the well-known house of Schiff, Jordan & Co., Vienna, Austria, and although their goods have been but recently introduced in this country, they have proved their merit and are rapidly growing in popularity.

P. & B. RUBEROID ROOFING FOR CENTRAL STATIONS, ETC.

The Standard Paint Co., 2 Liberty Street, New York, has recently taken up the manufacture of roofing for central stations, car sheds, etc., which has already been received with great favor in the trade.

The P. & B. Ruberoid roofing has for years been a standard article for car roofing and other railroad purposes, and is very extensively used by the leading railroads. It is unaffected by changes of temperature and always remains elastic. Extreme heat does not cause it to run, neither does cold crack it

This roofing is made from the best felt manufactured, is impregnated with an elastic, water and acid-proof composition, and the outside is treated with a similar elastic composition of tougher consistency, thus preserving indefinitely the life of the interior of the material. It contains no tar; is odorless and is easy to apply. It is absolutely water, acid and alkali-proof, and can be applied as well to a pitch or flat roof. With all of these qualities it is but natural, therefore, that the Standard Paint Co. should extend the use of its Ruberoid Roofing to electric stations, etc.

The Terre Haute (Ind.) Electric Street Railway Company, of which Mr. Russell B. Harrison is president, is using Ruberoid roofing on its power station and car sheds with the utmost satisfaction, and many other like concerns are experiencing the same results with it.

A TREASURE FOR TOURISTS.

"Health and Pleasure on America's Greatest Railroad," No 5, of the Four-Track Series for 1895, issued by the Passenger Department of the New York Central, from the press of the American Bank Note Co., surpasses in size and beauty any volume of like character ever published. No brief description can give an adequate idea of its excellence and utility. To summarize it in a few words, the book is a handsome volume of 504 royal octavo pages, with numerous maps and illustrations, beautifully bound in illuminated covers. The primary object of the book is to give useful information regarding the popular health and pleasure resorts of New York, New England and Canada; but it goes beyond this scope, and in a series of interesting chapters treats of the beauties of landscape and climate to be met with in California, Colorado, Utah, Yellowstone Park, Mexico, Japan and the Hawaiian Islands. The descriptive matter relating to the various features of interest in these localities is accompanied by over 300 illustrations, depicting the most beautiful scenery of the country. In addition to these features, epitomized table of routes, fares, hotel rates, etc., etc, render the book invaluable to traveller and tourist. The maps are all new and up to date and cover the Adirondack Mountains, Thousand Islands, Lake Region of Central New York and all the prominent resorts.

Every one who intends to get out of the city for the summer should secure a copy of this book and study the 1,000 tours it describes before coming to a decision. George H. Daniels, General Passenger Agent of the New York Central, will send a copy to any address in the world upon receipt of ten 2-cent stamps.

WOVEN WIRE BRUSHES.

The Belknap Motor Co., of Portland, Maine, are the patentees and manufacturers of the best woven wire commutator brush on the market.

ELECTRICAL and STREET RAILWAY PATENTS

Issued July 23, 1895.

542,982. Producing Pure Electric-Light Carbon. Edward G. Acheson, Monongahela City, Pa. Filed Aug. 25, 1894.

542,986. Electro-depositing Device. John Bossard, Dubuque, Iowa. Filed Nov. 11, 1893

543,000. Electrical Time-Annunciator. Edward M. Edgerton, Chicago, Ill. Filed Feb. 12, 1892.

543,003 Electro-medical Apparatus. Jacob R. Etter, Crawfordsville, Ind. Filed June 19, 1893.

543,016. Incandescent-Lamp Socket. Edgar H. Heath, Grand Rapids, Mich., assignor of one-half to John H. Beamer, same place. Filed Mar. 21, 1895.

543,021. Dynamo Electric Machine. Thomas Hooker, Syracuse, N. Y. Filed Apr. 26, 1894.

543,037. Hydrocarbon-Burner. Joseph H. Mathews, Canton, Ohio. Filed Feb. 6, 1893. Renewed Dec. 19, 1894.

543,042. Trolley-Wheel. Charles Mitchell, Yonkers, N. Y., assignor of five-eighths to Harry A. Archibald, same place. Filed Dec. 20, 1894.

543,055. Secondary-Battery Plate. John J. Rooney, Brooklyn, N. Y. Filed Nov. 19, 1894.

543,065. Electrically-Controlled Voting-Machine. Charles A. Stitzer, Central City, Neb. Filed Nov 27, 1893.

543,075. Traction-Wheel. Gustaf A. Anderson, Waynesborough, Pa, assignor to the Geiser Manufacturing Co., same place. Filed Dec. 1, 1894.

543,089. Meter for Alternating Electric Currents. Ludwig Gutmann, Pittsburgh, Pa. Filed May 20, 1890.

543,094. Motor for Bicycles. Nelson S. Hopkins, Williamsville, N. Y. Filed Dec. 12, 1894.

543,098. Street-Car Curtain. John Kilgour, Cincinnati, Ohio. Filed Jan. 10, 1895.

543,106. Village Telephone System. Charles E. Scribner, Chicago, Ill, assignor to the Western Electric Company, same place. Filed July 2, 1886.

543,130. Underground-Trolley System. Noel B. Ginochio, New York, N. Y., and Henry C. Bridger, Woodbridge, N. J. Filed Dec. 27, 1894.

543,151. Car-Fender. Frank Goff, Camden, and Thomas H. Joiner, Burlington, N. J. Filed Jan 2, 1895.

543,160. Telephone-Exchange. Wada Y. Shibata, San Francisco, Cal. Filed Oct. 11, 1894.

543,181. Electric Switch. John W. Hearn, Brooklyn, N. Y. Filed Oct. 3, 1893

543,184. Pneumatic Transfer-Tube System. Francis W. Jones, New York, N. Y. Filed Apr. 15, 1895.

543,186. Carbon-Holder. John C. Knight, New York, N. Y. Filed Jan. 15, 1895.

543,190. Art of Telephoning. Arthur E. Paige, Philadelphia, Pa. Filed Feb. 25, 1895.

543,198. Electric-Current Distributer. Elihu Thomson, Swampscott, and Edwin W. Rice, Jr., Lynn, Mass., assignors to the Thomson-Houston Electric Company, of Connecticut. Original application filed Apr. 24, 1884, Divided and this application filed Oct. 3, 1892.

543,223. Alternating Electric Motor. Joseph A. G. Trudeau, Ottawa Canada. Filed Apr. 6, 1894.

543,231. Writing-Telegraph. Thomas Ewing, Jr., Yonkers, assignor to William E. Gump. Brooklyn, N. Y. Filed Jan. 9, 1894. Renewed Dec. 24, 1894.

543,239. Car-Fender. Saul Garlick, Brooklyn, N. Y. Filed Oct. 29, 1894.

543,241. Writing-Telegraph. William E. Gump, Brooklyn, N. Y. Filed Feb. 24, 1894. Renewed June 25, 1895.

543,243. Electric-Arc Lamp. Daniel Higham, Boston, Mass. Filed May 2, 1895.

543,249. Process of Refining Sugar by Electrolysis. Emile Javaux and Charles F. Gallois, Paris, France. Filed May 26, 1894. Patented in France Jan. 16, 1894, No. 235,542; in Belgium Jan. 19, 1894, No. 108,138; in Austria Jan. 24, 1894, No. 44 1,877; in Spain Jan. 24, 1894, No. 15,403, and in Germany Jan. 25, 1894.

543,264. Car-Fender. Daniel F. Nial, Troy, N. Y. Filed Nov. 23, 1894.

543,270. Car-Arrester. Paul Schuster, New York, N. Y., assignor of one-half to Edward Hennig, Jr., same place. Filed Jan. 28, 1895.

543,271. Trolley Stand and Pole. Lawrence C. Seelye, Fort Edward, assignor of one-half to George W. Burnham, Luzerne, N. Y. Filed Jan. 2, 1895.

543 280. Incandescent Electric Lamp. George Westinghouse. Jr., Pittsburgh, Pa. Filed Aug. 29, 1892.

543,313. Telephone-Transmitter. Zorah E. Patrick, Chicago, Ill. Filed Jan. 18, 1895.

543,328. Telephone Attachment. Charles E. Bertels, Wilkes-Barre, Pa., assignor of one-half to Hedley Pedlar, same place. Filed Mar. 20, 1895.

543,336. Electric Registering Apparatus. Alphons Custodis, Dusseldorf, Germany. Filed Mar. 19, 1895.

543 346. Electric Transformer. John A. Mosher, Chicago, Ill. Filed May 7, 1895.

543,351. Electric Brake. William B. Potter, Schenectady, N.Y., assignor to the General Electric Company, of New York. Filed Mar. 23, 1895.

543,352. Safety Appliance for Electric Cars. William B. Potter, Schenectady, N. Y., assignor to the General Electric Company, of New York. Filed Apr. 9, 1895.

543 355. Electric Arc Lamp. Henry J. Sage, Chicago, Ill. Filed Feb. 13, 1895.

543,357. Electric Transportation System. Richard E. Sherman Chicago, Ill. Filed Mar. 1, 1895.

543,358. Electric Clock-Winding Mechanism. Louis H. Spellier, Philadelphia, Pa Henry Trumbore executor of said Spellier, deceased. Filed May 28, 1891.

543,364. Testing-Circuit for Alternating-Current Systems of Distribution. Herbert C. Wirt, Schenectady, N. Y., assignor to the General Electric Company, of New York. Filed Apr. 23, 1895.

543,372. Secondary Battery. Emil Boettcher, Leipsic, Germany. Filed May 12, 1890.

543,382. Electric-Railway System. John C. Henry, Westfield, N J. Filed May 13, 1895.

543,383. Dynamo-Electric Machine. Thomas H. Hicks, Detroit, Mich. Filed Jan. 13, 1894.

543,399 Electric-Arc Lamp. Samuel E. Nutting, Oak Park, assignor to George W. Furbeck and Joseph Kettlestrings, Chicago, Ill. Filed Oct. 5, 1894.

543,405 Car-Fender. Oscar Rothrock, New York, N. Y. Filed July 12, 1894.

543 409. Electrical Switch. Henry Stuebner, Philadelphia Pa. Filed Jan. 19, 1895.

543,425. Writing-Telegraph James H. Robertson, Brooklyn, N. Y, assignor to William E Gump, same place. Filed Jan. 9, 1894. Renewed Dec. 24, 1894.

543,426 Writing-Telegraph. James H. Robertson, Brooklyn, N. Y., assignor to William E. Gump, same place. Filed Dec. 19, 1894.

543,427. Writing-Telegraph James H. Robertson, Brooklyn, N. Y., assignor to William E. Gump, same place. Filed Mar. 21, 1895.

543,428. Writing-Telegraph. James H. Robertson, Brooklyn, N. Y., assignor to William E. Gump, same place. Filed Mar. 21, 1895.

543,429 Writing-Telegraph James H. Robertson, Brooklyn, N. Y., assignor to William E. Gump, same place. Filed Mar. 21, 1895.

543,435. Means for Arresting Motion of Electric Cars. Arthur K. Bonta, Hoboken, N. J., assignor to the Bonta Manufacturing Company, same place. Filed Mar. 21, 1895.

543,445. Electric-Arc Lamp William Jandus, Cleveland, Ohio. Filed Dec. 19, 1894.

ELECTRICAL AGE

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First Floor, World Building.

NEW YORK.

NEW YORK, AUGUST 10, 1895.

CONTENTS.

LIGHTNING'S QUEER WORK.

Some queer things are attributed to lightning sometimes. One of its latest pranks was displayed in New Brunswick, N. J., last Sunday night. A young man and woman were homeward bound from church, arm in arm, when a lightning stroke interposed. It struck the young man's umbrella and the shock was communicated to the young lady's person by way of the locked arms. The effect of this sudden disturbance was to take the curl out of the young lady's hair and to paralyze the arms of the two for a few moments, so that they could not be unshackled. The young lady avers, according to report, that the sensation was something like a sudden ice-water bath. If the truth were known it might be that the young man propounded a question which shocked the young lady's nerves. However, in the absence of further facts, the incident must be charged to Jersey lightning.

TROLLEY PARTIES.

Trolley parties are all the go now in places where electric railroads exist, and in every case, no doubt, this special feature of the business constitutes a source of considerable revenue. The possibilities in the matter of night illuminating effects, and the general attractiveness of electric cars, no doubt gave rise to this idea The result is that in the larger cities the railroad companies have provided the most elegant equipment for this service, and their enterprise is heartily endorsed and appreciated, judging from the liberal use of the facilities on the part of the public. Several Western cities have for a long time been the scene of nocturnal festivities of this nature, and the Eastern cities are now falling in line. In Philadelphia trolley parties are all the rage, and the Traction Company has among its rolling stock some special party-cars that are superb in their fittings and furnishings. A "trolley party" in that city recently consisted of 3,000 persons, requiring the use of 61 cars. The "party" was organized for the benefit of the German Hospital, the parade being headed by a car containing a band of music. Brooklyn has caught the fever, and elegant trolley-party cars are now being constructed. The Brooklyn Traction Company is also having built some special closed cars for theatre parties. These cars will be beautifully finished and resplendent with electric glory as they speed through the streets at night.

THE TELEPHONE SITUATION.

"The American Bell Telephone Company," says the *Boston Journal*, "is coming to rely on its strength as a manufacturing corporation, and its ability to meet any future competitor by offering the best service at the lowest rates. The reduction of its charges to subordinate companies enables these to extend their business and swell their receipts." These concessions on the part of the parent company, however, were not voluntary. No, indeed! The tottering patent foundation has practically collapsed and the enterprising independent concerns, which have just as good instruments as the Bell, came in and very naturally and easily walked off with much of its business. To save itself the Bell Company was thus forced to relax its grasp upon the subordinate companies, in order to allow the latter a little more leeway for action; but this generous spirit on the part of the parent was exercised rather tardily. The public will not easily forget the fact that they have been compelled to pay extortionate rates for telephone service for many years, and every encouragement is given on their part to the new independent companies in their efforts to crush the monopoly and render at least as good service at much less cost. The organization of these independent companies in the West, and a similar one in the East, is a significant phase of the telephone situation. This organized opposition will no doubt make the Bell Company soon wonder "where they are at."

LONG DISTANCE TRANSMISSION AT 10,000 VOLTS.*

The Pomona Plant.

BY GEORGE HERBERT WINSLOW.

The Pomona plant was installed in the summer and fall of 1892 for the San Antonio Light and Power Company, of Pomona, Cal. It was increased in the following spring, and early last year the capacity of the plant was doubled by duplicating the entire equipment. At the present time, when the plant has been in regular operation for more than two years, and its complete success has established confidence in the successful outcome of many similar projects of greater magnitude, it seems fitting to present a careful description of the entire installation The electric plant was installed under the personal direction of the writer, as electrical engineer, who presents many of his personal observations on its construction and operation.

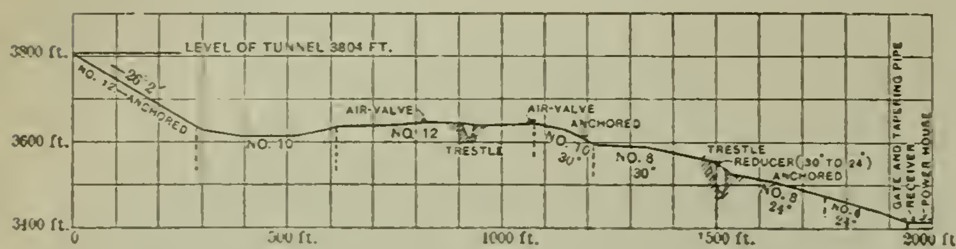


FIG. 1—PIPE LINE, POMONA PLANT. HEAD 398 FEET.

The plant is used to transmit energy from a waterfall to sub-stations at Pomona, 13¾ miles distant, and San Bernardino, 28¾ miles distant, from which points it is distributed for incandescent and arc lighting. It consists of a Pelton water-power plant and a Westinghouse alternating current transmission plant in which generators supply currents to sets of raising and lowering transformers operating at 10,000 volts, and delivering current to the local circuits at 1,000 volts.

The water-power for this plant is derived from the San Antonio creek, which is chiefly supplied by the melting snows and the rains on San Antonio Mountain. Side canyons, however, also furnish some water. The creek flows for several miles through a narrow valley at the upper end of the San Antonio canyon in a bed which it has washed for itself in the layer of boulders and gravel formed by the action of an immensely larger stream in past ages.

At the lower end of the valley a sharp ridge extends eastward from the side of a neighboring mountain, from which it originally split off, and blocks up the valley except at a narrow place at which bed-rock is exposed and through which the stream plunges suddenly downward at least 90 feet between precipitous walls of rock, forming the San Antonio Falls.

To utilize this fall, part of the water is diverted by a dam about 200 feet above the falls into a canal which conducts the water to a tunnel passing through the ridge. At the other end of this tunnel the water enters a large pipe leading to the power-house, which is located 412 feet below the level of the outlet of the tunnel.

A vertical projection of the pipe-line, giving the sizes of the pipe is shown in Fig. 1.

The pipe is of sheet steel, double-riveted throughout, and was delivered on the ground in sections having a length of 11 feet 6 inches. These sections consist of four sheets each three feet long.

The diameter of the pipe up to within 450 feet of the power-house is 30″, with the exception of the length which connects it to the sand-box at the top of the pipe, which length is considerably expanded, so as to allow the water to flow slower on entering, and thus to reduce the entrainment of air. Near the power-house a "reducer" is inserted in the pipe to reduce the diameter to 24″, and this size is maintained from this point to the power-house. The pipe was designed to carry 2000 miner's inches of water (measured under a head of six inches), without unnecessary loss by friction. The capacity is equivalent to 50 cubic feet per second, or 1882 H. P. at 390 feet effective head, assuming a wheel efficiency of 85 per cent. This is nearly three times the power for which the present station was built, but the extra capacity of 1000 horse-power obtained by increasing the capacity of the pipe costs so little when compared with the cost of building an entire new pipe-line, that it is much more profitable to lay the larger pipe in the first place, if sufficient water can ultimately be developed to utilize the added capacity.

The thickness of the pipe is increased as it nears the power-house, to provide for the increase in pressure in the lower parts. At the first bend it is made greater than that of the sections above it on either side, because the pressure on it is greater. After passing the second air-valve first No. 10 and then No. 8 steel is used, the latter size being continued to within a short distance of the power-house. The last few lengths are of No. 6 steel.

The horizontal distance between the mouth of the tunnel and the power-house is 1,940 feet, and the difference in level between the tunnel and the floor of the power house is 412 feet. The total length of the pipe, following the line, is 2,370 feet.

The sections of pipe as received from the makers were coated with asphalt both inside and out, and parts of this coat were of course scraped off through rough handling. After the pipe was laid and jointed, a man went through it and painted the joints with hot asphalt to prevent rusting.

In order to protect the pipe from the great changes in temperature which occur in the mountains between midday and midnight, earth and loose rock were placed around and on top of the pipe without any tamping, and where enough earth could not be conveniently obtained, brush was cut and piled on the pipe and covered with a light layer of earth and rock.

The lower end of the pipe is closed by means of a 24-inch Ludlow gate-valve, which is bolted to a cast-iron flange riveted to the end of the pipe.

The stem of the valve is geared to a small hand-wheel, partly on account of its weight, but chiefly in order that the gate may not be shut too quickly, as otherwise the pipe would be subjected to severe strains, resulting from suddenly checking the velocity of the column of water.

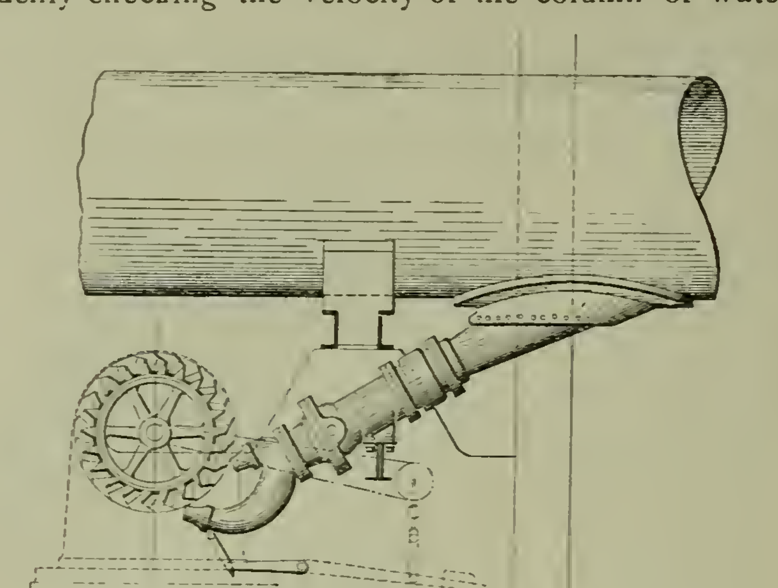


FIG. 2.—PELTON WATER-WHEEL WITH DEFLECTING NOZZLE.

For use under heavy pressures the gearing is also necessary in order to be able to move the valve at all. The head of water on this plant is so great that it is impossible to open the valve when the pipe is full, and, after closing the valve, it is necessary, before raising it, to partially empty the pipe by means of a relief-valve attached to the pipe close to the gate. The relief-valve is primarily designed to protect the pipe from shock by allowing the escape of a considerable quantity of water in case of an increase of pressure in the pipe; such, for example, as would occur should any obstruction partially close the opening of the gate. It has a circular valve so proportioned that a slight movement of it will afford a large open-

*A paper presented at the Twelfth General Meeting of the American Institute of Electrical Engineers, Niagara Falls, N. Y., June 27, 1895.

ing for discharge. The valve is held in place by a weighted lever, and is set so that a very slight increase above normal pressure will cause it to open.

The gate is connected by a tapering pipe of steel to a horizontal, cylindrical steel receiver 20 feet long and 42" inside diameter, from which the water is distributed to the wheels. The object of such a large receiver is to avoid the loss in head which would be occasioned by the eddies formed when drawing the water from the side of a smaller pipe. It also serves to keep air from being drawn into the discharge pipes in case it accumulates in the receiver.

Two tapering cast-iron pipes (a large and small one) are bolted to the lower side of the receiver at an angle of 30 degrees. These pipes conduct the water from the receiver to the under sides of two independent Pelton water-wheels,

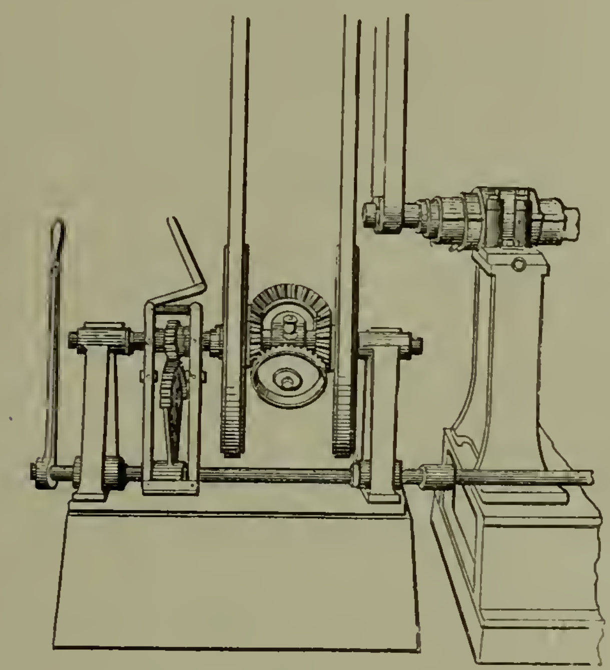


FIG. 3.—WATER-WHEEL GOVERNOR.

which drive an alternating current generator and its exciter

To the end of each pipe is attached a Ludlow gate-valve, the stem of which passes horizontally into the dynamo room through a bushing in the concrete wall. The larger of the two stems is geared to a hand-wheel; the other is fastened directly to a smaller hand-wheel. The flow from each pipe can thus be completely controlled from the dynamo room The pipe running to the generator wheel is provided below its valve with two nozzles cast in one piece and attached to the valve by means of a limited ball-and-socket joint, which permits them to be moved vertically to deflect the water. (See Fig 2.)

The pipe supplying the exciter wheel has below its gate a throttle-valve, the stem of which passes through the wall into the dynamo room, where it can be connected to a governor. The wheels are located directly below and in the plane of the receiver, and above a raceway which conducts away the water after it drops from the wheels.

The speed of a Pelton wheel is dependent for a given load and head of water upon the amount of water striking the wheel, and therefore to maintain a constant speed this amount must be changed every time the load changes, and in proportion to the latter. In the case of the generator-wheel this change is produced by deflecting the water. Constant-speed regulation may also be obtained by throttling the water, as is done in the case of the exciter-wheel. When the water is throttled there is loss in efficiency due partly to the scattering of the water as it flows from an aperture which it no longer completely fills (which causes much water to miss the buckets), and partly to the loss of head caused by friction in passing through the valve. With the deflecting nozzle there is no loss of efficiency due to this cause. There is, however, a great waste of water at light loads, since under a constant head the same quantity of water must be disposed of at all loads, and for light loads the greater part of it is wasted. To avoid this loss the use of a reservoir naturally suggests itself. It is an unfortunate fact, however, that high heads are confined to mountainous countries and that there a reservoir usually necessitates a high and consequently costly dam. The necessity of building a dam to withstand freshets so increase its cost as to make the use of a reservoir commercially impossible with high heads. Therefore, the water must continue to be wasted, and the chief apparent objection to deflecting nozzles is seen to be of no importance.

A set of tips of different diameters is supplied with each nozzle, so that the size of the jet used may correspond to the maximum load and thus unnecessary waste of water be avoided. The tips for the generator-wheel range from 1½ to 2½ inches in diameter, while those for the exciter are from $\frac{7}{16}$ to $\frac{3}{4}$ inch. When tips are used of the proper size for the full load there is no need of throttling at the full load, and, therefore, no loss from this cause; and with the deflection nozzle there is no waste of water at full load, so that for full load the two arrangements are equally good. This is not, however, the normal condition of operation of a lighting plant, for in such a plant each dynamo is driven by a separate wheel, and the load is constantly changing, so that here the deflecting nozzle has the advantage. The deflecting nozzle is also to be preferred under high heads, to avoid the risk of straining the pipe by suddenly checking the flow of water, as would be necessary with a throttle valve if the entire load were suddenly thrown off.

Regulation by throttling is, therefore, only advisable in cases where the head is not excessive, and where the quantity of water obtainable is limited, as is the case where it has to be stored in and supplied from reservoirs, or when the supply is liable to sudden stoppage. The writer recalls instances of its value in cases which occurred while he was at Bodie, Cal., in the fall of 1893. There the water was conducted 4,700 feet in an open ditch to the pipe, and was delivered by the pipe under 350 feet head to drive an electric generator for a 12-mile synchronous power transmission. In cold weather anchor ice would form and suddenly block up the ditch at some curve, and the water-pressure would begin to fall slowly owing to the gradual emptying of the pipe, which could no longer be kept full by the diminished flow from the lower end of the ditch, which now acted as a reservoir. Having throttle valves in the nozzle, however, very little water was wasted, and the plant was thus kept running until the ditch was cleared, whereas with a deflecting nozzle the pipe would have been quickly emptied, even if the gate valves had been used as throttling valves (which is feasible if the load only varies slightly). Sometimes the head became so low that it was necessary to throw off part of the load and to run at reduced speed to keep the motor in synchronism.

As already stated, the speed of the generating-wheel is maintained constant for different loads by deflecting the stream. This is done by raising or lowering the deflecting nozzles from the dynamo-room by means of a lever fixed to a shaft which passes through the wall and carries a short lever connected to the nozzles by a link. The weight of the nozzles is counterbalanced by a movable weight on a horizontal lever-arm fixed to the shaft. The change of position of the nozzles is made automatically by the use of the Pelton differential governor. The ability of this governor to keep the generator at a practically constant speed depends on the governor being driven at a constant speed. I say *practically* constant, for there must be *some* change in speed before the governor can act, and then an appreciable time is required for this action to produce its effect. The constant driving-speed in the present case is furnished by the exciter-wheel shaft. The arrangement for governing is briefly as follows: The generator is geared to stop itself by turning the water off the wheel, and the source of constant speed is geared to speed up the generator by a contrary action. These two actions neutralize each other when the generator speed is the same as the fixed speed, but when either preponderates the difference acts. Thus an increase in generator speed will act to stop the generator, while a decrease, by making the fixed speed predominant, acts to speed up the generator. The governor consists, in part, of two similar mitre-wheels which are mounted upon pulleys and placed face to face, loosely, upon a horizontal shaft, and are driven at equal speeds in opposite directions, one by the generator shaft, and the other by the exciter shaft. The speed of the pulleys is 200 R. P. M. In Fig. 3 it will be seen that between these wheels, and at right angles to the supporting shaft, there is fixed to the latter a cross-bar carrying two mitre-wheels, one at each end, which mesh with the two oppositely-revolving mitre-wheels first mentioned. The result is as long as the two outside wheels are revolving at the same speed the two central wheels will merely revolve upon their axis without tending to move in either direction the arms upon which they rotate. Now, if the generator-speed increases, the corresponding side of each central wheel will have to travel faster forward than the other side travels backward, and the difference between these two movements will result in a movement of the central wheels in the direction of a faster wheel, and the cross-bar will consequently move the same way. The shaft to which the cross-bar is attached will, of course, turn with it, and as this carries a pinion meshing in a toothed quadrant connected to the lever which controls the nozzles, the stream will be pulled away from the wheel until the generator speed falls to its normal value. This point is quickly reached with a full load, owing to the drag of the load, but for a light load the inertia of the armature and wheel prevent them from responding so readily, and so makes the governor act longer than it should. Consequently the generator is not only brought to its proper speed but is carried past it, which causes the governor to reverse, and sets up a regular *see-sawing* in the speed. This see-sawing is increased by a certain amount of lost motion which exists in the governor and its connections, and by the action due to the fact that for a full head and light load the jets only impinge slightly on the buckets, and since the jets are round and their upper edges alone strike the buckets (which are themselves curved in the opposite direction) a slight movement of the governor produces a much greater change in the speed of the wheel under light loads than when the whole of each jet is in use. This effect of the jets is more marked when the governor is working to cut down the speed than when it is increasing the speed, because *withdrawing* the jets a given distance causes a greater change in the quantity of water striking the buckets than would be caused by *advancing* the jets an equal distance. The see-sawing will be further increased if the nozzles are not fully counterbalanced, as they would then tend to fall away from the wheel.

(*To be Continued.*)

NOTES ON THE RECONSTRUCTION OF A SMALL CENTRAL STATION PLANT.

BY FRANKLIN L. POPE.

The financial condition of the smaller central station electric lighting plants throughout the country is at the present time by no means satisfactory, and in too many instances cannot even be truthfully said to be encouraging. A survey of the field shows that very few such plants located in towns having less than 10,000 inhabitants are earning more money than is necessary to meet their operating expenses and to provide for indispensable current repairs. In the state of Massachusetts, in which the operations of all electric lighting companies are by law made a matter of public record, it appears from the latest reports that the aggregate liabilities of the fifty-seven companies operating in that state, including stocks, bonds and floating indebtedness, amounted on June 30, 1894, in round numbers to $14,000,000, nearly all of which stands charged to construction account. The net earnings for the preceding year were $1,000,000, or about 7.1 per cent. on the total investment: a sum obviously quite insufficient to provide for depreciation and at the same time pay a fair dividend on the capital which has gone into the business. But if half a dozen of the larger plants, in cities like Boston, Lowell, Worcester, Springfield, Lynn and Fall River were excluded from the list, the showing for the smaller plants would be even far worse than it now appears.

Many of these small plants were started at an earlier day than could have been justified by any reasonable estimate of the business then in sight, and now find themselves hampered by inconvenient buildings, and with unsuitable machinery bought at high prices, and encumbered with defective business methods which experience has shown to be wholly inconsistent with the dictates of good judgment.

With the owners of many of these plants it has become a very serious question whether the easiest way out of the dilemma which confronts them may not be to relegate the entire plant to the junk-shop and the scrap-pile, and commence over again with new buildings, modern machinery and improved methods of administration. When the necessary capital is readily forthcoming, there can be no doubt that this would often be the wisest course of procedure, but, for obvious reasons, it is one which is not always nor even usually practicable. The alternative is to remodel the existing plant, bringing it as nearly as may be into accordance with the best modern practice and utilizing, so far as possible, the old material; a course which at least has the merit of avoiding an undue expansion of the construction account, in most cases already sufficiently burdensome.

Having been called upon during the past year to advise the owners of a plant of the character above referred to, in reference to certain changes which had been suggested as desirable, and having afterwards been employed in a professional capacity to design the work and superintend its execution, I have thought that some account of what we undertook to do and how we did it, might not be without interest to the members of the Institute.

The Great Barrington (Mass.) Electric Light Company was organized and commenced business in 1888. The population of the district intended to be served was about 3,000, and most of the expected consumers were located within 2,000 feet of the point decided upon for the station. This was built of wood in the most inexpensive manner possible, and was placed alongside the railroad for convenience in receiving coal, although at the same time the danger from fire was materially increased. The original outfit was an Edison 3-wire, equipped with a pair of 250-light 110-volt dynamos, and the company commenced business with 281 lights on contract at $10 per year each; wiring free. The centre of distribution was 1,800 feet from the station, necessitating over a ton of copper in the feeders alone. Generally speaking, the plant was well laid out, and well built as things went in those days. The two dynamos were belted to a single 80 H. P. Armington & Sims engine. The original cost of the plant was about $16,000. The following year a Schuyler arc plant for street-lighting was added, carrying 35 arcs, nominally of 1,500 C. P., which was run from the same engine and boiler. In 1890, the plant was considerably enlarged by the addition of a second arc machine, a Westinghouse 500-light alternator, and a second engine and boiler of the same capacity as the first. An 80 K. W. Westinghouse dynamo of more modern type was afterwards substituted for the original one.

Upon examining the plant last year, I found the Edison machines carrying on Saturday evenings a maximum load of some 450 lights, while three evenings in the week (with the stores closed) it fell to perhaps half that amount. The two Schuyler machines, with an aggregate capacity of 55 to 60 lights, were carrying about 38 to 40 or an equivalent of that amount, while the Westinghouse machine was seldom as much as half loaded, carrying a maximum of possibly 500 lights during three or four months of the summer season, and not much more than one-fourth that amount the remainder of the year. Necessarily with so many dynamos of different types, and with such a variable yet small average output, the consumption of coal was excessive as compared with the light delivered and paid for.

After a careful consideration of the situation, keeping in view the greatest possible reduction of present and future operating expenses, it was determined the wisest course to

*Abstract of paper presented at the twelfth General Meeting of the American Institute of Electrical Engineers, Niagara Falls, June 27, 1895.

pursue would be to consolidate the whole service so that it could be supplied with one dynamo, in place of five underloaded ones. In pursuance of this plan it was decided to adopt the two-phase alternating system, at a maximum pressure of 2100 volts in the primaries, and 105 volts in the secondaries, with a frequency sufficiently low to permit the advantageous use of induction motors if required. It was furthermore decided to abandon the steam plant, and to make arrangements to utilize some one of the excellent water-powers which were available within practicable distances.

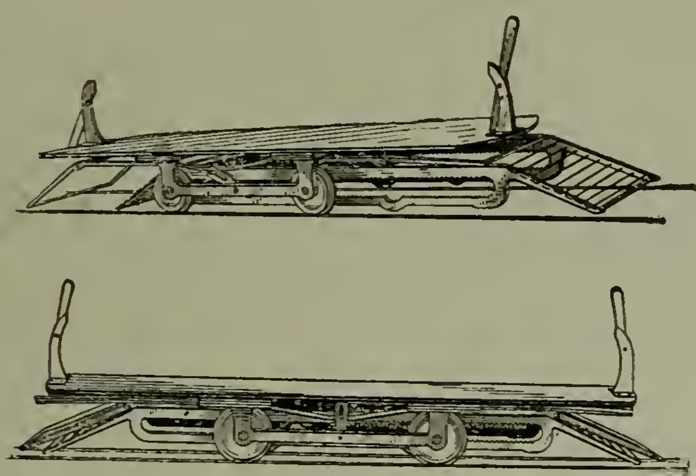
(*To be Continued.*)

THE BROCK AUTOMATIC FENDER.

The necessity for a reliable fender for electric and cable cars has for a long lime been painfully apparent, and judging from the great number of patents issued on devices of this class the solution of the problem is not so easy as it appears. Some of these inventions have meritorious features, but the great majority of them are practically worthless, and many of them, instead of saving life in case of accident, actually throw greater dangers into the situation, and rather increase the chances of injury than otherwise.

In case of emergency quick and positive action is necessary; therefore the reliable fender should work automatically, and not depend upon the human element. Reliable action on the part of the motorman or the gripman can rarely be depended upon under extraordinary circumstances, as a sudden demand for the exercise of cool judgment is likely to take him unawares and fluster him to such an extent as to render him incapable of the proper action the situation calls for.

Mr W. H. Brock, of Seabring street, Brooklyn, N. Y., took all of these facts into consideration when he invented his automatic fender, which is herewith described and illustrated. The Brock fender consists of a frame of light



BROCK'S AUTOMATIC FENDER.

steel or wood, across which is stretched a netting of rawhide or rope. It is attached to the running gear of the car and not to the car body. This method of attachment prevents the jumping up and down of the fender, which is a serious disadvantage. The fenders in position, attached to side bars and directly underneath each platform, do not project beyond the length of the car, and are made to drop down and run ont longitudinally with the car, and even with the track, thereby scooping underneath the object and carrying it on to the net of the fender.

The gripman or motorman need never touch the fender lever, as the fender works automatically. The fender is so arranged, however, that it can be worked by the motorman by the simple touch of a lever, should he observe any object on the track.

A light steel frame, which Mr. Brock calls the "operating rod," projects beyond the front of the car and when it strikes an object with a resisting force of 5 lbs. or less, the fender runs out and the rod slips back and up over it, out of the way.

Two side-bars of angle iron run underneath the car. On this frame are a top and bottom rack, one-quarter of an inch thick, and a pinion runs along this rack, when the mechanism has been set in motion. When the pinion drops in a pocket, the fender is in place in front of the car, projecting about 6 feet, and when the fender is underneath the platform it is so close to the surface of the ground that by no possibility could any one be dragged under the wheels.

The entire weight of the apparatus is less than 100 lbs. and experts who have examined this invention express the opinion that it is far superior to anything in the fender line that they have ever seen.

THE EASTERN TELEPHONE ASSOCIATION.

At the preliminary meeting of telephone manufacturers held at the Astor House, New York, on July 31, for the purpose of effecting an organization of independent telephone interests in the East, a committee of five was appointed to draft By-laws and a plan of organization. Another meeting will be held in a few days when it is likely that a permanent organization will be effected. There is no doubt now that the project will be carried through to success, and encouragement comes from many outside sources.

Among those present at the preliminary meeting on July 31 were: A. F. Stanley, of De Veau & Company, New York; J. D. Leatherbee, of the National Telephone Manufacturing Company, Boston; J. H. Scofield, of the Phœnix Interior Telephone Company, New York; Geo. W. Coy, of the Franklin Telephone and Electric Company, New York; H. C. Williamson, of the United Electric Telephone Company, New York; A. H. Chadbourne, of the United States Telephone Construction Company, Philadelphia; S. J. Tunbridge, of the Utica Fire Alarm Company, Utica, N. Y., James R. Strong, of the Tucker Electrical Construction Company, New York; H. H. Douglas, of the Century Telephone Company, Boston; Mr. King, of the Rhode Island Pulsion Telephone Company, Providence, R. I.; Mr. Palmer, of Palmer Bros., Mianus, Conn., and Mr. Wetmore, of the Manhattan Electrical Supply Company, of New York. Mr. Josiah Tice, of New Brunswick, N. J., by letter favored the objects of the meeting.

TROLLEY PARTIES IN BROOKLYN.

The Brooklyn Heights Railroad Company is having built a number of elegant open cars, especially fitted up for trolley parties. The cars will be longer than those now in use, and will be both costly and luxurious. Five or six special closed cars are also to be built for the use of theatre parties. These special cars will be elaborately arranged for lighting effects, and will surpass all previous efforts of this character.

In speaking of the matter, Secretary Williams of the company said:

"The system of the Brooklyn Heights Railroad Company, with 200 miles of track, extending from Flushing to Unionville, and, by a connection with the Brooklyn Queens County and Suburban road out to Jamaica, can give these trolley parties many charming experiences. Lovely scenery, interesting localities, and all the phases of city life, from the wealthiest residential districts to the most squalid haunts of poverty, can be reached in this city.

"People will learn more of this great city. More important even than this will be the element of innocent amusement. Each party can have music along which will provide fun not only for its members, but for the people along the streets through which it passes. We are sure, or as sure as can be, that the experiment will prove a success. The closed cars, which will be adapted for theatre parties, should also prove popular."

Electrolysis of Water.—Pure water resists the strongest electrolytic action, but if it is slightly acidulated with sulphuric or chlorhydric acid it is easily decomposed by an electric current. The acid remains apparently unchanged, its presence, however, reducing the electrolytic resistance of the water.

PHILADELPHIA'S ELECTRICAL INTERESTS.

CONTINUED FROM PAGE 64.

THE DIAMOND ELECTRIC CO.

We give herewith a half-tone illustration of the plant of the Diamond Electric Company, Philadelphia, which is located at 17th and Clearfield streets.

The building, which is of brick, is a very substantial structure, 95 feet by 120 feet, the interior space being divided into two main sections. One of these sections, 95x70 feet, is used as the dynamo room, and the other, 78x63, as the boiler room.

The dynamo plant includes one 2-phase Stanley 120-kilowatt dynamo, generating a current of 1,500 amperes at 2,000 volts. This machine, which is a superb specimen of electrical engineering work, is giving excellent satisfaction in its operation. By the proper combination of circuits at the terminals of the four fields the voltage of the machine can be changed from 1,000 to 2,000 very easily. The fields are connected to a terminal board on the face of the machine, which renders the commutation of the circuits a matter of much facility.

This is one of the first two-phase Stanley dynamos installed in Philadelphia, and it has proved itself so excellent a machine that over ten other dynamos of this make have been installed in other stations and isolated plants in Philadelphia during the past six months. It is but fair to state that the selection of these machines was brought about by Mr. W. J. Ready, manager of the Diamond Electric Company, who was so enthusiastic over his own experience with his Stanley dynamo that he did not hesitate to recommend its adoption in the other plants.

Besides the Stanley dynamo above referred to the Diamond Co.'s plant includes six 60 and four 80-light Fort Wayne Electric Corporation arc light dynamos, of the Wood type, each light being of 2,000 c. p., and two 750 single-phase Westinghouse dynamos. Also one 2,000-light alternator of same make.

The engine plant consists of one 150 and two 300-H. P. Green engines, made in Providence, R. I.; and the boiler plant, seven Coatsville, Pa., tubular boilers.

The Diamond Electric Co. lights 675 arc lamps for city use, and 160 commercial arcs. They also run 8,450 commercial incandescent lights

During the past year the business of the company has increased to such an extent that it was necessary to enlarge the capacity of the plant, which has been doubled in that time. And yet this expansion is not sufficient to accommodate the rapidly increasing business. The company is about to erect a new building alongside of the present one, which will double the present capacity of the plant.

In the new building the company will install four or five 100-light arc dynamos, and will increase the engine plant by two 500-H. P. Green engines. A new battery of boilers will also be installed. The new dynamo will be run by counter-shafting and belting, Schieren's electric belts being used.

EXTERIOR VIEW OF THE DIAMOND ELECTRIC CO.'S STATION.

A travelling overhead electric crane will also be added to facilitate the moving of the heavy machinery. When these additions are made the Diamond Company will have one of the best equipped and most complete plants in existence.

The Stanley Electric Co. will construct a 16-circuit marble switchboard, 12 feet high by 22 feet long, which will be equipped with Whitney Standard instruments.

The insulated wire to be used throughout the work will be furnished by Alfred F. Moore of Philadelphia.

The Diamond Electric Co. is now placing all of its incandescent circuits in underground conduits. Standard underground cables will be used in all the conduit work.

The officers of the Diamond Electric Company are: Charles A. Porter, president, 804 Girard Building; John B. Stauffer, secretary and treasurer, and W. J. Ready, manager.

THE PHILADELPHIA ELECTRICAL AND MANUFACTURING CO.

The Philadelphia Electrical and Mfg. Co. commenced doing business in November, 1892, and although goods of their manufacture have been on the market less than three years they have established for themselves almost a national reputation. Some of the most popular articles which they manufacture are their patent Spark Arresters for arc lamps and arc cut-outs, both of which are shown in the accompanying illustrations.

FIG. 1.

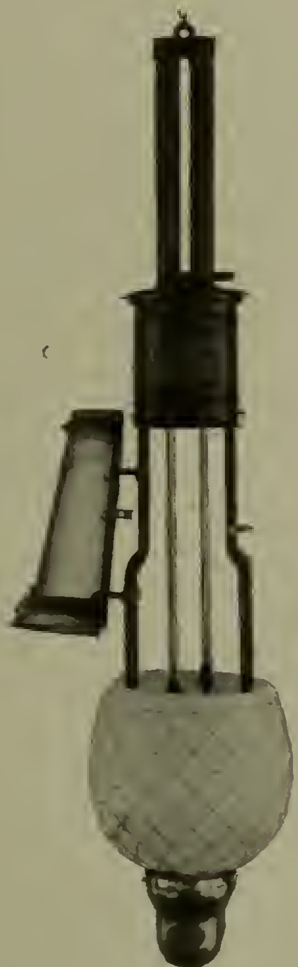


FIG. 2.

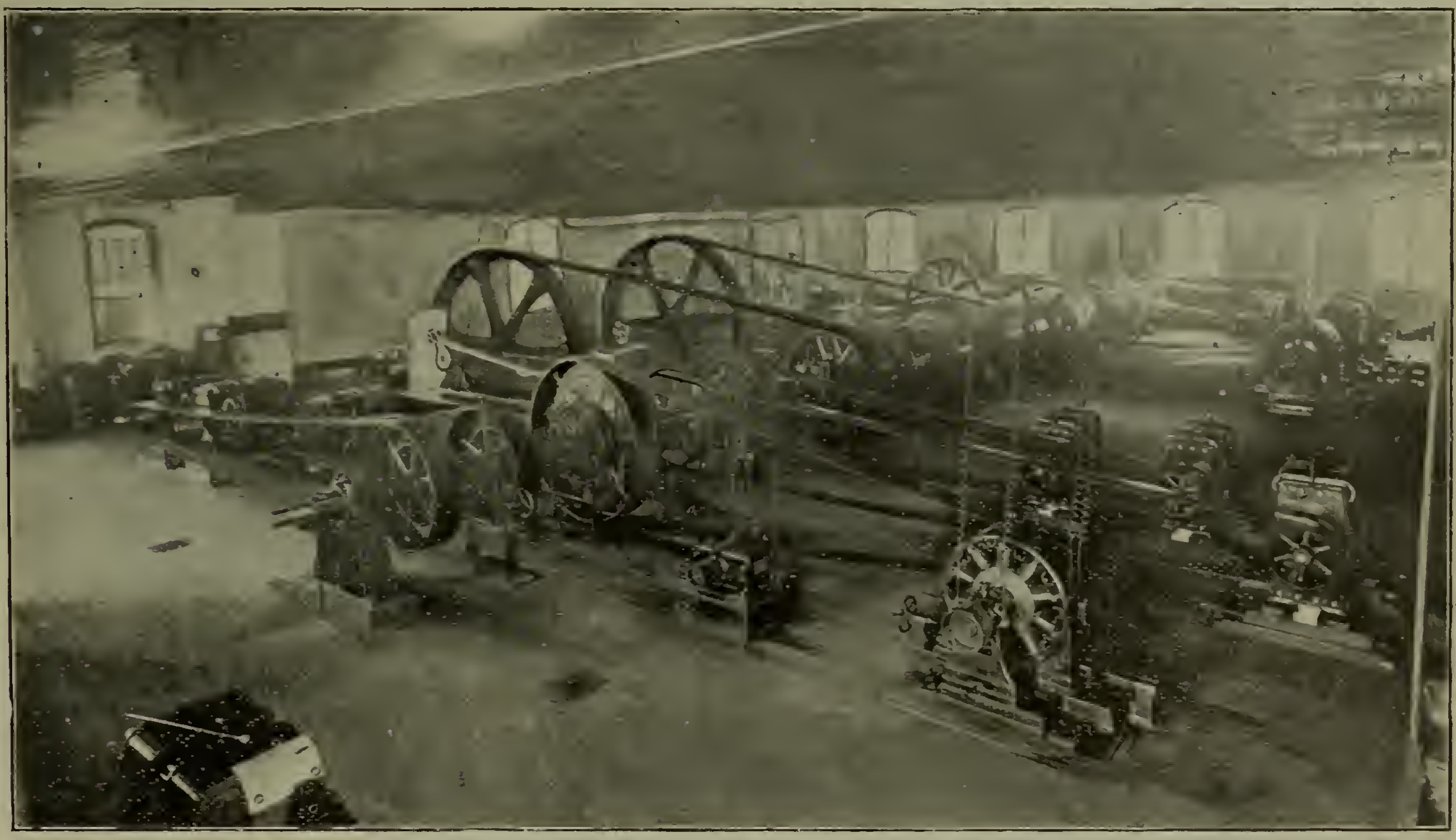
Figs. 1 and 2 show the arrester both open and closed as applied to the well-known T. H. lamp. They are also made to fit any style lamp, and owing to their construction and the thorough protection which they afford against fire from sparks or hot pieces of carbon, have been approved by the International Fire Underwriters' Association and also by the local boards in many of our larger cities.

Fig. 3 shows an interior view of the arc cut-out, which has some very strong points of merit not found in those of any other make, and which have proved to be a great success.

FIG. 3.

FIG. 4.

Fig. 4 shows the same cut-out which is designed to be placed in locations where a lever would not be easy of access and which is operated by means of two cords. In addition to the above articles the company manufacture globe nets, carbon cups, carbon holders, resistance boxes, machine brushes, etc., besides doing a general line of both light and heavy electrical repair work.

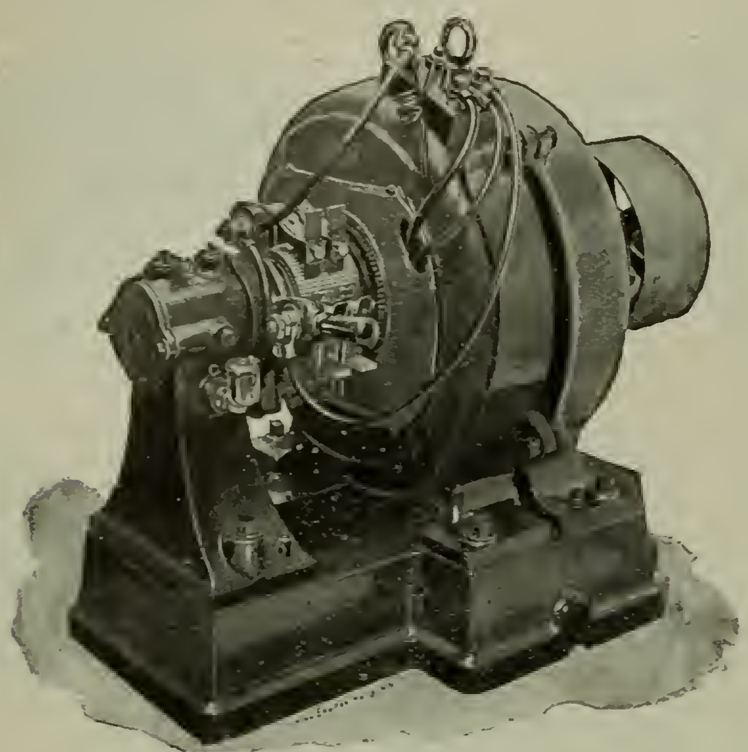


INTERIOR VIEW OF STATION OF THE DIAMOND ELECTRIC CO.

WALKER & KEPLER.

In the front ranks of electrical engineering firms in Philadelphia none occupies a more prominent position than Walker & Kepler of 531 Chestnut street.

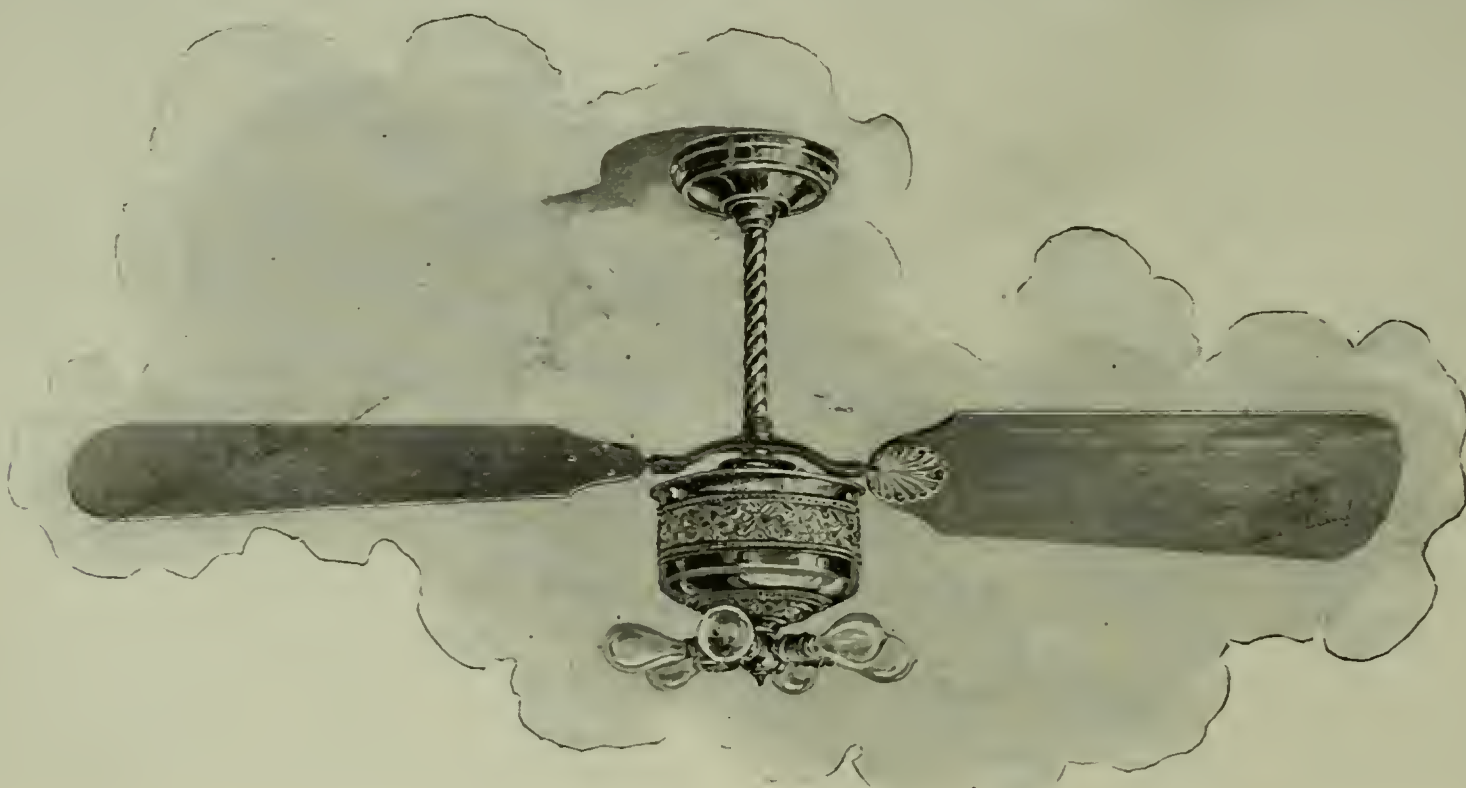
The firm will, next year, be able to celebrate its decennial anniversary, having been organized in 1886 under the copartnership of I. C. Walker and H. G. Kepler. Both gentlemen are well known in the electrical trades, and enjoy a high reputation both as to their technical and practical resources.



WALKER & KEPLER—LUNDELL MACHINE.

Walker & Kepler primarily carry on business as electrical engineers and contractors. They are the agents in Philadelphia for the Interior Conduit and Insulation Company of New York, of which company's goods they carry a large stock. They also represent the Siemens & Halske Company of America.

Among their large stock of goods are found a full line of electric and gas fixtures of all kinds, and electric light, electric power and electric railway supplies, plants of which class they install complete.



WALKER & KEPLER—LUNDELL CEILING FAN.

Among the fine examples of their installation work may be mentioned the lighting plants in the Bullitt Building, Philadelphia, with a capacity of 2,400 lights; the Drexel Building, 3,000 lights; the Temple College and Church, 1,500 lights, including two Siemens & Halske dynamos; and the Woman's Christian Association Building, 1,200 lamps and two Siemens & Halske dynamos. The equipment of these plants was all taken from Walker & Kepler's own stock of goods on hand, which included the dynamos, switchboards, switches, wire, gas and electric combination fixtures, and all the minor fittings.

The firm carries everything in the electrical line, represented in the installation of electric plants of every description. They now employ eighty workmen in their establishment and enjoy a large business.

THE HELIOS ELECTRIC CO.

This well-known concern, which used to be domiciled at 131 Filbert street, has moved to a larger establishment at 1223–1229 Callowhill street, Philadelphia. This company's products are well and favorably known all over the world.

The Helios arc lamp is second to none for light-giving-power and economy of operation. It is withal one of the most reliable and durable arc lamps made.

At their new quarters the company will have much better facilities for the manufacture of their lamps. There was a great deficiency of light in their old place, which rendered work difficult; but in the new there is plenty of that valuable necessity which will, of course, have the most beneficial results.

The Helios lamp was first brought to public notice in the spring of 1893, by Dan. Spruance. Mr. Spruance exhibited the Helios arc lamps at the World's Fair, which exhibition attracted great attention. The lamp jumped into a popularity which has been growing ever since, the result being that the company was compelled to seek larger facilities to conduct its business, as above mentioned. The company is preparing for a large fall trade and will be in a position, with its increased facilities, to handle it promptly and satisfactorily.

Mr. Spruance is at present in Colorado enjoying a well-earned rest.

PHILADELPHIA MENTION.

The Philadelphia Electrical Equipment Company, 816–822 Cherry Street, occupy the main floor, which is equipped with a complete outfit of machinery especially designed for electrical work. The company are contractors for electric railways, electric light plants and electric power plants, and gives special attention to the manufacture, reconstruction and repairing of dynamos, motors, armatures and commutators. The company is now adding to its plant new and improved lathes and planers for heavy dynamo and motor work, and has moved the supply department to the basement, in order to gain more room for expanding business. Mr. James R. Rettew, well known to the electrical fraternity, is manager of the company.

Frank H. Stewart & Co., 35 North Seventh street, carry a well-selected line of electrical supplies. Their stock includes motors, dynamos, desk and ceiling fans, arc and incandescent lamps, knife and flush switches, sockets, tubes, cut-outs, wires, shades, bell supplies, etc., etc. They are agents for the Dayton Fan & Motor Co., of Dayton, Ohio, and for the Perkins Electric Lamp Co. The firm is composed of Frank H. Stewart and P. Logan Bockius, both gentlemen being well known and experienced in their line.

(*To be continued.*)

FROM THE PACIFIC COAST.

(*Special Correspondence.*)

The Klamath Falls Light and Water Co., has been organized in Klamath Falls, Oregon, by Charles S. Moore, Geo. T. Baldwin and Harry V. Gates. It is proposed to furnish electric light, electric power and telephone service, and water for that place. The capital of the company is $2,000. The company has made a contract with the Klamath Falls Irrigation Company for the power to run the plant, and has bought a site whereon they will locate the power-houses, using the big springs bubbling up there for the water supply.

It is said in Tacoma that C. B. Wright wishes to compromise the $1,000,000 suit brought against the old Light and Water Company, of Tacoma, to recover the money paid the company for the plant now held by the city.

The town of Vale, Oregon, which is located 16 miles from the nearest railroad station—Ontario—will build a telephone line to connect the two places. The cost will be about $600.

The R. R. V. Telephone Company's lines will be extended to Giant's Pass and possibly to Eagle Rock. They now connect Ashland, Jacksonville and Central Point, Oregon.

The first electric sawmill on the Pacific coast is being fitted up in the building formerly used by the Fox Island clay works, at the foot of Fifteenth street, Tacoma. The plant is a re-sawmill, and will be run as a branch of the Olympia Lumber Company, of Olympia. A 16-horse-power electric motor, with city power, will run the machinery, which at present consists of a re-saw, planer, sticker and turning lathe.

Palmer & Rey, of Portland, Oregon, are putting in a pumping plant of a six-horse-power gasoline engine and a Jackson Whirlpool pump, for the Walla Walla Water Company. It will raise 400,000 gallons every 24 hours.

The Mercantile Gas and Electric Light Company has filed articles of incorporation at San Jose. The capital stock is placed at $500,000. Directors—J. V. McKiernan, Frank Whittaker, E. C. Randall, W. W. Wood, C. K. Fleming.

The electrical equipment of the Tacoma Traction Company's line from Tacoma to Fern Hill and Puyallup has been completed, and the new motor cars have superseded the steam dummies operating on a portion of the line.

The city council of New Whatcom, Wash., has voted to discontinue electric lighting when the present contract expires. There is still some talk of the city putting in its own light plant, it having been estimated that a plant large enough to run 100 arc lights and 2,000 incandescents can be put in operation for $12,000 to $15,000.

—Bidwell has found that light falling upon a recently demagnetized piece of iron produces an instantaneous revival of magnetism.

THE MONTMORENCY ELECTRIC POWER COMPANY'S WATER-POWER PLANT.

One of the interesting water-power plants for the generation of electricity on a large scale is that of the Montmorency Electric Power Co , of Quebec.

During a recent visit of a representative of The Electrical Age to Quebec, an opportunity was afforded, through the courtesy of Mr. F. H. Badger, Jr., the general manager of the company, to visit this interesting plant, which is located at the beautiful Montmorency Falls, seven miles east of Quebec.

In the city of Quebec there are at the present time 12,000 incandescent lamps ; 550 arcs, and motors aggregating 75 H. P., all of which are supplied with current generated at the Falls. These motors are 2-phase Stanley machines, and Mr. Badger stated that they worked perfectly and were self-starting.

The electric system is that of the Stanley Electric Mfg. Co., of Pittsfield, Mass.. and it is giving unqualified satisfaction in its operation in every detail.

The incandescent plant consists of three 500-K.W. two-phase S. G. C machines. The installation of the last one of the three has just been completed, the other two having been in operation since the first of last May.

The plant was run all last winter on two 40-K.W. machines.

The new 500-K W. generators are beautiful specimens of mechanical and electrical design. They are very massive and well-proportioned. The weight of the inductor alone of each machine is 20 tons, and the hauling of these heavy parts from the railroad to the power station, which is located 60 feet above, on the side of the rocky and abrupt hillside, is a task in itself that calls for the exercise of considerable engineering skill.

The exciters are Belknap dynamos made by the Belknap Motor Co.. Portland, Me.

The 2 phase machines are set on heavy beams soaked in paraffine for the purpose of affording the highest possible insulation, the beams resting on top of solid rock foundations.

There are 15 T.-H. machines which generate the current for the arc lights used in the city.

The pole line is of the ordinary construction and carries 20 incandescent wires and 22 arc wires. The size of the wire for the incandescent work is No. 0, and that for the arcs is No. 6. Only eight of the incandescent circuits are in use at the present time, however.

A very unique and efficient, as well as simple plan has been adopted to avoid damage from lightning strokes. Besides the Wirt lightning arresters in the station two barb wires are run along the pole line on the top outside insulators, with a ground connection at every fourth pole. Not the slightest damage has resulted to any of the apparatus or station during the most violent storms, and great faith is placed in the barb wire protective device.

The power of the station is furnished by eight water-wheels—four of 620 H. P. each and four of 300 H. P. Each of the large 2-phase machines is run by one of the 620 H. P. wheels. These wheels were made by J. C. Wilson & Co , of Glenoria, Ont., and are especially adapted for high head of water. Each wheel is 21″ in diameter. These wheels are located in the lower portion of the building, the power being transmitted to the dynamo room on the floor above, by means of a 50″ leather belt, made by Robert & Sadler, of Montreal.

The water-supply pipe is six feet in diameter, with a total length of 2,900 feet—1,500 feet from the Falls to the first gate house, and 1,400 thence to the station. The pipe was constructed on the spot, of iron imported from Scotland for the purpose, and has a maximum capacity of 4,500 H. P.

The head of the water at the station is 170 feet. From there the water is conveyed through another pipe giving a head of 60 feet, which is used for the operation of a mill in the locality.

The large Stanley machines generate 5,000 volt currents at the station. These currents are reduced to 2,000 volts by the use of step-down transformers at the sub-station, in the city, and thence conveyed through the city in the usual manner.

The entire equipment was furnished by the Stanley Company. The switchboard is provided with Whitney instruments and is located in a very accessible and convenient position.

The station is a substantial structure, 150 × 50 feet. The penstock runs the whole length of the building and has as many outlets as there are wheels.

One of the most interesting facts connected with the plant is the immense power exerted by a wheel as small as 21 inches in diameter. To the layman, 620 H. P. from so small a wheel at first thought seems impossible, but when the enormous head of water is taken into consideration the results are more easily understood.

Mr. L. Burran is the electrician of the company, and under his special charge all of the vast undertakings at this plant have been carried out in a manner that reflects great credit upon his ability.

Mr. F. H. Badger, jr., the general manager, is well known to American electric-light managers. He is naturally very enthusiastic over what his company has accomplished and showed the utmost courtesy to our representative in his search after facts and figures. Mr. Badger is an experienced electrical engineer and manager, and to his experience and skill the unique and successful results attained by his company are mainly due.

RESUSCITATION AFTER SHOCKS.

The New York *Tribune*, in its issue of August 5, prints an article on the subject of resuscitation after electric shock, in which is incorporated an interview with Mr. Thos. A. Edison.

The recent stories which have gained wide circulation touching the question as to whether heavy electric shocks do or not kill formed the basis of the *Tribune's* investigation, and it was for the purpose of getting the opinions of authorities on the subject that Mr. Edison and Mr. Nikola Tesla were interviewed.

Mr. Edison characterized as "nonsense" the stories of resuscitation of criminals after having been shocked in the electric chair. Death, he said, was absolute and painless.

In explaining to the reporter that voltage alone did not kill, that amperes, too, were necessary, he stated that probably a current of two amperes with the pressure used in electric executions was sufficient to kill.

The contacts between the terminals of the wire, or electrodes, and the human body should be good, to insure the passage of the current through the latter, he continued. "About thirty linemen are killed every year, and these poor fellows usually touch the fatal wire only for a second, are partially protected, perhaps, by their clothing, and often receive a current at a lower voltage than is employed for executions. Yet, even with such poor contacts, see the result! In carrying out the death sentence, pains are taken, not only to have a suitable current and to prolong its administration, but also to see that the contacts are thoroughly made. Great attention is paid to this vital point."

Mr. Tesla was approached, but without success as far as obtaining any information or opinion was concerned. He declined absolutely to say a word for publication.

THE AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION.

This Association will hold its fifth annual meeting at "The College of Physicians and Surgeons, of Ontario," in Toronto, Canada, on Tuesday, Wednesday and Thursday, September 3d, 4th and 5th, 1895. Dr. Emil Heuel, 352 Willis avenue, New York city, is the secretary.

SCIENTIFIC FACTS.

The weight of the ether is so slight that no adequate idea of its lightness can be conveyed by numbers. Yet by calculations based upon proper assumptions it can be shown that the weight of a cubic foot of ether is $\frac{2}{3} \times 10^{-20}$ of a lb.; or, if put into fractional form, about

$$\frac{2}{300,000,000,000,000,000,000}$$

of a pound.

The earth by moving through the stellar regions of space is opposed in its motion by the ether to a slight extent. By the above figures it is possible to understand the impalpability of the ether in small masses, yet in general its effect in retarding the motion of the earth is such that it would take 1,666,000 trillion years to bring the earth to rest. The loss of energy experienced per annum by its resistance is

$$\frac{6}{10^{22}}$$

of the total.

If the kinetic energy of the earth be represented by the following:

$$\frac{4}{3} \pi r^3 \times 62\tfrac{1}{2} D \times \frac{V.^2}{2g},$$

then the above fractional part of this will represent in exact quantities the rotative power lost.

La Place has calculated that gravitation if propagated through an elastic medium would require a velocity of 100 million times that of light in order to be instantaneous. Therefore, as light moves at the rate of 186,000 miles a second, gravitative effects move through space with the velocity of 186,000,000,000,000 miles a second.

ELECTROLYSIS OF ORES.

The electrolytic separation of metals from their ores is accomplished by first reducing the crude ore chemically to salts capable of being electrolyzed. Different salts of the same metal, treated by different methods, yield to electrolysis with different degrees of facility, and produce the metal in varying degrees of purity and in variable quantity with the same current. On the nature of the preliminary process, therefore, depends the success or failure of the results. Among the various ores reduced in this manner are those of zinc, lead, copper, silver, gold, aluminum, sodium and magnesium.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES.

The next annual convention of the Association of Edison Illuminating Companies will be held at the Hotel Cadillac, Detroit, Mich., August 13, 14 and 15.

The first two days of the convention will be devoted to papers with discussions, together with any business which may come before the meeting. On the last day the delegates will be entertained by The Edison Illuminating Company of Detroit and the General Electric Company.

On account of the large number of short papers to be presented, the proceedings of the convention will be particularly interesting, and as many new companies have been admitted a large attendance is expected.

This year's officers of the association are: President, C. L. Edgar, Boston, Mass.; Vice-President, A. L. Smith, Appleton, Wis.; Secretary, W. S. Barstow, Brooklyn, N.Y.; Treasurer, J. W. Lieb, Jr., New York, N. Y.

—In alternating circuits the practical rule is that the amount of copper varies inversely as the square of the E. M. F.

VICTORY OF ARMOR OVER GUNS IN ACTUAL BATTLE

The failure of the heavy projectiles to penetrate the Chinese armor which they struck, while it strengthens the argument of those who favor the battle-ship as the chief constituent of naval force, deserves the close attention of all persons, lay as well as naval, who are perplexed by the alternate crowing of both parties in the wearisome contest between guns and armor. The result shows, as most of us could have foreseen had we stopped to think, that armor is actually a far better protection than is indicated by the trials of the testing ground, where, for purposes of extreme proof, all the off chances are given to the gun. On the trial ground the victory of the gun has, with occasional fluctuations of opinion, been generally taken as proved In the Yalu fight the armor, thanks to the operation of causes carefully excluded in testing, came out ahead when it was struck.—["Lessons from the Yalu Fight," By Capt. A T. Mahan, in the *Century* for August.

Street Railway Notes.

The Norfolk, Albermarle and Atlantic R. R. Co. officials are, it is reported, considering the plan of changing the motive power to electric. The line extends from Norfolk, Va , to Virginia Beach. B. P. Holland, Norfolk, Va., is superintendent.

J. K. Martin, Ocala, Fla , can give information regarding the proposed Ocala and Silver Springs electric road.

The Toronto Railway Company, which operates by electric power the only street railway in Toronto, has issued £323,000 of first mortgage 4½ per cent sterling bonds Of this amount £250,000 was issued in Canada and the remainder in London. When the London subscription lists closed, on August 2, about $150,000 had been subscribed.

The Franklin Terminal Railway Co , Franklin, Pa., has been incorporated for the purpose of constructing an electric railway.

Telephone Notes.

The Gonzales Telephone Co., Gonzales, Texas, has been organized to build a long-distance system. L. P. David and A. J. Moore are interested in the project.

The Rockport Telephone Co., Rockport, Texas, has been organized by C. W. Booth and others, with a capital stock of $10,000.

A new telephone company is being organized in Sulligent, Ala., for the purpose of building a line between Sulligent and Vernon.

A new telephone exchange is to be established in Jacksonville, Fla. W. N. Shine, of Tallahassee, and A. H. King, of Jacksonville are principals in the enterprise.

TELEPHONE PATENTS ISSUED JULY 30, 1895.

Contrivance for Disinfecting Telephone Apparatus. Rudolph Lamarche, Hamburg, Germany. (No. 543,490.)

Signaling Apparatus for Telephone Exchange Circuits. Joseph J. O'Connell, Chicago, Ill. (No. 543,559)

Transmitting and Receiving Attachment for Telephones. Hosea W. Libbey, Boston, Mass. (No. 543,626.)

Telephone Exchange. Wada Y. Shibata, San Francisco, Cal. (No. 543,708.)

Telephone. Norval L. Burchell, Washington, D. C. (No. 543,798.)

New York Notes.

Office of the Electrical Age,
World Building, New York,
August 5, 1895.

The Electric Repair Works, 465 Greenwich Street, New York, A. K. Warren & Co., proprietors, electrical and mechanical engineers, are doing a good trade. They make a specialty of reconstructing and repairing armatures, dynamos, power generators and motors, and their work gives the best of satisfaction. They also manufacture commutators for dynamos and motors, and reconstruct machines of this class. They have had long experience in this line of business, and have a large shop giving the best of facilities for handling their business with promptness.

The Clonbrock Steam Boiler Co., of Brooklyn, is installing two 600 H. P. "Climax" boilers in the station of the Newark Electric Light and Power Co., Newark, N. J. These two boilers will give the station a total boiler capacity of 4,700-H. P., all Climax boilers. These boilers are giving the best of satisfaction.

H. Krantz, 628 Fourth Avenue, Brooklyn, N. Y., manufactures switchboards, switches, panel-boards, electrical and mechanical specialties. He carries a large stock of goods and is doing a fine trade. His work is of the very best character, and the apparatus of high excellence.

W. T. H.

Possible Contracts.

C. C. Shelton & Co., Chattanooga, Tenn., will install an electric light plant in their flour mill.

R. S. Scott and Hamilton White, Des Moines, Ia , are interested in a project to build an electric road between Lebanon and Bagnell, Mo.

An electrical subway system is to be constructed in New Orleans, La , for telephone, telegraph and other electric wires. A. Perilliat, state engineer, can give further particulars.

The school of the Christian Brothers, at Ammendale, Md., may be lighted by electricity.

For particulars regarding a proposed electric light plant in St. Augustine, Fla., T. J. Appleyard, of Sanford, Fla., or E. M. Hammond, of Orlando, Fla., may be addressed.

The Electric Cotton Mill Co., Athens, Ga., will run its proposed new plant with electric motors.

New Corporations.

Merrill Telephone Company, Merrill, Wis., has been incorporated with a capital stock of $10,000.

The Portland Extension Railroad Company, Gorham, Me., by W. M. Davis, of Portland, and William Wheeler, of Brooklyn, for the purpose of building an electric road from Westbrook to this place.

The Pittsburgh, Sheradon and Carnegie Traction Company, Allegheny, Pa , to build an electric road from that city to Washington, Pa. Capital stock, $42,000.

Fall River Street Railway Company, Fall River, Mass., by Wendell E. Turner, Arnold B. Sanford, David Beattie, J. E. Osborn and others. Capital stock, $50,000.

The Home Standard Telephone Company, Albany, N. Y., has been incorporated by Henry Russell, John F. Farrell, Charles L. A. Whitney, William H. Keeler and others, of Albany. Capital stock, $350,000.

The Perkins Electric Switch Company, Hartford, Conn., has increased its capital from $50,000 to $125,000.

Yarmouth Telephone Company, Yarmouth, Me., has been incorporated, with John Coombs, president; A. H. Coombs, treasurer, for the purpose of manufacturing and dealing in electrical goods, etc. Capital stock, $10,000.

The Erie and Eastern Street Railway Co., Erie, Pa. Capital stock of $25,000.

The Pine Plains Light Co., Pine Plains, N. Y., by John R. Thompson, Fredrick Nostwick and Frank Eno and others. Capital stock, $10,000.

The Mystic Valley Street Railway Co., Stoneham, Mass., to build an electric railway from Stoneham to Arlington via Winchester. Capital stock, $65,000.

The Jenkintown and Fox Chase Railway Co., Jenkintown, Pa., by Charles H. Noble, Howard Fleck, and others, to operate from Greenwood avenue and York street, to Fox Chase. Capital stock, $20,000.

The Consolidated Traction Co., Pittsburgh, Pa., by C. Magee, George W. Elkins, and others. Capital stock, $15,000,000.

SPELTER FOR BOILER PRESERVATION.

The use of spelter for the disincrustation and preservation of steam boilers has attracted the attention of steam users for some time. Its superiority over so-called scale-eradicators was accidentally discovered three years ago by one of the engineers of the steamship "St. Laurent." He having on the ship's departure from Havre, France, left a plate of spelter inside of one of the boilers, was much surprised, when some time later on inspecting that boiler, to find therein neither incrustations nor anything left of the forgotten spelter plate. This fact having been circulated, various experiments were made, and among others by the Vieille Montagne Company, in order to test the value of the alleged disincrustant; these experiments met with excellent results.

The Vieille Montagne Company exhibited at the Semi-Centennial Exhibition at Brussels, Belgium, a plate of spelter that had lain six months in the heater of one of their steam-engines. The plate had lost a portion of its weight, and, while keeping its shape, had become a spongy and crumbling mass. The fact of the transformation of spelter, and its dissolution, is attributed to a galvanic current taking place inside of the boiler. Two metals found therein, iron and spelter, the one negative, the other positive, form the two poles of the battery. It is probably this electrical phenomenon which prevents the formation of incrustations, by virtue of an action similar to that which is produced on the hulls of iron vessels sheathed with zinc.

Recent experiments show that the proportion of spelter to use as a disincrustant is about forty-five pounds by each one hundred horse-power for three months' use.

H. Lemarche's Sons, 83 John Street, New York, are the agents for the Vieille Montagne Zinc Mining Co., of Belgium, and carry a large stock of zinc rods for Leclanche batteries, and zinc plates for electrical uses; Crow-foot and Daniell's zincs; also for Bunsen, Star, Grove and other batteries; zinc wire, bellows nails, spelter, bar iron, muck bars and foundry iron.

ELECTRIC LIGHT INTERESTS IN NEWBURGH.

A despatch from Newburgh, N.Y., says the Edison Electric Light Company, of that city, which the General Electric Company lost control of not long ago, and then, through the aid of the courts, obtained it again, was on July 31 consolidated with the opposition company, the Newburgh Electric Light and Power Company. The agreement includes the capitalization of the new company at $250,000. It is to be known as the Consolidated Gas, Electric Light, Heat and Power Company of Newburgh.

THE MICHIGAN ELECTRIC COMPANY.

The Michigan Electric Company, of Detroit, has recently completed an arrangement with the General Electric Company, and the Edison Illuminating Company, of Detroit, covering the selling agency of General Electric machinery and supplies in Michigan, and consequently the General Electric Company will at once close the office they have maintained in Detroit. This arrangement covers the entire line of General Electric manufactures, including lighting generators, motors, incandescent lamps, and all their various lines of machinery and supplies.

The Michigan Electric Company, which was incorporated about two and a half years since, has, during that period, grown rapidly, and today has one of the largest and best equipped supply houses in the country, and are making themselves felt as strong competitors for the supply business in Michigan.

They have, however, made an exception in the matter of overhead railway material, in which line they will continue to manufacture and sell the "Michigan" hangers, etc., which have obtained a most satisfactory recognition among the street railway companies, and have proved to be just what was claimed for them, viz.: the simplest, strongest and most practical overhead devices made.

The Michigan Electric Company have recently engaged Mr. H. E. Baldwin, formerly representative of the General Electric Company in Kansas, Missouri and Oklahoma, who will look after their state trade, and Mr. L. J. Baldwin will hereafter be in charge of the sales at the company's headquarters.

NOLL & SIBLEY.

The partnership of Noll & Sibley, with headquarters at 253 Broadway, New York, was, on August 1 dissolved by mutual agreement. The dissolution of the firm was an amicable arrangement, due solely to the retirement of Mr. Frederick Noll to accept a most flattering and substantial offer in another line of business. The business of the late firm will be conducted as heretofore, at the same place, under the name of C. C. Sibley & Co.

Trade Notes.

The Adams Electric Co., Elkhart, Ind., manufacturers of the Adams Improved Transformer, have enlarged their factory and repair shop in order to better handle the increasing business; but even with these extended facilities the company is compelled to run the factory overtime to keep up with the business. The improved transformer has been well received in the trade and is praised by all who use it. The demand for these transformers is constantly increasing.

The Harrisburg Foundry and Machine Works, Harrisburg, Pa., has just issued a booklet describing what is said to be the handsomest engine room in the world – that of Keith's new theatre in Boston. The engine plant consists of three Ideal engines made by the above-named company, each of 175 H. P., with a sufficient aggregate of power to run 6,000 16-c. p. incandescent lamps. The engines run at a speed of 270 revolutions a minute and are practically noiseless. They are finished in a superior manner, all the trimmings being nickel-plated. The engine room is finished in a very artistic manner, and is said to merit the claim that it is the finest in the world.

WOVEN WIRE BRUSHES.

The Belknap Motor Co., of Portland, Maine, are the patentees and manufacturers of the best woven wire commutator brush on the market.

ELECTRICAL and STREET RAILWAY PATENTS

Issued July 30, 1895.

543,490. Contrivance for Disinfecting Telephone Apparatus Rudolph Lemarche, Hamburg, Germany. Filed July 24, 1894.

543,495. Electrical Controlling System for Elevators. Cyprien O. Mailloux, New York, N. Y. Filed May 28, 1895.

543,502. Electric-Arc Lamp. Samuel E. Nutting, Chicago, Ill., assignor to George W. Furbeck and Joseph Kettlestrings, same place. Filed Apr. 5, 1894.

543,522. Brake for Railway-Cars. Rowan T. F. Dodds, Louisville, Ohio. Filed Sept. 10, 1894.

543,523. Starting or Stopping Device for Electric Motors. Jonathan P. B. Fiske, Alliance, Ohio. Filed Nov. 14, 1894

543,524. Device for Automatically Operating Brakes and Rheostats. Jonathan P. B. Fiske, Alliance, Ohio. Filed Dec. 6, 1894.

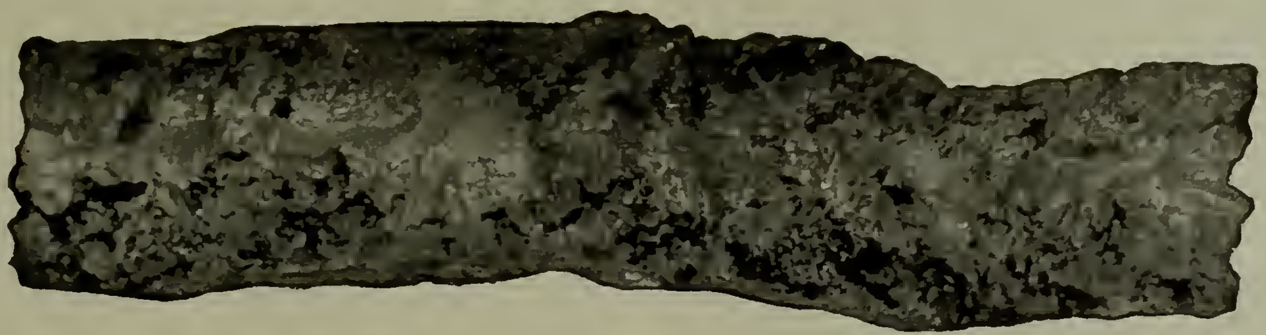
543,525. Electric Motor and Brake Mechanism Therefor. Jonathan P. B Fiske, Alliance, Ohio. Filed Feb. 9, 1895.

543,529. Electric-Trolley. George W. Hooper, Rochester, N. Y., assignor to James S. Baker, same place. Filed Sept. 11, 1894.

543,544. Electric-Car Brake. George B. Damon, Lowell, Mass., assignor of one-half to Gardner W. Pearson, same place. Filed Apr. 9, 1894.

543,548. Burglar-Alarm. Joshua Given, Elgin, Ill. Filed Oct. 9, 1894.

543,557. Overhead Travelling Crane. Thomas R. Morgan, Sr., Alliance, Ohio, assignor of three-fourths to Thomas R. Morgan, Jr., John R. Morgan, and William H. Morgan, same place. Filed Sept. 10, 1894.



CROSS SECTION OF PLATE, BROKEN TO SHOW POROSITY.

No. 50 Exchange Place,

New York, July 17th, 1895.

Dear Sir :

The undersigned cordially invite you to examine and test a new Storage Battery, which by our method of manufacture we are enabled to put on the market at *one-half* the cost of any Storage battery now in general use.

A commercial plant of 60 cells has just been completed at No. 84 Pearl St. corner of Front St., Brooklyn, and can be seen at any time.

The main features of this battery are :

First. It has all the advantages of the Planté type of cell and none of the disadvantages, such as the use of innumerable thin lead plates that are soon eaten up, allow the peroxide to peal off, and the cost of which is much greater than by our method.

Second. Being of the Planté type, the active material is formed by electrolytic action and is therefore free from all extraneous matter such as is mixed with the different oxides that are mechanically applied to batteries of the Faure type.

Third. Our plates are thick and well put together, and being very porous and spongy before they are formed electrically, have the active material deposited in the many large and small cells and interstices throughout the body of the plates, instead of only on the outer surface, as in the case of the ordinary plates.

Fourth. The amount of surface throughout the plate is very great, owing to the great porosity of the same.

Fifth. Although very porous, the plates are not made so by compressing a quantity of particles into partial contact with each other, (which produces a very fragile plate and one of high resistance), but is *one continuous mass* of lead with a sponge-like formation.

Sixth. It is entirely free from any question of infringement of any other battery; and our claims are simple and controlling.

Seventh. This is the only battery, where porous lead is used, that has the plate made of one piece of lead.

Eighth. When extreme lightness is a desideratum, for special purposes, our battery can be made to weigh less than one-half as much as any other now in use, of the same capacity, and yet its life remain as long, at least, as any other.

Very respectfully,

J. HERON CROSMAN,
Room 29, No. 50 Exchange Place.

J. HART ROBERTSON,
Electrician,
No. 84 Pearl Street, Brooklyn.

543.559. Signaling Apparatus for Telephone-Exchange Circuits. Joseph J. O'Connell, Chicago, Ill., assignor to the American Bell Telephone Company, Boston, Mass. Filed May 14, 1895.

543. 564. Reactive Coil. Edgar E. Stark, New York, N. Y., assignor to Sigmund Bergman, same place. Filed Feb. 21, 1894.

543 581. Automatic Car-Ventilator. George H. Maynard, Boston, Mass. Filed July 12, 1894.

543 587. Machine for Making Tubing. James. S. Wilson, Chelsea, Mass. Filed June 7, 1894.

543 591. Railway Signaling System. Thomas B. Dixon, Henderson, Ky. Filed Nov. 17, 1892.

543.592. E ectrical Railway Signaling System. Thomas B. Dixon, Henderson, Ky. Filed Oct. 5, 1893.

543,594. Electrical Railway Signaling System. Thomas B. Dixon, Henderson, Ky. Filed July 10, 1894.

543.595. Electrical Railway Signaling System Thomas B. Dixon, Henderson, Ky. Filed Aug. 20, 1894.

543,596. Electrical Railway Signaling System. Thomas B. Dixon, Henderson, Ky. Filed Aug. 20 1894.

543,597. Track-Instrument. Thomas B. Dixon, Henderson, Ky. Filed Aug. 20, 1894.

543,613. Manhole for Underground Conduits James F. Cummings, Detroit, Mich., assignor to the Cummings & Engelman Conduit Company, same place. Filed Nov. 6, 1894.

543,616. Internal Illuminator and Probe. Willard E. Dow, Braintree, Mass. Filed Feb. 16, 1895.

543 618 Burglar-Alarm. John H. Finley, Morgantown, assignor of one-fourth to Clay P. Johnson and George M. Johnson, Reedyville, Ky. Filed Oct. 13, 1894.

543,625. Machine for Boring Joists for Electric Light Wiring. John G. Henderson and Robert H. Henderson, Chicago, Ill. Filed Oct. 3, 1894.

543 626. Transmitting and Receiving Attachment for Telephones. Hosea W. Libbey, Boston, Mass. Filed Oct. 9, 1894.

543,653. Electric-Brake Shoe. William B. Potter, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed Mar. 30, 1895.

543,654. Electric Soldering-Iron. Frank B. Rae, Detroit, Mich, assignor to Charles L. Coffin, same place. Filed Sept. 18, 1894.

543.655. Watchman's Time-Recorder. George F. Ransom, Milwaukee, Wis., assignor of one-half to Harold G. Underwood, same place. Filed Sept. 4, 1894.

543,670. Four-Motor Reversing-Switch. Frank E Case, Schenectady. N. Y., assignor to the General Electric Co. of New York. Filed May 15, 1895.

543.673. Process of Extracting Precious Metals from their Ores. Middleton Crawford, Colorado Springs, Colo., assignor of three-fourths to Thomas C. Parrish and Duncan Chisholm, same place, and James Pourtales, Silesia, Germany. Filed Oct. 29, 1894.

543,680. Secondary Voltaic Battery. Ludwig Epstein, London, England. Filed Jan. 5, 1895. Patented in France Jan. 2, 1895, No. 244,081; in Belgium Jan 2, 1895, No. 113,496; in Italy Jan. 18, 1895, LXXIV, 245, and in Canada Feb. 4, 1895, No. 48,124.

543,686. Thread-Guide for Electrical Stop-Motions. Robert C. Holt, Troy, N. Y. Filed Oct. 29, 1894.

543.687. Car-Fender. Thomas Houghton, Philadelphia, Pa. Filed May 11, 1895.

543.707. Electric Clock-Winding Mechanism. William S. Scales, Everett, assignor to the Columbian Clock Company, Boston, Mass. Filed Nov. 12, 1894.

543.708. Telephone-Exchange. Wada Y. Shibata, San Francisco, Cal. Filed Nov. 24, 1893.

543.716. Car-Brake. Addison Barker, Camanche, Iowa. Filed May 22, 1894.

543.721. Signaling on Railways and Means Therefor. Edwin Blakey, Bradford, assignor to the Automatic Electric Railway Signal Company, Liverpool, England. Filed June 11, 1894.

543 729. Electric-Arc Lamp Charles E. Harthan, Lynn, Mass., assignor, by mesne assignment, to the General Electric Company, Schenectady, N. Y. Filed Nov. 21, 1894.

543 775. Car-Fender. George H. Modemann, New York, N. Y. Filed July 2, 1894.

543.785. Railway Signaling. Jens G. Schreuder, Edgewood Park, assignor to the Union Switch and Signal Company, Swissvale, Pa Filed Mar. 28, 1894.

543.793. Switch and Signal Mechanism. John V. Young, Boston, Mass., assignor to the Union Switch and Signal Company, Swissvale, Pa. Filed Aug. 29, 1894.

543.798. Telephone. Norval L. Burchell, Washington, D. C. Filed Oct. 29, 1894.

543,800. Electric Heating-Rug. Jesse R. Davis, Parkersburg, W. Va., assignor of one-third to Charles A. Wade, same place. Filed July 11, 1894.

543,824. Electro-deposition of Alloy. Henry J. Altman. New York, N. Y., assignor of one-half to Max H. Fischer, same place. Filed Apr. 12, 1894.

ELECTRICAL AGE

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CONTENTS.

ELECTRICALLY PROPELLED CANAL BOATS.

The use of electric power for the propulsion of boats on the Erie Canal is, no doubt, only a question of time. A beginning in that direction will be made on September 25, when a test of a new system will take place between Buffalo and Tonawanda. A stretch of four miles of the water-way will be the scene of the experiments, which are to be conducted by the Cataract General Electric Company. The power to generate the electric current will be furnished by the Niagara Power Company.

ELECTRIC POWER ON THE PENNSYLVANIA RAILROAD.

The Burlington and Mt. Holly Branch of the Pennsylvania Railroad became a full-fledged electric railway on July 22, and the steam locomotive gave, figuratively speaking, a sad farewell blast on its whistle. The Pennsylvania Railroad Company is known to be one of the most conservative concerns of its kind, and when it makes a departure in any branch of its vast business it is always after careful consideration and deep investigation into the claims made for the system or apparatus substituted. Therefore the endorsement of the electric system of propulsion for railroad purposes thus given by the Pennsylvania Railroad is one of the most substantial proofs that the sphere of the steam locomotive is destined to become considerably narrowed. The length of the Burlington and Mount Holly branch is eight miles. In this connection the article printed on another page concerning the arrangements made between the Westinghouse Electric and Mfg. Co. and the Baldwin Locomotive Works, for the building of electric locomotives by the latter, will be of special interest to our readers.

TO TEST THE VALIDITY OF THE BERLINER PATENT.

The long looked-for outbreak of hostilities between the American Bell Telephone Co. and some other concern on the basis of the Berliner transmitter patent has at last occurred, and the "some other concern" selected to stand up before the Bell Company's fire is the National Telephone Manufacturing Co., of Boston. The preliminaries of the contest have all been arranged, and on the first Tuesday in September (the 3d) the case will be heard before the United States Court in Boston. The Bell Company seeks to restrain the National Company from infringing the Berliner patent, and the legal contest will no doubt be a lively one. There is considerable divergence of opinion as to the real situation. One party holds that the newly organized Eastern Telephone Association will champion the cause of the defendant; while another party claims that it is a friendly suit, and that the Eastern Telephone Association has nothing to do with it except as an interested spectator. Which of these assertions is correct is known only to those directly interested, and they, up to the present time, have pursued diplomatic secrecy as to the inside facts. If the case is to be a genuine test of merit then the National Company is entitled to and undoubtedly will receive the unqualified support of the Eastern Association, for never has there been a more worthy cause to contend for than the nullification of this the most unjust monopoly of modern times. It is abhorrent to every sense of justice that the telephone or any other monopoly should be prolonged 17 years on such a pretext as that afforded by the flimsy Berliner patent, and it is hoped that the pending suit will be a real test of the case on its merits. The extent of the Bell Company's influence is very great; but that company does not control the actions of everybody, and the Eastern Telephone Association will at the proper time let the telephone octopus know that organized independent action is something that cannot be trifled with.

NOTES ON THE RECONSTRUCTION OF A SMALL CENTRAL STATION PLANT.

BY FRANKLIN L. POPE.

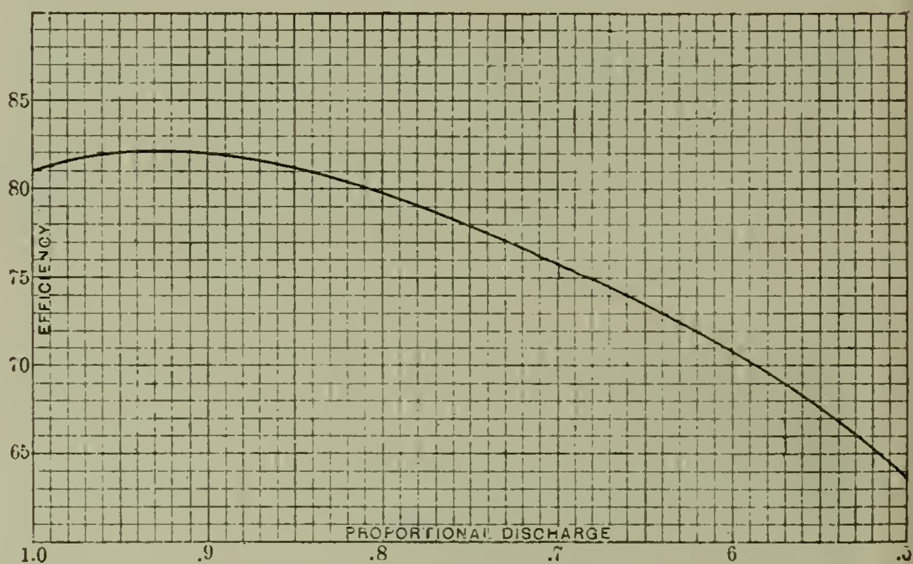
(*Concluded from Page 75.*)

In laying out the plant it was determined to bring the main feeders directly to a distributing station in the village, to be used principally as a convenient headquarters for testing the circuits and controlling the street-lighting service. In laying out the transmission line a surveyor was employed, and a preliminary line was run directly from the power-house to the distributing-station. The air-line distance was found to be 5.15 miles. About half the distance the transit-line was found to so nearly coincide with existing highways, that the consent of the local authorities was obtained to set the poles along the highway location; the remainder of the route lay principally through uncultivated land of little value. This enabled the line to be located with long stretches absolutely straight, avoiding all sharp angles; a very important consideration when heavy wires are used. The poles were of selected chestnut with natural butts, usually set five feet in the ground at maximum intervals of 125 feet. The poles were ordinarily 25 feet long and eight inches thick at the small end. Shorter poles were sometimes used on elevations and longer ones in depressions, in order to equalize the strain as much as possible. The insulators used were of the large double-bell white porcelain type (German government standard), and were imported by us from Berlin. The insulator of the top wire is set upon a malleable iron stem 14 inches long screwed into the top of the pole, which is tapered to five inches diameter and protected from splitting by driving on a wrought-iron ring. The tapered part of the pole, as well as the top, was given a coating of mineral paint mixed as thick as it could be spread with a brush. The insulator of the second wire is carried on a malleable iron goose-neck, screwed into a ⅝-inch hole bored in the side of the pole, in such position as to bring the wires about 16 inches apart. Another hole was bored on the opposite side of the pole, intended to take the goose-neck of the third wire at some future time, leaving the same interval between the second and third wires. The porcelain insulators are fixed to their iron supports by a packing of oakum placed between the screw-threads, which serves to prevent any danger of breakage by expansion or contraction. The line-wire is laid in a groove formed in the top of the insulator, except upon the curves and angles, in which case it is tied at the side in a circumferential groove, as is usual in this country. The feeder-wires were of No. 3 B & S. soft copper, covered with weather-proof "insulation" along the highway as a (concession to enlightened public opinion), but elsewhere bare. The lengths of wire were joined with McIntyre twisted couplings. Only two feeder wires have as yet been strung, providing for a single-phase current from one side of the two-phase generator, but it is the intention to run a third feeder hereafter, which will enable two-phase induction motors to be connected to the same distributing system.

A pair of telephone wires of No. 12 steel were strung below the feeder wires, and these were supported upon small German porcelain insulators on iron goose-necks on opposite sides of the poles. These wires were transposed at intervals of about a mile, in order to eliminate the inductive effects of the alternating current in the feeders. The feeder lines were carried under the railroad at an undergrade crossing by placing the insulators upon iron brackets leaded into the stone abutments. The plan of construction above described makes a strong, handsome and durable line, while the insulation of the circuit even in the worst of weather is simply faultless.

The system has been planned to deliver the current at the distributing station at a uniform pressure of 2,100 volts. Two distributing centres were fixed upon in the old Edison 3-wire network, and at each of these points a pair of large transformers, having a ratio of 20 : 1, were fixed upon a pole, with their respective primaries in series between a pair of branch feeders from the distributing system, and their secondaries were coupled in series in like manner with the neutral wire between them. None of the consumers on the old Edison system knew when the change had been made to the new service from anything they were able to notice in the behavior of the lights.

The next thing done was to reconstruct the street-lighting system. In place of the 36 arcs of 1500 nominal c. p. formerly in use we substituted 126 incandescent lamps of 50 volts and 32 c. p., placed in Iona fixtures projecting horizontally from the poles 14 feet above the ground. The lights, as a rule, were fixed upon every alternate pole, but in the business centre, the street being broad, they were placed on each side at intervals of about 250 feet, and staggered, so as not to come opposite each other. A Shallenberger shunt cut-out was applied to each lamp. The usual number of lamps in each circuit was 42, although we have since placed, in some cases, as many as 47 in one series without reducing the brilliancy of illumination sufficiently to be noticeable by any one but an expert. One end of each street-lighting circuit is joined to a special feeder leading to the sub-station, where it is connected with the main feeder through a knife-switch. The other end of each lamp-circuit is connected to any conveniently located branch feeder of the regular commercial



EFFICIENCY CURVE OF WATER WHEEL.

lighting service. Each lamp circuit has, or will have, a fuse-block and cut-out enclosed in a weather-proof box at each end, where it joins the opposite feeders. These 32-c. p. lamps, when run at full candle-power, furnish a most satisfactory illumination and give the streets a very attractive appearance.

It has been found to be desirable to use a lamp of rather low efficiency for the street-lighting service, as there is always danger of leakage and short circuits from wet boughs of trees and other objects getting into contact with the wires, and thus diverting an abnormal current through some portion of a lamp circuit. In such case, a lamp of high efficiency is pretty certain to be burned out, or at least to have its career of usefulness materially abridged. In this plant the average consumption of energy in the street-lights, including lamps, lines, shunts, and leakage is found to be about 140 watts per lamp of 32 c. p.

Perhaps the most ticklish part of the whole undertaking was the changing over of the Westinghouse system, which was a 1,050-volt primary and a 52-volt secondary, running at 16,500 alternations. In accordance with the new plan it was, of course, necessary to double the pressure both in the primary and secondary circuits, and to substitute 104-volt for 52-volt lamps throughout. A preliminary test of one of the transformers demonstrated, that which perhaps might have been foreseen from theoretical considerations, viz: that a dangerous quantity of heat was developed within a few hours when it was used to convert from 2,000 volts down to 100. In order to utilize, so far as possible, the old transformers, and at the same time avoid the above difficulty, various expedients were resorted to. Wherever a group of consumers was located in one neighborhood, a pair of large transformers was installed, with secondary mains extending from 500 to 600 feet in various directions; these transformers being of course placed in series with each other Scattering consumers, as far as practicable, were connected together in small groups and supplied by a pair of small transformers coupled in the same way. The Westinghouse meters, having been originally constructed for a frequency of 16,500 alternations, ran slow when the frequency was reduced to 8,000. The necessary coefficient for correction of the readings was easily ascertained by experiment, and as fast as possible the meters were fitted with new disks, supplied by the Westinghouse company at a trifling expense, and adapted to the lower frequency.

Of course it will be understood that the reason for resorting to these various shifts and expedients was merely that we might utilize the old apparatus as far as it could possibly be done, and also that we might carry on the work of reconstruction, for the most part, with the ordinary working force of the establishment.

The horizontal double turbine which is used to drive the two phase generator has done such good work that it deserves a few words of commendation. The selection of the best among the many available types of turbines for electric work is a matter which merits far more consideration from a scientific standpoint than it generally receives.

It is but just to say that it is seldom that a turbine makes so favorable a showing, not only in this but in other respects, as the one provided by the company from which we lease our power.

When the quantity of water used was diminished from 81.75 to 42.55 cubic feet per second the percentage of efficiency fell only from 80.99 to 63 9, and what is even more remarkable, it was found that the efficiency remained well above 80 per cent. over a range of variation of discharge from 83.22 to 70 cubic feet per second, or 15.9 per cent. More than one type of turbine, which enjoys a high reputation and extensive sale among manufacturers, will not reach 65 or even 60 per cent. efficiency at "three-quarters gate," while the 33" wheel above referred to has been found to give, by actual test, 78 per cent. under similar conditions.

The turbine carries upon its shaft a driving pulley 100 inches in diameter weighing 11,000 lbs., which serves as a balance-wheel. It is also provided with a Replogle electric governor operated by three cells of gravity battery, which has never failed to do its work quickly and certainly, even under trying conditions.

In carrying out this work, some things have been learned by experience which may be of use to others called upon to advise or to undertake the construction of similar works, and I will therefore venture to summarize some of my conclusions as follows:

1. In considering the advisability of operating an electric plant by water-power do not on any account neglect to ascertain, from authentic sources of information, just how much water can be depended upon during the low stage in an extra dry year, *for this is the measure of its value for electric work* except when used as an auxiliary to steam. The ordinary estimates of the commercial value of a water-power are only too apt to prove preposterous exaggerations.

2. If rights of way or releases of damages can be obtained without too much trouble and expense, it is better to build the feeder line as directly across country as may be than to follow a highway. The saving in cost of construction will usually be more than enough to pay for the right of way, and on such a route there need be no interference from trees, while many inconvenient angles and much trouble in guying and bracing are avoided. Shorter and stouter poles may also be used, in itself a very important consideration.

3. In electric line-construction it is preferable to dispense with cross-arms, unless there are more than six wires. The best arrangement is to place one wire on a top pin and the others alternately on the front and back of the pole, at a vertical distance apart of 12 inches. This construction not only costs less than properly braced cross-arms, but is much less conspicuous and therefore much less objectionable in a public street; is less interfered with by trees; and is far more durable. Much trouble is caused by the decay of cross-arms after they have been exposed a few years to the weather; they split at the ends so that the pins come out, and not infrequently break in the middle, thus fouling the wires.

4. In medium-sized towns and cities, especially in shaded streets, the incandescent lamp may be made to give a far better distribution of light for the same money than is possible with the "half-arcs" so extensively used, and is much less troublesome to maintain in good working order. My own experience leads me to think that the lamps ought not to be of less than 24 or more than 32 candle-power. Use lamps of low rather than high efficiency, but run them at full candle-power or even a trifle above. Good street lights, well arranged and renewed sufficiently often, are the best possible advertisement for any electric company.

5. Use large transformers as far as practicable, placing the consumers within 500 or 600 feet radius upon secondary mains. We have used both two-wire and three-wire mains. The latter plan is certainly to be recommended when the distance approximates or exceeds 500 feet, but for short distances, as for example, when distributing within a single block at a pressure of 100 volts or more, it is a question whether the gain in cost of copper over the two-wire plant is of sufficient importance to offset the additional complexity.

6. It was found that raising the voltage in the residence district from 1,000 : 50 to 2,000 : 100 greatly improved the uniformity of distribution by lessening the potential drop without entailing any corresponding disadvantages. It would seem to be preferable, on every account, to use the higher pressure.

7. One of the most important minor points in the management of a plant is apt to be too much neglected; the maintenance of the insulation of the wires by promptly replacing all cracked and broken insulators, and by keeping the wires absolutely free from contact with uninsulated objects. The covered wires which lead into the hoods of the street lamps need to be carefully looked after.

8. Number all the poles with yellow paint applied with a stencil on a black ground, and keep a record book of the position of each one and its distance by the line from the test-station.

9. In selecting a turbine wheel, consult competent authorities as to the available fall and minimum quantity of water, and when making the purchase do not expect to get a thousand-dollar wheel for a hundred dollars. Pay a fair price and insist, not only that the wheel shall be well made in every way, but that it shall be tested by an expert before acceptance. If it does not give an average efficiency of 76 per cent. between half-gate and full gate it is not advisable to accept it, inasmuch as you can easily do better, as our own experience proves.

10. I think our experience shows that it is possible to largely increase the net earnings of an old plant without necessarily refitting it throughout, but plenty of time should be taken for consideration as well as for execution, in order to secure satisfactory results with a moderate expenditure.

THE EASTERN TELEPHONE ASSOCIATION.

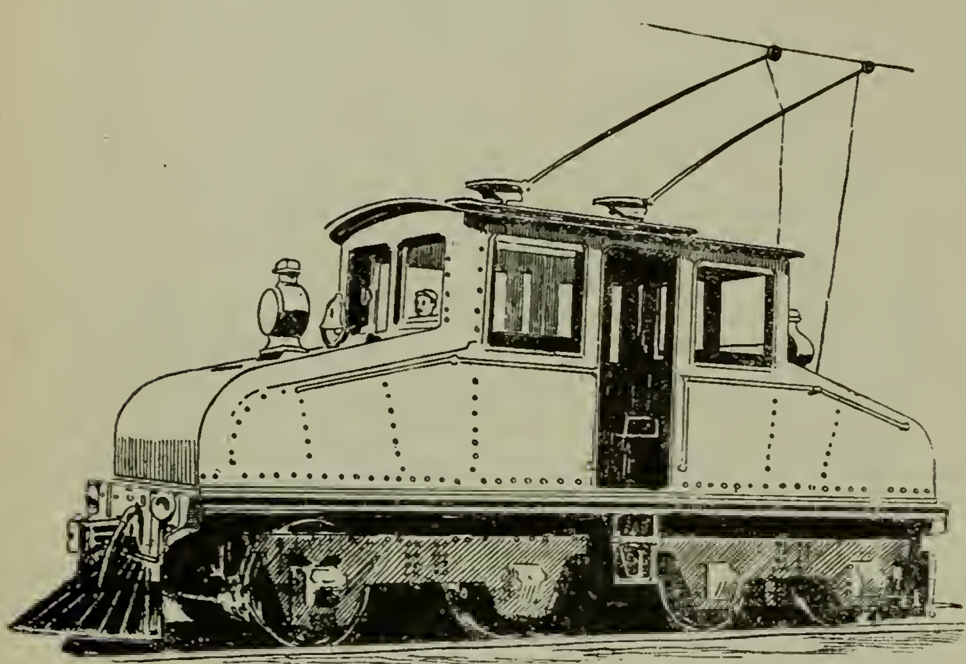
On Wednesday, Aug. 7, the committee appointed to perfect plans for the organization of the Eastern Telephone Association was held at the Astor House, New York. The proposed constitution, by-laws, etc., were considered and agreed to, the same to be submitted to a general meeting of the members of the Association for ratification. This meeting was set for Thursday, August 15, at the Astor House, and it is thought that the plans formulated by the committee will be adopted practically as they are reported to the main body.

IMPORTANT DEAL BETWEEN THE WESTINGHOUSE CO. AND THE BALDWIN LOCOMOTIVE WORKS.

On August 5 the Baldwin Locomotive Works, of Philadelphia, and the Westinghouse Electric and Mfg. Co., Pittsburgh, completed a deal by which the Baldwin Company will build electric locomotives. This is the beginning of what will probably be an undertaking of great importance to the motive power of railways in the future.

The two concerns have combined interests, so far as relates to the construction of locomotives under certain patents and after certain designs, in which electric power will be the method of propulsion. It is stated that the Baldwin Company will build electric locomotives on a large scale.

The kind of locomotive which the combined plant of the Westinghouse and Baldwin Companies will produce will be practically of the same type as the experimental locomotive used on the New York, New Haven and Hartford Railroad, on the Nantasket Beach division. A locomotive of similar construction will probably be used on the Burlington and Mount Holly branch of the Pennsylvania Railroad, upon which the overhead electrical equipment has been adopted as an experiment.



WESTINGHOUSE-BALDWIN ELECTRIC LOCOMOTIVE.

Referring to the combination the New York *Sun*, on August 10, prints an editorial article in which it is stated that "the problem of the use of electricity for such a purpose [railway locomotion] may now be regarded as solved, after many years of experiment and investigation.

"The steam railroads are discovering that as a means of self-protection against competing electric roads, in suburban traffic, for instance, they are likely to be compelled to make extensive use of the new agent. Electricity permits, and its profitable employment requires, that its motive force shall be put to constant service. By its means trains can be run with very brief interruptions and at small proportionate expense, and hence its superiority to steam on the short distances of suburban travel, so enormous in amount, seems to be unquestionable. It would enable a railway to run its trains in almost continuous procession, so that the traveller would find the transportation ready for him whenever he arrived at the station, or, at most, he would have to wait for it for a few minutes only. He would not have to consult a time-table and exhaust himself in hurrying to catch a train to save himself from a cold dinner or from the reprobation of his employer.

"Moreover, the electric lines are gradually becoming continuous between large centres of population, running through town after town; and inevitably they will be consolidated in systems, which will make their competition with the steam roads still more serious, if those are not prepared to meet it by themselves making use of the electric motor. The railroad situation has been changed radically by the introduction of the new agent, and the railroads accordingly must adjust themselves to the novel conditions or suffer because of them. At present the prospect of the use of electricity in long hauls on the great trunk lines seems at least far distant. Those concerned in this manufacturing combination say that they are not influenced immediately by any such outlook; but they must foresee that eventually the motor which demonstrates its superiority in the more restricted sphere is sure to be adapted and developed for the largest and broadest use. They are making ready for the coming day of the general triumph of the electric motor over steam."

THE WASHINGTON AND BALTIMORE ELECTRIC LINE.

The Columbia and Maryland Electric Railway, which is to run between Baltimore and Washington, and the contract for the building of which was recently awarded to E. D. Smith & Co., of Philadelphia, will be, according to the contract, completed within one year.

The line will be a double-track road with 85-lb. steel rails, standard ties and stone ballast. Heavy masonry bridges are to be constructed, and the whole road will be equipped as substantially as a steam railroad. The firm is also to build a branch road from Baltimore to Ellicott City, Md., a distance of about ten miles. The aggregate cost of construction of both roads will be nearly $3,000,000.

There are to be two power stations, one on the Patapsco River and the other at Laurel, Md. The contracts for the overhead construction of the road and the equipment with rolling stock have not yet been awarded. The motors used will be of great capacity in order to maintain a high rate of speed.

Widener & Elkins, of Philadelphia, have announced that it is their intention to make the road a through line between the two cities, and to have it enter into active competition with the steam roads. Fast time is to be made by trolley express trains, and the terminal facilities in both cities will be ample for a heavy traffic.

ELECTRIC STREET RAILWAYS IN EUROPE.

The following is a list of electric street railways in Europe as published in the *Deutsche Zeitschrift für Electrotechnik.* It gives the length of track and the number of motor cars of each road. Some of the roads named are under construction, and are incorporated in the list, at the end.

Place.	Length of track in miles.	Number of motor cars.
Working.		
Halle	10.5	36
Gera	6.6	18
Kiev	8	39
Breslau	17.4	40
Essen	13.7	24
Chemnitz	14.8	28
Christiana	4.6	15
Dortmund	9	30
Lübeck	8.5	28
Plauen	3.7	9
Konigsberg	3.4	8
Altenburg	2.5	7
Buda Pesth	25	92
Hanover	14.3	32
Dresden	7.5	16
Genoa	1.2	4
Barmen	3.7	15
Mülhausen	3	9
Lichterfelde	8.5	10
Lemberg	10	16
Bucharest	5.3	5
Modling	3.7	8
Frankfort-on-Main	4.2	18

(*Continued on Page 94.*)

PRINCIPLES OF DYNAMO DESIGN.

BY

Newton Harrison, E.E.

(*Continued from Page* 60.)

An important point to be observed in the construction of compound wound machines is the time interval elapsing between the application of a magneto-motive force and its resultant magnetization.

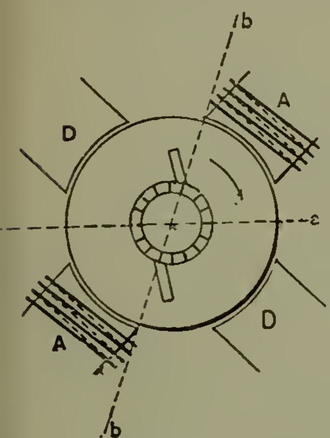


FIG. 1.

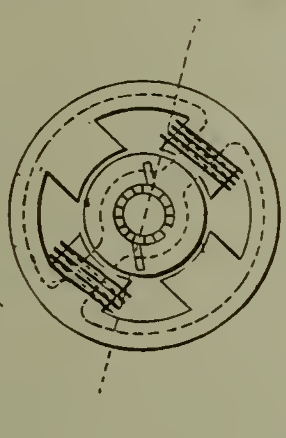


FIG. 2.

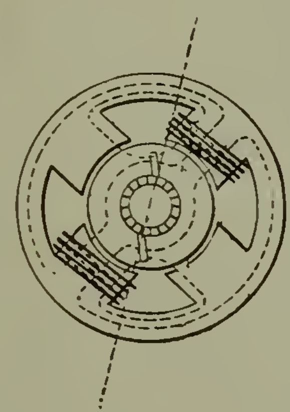


FIG. 3.

A variety of means for effecting the field strength of machines have been employed, such as the division of the field winding into distinct windings of a percentage of the total turns to each; then varying the field by the commutation of more or less of the turns as required to strengthen or weaken the field. A great objection to such methods, however, arises from the fact that the iron does n ot immediately obey the influence tending to affect it.

Therefore, for a rapid or instantaneous means of regulation this method possesses ineradicable defects. But the increased strength of field for regulative purposes, such as called for by the demands of daily practice, can be most efficiently produced by the use of laminated fields and a low saturation. There are cases in electric railroading in which it is absolutely necessary to have a compound wound machine that will respond with facility to the changes of load put upon it. The immense variations created by the sudden starting of many cars at the same time will require a positive action in the generator of the proper amount to compensate for the sudden drop experienced along the line and the heavy rush of current from the generator; therefore the necessity of having due observance made of the above conditions will be best appreciated in such extreme cases. In electric light practice, especially where there are simple isolated plants, the degree of regulation is not carried on between such wide limits. The grouping of lights is such that a gradually increasing load is all that is experienced at the most by the sudden throwing on of any circuit, unless the entire plant illuminates one large chamber. The actual practice of compounding as witnessed in the shop was as follows. The shunt coils were adjusted until the normal E. M. F. was being generated; then the compound winding, which consisted of a flat band of copper wound around the pole-pieces, was arranged on the dynamo; then a series of rheostats consisting of iron wire wound on slate frames equal to the greatest load was thrown on to the machine. The flat bands of copper were then reduced in length until the variation in voltage caused by the sudden throwing on of the entire load was limited to one and one-half volts. To compound by this process a Corliss engine of equivalent make must be employed to take up the sudden strain thus experienced.

For *over-compounding* the E. M. F. is increased so that at full load the loss in the line subtracted from the E. M. F. of machine leaves the proper potential difference in the feeders or mains. The graphical representation of such a system of regulation is of great interest to the designer. It will easily indicate the under or over-compounding, and its effect upon the practical requirements of the machine. It is possible to compound in such a way as to give rise to very much more than the proper and necessary voltage. This is detrimental in the sense of being a useless waste of power and an over-excellent system of regulation. Its effect upon the cost of a plant for lamps would be an item of such proportions as to show its destructive effects. Under-compounding, on the contrary, would mean a poor illumination if not carried out to the proper point and show a little better regulation than that without any compound coil. Elihu Thomson, in common with other competent engineers, has made the statement that the output of a machine is less limited by the armature reaction, and therefore the necessity for compound winding, than by the heat capacity of the armature. Like the strains and stresses which may be put upon materials without fracturing them, the consequence, or lack of usefulness in all cases is limited by either the inability of the material to stand the strain or the possible effects of this strain upon other adjacent parts. The absence of heat from the armature is a most important point of undoubted weight when armature reaction is considered.

The gradual tendency to destroy the E. M. F. of a dynamo, due to the negative effects of the current in the armature, and probably the number of cases in which the ordinary compoundings were not actually automatic in their effects, might have led to the development of the novel and unique method of Thomson. In this, advantage is taken of the magneto-motive force of the armature to create a new path in which this magneto-motive force might act to increase the field strength of the dynamo so that an increase of current in the armature would by the proper guidance be made to act favorably upon the field.

The illustrations show clearly the means employed. A pair of dead poles are arranged, in a bipolar machine at right angles to the original pair, so that the magnetizing effect of those coils at right angles to the dead poles is immediately available. Thomson recommends that they be made adjustable, so as to follow the field around to its strongest point of cross magnetization. All of the effects of under or over-compounding can be easily obtained by this means. The adjustment must also be observed between the speed of the armature, the turns on the armature and the initial strength of field. Fig. 1 represents the

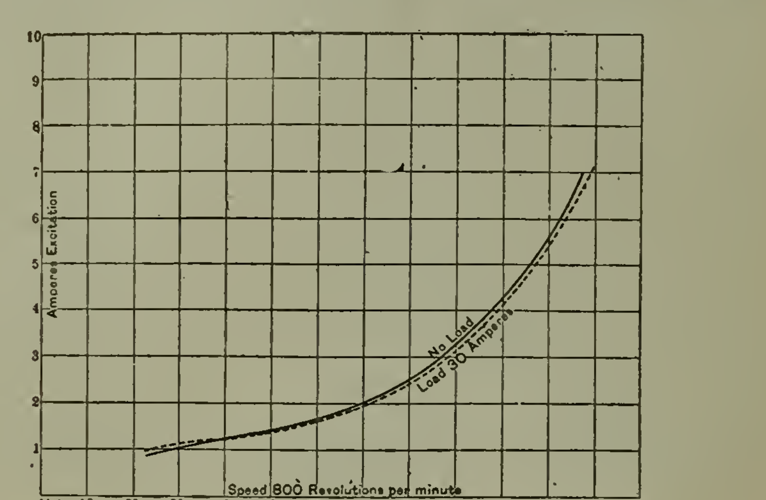


FIG. 4.

arrangement of poles in an ordinary bipolar machine, commutation being carried on within the magnetic fringe of the pole-piece. In Figs. 2 and 3 the appearance of the magnetic circuit with and without load on the armature is represented.

In Fig. 2, as there is no load, no flux issues into the dead or inactive pole-pieces, but in Fig 3 the flux between the pole face and the armature of the dead poles increases in the direction of rotation.

The curve of the load, Fig. 4, is given with the variations consequent upon any change, the volts running up to 120 and the amperes 7 in the fields, the difference between a load of 30 amperes and no load is so slight as to excite admiration. The probable expense of so peculiar a method would be high as compared with the few turns ordinarily used in compounding moderately large machines; yet the beauty of so finely automatic and self-contained a manner of regulation is worthy of the closest attention.

(*To be continued.*)

PHILADELPHIA'S ELECTRICAL INTERESTS.

CONTINUED FROM PAGE 79.

THE ELECTRIC STORAGE BATTERY CO.

The substantial worth of the electric accumulator is at last being recognized in this country, and it is rapidly growing in favor and use. In the past few years many different makes of accumulators have been put upon the market, but very few withstood the supreme test of time, and the past is liberally dotted with the tombstones of departed storage batteries.

It is one of nature's laws that the fittest shall survive, and the operation of this immutable law is abundantly illustrated in the case of that most excellent electrical device—the accumulator—as in other things. Through the gradual sifting process one battery remains which is fully entitled to the field through its own merits, and which will likely hold it for a long time to come.

The Chloride Accumulator is well-known to all of our readers and it has proved itself to be a battery worthy of every claim made for it. It is not an experimental thing, but an every-day fact, doing duty as regularly and as reliably as the most perfect machine ever devised by man. Thousands of cells are in daily use in scores of places throughout the country and we have yet to hear of the first reported failure.

The Electric Storage Battery Company, of Philadelphia, appreciating the necessity for a commercially perfect system of electric storage, set to work over five years ago to produce such a system, and with the results of their efforts all are now quite familiar. It may be said that the perfected accumulator is so far in advance of anything hitherto attained that its advent inaugurated a new era in electric storage.

The Chloride Accumulator was the subject of a careful investigation by the Franklin Institute, Philadelphia, in 1894, and so favorable was the report made upon it that the inventor of the battery, Clement Payen, was awarded the John Scott legacy premium and medal.

The Electric Storage Battery Company now produces accumulators with every desirable quality, viz.: A high rate of charge and discharge without injury to the plate, a high storage capacity and the maintenance of the voltage through a very large percentage of the capacity. Besides these qualities, may be mentioned those of increased durability and economy of space.

It has become recognized that an accumulator plant is as essential to the economical operation of an electric light or power station, as is a gas-holder to the operation of a gas works, and the Chloride Accumulator has rapidly grown in favor for such uses One of the most noteworthy plants of this character is that in the station of the Germantown Electric Light Company, of Philadelphia, an illustration of which is given herewith (Fig. 1).

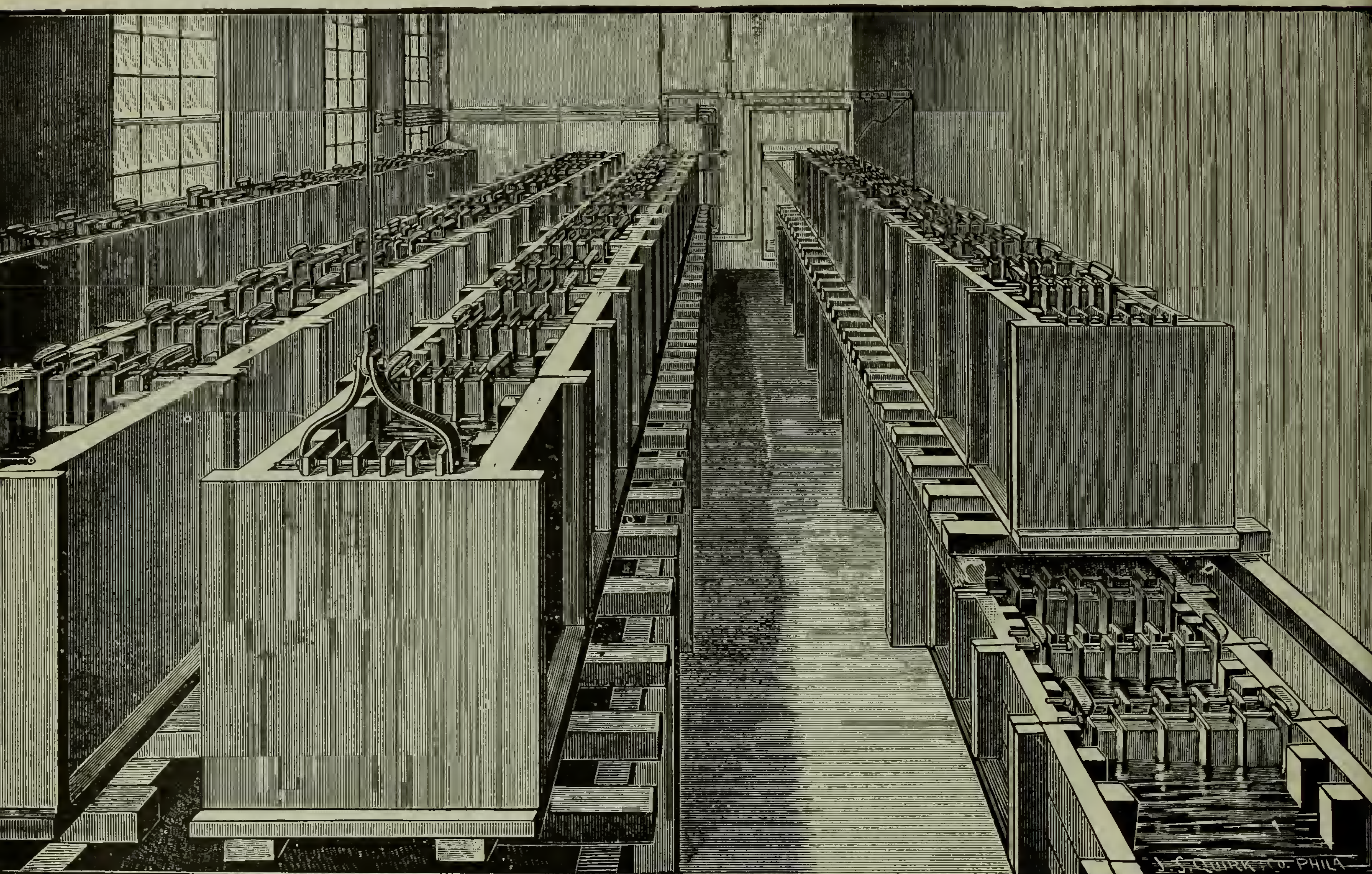


FIG. 1.—CHLORIDE ACCUMULATOR PLANT, GERMANTOWN ELECTRIC LIGHT CO., PHILADELPHIA.

This battery consists of 120 elements of the chloride type "G," eleven plates each. They are installed on the three-wire system and have a normal discharge of 100 amperes on each side and a capacity at this rate of 2,000 ampere-hours.

The special object of this battery is to carry the day load of the station for the commercial lighting and power circuit and also at times to carry a portion of the "peak" of the night load. The engines are shut down at daylight and the battery carries the whole load until dusk, at which time it is thrown out of circuit. It is charged between midnight and 6 A. M., when the station load is small. The cost of charging is practically nothing, as the machinery is more efficient and no extra labor is required, while during discharge the working force of the station is considerably reduced, the battery requiring but slight attention. The potential is maintained in discharge by cutting in reserve cells. The advantages of such a plant, therefore, are obvious.

tery been installed to store up the energy as generated. Another notable central station plant is being installed in one of the stations of the Edison Illuminating Company of New York, and having a capacity of 8,000 ampere-hours at 150 volts.

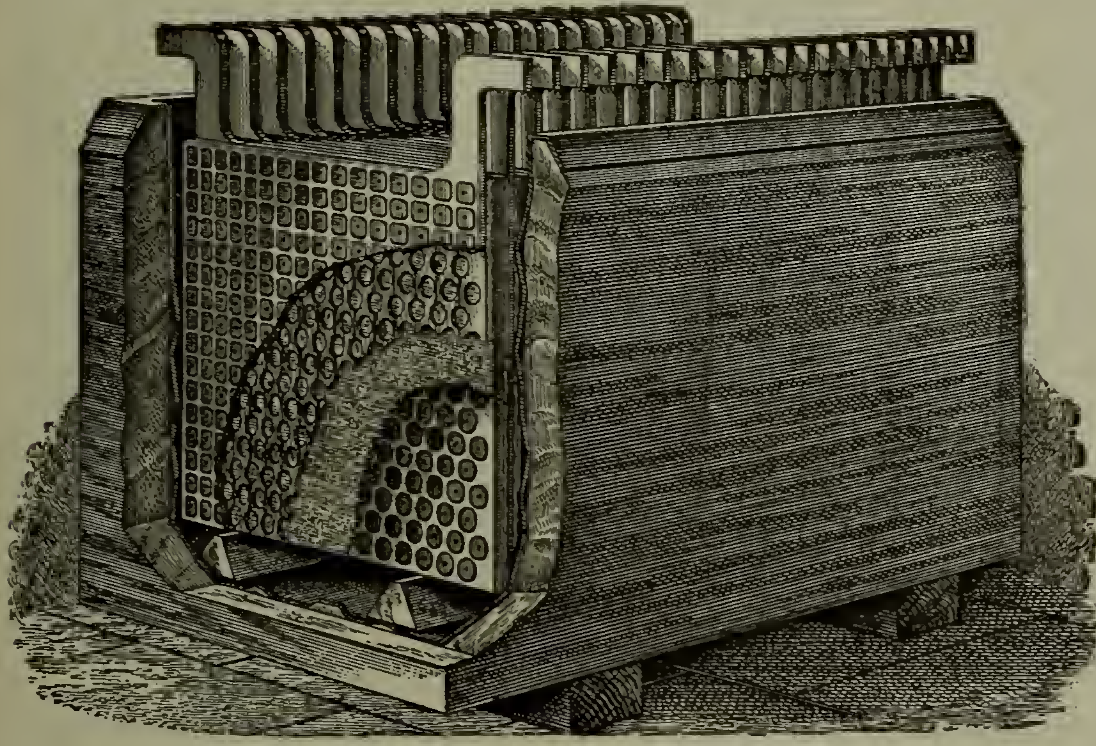


FIG. 2.—TYPE "G" CHLORIDE ACCUMULATOR.

FIG. 3.—TYPE "D."

A large central station for heat distribution has been operated for some time in Toledo, O., in which a chloride battery is used to store up the energy developed in the heating process. Heat is furnished to several dwellings by hot water, the water being heated by the exhaust steam from an engine which furnishes power to a dynamo used in charging the batteries. These dwellings are thus lighted by power that would be entirely lost had not a battery been installed to store up the energy as generated.

FIG. 4.—STANDARD SWITCHBOARD.

Storage plants are also of inestimable value as regulators of pressure, in case of fluctuations of load, and several such plants are now in daily use, notably by the Electric Light and Railway Company, Merrill, Wis. Many accumulators have been installed by the company for isolated lighting in factories, residences and large office buildings, and in every case the cost of light has been reduced to a very small item. They are also being extensively used in telegraph offices for the operation of local instruments, and many such plants are in successful daily operation.

Fig. 3 is an illustration of type D cell, glass jar. The size of the plates in this cell is 6 x 6 inches. This cell is made with 3, 5, 7, 9, 11 or 13 plates. The plates of type E cell measure 7 3/4 x 7 3/4 inches, this size cell being used for plants of 50 lights and over. For plants of 100 lights or more type F is used, with plate 10 1/2 x 10 1/2 inches.

The type G cell (Fig. 2) has plates 15 1/2 x 15 1/2 inches, and is designed for 200 lights and over. The plates are contained in a lead-lined tank, substantially built, the illustration showing the construction very clearly.

The standard switchboard of the Electric Storage Battery Co. is well shown in Fig. 4. This board is designed for isolated plants, the switches and instruments being mounted on a slab of white Italian marble, all the connections being made at the back of the board. The marble is set in a massive frame of polished oak, with brass cornerpieces, which give the switchboard an exceedingly handsome and artistic appearance.

These switchboards are made in sizes for 50, 100, 200, 300 and 500 amperes.

The Raymond Electric Co.—One of the oldest electrical concerns in Philadelphia is the Raymond Electric Co., 501 Chestnut street, manufacturers and dealers in general electrical appliances. They do all kinds of electric work, including electric gas lighting, burglar alarms, electric bells, watchman's clocks and incandescent wiring. Mr. W. I. Raymond is the manager.

The Resistance of one foot of commercial copper wire, one mil in diameter, is 10.8 ohms.

THE BALDWIN LOCOMOTIVE WORKS.

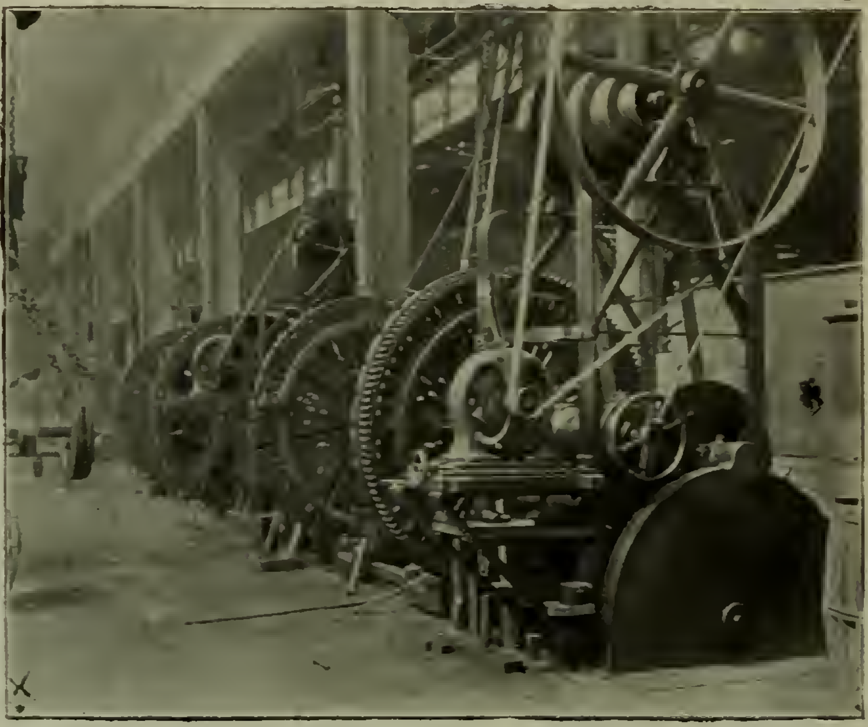
The first use of electric power in this immense establishment was in 1890, when the erecting shop was rebuilt. Here were put in two 100-tons' capacity Sellers electric travelling cranes. At first some trouble was experienced with the motors, burning out armatures, etc., but this was soon overcome and ever since then the company has had most satisfactory work from these cranes. Little was added to the electric plant beyond the running of two or three small line shafts, elevators, etc., until 1894, when the wheel shop was rebuilt. The old shop had a great deal of line shafting and several post cranes, and was very dark.

It took some twenty-five laborers to handle the heavy driving wheels, loading and unloading the machines, and on account of the continual strain on the girders from the jib cranes it was found almost impossible to keep the shafting in line. It was therefore decided to do away with shafting, belting and jib cranes in the new shop and put in a ten-ton Sellers electric traveling crane and run all of the machines by individual motors.

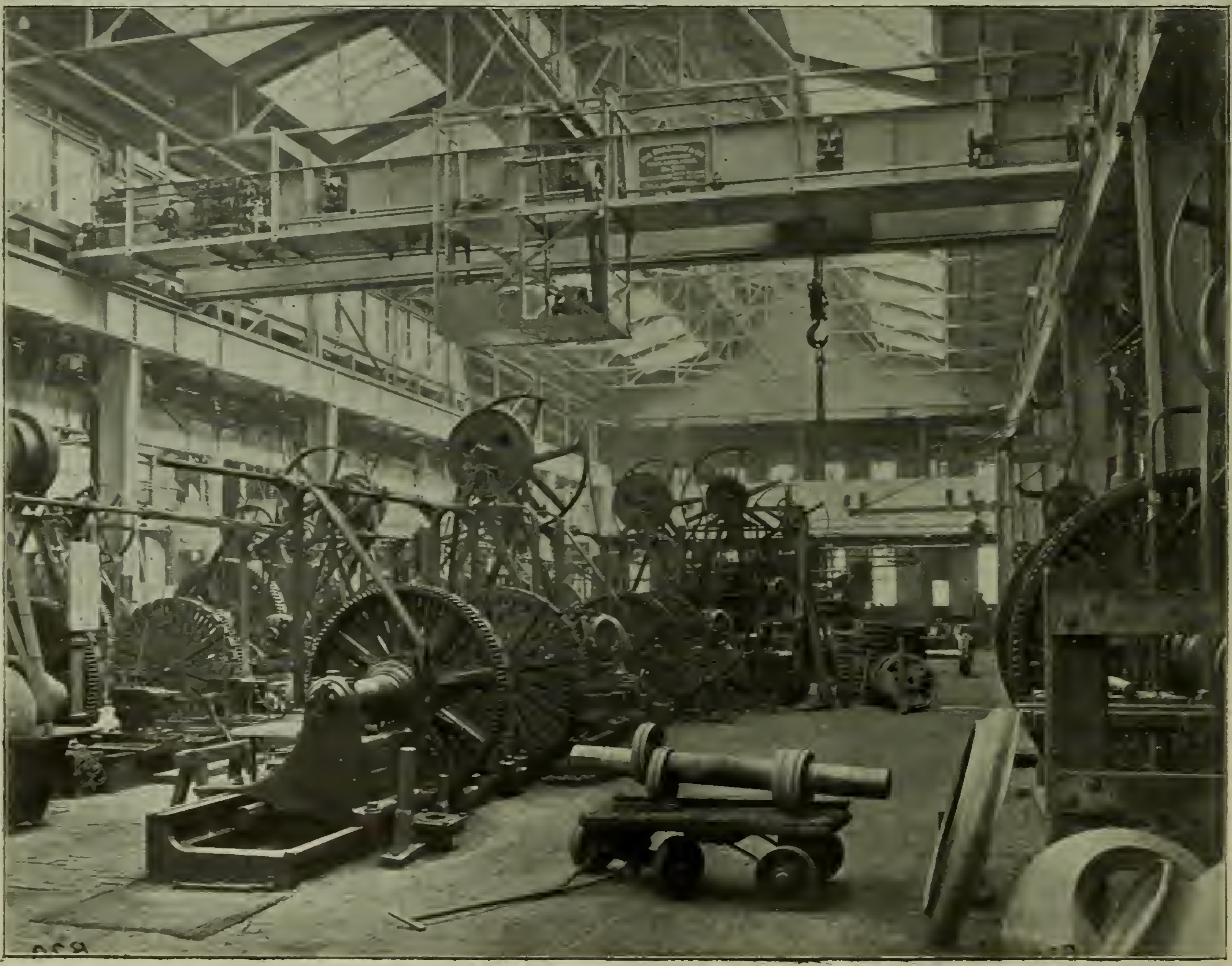
Since the completion of this shop the results have far surpassed expectations. The company now handles the work with one man, who is in charge of the crane (excepting the crane runner, of course), where before twenty-five men were needed. A pair of driving-wheels is loaded on a machine in five minutes where it took one-half an hour before.

Careful tests have been made of the power required for this shop, and the company finds a gain of from 20 to 30 per cent. by doing away with the line shafting and belting. It is able to get twice as much light from the skylights, because everything overhead is free from obstructions.

Many suggestions were offered by different electricians as to what was the best way of driving the machines, but none were altogether satisfactory, because the changes of speed which are required to operate these machines necessitated complications either electrically or mechanically, which were unsatisfactory.



ELECTRICALLY DRIVEN WHEEL MACHINE.



ELECTRIC CRANE, BALDWIN LOCOMOTIVE WORKS, PHILADELPHIA.

After much thought and consideration it was decided to hold on to the cone pulleys for variable speeds because, by doing so, it enabled the use of the plain motor running at one speed only and to connect with belting to the machine This the company believes is superior to gear connection, on account of the elasticity of the belt, which saves any sudden jar upon the motor, that might arise from various causes.

The motors for the wheel shop aggregate some 250 H. P. and are all driven by a 100-H. P. Westinghouse generator, which is seldom loaded to its full capacity, and then only for a few seconds at a time. This proves that all of the motors are never working at full load together, although all may be running.

This is a very novel shop throughout and has given the utmost satisfaction. Indirectly this is all due to the electric power, because otherwise the company must have held on to the line shafting and belting, and consequently could have had no travelling crane.

The Baldwin Company are now putting in a 250-H. P. direct-connected Westinghouse engine and generator, and are putting travelling cranes in the frame shop, which will be driven by electric power, besides three of the machine shops.

The accompanying illustrations are from the *American Machinist*, of New York.

BURK & PICKERING.

At No. 26 North Seventh Street, Philadelphia, is located the well-known establishment of Burke & Pickering. This firm carries on a large business in electrical construction, contracting, engineering, and repair work. They possess a large shop with splendid facilities for carrying on their business, which also includes the manufacture of electrical specialties and experimental work of all kinds.

This firm is licensed by the Philadelphia and Middle Department of Fire Underwriters' Association and the Edison Electric Light Co., and enjoys the distinction of being the only authorized wiring agents for the Citizen's Electric Light and Power Company. They are also members of the Master-Builders' Exchange.

Their headquarters are well stocked with a large supply of electrical goods of every description, and they give their special attention to arc and incandescent lighting, electric motors, fire alarms, electric gas lighting, burglar alarms, call bells, watchmen's time registers, telephones, speaking tubes and difficult repairing.

The firm consists of Sidney M. Burk and Harry H. Pickering. Both gentlemen have had extensive experience and have built up an excellent business.

THOMPSON & ALLEN.

This firm is one of the largest manufacturers of arc light supplies in Philadelphia. Their headquarters are at 1303-1307 Buttonwood street, and centrally located in the trade.

Thompson & Allen have a new process of hardening copper commutator segments, which they are using in refilling all kinds of commutators. They have been using this copper for over a year and have given it a careful and thorough test, with very gratifying results as to its durability. The firm makes a specialty of armature winding, and does electrical repairing of every kind. They manufacture a full line of arc light supplies, all of which are of the best material and finish.

The house is known for its reliability. They are bringing out a new trolley wheel, which will be superior to anything now in use.

In addition to the branches of business referred to they buy and sell second-hand dynamos and motors, and are doing a good trade in this line.

The firm is composed of F. H. Thompson and H. S. Allen, both being experienced in their business.

—In testing an Edison-Hopkinson dynamo, Dr. Hopkinson found it to have an efficiency of 93 per cent., the 7 per cent being lost, as follows :—Power lost in armature, 3.17 per cent; lost in magnet windings, 1.66 per cent; lost in core 1.94 per cent.

SHEBLE & PATTON, LTD.

This concern is doing some excellent work in the introduction of two-phase alternating current motors in Philadelphia. They are furnishing Stanley two-phase motors of any capacity and for any purpose for operation on the circuits of the Diamond Electric Co., the Kensington Electric Co., the Suburban Electric Co., and the Powelton Electric Co.

The firm also installs the direct-current apparatus of the Commercial Electric Co., and its work is uniformly of the best character in every respect.

In addition to the installation of the apparatus above named, the company manufactures in quantity a number of specialties, principally electrical, on order and on royalty, and they have a well-equipped and excellently lighted shop for this work. The factory is filled with machinery of the latest improved design for the particular work for which they are used, and the output of the shop is considerable. Experimental work, and repairing of all kinds, constitute an important branch of the business.

The Company is composed of Franklin Sheble, M. E., and Price I. Patton. Their headquarters are at 1026–1028 Filbert street, and they enjoy a large trade in Philadelphia and vicinity.

The Commonwealth Electric Construction Company, which is at present carrying on business at 413 Market street, Philadelphia, will soon move to larger quarters. While they now have a fine location, occupying the main floor, they have not half enough room to handle their rapidly expanding business. This company manufactures motors and dynamos, and do a general electric construction business. They install electric plants of every description, and give careful attention to the repairing of dynamos and motors. They also do electric wiring for all purposes. Mr. Louis B. Henry is the president of this company, and his establishment enjoys an excellent reputation in the trade.

(*To be Continued.*)

TO TEST THE VALIDITY OF THE BERLINER PATENT.

The American Bell Telephone Co., on August 6, served papers upon the National Telephone Manufacturing Co. in a suit for an order restraining the latter from infringing the Berliner patent. A hearing is assigned before the United States Court, Boston, for the first Tuesday in September. The Berliner patent, it will be remembered, was recently declared invalid by Judge Carpenter of the Uuited States Court, but the Appellate Court reversed Judge Carpenter's decision. The suit against the National Company is the first one brought by the Bell Company under that patent, and its result will determine whether the Bell Company's monopoly shall continue another seventeen years.

BROOKLYN'S FIRST TROLLEY PARTY.

A jolly trolley party inaugurated the new idea in Brooklyn on the night of August 7. Six trolley cars of the Brooklyn Heights Railroad Company were sent down to Ulmer Park bearing a load of guests. The cars were hung with flags and bunting and brilliant with electric lights. Each car was illuminated in red, white, and blue, and over one hundred lights shone on every car. The cars ran over all the lines of the company and met at the City Hall shortly after 8 o'clock.

Then the six proceeded in a line along Court street to Bensonhurst.

Among the guests were Ex-Gov. Flower, Ex-Lieut. Gov. Sheehan, and Silas Dutcher, the party making over 300 persons in all.

A banquet was given at Ulmer Park, after which the party returned to the city. The cars were very handsomely decorated.

(*Continued from Page 88.*)

Bochum	4.8	5
Remscheid	5	7
Gotha	1.2	5
Hamburg	26	36
Erfurt	7	29
Brussels	19.3	35
Leige	2	5
Belgrade	6.2	7
Baden-Vöslau	6	9
Zwe ikau	4.5	11
Aix la Chapelle	26.5	40
Ulm	2.5	8
Düsseldorf	2	8
Munich	...	2
Biasewitz	6.5	10
Vevey-Montreux	6.2	..
Bremen	10	25
Gmunden	1.6	3
Murzen	2.5	4
Marseilles	8	14
Sissach-Gelterkinden	1 4	1
Zurich	...	..
Mont Selève	5.3	12
Montferand	5	22
Stans	3 2	..
Chavornay	2.5	..
Geneva	3.5	..
Bordeaux	6.5	16
Lyon	6.2	12
Havre	15	40
Roubaix	10	18
Milan	8.1	19
Florence	5	14
Leeds	5.3	6
Liverpool	1.3	40
South Staffordshire	21	56
Bessbrook-Newry	3	3
City and South London	6.5	16
Douglas and Laxey	14	9
Port Rush	5	5
Guernsey	3	7
Brighton Beach	1	2
Blackpool	1	..
Building.		
Spandau	7.2	24
Genoa (Societa di Ferrovie Electriche e Funicolari)	12.6	35
Genoa	7.5	20
Kiel	9.3	33
Danzig	13	35
Stuttgart	14.4	50
Chemnitz	5	10
Leipzig	28.5	70
Bilbao-Santurce	9.3	14
Bilbao-Las-Arenas y Alporta	11.2	14
Bromberg	2.8	18
Strassburg	4.8	18
Lübeck (extension)	2.5	4
Buda Pesth (extension)	5	15
Gelsenkirchen	18	16
Basle	3	9
Pankow (near Berlin)	4	8
Barmen (extension)	2.5	10
Hamburg	53	100
Lyon	45	100
Montfermeil	4	5
Oporto	1	3
Varese	3	5
Dublin	16	20
Bristol	7	8

TOTALS.

Country.	Track in miles. Working.	Building.	Total.
Germany	203.9	196.0	399.9
France	60	49	109
England	37.6	46.5	84.1
Austria	38.7	5	43.7
Italy	6.2	23.1	29.3
Switzerland	23.4	3	26.4
Belgium	21.3	..	21.3
Spain	..	20.5	20.5
Russia	8	..	8
Servia	6.2	..	6.2
Roumania	5.3	..	5.3
Sweden	4.6	..	4.6
Portugal	..	1	1

COPPER AND ZINC PRODUCTION IN 1894.

The review of copper and copper mining for the year 1894, made by the United States Geological Survey, has been completed. It says that copper mining suffered from the general depression of the year. Still, consumption was in advance of 1893, but an enlarged production could only be marketed by means of lower prices. The exports were less than 1893 and were almost entirely of the refined metal. The production of copper for 1894 was 156,120 tons. A little over half of this came from Montana and two-thirds of the remainder from the Lake Superior mines. The available copper supply in 1894 is placed at 195,000,000 pounds, not including stocks from previous years. The exports from the United States for 1894 were 173,000,000 pounds, valued at over $16,000,000.

The production of zinc decreased in 1894. The production of spelter during the year was in round numbers 75,000 short tons. The product of zinc oxide in 1894 was 21,442 tons.

PHILLIPS' ANNUAL CLAM BAKE.

The 25th anniversary of the founding of the business of the American Electrical Works, of Providence, R. I., by Eugene F. Phillips, will be observed on August 17, when the 17th annual Rhode Island clam dinner will be tendered by the company to the electrical fraternity. This interesting event will take place at Haute Rieve, Union Club House, near Providence.

STANDARD RESISTANCES FOR STRONG CURRENTS.

The new standard resistances of the Berlin Reichsanstalt for measuring large currents by the voltage at the terminals of a known resistance, are described by Dr. Feussner in the *Electrotechnische Zeitschrift*. The first resistance has a value of 100 microhms, and can be used for currents up to several hundred amperes, and for a short time up to 1,000; the second resistance has a value of 10 microhms and is intended for currents up to 10,000 amperes. Instead of the usual bands of metal, these resistances are made of a casting of manganin in the form of a short hollow cylinder, having about the same width as its diameter and having a thick wall, about equal to a little less than one-third of its outside diameter; numerous holes are drilled through it, parallel to the axis, so as to increase the resistance to the desired amount, and to serve for the circulation of the oil in the bath in which the cylinders are placed. The connectors are made of large copper bars inserted in two holes, parallel to the axis and diametrically opposite to each other, the current therefore flowing through the two halves of the manganin ring in multiple; these terminals are carefully soldered with silver. The connections for the voltmeter are made of manganin strips screwed to the cylinder near where the copper leads enter it, and are soldered with tin. Great care is taken to have the leads sufficiently large; those in the small apparatus are made of round copper bars 15 mm. (about 5/8 in.) in diameter, and in the large one about 50 mm. (about 2 in.) in diameter, being a little less where they pass through the casting.

IMPORTS FOR ELECTRICAL PURPOSES.

Among the imports of the United States, as furnished in advance sheets by the State Department, Washington, D. C., we find several items relative to electricity which may be of interest to our readers. These advance sheets are a partial covering of the imports from foreign countries for the months of January, February and March of the current year.

Carbons were imported from Vienna to the value of $5,507.97.

Turning to the returns from Canada, we find that copper regulus valued at $12,214 70 was imported from St. Johns, N. F.; from Montreal, $149.60 worth of platinum; asbestos to the value of $19,795 from Sherbrooke, and from Montreal to the value of $21,793.09; plumbago from Colombo, Ceylon, valued at $16,450.

The exports from France to the United States include platinum valued at $43,100 from Paris.

From Berlin, Germany, we received various electrical goods valued at $2,113.50; from Hanover, telephones to the value of $336 34; electric carbons from Bamberg, valued at $1,085.40; platina wire and platinum from Frankfort at a value of $26,069.10; electric carbons from Nuremberg, valued at $26,972.31.

From Guaymas, in Mexico, we imported 411,000 pounds of graphite, valued at $2,080; from Nuevo Laredo, copper matte valued at $120,588.74.

From St. Petersburg, Russia, platinum was exported to the United States to the value $20,874.

"THE COMMERCIAL TRAVELLERS' HOME MAGAZINE."

This excellent magazine, which is published in Binghamton, N. Y., contains in its August number some fine and timely reading matter. The paper of Dr. Louis Duncan, on "Electricity vs. Steam on Railways," occupies several pages, and will no doubt be read with interest by the commercial travellers, who travel more than any other class of people. Most all electrical people are interested just now with the rest of Americans in the coming yacht race for the America's Cup, between the "Defender" and "Valkyrie III." Frederic Cameron contributes an excellent article entitled "The Race for the America's Cup," which gives a history of the yacht races from the beginning up to the present time, and includes excellent illustrations of the two aquatic giants of this year and those of former years.

ELECTRIC EXECUTION.

Murderer Richard Leach paid the penalty of his crime in the electric chair at Sing Sing prison, N. Y., on August 5. The voltage of the current was first 1,740; it was then reduced to 300, and then increased to 1,700. The duration of the contact was one minute and 57 seconds. Death was instantaneous and painless, according to the statement of the attending physicians.

THE VALUE OF ADVERTISING IN THE ELECTRICAL AGE.

Abstract from a letter just received by us from a well-known manufacturing concern: "I want to thank you for the good you have done our company. * * . * Our transformer is booming, also our repair shop, and we owe it to the good your paper has done. We have tried several of the leading electrical papers but have had poor results. If we can do you any good in any way we shall do so."

Tesla Oscillator.—*The New Science Review* for July contains an interesting article by Lieut. F. Jarvis Patten on the Tesla Oscillator.

INVESTIGATING THE BRIDGEPORT TRACTION COMPANY.

At the meeting of Bridgeport, Conn., Common Council, on August 6, city attorney Toomey presented a report of an investigation of the city's relations with the Traction Company and recommended that a committee be appointed to learn if possible why the street railway was not built according to specifications. The report criticises several ex-city officials and the electrical expert in the employ of the city at the time the lines were being constructed. A committee of five was appointed as recommended.

The Bridgeport Traction Company is controlled by Newark, N. J, capitalists. They bought the franchise of the Bridgeport Horse Railway Company, and from the Legislature of 1893 secured a charter which gave them permission to substitute electricity as a motive power. At the same time they secured permission to run lines of track on nearly every street in the city. It is now claimed that the requirements imposed by the Council Council were not lived up to.

Street Railway Notes.

There is talk of building an electric railway—the longest line in existence—from Marion, Ind, to Chicago. Chicago is gradually annexing the State of Indiana.

The Athol and Orange (Mass.) Electric Railroad has passed into the hands of its new owners.

An electric railroad between Bluffton and Camden, Conn., is projected,

The Shelby County Telephone Co., Shelbina, Mo., has been incorporated by Henry Reinheimer, T. Borden and others, with a capital stock of $6,000.

The building of the Haverhill and Danvers Electric Street Railway, between Haverhill and Danvers, Mass., is now assured.

An electric road is to be built between Dedham and Walpole, Mass. A company by the name of the Norfolk County Electric Street Railway Co. is being organized for the purpose.

A small war exists between the government of the village of Seneca Falls, N. Y., and the street railway company of that place. T. J. Yawger, President of the village of Seneca Falls; Chief of Police William B. Harper, and Chief of the Fire Department Joseph Mckeon, were arrested on warrants which charge the inciting of a riot, and two of the men named are charged in addition with assault in the third degree. This is the result of President Yawger's calling out the fire department and ordering a stream turned on the street railway employes.

Possible Contracts.

Col. Dunbar has purchased the plant of the City Electric Light Co., Kalamazoo, Mich., and changed the name to the Dunbar Electric Light and Power Co.

A company will be organized in Willimantic, Conn, to manufacture electric carriages. Charles H. Barrows, the inventor of the carriage, is interested.

Henry T. Douglas, chief engineer, Equitable Building. Baltimore, can give particulars regarding the contract for building the Washington and Baltimore Electric Railroad.

The Montgomery Cotton Mills, Montgomery, Ala., have decided to install an electric light plant, including engine, boiler.

Canton, Miss., will build its own electric light plant. For further particulars address City Clerk H. W. Latimer.

The Knoxville Electric Street Railway Co., Knoxville, Tenn., contemplates the enlargement of its power plant to double its present size.

The Nevada Electric Light Co., Nevada, Mo., has secured the franchise to operate a street railway.

New York Notes.

Office of the Electrical Age,
World Building, New York,
August 12, 1895.

Paul Thompson, receiver of the Bergmann Gas and Electric Fixture Company, filed in the United States Circuit Court, on August 5, a report showing that he has realized on the assets of the company $17,040.99, which he has on hand. He also states that he has received claims against the company amounting to $928,106.30, $185,931.24 of which he believes to be just and true. W. T. H.

Telephone Notes.

It is reported that the Turkish government will permit the erection of a telephone line between Constantinople and Sofia. Turkey is one of the few European governments that have resisted the introduction of this modern invention. The Turkish brain is not suited for such conditions.

The Berea, Richmond and Kingston Telephone Co. has been organized in Berea, Ky., and will build telephone lines.

John W. Woodland, Bruce B. Gootree, Gen'l Felix Agnus, Wm. S. Thomas and R. M. Galt, all of Baltimore, are interested in the Standard Telephone Co., of Washington and Baltimore, which was recently organized. The office of the company is in the Equitable Building, Baltimore.

The Grenada Telephone and Telegraph Company, Grenada, Miss., has been incorporated by B. L. Roberts, Emile Levy and H. W. Latimer. Capital stock, $250,000.

With a capital stock of $5,000 the Columbia Telephone Company, of Columbia, S. C., has been organized by W. Y. Abrahams, W. B. Lowrance, F. D. Kendall, A. R. Stewart, R. G. Johnstone, T. J. Harper and J. B. Friday.

J. H. Lory, Clarksville, Tenn., is interested in a project to build telephone lines in that vicinage.

Leslie P. David, A. J. Moore and H. L. Kokernot, Gonzales, Texas, are interested in the recently organized Gonzales Telephone Co. The company has a capital of $30,000.

Staunton, Va., will have a mutual telephone exchange.

TELEPHONE PATENTS ISSUED AUGUST 6, 1895.

Telephone. John S. Biggar, San Francisco, Cal. (No. 543,843).

Telephone Exchange System. Charles E. Scribner, Chicago, Ill. (No. 543,901).

Apparatus for Telephone Switchboard. Charles E. Scribner, Chicago, Ill. (No. 543,902).

Coin Signal Apparatus for Telephone Pay Stations. Samuel Alexander, Hartford, Conn. (No. 544,077).

New Corporations.

The Delavan Light and Fuel Company, Delavan, Wis., by A. N. Kendrick, E. P. Williams and others, with a capital stock of $16,000.

The Homestead and Calhoun Park St. Railway Company, Homestead, Pa. Capital stock, $18,000.

A New York syndicate is reported to be contemplating the utilization of power from the Kanawha Falls, Charleston, W. Va., for electric light and power.

The Fall River Street Railway Company, Fall River, Mass., at meeting of stockholders held recently, elected the following officers: President, Wendell E. Turner; Treasurer, John T. Robertson; Clerk of Corporation, James F. Jackson. The work of constructing the road will begin by the middle of next month.

The American Telegraph Supply Co., of Atlanta, Ga., has been organized by D. M. Dunn, F. J. Hoyle and S. H. Howell, to manufacture and deal in telegraph supplies. Capital stock, $250,000.

TRADE CATALOGUES.

The Fischer Foundry and Machine Company, Pittsburgh, Pa., has issued a new catalogue of the "Fischer" Automatic Steam Engines. These engines are in extensive use for electrical purposes. C. H. W. Copeland, 141 Liberty street, is the Company's New York agent.

The National Conduit Manufacturing Company, *Times* Building, New York, lays before the public a record of its work in the various cities, in a beautifully illustrated and gotten-up catalogue. Excellent half-tone engravings show the company's method of laying down its system, the views being taken in many of the cities where it has done work.

Trade Notes.

Thomas P. Benton & Son, La Crosse, Wis., have succeeded Benton & McDonald, manufacturers of electrical instruments.

Pepper & Register, Philadelphia, have secured the contract for the overhead equipment for the Catonsville division of the City and Suburban Railway Co., Baltimore, Md.

E. D. Smith, of Philadelphia, has closed the contract to build the Washington-Baltimore electric road. Thirty-six miles of double track, with 80-pound steel rails, and a branch to Ellicott City, Md., will be laid.

G. T. Evans & Co., electrical contractors, 830 Liberty avenue, Pittsburgh, Pa., have gotten up a handy table for computing weights, losses, etc., of copper wires. It will be found very useful for wiremen and electricians in general.

WOVEN WIRE BRUSHES.

The Belknap Motor Co., of Portland, Maine, are the patentees and manufacturers of the best woven wire commutator brush on the market.

ELECTRICAL and STREET RAILWAY PATENTS

Issued August 6, 1895.

543,836. Alternating-Current Motor. Engelbert Arnold Zurich, Switzerland. Filed Oct. 9, 1894.

543,843. Telephone. John S. Biggar, San Francisco, Cal. Filed Nov. 16, 1894.

543,849 Car-Fender. Rufus O. Clark, Marlborough, Mass. Filed Apr. 15, 1893.

543,855. Short-Circuiting Device for Stopping Dental Motors. Francis N. Denison, Toronto, Canada. Filed Oct. 9, 1894.

543,865. Electric Meter. Jesse Harris, Lynn, Mass. Filed Oct. 4, 1894.

543,867. Construction and Operation of Electric Railways and Tramways. Isaac W. Heysinger, Philadelphia, Pa. Filed Apr. 11, 1892.

543,879. Automatically-Operated Fire-Alarm. Frank K. Ludlow, Madisonville, Ohio. Filed Dec. 18, 1894.

543,885. Electric Battery. Robert McL. McDonald and Alexander McDonald, Dalmuir, Scotland. Filed Nov. 13, 1894. Patented in England May 3, 1894, No. 8,808.

543,892. Method of and Means for Extinguishing Electric Arcs. Wm. B. Potter, Schenectady, N. Y., assignor by mesne assignments to the General Electric Company, same place. Filed Nov. 30, 1894.

543,895. Construction of Armatures for Dynamo-Electric Machines. William B. Sayers, Bearsden, Scotland. Filed Aug. 16, 1894. Patented in England May 30, 1893, No. 10,134.

543,896. Fire-Alarm. Charles F. Scofield, Bridgeport, Ala. Filed Aug. 16, 1894.

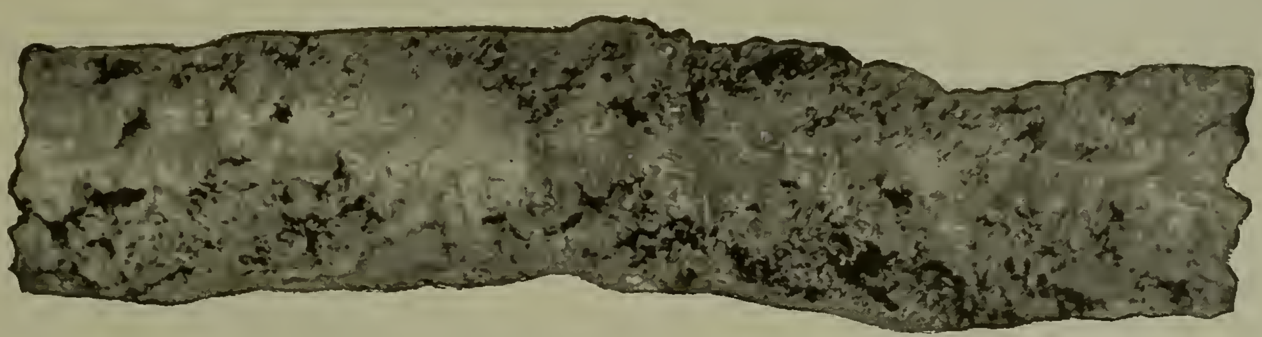
543,900. Electric-Arc Lamp. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Mar. 12, 1891.

543,901. Telephone-Exchange System. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Nov. 12, 1894.

543,902. Apparatus for Telephone Switchboards. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Dec. 8, 1894.

543,904. Car-Brake. Bert Sickles, Covington, Ky., assignor of three-eighths to Joseph S. Wohlgemuth, Cincinnati, Ohio. Filed Jan. 26, 1895.

543,907. Controlling Phase Relations. Charles P. Steinmetz, Lynn, assignor to the General Electric Company, Boston, Mass. Filed Sept. 9, 1893.



CROSS SECTION OF PLATE, BROKEN TO SHOW POROSITY.

No. 50 Exchange Place,
New York, July 17th, 1895.

Dear Sir:

The undersigned cordially invite you to examine and test a new Storage Battery, which by our method of manufacture we are enabled to put on the market at *one-half* the cost of any Storage battery now in general use.

A commercial plant of 60 cells has just been completed at No. 84 Pearl St. corner of Front St., Brooklyn, and can be seen at any time.

The main features of this battery are:

First. It has all the advantages of the Planté type of cell and none of the disadvantages, such as the use of innumerable thin lead plates that are soon eaten up, allow the peroxide to peal off, and the cost of which is much greater than by our method.

Second. Being of the Planté type, the active material is formed by electrolytic action and is therefore free from all extraneous matter such as is mixed with the different oxides that are mechanically applied to batteries of the Faure type.

Third. Our plates are thick and well put together, and being very porous and spongy before they are formed electrically, have the active material deposited in the many large and small cells and interstices throughout the body of the plates, instead of only on the outer surface, as in the case of the ordinary plates.

Fourth. The amount of surface throughout the plate is very great, owing to the great porosity of the same.

Fifth. Although very porous, the plates are not made so by compressing a quantity of particles into partial contact with each other, (which produces a very fragile plate and one of high resistance), but is *one continuous mass* of lead with a sponge-like formation.

Sixth. It is entirely free from any question of infringement of any other battery; and our claims are simple and controlling.

Seventh. This is the only battery, where porous lead is used, that has the plate made of one piece of lead.

Eighth. When extreme lightness is a desideratum, for special purposes, our battery can be made to weigh less than one-half as much as any other now in use, of the same capacity, and yet its life remain as long, at least, as any other.

Very respectfully,

J. HERON CROSMAN,
Room 29, No. 50 Exchange Place.

J. HART ROBERTSON,
Electrician,
No. 84 Pearl Street, Brooklyn.

543,919. Method of Connecting Ends of Electric Conductors. John T. Beswick, Brooklyn, assignor to the General Incandescent Arc Light Company, New York, N. Y. Filed Feb. 9, 1895.

543,924. Car-Fender. James B. Campbell, Pittsburgh, Pa. Filed Apr. 18, 1895.

543,929. Electric Temperature-Controlling Device. Sven A. Ekehorn, Milwaukee, Wis. Filed May 1, 1894.

543,931. Primary Battery. George H. Gardner, Boston, Mass. Filed July 5, 1894.

543,933. Electric Signal for Railway-Trains. John C. Henry, Westfield, N. J. Filed Apr. 20, 1895.

543,950. System of Electric Distribution. Elihu Thomson, Swampscott, assignor to the General Electric Company, Boston, Mass. Filed June 28, 1894.

543,960. Electrical Conductor. Gorham Gray, Boston, Mass., assignor to the Spiral Wire Company, Portland, Me. Filed Dec. 14, 1894.

543,963. Rheostat Controller. Clyde Landers, Tacoma, Wash. Filed Mar. 27, 1894.

543,965. Electrical High or Low Water Alarm. Bernard McCabe, Boston, Mass. Filed Dec. 15, 1894.

543,966. Circuit-Closer. William Nutt, Crawfordsville, Ind. Filed Nov. 6, 1894.

543,972. Car-Fender. Cornelius Sullivan, Newark, N. J. Filed Dec. 17, 1894.

543,978. Electric Condenser. Charles S. Bradley, Avon, N. Y. Filed May 11, 1895.

543,984. System of Multiplex Telegraphy. Thomas B. Dixon, Henderson, Ky. Filed Oct. 19, 1894.

543,985. Incandescent Conductor for Electric Lamps. Thomas A. Edison, Menlo Park, N. J., assignor to the Edison Electric Light Company, New York, N. Y. Filed Aug. 7, 1882.

543,987. Filament for Incandescent Lamps. Thomas A. Edison, Menlo Park, N. J., assignor to the Edison Electric Light Company, New York, N. Y. Filed Oct. 20, 1882.

544,034. Electric-Lighting System. Edward F. Gavin, New York, N. Y. Filed Sept. 28, 1894.

544,037. Converter System for Electric Railways. Thos. Harper, New Brunswick, N. J. Filed June 29, 1894.

544,047. Rheostat. William O. Meissner, Chicago, Ill. Filed Nov. 20, 1893. Renewed Jan. 11, 1895.

544,056. Conduit System for Electric Railways. James Thomas and William R. Thomas, Catasauqua, Pa. Filed Dec. 6, 1894.

544,066. Electric-Arc Lamp. John A. Mosher, Chicago, Ill. Filed May 11, 1895.

544,077. Coin Signal Apparatus for Telephone Pay Stations. Samuel Alexander, Hartford, Conn. Filed Nov. 13, 1893.

544,084. Fire-Alarm Signaling Apparatus. Gilman W. Brown, West Newbury, Mass., assignor of one-half to Haydn Brown, same place. Filed Sept. 1, 1892.

544,094. Automatic Cut-Out for Electrical Converters. William J. Greene, Cedar Rapids, Iowa. Filed Mar. 9, 1895.

544,107. Magneto-Electric Bell. Leland Moore, Brooklyn, N. Y., assignor of one-half to John C. Reilly, same place. Filed Apr. 11, 1895.

544,118. Safety Electric Motor. William R. Polk, Jr., Atlanta, Ga. Filed Feb. 20, 1894. Renewed Dec. 24, 1894.

544,123. Electric Signaling System. Charles A. Rolfe, Chicago, Ill. Filed Jan. 8, 1895.

544,139. Car-Fender. Charles M. Vandegrift, Philadelphia, Pa. Filed Apr. 19, 1895.

544,153. Vessel for Electrolytic Separation. Wilhelm Borchers, Duisburg, Germany. Filed Dec. 31, 1894.

544,157. Trolley-Wheel. Jesse Conway, Baltimore, Md., assignor of five-eighths to James F. Morrison, same place. Filed Jan. 4, 1895.

544,195. Car-Fender and Wheel-Guard. George E. Shoemaker, Philadelphia, Pa. Filed Feb. 11, 1895.

544,198. Electric Railway. Francis Taylor, Charlotte, N. C., assignor of one-half to Irvin W. Durham, same place. Filed Nov. 30, 1894.

544,209. Electric Railway and Tramway. Jean Claret, Lyons, and Olivier Wuilleumier, Clermont-Ferrand, France. Filed July 25, 1893. Patented in France, Nov. 3, 1892, No. 228,291, and in England, June 2, 1893, No. 10,843.

544,224. Electric Alarm-Lock for Tills. Charles Helm, Indianapolis, Ind. Filed Apr. 23, 1895.

544,236. Controlling-Switch for Electric Motors. William J. Pohlman, Woodbrook, assignor of one-half to J. Edgar Orrison, Baltimore, Md. Filed June 4, 1895.

544,244. Street-Car Fender or Guard. Casper S. Yost, George W. Baumhoff, August H. Hagemeier, Frank Fitzler and Otto Schmid, St. Louis, Mo., assignors of one-sixth to James Adkins, same place. Filed Jan. 5, 1895.

544,261. Alternating-Current Motor. Robert Lundell, Brooklyn, N. Y. Filed Oct. 22, 1894.

ELECTRICAL AGE

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NEW YORK, AUGUST 24, 1895.

CONTENTS.

TO REMAIN IN SHENECTADY.

According to a despatch from Schenectady, N. Y., the General Electric Company will not move its plant from that place, as was rumored a few weeks ago The company has decided to remain in Schenectady, and is completing plans for the addition to its plant there of a new building, to cost $200,000. It is now stated that the company's works at Harrison, N. J., and Lynn, Mass , will ultimately be removed to Schenectady.

SIEMENS & HALSKE TO BUILD ELECTRIC LOCOMOTIVES.

It is reported that the Siemens & Halske Electric Company of America and the Yerkes interests in Chicago have combined in opposition to the recent arrangement between the Westinghouse Company and the Baldwin Locomotive Works. The object of the combination is to build electric locomotives.

THE MONTREAL CONVENTION.

The approaching convention in Montreal of the American Street Railway Association promises to be of unusual interest, and active preparations have been commenced which point to a large and interesting exhibition of supplies and apparatus. Every possible facility will be afforded to intending exhibitors to display their goods, and the building to be used for the purpose is excellently suited for such an exhibition. There should be a large and representative turnout, and from present indications no efforts are to be spared to make the meeting a grand success.

THE EXCELSIOR AND GENERAL ELECTRIC COMPANIES SEPARATE.

We learn on reliable authority that the relations between the General Electric Company and the Excelsior Electric Company have been severed, and that the latter will now go its own way rejoicing. The stockholders and bondholders of the latter company, after long forbearance, and seeing no returns from their investments and no prospects of future business, forced the General Electric Company to sell back to them the original stock. Now the Excelsior Company is an independent concern and will, on its own merits, re-enter the market for business, an abundance of which it can secure, as the Excelsior system is one of the best known.

THE EASTERN TELEPHONE ASSOCIATION.

The General Telephone Protective Association, which is the name of the eastern association now being formed in this city, is now practically organized; all there is remaining to do is for each member to subscribe to the constitution and by-laws. This final act will take place at the Astor House, in this city, on Wednesday, August 21. At the meeting last week the by-laws, as drafted by the committee, were submitted. They were thoroughly discussed from every point of view, and modified in some particulars to meet the views of a majority of the members. The by-laws are now satisfactory to all concerned, and as soon as the signatures of the members have been affixed thereto the association will become an important factor in the telephone field. There is only one object for the existence of the association and that is to protect purchasers of telephones against infringement suits based upon the Berliner patent. The purchaser of every instrument will receive with his purchase the guarantee of the association, from whatever company he makes the purchase (assuming, of course, that the seller is a member of the Protective Association). This guarantee will protect the purchaser, and by its provisions the association will assume all legal responsibility. The motto, "In union there is strength," was never more applicable than it is in this instance, and to fight the common enemy all independent interests should unite in the one purpose of the association. The benefits of membership in this association are many and obvious, the principal of these being that by unanimity in action the business of introducing telephones will be greatly fostered, and public confidence in the use of the same will be established.

LONG DISTANCE TRANSMISSION AT 10,000 VOLTS.*

The Pomona Plant.

BY GEORGE HERBERT WINSLOW.

(*Continued from page* 74.)

In order to avoid see-sawing it is the practice in this plant to reduce the head every morning during the light load. This is readily done by opening the extra 4″ relief valve and allowing water to escape until the pressure has gone down to that corresponding to the desired head. The valve is then set tentatively until the pressure remains about constant, when the final adjustment is made by partly closing the valve on the generator-wheel pipe. Meanwhile the governor throws more and more of the stream onto the wheel to compensate for the decrease in head, and the see-sawing stops. Where a deflecting double nozzle is used it would seem advisable to have in the upper branch a throttle valve so connected to the deflecting levers that when running under light load the valve would be entirely closed and the regulation be attained by deflecting the open nozzle. When the whole stream of this nozzle had come into use and more water was required, the valve would be open. In this way the water would be used during light load under more favorable conditions than obtained with a simple deflecting nozzle, see-sawing would be avoided, and in case the supply of water became less, either suddenly, as by a sharp freeze, or gradually, because of diminished rainfall, the water would be used most economically and efficiently during the time of maximum load, which is the critical time. The effect of such an arrangement of the nozzles and valves would be to increase the capacity of the plant for a given minimum water supply, the period of minimum supply being precisely that in which all possible economies are of value. It may be objected that tips of such a size be used as would bring both streams into full use during maximum load, and that then no valves would be required, but against this is the fact that the maximum load (particularly in a lighting plant) does not reach the same value every night and that it is, therefore, always necessary to use tips large enough to meet the possible demand of any night.

In order to avoid breaking the teeth of the quadrant in case the governor should continue to act after it has moved the nozzles to either their highest or their lowest point, the pinion on the governor shaft is mounted loosely between two laterally movable toothed ratches which normally hold it in a fixed position, but either of which will be automatically disengaged by an adjustable lug on the corresponding side and end of the quadrant when the latter reaches either of its extreme positions, and will thus allow the pinion to stop, though the shaft continues to turn. Both ratchets may be instantly disengaged by hand and the position of the nozzles be regulated by a hand lever when starting up, or in case of accident to belts or of decrease in head of water.

To start the plant the governor ratchets are first disengaged and the exciter is brought to a moderate speed ; the generator is then started and its field is charged; it is then brought to about three-fourths of its full speed, and the speed of the exciter is then slowly increased until the cross-bar on the governor ceases to move. At this moment the ratchets are thrown in, and the governor takes charge of the generator-speed. The speed of the exciter is now slowly increased to its full value, which of course brings the generator to full speed.

The speed of the exciter-wheel is regulated by a small throttle-valve, the changes in the position of which do not have any noticeable effect on the pressure in the pipe, owing to the small size of the jet controlled. This valve is so made as to have an equal pressure on each side of its axis when partly open, and hence can be moved from one position to another with little effort, which makes it of special value for use with automatic governors. When tightly closed, however, the areas subjected to pressure are no longer equal, and the valve sticks tightly. To obviate this the edges of the valve are battered slightly so as to prevent it from being completely closed.

An effort was made to automatically govern the exciter by means of a ball governor driven by a belt from the exciter-wheel shaft and actuating the valve by means of two leather friction-cones acting alternately on a beveled disk geared to the valve, but this proved unsatisfactory and was finally discarded, chiefly on account of the difficulty of maintaining the proper adjustment, by reason of the wearing away of the cones and of their swelling from dampness. The exciter was therefore controlled directly by hand for a long time. At present the valve is worked from a distance by a simple electrical arrangement devised by Mr. Imlay, in which advantage is taken of the fact that when the exciter is at full speed the movements of the valve necessary to regulate the speed are small.

The device consists essentially of two fixed solenoids in series, energized by current from the exciter and normally acting with equal force on two iron cores supported respectively at the opposite ends of a walking-beam connected by levers to the valve, their normal function being to keep the valve stationary. Either of the coils may be short-circuited at will by means of a relay controlled by two keys and likewise actuated by current from the exciter. When either coil is short-circuited it ceases to hold its core, and the core on the other end of the walking-beam is pulled down by its own coil, thereby turning the valve in a corresponding direction. In order that this movement may not be too rapid the coils and cores are immersed in oil, which causes the coils to act as dash-pots to the cores ; by this means the movement of the valve may be made as slight as is desired.

The relay is not really necessary, but was used to break the circuit in experiments made before the plan of short-circuiting one coil was devised, and has been retained because very convenient. A momentary closing of either key suffices to correct any change of speed, such changes being indicated by the compensating voltmeter. The current in the coils is reduced by a resistance in series with them about equal to that of one coil, and the current for the relay is shunted from the resistance at about two volts. The current normally passing through the coils and resistance is about two amperes at 100 volts (about ¼ H. P.) and when one coil is short-circuited the current in the other increases to three amperes, so that the maximum power used is ⅖ H. P.

The power-house is 66 ft. long by 30 ft. wide, and has walls 12½ ft. high. The walls, which are of concrete, were all built by tamping concrete in a space between temporary wooden walls forming a mould, a few feet of wall being built at a time, and the planks then loosened and raised to the height of the next section, the walls being thus made at the least expense for timber. The best English Portland cement was used. The walls were consolidated and cement saved by the use of well-washed fragments of rock imbedded in the concrete. In order to obtain the greatest available fall the power-house was placed as far as possible below the level of the fall. This necessitated blasting into the side of the hill so far that the entire wall next the hill was below the level of the adjoining rock. The wall was built against the rock, and consequently became damp as soon as the rainy season set in, but this did not affect the 10,000-volt bank of transformers set on a rack beside the wall.

The station was built to accommodate four 120-K.W. 7,200-alternation, 12-pole, single-phase Westinghouse alternators, with their full complements of raising transformers and switchboard apparatus and two exciters. The first installation consisted of one generator with one 90-ampere 125-volt "I" exciter, capable of exciting the four alternators, and of 126-K.W. capacity of oil transformers in 21 units of 6 K.W., one of those units being kept as a reserve.

Several different methods of connecting the raising and lowering transformers were given careful consideration, the test of actual use favoring a series connection for both primary and secondary coils of both sets of transformers, a plan which has proved to be thoroughly reliable in its practical operation at the Westinghouse plant at Portland, Oregon. It was however decided, in order to be able to change the initial pressure on the line in case of accident to any of the converters, to connect the primary coils of the raising transformers in multiple to the dynamo, put the line coils all in series with the line and with a similar set of coils in the lowering transformers, and connect the other coils of the latter in multiple to the distributing circuits.

The next question was what size of transformers should be used. Many small transformers meant less cost per unit for repairs, greater facility of handling, and greater flexibility in case it were desired to change the voltage on the line. Their use, however, also meant greater first cost, more complication, and somewhat lower efficiency, but these points were outweighed by the former, and a transformer unit of 6 K.W. was chosen. Each transformer is contained in a cast-iron box provided with vertical outside ribs, which serve to stiffen it, and also to cool the oil with which the box is filled, and which entirely covers the transformer. The box is covered by a cast-iron lid, which has conducting and radiating ribs both outside and in, the inner ones dipping into the oil at its hottest part and helping to cool it. The oil when heated rises through open

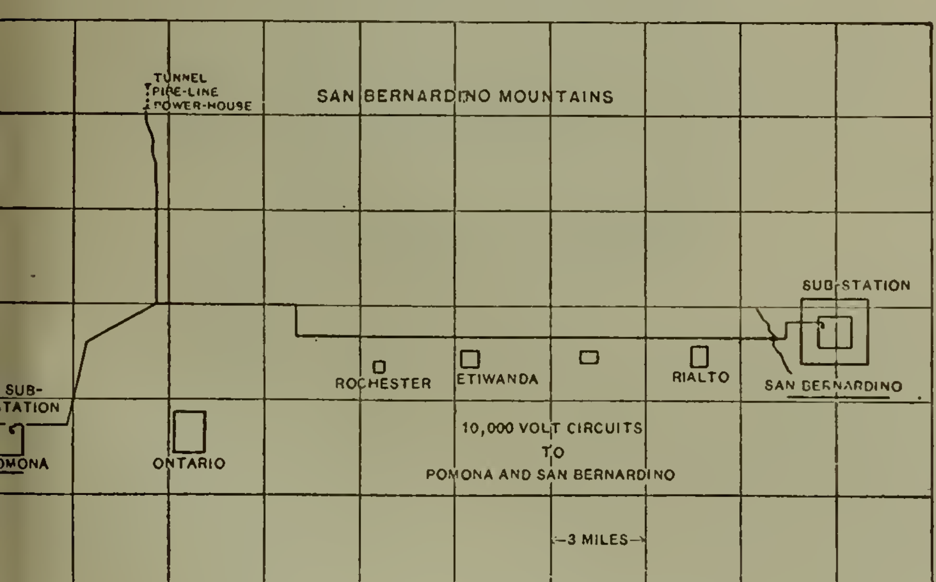


FIG. 4.—ROUTE OF LINES.

spaces around the coils and spreads out in all directions' guided by the ribs on the lids, and sinks slowly down between the core and the sides of the box, thus having ample opportunity to become cooled. Each box is provided with a pet cock, at the bottom, by which to draw off the bottom layer of oil, should it become too thick for evaporation. It also has an oil-gauge to show whether the tops of the coils are completely covered without having to raise the lid. The boxes are supported upon a substantial timber frame, upon the top of which two iron bands serve incidentally to protect the wood, but chiefly to metallically connect the boxes to each other and to the earth, in order to dissipate the static charge received by the boxes, which is very unpleasant. The core of the transformer is connected to the box by a copper strip fastened around a block of wood upon which the core rests in the box, and to provide against the danger which would result from accidental connection between the primary and secondary coils, an insulated sheet of copper is placed between the latter and close to the dynamo-coil, and is connected to the core by a tongue which is stuck between the plates.

The line-coil, of No. 7 B. & S. gauge wire, is inside the dynamo-coil, and is kept everywhere at a distance of one-half inch from latter, the ground plate, and the core by walnut blocks boiled in paraffin, between which ample openings are left for circulation of the oil. The ratio of transformation is 1,000 to 450, so that in a bank of twenty transformers the dynamo-pressure required for 10,000 volts, and on open circuit is 1,110 volts, and on full load about three per cent. more than this, or 1,140 volts. The space between the 1,000-volt coil and the core is one-eighth of an inch. The terminals of the line-coils are brought up through the oil in mica-fibre tubes passing through heavy glass bushings held in paraffined wooden blocks which are attached to the sides of the boxes. The 1,000-volt terminals are similarly supported, but without glass bushings. The transformers are all connected in multiple to the dynamo-circuit, which is supported directly above them on a light pine framework, which also supports the fuse-blocks. The latter are single-pole, and the fuse passes through a hole in a marble block, the object of so confining the arc being to blow it out by its own force. Only one fuse is used on each transformer. The secondary or line coils are all connected in series by U-shaped insulated wire connections, which may be readily detached when making periodical tests for insulation of terminals, and which are entirely independent of the framework supporting the dynamo circuit. Accidental contact with the exposed connectors is prevented by the framework above mentioned, and there is an inflexible rule that the high tension side of the transformers shall not be touched under any circumstances whatever, while the dynamo is running.

Clark's insulation is used on all wires connected to the transformers and to the dynamo, and the terminal wires of the full bank, which must often be disconnected for testing, are further insulated by heavy glass tubes at points where they might come in contact with other wires. All other transformer wires are supported upon double petticoat glass insulators, and all dynamo wires upon porcelain knobs.

The switchboard is of narrow red-wood boards, tongued, grooved and beaded, nailed on a framework of yellow pine, the latter supported on porcelain insulators to keep it dry. The switchboard outfit for the one generator and one exciter consists of two 120-amp. fuse blocks, field rheostat with a 25-amp. D. P. field switch with fuses, one 150-amp. ammeter and a 200 amp. D P. jaw-switch. From this switch the current passes to two 4-dynamo, marble switch-panels which are connected in multiple to the dynamo, and are each provided with two pairs of contact plugs. By means of these panels and of the two 200-amp. dynamo-changing switches below them, any feeder can be operated from any dynamo which is connected to the switch-panels. Between each panel and its switch is a pair of 65-ampere Wurts shunt-wire fuse blocks, each provided with an extra fuse, and should it be desired to double the fuses during the run, on account of overload or of weakness in the fuse. The remaining instruments on each feeder are a voltmeter, a No. 1 switchboard converter and a 150-amp. type "E" compensator. When both feeders were run from one alternator, one voltmeter was connected to the generator and the other to the feeder, and in this way the amount of compensation could be watched

The oil-transformers were tested before shipment with 20,000 volts between the line-coil and the core, and were taken out of the oil and boxed. In order to expel any moisture which might have been absorbed by the insulation of the coils or have condensed on the cores during their long journey, the transformers were connected in two banks of ten each, the line-coils of each set being connected in series to the generator, which was run at a reduced speed, and the secondary coils each short-circuited on itself. The coils were thus gradually heated to a point somewhat above the boiling-point of water, which at that elevation was about 201 deg. F. They were kept at this temperature for a short time and then paraffine oil of a special grade ("Diamond") was poured slowly into the boxes at the edges so that the coils would begin to absorb oil at their lower ends, and thus drive upward the air and volatile gases occluded by the insulation. The transformers were then again brought to their former temperature, which caused expansion and partial expulsion of the air remaining in the insulation. Some of the air would, however, collect under the insulation at the top of the coils, and had to be freed by mechanical agitation, produced by stirring the folds of insulation or by pounding on the boxes. The heat caused volatization of some of the lighter elements of the oil, these coming to the surface as bubbles, just as the air did first, and the agitation was kept up at intervals until bubbles from this cause also were entirely eliminated.

The 20 transformers, then connected as they would be when in regular use, and the two terminals of the line-coils, which were to give 10,000 volts, were connected in series with one hundred 100-volt lamps, which were then brought to full candle-power, showing that the transformers were all in good condition. A similar test was then made at Pomona at the end of the 14-mile transmission line running to that place, after which the transformers there were prepared for work in the same way as at the power-house, except that the grouping and initial voltage were changed.

There are two transmission lines, one 13¾ miles long, which supplies Pomona, and another 28¾ miles long, which supplies San Bernardino. Each line consists of two No. 7 B. & S. gauge wires. The joints in the wire are made with McIntire connectors. To further improve the joint the ends of the wires were bent back side by side and soldered together. After the Pomona line was completed and the first ten miles of the San Bernardino line was put up, the supply of connectors ran out, and the regular telegraph joint was substituted. The conductivity was assured by soldering as before. (See Fig. 4.)

The wires are supported upon large double-petticoat flint-glass insulators designed for this plant. These insulators are of perfectly clear flint-glass, which gives a better surface-insulation than is attainable with any other kind of glass.

(To be Continued.)

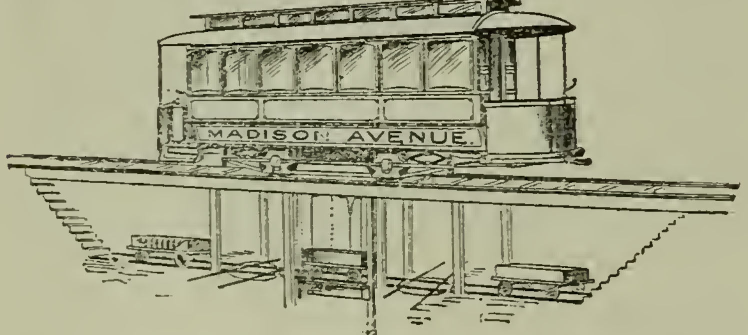
STORAGE BATTERY CARS IN NEW YORK.

The New York and Harlem Railroad Company, which operates the Fourth and Madison avenues street-car lines, will, about the middle of October, place upon its lines some improved storage battery cars.

This is the company, it will be remembered, that a few years ago ran some Julien storage battery cars, but owing to the storage battery litigation then existing the experiments were abandoned.

The success of storage battery cars in Paris, and the settlement of all legal entanglements, have led the New York and Harlem Company to resume its experiments.

The new cars will be equipped with Chloride accumulators, made by the Electric Storage Battery Company of



STORAGE BATTERY CAR, MADISON AVE., NEW YORK.

Philadelphia. The cars are now being built by the John Stephenson Co. of New York, and their general design includes some novel features. The batteries will not be carried in the car-body, as has been the practice heretofore, but will be suspended from the truck under the centre of the car, as shown in the drawings. The tray or box containing the batteries is readily and quickly detachable from the truck and removed, for the purpose of charging, on a small transfer car running on rails to and from an elevator situated between the street-car tracks and running beneath the floor to a cellar or subway, the elevator being adapted to hoist the batteries into place on the car truck, or to remove them therefrom, as the case may be.

By this novel arrangement a car can be loaded and unloaded in about half a minute. It will be seen that with this new system of carrying the batteries on the truck any car body is adapted for use in this service, thereby saving a company adopting the system considerable expense by enabling it to use its present car bodies.

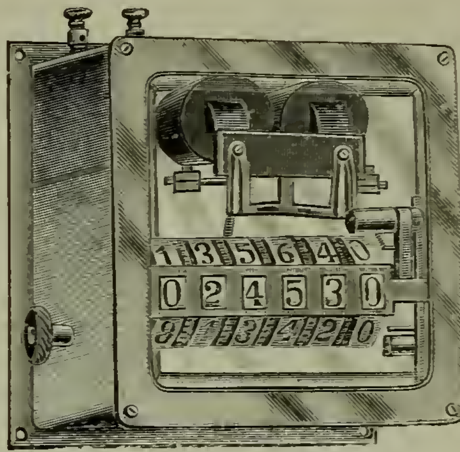
The cars will have 18-foot bodies and will be mounted on Peckham trucks. The electrical equipment will be that of the General Electric Company.

THE VERNON ELECTRIC COUNTER.

This apparatus is designed for the use of newspaper publishers to keep a record of the number of copies printed. The circuit is closed every time the press makes one revolution and one unit is added to the total count.

It is evident that the counter can be placed at any distant point from the press—at the desk of the editor, for instance.

This counter is accurate in its record and indicates precisely when the working-off of an edition begins and when



VERNON ELECTRIC COUNTER.

the press stops. It can be easily set at zero, without opening the case, which is securely locked.

This counter is claimed to be superior to any other on the market, and is reliable at all times. It is handled by Mr. Henry J. Winser, 39-41 Cortlandt street, New York.

Mr. Winser is also general agent for the Vernon Fare Register for street car uses. This register made a great record at the World's Fair in recording the number of admissions to the grounds.

It is largely used by street railroad companies and is perfectly reliable in its action. It is simple in construction and cannot be deranged or tampered with.

The Consolidated Traction Co , Newark, N. J., is using a large numer of these registers with the best of satisfaction.

THE BALDWIN ELECTRIC LOCOMOTIVES.

The Baldwin Locomotive Works, Philadelphia, expects to have ready for inspection, in two or three weeks, an electric locomotive constructed after the new designs of the Westinghouse-Baldwin combination. Two classes of trucks will be made for these locomotives—one for light work, such as that required on elevated roads, and the other for heavier, or suburban traffic. It is claimed that speeds varying from 40 to 90 miles an hour can be attained with these engines, according to the power of the motors and service.

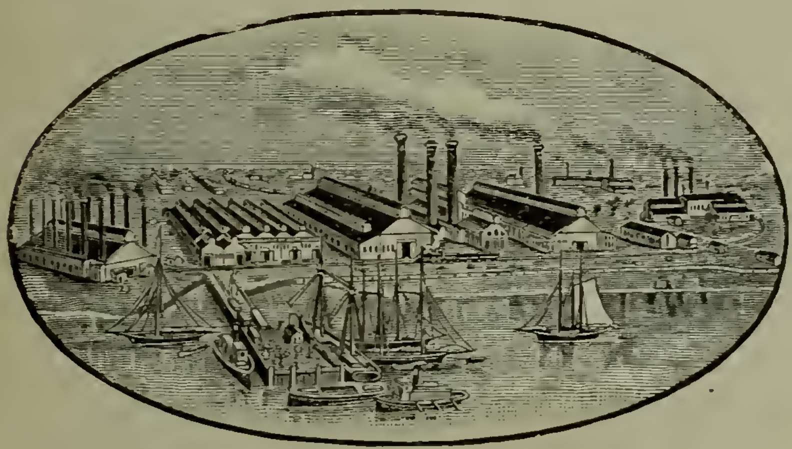
University of Minnesota.—We have received with the compliments of Prof. George D. Shepardson, Department of Electrical Engineering, University of Minnesota. Minneapolis, Minn., a copy of the "Year Book of the Society of Engineers," for 1895, of that University. Among the excellent articles it contains we find the following on electrical subjects: "Some Alternate Current Notes," by Harry L Tanner; "Competitors of Electric Light," by George D. Shepardson; "Economy of Conductors used in the Transmission of Currents for Electric Railways," by Edward P. Burch; "Rating a Price Current Meter," by Leslie H. Chapman.

PHILADELPHIA'S ELECTRICAL INTERESTS.

CONTINUED FROM PAGE .

MORRIS, TASKER & CO.

Among the large industries of Philadelphia there is one that has been in constant touch for many years with the rapid progress made in electric lighting, electric railway, and other branches of electric line work. This concern is



WORKS OF MORRIS, TASKER & CO., INCOR.

widely known in the electrical field through the poles it manufactures for carrying telegraph, telephone, electric light, electric power and electric railway wires—we refer to Morris, Tasker & Co., incorporated, of Philadelphia.

This is one of Philadelphia's oldest industries, having been established in 1821, and incorporated in 1888 under the present name. A view of the works at New Castle, Del., a few miles below Philadelphia, is given in one of our illustrations. Morris, Tasker & Co. manufacture, besides electric light and electric railway poles, boiler tubes, wrought iron pipe and fittings. An idea of the size of their mills may be had from the fact that they have a capacity of from 300 to 500 poles per day. The poles are made of wrought iron and steel tubes, jointed with the special S. S. S. joint, which has become recognized as the strongest used for this class of work. This fact is made abundantly evident when strains of as much as 7,000 lbs. can be put upon the span wires with perfect safety—the company making poles for all strains up to this limit.

The accompanying illustration (Fig. 1) of an electric light pole gives an excellent idea of the method of construction of these poles. The base section, it will be noticed, is of the largest diameter, and ornamental in design; the middle section is a little smaller, and the top one the smallest. The joints are very tight, preventing the admission of moisture, and very strong.

Fig. 2 shows the well-known Duggan Patent Adjustable and Flexible Bracket, for electric light and electric railway poles, of which Morris, Tasker & Co. are the sole manufacturers. This style of pole is designed to carry the feeders as well as the trolley wire, and it will be noticed that both the feeder wire support, or cross arm, and the bracket are adjustable with reference to the pole. By means of clamps these parts may be placed at any height within prescribed limits, and this adjustable feature makes the pole a universally servicable one.

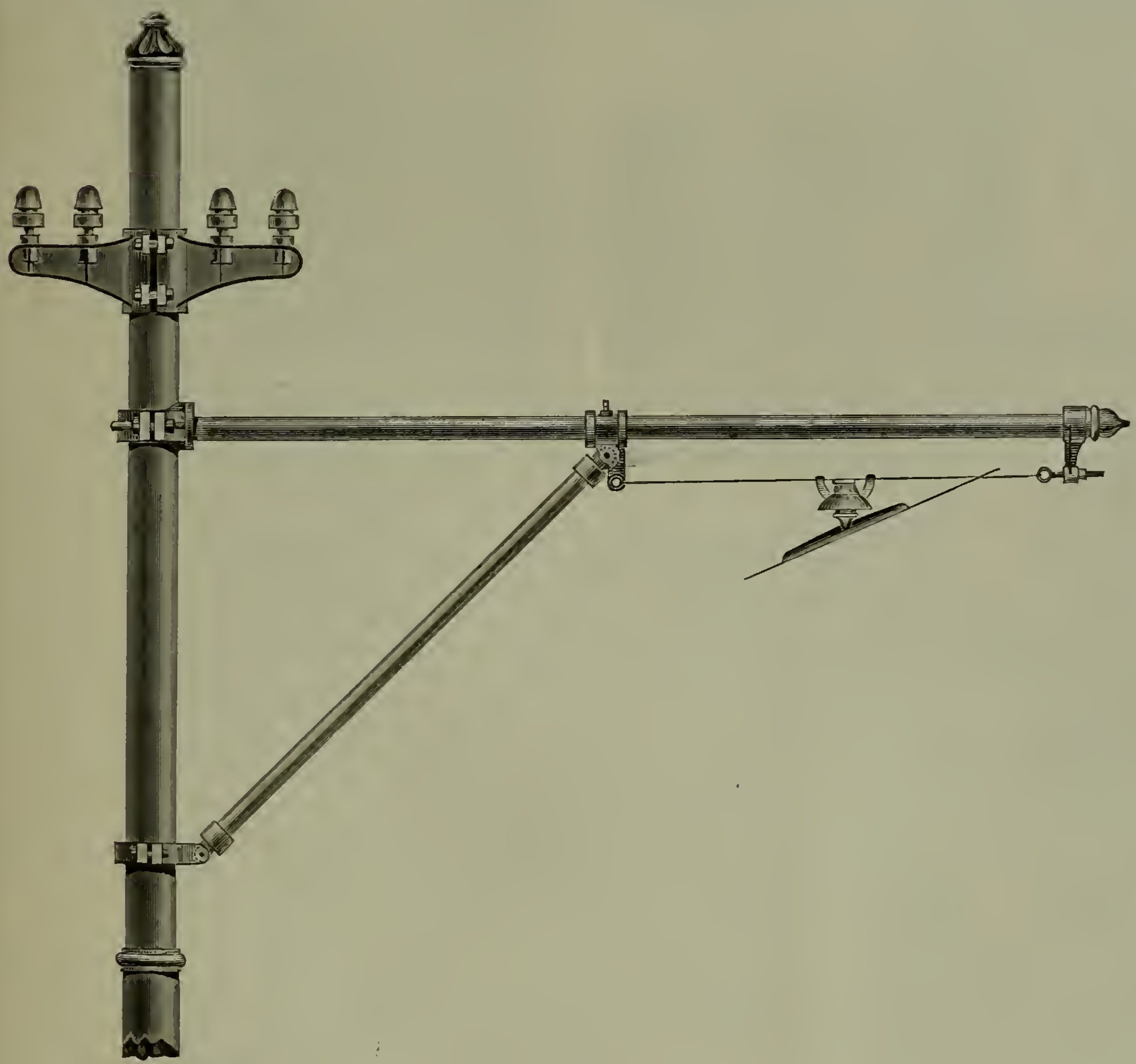


FIG. 2.

FIG. 1.

—The first electric street railway in Berlin was opened this month. It was built by Siemens and Halske.

PARTRICK & CARTER CO.

The name with which this article is headed is that of one of the oldest houses in the electrical supply business, and none is better known to the trade at large.

This house was established in 1867, when the telegraph was the only electrical industry, and necessarily dealt mainly in telegraph apparatus and supplies. But as electrical inventions multiplied in later years, and there sprang up a demand for supplies for use in the newly developed fields of electrical application, Partrick & Carter were abreast of the times. With keen foresight they perceived what the future had in store and branched out into the general electrical supply business, and prepared themselves to answer all calls for goods for any branch of the electrical trade. They now have one of the largest general electrical supply houses in the country, at 125 South Second Street, Philadelphia.

The firm is now known by the name of Partrick & Carter Company, although the old name still clings to the business. However, whether it is Partrick & Carter or the Partrick & Carter Company, it is all the same—the old reliable supply house of Philadelphia.

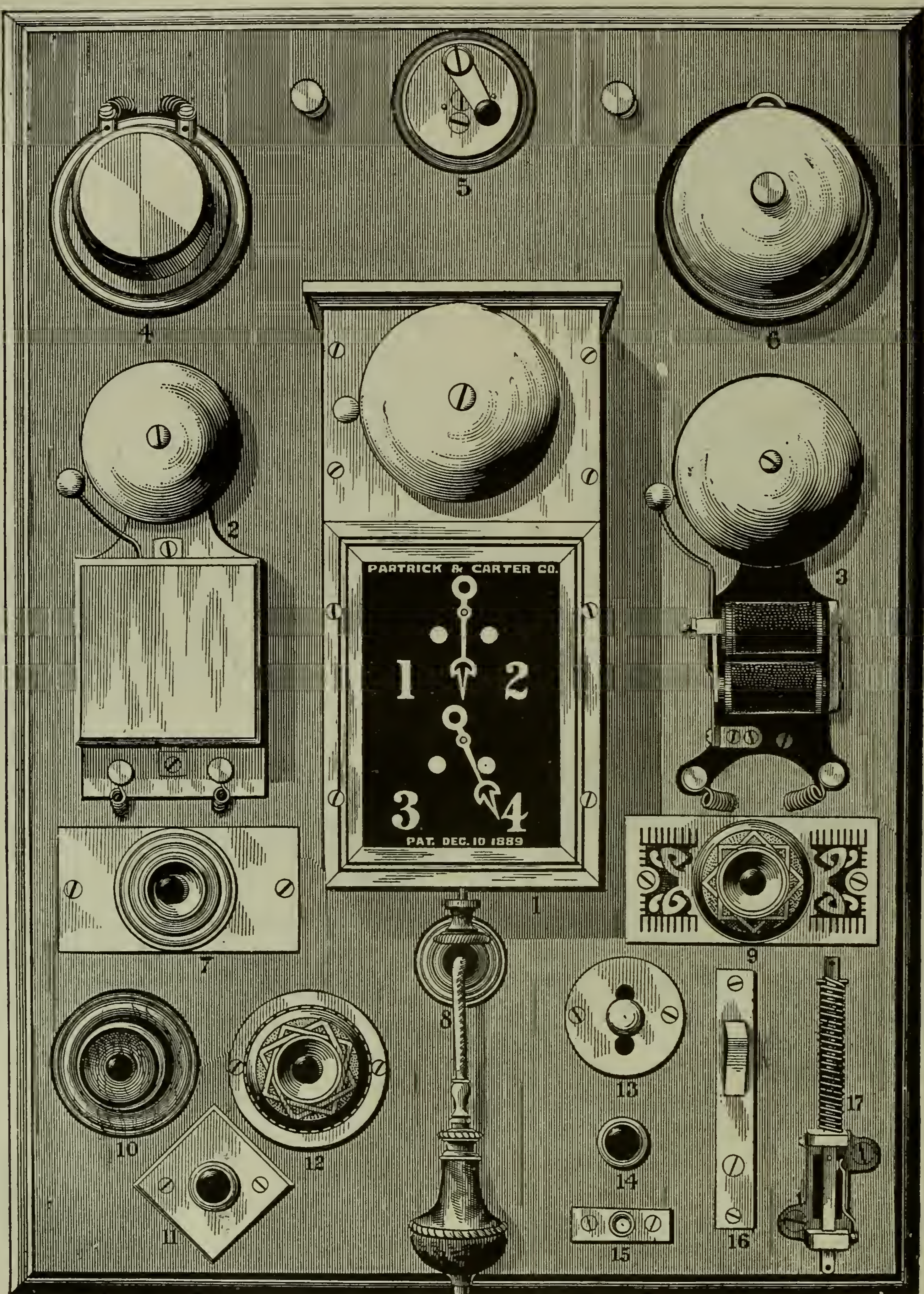


FIG. 3.—PARTRICK & CARTER'S SAMPLE BOARD.

It would fill a page to enumerate all the articles manufactured and dealt in by Partrick & Carter Co. They make a specialty of a needle annunciator, which is well known in every state in the Union and in foreign countries. The Partrick & Carter needle annunciator is the standard for hotel purposes, and it is said to be superior to any other device of the kind ever produced. The Guest Call and Fire-Alarm has met with unqualified success and approval, the system complete being thoroughly reliable.

The firm makes as well house annunciators and alarms, automatic annunciators, steamship and car annunciators—in short, everything in the general supply line.

Partrick & Carter Co.'s hallway hotel fire-alarm system has so many meritorious features that a brief description and illustrations of the apparatus will not fail in interest.

Fig. 1 shows the fire-alarm gong for the hall, and Fig. 2 the glass signal box.

These gongs are provided with a box for holding two cells of dry battery and an automatic drop. These drops are connected in series to their respective boxes in the halls and pushes located in the office. Upon pressing the fire-alarm buttons the drops in the various boxes in the series, or floor, operate and close the local circuit of their respective bells and batteries. The bells will continue to ring until reset.

In each hall or other designated place are located small alarm boxes containing a push button, the boxes being provided with a thin glass front, which is broken when it is necessary to use the button. The pushing of any one button on any floor will cause all the bells on that floor to ring continuously until stopped by resetting the automatic drop in the bell box. This system is entirely independent of the ordinary annunciator system.

The company guarantees for this system the best results, less complication and less expense for installation and

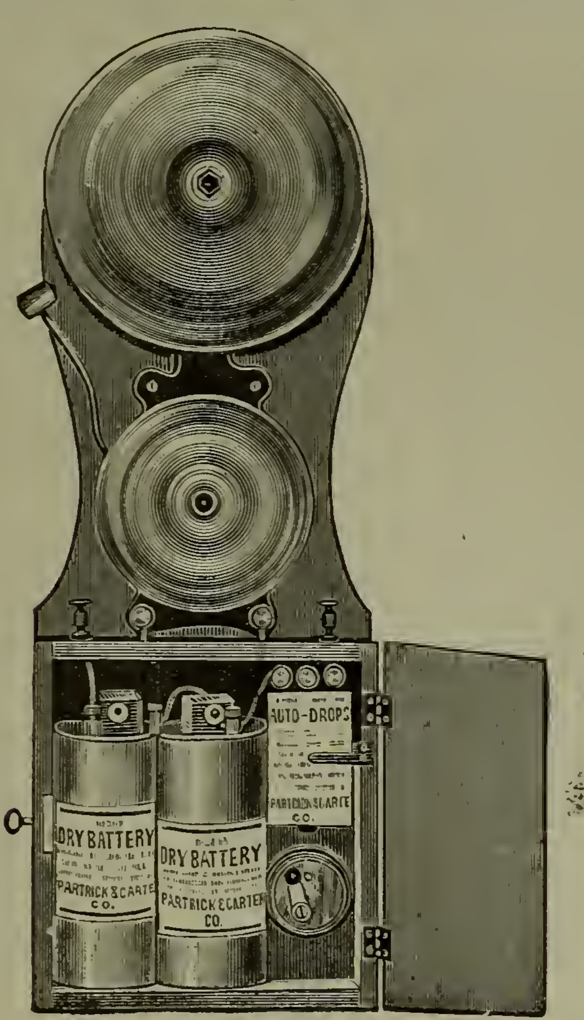


FIG. 1.

maintenance, and greater safety for the guests than can be obtained from any other.

The large illustration (Fig. 3) is of Partrick & Carter Co.'s sample show board. It displays a needle annunciator, and bells and push buttons of various designs and for different applications. All of the apparatus are connected in complete working order for practical exhibition. The board is 15x22 inches in size.

The members of the firm are Franklin S. Carter, Chas. M. Wilkins and E. Ward Wilkins, and they trade under the title of Partrick & Carter Co.

(*To be Continued.*)

ELECTRICITY IN DENTISTRY.

At the annual meetings of the New Jersey State Dental Society, and of the American Dental Association, both of which were held at Asbury Park, N. J., the week before last, several papers on the subject of electricity in dentistry were read.

Dr. Wm. L. Puffer, assistant professor of electrical engineering at the Massachusetts Institute of Technology, Boston, read a paper on "The Electrical Principle Applied to Dentistry," and Dr. H. W. Gillette read one on "Electro-Therapeutics Obtunding Sensitive Dentine."

FIG. 2.

Dr. Chas. A. Meeker, of Newark, N. J., practically demonstrated the bleaching of teeth by cataphoresis, using pyrozone for the purpose.

There were several exhibits of electrical apparatus. The Edison Manufacturing Co., of New York City, showed a complete electrical-dental plant. It included a suspended dental motor, operated by eight cells of Edison-Lalande battery; a Kennelly adapter for use on a 110-volt Edison circuit, and a Kennelly step-down transformer. Edison family and physicians' faradic batteries were also shown.

The W. J. Davis Electric Co., Pittsfield, Mass., had an alternating current motor for dental purposes. With it was shown a rheostat for starting and reversing the motor.

The Electro-Therapeutic Company, of New York, had a fine display of apparatus, including a noiseless reversible motor, with instantaneous magnetic stopping attachment for operating dental engines. This company's current adapter was also in evidence. This device is used for regulating and controlling street current for galvanic and faradic work. The Phillips electric headlight was also shown by this company.

Among other exhibits were the Custer electric furnace for dental work, and one by the Dental Protective Supply Co., of Chicago, which used a Lundell motor for the power necessary for the exhibit.

Dr. Charles A. Meeker, of Newark, N. J., is the secretary of the New Jersey State Dental Society.

PERSONAL.—Arthur Loretz, jr., who for a number of years has been the New York manager for the National Water-Tube Boiler Company, of New Brunswick, N. J., has resigned and accepted a position with the Abendroth & Root Mfg. Co., 28 Cliff Street, New York. The latter company is to be congratulated on their good fortune in securing the services of one so able as is Mr. Loretz, and we trust the National Company will find as good a representative to look after their interests in New York.

THE TROLLEY IN CHICAGO.

As to the trolley wires,
It has been found
Cheaper to put the people
Under the ground.
—Chicago *Daily Tribune.*

PRINCIPLES OF DYNAMO DESIGN.

BY

Newton Harrison, E.E.

(*Continued from Page* 89.)

This means of compounding. unlike the method of Ryan, is very unique on account of the unexpected employment of the armature itself for the very purpose that is most objectionable. The greater the reactive effect of the armature turns, the more heavily will the new flux influence the regulation. The great object of compound winding is twofold. First, to overcome armature reaction; secondly, to compensate for the drop of potential in armature and line. It may be understood that a great variety of smaller troubles are often the cause, collectively, of a serious fault whose development would be a matter of some consequence; as, for instance, parasitical currents in the conductors of the armature, too much hysteresis in the armature core, or heating at junctions between commutator and armature. The origin of such defects arise either from bad design in the beginning, or the subsequent effects of originally good design due to the unexpected development of incidental faults. The exact amount of magnetomotive-force to be applied for the elimination of armature reaction and drop is to be calculated for when the assumption is made regarding the amount of load; either quarter, half or full load. The considerations governing the angle of lead with the ampere-turns to be counted upon have been discussed, so that the magnetomotive-force to be directly utilized for the purpose of generating in the armature enough volts to equal the loss in both line and armature may be calculated.

If the full-load conditions are to be satisfied the loss in the armature conductors, if five volts, would require additional lines of force, that can be calculated by the fundamental rule

$$N = \frac{E \times 10^8}{I \times n},$$

where E = volts lost in armature,
I = inductors armature,
n = speed in revolutions per second.

If, therefore, the loss is five volts as calculated at full load, and the speed per second 30 revolutions, then, if the inductors equal 200, the lines of force to be used as an addition to the rest are

$$N = \frac{5 \times 100,000,000}{200 \times 30}$$

Lines of force = 83,333

The ampere-turns required for the creation of this extra field strength are obtained by referring to the past methods. The permeability will be about constant with these conditions existing, because the object of all additions to the winding is to keep the field constant, or at least of such a strength as to preserve not only a uniformity of pressure but the proper difference of potential where it is most needed. The permeability will not fluctuate between very wide limits unless an unbalanced field exists, whose permeability may therefore be greatly varied by slight causes. These generalizations do not express one iota of the numberless cases which call for some change in the general tenor of their design, generally traceable to the excessive drop in the armature or heavy reaction without sufficient compensation in same.

Compound-wound machines are frequently unable to grasp the external variations with sufficient rapidity to cause the regulation expected without a sudden jump from the lights. Although every armature as part of a dynamo should not be deficient in catching up with the sudden load, the strain is sometimes too much for the moment, and the effects observed are very noticeable.

(*To be continued*).

ASSOCIATION OF THE EDISON ILLUMINATING COMPANIES.

DETROIT CONVENTION.

The Eleventh Annual meeting of the Association of the Edison Illuminating Companies was held at the Hotel Cadillac, Detroit, Mich., on August 13, 14 and 15.

The first session was called to order at 10 A. M. on August 13, by C. L. Edgar, the president.

After the roll call the executive committee, represented by its Chairman, Mr. John I. Beggs, made a report recommending the acceptance of the application of three companies for admission, *i. e.*, Edison Electric Light and Power Co., Pottsville, Pa.; the Toledo Electric Co., Toledo, Ohio; the Sault Ste. Marie Co., Sault Ste. Marie, Mich., and they were declared admitted to membership.

The report of the committee on Lighting Protection, Ground, Grounding the Neutral in three-wire systems, Cross with High Tension Systems, was made by Mr. A. E. Kennelly and accepted, and the committee discharged.

Addresses were then made by Mr. S. D. Greene of the General Electric Co., Mr. Samuel Insull, of Chicago, and Mr. John I. Beggs, of Cincinnati, on "The Relations of the General Electric Co. to Edison Licensee Companies."

After considerable discussion Mr. W. L R. Emmett, of the General Electric Co., was called upon for a paper entitled "Some Comparison between the Direct-Current Low-Tension System and the Alternating Current and Multiphase System for Central Station Lighting." Mr. Emmet was unavoidably absent, and his paper was ordered printed in the minutes. The session then adjourned.

The second session was held at 2 P M. and the Storage Battery Committee made its report, which was followed by a discussion. Mr. Muller, of Hagen, Germany; Mr. C. L. Edgar and Mr. J. W. Leib, Jr., gave their experiences with storage batteries.

A paper by Messrs. Pierce and Hale was then read by Mr. C. L. Edgar, of Boston. The title of the paper was "Energy Losses in the Boston Edison Station."

After discussion on this paper the session adjourned. The evening was given up to a car ride and visit to Lalla Rookh, by courtesy of the Detroit Edison Co.

The third session was called to order at 10 A. M., August 14. A paper by Mr. W. S. Barstow, on "Method of Charging for Current for Incandescent Lamps and Motors," provoked much discussion, which with Mr. Arthur Williams' paper, "Relation of Company to Customer," occupied the entire morning. The session adjourned at 1 P. M.

The fourth session opened with a discussion by Mr. Beggs, Mr. Greene and Mr. Howell, on Incandescent Lamps, the Welsbach Light and Acetelene Gas.

A paper by Mr. C. D. Haskins on "Facts in Relation to Mechanical Recording and Chemical Meters" was then read and discussion followed.

The evening was taken up by a drive and lunch on Belle Isle, by courtesy of the Detroit Edison Co. and the General Electric Co.

In accordance with past custom, the last day of the convention (August 15) was given to entertainments. This took the form of a delightful sail along the river at the invitation of the Detroit Edison Co., who, together with the General Electric Co. received the thanks of the convention for their past courtesies.

Those present were .

J. W. Lieb, Jr., assistant general manager Edison Ill. Co., New York; W. S. Thompson, inspector Detroit Edison Co., Detroit, Mich.; John I. Beggs, vice-president and general manager Cincinnati Edison Electric Co., Cincinnati, O.; Geo. A. Redman, general superintendent Rochester Gas and Electric Co., Rochester, N. Y.; Adolph Muller, Hagen, Germany; E. M. Clark, meter department, Detroit Edison Co., Detroit, Mich.; W. S. Barstow, general superintendent Edison Electric Ill. Co., Brooklyn, N. Y.; Geo. Wiley, Detroit Edison Co., Detroit, Mich.; Daniel McCoy, president Edison Light Co., Grand Rapids, Mich.; Geo. W. Cato, electrician Detroit Edison Co.; A. F. Walker, superintendent Edison Electric Co., Grand Rapids, Mich.; Sam'l Scovil, vice-president Cleveland Electric Ill.

Co., Cleveland, O.; Winfield S. Jewell, general manager Toledo Electric Co., Toledo, O.; Geo. Peck, president Detroit Edison Co., Detroit, Mich.; Hoyt Post, attorney Detroit Company, Detroit, Mich.; C. L. Edgar, vice-president and general manager Edison Ill. Co., Boston, Mass.; Arthur Williams, general inspector Edison Electric Ill. Co., New York; B. E. Sunny, General Electric Co., Chicago, Ill.; J. R. Lovejoy, General Electric Co., Schenectady, N. Y.; Luther Stieringer, New York; Robt. Lindsay, general superintendent Cleveland Electric Ill. Co., Cleveland, O.; S. D. Greene, general manager light department General Electric Co., Schenectady, N. Y.; H. T. Edgar, general manager Edison Ill. Co., Atlanta, Ga.; A. D. Page, General Electric Co; C. P. Gilbert, general manager Detroit Edison Co., Detroit, Mich.; Caryl D. Haskins, meter department, General Electric Co.; J. S. Crider, Edison Electric Ill. Co., Cumberland, Md.; Sam'l Insull, president Chicago Edison Co., Chicago, Ill.; F. Sargent, consulting engineer, Chicago Edison Co., Chicago, Ill.; W. S. Andrews, General Electric Co.; M. A. Beal, secretary and treasurer Forest Electric Light and Power Co., Rockford, Ill.; Edwin R. Weeks, general manager Edison Electric Light and Power Co., Kansas City, Mo.; Chas. R. Price, treasurer New Bedford Gas and Electric Light Co., New Bedford, Mass.; A. W. Field, secretary and manager, Columbus Edison Electric Light Co., Columbus, O.; Geo. R. Stetson, president New Bedford Gas and Electric Light Co., New Bedford, Mass.

NOTES.

The meetings of this convention were particularly interesting on account of the lengthy and interesting discussions on the various papers.

Mr. Thos. A. Edison sent regrets for his inability to attend, as he was unable to leave his mining interests at Edison, N. J.

The General Electric Co. presented each member of the association with a handsome badge representing the fields of a multipolar generator, from the centre of which hung a miniature incandescent lamp. The title of the association, the place of meeting and the date, were neatly arranged around the field.

The next convention will be held in, or in the vicinity of Brooklyn, commencing the second Tuesday in August, 1896, and continuing three days.

THE BURLINGTON AND MT. HOLLY ELECTRIC ROAD.

In our last issue we made a brief reference to the opening of the Burlington and Mount Holly Electric Railroad, which is a branch of the Pennsylvania Railroad. A few more details of this noteworthy enterprise will be of general interest to our readers.

The power plant, which is located at the Mount Holly end of the line, consists of a Westinghouse direct-coupled generator and compound engine, the steam being generated by a 300 H.P. Climax boiler.

The motor cars, of which there are three, are a little smaller in size than the standard Pennsylvania coach. They have an enclosed vestibule at each end with side doors, and are handsomely finished both inside and out. They were built by the Jackson & Sharp Co., of Wilmington, Del. The same company's trucks are used, and the axles, supports, etc., are especially designed to carry 75 H. P. Westinghouse motors, of which machines two of the cars carry two; the third car having four 50 H. P. motors.

Each car has a baggage compartment, with the usual side doors, and seats in the same section for the convenience of smokers.

The overhead electric construction is used throughout the length of the line, the trolley wire being 22 feet above the rails. There are two feeders, each of 500,000 C. M. diameter, No. 00 hard-drawn copper wire being used for the service wire. The track construction is the same as that for a steam road, excepting that the rail joints are bonded and connected with two supplementary wires.

Regular passenger coaches are hauled as trailers, and the motor cars have sufficient power to haul a train of coaches at a speed of from 45 to 60 miles an hour

The cars are equipped with Westinghouse air-brakes, an electric motor being used for compressing the air.

The distance between Burlington and Mt. Holly, N. J., is eight miles and ten trains are run each way daily, the fare being 10 cents each way.

THE WESTINGHOUSE AND GENERAL ELECTRIC DEAL.

A dispatch from Pittsburgh, Pa., on August 13, gives a statement from Mr. George Westinghouse regarding the recently reported negotiations between his company and the General Electric Company. He said: "Three months ago Mr. Twombly, a director of the General Electric Company, had asked me if the Westinghouse Company would be willing to exchange patent licenses upon a basis which would terminate the costly litigation between the two companies.

"Mr. Twombly was informed that the Westinghouse company would enter into a general exchange of licenses, and a memorandum was drawn and committees were appointed by the parties to discuss an agreement upon the lines of such memorandum. No meetings of those committees were held, for reasons which only the General Electric officials can explain. It is said to have been due to irreconcilable differences among themselves."

Mr. Westinghouse went on to state that after some delay further offers and negotiations were made and committees were appointed for both companies. These committees met in New York on last Tuesday, Wednesday and Thursday (August 6, 7 and 8,) Charles A. Coffin, president of the General Electric Company, being one of its committee. An agreement was apparently reached, but this was afterward receded from by the General Electric Company. They afterward asked for 30 to 60 days to reconsider the subject.

Then the Westinghouse Company declined to go further, believing that the negotiations had already been used in Wall street for stockjobbing purposes. The suggestion made that the companies had agreed upon prices and a division of territory was erroneous, Mr. Westinghouse said.

THE THERMO BATTERY.

Melloni constructed a thermo-pile which gave rise to quite some little excitement in scientific circles.

Since his invention, the growth of the thermo battery has employed the energies of quite a class of inventors. One of its most interesting applications is that of investigating very faint differences in temperature. A high resistance galvanometer in connection with a thermo battery can indicate the current developed by the heat of the breath upon the battery. The creation of a current of electricity by the juxtaposition of two dissimilar metals has opened up quite a peculiar field of inquiry. It has shown that although two dissimilar metals in *contact* will develop a potential difference in accordance with the law governing the E. M. F. of two different substances, it has also illustrated the equally important fact that the *application of heat, at the point of juncture*, causes an E. M. F. to be set up. Yet a phenomenon equally as interesting is that which is the result of the passage of a current through the point of juncture between two metals. The temperature will fall if the proper selection of metals has been made. It is possible to freeze water solid by the application of this method. It is called in such a case the Peltier effect, to distinguish it from the other.

It has been calculated that the heat produced in the brain by the solution of a ten-minute problem is sufficient (if the battery be pressed against the brow) to give rise to a current which if sent into a motor, would give it ample power to drill through a plank one inch thick.

CAUSE AND EFFECT.

The contraction of the sun by one ten-thousandth of its diameter has supplied the heat necessary for this earth since the Christian era. The weight of a cubic mile of hydrogen at the sun would weigh more than the most colossal of the Egyptian Pyramids. The volume of the sun is equal to 650,000,000,000 cubic miles and has cooled in 5,000 years about one-tenth of a degree Fah.

These facts tend to show the fierce heat of the sun; the great pressure under which its constituents are laboring and the enormous volume, the stupendous mass of its bulk. This is but the faintest outline of the conditions existing, not only at the sun but at the myriads of unseen spheres, whose light is even now on its way to reach use Cold, silent and impenetrable are the vaults of space, yet in its distant recesses shall lie buried for æons of years to come the mysterious light and growing warmth of future worlds. Some have spoken of the "music of the spheres;" but no silence is more perpetual than the everlasting quietude of space.

Were it not for the communion established by the presence of the ether, the harmony of colors and all those intricate relationships expressed by the rising light of dawn would be forever lost to our sight.

Within the universe is always met this connecting link between world and world. As far as our intelligence can reach we form a mental picture of the limitless ether ocean with its few isolations, its recurrent solidifications and outspanning stretches of impalpably fine world-matter.

Yet, withal, the question forever faces us. "Is this cause and effect?"

The primordial atoms of the first nebulous condensation expressed a tendency that involved the entire after-history of the universe. Why should atoms gravitate toward one another? Or, as Spencer has discovered, why should the homogeneous become the heterogeneous? There is so much positive inquiry in this remark that upon it a superstructure has been built which constitutes in itself the entire architecture of modern science. Many of the attractive tendencies in nature have required the primary phenomenon of gravitation to occur before the latent and secondary effects could follow. After one general effect has been observed the more important though not less interesting chemical attractions ensue. There are many effects in nature which are incomprehensible to our limited mentality. And why so? Simply because we can not reconcile a cause and effect until we understand the *process*. That is our weakness and shall always remain so. To be of infinite intelligence would mean an ability to grasp the innumerable processes through which a cause frequently is so far removed from an effect that the relation between the two seems too remote to admit of a proper reconciliation.

But does that in any way destroy the actual relationship because it is but the complex product of concentered causes?

This much can be said of so popular a theory—it has originated because the processes of the mind are of a kind that could give rise to none other. The very nature of our intellects forces us to the belief in effects subsequent to every cause; thus making an endless chain—a perpetual cycle of impressed and endless forces.

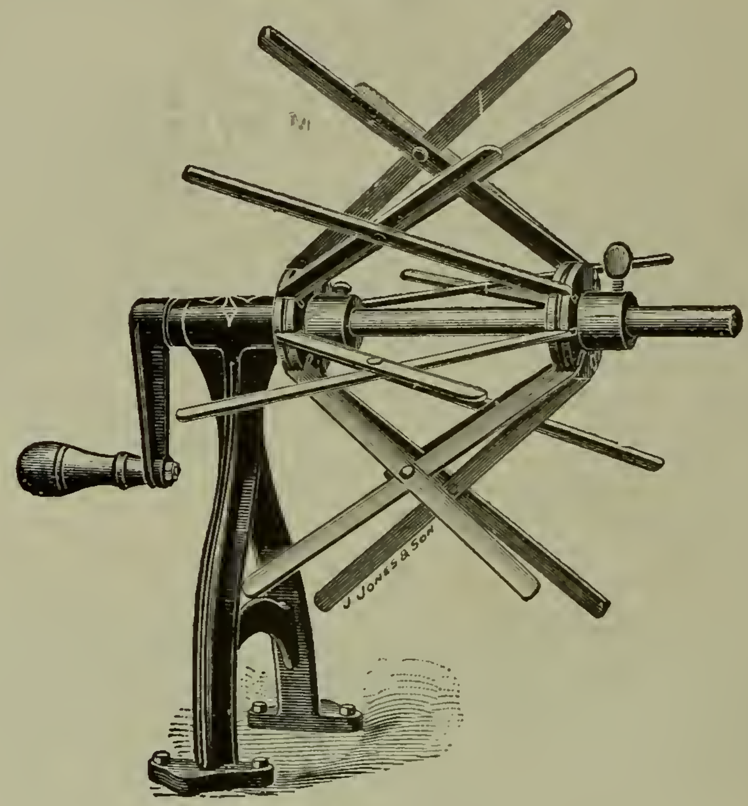
The myriads of living types and uncountable geological formations could never have existed had not that great and mysterious aggregation first occurred. From matter that was impelled by invisible forces to condense and collect sprang the shining nebula—the glowing brightness of a new born sphere—the budding maturity of an inhabited planet.

Ways That Are Dark In Wales.—According to the *South Wales Daily Post*, one of the reasons for delay in introducing electric lighting into Swansea is the great distance between the poles which support the lamps, the present arrangement of lamp-posts being found very convenient by gentlemen returning home after a "smoker" or banquet.

NEW WIRE WINDER.

The wire winder illustrated herewith is a very convenient device where it is desired to wind and rewind wire. It is of great service, particularly to hardware dealers, electricians and dealers in electrical supplies.

By loosening the thumb screw on the loose collar holder, the circumference of the reel may be enlarged or diminished at will, thus giving the coil any desired size, within the limits of the winder.



JONES WIRE WINDER.

This winder is made by J. Jones & Son, 67 Cortlandt street, New York. The frame is of good cast iron, japanned, and the other parts, except the handle (wood) are made of steel, coppered and lacquered.

This winder is neat, very serviceable and inexpensive.

A NEW FIELD FOR ELECTRICITY.

An important matter that should not escape the attention of our marine, and indeed ought to be very promptly considered by our naval authorities, is a better method of protecting vessels from corrosion and fouling. There cannot be too much interest manifested by the public, and particularly by congressmen, relative to saving millions of money in the reduction of annual expenditure on war vessels; and there is no reason why enterprise leading in this direction should not be encouraged by the future policy of our government. If it is at all desired and possible to have swift vessels, their graded speed should not be reduced by obstructed friction caused from foul bottoms.

To neglect this matter means damage from corrosion, which quickly follows, and lowering of speed that renders the vessel unfit for active service, unless it is frequently docked and scraped. The question of dry-docking and painting bottoms of vessels with any of the anti-fouling and anti-corrosive compositions is one of utmost importance and has received serious thought, but the ideal requirement has not been fully attained.

Protection of vessels from the destructive agencies in sea water has also been attempted by metallic and nonmetallic coverings, but all experiments thus far have proved failures.

It is well known that the United States vessels in water far from docking facilities lose sometimes fifty per cent. of their speed efficiency, while they double their consumption of coal, and it has been estimated that the cost of docking, cleaning and painting the cruiser Chicago at suitable intervals during a three years' cruise requires the expenditure of $100,000. Past experience shows an annual increase in this outlay, and unless a remedy is very soon provided the maintenance of war vessels alone will be something difficult to compute. Nothing has been acceptably done, and every known remedy has been almost a failure. It is time, therefore, that a stride should be taken to place our marine in advance of its present state.

Admitting that some precaution has previously been made, and that thousands of dollars have been expended in testing various coverings, yet should there not be greater effort and more inducement extended by our government toward individual effort to encourage some practical and safe remedy? It is now claimed that a Kentuckian has at last discovered that, by the use of certain compounded ingredients in connection with electrical treatment, that a body has been created that stands and is proof against the action of sea water and against corrosion and fouling.. It is believed that docking will be unnecessary after a vessel has been once properly prepared and launched, as the hull will be kept clean electrically. The enamel has been submitted to a test with most satisfactory results which have so far exceeded expectations, and the belief is that this system is destined to play an important part in the economy of our merchant marine and new men-of-war of the future.

THE CLAM BAKE AT PROVIDENCE.

The 17th annual clam bake of the American Electrical Works, Providence, R. I., was tendered to the electrical fraternity at Haute Rieve, on Saturday, August 17, and was largely and enthusiastically attended, about 200 persons being present. Before the feast, football, baseball, rifle-shooting and other out-door sports were indulged in. The usual group photograph was taken and then the hungry crowd sat down to the tables which were groaning under the weight of things good for the inner man. By the time the feast was over the groaning was transferred from the tables to the men.

President Eugene F. Phillips rapped for order after the clams had been devoured and cigars lighted, and extended a hearty welcome to his guests. He named Mr. Thomas D. Lockwood, of Boston, as toastmaster. Mr. Lockwood in his usual happy style kept the company in the best of humor, and called on several gentlemen for responses to toasts. Mr. Ralph W. Pope responded to the toast of "Telegraphy;" "The Telephone" was taken care of by Mr. T. D. Lockwood, and "The Electrical Press" by W. S. Key. Other toasts responded to were "The Electrical Transmission of Power," by C. S. Sergeant, of Boston; "The Electric Light," by Capt. Wm. Brophy.

President E. F. Phillips concluded the programme by giving a sketch of the American Electrical Works and its early struggles, and after a general handshaking and *adieus* the party scattered to the four winds of heaven.

Mr. Frederick Noll.—The Interior Conduit and Insulation Co., 527 West 34th street, New York, have secured the services of Mr. Frederick Noll, late of the firm of Noll & Sibley, whose dissolution was announced in our last issue. Mr. Noll, who has been well-known in the electrical trade of New York city for the past 15 years, will manage the sales of interior conduit motors, dynamos, fans, etc., for the metropolitan district of the Interior Conduit and Insulation Co.

A highwayman held up a trolley car on the main street of Wichita, Ks, recently. The only passenger, a man, was relieved of $70, and the conductor was persuaded to part with his gold watch and some small change. Many people witnessed the bold proceeding but were afraid to interfere.

—It is stated that the General Electric Company has bought at auction the plant of the Morristown Electric Light Co., Morristown, Texas, paying therefor $4,000. After making some necessary changes the service will be continued.

Street Railway Notes.

Propositions will be received to change the Brunswick Street Railway, Brunswick, Ga., to the electric system. For further particulars address W. A. Jeter, Macon, Ga.

A. St. Clair, D. E. Johnston and T. H. Graham, Graham, Pa., are interested in the proposed Graham-Bluefield Electric Railway.

The Little Rock (Ark.) City Council has granted a franchise to the Boulevard Street Railway Company. J. H. Healey is manager of the company.

An electric railroad is to be built between Louisville and Fairfield, Ky., and the right of way for the same is being secured. J. C. Wright and Chas. Fagenbush are interested in the project.

Ex-Congressman W. F. Daniels, of Franklin, N. H., is interested in a project to build an electric street railway in that place.

A. A. Hoover, of New Berlin, Ohio, Lew Smith, of Greentown, Ohio, Milo White, of Springfield, Ohio, and H. Nees, of Uniontown, Ohio, have incorporated a company to build a street railway from Canton to Akron. The enterprise is backed by W. A. Lynch, of Canton, president of the local street railway and the Canton and Masillon Inter-Urban Line.

New York Notes.

Office of the Electrical Age,
World Building, New York,
August 19, 1895.

The firm of Doubleday, Mitchell & Co., No. 27 Thames Street, New York, on August 2 was dissolved by mutual consent. Mr. Charles D. Doubleday will continue the business under his own name and assume all the liabilities and contracts of the firm.

J. P. Hall, electrical contractor, 143 Liberty street, N. Y., is installing two 600-light Westinghouse generators in the Beresford Hotel, and wiring the building for 200 additional lights. These two generators displace two 300-light Loomis machines, which Mr. Hall will sell at a low figure for cash; they are both in perfect order. Mr. Hall is also wiring the annex of the San Remo Hotel for 1200 lamps, and installing an 8 x 12 white marble switchboard, with instruments for 5 generators and 22 circuits. He is also wiring a large apartment house and a private house, at Nos. 268 and 270 W. 34th street, for 500 lamps and two electric elevators. Among other wiring contracts now under way is that for 400 lights in Building No. 6 at the Brooklyn Navy Yard. W. T. H.

New Corporations.

Pontiac and Sylvan Railway Company, Pontiac, Mich., has been incorporated by H. B. Mills, Thaddeus H. Smith and William S. Hinman. Capital stock, $50,000.

Danville and Northwestern Electric Railway Company, Danville, Ill., has been incorporated by W. T. Cunningham, John W. Dale, William P. Chandler and others. Capital stock, $100,000.

The Connersville Electric Light Co., Connersville, Ind., has been incorporated by G. W. Ansted, Wm. Newkirk, J. B. McFarland and J. M. Herron. Capital stock, $18,000.

The New Bethlehem Electric Co., New Bethlehem, Pa., has been incorporated by G. S. Thomas, C. E. Andrews, H. Andrews, and others, with a capital stock of $1,000.

Kokomo and Greentown Street Railway Co., Kokomo, Ind., has been incorporated by W. E. Snow, A. Avery, C. H. Hilton, J. S. McDonald, all of Detroit; F. N. Allen, of Kokomo. Capital stock, $50,000.

Attica Power Co., Attica, Ind., has been incorporated by C. J. Haller, P. R. Zeigler, Will Zeigler, J. A. Wilson, and others. Capital stock, $10,000.

The Portchester, Rye, Harrison and White Plains Electric Railway Co., Portchester, N. Y., has been incorporated by John W. Lounsbury, Wm. Ryan, of Portchester; John Duffy, of White Plains; Ebenezer Bull, of Harrison, Charles B. Haines, of Kinderhook, and others. Capital stock, $150,000.

The Danville and Northwestern Electric Co., Danville, Ill., has been incorporated by W. W. Hatch, of New York, and Citizens of Danville, to construct a railroad from Danville, Ill., to Gilman, Ill.

Telephone Notes.

It is stated that the New Standard Telephone Co., recently organized in Baltimore, Md., will build a plant for 5,000 instruments, with provision to increase the number to 10,000.

A telephone franchise in Kansas City, Mo., is asked by F. A. Faxon, T. K. Hanna, W. F. Johnson and others.

The Texas Telephone Co., Benham, Texas, has been organized by J. G. McGrady, A. B. Cross and George M. Heard, with a capital stock of $5,000.

The Telephone Publishing Co. has been incorporated in Waco, Texas, by H. H. Shar, W. W. Seley, and others.

The Richmond Standard Telephone Co. has been chartered in Richmond, Va. R. H. Smith, Richmond, is secretary and treasurer of the Company.

The Standard Telephone Company, Baltimore, Md., has been incorporated by John W. Woodland, General Felix Agnus, Robert M. Galt and others. Capital stock, $140,000.

The Columbia Telephone Co., Charleston, S. C., has been incorporated by W. Y. Abrahams and others. Capital stock, $5,000.

TELEPHONE PATENTS ISSUED AUGUST 13, 1895.

Telephone Switch. Frank R. Whitney, Lewiston, Me., (No. 544,335).

Multiple Switchboard System. Oro A. Bell, Brooklyn, N. Y. (No. 544,341).

Plug and Cord for Telephone Switchboards. Frank R. McBerty, Downer's Grove, Ill. (No. 544,369).

Automatic Signaling Device for Telephone Switchboards. Frank R. McBerty, Downer's Grove, Ill. (No. 544,370).

Electric Grounding Switch. Charles E. Scribner, Chicago, Ill. (No. 544,383).

Single-Cord Grounded Circuit System for Multiple Switchboards. Charles E. Scribner, Chicago, Ill. (No. 544,384.)

Test Signal for Multiple Switchboards Charles E. Scribner, Chicago, Ill. (No. 544,385).

Telephone Switchboard Apparatus. Charles E. Scribner, Chicago, Ill. (No. 544,386).

Telephone Exchange System. Charles E Scribner, Chicago, Ill. (No. 544,388).

Signal Apparatus for Telephone Exchanges. Joseph J. O'Connell, Chicago, Ill. (No. 544,545).

Apparatus for Telephone Exchanges. Joseph J. O'Connell, Chicago, Ill. (No. 544,546.)

Trade Notes.

W. A. Robinson & Co., of Macon, Ga , have secured the contract to build an electric plant in West Point, Ga.

G. Weiderman, 307 Flatbush avenue, Brooklyn, N. Y., has a small stock of $18 battery motors which he will sell at $2 each. This is a bargain.

The Electric Storage Battery Co., of Philadelphia, has recently closed a contract for the installation of 66 cells, type G 11, Chloride accumulators, in the Liederkranz Club, New York city. The capacity of the battery is 1,000 ampere-hours. The company has also sold a plant of 120 cells, type F 19, with a capacity of 900 ampere-hours, to the Argentine Republic. These cells are to be installed in the government building at Buenos Ayres, and used for light and power purposes. Seven hundred and twenty-five cells of chloride accumulators of various sizes are being installed in main office of the Western Union Telegraph Co., Washington, D. C. These cells will be used for main and local wires.

WOVEN WIRE BRUSHES.

The Belknap Motor Co., of Portland, Maine, are the patentees and manufacturers of the best woven wire commutator brush on the market.

ELECTRICAL and STREET RAILWAY PATENTS

Issued August 13, 1895.

544,278. Electric Rheostat. Francis B. Badt, Chicago, Ill., assignor to the Siemens & Halske Electric Company of America, same place. Filed May 31, 1895.

544,283. Conduit for Electric Conductors for Railways. Frank L. Capps, Newark, N. J. Filed Sept. 18, 1894.

544,289. System of Electrical Distribution. Stanley C. C. Currie, New York, N. Y. Filed Nov. 27, 1893. Renewed Dec. 21, 1894.

544,306. Conductor for Electric Railways. Paul C. Just, Chicago, Ill, assignor to Albert G. Wheeler, same place. Filed Feb. 6, 1893.

544,312. Trolley for Underground Electric Railways Myron D. Law, Washington, D. C., assignor to Albert G. Wheeler, Chicago, Ill. Filed Jan. 31, 1894.

544,313. Travelling Contact Device for Electric Railways. John C. Love, Philadelphia, Pa., assignor to the Love Electric Traction Company, Chicago, Ill. Filed Sept. 5, 1893.

544,318. Multiple-Fuse Switch. Josef Melzer, Saaz, Austria-Hungary, assignor, by direct and mesne assignments, of eleven-sixteenths to Ernest Konigslow, Francis C. McMillin, and Albert W. Mayers, Cleveland, Ohio. Filed Oct. 20, 1893.

544,329. Commutator-Connection for Dynamo-Electric Machines. Henry H. Wait, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Mar. 1, 1895.

544,331. Globe-Netting for Arc Lamps. Ernest P. Warner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Sept. 18, 1894.

544,332. Electro-magnetic Damper for Measuring-Instruments. Ernest P. Warner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Sept. 18, 1894.

544,335. Telephone-Switch. Frank R. Whitney, Lewiston, Me. Filed Jan. 30, 1894.

544,341. Multiple Switchboard System. Oro A. Bell, Brooklyn, N. Y., assignor to the Western Electric Company, Chicago, Ill. Filed Feb. 21, 1893.

544,343. Magnet-Forming Machine. Orlando P. Briggs, Chicago, Ill., assignor to the Western Electric Company, same place. Filed January 20, 1894.

544,345. Printing-Telegraph. Charles L. Buckingham, New York, N. Y. Filed Apr. 16, 1894.

544,346. Printing-Telegraph. Charles L. Buckingham, New York, and Emil Germann, Brooklyn, N. Y.; said Germann assignor to said Buckingham. Filed Jan. 10, 1895.

544,347. Printing-Telegraph. Charles L. Buckingham, New York, and Emil Germann, Brooklyn, N. Y.; said Germann assignor to said Buckingham. Filed Jan. 10, 1895.

544,348. Printing-Telegraph. Charles L. Buckingham, New York, and Emil Germann, Brooklyn, N. Y.; said Germann assignor to said Buckingham. Filed May 20, 1895.

544,350. Spring-Motor. Thomas A. Cross, Bardwell, Ky. Filed Dec. 14, 1894.

544,351. Relay. Thomas B. Dixon, Henderson, Ky. Filed Nov. 17, 1892. Renewed July 10, 1895.

544,361. Construction and Method of Operating Dynamo-Electric Machines. Frederick H. Loveridge, Coldwater, Mich. Filed Aug. 2, 1894.

544,363. Thermostatic Instrument. Morris Martin, Malden, Mass. Filed June 5, 1893.

544,365. Synchronism-Indicator. Ralph D. Mershon, Pittsburgh, Pa. Filed Nov. 12, 1894.

544,368. Strong-Current Arrester. Frank R. McBerty, Downer's Grove, assignor to the Western Electric Company, Chicago, Ill. Filed May 31, 1894.

544,369. Plug and Cord for Telephone-Switchboards. Frank R. McBerty, Downer's Grove, assignor to the Western Electric Company, Chicago, Ill. Filed Sept. 18, 1894.

544,370. Automatic Signaling Device for Telephone-Switchboards. Frank R. McBerty, Downer's Grove, assignor to the Western Electric Company, Chicago, Ill.

544,372. Manufacture of Electric Cables. William R. Patterson, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Aug. 24, 1891.

544,373. Art of Drying Electric Cables. Wm. R. Patterson, Chicago, and Charles H. Rudd, Evanston, assignors to the Western Electric Company, Chicago, Ill. Filed Sept. 30, 1891.

544,383. Electric Grounding-Switch. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Dec. 6, 1887.

544,384. Single-Cord Grounded-Circuit System for Multiple Switchboards. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Dec. 1, 1890.

544,385. Test-Signal for Multiple Switchboards. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed July 7, 1891.

544,386. Telephone-Switchboard Apparatus. Charles E.

National Electric Light and Street Railway Associations.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

President, C. H. Wilmerding, Chicago, Ill.; 1st Vice-President, Frederic Nicholls, Toronto, Canada; 2d Vice-President, E. F. Peck, Brooklyn, N. Y.

Members of Executive Committee: E. H. Davis, Williamsport, Pa, (one year); W. R. Gardiner, Pittsfield, Mass.; George A. Redman, Rochester, N. Y.; J. J. Burleigh, Camden, N. J. Next meeting, New York, May or June, 1896.

AMERICAN STREET RAILWAY ASSOCIATION.

Next meeting, Montreal, Que., October, 16, 17 and 18, 1895.

President, Joel Hurt, Atlanta, Ga.; Vice-President, W. Worth Bean, St., Joseph, Mich.; 2d Vice-President, John M. Cunningham, Boston, Mass.; 3d Vice-President, Russell B. Harrison, Terre Haute, Ind., Secretary and Treasurer, William J. Richardson, Brooklyn, N. Y.; Executive Committee, Henry C. Payne, Milwaukee, Wis.; W. H. Jackson, Nashville, Tenn.; D. G. Hamilton, St. Louis, Mo., C.C. Cunningham, Montreal, Canada; J. N. Partridge, Brooklyn, N. Y.

NEW YORK STATE STREET RAILWAY ASSOCIATION.

Next meeting, Albany, N. Y., third Tuesday in September, 1895.

President, G. Tracy Rogers, Binghamton; First Vice-President, John H. Moffitt, Syracuse; Second Vice-President, W. W. Cole, Elmira; Secretary and Treasurer, William J. Richardson; Brooklyn; Executive Committee, D. B. Hasbrouck, New York; John N. Beckley, Rochester; Daniel F. Lewis, Brooklyn.

OHIO STATE TRAMWAY ASSOCIATION.

Next meeting, fourth Wednesday in September, 1895.

President, Albion E. Lang, Toledo; Vice-President, W. J. Kelly, Columbus; Secretary and Treasurer, J. B. Hanna, Cleveland; Chairman Executive Committee, W. A. Lynch, Canton.

MASSACHUSETTS STATE STREET RAILWAY ASSOCIATION.

President, T. H. Cunningham, Boston; Secretary and Treasurer, A. S. Butler, Lawrence; Executive Committee, Samuel Winslow, Alfred A. Glazier, Boston; P. F. Sullivan, Lowell; E. C. Foster, Revere; Horace B. Rogers, Brockton; A. E. Smith, Springfield; Prentiss Cummings, Boston.

THE TEXAS STREET RAILWAY ASSOCIATION.

President, W. H. Sinclair, Galveston; vice-president, C. A. McKinney, Houston; Secretary and Treasurer, C. L. Wakefield, Dallas. Directory: The officers and W. H. Weiss, San Antonio and George B. Hendricks, Fort Worth.

Next meeting, Galveston, third Wednesday in March, 1896.

PENNSYLVANIA STATE STREET RAILWAY ASSOCIATION.

Next meeting, first Wednesday in September, 1895.

President, John A. Rigg, Reading; First Vice-President, Robert E. Wright; Secretary, S. P. Light, Lebanon; Treasurer, W. H. Lanius, York.

THE MAINE STREET RAILWAY ASSOCIATION.

President, W. R. Wood, Portland; Secretary and Treasurer, E. A. Newman, Portland; Executive Committee, W. R. Wood, Portland; George E. Macomber, Augusta; F. M. Laughton, Bangor; Frank W. Dana, Lewiston; Amos F. Gerald, Fairfield.

MICHIGAN STATE STREET RAILWAY ASSOCIATION.

President, W. L. Jenks, Port Huron; Vice-President, W. Worth Bean, St. Joseph; Secretary and Treasurer, B. S. Hanchett, Jr., Grand Rapids; Executive Committee, the Officers and David H. Jerome, Saginaw, and Strathern Hendrie, Detroit.

THE STREET RAILWAY ASSOCIATION OF THE STATE OF NEW JERSEY.

President, Thos. C. Barr, Newark, Vice-President, W. S. Scull, Camden; Secretary and Treasurer, Charles Y. Bamford, Trenton; Executive Committee, Officers and C. B. Thurston, Jersey City; H. Romaine, Paterson S. B. Dod, Hoboken.

Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Dec. 26, 1894.

544,387. Electro-magnetic Signal. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Jan. 8, 1895.

544,388. Telephone-Exchange System. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed May 13, 1892. Renewed Feb. 11, 1895.

544,391. Electric-Railway Conduit System. Lorenzo H. Sherwood, Mount Vernon, N. Y. Filed Sept. 7, 1894.

544,396. Winding of Dynamo-Electric Machines or Motors. Elihu Thomson, Swampscott, Mass., assignor to the General Electric Company, of New York. Filed Jan. 27, 1894.

544,404. Car-Fender. John S. Detwiler, Philadelphia, Pa. Filed Jan. 2, 1895.

544,417. Truck for Street-Railway Cars. Louis T. Pyott, Philadelphia, Pa, assignor of one-half to Daniel E. Waters and William G. Vernon, same place. Filed Mar. 12, 1895.

544,419. Electric-Wire Containing Hat or Cap Band. Alfred M. Rodriguez, Brooklyn, N. Y., and Edward D. Rockwell, Bristol, Conn. Filed June 10, 1895.

544,430 Support for Electrical Batteries used on Vehicles. Thomas Froggatt, London, England. Filed May 1, 1895.

544,436. Automatic Safety Appliance for Electric Conductors. Adelbert E. Hutchins, Detroit, Mich. Filed May 9, 1893.

544,468. Car Wheel and Axle. Albert Porter, Chicago, Ill. Filed Mar. 28, 1895.

544,471. Trolley Wheel and Bearing. Edmond Verstraete, St. Louis, Mo., assignor of one-third to Ernest G. Bruckman and Samuel E. Bruckman, same place. Filed Nov. 22, 1894.

544,489. Truck for Street Cars. George F. Shaw, Dedham, Mass. Filed Nov. 1, 1894.

544,501. Cleat for Holding Electric Wires. Elisha W. Buffinton, Fall River, Mass., assignor of one-half to Albert F. Dow, same place. Filed Mar. 15, 1895.

544,502. Support for Incandescent Lights. Charles A. Carmany, Middletown, Pa. Filed Sept. 8, 1894.

544,514. Electric Gas-Lighter. Erik Orling, Stockholm, Sweden, assignor to the Aktiebolaget Inventor, same place. Filed Feb. 5, 1895. Patented in Sweden, Feb. 23, 1893, No. 4,542; in Germany Mar. 28, 1893, No. 72,775; in Belgium June 3, 1893, No. 104,923; in Switzerland Aug. 25, 1893. No. 7,449; in Italy Sept. 30, 1893, XXVIII. 34,792, LXVIII, 214; in England, Nov. 28, 1893, No. 22,858; in France, Dec. 22, 1893, No. 224,311, and in Portugal Aug. 16, 1894, No. 1,901.

544,529. Electric-Arc Lamp. Richard H. Cunningham, Richmond, Va Filed Sept. 8, 1894.

544,531. Insulated Electric Conductor. Tobias N. Hallanger, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Feb. 18, 1893.

544,545. Signal Apparatus for Telephone-Exchanges. Joseph J. O'Connell, Chicago, Ill., assignor, by mesne assignments, to the American Bell Telephone Company, Boston, Mass. Filed Apr. 17, 1893.

544,546. Apparatus for Telephone-Exchanges. Joseph J. O'Connell, Chicago, Ill., assignor, by mesne assignments, to the American Bell Telephone Company, Boston, Mass. Filed Apr. 17, 1893.

544,552. Electro-therapeutic Appliance. John E. Wiles, Milwaukee, Wis. Filed Jan. 14, 1895.

544,565. Car-Fender. Samuel A. Darrach, Newark, N. J., assignor to the Darrach Car Fender Company, same place. Filed Apr. 25, 1895.

544,567. Electrical Signaling Apparatus. William W. Dean, St. Louis, Mo., assignor to the Bell Telephone Company of Missouri, same place. Filed Sept. 24, 1894.

544,574. Safety Car-Brake. Jefferson U. Elwood, McKeesport, Pa., assignor to himself and Duane P. Smith, same place. Filed Jan. 16, 1895.

544,578. Electric-Arc Lamp. John H. J. Haines, New York, N. Y., and Alexander B. Fernald, Jersey City, N. J. Filed Nov. 20, 1894.

544,579. Electric-Arc Lamp. John H. J. Haines, New York, N. Y., and Alexander B. Fernald, Jersey City, N. J. Filed Nov. 20, 1894.

544,610. Process of and Apparatus for Extracting Ores by Electrolysis. Edward W. Clark, Butte Mont., assignor of two-thirds to Edwin M. Clark and the Western Iron Works, same place. Filed Nov. 5, 1894.

544,633. Combination-Dynamo. Ernest P. Warner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Feb. 24, 1890.

544,634. Electric-Light Attachment for Gas-Burners. Frank A. Webb, Beverly, Mass., assignor of five eighths to Rufus H. Woodbury and John R. Webb, same place. Filed Mar. 11, 1895.

544,644. Fountain Ink-Roller for Telegraph-Registers. Charles A. Rolfe, Chicago, Ill. Filed Oct. 13, 1894.

544,645. Ink-Roller for Telegraph-Registers. Charles A. Rolfe, Chicago, Ill. Filed Apr. 18, 1895.

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CONTENTS.

MR. EDISON'S TRIBULATIONS.

Mr. Thomas A. Edison has been enjoined by a New Jersey Court from sending kinetophones abroad. Mr. Edison needn't worry about that; he can easily dispose of all of his instruments in this country so long as he can provide views, "prize fights," etc. If the foreigners must see the kinetophone, let them organize American kinetophone excursions.

THE BELL COMPANY AFTER MORE.

The Bell Company is kicking hard in its efforts to protect its precious Berliner patent from alleged infringement. In addition to "jumping on" the National Telephone Manufacturing Company it has directed its attention to the Century Telephone Company and the Bay State Telephone Company, of Boston, against which concerns it has entered suit. Nobody is infringing the Berliner patent, so what is the need of this useless bluster and expense. The patent has been killed once, and by common consent, excepting the Bell Company's, is acknowledged dead. The present situation, as far as the telephone company is concerned, aptly illustrates the case of the drowning man clutching at straws.

TREATING CLAY ELECTRO-MAGNETICALLY.

The presence of iron in potters' clay renders the clay undesirable for the manufacture of pottery, and too much of the same metal in sand unfits the sand for use in the manufacture of glass. There is plenty of clay and sand which is practically valueless on account of the admixture of iron, but there is now a promise that by the proper application of electricity this now waste and useless matter can be made available for manufacturing purposes. Two gentlemen in Wellsville, Ohio, have invented a method, by the aid of electro-magnetism, of extracting iron from clay and sand. It is stated to be successful, and a company has been organized to exploit the invention.

HAWAIIAN CABLE.

The Hawaiian government has granted to Col. Z. S. Spalding an exclusive franchise for laying a submarine telegraph cable from San Francisco to Honolulu. The franchise also includes an annual subsidy of $40,000. The aid of the American government will be sought when Congress next meets. There has been a good deal of talk and figuring about laying a trans-Pacific cable by way of the Hawaiian Islands, but little else has been done. Col. Spalding, therefore, deserves the credit for doing more in this direction than anyone else, and while his plans do not appear to contemplate crossing the Pacific Ocean with the proposed cable, his objective point is of more importance to the United States.

ENGLISH TRUNK TELEPHONE LINES.

On another page will be found an interesting article on the trunk telephone lines of the English government. The government operates the lines connecting the towns and cities with each other, while the work of the National Telephone Company and its allies is confined to the cities and towns themselves. Leeds is the long-distance telephone centre, and there the main switching of the trunk line system is done. The new government service was recently inaugurated, the occasion being made one of interest. Several prominent officials, members of Parliament and others conversed from London with various places in the kingdom, and in the evening of the same day further trials of the conversing powers of the instruments were made. The evening attendance was a notable one, and included Lord Kelvin, Lord Rayleigh, Prof. Hughes, Prof. Silvanus Thompson. It is stated that the English long-distance lines have proved a great success, telephonically. The minimum time allowed for conversations is three minutes. The mileage of wire completed to date is 7,595 miles, metallic circuits being used.

THE BOOSTER SYSTEM.

The great advantages offered by the use of a Booster in electric lighting stations have been practically and satisfactorily demonstrated by the Brooklyn Edison Illuminating Co., of Brooklyn, N. Y. The function of a Booster is to raise the pressure of a feeder circuit to meet the demands of an outlying district, where the business is not sufficient to warrant the outlay required for a sub-station.

The Booster is a motor-driven direct-connected generator, the motor deriving its energy from the bus-bars. The generator is connected in series on the feeder whose pressure is to be raised, and by either special field-winding and compounding, or hand regulation, the normal pressure of the feeder is increased in proportion to the load on that feeder, thereby automatically taking up the drop on the line. By such an arrangement a practically uniform voltage is available at the service end of the feeder under all conditions of load..

This system is the invention of Mr. W. S. Barstow, the general manager of the Brooklyn Edison Illuminating Co., and is applied with unqualified success to constant potential feeders covering large areas.

Boosters are in use in the first and third district stations of the Edison Company, that in the first district station being illustrated herewith.

The middle machine is the motor, all three being set on one base, which arrangement gives great rigidity to the system.

The motor is a 220-volt shunt wound machine.

The advantages of the Booster system may be thus enumerated:

It enables current to be economically supplied from a lighting station in a business district to a residence district which would not warrant the outlay required for a substation.

It does away with all feeder equalizers and other energy-consuming devices for obtaining equal distribution of pressure at the lamps.

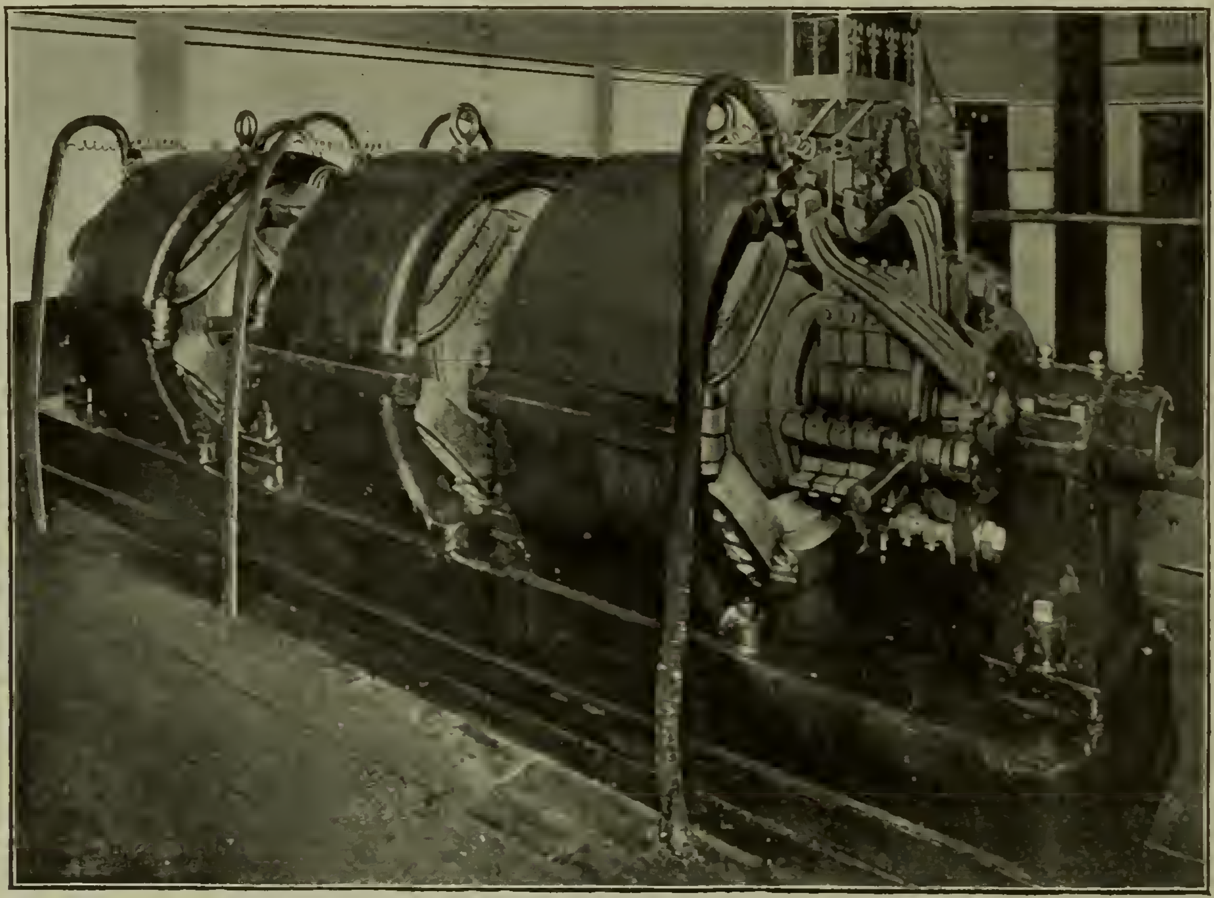
It allows of the tying together of the centres of distribution of several stations, so that the load of any station may be at once assumed by any one of the others.

It enables any feeder on a multi-pressure bus system to be transferred from one bus to another without causing any lamps to flicker.

It reduces the first cost of railway feeder systems from 25 per cent. to 75 per cent.

It furnishes a convenient means of throwing at once an extra pressure upon any feeder receiving an extra load.

The machines illustrated herewith were installed by the Crescent Electric Machine Co., 635 Kent avenue, Brooklyn, N. Y., and is in daily service in the Brooklyn Co.'s first district station with the most satisfactory results.



BOOSTER PLANT IN FIRST DISTRICT STATION, BROOKLYN EDISON ILLUMINATING CO.

AN ADVANCE IN ELECTRIC CONDUIT STREET RAILWAYS.

America's metropolis, the city of New York, at last has in operation an electric—open conduit—street railroad which will probably prove satisfactory to the public as well as to the company operating it. It is strange, indeed, that a problem relatively so simple as the building of a successful road of this kind should have been held up for so long a time as one of the bugbears of practical engineering. Conduit roads, it is true, there have been many, some on paper and some in actual service, but of these latter the one at Budapest is the only one which has heretofore been distinctly successful, not so much because of any specially remarkable feature of construction, as because of the favorable condition of that city's streets, which have always been held up as models of good paving and cleanness. Serious filthy accumulations in the Budapest conduits, and consequent traffic interruptions, have therefore been almost unknown there. What has proved itself to be good practice at Budapest, however, was not necessarily good practice in every other city, particularly not where clean streets were the exception rather than the rule and where the conduit was likely to be called upon, at almost any time, to carry off large quantities of storm water. Too great a saving in the first cost of construction and, as a rule, therefore, too small a conduit have sealed the fate of nearly every open-conduit road thus far built; but, instead of recognizing this as the true difficulty, inventors have in the main sought to supplant the open conduit by various other forms, nearly all of them much too complex and delicate to warrant serious thought of their adoption. The result has been hundreds of patents, more or less interesting, but worthless. The open-conduit idea is quite good enough, but it should be worked out with an ordinary amount of common-sense, and with due regard to the plain fact that extreme economy in cost of conduit is no economy at all. Make the conduit big enough, so that dirt falling into it will not quickly fill it up, and ordinary rain storms will not be able to flood it, then you will have satisfied the underlying principle of success. Of this the New York line referred to will, in all probability, give further proof, and in so doing will make a distinct advance in the matter of street-car propulsion in big cities.—*Cassier's Magazine* for September.

THE EDWARDS AUTOMATIC FENDER.

The car fender illustrated herewith seems to be a perfect safeguard, and is attracting much attention among street railway people. It has been given a practical public test in Brooklyn with the most satisfactory results, the press of New York and Brooklyn referring to it in the most complimentary manner.

The Edwards automatic fender is entirely mechanical in its action, and literally picks a person up from the ground without injury. It is reliable in its action; simple in construction and cheap to install, and with its use it is impossible for any one to be run over by a trolley or cable car, or even suffer the slightest injury.

The fender is made of two iron arms, so jointed as to

FIG. 1.

permit of its being folded up when not in use. Attached to the lower arm is a swinging frame or platform which is balanced on pivots. The front part of the frame is a trifle heavier than the back half, so that by its own gravity it keeps close to the ground.

By means of set screws placed under the side arms the platform may be raised or lowered and kept at any desired distance from the ground. The oscillation of the car body does not affect the position of the fender with reference to the ground, and should the fender come in contact with any slight obstruction on the road bed a spiral spring attached to the front raises the platform sufficiently to permit the obstruction to pass under. The platform, then, by its gravity resumes its original position.

The spiral spring referred to is an important part of the fender, and is designed to prevent breaking or other injury to a person's leg in case of accident. In the event of any one being struck by the fender the person cannot be knocked down or run over, even if lying flat on the ground, but will instead be naturally thrown into the pocket of the fender, with the feet about 24 inches clear above the ground, and there securely locked by an automatic latch. In such an event the back part of the platform drops down

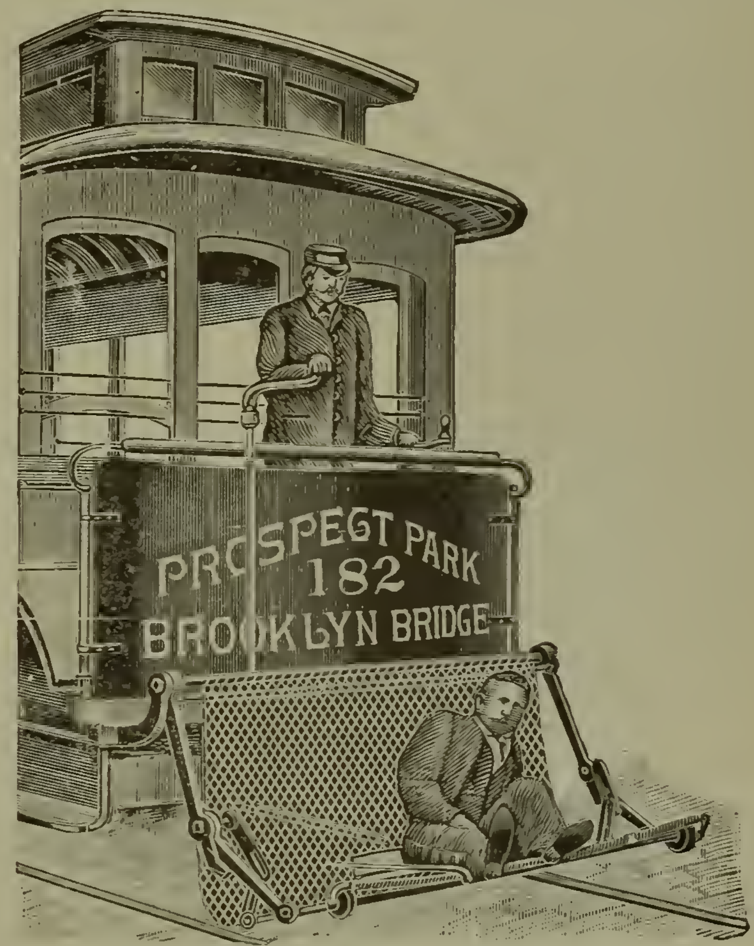


FIG. 2.

while the front part raises, and in this position it remains until the car stops and the person is released. The latch is then unlocked and the fender assumes its original position.

One of the excellent features of this fender is the ease with which it can be attached to a car, which can be done

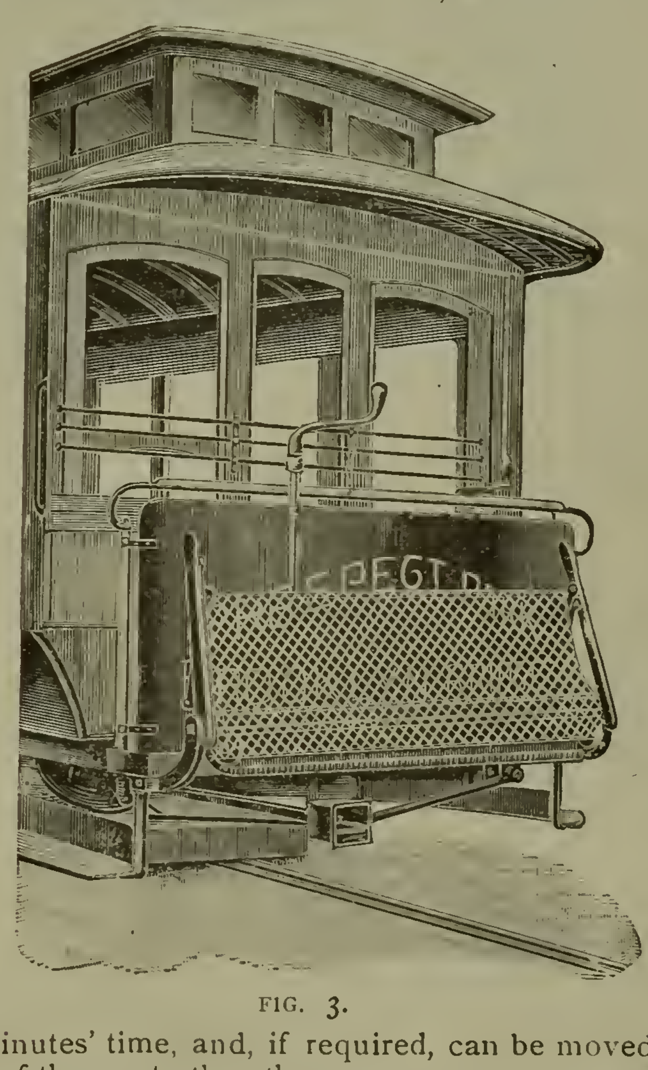


FIG. 3.

in ten minutes' time, and, if required, can be moved from one end of the car to the other.

When not in use the fender can be compactly folded away, as shown in one of our illustrations.

The Edwards fender, while light, is sufficiently strong to withstand ordinary shocks of collision, and in case of damage is easily repaired. The body of the fender is filled in with patent flexible wire, which gives the device a very neat appearance.

It is interesting to note the fact that the committee of citizens who presented to the Mayor of Brooklyn the petition respecting life-saving fenders on the Brooklyn trolley cars, stated in their letter that after careful examination of the different fenders they found the Edwards fender superior to any they had seen.

A fender was placed on one of the Atlantic avenue cars, Brooklyn, and after a few days' trial Mr. W. H. McKaig, the master mechanic of the road, wrote to Mr. Edwards expressing great satisfaction with its action. Mr. McKaig thinks it is the best fender he has seen.

The Edwards Automatic Life-Saving Car Fender is manufactured by the Albert Edwards Car Fender Co., 26 Court street, Brooklyn, N. Y.

Fig. 1 of our illustrations shows the fender in its normal position at the front end of the car. The swinging frame is clearly shown, and its action may be readily understood. Its practical operation is shown in Fig 2, where a man has been taken up, and he is seen lying on the fender in perfect security.

Fig. 3 shows the fender folded up and placed out of the way.

THE ENERGY OF RAIN STORMS.

The conditions that tend to cause a rainfall are not of an unusual character. The formation of a cloud seems to be due to the partial saturation of a mass of air with aqueous vapor, which rising into the atmosphere becomes by a natural process expanded and in part condensed, thus producing the well-known cloud formations. The amount of vapor contained in a given volume of air varies according to its position with respect to the earth. At the seashore a mass of vapor occupying one cubic meter of space and having a temperature of 20° Centigrade (68° Fah.) contains about 17.1 grammes of water. If this mixture of air and moisture be lifted to a height of 3,500 meters it will have only 9 6 grammes per cubic meter. Further calculations would show that at 4,200 meters in height there are 8.2 grammes, and at 8,500 meters or approximately 25,500 ft., about four to five miles above the earth, a cubic meter contains only 3.9 grammes of cloud matter.

The amount of material thus set in motion by the process of condensation can be to some extent calculated. The area of a rain belt or of an ordinary localized storm can be determined with a fair degree of exactitude. The energy residing in a mass of dessicated liquid at such enormous heights can be faintly estimated. Its potential energy loses when it becomes kinetic, due to the friction of the air, but each little drop tends to bring about a large sum total of considerable significance. The velocity of a body falling into a non-resisting medium would be

$$v = \sqrt{2\,g\,h},$$

where v = velocity per second,
g = 32.2 ft. = acceleration,
h = height in feet,

by which the velocity due to any height can be determined. The energy given out by a moving body falling through any distance is dependent upon the velocity of the body and can be ascertained by the formula

$$w = \frac{1}{2}\,m\,v^2$$

where w = work,
m = mass.

So that a sheet of rain-drops descending through thousands of feet of space could impart an immense amount of energy to a body designed to receive and utilize its force.

The theoretical velocity of a drop falling from a height of 10,000 ft. would be

$$v = \sqrt{2 \times 32.2 \times 10{,}000.}$$
$$= 802 \text{ ft. per second.}$$

The work done by one pound of water in falling from such a height would be

$$w = \frac{1}{2} \times 1 \times 644{,}000,$$

= 322,000 ft. lbs., and the time required for it to fall would be

$$t = \sqrt{\frac{2\,h}{g}}$$
$$= \sqrt{\frac{2 \times 10{,}000}{32.2}}$$
$$= 24.9 \text{ seconds.}$$

Should a storm continue for many hours the number of inches of water that has fallen would enable us, by knowing the area of the storm, to compute the mass in pounds, and this mass falling from a height of any number of feet would be capable of delivering an amount of energy calculable by the above methods.

One ton of water would deliver foot pounds equal to

$$\frac{1}{2} \times 2{,}000 \times [10{,}000]^2 = 100{,}000{,}000{,}000$$

if falling from a height of 10,000 ft. in the air.

The rain-fall in London is 23.5 inches, or about two feet. The foot pounds delivered in a year could be determined by considering an average area of so many square miles as the seat of the most rain, and thus obtaining the cubic feet and weight of water that has fallen. If a general mean average of 10,000 feet be settled upon for the value of h, then the energy delivered per 10,000 of miles of country can be found.

A district 100 × 100 miles would contain an area of 278,784 × 10^6 sq. ft., and comprise in the neighborhood of London for 50 miles on each side a volume of water equal to 557,568 × 10^6 cubic feet. At 62½ lbs. per cubic ft. the weight of water per annum in such an area would be 174,244 × 10^5 tons or over 17 billion tons, and the foot pounds of energy in such a mass falling from 10,000 feet would be 174,234 × 10^{13}, or almost two million hundred billion foot-pounds, or 600,000 hundred million horse-power per year. The energy of a passing shower is nothing more than the sun's consuming rays alive once more. Both the drooping flower and the raging torrent look forth alike to its beneficent influence.

In the mysterious economy of nature there is nothing more unspeakably beautiful than this great and continual resurrection—nothing that so betrays the resistless changes and unresting weariness of our own persistent lives.

DEATH OF B. W. FLACK.

Benjamin W. Flack, vice-president and general manager of the Baltimore branch of the Standard Oil Company, died at his home in West Arlington, Md., on August 24, of nervous prostration. Mr. Flack was an old telegraph man, having entered the service of the Western Union Telegraph Company as a messenger, at Pittsburgh, with Thomas T. Eckert, now president and general manager of the company. Mr. Flack was an operator in the War Department during the war, and was for some time President Lincoln's private telegraph operator. He afterwards returned to Pittsburgh and engaged in the oil business, continuing in the same until his death.

Mr. Flack was born in Monongahela City, Pa., fifty-two years ago. He was a member of the Old-Time Telegraphers' Association.

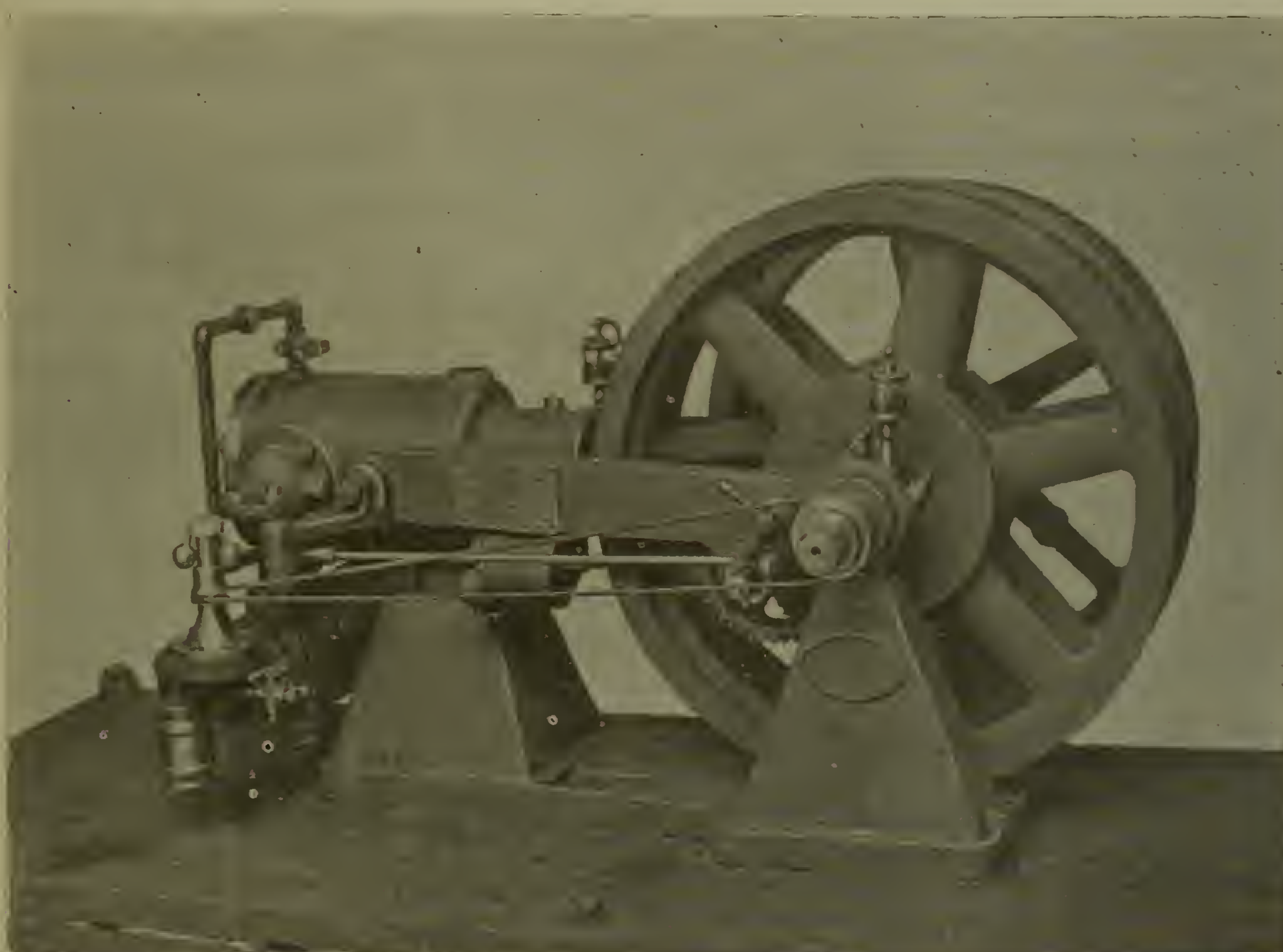
PHILADELPHIA'S ELECTRICAL INTERESTS.

CONTINUED FROM PAGE 105.

THE "PRIESTMAN" SAFETY OIL ENGINE.

This engine, which has gained so high a reputation in England, has been introduced in this country by Messrs. Priestman & Company, whose office and works are at Front and Tasker Streets, Philadelphia.

Dr. Coleman Sellers, Professor Unwin, and Lord Kelvin (whose names have been so prominently connected as mechanical and scientific experts, in the construction of the Niagara Falls Power Plant,) have, at different times, carefully brought before the public the special features of this engine, in which have been overcome the difficulties that for many years past had baffled all attempts to produce an engine successfully using the heavy or safe mineral oil of high-fire test known as coal-oil.



THE "PRIESTMAN" SAFETY OIL ENGINE.

We illustrate an engine adopted by the Navy Department, and which, for many months, has been in constant operation at the Norfolk Navy Yard, Norfolk, Va., for electric lighting and power purposes. It has been erected in a box car, and the entire electric plant is therefore able to be moved from place to place. Power and light are thus supplied to the various ships in course of construction, or being repaired, by an engine working automatically without any steam, boiler or fire. The above illustrates but one of many hundreds of these engines, which are proving their very great usefulness, not only in numbers of different localities in this country, but also in nearly every country of the world.

The clearance space in the cylinder at the back of the piston may be termed the seat of power. A single revolution of the engine secures and compresses the requisite quantity of oil, which, after being thoroughly mixed with air and sufficiently warmed, passes to the cylinder. Upon reaching the cylinder it is ignited by means of an electric spark, which latter plays between two platinum points, after the charge of oil has been compressed by the return stroke of piston. By this simple process incessantly and automatically repeated the power is developed, the dead gases on the return stroke of the second revolution being discharged to the outer air after having been carried around the mixing chamber and utilized to maintain the requisite heat therein.

The engine was constructed several years ago as a gasoline engine, but for divers reasons Messrs. Preistman Brothers, of England, were induced to spend some years on experimental work, which resulted in the discovery of a method by which heavy oil or liquid carbon could be broken up into excessively fine globules, without the oil passages becoming clogged. The oil so treated is capable of being charged with a sufficient proportion of atmospheric air as results in obtaining perfect combustion. These heavy oils are composed of hydro-carbons, vaporizing at different temperatures, and it has been this complex constitution of these oils which gave rise formerly to so many practical difficulties when attempted to be used in an unbroken liquid state.

An oil engine which generates power at so small a cost as 1½ cents per horse-power hour, using a fuel safe and easily handled, and occupying little space, is a subject of great interest to those who are considering the best method of producing power in small units.

In first cost the engine is higher than either gas or steam-engines; it is necessarily so, on account of the cost of the requisite substitutes for steam-boilers, or gas-works, as the case may be. Safe oils cannot be successfully used for power purposes unless, besides being broken up into fine particles, these particles are sufficiently warmed, and arrangements are therefore necessary by which a proper heat is automatically maintained by the operation of the engine itself.

Both the Franklin Institute and American Institute have recognized this important departure in the production of power, and awarded special medals to the inventors of this engine. One of these engines may be seen in almost constant operation in the rear of the University Club House, 1316 Walnut Street, Philadelphia, where it has been in use for the past nine months for electric lighting.

We understand the savings effected by this engine have been very considerable. There can be little doubt but that, as in so many other similar instances, the difficulty of first cost will be successfully overcome, and, in that case, there can be little question as to the enormous use which an engine so safe and simple will be put to in this country, where labor or money-saving devices are eagerly adopted.

J. GRANT HIGH & CO.

In 1890 Mr. J. Grant High, seeing a growing demand for knife switches, started in a small shop for the manufacture of this line exclusively. His business kept on with a steady increase until in May, 1894, he found that it had grown so fast that he was unable to handle it with the capital then available. At that time he had about 2,000 square feet of floor space and eight employés.

He then took into partnership with him Mr. George T. Eyanson. With that increase of capital and help the business grew even faster than before, and at the end of the year 1894 they had done over twelve times as much business as in the year previous.

They had in the meantime increased their plant until it occupied, as at present, the whole of their six-story building, giving them over 6,000 square feet of floor room.

The switches and switchboards of their manufacture go all over the world, they having customers in Australia, Japan, Chili, France and Canada. The firm has installed switchboards in the Warden Tenement Mill Building, the *Philadelphia Inquirer* Building, the Drexel Institute, the Fairmount Wooster Mill, the Pennsylvania State Normal School, the Pencoyd Iron Works, the Cresson Shafting Works, the steamships "New York" and "Savannah," the Rocksboro, Chestnut Hill and Norristown Railroad, the Pikestown, Emery Grove and Reisterston Railroad, the Pottstown and Ringing Rock Railroad, the Wilmington City Railroad and many other places. The latter part of this month they will ship an immense switchboard for the Anaconda Electric Light and Power Railway at Anaconda, Montana.

The factory is now running steadily from 7 A. M. until 11 P. M., employing 46 mechanics.

Judging from the demand for it, the Eyanson Quick Break Switch for railroad work, which this firm put on the market a little over a year ago, has filled a long felt want.

The firm of J. Grant High & Co. is composed of J. Grant High, President; George T. Eyanson, Manager, who looks after the manufacturing part of the business, and Cyrus C. Armpriester, Treasurer—all young men, looking for business.

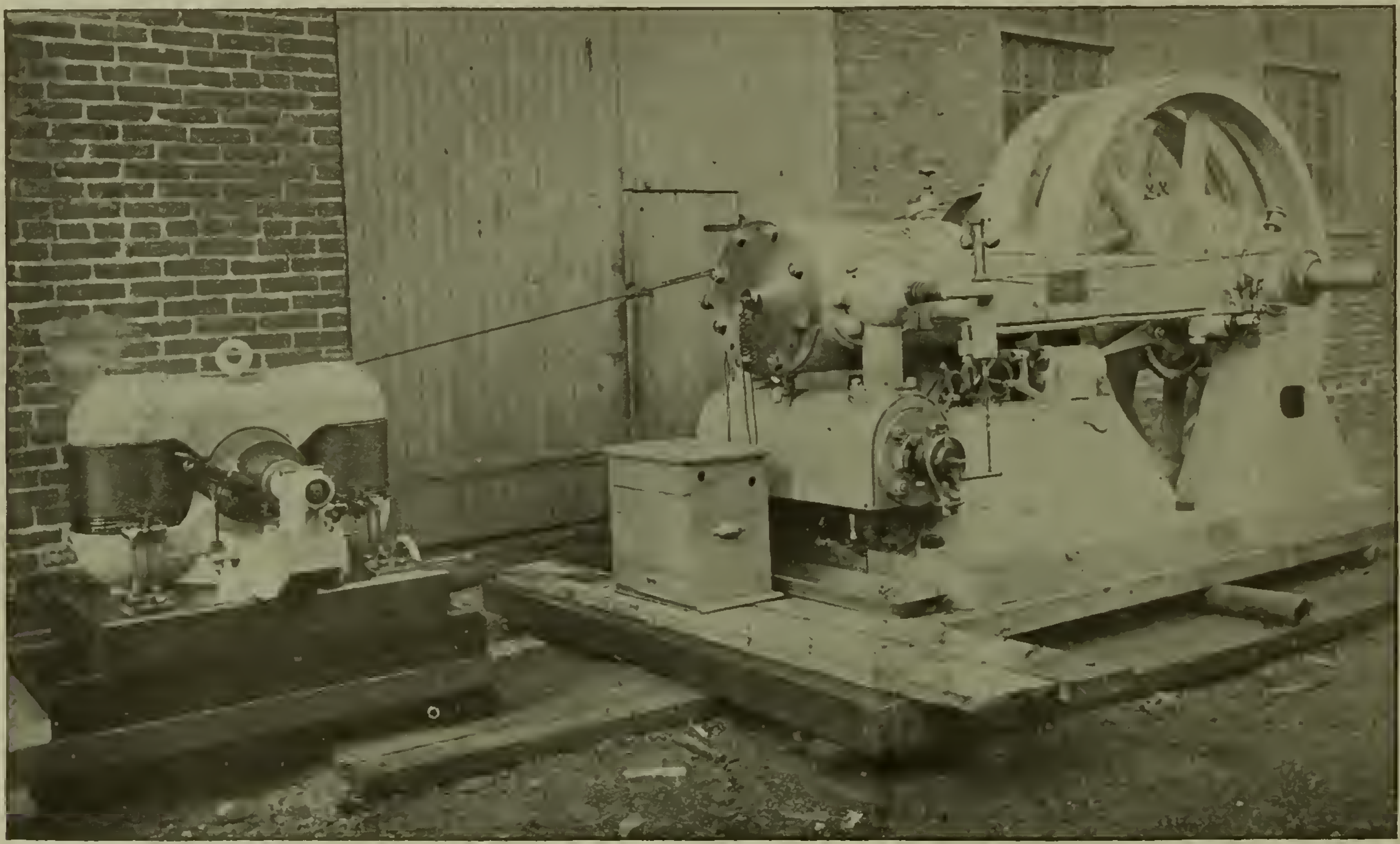
The headquarters of the firm are at 123 North Third street, Philadelphia. The house has branch offices at Chicago and New York, the latter having been opened a few weeks ago. (*To be Continued.*)

THE FLIGHT OF HUMANITY.

We are rapidly leaving behind us that period from which Milton dates the Fall of Man, and are about to behold his inspiring ascent; his eagle-like flight into the terrifying heights of the aerial ocean.

What are the limits nature has imposed upon us, such that not even the long and happy line of winged ancestors have left any rudiments capable of development or even of secondary use in our unfortunate frames?

The rapid movement of the humming bird, or the dignified descent of the condor, speaks well of the perfect adjustment existing in the natural order of things, of the enforced necessity that grinds out even two such dissimilar types, but it does not admit of even artificial duplication for the purposes which aerial locomotion by man does demand.



"PRIESTMAN" ENGINE AT NORFOLK NAVY YARD.

The first balloon of Montgolfier, fed by the smouldering straw, arose into the atmosphere, not like the bee or bird, but with a dead and pendulous movement. Although the specific gravity of all objects determines their efficiency for either marine or aerial purposes we have in contradiction of this generality the steel cruiser or the alert torpedo, which, in virtue of their external form, can float and move with lightness and precision. Therefore, the imitation of living types are useful in so far as they illustrate to us the same principle—the perfect guidance of an object *heavier than air*, but sustained by an effort originating *within*.

The experiments of the Smithsonian Institute, the rapid rotation of an inclined plane, showed the absolute possibility of rising into the air by an engineering device of a positive nature. A heavy mass rose upwards when the proper speed was attained. Renard and Krebs, Tissandier brothers with their dirigible balloon, and the great engineer, Maxim, have made this subject their life study. When Glaisher towered above the earth in his balloon, the string of the valve in his clenched teeth, his companion rigid at the bottom of the car, and a fading consciousness sweeping away the last efforts of an observing mind, he, above all, felt the pressing danger—the cruel cold—the enfeebling effects of a weakened atmosphere, with the awful catastrophes of others creating its own agony in his mind.

To rise into the air we must bore our way through it; we must take advantage of the inertia of even so elastic a medium as the atmosphere. By a series of inclined planes arranged around a hub, and the proper speed of rotation, there is no reason why a pull should not be developed depending upon the three factors: the pitch of the blades, their velocity, and the density of the air.

Let us mount upwards, and leave the busy earth, to view the outstretching fields, the shining lakes and snow-clad tops of distant hills.

PRINCIPLES OF DYNAMO DESIGN.

BY

Newton Harrison, E.E.

(*Continued from Page* 106.)

Compounding for Different Speeds.

There is a definite relationship existing between the speed and lines of force in self-regulating machines. It was at one time thought that compounding should be carried on for a given speed, and that any other speed would not mean any definite automatic regulation. But compounding for different speeds has by investigation been proven to be to a large extent unnecessary. The presence of a series coil does not imply other than a means by which the field strength is retained and its deficiencies along with those of other parts of the machine compensated for. If the shunt coil retains its strength and acts as a ready and effective source of magnetism in spite of the negative effects of the armature, the series coil might be dispensed with; but the chances of a regulation that would be satisfactory would be but slight and at least involve the great sacrifice of other important parts.

It can be understood that the shunt coil develops a M.M.F. proportional to the speed of the machine, because with greater speed, which means a higher E. M. F., the ampere turns of the shunt increase and therefore the M. M. F. But the series coil becomes more or less useful as the shunt coil develops more or less M.M.F., and thus would be of but little use when the machine is not greatly loaded. Therefore, if a certain speed will give perfect regulation, the falling away of the number of revolutions would simply increase, within certain limits, the effect of the series coil and thus develop that automaticity of action so desirable. It is thus seen that the lines of force of the shunt coil are proportional to the speed of the armature, and that if at one speed regulation is good, at another speed the regulation would also be approximately fine on account of the series coil. When the normal speed becomes decreased, the regulation is weak when there is a large resistance in circuit; that is to say, the volts become less. When the speed increases, the voltage will only fall if the external resistance is too low, or if it is gradually diminished. This peculiar point in the regulation of dynamos can be examined graphically by drawing the curve due the relation between the E. M. F. and external resistance of both a series and shunt machine; the flexibility of the system then becomes evident by the fact that the resistance which caused one to fall made the other rise, and thus provided the most automatic means devisable for such a purpose. The great object in view in the adjustment of the two windings is to be sure that the saturation due to the shunt coil is not too great, but will allow a change in the field to occur without imposing too much upon the ampere turns that might be used. The lack of proportion existing between the effects of the two windings is only true when the permeability has greatly fallen, due to saturation by the shunt coil, thus giving no very wide limits within which to work.

To recapitulate, the calculation of turns for the series coil would be known by the formula

S = number regulating coils
r_a = resistance arm.
r_m = resistance series coils

$$S = \frac{r_a + r_m}{n\,C\,q},$$

n = speed,
C = conductors,

$$q = \frac{\dfrac{4\,\pi}{l}}{\dfrac{\varepsilon}{\mu\,A}},$$

in which the internal resistances only are taken into account. The rule expresses one slight variation when the proper consideration of armature-action is made. In this case the demagnetizing turns of the armature will be included between twice the angle of lead, thus making the formula

$$S = \frac{r_a + r_m}{n\,C\,q} + D\,v$$

D = number of conductors within the angle of lead,
v = leakage coefficient.

The above constitutes a means by which the entire regulation can be effected, the satisfaction of which cannot be excelled.

Simply to render the process by which the proper conclusions can be drawn as clearly as possible the following treatment of Thompson is highly recommendable.

The conditions called for are Series regulating coils + Permanent magnets.

If $E = n\,C\,N$

the potential difference $e = E - (r_a + r_m)\,i$.

The field is composed of two parts, N, the entire field at any instant and N_1, the permanent field.

That depending upon the current i is equal to

$$\frac{\dfrac{4\,\pi\,S\,i}{l}}{\dfrac{\varepsilon}{\mu\,A}}$$

If the above nomenclature be followed then

$$\frac{\dfrac{4\,\pi}{l}}{\dfrac{\varepsilon}{\mu\,A}} = q,$$

or we have

$$N = N_1 + q\,S\,i,$$

thus giving by substitution in

$$e = E - (r_a + r_m)\,i,$$
$$e = n\,C\,(N_1 + q\,S\,i) - (r_a + r_m)\,i, \text{ or}$$
$$= n\,C\,N_1 + n\,C\,q\,S\,i - (r_a + r_m)\,i.$$

These three terms indicate the expressed conditions of regulation. The first contains the speed and two constants; the last two, the current. If S is predetermined, then the speed of regulation will be that at which the value for e contains only constants. If, however, n is assumed, then S must be evaluated in such a way that the terms containing the variable factor disappear. The last two terms will cancel if, by the variation of S or n, the result $n\,C\,q\,S = r_a + r_m$ is attained; then we have $n_1\,C\,q\,S\,i - (r_a + r_m)\,i = O$, by which we can understand that $n_1\,C\,q\,S = r_a + r_m$, if S and n_1 be properly varied. The above equation is of considerable importance, because it justifies the belief in the constancy of e if the above conditions be observed; then the resulting formula $e = n_1\,C\,N_1$ = a constant, as the adjustment of conditions called for.

(*To be continued*).

SKIN RESISTANCE.*

BY PROF. GEORGE FORBES

I now wish to introduce to your notice a subject which has attracted considerable attention during the last eight or nine years in the use of alternating or interrupted currents. I speak of what has gone by the name of "skin resistance." The fact has certainly been proved—and it could not be otherwise, from the mathematical treatment of the question—that when we pass a high frequency alternating current through a conductor the flow of current is not uniform throughout the section of the conductor. It is, partially at least, confined to the exterior layers of the conductor. At the centre there is not so much current passing as there is through an equal section of the outside, and therefore the resistance of the conductor is composed more of the resistance of the external parts than of the central part, because if we make the frequency high enough we can cause the current to cease flowing from the central part entirely. In that case, the material which is offering resistance is simply a tubular conductor and not a solid conductor. That is the meaning in which the term "skin resistance" must be read.

It was, I think, in the presidential address to the Institution of Electrical Engineers in, I believe, the year 1886, that Prof. Hughes first introduced this seriously to the notice of electricians. I do not mean to say that some of the effects had not been observed before, and I do not say that it was not known that there might be difference of flow in different parts of the section of the conductor, but that was the first date when this resistance was proved to consist of a pure, definite resistance, and was measured in ohms as a resistance by Prof. Hughes. Up to that time people had been perfectly well aware that, in using the methods of the Wheatstone bridge, if you kept the key of the galvanometer, a deflection of which indicates divergence from the resistance, down, and interrupted the circuit, you could not get a true reading. Generally, this was ascribed to self-induction, which at the time of breaking the circuit with the electric battery made itself apparent, but which to a far greater extent, except when you are using coils, was often due to what Prof. Hughes showed to be really an increase of the resistance, and that increased resistance is due to the electric current being at the outside instead of being uniformly distributed through the section of the conductor which was carrying the current. Now, the explanation of this is not difficult to seek. You remember in the last lecture I had two wires of about seven feet long parallel to each other. I passed an electric current through one, and at the moment of making that circuit the other, whose circuit was completed through the galvanometer, showed an induced electric current, and at the moment of breaking the primary current the circuit connected with the galvanometer showed an induced current, but in the opposite direction to that previously exhibited. Thus, in an interrupted current, at the moment when a change in the direction of the electric current takes place, there is a reverse effect due to mutual induction. Now, suppose that this rod on the table (which is merely for illustration) consisted of a bundle of wires, and I insulated and separated out one of the external wires, and then sent through the whole bundle an electric current, there will be an induction current in either of those which I have selected and insulated; there will be in those an opposing E.M.F., a force tending in the opposite direction to that in which the primary current is going. But if you will notice the position of all the wires in the bundle relatively to one of them on the outside, and also notice the position of them relatively to the central wire, you will see that the central one has far more wires within a short radius of it than the external one has. Therefore the opposing force on the central wire is much greater than the opposing force on the external one; so that, when I suddenly pass an alternating current through a bundle of wires, at each change in the direction of the current there is an opposing force in both these wires, but the opposing force in the central wire will be much greater than that in the outside wire. That is to say, there is an opposing force in each of the wires of the bundle, but a greater opposing force in the central part, and therefore the current will not flow so powerfully there as it does at the outside. If, therefore, we have the whole bundle grouped into a solid conductor, the central line has always an opposing E.M.F. which is greater than the opposing E.M.F. at any other portion of the section. Therefore the current is mainly passing through the external part of the conductor, and that causes an increase of resistance, which was actually measured by Prof. Hughes by means of the ingenious apparatus he produced on the occasion to which I have referred.

Now, here is a brass tube with which, however, it would take some time to show you the effect, because it needs a very sensitive galvanometer, and it takes some time to bring it to rest. Prof. Hughes showed that the additional resistance produced by an iron conductor was much higher than a conductor made of any other mate·ial. Therefore, I will proceed by utilizing an iron tubular conductor with a wire suspended through its centre and another insulated wire lying on its surface, and I wish to show you the different effects of induction in these two cases. I will begin with the outside wire, which is subjected to the induction at varying distances up to the diameter of the tube. There will only be a deflection in this case of two or three divisions of the scale on the screen, so you will please watch carefully and make the measurements for yourselves. [*Experiment*] There, you see, it goes nearly up to the two divisions. I passed the current through this mass of iron, and the induced current on the outside parts of the wire was sufficient to deflect it through about one and a half divisions of the scale. Now change the connections, and you will see the great difference there is. [*Experiment.*] This time you see that the deflection passed along nearly the whole length of the scale. That is the deflection obtained with the wire which passes through the centre of the tube, showing the enormous difference of the E. M. F. in the two parts. This enormous effect in the case of the iron is due to the fact that the iron becomes magnetized by the passage of the electric current through it. It becomes circularly magnetized—lines of force cut the wire which is suspended in the middle of the tube, and in cutting it they exert a force greater than the E. M. F. that there would be if there had been no iron, which is easily magnetized, or if the iron had been replaced by copper, through which you cannot get so great an amount of magnetism so easily. This illustrates the general principle of skin resistance. I may say that in actual practice an engineer is seldom troubled with this except when he is coming to very large works, where the cables are very thick indeed. With all the cables that we have been accustomed to in industrial work in this country there should be no trouble whatever; and it is only when you come to cables of 1 in. or 2 in. in diameter that the trouble would come to be serious. But when once you lower the frequency as we have done on the other side of the Atlantic, this trouble disappears entirely. Up to any size that we wish to use for our conductors there, there is not the slightest trouble from the extra resistance produced in this way.

* Abstract from lecture delivered before the Royal Institution, London.

MEASURING THE VELOCITY OF PROJECTILES. —We have received, with the compliments of the authors, a copy of a book describing the experiments with a new polarizing photo chronograph, applied to the measurement of the velocity of projectiles. The authors and experimenters are Dr. Albert Cushing Crehore, of Dartmouth College, and Dr. George Owen Squier, First Lieutenant, Third Artillery, U. S. A. It is well illustrated by several excellent half-tone cuts and diagrams.

THE NATURAL MAGNET.—The natural magnet is a hard, black stone, which has the property of attracting iron. It is supposed to have been first discovered in Magnesia, a country of Asia Minor, whence comes its name. It was known at least 500 years before the Christian era and is described by Plato and Euripides. It is very rare.

ENGLISH GOVERNMENT TRUNK TELEPHONE LINES.

What may be called the "Telephone" policy of the Government took definite shape in 1892. In that year, the terms of the agreement with the National Telephone Company and its allied undertakings were settled by the late Administration. Under this agreement, as is well known, the operations of the company were to be confined to the purely local exchange work in towns and defined areas, while the Government reserved to itself the right to work all the trunk lines connecting these towns and areas with each other.

For the acquisition of the existing trunk lines of the companies, and the provision of a "backbone" system of heavy wires, with the necessary spur lines connecting all the chief towns of England, Scotland and Ireland together, Parliament provided, by the Telegraph Act of 1892, the sum of £1,000,000.

The mileage and weight of the wires comprising this system are as follows :—

2,719 miles of copper wire	800 lbs. to the mile.
4,914 " "	600 " "
2,646 " "	400 " "
96 " "	in a four-wire submarine cable, 24 miles long.
Total length of wire	10,375 miles.
Total weight of copper	2,829 tons.

The mileage actually completed to date is 7,595 miles. All the circuits are metallic loops.

The wires centre on Leeds, which will be telephonically the heart of the kingdom. It will be the main switching station for the Post-Office trunk wire system.

On Wednesday last a formal inauguration of the new service was held at the General Post-Office. The wires from the North were led into the new Post-Office building, and a distinguished party of gentlemen conversed with the various towns along the route. Among those present were Mr. Arnold Morley (Postmaster-General), the Lord Mayor of London, several members of the Select Telephone Committee of the House of Commons, including Lord Kelvin, W. H. Preece and others. Speech was excellent in all cases, conversation being easily maintained even to Dublin, in the ordinary natural tone of voice.

In the evening of the same day the new lines were introduced to the scientific world at the Royal Society *soirée*, connections being made to Burlington House for the occasion. Two circuits were connected up, viz.: those to Glasgow and thence to Edinburgh, and to Dublin and Belfast *via* Carlisle and Stranraer. In addition to conversation, vocal and instrumental music was rendered at all four towns to which connection was made. The experiments were most successful and charming in every way. Receivers were so connected to the lines, that six or eight persons could listen at each circuit simultaneously. Among those who tested the circuits were Lord Kelvin, Lord Rayleigh, Prof. Bryce, M.P. (President of the Board of Trade), Prof. Hughes, Sir Douglas Galton and Prof. Silvanus Thompson.

The instruments used at all stations were the double-pole Bell receiver and the Deckert transmitter. The latter is an Austrian instrument, of the granular form, and is an improvement on the well-known Hunnings transmitter. It has been tested most carefully by the Post-Office technical staff, and for general all round efficiency has been found superior to all other transmitters that have been tried.

The lines are built according to the K R law, familiarized to the scientific world by Mr. Preece. The total capacity (K) into the total resistance (R) of the line determines its value as a means of conveying speech by telephone. The product (K R) referred to a constant, indicates whether speech will be excellent, good, fair, or poor. The applicability of this law to the problem to be solved has been questioned, especially by American telephone engineers. But it is not now necessary to discuss the correctness of the law. It is enough to say that the telephone lines built by the British Post-Office have proved a great success telephonically. From the practical point of view, therefore, the K R law comes out all right; as our American cousins would say, "There are no flies there." It remains to be seen whether the new means of communication will be made sufficient use of by the public to enable a commercial success to be registered, in addition to the scientific and engineering success that has been assured.

The rates for conversation on these new trunk lines will be :—

Up to 20 miles	3d.	per talk.
Up to 40 miles	6d.	"
Each 40 miles, or part of 40 miles, additional	6d.	"

Conversations in all cases mean the use of the wires for three minutes.

Some of the principal rates are :—

London to Edinburgh	4s. 6d.	per talk.
" Glasgow	4s. 6d.	"
" Dublin	7s. 6d.	"
" Cardiff	2s. od.	"
" Plymouth	2s. 6d.	"

The circuits will very shortly be open for public traffic. —*Electrical Review*, London.

THE COST OF STEAM-POWER. II.*

BY CHAS. E. EMERY, PH. D.

§ 1. Previous articles of the writer on this subject dealt with the problem as it practically presented itself at the several times. The first article in 1883 † referred particularly to results which had been obtained in a number of typical cotton mills by the use of the ordinary condensing engines in vogue at the time. A more recent article in 1893 ‡ discussed the question of the cost of steam-power in 500 H. P, units or multiples of the same, developed in different kinds of engines, including the more modern triple compound engines. The first paper was based on actual conditions, the second on assumed conditions, the best experimental results being considered, but afterward modified by judgment so as to give a final result which would approximate the conditions, or ordinary average working. In a later and more general article published in 1895§ the method employed to increase experimental results to an approximately practical basis was outlined, but otherwise the inquiry was extended little or no further than before.

§ 2. In connection with the proposed supply of power in large units from Niagara Falls and other undertakings of a similar character, the question naturally arises : What would be the cost of steam-power if also applied in large units and generated with modern machinery of the most approved type? The question would be a simple one if it involved only the amount of coal consumed at a definite price, and the labor required to handle the coal and attend to the machinery. It is very common to compare the value of two engines simply by the relative amount of coal consumed, assuming that other costs incident to the development of the same power will be the same in all cases. Even if the assumption be substantially correct, it has a more important bearing on the results than appears at first sight. The cost of coal is for ordinary engines of moderate size only about one-third of the total cost of steam-power, so, if the other costs remain nearly constant, moderate savings in the cost of coal will not proportionally decrease the cost of the power.

§ 3. In large plants operated nearly at full capacity, the best types of steam machinery can be profitably employed, the cost of superintendence will be reduced and the cost of labor required for operation materially decreased. The decrease of labor depends largely on the size of steam unit it is found practicable to employ. Triple compound engines of 10,000 to 15,000 H. P., each are

* A paper presented at the twelfth General Meeting of the American Institute of Electrical Engineers, Niagara Falls, N. Y., June 26, 1895.
†Trans. Am. Soc. C. E., vol xii., p. 425, Nov., 1883.
‡Trans. Am. Inst. El Engrs, vol. x., p. 119, March, 1893.
§The *Engineering Magazine*, vol. viii, p. 796, Feb., 1895.

used quite successfully in our large ocean steamers, but it is considered that these units are altogether too large for the problem we are considering.

§ 4. Any supply of power must be adapted to the nature of the demand, which for most industrial operations is variable, and it is desirable to make the steam units of such size that one or more of the same can be grouped together to carry the load at any time without either overloading or greatly underloading either of such units. In a large plant, upon which presumably many different manufactories depend for power, there should be a spare unit which can be used in case of accident and ordinarily employed in regular turn so that all the machinery can be kept in repair.

§ 5. It will thus be seen that the size of the units is limited by the conditions above stated. If 20,000 H. P. as a maximum were to be delivered, two units of 10,000 H. P. each would do the work, but evidently the spared engine would require also to be 10,000 H. P. and this would involve too large an amount of capital in spare machinery. At Niagara Falls four connected turbines and dynamos of 5,000 H. P. each are being erected in a preliminary plant so that only 15,000 H. P. maximum can be delivered if the principles above outlined are strictly carried out, though evidently contracts can be drawn to provide that the power may be stopped in case of accident, the same as in a private establishment, and thereby all the wheels and engines put in service at the same time, but it is probable that one unit will be practically kept in reserve and more units added as the demand warrants. With steam-power there would be some advantages for a 20,000 H. P. plant in adopting a unit of 2,500 H. P., on which basis with one spare unit of this size there would be nine such units in all. There is an advantage in having all the engines alike, as the parts required for repairs are then duplicates of each other, the units can be more suitably arranged in the building and the labor better distributed. When it could be done without too much detail, it would be desirable to couple together several engines of 2,500 H. P. each, so that they would be capable also of independent operation. Another method would be to disregard absolute uniformity when so much power is to be delivered and have several duplicates of two different units, say one of 2,500 H P. and another of 5,000 H. P., which would either require the size of the spare engine to be increased, or that the other engines be slightly overworked in case of accident. For simplicity, however, all the costs will be assumed alike with either arrangement.

§ 6. The average cost per H. P. when the load is variable is considerably greater than if the power be furnished continuously. Coal is wasted in building up the fires and in caring for them when not required, all supplies are increased from the necessity of starting new after every stoppage, and there is an important loss due to the interruption of the regular hours of labor. A sufficient force must be kept on hand at all times to provide for any demand, and the watches of the men arranged in some practical way so as to proportion the labor to the work to be done as nearly as possible.

§ 7. It is desirable at the outset, however, to ascertain what steam-power will cost under the most advantageous conditions as to demand, and we therefore submit a preliminary estimate based on the assumption that 20,000 H. P. can be sold for every hour in the year. The details of the estimate are discussed afterward.

§ 8.

TABLE I.

SHOWING COST OF STEAM-POWER ON BASIS OF GENERATING 20,000 H. P CONTINUOUSLY EVERY DAY IN THE YEAR.

			Per Cent. of Total Cost.
1.	Yearly cost of coal for 20,000 net H. P. operated continuously every hour in the year, based on a consumption of 1.25 pounds of coal per indicated H. P. per hour, § 10 Cost of coal assumed at one mill per pound, or $2.24 per ton, § 12. Engine efficiency assumed at 92.3 per cent., § 11	$237,250	43.4
2.	Estimated cost of labor, § 13	60,444	11.1
3.	Estimated cost of supplies and regular repairs, § 14	105,120	19.2
4.	Estimated interest, insurance, taxes and cost of renewals, § 15—16	144,000	26 3
5.	Total	$546,814	100.0

Which divided by 20,000 gives the following:

6.	Cost of steam-power per H. P. per year on basis of 20,000, H. P. delivered every hour in the year	$27.34
7.	Cost of steam-power per H. P. per year on above basis, if 5 per cent. of the original cost of plant, § 16, be charged for dividends, and $1.00 per H. P. added for general business expenses, § 18 ... 27.34 + 3.60 + 1.00 =	31.94
8.	Cost of steam-power per H. P. per year on above basis, if 10 per cent. of the original cost of plants § 16, be charged for dividends, and $1.00 per H. P. added for general business expenses, § 19, 27.34 + 7.20 + 1.00 =	35.54

§ 9. This cost is, for reasons which will be discussed later, lower than it is probable any plant can be operated under commercial conditions. This price is somewhat higher than those given in the papers previously mentioned, simply because operation is supposed to be continued every hour in the year.

§ 10. The cost of coal above outlined is derived as follows: The best triple compound engines have developed a H. P. for a little less than 12 pounds of water per H. P. per hour, and boilers have been constructed which at actual pressure from actual temperature offered, evaporated 10 pounds of water per pound of first quality coal. Both these results are under experimental conditions, but we must assume that in a large plant like this all details will be so well attended to that fair experimental results may be obtained all the time. We therefore assume that the power will be produced regularly for 1¼ pounds of coal per indicated horse-power per hour, which would be obtained with engines requiring 12½ pounds of feed-water per H. P. if the boilers evaporated 10 pounds of water per pound of coal, or if the boilers evaporated 9.6 pounds of water per pound of coal and the engines only required 12 pounds of water per H. P. per hour.

§ 11. For permanent work of the kind assumed, engines of comparatively slow speed should be selected and, although some of the work might be directly connected, part of it at least would necessarily be operated by some method of transmission. The frictional losses of the engines and the more important features of transmission to the work done have been assumed at 7.69 per cent., so that the amount of coal per indicated horse-power above assumed must be increased by $\frac{1}{12}$ to give the coal per net H. P.

§ 12. The cost of coal per ton varies greatly in different parts of the country. The actual cost of mining bituminous coal is as low as 25 cents per ton, in some locations, and the coal can be delivered on the cars at a good profit at 50 cents per ton. At deep mines the cost of mining is greater, but in all cases the principal cost of coal is the transportation, which has been reduced from time to time by increasing the size of the coal cars and the weight of the train, and by reducing the grade in the direction of traffic, until it is credibly stated that coal can be hauled on the main trunk lines, at a profit, for one-half cent. per ton per mile, thus adding only $0.50 per ton for each 100 miles of haul. The lateral roads with undulating grades cannot haul coal at as low a rate as this. There is, moreover, to be added the general selling expenses, so it has been assumed that along the lakes, although comparatively near coal mines, the best quality of coal will cost but little over

$2. per ton if purchased in large quantities, though this price must be increased on the seaboard fully 75 cents, and for ordinary consumers, of course, much more. The price upon which comparison has been made is one mill per pound, or $2.24 per ton, to include the cost of delivery directly in front of the boilers. The cost in line 1, §8, is derived simply by multiplying the net power, 20,000, by 1¼, the coal per indicated horse-power, adding $\frac{1}{12}$ to allow for friction, and multiplying the result by 8760, the number of hours in the year, and $0.001, the price per pound. The next item, that of labor, is made up as follows :

(*To be Continued.*)

COMMERCIAL CABLE CO.'S NEW BUILDING.

The Commercial Cable Building Company has been incorporated at Albany for the purpose of erecting a building for the Commercial Cable Company, on New street, adjoining the Stock Exchange, New York. The capital of the new company is placed at $1,000,000. Mr. John W. Mackay is president, and the Board of Directors consists of George G. Ward, A. B. Chandler, Wm. H. Baker, Edward C. Platt, George Clapperton and William W. Cook—all directors and stockholders of the Commercial Cable Co.

The new building will be 18 stories high, surmounted by a 3-story dome, making 21 stories in all above ground The three lower stories will be of white marble, while the rest of the structure will be of gray brick and terra-cotta. Harding & Gooch will be the architects, and the architecture of the new building will be of the Renaissance order.

The main object of this undertaking is to provide permanent headquarters for the cable operating staff.

The rest of the building will be rented as offices.

Resigned.—Mr. Osborn P. Loomis has resigned his position as treasurer and electrical engineer of the American Engine Co , of Bound Brook, N. J. He writes us that his plans for the future are incomplete and at present is enjoying a short vacation.

Sold Out By The Sheriff —The effects of the Jaeger Electric Lamp Co., No 154 W 27th street, New York, have been disposed of by Deputy Sheriff Dunphy. The company was organized in New Jersey last February, with a capital stock of $10,000. We understand that the business will be resumed under new conditions.

Information Regarding the A. I. E. E.—The American Institute of Electrical Engineers has issued a little pamphlet to meet the demand for information regarding the work of the Institute and how to join it. It is of a convenient size for the vest pocket and includes a list of the members. Copies of the pamphlet can be obtained from Ralph W. Pope, Secretary, 26 Cortlandt street, New York.

University of Nebraska.—The announcement for 1895-96 of the Department of Electrical and Steam Engineering of this institution has just been issued. The illustrations of the building and plant show that the equipment and facilities are complete.

THE GENERAL TELEPHONE PROTECTIVE ASSOCIATION.

The organization of the General Telephone Protective Association was completed on August 21, and is now a tangible entity, and will undoubtedly soon develop a high potential. The operations of the association will be confined to the territory east of Pittsburgh, and steps will probably be taken to form some sort of an alliance with the Western Association, which was organized a few weeks ago. Nothing definite has yet been accomplished in this direction, however.

The General Association starts out with a membership of 16, with many more concerns to hear from. This is a very encouraging beginning It really represents the backbone of the independent telephone interests in the East, and unyielding determination to secure and maintain justice. The association will send its counsel to Boston to watch over the trial of the case of the Bell Telephone Co. against the National Telephone Manufacturing Co., which begins on September 3, next.

The object of the association, as stated in our last issue, is to protect its members and their customers against suits of infringement of the Berliner patent, No. 463,569.

PROPOSALS FOR TELEPHONES.

Sealed proposals for furnishing telephones and switchboards will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until 1 o'clock P. M., Monday, Sept. 16, 1895, and will be publicly opened immediately thereafter.

The following are the number required :

Navy Yard, Boston, Mass., 4 telephones, one 8-drop switchboard.

Navy Yard, New York, N. Y., 31 telephones, one 50-drop switchboard.

Navy Yard, League Island, Pa , 3 telephones, one 8-drop switchboard.

Navy Yard, Washington, D. C., 8 telephones, one 16-drop switchboard.

Navy Yard, Norfolk, Va., 19 telephones, one 30-drop switchboard.

Navy Yard, Port Royal, S. C., 2 telephones, no switchboard.

To be complete in all respects, with transmitter, receiver and bell ; with battery and magneto generator, if required in the system proposed; and with all the parts necessary for the satisfactory working of the instrument. To be of good workmanship and finish. All parts must be easy of access for repairs and adjustments. The tone must be of good quality, distinct, and loud enough for satisfactory service. May be either battery or magneto transmitters. All telephones to be wall instruments.

The switchboards to be complete in all respects, and to be fitted with listening keys, operator's telephone, and lightning arresters. Must be of substantial construction, and of good workmanship and finish. All contacts and connections to be easy of access for inspection and repair. The board to be arranged so as to afford ease and facility for manipulation. To be adapted to ground return circuits.

Possible Contracts.

Steps are being taken to establish an electric light plant in Lyndonville, Vt.

An electric light company is being organized in Van Buren, Ark. Col. Sheldon is interested.

The Montgomery Electric and Supply Co., of Montgomery, Ala , it is reported will build the proposed electric railway between Tuskegee and Cheraw.

There is talk in Baltimore of the erection of an electric light plant by the city for the lighting of Druid Hill Park. The mayor can give further particulars.

The Washington, Alexandria and Mt. Vernon Railway Co., Washington, D. C., will build a power plant.

The Eckington and Soldiers' Home Electric Railway Co., Washington, D. C., it is reported, will introduce the trolley system on its belt line.

The Citizens' Railway Company has been incorporated in Knoxville, Tenn., to build an electric railroad in that place. W. G. McAdoo, F. K. Huger and others are interested.

The Macon and Indian Spring Electric Railway Co., Macon, Ga., is about to let contracts for the construction of a trolley line in that city.

The Richmond Traction Co., Richmond. Va, has recently organized in Richmond. John Skelton Williams, of Richmond, and J. W. Middendorf, of Baltimore, are interested.

Allegheny and Chartier Railway Company. Allegheny, Pa, has been incorporated by George H. Brown, G. T. Updegraff, and T. M. Sieman, with a capital stock of $15,000.

New Corporations.

Kane Electric Company, Kane, Pa., has been incorporated by C. H. Kemp, F. A. Lytle, Joshua Davis, Thomas L. Payne and others. Capital stock, $1,000.

Auburn Inter-Urban Electric Railway Company, Auburn, N. Y., has been incorporated by Daniel L. Ramsay, Samuel E. Bell, George W. Elliott and others.

The Alek Manufacturing Company, New York, N. Y., incorporated by Emil Klaber, Jacob Greenburg and Eugene F. Croew, 13 Astor Place, to manufacture electrical novelties. Capital stock, $10,000.

The Ouachita Power Company, Hot Springs, Ark., has been incorporated by I. C. Hunsicker, of Reading, Pa; R. Murray, J. J. Walker and J. B. Higdon, of Hot Springs, to manufacture electricity, etc. Capital stock, $200,000.

The City of Weatherford Water, Light & Ice Company, Weatherford, Tex., has been incorporated by P. V. Bryan, W. P. Anderson, G. A. Holland, and W. T. Hudgeins, with a capital stock of $80,000.

The Buena Vista Light and Power Co., Buena Vista, Va., has been chartered. S. H. Egolf is president; R. B. Embree, secretary and treasurer. The company has leased the city's electric light plant.

Mountain Electric Light Company, Summit N. J, has been incorporated by Carroll P. Bassett, Adolph Wagner and Frederick Green. Capital stock, $100,000.

The Herrington Water, Light and Power Company, Herrington, Kan., has been incorporated by W. S. Morgan, W. S. J. Towner and others, with a capital stock of $25,000.

The City Electric Light Company, Danville, Ill., has been incorporated by Frank Lindley, Daniel Gregg, and Robert Holmes, with a capital stock of $15,000.

Oil City Rapid Transit Company, Oil City, Pa., has been incorporated by James W. Roland. Charles W. Mackey, William H. Forbes and Edward E. Hughes, with a capital stock of $70,000.

Milton Electric Light Company's plant. Milton, Pa, is to be enlarged and the wires extended to Watsontown.

Hasbrouck Heights Light, Heat and Power Company, Hasbrouck Heights, N. J, has been incorporated by Edward M. Anson, Julius Vialois, David B Mitchell, George Broughton, Jr., and John Hanson. Capital stock, $50,000.

Telephone Notes.

The Western Union Telephone Company, Chicago, Ill., has been incorporated by Arthur Dixon, Wilfred Massey, and Samuel T. Forster. Capital stock, $100,000.

The Home Telephone Company, Lewisburg, Pa., has been incorporated by Cyrus Hoffa, W. D. Himmelrich and C. H. Hassenpling, to operate in Union and Northumberland Counties Capital stock $10,000.

The Texas Telephone and Telegraph Company has been organized in Galveston, Texas, for the purpose of building a telephone system in that city. The company has a capital stock of $100,000, and among the incorporators are M. M. Levy, J. Lobit, W. Davenport and S. Blum.

A telephone franchise has been granted by the city of Hearne, Texas. The Mayor can give further particulars.

The Atlanta Telephone Co., Atlanta, Ga., intends to build a shop for the construction and repair of telephones.

A charter has been applied for for the organization of the Jefferson Telephone and Telegraph Company, Jefferson, Ga. The object of the company is to construct lines to Atlanta, Ga., a distance of 18 miles, and eventually to other places. Among those interested in the project are H. W. Bell, F. L. Pendergrass, J. N. Holden and J. E. Randolph, of Jefferson.

The Cynthiana Telephone Co., Cynthiana, Ky., has been organized by F. R. Phillips, of Covington, Ky., and others. Capital stock, $10,000.

TELEPHONE PATENTS ISSUED AUGUST 20, 1895.

Telephone Switch and System. Ernest C. Wilcox, Meriden, Conn. (No 544,711).

Magneto Electrical Telephone. Max Frank, Munich, Germany. (No 544,890).

Telephone Exchange Apparatus. Joseph J. O'Connell, Chicago, Ill. (No. 544,901).

New York Notes.

Office of the Electrical Age,
World Building, New York,
August 26, 1895.

Chas. A. Schieren & Co., Ferry street, City, have received orders from the Southern Electric Co., Philadelphia, for 560 feet of three-ply Electric belt, 64 inches wide, and 463 feet of 26 inch three ply perforated belt for the Rouen (France) Electric Light Company. Both orders were received within a week of each other.

The Ball & Wood Co., of New York, reports that never in the history of its business has it had so many orders on its books as at present. This condition of affairs has compelled it to make not only a large addition to its works in building a new boiler house and rearranging its steam plant, but also in the purchase of more large tools. Recent orders include engines for Milwaukee, Wis.; Terre Haute, Ind.; McGregor, Iowa; Helena, Mont.; Denver, Colo.; Colorado Springs, Colo.; New Orleans, La.; Altoona, Pa; Wilkesbarre, Pa., and Flatbush, N. Y., besides a large number for new buildings now going up in New York City. Both from its Chicago and New York offices this company reports some stiffening of prices, and altogether it is confident the improvement in business will continue.

Mr. F. M. Hawkins, Thames Building, New York, representative of the Electric Engineering and Supply Co., of Syracuse, N. Y., has secured a contract to furnish all the panel and switchboards for the new building of the Young Men's Christian Association, 56th and 57th streets. These boards will be made of Italian marble, highly polished and set in iron frames with polished brass supports. The instruments will consist of two 300 and one 750 ammeters; one 125 and one 250 voltmeter; one voltmeter switch; three rheostat dials of the Electric Engineering and Supply Co.'s special pattern; four main dynamo switches, and 11 circuit switches of capacities ranging from 75 to 200 amperes.

Mr. Jas. J. Pearson, proprietor of the Capo-Farad Battery and Appliance Works, 27 Thames street, New York, is pushing the Capo-Farad and Midget cells for all they are worth—and they are worth a good deal. The Midget is a trifle smaller than the Capo-Farad, and almost as strong, and Mr. Pearson will hereafter make the two sizes. These cells have been greatly improved and they represent the greatest amount of electric force in the smallest amount of space. W. T. H.

Street Railway Notes.

The West End Street Railway Company, of Boston, on August 23, declared a dividend of 3½ per cent. on its common stock, payable October 1 next.

The report of the Metropolitan Street Railway Company, of New York City, for the quarter ending June 30, shows an increase in gross earnings, as compared with the same period last year, of $60,411, and a decrease in operating expenses and taxes of $35,485. The total income shows an increase of $180,289.

The report of the Eighth Avenue Railroad Co., of New York City, for the year ending June 30, shows a decrease in gross receipts of $23,897, compared with those for 1894, and an increase in operating expenses of $17,245; decrease in net earnings $41,142.

The report of the Brooklyn Heights Railroad Company, Brooklyn, N. Y., for the quarter ending June 30, shows the following changes as compared with the same period last year: decrease in gross earnings, $97,658; increase in operating expenses and taxes, $10,318; decrease in net earnings $107,976.

Trade Notes.

The Ransome Subway Company, Monadnock Block, Chicago, Ill., has issued a pamphlet describing its system of monolithic subways for sewers, electric conduits, drains, cable and electric roads, ditches, water pipes, tunnels, etc. Under this system of construction the pipe or ditch is formed directly in the ground without breaks or joints.

WOVEN WIRE BRUSHES.

The Belknap Motor Co., of Portland, Maine, are the patentees and manufacturers of the best woven wire commutator brush on the market.

ELECTRICAL and STREET RAILWAY PATENTS

Issued August 13, 1895.

544,647. Automatic Electrical Railway-Signal. Chas. R. Alsop, Middletown, Conn. Filed Oct. 22, 1894.

544,654. Plant for Generating Electricity. George R. Bowen, San Antonio, Tex., assignor of one-half to William Warren Gibbs, Philadelphia, Pa. Filed Feb. 21, 1895.

544,668. Apparatus for Electroplating. Frank Engelhard and Frederick H. Engelhard, Springfield, Mass. Filed Mar. 23, 1892.

544,673. Secondary Battery. Frank King, London, England. Filed Apr. 5, 1895.

National Electric Light and Street Railway Associations.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

President, C. H. Wilmerding, Chicago, Ill.; 1st Vice-President, Frederic Nicholls, Toronto, Canada; 2d Vice-President, E. F. Peck, Brooklyn, N. Y.

Members of Executive Committee: E. H. Davis, Williamsport, Pa, (one year); W. R. Gardiner, Pittsfield, Mass.; George A. Redman, Rochester, N. Y.; J. J. Burleigh, Camden, N. J. Next meeting, New York, May or June, 1896.

AMERICAN STREET RAILWAY ASSOCIATION.

Next meeting, Montreal, Que., October, 16, 17 and 18, 1895.

President, Joel Hurt, Atlanta, Ga.; Vice-President, W. Worth Bean, St., Joseph, Mich.; 2d Vice-President, John M. Cunningham, Boston, Mass.; 3d Vice-President, Russell B. Harrison, Terre Haute, Ind., Secretary and Treasurer, William J. Richardson, Brooklyn, N. Y.; Executive Committee, Henry C. Payne, Milwaukee, Wis.; W. H. Jackson, Nashville, Tenn.; D. G. Hamilton, St. Louis, Mo., C. C. Cunningham, Montreal, Canada; J. N. Partridge, Brooklyn, N. Y.

NEW YORK STATE STREET RAILWAY ASSOCIATION.

Next meeting, Albany, N. Y., third Tuesday in September, 1895.

President, G. Tracy Rogers, Binghamton; First Vice-President, John H. Moffitt, Syracuse; Second Vice-President, W. W. Cole, Elmira; Secretary and Treasurer, William J. Richardson; Brooklyn; Executive Committee, D. B. Hasbrouck, New York; John N. Beckley, Rochester; Daniel F. Lewis, Brooklyn.

OHIO STATE TRAMWAY ASSOCIATION.

Next meeting, fourth Wednesday in September, 1895.

President, Albion E. Lang, Toledo; Vice-President, W. J. Kelly, Columbus; Secretary and Treasurer, J. B. Hanna, Cleveland; Chairman Executive Committee, W. A. Lynch, Canton.

MASSACHUSETTS STATE STREET RAILWAY ASSOCIATION.

President, T. H. Cunningham, Boston; Secretary and Treasurer, A. S. Butler, Lawrence; Executive Committee, Samuel Winslow, Alfred A. Glazier, Boston; P. F. Sullivan, Lowell; E. C. Foster, Revere; Horace B. Rogers, Brockton; A. E. Smith, Springfield; Prentiss Cummings, Boston.

THE TEXAS STREET RAILWAY ASSOCIATION.

President, W. H. Sinclair, Galveston; vice-president, C. A. McKinney, Houston; Secretary and Treasurer, C. L. Wakefield, Dallas. Directory: The officers and W. H. Weiss, San Antonio and George B. Hendricks, Fort Worth.

Next meeting, Galveston, third Wednesday in March, 1896.

PENNSYLVANIA STATE STREET RAILWAY ASSOCIATION.

Next meeting, first Wednesday in September, 1895.

President, John A. Rigg, Reading; First Vice-President, Robert E. Wright; Secretary, S. P. Light, Lebanon; Treasurer, W. H. Lanius, York.

THE MAINE STREET RAILWAY ASSOCIATION.

President, W. R. Wood, Portland; Secretary and Treasurer, E. A. Newman, Portland; Executive Committee, W. R. Wood, Portland; George E. Macomber, Augusta; F. M. Laughton, Bangor; Frank W. Dana, Lewiston; Amos F. Gerald, Fairfield.

MICHIGAN STATE STREET RAILWAY ASSOCIATION.

President, W. L. Jenks, Port Huron; Vice-President, W. Worth Bean, St. Joseph; Secretary and Treasurer, B. S. Hanchett, Jr., Grand Rapids; Executive Committee, the Officers and David H. Jerome, Saginaw, and Strathern Hendrie, Detroit.

THE STREET RAILWAY ASSOCIATION OF THE STATE OF NEW JERSEY.

President, Thos. C. Barr, Newark, Vice-President, W. S. Scull, Camden; Secretary and Treasurer, Charles Y. Bamford, Trenton; Executive Committee, Officers and C. B. Thurston, Jersey City; H. Romaine, Paterson S. B. Dod, Hoboken.

544,677. Trolley-Arm and Attachment Therefor. George Maag, Newark, N. J; Joseph Ayres administrator of said Maag, deceased. Filed Dec. 12, 1894.

544,685. Electric Locomotive. Edwin H. Porter, Radford, Va. Filed June 22, 1894.

544,692. Car-Fender. John F. Saitz and Frederick W. McKee, Pittsburgh, Pa., assignors to Frederick W. McKee and Samuel Kelly, same place. Filed May 6, 1895.

544,696. Dynamometric Governor. William N. Smith, Chicago, Ill Filed Aug. 16, 1894.

544,711. Telephone Switch and System. Ernest C. Wilcox, Meriden, Conn. Filed May 13, 1895.

544,742 Car Fender. Francis McDowell, Philadelphia, Pa. Filed Feb. 7, 1895.

544,745. Electrically-Controlled Weighing Apparatus. Lorenzo H. Nutting, Davenport, Iowa. Filed Nov. 13, 1894.

544,747. Manhole for Electric-Cable or Other Subways. Ernest L. Ransome, Chicago, Ill. Filed Jan 11, 1895.

544,749. Electric Motor. Benjamin P. Remy, Peru, Ind. Filed Nov. 24, 1894.

544,750. Car-Fender. John A. Shank, Lancaster, Pa., assignor of one-half to Henry R. Wolpert, same place. Filed June 21, 1895.

544,768. Electric Elevator. Nils O. Lindstrom, Union Course, assignor to the A. B. See Manufacturing Company, Brooklyn, N. Y. Filed May 16, 1895.

544,774. Automatic Safety Trolley. James B Scranton, New Haven, Conn. Filed Mar. 30, 1895.

544,778. Insulator for Electric or Other Wires. Clinton Sproat and Edward N Farr, Taunton, Mass. Filed Jan. 2, 1895.

544,779. Car-Fender. Joseph N. Wieczorek, Boston, Mass. Filed Jan 15, 1895.

544,780 Electric Elevator. John C. Winters, Mount Morris, N. Y Filed Dec 3, 1894.

544,781. Electric Switch Thomas H Brady, New Britain, Conn. Filed May 3, 1895.

544,794. Trolley-Arm and Wire-Finder. Frederick W. Riess, Philadelphia, Pa Filed June 10, 1895.

544,844. Carbon-Brush Holder for Dynamo-Electric Machines Alexander J. Churchward, Brooklyn, N. Y. Filed May 14, 1894.

544,847. Apparatus for Insulating Electrical Conductors. Louis W. Downes, Providence, R. I. Filed Apr. 6, 1895.

544,854. Car-Fender. John J. Kirkness, Baltimore, Md. Filed Apr 20, 1895.

544,861. Applying Power at a Distance by Means of Electricity. James F. McLaughlin, Philadelphia, Pa. Filed Oct. 8, 1891.

544,862. Electric Railway. James F. McLaughlin, Philadelphia, Pa. Filed Apr. 17, 1895.

544,863. Electric Railway. James F. McLaughlin, Philadelphia, Pa. Filed May 3, 1895.

544,873. Car-Fender. August Weismantel, Brooklyn, N. Y. Filed May 6, 1895.

544,876. Ships Telegraphic Apparatus. Johannes K. Adelsberg, Liverpool, England, assignor to the Walker's Engine Speed Indicator and Recorder Company, Limited, Durban, Natal. Filed Mar. 16, 1895.

544,890. Magneto-Electrical Telephone. Max Frank, Munich, Germany. Filed June 30, 1894.

544,901. Telephone-Exchange Apparatus. Joseph J. O'Connell, Chicago, Ill., assignor, by mesne assignments, to the American Bell Telephone Company, Boston, Mass. Filed Apr. 29, 1893.

544,919. Car-Fender. John B. Hoagland, St. Louis, Mo., assignor of five-eighths to L Frank Ottofy and James A. Lane, same place. Filed Apr. 8, 1895.

544,932. Car-Fender. Alamado B. Russ, Chicago, Ill. Filed Jan. 16, 1895.

544,937. Electric Train Signal. Francis C. E. von Sternberg, Brooklyn, N. Y. Filed Apr. 13, 1895.

545,005. Multiple Electric Circuit and Mechanism for Maintaining Same. Timothy K. Ames and Elbert A. Parker, Peterborough, N. H. Filed Oct. 19, 1894.

545,008. Burglar-Alarm. Frederick Bex, Brightwood, D. C. Filed Dec. 20, 1894.

545,009. Trolley. George W. Biddell, Chattanooga, Tenn. Filed Feb. 2, 1895.

545,020. Electrically-Controlled Winding Mechanism for Time-Locks. William H. Hollar, Philadelphia Pa.; George L. Weaver, Boston, Mass., and Anthony Kennedy, Charlestown, W. Va.; said Weaver and Kennedy assignors to said Hollar. Filed Apr. 1, 1895.

545,021. Electric Winder for Time-Locks. William H. Hollar, Philadelphia, Pa.; George L. Weaver, Boston, Mass., and Anthony Kennedy, Charlestown, W. Va; said Weaver and Kennedy assignors to said Hollar. Filed Apr. 17, 1895.

545,039. Life-Saving Guard and Fender for Trolley-Cars, etc. Joseph Weinmann and Benjamin F. Sharp, Philadelphia, Pa. Filed Dec. 24 1894.

ELECTRICAL AGE

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NEW YORK, SEPTEMBER 7, 1895.

CONTENTS.

A PROBLEM.

It is a question today whose answer may be heard from a thousand sources—Will the steam-engine be supplanted by the gas engine? Is gas so cheap, or steam so dear, that the ratio of cost per horse-power entirely destroys the future of steam? We think not. There are theoretical possibilities in both that may blind the public eye. A thousand and one cases arise where circumstances so compensate for the ingress of the gas engine that the proclamation goes forth exalting its virtues, disregarding its cost and crying out its distinctive superiority. There was a time when gas was a luxury, and the taper and oil lamp held undisputed sway. Gas was dearer; why should it be used? When we compare an article from the standpoint of convenience and cheapness we are brought face to face with an old, old problem. The candle, oil lamp, gas jet and electric light have assumed a position in the public eye, and the steam-engine, gas engine and electric motor are placed beside them. To which shall the position of superiority be given so that all conditions shall be satisfied? The new departures whose influence has caused the rapid growth of gigantic industries are not the mere mushrooms of the age. They speak of the day when experience will measure the merits of all things; when light, and power, and heat will spring from newer and more mysterious sources, as the sign of a firm and progressive civilization.

THE BUFFALO ELECTRICAL TRADE ORGANIZES FOR MUTUAL PROTECTION.

The electrical supply dealers and contractors of Buffalo, N. Y., have formed an association for mutual benefit and protection, and the placing of the electrical business in that city on a better footing.

At a meeting of the association on July 12 last, resolutions were passed by a unanimous vote to the effect that the Association "is capable of taking care of the trade in this city (Buffalo); that all supply dealers be notified, and their co-operation respectfully requested."

This association asks all manufacturers, jobbers, commission houses and agents to refer to the supply houses in Buffalo, all persons in the city, outside of the regular trade, who desire to purchase goods.

All such goods must be sold to the outside trade at list prices.

This action on the part of the Buffalo dealers is the result of the unbusiness-like transaction of certain manufacturers of electrical goods, who are distributing broadcast circulars offering to sell goods to any one in any quantity at the regular trade price.

This method of doing business is naturally looked upon with great disfavor by those who trade in a legitimate manner, and it is in the hope that these illegitimate concerns shall receive their just reward that the Buffalo trade has taken up the defensive. It would be of great benefit to the trade in general if other cities would organize for the same purpose.

The real situation is expressed in a letter written by a New York manufacturer on receipt of a notice of the formation of the Buffalo Association. He says:

"In view of the well-known fact that manufacturers and extensive dealers in electrical goods, many of whom are located in the City of New York, are extensively advertising and distributing broadcast among the people illustrated circulars offering their goods at greatly reduced rates and are disposing of such goods at extremely low prices to any one who will purchase, whether the demand be for a single article or a greater number, and without questioning whether such purchasers are legitimately engaged in the electrical business or otherwise, I have often wondered why the trade quietly submitted and tendered their aid to the furtherance of such utterly selfish and nefarious practices by a continuance of patronage rather than a general boycott."

Now the ice has been broken the matter should be taken up in earnest in every city and handled without gloves.

THE ATLANTA EXPOSITION.

On September 18, Atlanta's star of fortune will reach the zenith. On that date and for a period of 104 days thereafter, Georgia's metropolis will be the centre of interest and attraction to a good share of the country, particularly of the Southern section.

On the date first mentioned the great Cotton States and Internatioal Exposition will open, and will remain open until December 31, 1895.

The work of developing this exposition and making it a success, as far as the show itself is concerned, was a great undertaking, but it was backed by Southern pride in Southern institutions and possibilities, and the energy displayed in carrying forward the plans has excited the admiration of the American people at large.

The wonderful natural resources of the great South will be illustrated in the best manner possible at this exhibition, and no efforts are being spared to show to the world what capital and labor combined can produce in that region.

The electrical building will naturally attract the attention of electrical people more than any other. We give

ELECTRICAL BUILDING, ATLANTA EXPOSITION.

herewith an excellent illustration of this building made from a recent photograph.

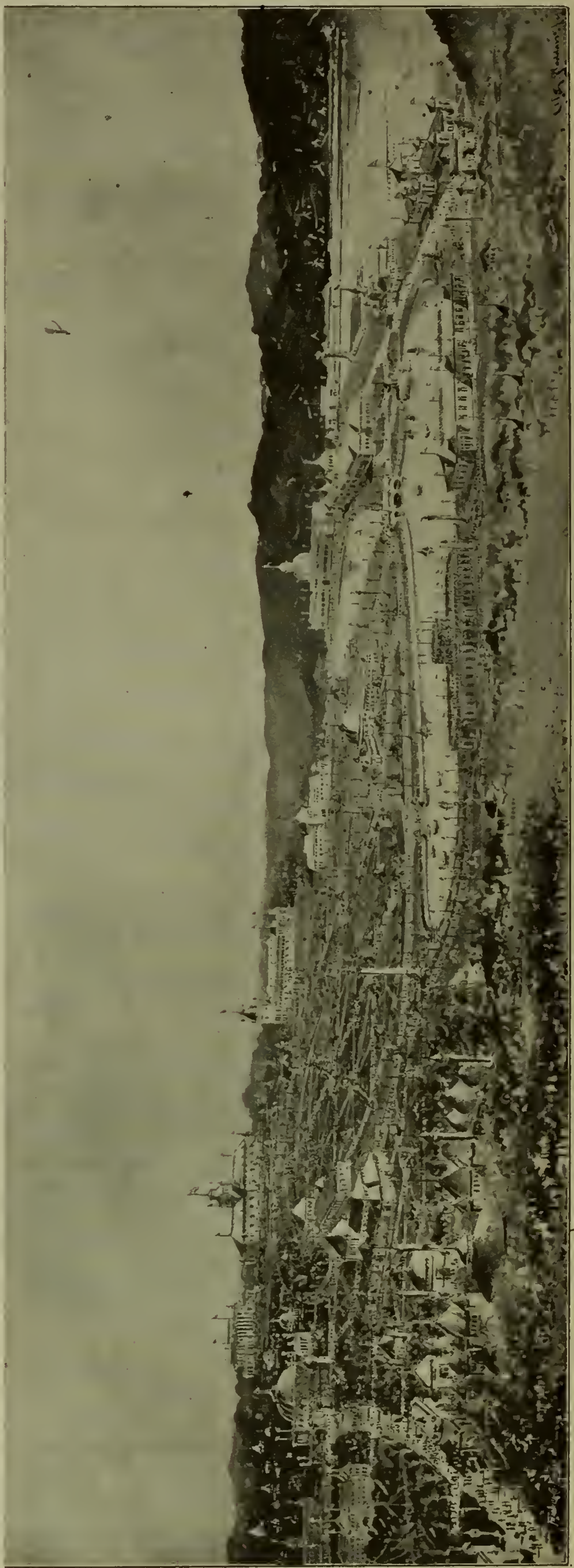
The structure, in its general dimensions, is about 275 feet long and 75 feet wide. At the centre it is surmounted by a dome from which an excellent view of the grounds and buildings is obtained.

The exhibition space is all on the ground floor, the spaces being arranged along the sides and ends of the building and down through the centre, with aisles between. There is also a large space, 44 × 23 feet, immediately under the dome, running crosswise of the building. The large central spaces, running lengthwise, of which there are two, are 81 by 24 feet in size, with 10-foot aisles on all four sides.

There are six entrances to the building, one on each end, three on one side and one on the other. As will be noticed in the engraving, there is an abundance of light, and in every way the building has been constructed to give exhibitors the best facilities for the display of their goods.

Among the well-known concerns who will have extensive exhibits are the following: The General Electric Co., with at least 1,000 square feet of space; the Westinghouse Electric and Mfg. Co., the Brush Electric Co., the Fort Wayne Electric Corporation, the American Bell Telephone Co., the Western Electric Co. and many others.

The great electrical fountain, designed by Mr. Luther Steiringer, of New York, occupies the centre of the lake on which Electricity Building fronts. Many new and beautiful electrical effects will be produced by this fountain, which is said to surpass all previous efforts in this direction in ingenuity and novelty. Twenty-three powerful electric projectors will be used, each of 250,000 candle-power, and when the fountain is in complete operation it is said the effect of the different colored lights and combinations of the same will be beautiful beyond description. Mr. Steiringer is a master of his unique art.



BIRD'S EYE VIEW OF THE ATLANTA EXPOSITION GROUNDS.

We give, besides a view of the Electrical Building, a bird's-eye view of the grounds entire.

ELECTRICAL CARNIVAL IN SACRAMENTO.

September 9 will be a gala day in Sacramento, California. On that date the citizens of that city will hold a grand Electrical Carnival to commemorate the successful installation of the great long distance electric power plant by the Folsom Water-Power Company, and at night electricity will entrance the city. There will be a grand parade of floats, etc., brilliantly lighted with electric lamps of every imaginable color and design. There will also be arches gorgeously decorated with electric light designs, all blazing with the brilliancy of the noon-day sun.

ELECTRICAL CARNIVAL, SACRAMENTO, CAL.

We give herewith an illustration showing some of the night electrical effects and decorations, which are planned for this occasion.

In the carnival it is estimated that 10,000 Native Sons of the Golden West of California will participate.

On July 13, 1895, electric power was received at the substation of the Sacramento Electric Power and Light Company in Sacramento City from the great works of the company, twenty-two miles away, near the town of Folsom. At that point a massive stone dam, making a fall of eighty feet, has been built across the American River, a torrential stream, just as it emerges from the foothills of the western slope of the Sierra Nevada.

The power developed, as it is delivered, is 4,000 horse-power. This is capable of indefinite increase as the demand for electricity for light or power may require.

ELECTRIC COMMUNICATION WITH LIGHTSHIPS.*

Several lightships have been put in electrical communication with the shore, and a trial is to be made of the inductive system, in which the cable lies wholly on the bottom of the sea, and the signals are transmitted over the intervening space to the apparatus on board by electromagnetic induction. The apparatus to be used is the invention of Mr. Sydney Evershed, and its principle is illustrated diagrammatically in the annexed illustration. Fig. 1 shows a light-ship, B, able to swing round a mushroom anchor. Around the circle which it is capable of occupying there is laid, on the sea bottom, a ring of cable, A, connected to the shore station, as shown. A secondary coil is fixed on the ship, and should consist of, at least, 50 turns of insulated wire, of as low a resistance as possible. If the ship is built largely of iron, the secondary coil should be arranged around the outside of the bulwarks; its magnetic axis must be as nearly as possible normal to the plane of the ship's decks. Interrupted currents are sent through the submarine cable by means of a key, K, and a contact-breaker, W, driven at such a speed as to interrupt the current several thousand times a second. The discontinuous currents in the cable ring, A, produce rapidly alternating electromotive forces in the secondary coil and alternate currents pass through the telephone, T, and indicate their presence by the buzzing of its diaphragm. The signals are read by the Morse code. The difficulty with inductive telegraphy lies in calling the attention of the operator, as, of course, he cannot live with the telephone at his ear. This difficulty appears to have been removed by Mr. Evershed in an exceedingly ingenious manner by the invention of a cumulative impulse relay, illustrated in fig. 2. A rectangle of wire, V, is clamped in an insulating support, I. One side of the rectangle is placed between the poles N. and S. of a powerful magnet, and when the rectangle is traversed by laternating currents, timed to correspond to its frequency of vibration, it receives a series of cumulative impulses, and is set in vibration. This vibration brings it against a contact on the similar rectangle, P, which is tuned in unison with V. When the two touch, the circuit of a local battery is closed, and a bell rung. The two similar rectangles are used to prevent accidental contact due to mechanical jars. The second rectangle may be traversed by alternating currents in the opposite direction to the first. The currents employed in calling are not the same as those for speaking. A frequency of 30 to 40 periods per second is suitable, and is obtained by means of a tuning fork or other similar device. The vessel on which the induction telegraph is to be tried in the first instance is the *East Goodwin*, which lies outside the Goodwins, and will require a cable of some 10 nautical miles in length.

* *Engineering*, London.

TELEPHONY IN SWEDEN.

Sweden's state telephone is soon to be connected with the state telegraph. Instead of addresses the telephone numbers will be used, the telegraph clerk looking up the address. Messages may be telephoned to the telegraph office and telephoned back, thus dispensing with the greater number of the messenger boys, as in Sweden nearly everyone uses the telephone.

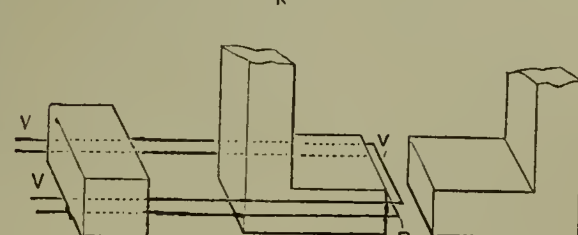


FIG. 2.

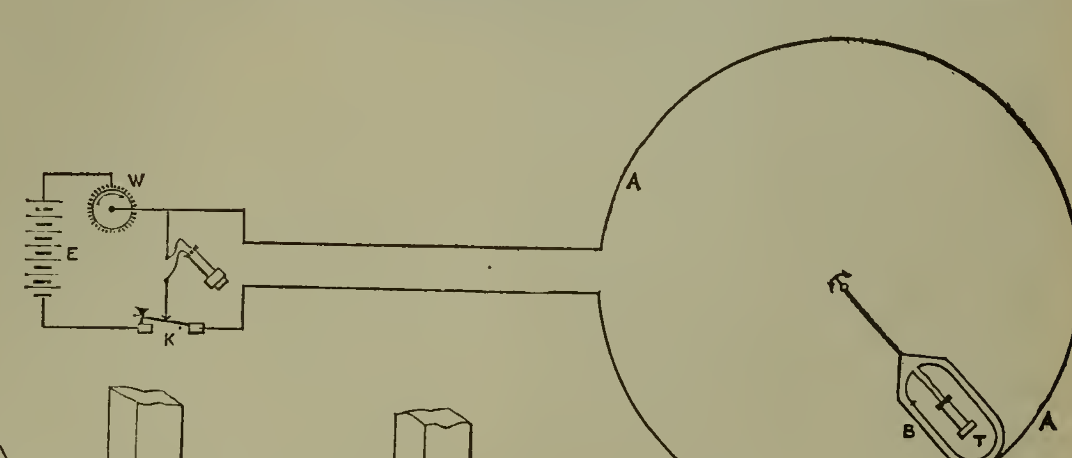


FIG. 1.

The Brooklyn Heights Railroad Company, of Brooklyn, N.Y., with the co-operation of the city authorities, has made arrangements to illuminate the fountain on the Prospect Park plaza with various colored electric lights.

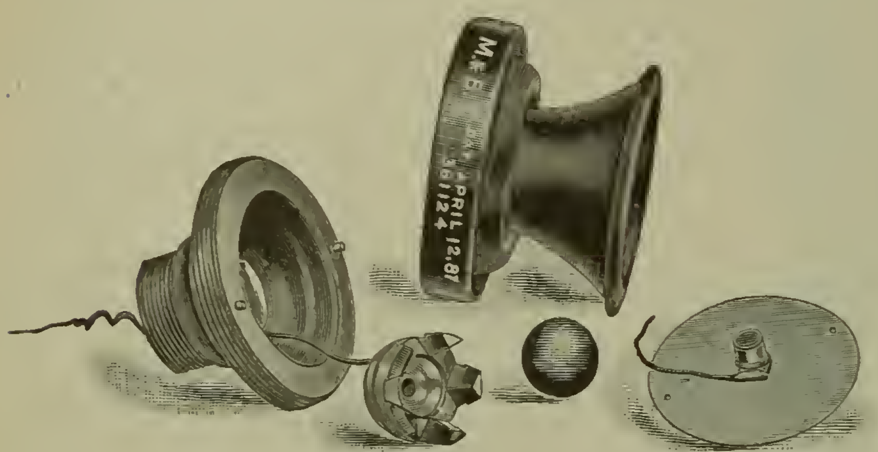
PHILADELPHIA'S ELECTRICAL INTERESTS.

CONTINUED FROM PAGE 118.

THE M. & B. TELEPHONE.

Although the M. & B. telephone is manufactured under patents which were taken out some years ago, it has only been within the last few months that the instruments have been ready to put on the market The first complete standard instruments were sent out in May, although the M. & B. transmitter had been in use for years on private lines. Since than a large number have been placed throughout the United States. They met with universal approval from the start, on account of their extreme simplicity and perfect operation.

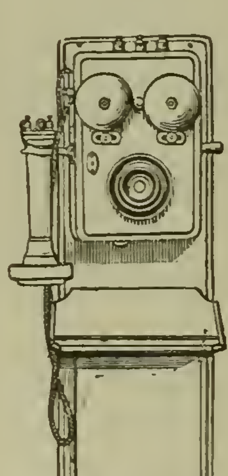
The United States Telephone Construction Co., Bullitt



M. & B. TRANSMITTER DISMANTLED.

Building, Philadelphia, Pa., who manufacture the M. & B. telephones and are the sole agents for the United States, have exercised the utmost care in the construction of their instruments that they should be free from any infringing devices and that the materials and workmanship should be of the very highest order, which in a large measure accounts for the immediate success of the telephone. Within the past year a great many different forms of transmitters have been manufactured and sold, but the manufacturers of the M. & B. claim that theirs is the only one which is not covered by the famous Berliner patent. The accompanying illustration of the M. & B. transmitter shows its extreme simplicity. In the back of the rubber transmitter case is fastened a small metallic basket, which is shown in the cut

M. & B. DESK SET.



M. & B. SIZE A.

pulled out. The arms of this basket form little tracks or runways for the the carbon ball, which is also shown in the cut. These balls are $\frac{1}{16}$ of an inch in diameter.

The ball is placed in the basket, the diaphragm put over the rubber case, the mouth-piece screwed on and the transmitter is ready to operate. When the parts are assembled the point on the diaphragm comes on a level with the centre of the ball, and owing to the angle of the arms of the basket, or runway, this ball is kept normally in contact with the point of the diaphragm. As soon, however, as any one speaks in the mouth-piece the diaphragm commences to vibrate, and with every vibration a movement of the ball takes place which breaks the battery circuit at this point of contact; hence the name "Make and Break" and the well-known sign "M. & B." It will be seen from this description that the M. & B. transmitter is novel in many respects, and that the electrodes are not in constant contact. It will be remembered that all the claims in the Berliner patent are based on the electrodes being in constant contact. The M. & B. principle is set forth in the claims of the broad method, patent No. 361,124, issued April 12, 1887, under which these transmitters are manufactured.

The United States Telephone Construction Co. claim that the M. & B. telephones give better and more perfect articulation, that every syllable of a word is clearly heard, that

M. & B. STYLE D.

the volume of sound is great and yet there is no sputtering or snapping sounds which are heard in some other transmitters.

Every one of the M. & B transmitters is a long distance instrument. In a recent test made a whisper could be plainly heard a distance of 150 miles, using only one cell of dry battery.

Another claim which is of importance to all is the simplicity of construction. The M. & B. transmitter is the simplest transmitter made. It cannot get out of adjustment, has no springs or points to adjust, it can not pack as do all forms of granular carbon transmitters; in fact, there is nothing about it that can get out of order. This transmitter is mounted in various standard sets, some of which are shown here. Besides the M. & B. telephone, the United States Telephone Construction Co. are prepared to furnish switchboards for exchange work, either ground or metallic circuit, and to supply all materials necessary for the complete equipment of exchanges of the highest types. They have in their employ men of long and varied experience in the telephone field and are prepared to give expert advice on all subjects pertaining to the installation of exchanges.

HARRISON SAFETY BOILER.

Among the various "safety" boilers in the market none perhaps is better known than the improved Wharton-Harrison Safety Boiler manufactured by the Harrison Boiler Works of Philadelphia.

This boiler is peculiar of construction, and has received

FIG. I.

awards and medals from various institutes and expositions.

The boiler is constructed of hollow cast spheres (Fig. 1) termed "units." These units are combined in vertical sections, called "slabs," by means of bolts passing through their centres, which are entirely surrounded by water. The joints are made perfectly steam and water-tight and no packing whatever is necessary.

The "slabs" to the required number and of the size to suit are suspended side by side from a suitable iron framework (see Fig. 2), being connected at top and bottom to form a proper steam and water coupling. They are hung one inch apart, by bolts, and slightly inclined upward from front to back so as to secure a uniform area of steam-

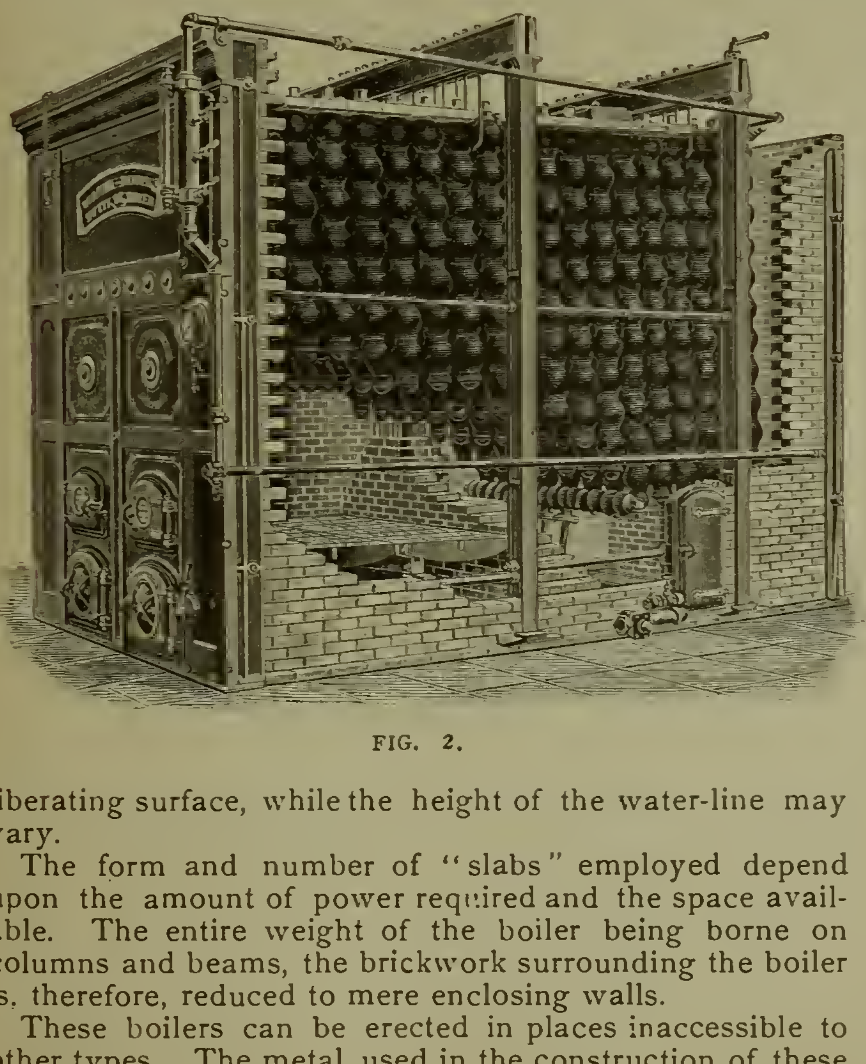


FIG. 2.

liberating surface, while the height of the water-line may vary.

The form and number of "slabs" employed depend upon the amount of power required and the space available. The entire weight of the boiler being borne on columns and beams, the brickwork surrounding the boiler is, therefore, reduced to mere enclosing walls.

These boilers can be erected in places inaccessible to other types. The metal used in the construction of these boilers is of special brand, secured after thorough and costly analysis and a series of tests extending over some years.

The advantages claimed for this boiler are—1, Safety; 2, Dry Steam; 3, Rapid Generation of Steam; 4, Durability; 5, Accessibility of all parts for Cleaning or Repairs; 6, Facility of Erection or Repairs; 7, Economy of Fuel; 8, Ease of Transportation; 9, Increasing the Capacity; 10, Inexpensive Brickwork, and 11, Excellence of quality of Fittings throughout.

The Cochrane Feed-Water Heater and Purifier, which is also manufactured by the Harrison Works, is illustrated in Fig. 3. It is square in horizontal section with top and bottom slightly dished. Each side is formed of one or more cast-iron plates strongly ribbed, which are bolted together at the flanges, and made steam and water-tight with rust joints calked from the inside, thus forming a very strong and rigid shell not affected by the pulsations of the exhaust steam The steam inlet is through the separator attached on the outside of the heater.

The upper portion of the heater contains separate trays varying in number according to the size of the heater.

FIG. 3.

These trays are slightly inclined and have the lower edge turned up and serrated to subdivide into fine portions the water which passes over them. The trays, which are interchangeable, are fixed in place to prevent any noise from the pulsations of the exhaust.

The hand holes and cleaning doors are conveniently placed and so arranged that they offer easy access to all parts of the heater, being easily and quickly removed and replaced.

On the inlet pipe, outside of the heater, is placed a regulating valve which controls the cold water supply.

The Cochrane Separator, for horizontal pipes, is shown in Fig. 4.

This separator takes water out of live steam, oil out of exhaust steam, oil out of ammonia gases, etc. The steam outlet and inlet openings, which are laterally opposite each other, are separated by a ribbed or corrugated plate, known as the "baffle" plate, which effects the separation. For the passage of the steam through the separator there are provided two openings, one on each side of the baffle plate. These openings are protected by a special deep rib to prevent the side travel of the particles of water or oil toward the passage-ways, the other ribs or corrugations also preventing the separated particles from taking the same course as the current of steam. In order to minimize friction, the combined area of the passage ways is made to greatly exceed the area of the entering pipe; the baffle plate itself being so proportioned and placed that the effi-

FIG. 4.

ciency is brought to the highest point. The course for the steam through the separator is particularly free and easy. The sides of the separator converge toward the centre from all directions and lead direct to the receiving well or reservoir, the mouth of which is specially protected in

FIG. 5.

order to prevent the separated particles being picked up during their descent to the well or after they reach the well.

Fig. 5 shows the Cochrane Separator for vertical pipes.

DEPRESSED WIRES IN PHILADELPHIA.

Philadelphia's ownership of electrical sub-structures in the streets is a somewhat novel application of the princip'e of municipal ownership, and one in the workings of which all cities must be interested, says *Municipality and County* in its August number. The city owns 146,299 feet of conduit, and 897,413 feet of duct, which, under the terms of an ordinance passed April 10, 1893, have been p rtially leased to various private corporations for an aggregate yearly rental of $4,590. In addition to this specific yearly rental, the city grants the use of these conduits to the electric light companies, which, by way of compensation, make a reduction of three cents for every light used by the city on the circuit where the city's conduits are used. This reduction amounts to $5 453, and brings the actual revenue derived for the underground plant up to over $10,000 a year, or about 3% on the investment. The companies using the city's conduits, amount used, and price paid per year, are as follows:

Bell Telephone Company, one duct, 3 miles and 4,667 feet long; occupied by one cable containing 200 wires, annual rental..............	$ 950
Western Union Telegraph Company, four ducts, each two miles, 1,467 feet long, annual rental	3,000
Pennsylvania Railroad Company, two ducts, one mile, 4,242 feet long, annual rental..........	550
Also twenty pairs of wires making nine miles of conductor, annual rental....................	90
	$4,590

The present head of the electrical bureau of Philadelphia, who, by the way, has the marvelous record of having been connected with the bureau since its inception in 1856—a continuous service of thirty-eight years—is of the opinion that if the policy of building and purchasing sub-ways should continue, the city will eventually be in receipt of a permanent income therefrom.

The work is going on all the time; poles are coming down and wires going underground. Altogether there were, on January 1, 1895, 1,842,648 feet of conduit in Philadelphia, or 13,401,065 feet of duct, of which the city owns the amount above stated. In 1894 the total amount of conduit laid by all parties was 42,238 feet, each conduit containing from 4 to 12 ducts, and 96 miles of overhead wires were removed, for which underground accommodations had to be provided.

The dangers of overhead and the advantages of underground wires, both to the public and to private companies, are so well illustrated by Mr. Walker, the chief of the Philadelphia electrical bureau, that his statement on this subject is copied in full, as follows:

The recognizedly dangerous features of the overhead trolley and electric light systems were perhaps never more forcibly illustrated than during the storm of December 27, 1894. The snow, winds, sleet, etc., incidental to such a severe winter storm, in this instance were aggravated to a high degree, causing wires, poles, etc., that would perhaps have withstood many storms of less magnitude, to be broken and twisted and fall to the surface of the highways, meeting in their descent a new danger (the trolley wires) never before experienced during a severe storm in this city. The resultant effect, in instances where contact with these wires was sustained, were particularly damaging. Telegraph and telephone instruments were so badly burned as to be utterly unfit for use again. The dangling wires, heavily charged to a degree that caused death to a number of horses, made it exceedingly dangerous to the men repairing the wires of the city and private corporations, but fortunately no human lives were sacrificed. The "guards" placed above the trolley wire to protect it from contact with other wires falling upon it became in themselves a danger. In many instances they broke and coiled around the trolley wires, and dangling in the street, twisted and moved about, so as to make it almost impossible for horses and pedestrians to avoid them. It is to be inferred that the protecting devices placed in the power houses of the railway companies were active on this occasion, but from the length of time the current remained on the cross wires it is presumed they were held in position with a view of keeping their cars in motion. This action on the part of the companies left the wires charged until they were burned off or removed. In all cases where hanging wires were found to be charged, the police officers stood guard over them, and cautioned drivers of teams and pedestrians of their danger.

Under ordinary conditions the "guard" wires might possibly have prevented others from coming in contact with the trolley wires, but in instances of this kind they are utterly useless; in fact, become a danger in themselves by breaking and falling to the street. Even when they remain in position the foreign wires, falling from all directions, dropped between the "guards," and, being in contact with the trolley, carried the currents to the guards, which, being fastened and ground to the iron poles, presented an additional danger to any one touching the poles.

The possibility of danger from contact with electric light wires is largely lessened in so far that they are in most instances below all others on the poles, and being on the side of the street instead of the centre, as are the trolley wires, contact with them largely depends upon which side the street the wire falls from, and the method in which it is handled after falling. If its end should be pulled under the wires on the poles and fastened to an iron awning or gas lamp, as is usually the case, it is likely to be crossed with the electric light and all other wires on the outside of the pole, diverting the current to them, thus endangering the instruments, etc., connected, and the men whose duty it is to keep them clear of trouble. The underground wires remain practically intact, as from their secure position they do not feel the effects of the storm. It occurs to me that this is but another and forcible illustration of the necessity, so long advocated by this department, of depressing all wires, the practicability of which, so long questioned, is now being recognized by all in so far that they are placing electric light, telegraph, telephone and trolley wires underground.

The following table will show the cost per foot per duct of the conduits laid during the year 1894, including manholes and the restoration of the streets, complete, ready for the cables :

	Per Foot.	Per Mile.
Fairmount avenue, between Broad street and Pennsylvania avenue, 6 ducts	$0.17 $\frac{45}{100}$	$ 921.36
Lehigh avenue, between Park and Kensington avenue, 6 ducts	.16 $\frac{76}{100}$	884.93
Ridge avenue, between Vine street and Columbia avenue, 9 duct	.19 $\frac{51}{100}$	1,030.13
Christian street, between Swanson street and Sutherland avenue, 4 ducts	.21 $\frac{1}{10}$	1,114.08
Broad street, east side, between Chestnut and Christian street, 12 ducts.	.21 $\frac{98}{100}$	1,160.54

ANOTHER CASE OF RESUSCITATION IN ROCHESTER.

Harry W. Sherman, for fourteen years a lineman in the employ of the Rochester Gas and Electric Company, Rochester, N. Y., received a shock from a live wire on August 28, and was apparently dead for six minutes when he recovered consciousness, after being subjected to the d'Arsonval treatment, which is similar to that used in cases of drowning. His right hand and wrist were badly burned, but he is otherwise all right.

He said that he did not know when he received the shock. He was entirely unconscious and knew nothing until he began to feel the pain in his burned hand. The wire carried from 1,600 to 1,800 volts and was short-circuited by the man's body, he receiving the entire voltage through his body. The accident occurred at the lower falls station. Sherman was on the roof working among some deranged wires when he received the shock.

THE NEW YORK STATE STREET RAILWAY ASSOCIATION.

The Street Railway Association of the State of New York will hold its annual meeting in Albany on September 17, and the meeting promises to be one of practical interest and benefit to all present. A feature of the programme will be the presentation of several papers upon subjects of every-day importance to street-railway men. All papers prepared and read before the convention will be brief and concise, fifteen minutes being the limit of time allotted to each.

Following is a list of topics for papers and discussion : Points on financial organization. Car mileage record—Its advantages. Improvements needed in electric motors. Suggestions for special track construction. How can we increase travel, especially in smaller cities? Are we laying too many miles of track to reach a few people? Is selling tickets at reduced rates an advantage or disadvantage? The maintenance of power-station from an economical stand-point. How to keep car-bodies clean—A plan for daily inspection and care. Fenders—Are they practicable?—Their advantages and disadvantages. Is a freight or mail service profitable or unprofitable on street railways? The use and abuse of transfers, and are they advantageous in smaller cities? Overhead construction; maintenance of same, and suggestions for new work. How can we prevent accidents and increase the general efficiency of employés? How shall we heat cars?—The relative cost and advantages of electricity and stoves. General track construction and the most approved method—Suggestions for improvement. How to prevent collusion on the part of motormen and conductors to defraud the company? The best method of and the advantages gained by rotating crews and distribution of runs. The relative advantages and disadvantages of single and double trucks for interurban service. Can small electric roads be operated to advantage in conjunction with small electric light companies? Report blanks, time sheets, etc., and their general usefulness to the superintendent—Suggestions for forms. The daily inspection and care of car equipments.—How to accomplish the best results with the least expense. The daily record-book of conductors' returns—its necessity and advantages—Suggestions for headings. The best method of promoting personal interest on the part of the employés in the affairs of the company. Signals and intercommunication with reference to maintenance of schedule on single-track street railroads. The proper form of liability insurance—Can a company insure themselves to advantage by establishing a fund? What is the proper and most efficient method of protecting a street railroad company from dishonesty of employés? Street-car wheels—Should they be made heavier, to avert possibilities of accident?—Is it possible to establish a standard? Street railway legislation—How can it be met to best subserve the interests of street railroad companies and the public? The comparative advantages and disadvantages of operating long or short cars—The extra expense and increased capacity considered. How shall we prevent pounding down of track joints?—How shall we remedy the evil, when it exists, without replacing entire track? Power from the trolley circuit—Is it practicable? Why do the fire insurance companies object?—What should be done to overcome the objection? Pleasure resorts and their advantages to street railroads—Are they profitable? How should they be conducted and maintained to attract the largest number of people and secure permanency? Can cities of less than 15,000 inhabitants support a street railroad of moderate mileage, carefully and well built at present prices, without over-capitalization of costs, owned and handled by local parties?—What measure of profit can be expected therefrom?

A special invitation is given to supply men to be present, and a suite of rooms will be set apart for display of samples, small models, etc.

The officers of the association are: G. Tracy Rogers, of Binghamton, president; John H. Moffitt, of Syracuse, 1st vice-president; Wm. W. Cole, of Elmira, 2d vice-president. The office of secretary and treasurer is vacant, owing to the death of Wm. J. Richardson, who was the last to fill these positions.

McE. CUT-OUTS.

A new line of cut-outs has recently been placed upon the market by Mr. Edward J. McEvoy, of Thames Building, Thames and Greenwich streets, New York City, and the features of these devices are worthy of special reference.

The bases of these cut-outs are made of the best quality of porcelain, special attention being given to design and finish. In construction these devices receive particular care.

The connecting bars are made of metal having superior conductivity, and run from end to end of the cut-out in grooves laid at right angles with the main wire grooves. The latter grooves are divided by a solid wall of porcelain, which absolutely prevents short-circuiting and arcing.

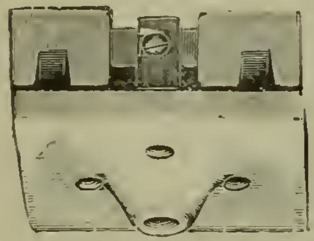


FIG. 1.

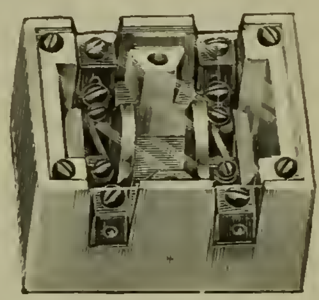


FIG. 4.

The main connections are made with a binding-screw that is claimed to be superior to anything of the kind on the market; the branch connections are made by inserting the wires in a solid piece of metal through which a set-screw penetrates, insuring a perfect contact. Between the main and branch connections is a receptacle in which a porcelain fuse-cap is inserted.

The renewal of the fuse is very easily accomplished. By loosening two screws the fuse cap can be readily removed and replaced without the slightest danger of causing short-circuiting or arcing.

The accompanying illustrations show the various McE. cut-outs, etc., for commercial and marine work.

Fig. 1 represents a ceiling rosette for drop lamps. This rosette has many superior points; all connections being protected and insulated by procelain. It is of standard size and guaranteed to give more general satisfaction than any rosette made.

Fig. 2 shows a 4-way branch cut-out, and Fig. 3 a single branch cut-out.

The vertical cut-out (Fig. 4) is used on main lines in changing the sizes of wires from larger to smaller, or *vice-versa*.

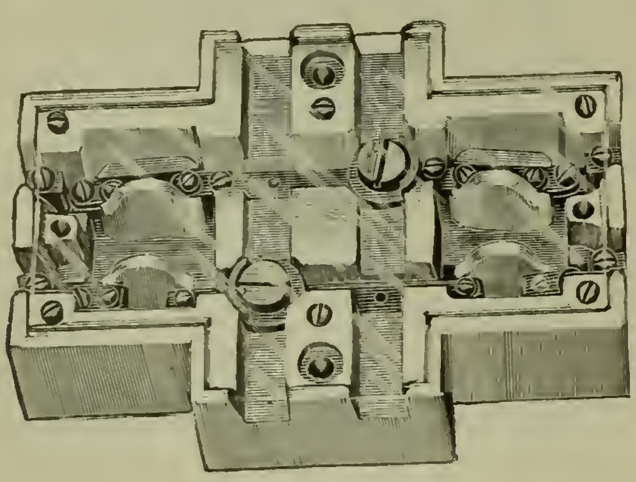


FIG. 2.

The main wire 4-way cut-out, shown in Fig. 5, will take in, easily, conductors as large as 0000, and a 3-way main line cut-out is shown in Fig. 6.

Fig. 7 shows the fuseless branch block, which does away with all soldering and splicing. This branch block is designed especially for marine work and is used on the new American Line steamers "St. Louis" and "St. Paul."

Mr. McEvoy's goods are used extensively by the United States government on its new warships, having been installed on the cruisers "New York," "Columbia" and "Minneapolis," and battleships "Indiana" and "Massachusetts." They will also be used on the new ships "Brooklyn" and "Iowa."

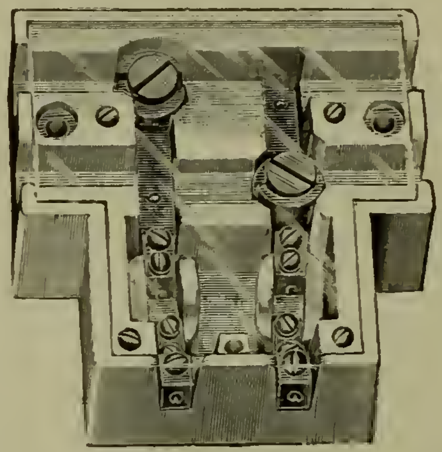


FIG. 3.

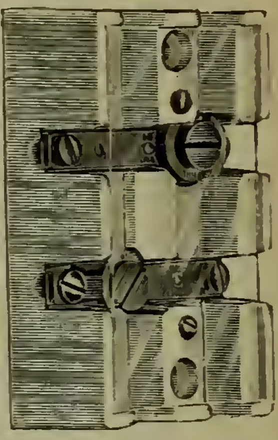


FIG. 7.

Mr. McEvoy was for a long time the electrical constructor of The William Cramp & Sons Ship and Engine Building Company, of Philadelphia, but is now conducting a similar business in an individual capacity. His long experience in marine work has enabled him to produce electrical devices best suited for this class of work, and whereever his goods are in use the utmost satisfaction has been given. In a later issue we will describe and illustrate Mr. McEvoy's marine cut-out outfits.

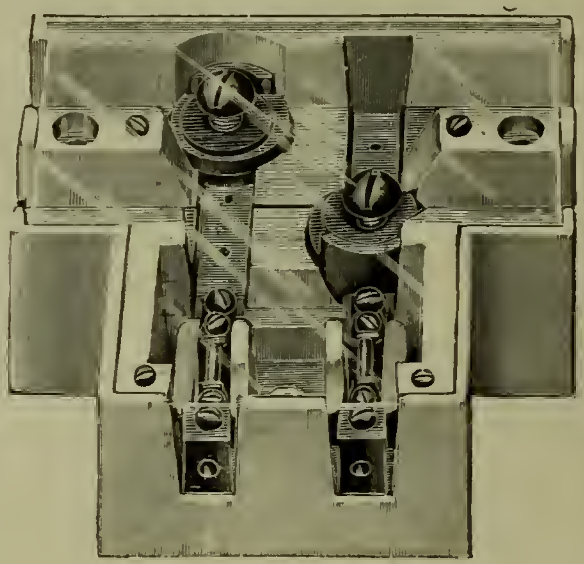


FIG. 6.

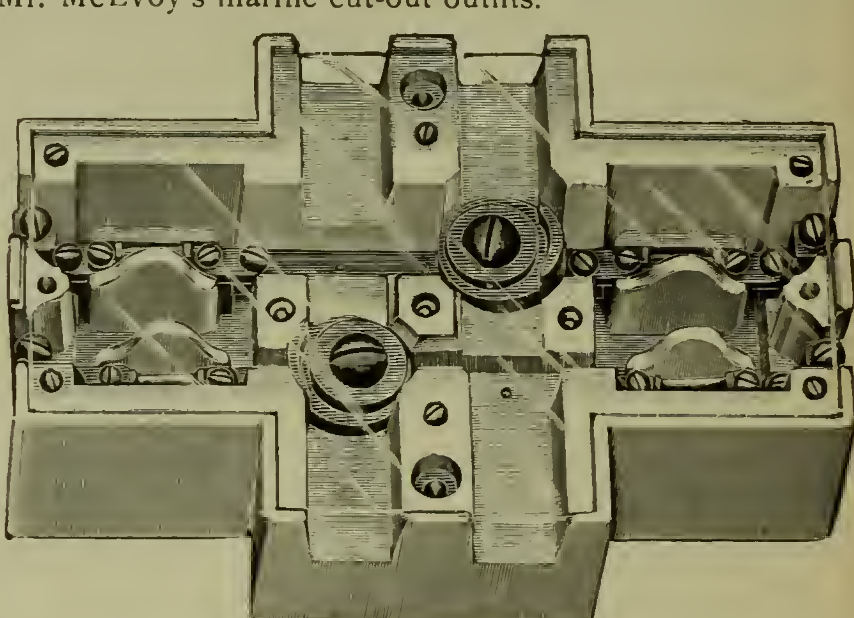


FIG. 5.

Machine Telegraphy—We have received from Mr. P. B. Delany, the well-known electrical inventor, of South Orange, N. J., a copy of his pamphlet describing his system of machine telegraphy. This is a new system of automatic transmission and chemical recording which develops the carrying capacity of telegraph wires to the fullest extent. The pamphlet contains some interesting reading.

THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

President C. H. Wilmerding, of the National Electric Light Association, has called a meeting of the executive committee, to be held in New York city on Tuesday, September 10, for the purpose of discussing the advisability of holding an electrical exhibition in connection with the next convention of the association, which will take place in New York city, next May.

The following is a copy of a letter relating to the subject of an exhibition sent to the supply dealers by President Wilmerding.

New York, August 28, 1895.

Gentlemen:

It has been suggested that an electrical exhibition be held in connection with the next annual convention of the National Electric Light Association, which will take place next May in New York. The executive committee of the association proposes to act very shortly on this proposition, but before doing so I feel that we should obtain an expression of opinion from those to whom we would look for the very essential features of such an undertaking, namely: the exhibits. The intention is that in case such an exposition is held, it shall be something of considerably more importance than any of the exhibitions that have been made in connection with previous conventions of this association; and unless we feel assured that there is a very general desire on the part of the manufacturers to enter into such a project and to give it their hearty co-operation, we should prefer that the matter be dropped.

I should therefore esteem it a favor if you would reply, stating what your views in general on this subject are and whether there would be a reasonable chance of your taking part in such an exhibition.

Yours truly,
C. H. Wilmerding,
President.

It is evident that there is a strong sentiment in favor of holding an exhibition that will do honor to the trade. As the next convention of the National Electric Light Association will be held in New York, an extraordinary exhibition of electrical apparatus and supplies at the same time would bring the electrical business into closer touch with a great mass of the people, who are as yet totally ignorant of the practical application of electrical machines and devices. They see the electric light, and they know street-cars go by electricity, but as to how the electricity is generated and applied they are quite as much in the dark as a new-born babe. Therefore a big exhibition, widely advertised, held, say, in Madison Square Garden, would attract great crowds and help to stimulate popular interest in electrical industries. The exhibition must be open to the public, because it is with the public that the demand for electrical apparatus originates, and if the people see and become interested in the practical features of electric lighting, electric railways and the other countless applications of electric current, they will naturally take more interest in them and the demand will thus be increased.

There is no more appropriate place to hold the proposed exhibition than Madison Square Garden. If it could be had for a month it would be crowded every day and night, and a great benefit to the trade would result. It might be arranged to hold the convention itself during the first week of the exhibition, and the two events together would constitute a drawing card. Should any shortage occur to meet expenses The Electrical Age will go down in its pocket and help make up the defficiency. But it does not seem possible that anything of the kind could occur, in view of the extraordinary opportunity such an exhibition would offer to the trade in general for the display and advertising of electrical goods. Every one in the business, either as manufacturer or dealer, would certainly work to make the show a big success.

PRINCIPLES OF DYNAMO DESIGN.

BY

Newton Harrison E.E.

(*Continued from Page* 119.)

Sparking.

It is known that armature reaction is not the only source of trouble in an armature. Sparking usually develops when some fault of possibly as great consequence begins to become evident. If at the brushes, it is the sign of a variety of troubles, amongst which may be classed self-induction as that which is the most unique.

The addition of ampere-turns to the armature tends to increase the twisting effect of the field, throwing the line of commutation around further and increasing sparking, unless the position of the coils with respect to the fringe be observed. This is one of the reasons why the ampere-turns on the armature should not exceed a certain amount. Frequently the core, if toothless, is filled up to a certain depth regardless of the above-expressed conditions; the air-gap, however, shows that limitations must be imposed, first, as regards its depth and thus the number of turns, and, secondly, by the nearness of the turns to the pole-piece. The other element which plays its part in the general shaping of the armature is the surface allowed for radiation, that is to say, the watts emitted per square inch of armature winding. The gap greatly determines the limiting load of the machine. Ayrton and Perry have shown that the best proportion is such that "The magnetic reluctance of the space occupied by the winding on the armature is equal to the reluctance of the rest of the magnetic circuit," which is equivalent to the statement that the magnetic resistance of the dynamo should be twice that of the air-gap when the machine is at its greatest normal load. The element that tends to eliminate sparking is thus tacitly considered. By the arrangement of the number of ampere-turns on the armature, so that they bear a definite ratio to those on the field at full load, a sparkless condition can be obtained that would satisfy the most critical mind.

This reference to the half reluctance of the air-gap to that of the rest of the machine is worthy of the closest attention. It bears a relationship to the stage of permeability of the iron of both armature and magnet core, such that when they are brought to a certain critical point a harmony of conditions exists which fails when this point is passed. The instant of commutation is such that unless a reversal of current occurs in the coil at the moment described injurious sparking is an expected incident. The cause of this state is the cross-magnetization of the armature itself, which destroys the field at certain effective places, preventing a rapid and positive reversal. The fringe of magnetic lines, however, is sometimes artificially prolonged when so required, or the pole-piece slotted longitudinally so that lines of force tending to cross-magnetize would have to pass through these slots and thus lose their M. M. F. Were it possible to automatically separate the two halves of the armature core in a direction parallel to the normal field at every point of revolution, the cross-magnetization would be successfully reduced and sparking and great lead also.

The cross-flux reduces the strength of field at two pole corners and increases it at the other two. If the amount be calculated for purposes of design, then the following method is best: Let the angle, including the pole-pieces be called $\propto$, then the ratio between $\propto$ and 180° will represent the percentage of turns on $\frac{1}{2}$ the armature which are affecting one pole-piece. If $\propto = 60^\circ$, then $\frac{\propto}{180^\circ} = \frac{60^\circ}{180^\circ}$

$= \frac{1}{3}$ of the ampere-turns on one-half the armature are injurious to the pole-piece. The ampere-turns of the armature are $\frac{1}{2} C \times \frac{1}{2} i_a$, and on 180° would be $\frac{1}{2}$ of that. The product of $\frac{4\pi}{10}$ into the above factors can be technically admitted without further explanation. Then the formula for the cross-magnetization under a pole-tip is

$$\frac{1}{2} C \times \frac{1}{2} i_a \times \frac{4\pi}{10} \times \frac{\alpha}{180^\circ}$$

C = armature turns,
i_a = armature current,
α = arc of embrace.

An arbitrary value can be assumed for the angle of the pole-piece. If it be 120°, as is the general value, we have

$$\frac{1}{2} C \times \frac{1}{2} i_a \times \frac{4 \times 3.1416}{10} \times \frac{120^\circ}{180^\circ} = .105\, C\, i_a$$

This would express the point to which the load could be carried if the lines of force from the armature so completely diminished those from the field that the field under the pole-tip became zero. The so-called *circumflux* of an armature is equal to the armature current into the conductors divided by the number of poles. The load that can be safely carried is expressed by a formula given by an authority as follows :

$$\frac{85{,}000\, r \times l}{b} = \frac{C\, i_a}{p}$$

p = no. poles,
r = radical depth core,
l = length across gap,
b = length of curved face of pole-piece,
C = turns armature,
i_a = current armature.

The more practical value for the constant is 85,000, so that the formula is the result of a series of averages, being correct for the majority of cases.

In terms of the diameter, the circumflux for a ring two-pole armature is $390d$ if

$$b = 1.05d,$$
$$r = .1d,$$
$$l = .05d.$$

(*To be continued*).

THE TELEPHONE IN RUSSIA.

Russian telephones are divided into three classes—those belonging to and worked by the state; those appertaining to private and public companies under a contract with the state; and those erected by municipal authorities, railway companies and private persons for their own use. In 1894 there were in operation 34 state telephone systems, with 43 exchanges. In that year public telephone lines were laid in Tomsk, Tjumen Jaroslav, Smolensk, Chernigov, Jalta and Gatschina. The number of subscribers was 9,398; the lines were 2,582 versts in length. There were 11 telephone systems of the second-class mentioned, with 8,000 subscribers and 1,152 versts of lines; while the number of private telephones is stated to be "very large." In January of the present year, state telephone lines were inaugurated at Ekaterinoslav and Feodosia, and others are in course of installation, or are projected, at Samara, Yambov, Poty, Batoum, Novorrossijsk, Berdyansk, Jekaterinoslav. From January, 1895, the tax on municipal telephones has been reduced by 25 per cent. in order to encourage the development of the use of the telephone in the Czar's dominions.

THE COST OF STEAM-POWER. II.*

BY CHAS. E. EMERY, PH. D.

(*Continued from Page 123.*)

§ 13. Without attempting to arrange watches it is assumed that on the average there would be required in such a station at all times

One attendant for each 2,500 H. P. Engine, or eight men in all, at 25 cents per hour..	$2.00
14 firemen and 3 additional men at the same pay to care for pumps, etc., and to keep the premises clean; total, 17 men at 20 cents per hour..........................	$3.40
Total cost of labor per hour.....	$5.40

There would also be required a chief engineer, 3 assistant engineers and some clerical help, which under the head of superintendence would cost, say, $13,140 per year, or $1.50 per hour, making a total of $6.90 per hour. The total cost for labor and superintendence for one year of 365 days, or 8760 hours, at $6.90, is $60,444, as given in line 2 of § 8.

§ 14. The cost of supplies and repairs in connection with the boilers and large condensing engines in the cotton mills of Fall River proved upon investigation several years ago to be approximately $\frac{8}{10}$ of a mill per horse-power per hour. With the hope that this cost can be reduced in an immense plant of this kind the quantity in line 3 has been extended on the basis that the cost will be only 0.6 mill.

20,000 H. P. × 8,760 hours × $0.0006 = $105,120, as written in line 3 of § 8.

§ 15. The above estimates only provide for regular repairs. Independent of this a certain percentage of the first cost should be put at interest every year to provide for renewals of the machinery, and provision made also for paying taxes and insurance. Calling these three 5 per cent. of the cost, and considering that a company which can build so large a plant can possibly borrow money at 5 per cent., 10 per cent. of the total cost will be required for these several items.

§ 16. The total cost of such a plant cannot be determined accurately in advance. The present prices for steam machinery are very low, and it might be possible to buy engines of the best type with necessary boilers ready for erection for $30 per H. P. To this price, however, must be added the cost of the land upon which the plant is to be erected, the cost of foundations, of erection, of the buildings, of the chimney, the pipe connections, the general means of transmission, and the multitude of minor details, required for fitting up such a place ready for use. The probable cost has been fixed at $64. per H. P., and as at least $\frac{1}{8}$ surplus power will be put in the station there will be required a steam plant of 22,500 H. P. which at $64 will cost complete $1,440,000, 10 per cent. of which as required above is written in line 4, § 8.

§ 17. Referring to line 6, § 8, we find that the "Cost of steam-power per H. P. per year on the basis of 20,000 H. P. delivered every hour in the year" is $27,34. The price at which this power can be sold to consumers will depend upon the way the company furnishing the power is organized. The interest on the cost is already provided for in line 4, so the net cost given, viz.: $27.34, would be that chargeable to power if the same company that built the works used the power, or if an association of individuals should build the plant and simply charge themselves with its cost.

§ 18. If, however, a private company with ample means should build the plant on a cash basis and wish to sell power and realize a return of five per cent. on first cost, independent of interest on the money invested, the modified cost would be $27.34 plus five per cent. of $72. (§ 16) viz. $3.60, to which should be added, say, $1 per H. P. for general business expenses, making the total charge $31.94, shown in line 7, § 8, the same method being used in reference to similar lines in Tables II and III.

§ 19. If, however, the promoters desired ten per cent.

profit on original cost or a proportionally less percentage on stock and bonds issued in excess of first cost, the modified cost per H. P. per year would be $27.34 plus ten per cent. of $72. (§ 16) viz. $7.20, to which adding $1 per H. P. as before for general expenses gives as the total charge under these conditions $35.54, shown in line 8, § 8, the method applying to Tables II and III as above explained.

§ 20. We are now prepared to ascertain the variations in result which would be produced if the power were considered variable. For this purpose let us assume there will be sold :

		Daily H. P. Hours.
1.	20,000 H. P., 10 hours per day	200,000
2.	12,000 H. P., 10 hours per day	120,000
3.	5,000 H. P., 4 hours per day	20,000
4.	Total daily H. P. hours	364,000

which would probably be required on, say, 309 working days in the year.

5.	Total H. P. hours. 309 days	105,060,000
	Then if 5,000 H. P. were required for the remaining 56 holidays in the year:	
6.	Total H. P. hours, 56 days of 24 hours, 5,000 H P.	6,720,000
7.	Total H. P. hours per year	111,780,000
	Average H. P. per hour during the year:	
8.	Previous result ÷ 8760 =	12,760 H P.

The average H. P. is therefore 63 80 per cent. of the maximum. This percentage is frequently termed the "power factor," and is rather higher than has been found in practical cases heretofore. An estimate of the cost on this basis will be given in advance as before and explained afterward.

§ 21.

TABLE II.

SHOWING THE COST OF STEAM-POWER ON BASIS OF GENERATING 20,000 H. P. MAXIMUM AND AN AVERAGE OF 12,760 H. P. FOR EVERY DAY IN THE YEAR.

			Per cent. of total cost.
1.	Yearly cost of coal, § 22	$157,644	37.3
2.	Estimated cost of labor, § 23	47,652	11.3
3.	Estimated cost of supplies and regular repairs, § 25	73,584	17.4
4.	Estimated interest, insurance, taxes and cost of renewals, § 26	144,000	34.0
5.	Total	$422,880	100.0
	Which divided by 12,760, the average H. P., § 20, gives the following :		
6.	Cost of steam-power per H. P. per year on basis of delivering 20,000 H. P. maximum and an average of 12,760 H. P. for every day in the year		$33.14
7.	Cost of steam-power per H. P. per year on above basis if 5 per cent. of the original cost of plant be charged for dividends and $1 per H. P. added for general expenses, § 18, 33.14 + 3.60 + 1.00 =		37 74
8.	Cost of steam-power per H. P. per year on above basis if 10 per cent. of the original cost of plant be charged for dividends and $1 per H. P. added for general expenses, § 19, 33.14 + 7.20 + 1.00 =		41.34

§ 22. The cost of coal is made up as follows: By reference to §20 it will be seen that 15,000 H. P. of boilers out of 20,000 must be shut down daily for periods varying with the demand, and it is considered that it will require an amount of coal equal at least to the average consumption for one hour during regular operation, to maintain banked fires, overcome radiation, and bring the fires to average working condition when they are again put in operation. The total daily H. P. hours in line 4, §20, is therefore increased 15 000 and multiplied by 309; the horse-power hours for the 56 holidays, line 6, are then added to the same; the sum multiplied by 1.25 pounds of coal per H. P. and by one mill per pound and one-twelfth added to the whole for friction, which gives the result written in line 1, §21.

§ 23. The labor cannot be distributed accurately until the variations of loading are developed practically. On any definite basis, such as is assumed in §20, the watches could be arranged so that there would be little loss of time, but in practice there would be a variation of load at the same hour on different days. For instance, with the electric lighting part of the load, the demand would vary with the weather; with the cable or electric railroad portion of the load the demand would be greater on particular days and seasons, and vary also somewhat with the weather, so to be provided for unexpected demands there must be a surplus of labor. Such surplus will be assumed at 20 per cent. for the 214 hours of reduced power per working day, shown in § 20, lines 2 and 3, equivalent to labor for 28,000 H. P. hours per day, or 8,652,000 H. P. hours for 309 days. Adding only 10 per cent, for 56 holidays gives 6,720,000 × 1.1 = 7,392,000 H. P. hours. Adding both to the total H. P. hours, § 20, viz.: 111,780,000, gives a total for the year of 127,824,000 H. P. hours, which at $0.00027 per H. P. easily derived from § 13 gives:

Cost of labor per year	$34,512
Cost of superintendence per year, from § 13	13,140
Total for labor and superintendence per year as written in line 2, Table II., § 21	$47,652

§ 24. The cost of labor and superintendence above is $100 \times \$47,652 \div 60,444 = 78.83$ per cent. of that required for full operation throughout the year shown in § 8, although the average power developed is only 63.80 per cent., § 20.

§ 25. The cost of supplies and regular repairs, line 3, will be somewhat greater proportionally than for continuous operation, and is estimated to be 70 per cent. of the similar costs given in § 8, $\$105,120 \times 0.70 = \$73,584$, which is written in line 3, § 21.

§ 26. Evidently the interest, insurance and taxes given in line 4. § 8, are not modified, and the percentage allowed for renewals is so small as not to materially affect the result, so the amount given in line 4, § 8, is repeated in same line of Table II.

§ 27. The presentation in Table II. will give a fair idea of the prices it would be necessary to secure on installing a large steam plant to furnish power in various quantities to consumers on the premises, or to apparatus for transmitting power to the same, the costs of which transmission are not included. The costs at which the power can be sold under certain specified conditions, as stated in lines 7 and 8, § 21, are the only features that directly interest consumers of power.

§ 28. A large proportion of the power in manufacturing establishments is used only 10 hours per day, so this investigation would not be complete if it did not include a presentation of the cost of steam-power generated with large units for 10 hours per day. Such an estimate is made in Table III., the explanation of the items being given afterward as heretofore.

(To be Continued.)

THE AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION.

The fifth annual meeting of the American Electro-Therapeutic Association was held at the College of Physicians and Surgeons of Ontario, Toronto, Canada, on Tuesday, Wednesday and Thursday of this week. The programme was a lengthy one, and included many papers on electro-therapeutics.

—The effect of electric currents on German silver, and alloy of gold and silver is to render those metals brittle.

MEASURING ELECTRIC CAPACITIES.

Mr. H. Bordier, in a paper read before the Academie des Sciences, describes a method of measuring electrical capacities, based upon an experiment by Prof. D'Arsonval. If condensers of increasing capacity are placed successively in series on the same induction coil, and if, either by the aid of a rheostat or by moving the coil by predetermined steps, the moment is found determined in which the least sensation produced by the current on the skin is perceived, it is found that this moment varies for each added capacity. With a microfarad divided into tenths, it is stated to be easy to find two positions either of the rheostat or of the coil which correspond to the initial sensations produced by each tenth of microfarad added. The method allows a very approximate measurement of the capacity of the body of man to be obtained. The results showed : First experiment, 0.002 microfarad; second experiment, 0.003 microfarad; average value, 0.0025 microfarad. This capacity is about 58 times greater than that of a homogeneous conductor, the surface of which would be equal to that of the human body. It is suggested that this capacity, relatively large, of the human body is due to phenomena of condensation occurring in the heart of the organism.

NAPOLEON'S TREATY OF COMMERCE WITH THE UNITED STATES.

The United States had suffered much from the pretensions of the Directory to control its commerce in the French interest, on the plea of gratitude. The declaration of neutrality made by Washington in 1793, on the formation of the first coalition, was ill received in Paris; the treaty of commerce concluded with England in the following year was regarded by the French government as a breach of neutrality, and the Directory suspended diplomatic relations. Their insolent agents and sympathizers in the United States had so embroiled the question of the relations of that nation with the two countries respectively that it became a matter of party politics, and threatened a rupture between the two republics, especially when Talleyrand's unblushing effrontery in demanding enormous bribes from the American envoys was made public. Great as their obligations were, the United States had no intention of becoming either openly or secretly tributary to France. The recognition of their neutrality by England had given them the whole colonial trade of France, Holland and Spain. Their principle was virtually that of the armed neutrality of 1780; that neutral ships made neutral goods (free ships, free goods). For this they were ready to fight. The First Consul was wise enough to recognize the justice of the claim, and lost no time in concluding, on September 30, 1800, a treaty of commerce which for the time removed all sources of friction between his government and that at Washington—[Prof. Sloane's Life of Napoleon in the September *Century*.

EQUIPMENT NOTES.

The Vance Electric Co., 136 Liberty street, New York, has the contract for wiring the new building of the Y. M. C. A., 56th and 57th streets and Seventh avenue, New York. The plant will include three General Electric dynamos and three Ames engines.

A large new office building is being erected at 122 Liberty street, city, by Wm. Wallace the builder. Mr. Oswald Wirz, of 822 Broadway, is the architect. It is reported that the Western Electric Company has a grip on the electrical equipment.

Two large syndicate buildings are going up, one on the corner of Nassau and Liberty streets and the other on Bowling Green, next to the Washington Building. W. & G. Audsley are the architects.

The Vance Electric Co. has the contract for the electrical equipment for the new Ninth Regiment armory on 14th street, near Sixth avenue. Cable and Sergeant are the architects. Current will be taken from the street circuit.

The Vance Company has also the contract for wiring Zella Gibbs' building, 65 Murray street. The street circuits will supply the lighting current.

WASHINGTON NOTES.

The Washington, Alexandria and Mount Vernon Electric Railway Company has filed a deed of trust upon all its property and franchises, under date of August 1, 1895, and is made in favor of James S Swartz and F. H. Hipple, as trustees for the Real Estate Trust Co., of Philadelphia, for the purpose of securing $750,000 in bonds, consisting of 750 bonds at $1,000 each, payable August 1, 1925, bearing interest at 5 per cent payable semi-annually.

There is an indebtedness of $200,000 on the road, and it is proposed to pay this off by the sale of the bonds; also to extend the road to Arlington Cemetery and Rosslyn.

The president and secretary of the road are G. E. Abbot and F. H. Hipple, respectively. Mr. Hipple is also president of the Real Estate Trust Company.

A yearly contract has been made for the lighting of the Keeley Institute at Laurel, Mo., by 90 electric lights, which are to be furnished by the Laurel Electric Light Co.

The difficulties surrounding the construction of the Great Falls Electric Railway Company have been arranged in such a way that, although not yet entirely overcome, work can be proceeded with and rapid progress is being made.

Possible Contracts.

Joseph M. Cone, Baltimore, Md , will erect a large warehouse which will be lighted by electricity. It will have passenger and freight elevators. Charles E. Cassell is preparing the plans for the building.

Guy's Hotel in Baltimore is to be enlarged. Further particulars can be obtained from Mr. Thos. Boylan, the manager.

There is talk of building a trolley line between Powhatan and Harrisonville, Md. H. C. Ridgely, of Baltimore, is interested.

An electric railroad will be built between Petersburg and Manchester, Va., Mr. John Robertson having secured a franchise for the same.

H. J. Isbell, of Parsons, Kas., and others are taking steps looking to the establishment of an electric light plant in Van Buren, Ark.

The Richmond Traction Co., Richmond, Va., contemplates the erection of a new power house. J. S. Williams, Richmond, can give further particulars.

Telephone Notes.

The Jefferson Telephone Co., Jefferson, Ga., is in the market for equipment.

A new telephone company is being organized in Tarboro, N. C.

A new telephone system is being constructed in Point Pleasant, W. Va., by D. S. Snyder.

The Interstate Telephone and Telegraph Company, Wilmington, N. C., has secured its franchise, and work on construction of its plant will begin at once. Mr. L. L. Pritchard is the manager.

The Memphis (Tenn.) Telephone Company has received permission from the city authorities to construct its system.

Nashville, Tenn., has a new telephone company which has just been organized. Mr. J. E. Thompson, of Murfreesboro, is one of the interested parties.

TELEPHONE PATENTS ISSUED AUGUST 27, 1895.

Telephone Holder and Cut-Out. Arthur F. Boardman, Somerville, Mass. (No. 545,191).

Combined Telephone Receiver-Support and Switch. George F. Shaver, Yonkers, N. Y. (No. 545,253).

Telephone and Return-Call System. Thomas R. Brimner, Baltimore, Md. (No. 545,402).

Telephone. George F. Shaver, Yonkers, N. Y. (No. 545,416).

New Corporations.

The International Electric Light Co. has been incorporated in St. Louis, Mo. Capital stock, $15,000. Incorporators, J. M. Davey, Geo. Delisle, H. B. Russell, and others.

The People's Electric Light, Heat and Power Co., Avoca, Pa., has been incorporated by James Butler, John A. Gillick, Michael McDonald, John Hailstone and Thomas Walsh. Capital, $25,000.

The Fort Wayne and Lake Everett City Street Railway Co. has been incorporated in Fort Wayne, Ind. Capital stock, $300,000.

The Dickenson Electric Supply Co., of New York city, has been incorporated by H. B. Ritter, H. H. Dickenson and Allen S. Goodacre. Capital stock, $10,000.

Buena Vista Light and Power Co., Buena Vista, Va., has been incorporated with S. H. Egolf, president; R. R. Embree, secretary and treasurer. Capital stock, between $5,000 and $25,000. This company has leased the City Electric Light Plant.

The Hermann Electric Light Co., of Hermann, Mo., has been incorporated with a capital stock of $8,000. Incorporators, George Mittendorf, Theodore Graf, F. Frank and others.

Trade Notes.

The General Western Agency for Kerite wires and cables is now exclusively in the hands of Mr. S. F. B. Morse, 1014–1015 Marquette Building, Chicago.

The Partridge Carbon Brush is quite as necessary to an electric motor as is the field-magnet or the armature. These excellent brushes are growing more and more in favor every day. The Partridge Carbon Company, of Sandusky, Ohio, have no complaints to make about business—they have plenty of it.

The C. W. Hunt Company, 45 Broadway, New York, has just issued its catalogue No. 9506, entitled "Coal Handling for Steam Generation." It describes the Hunt system of handling coal, which is so extensively used in large street railway plants. Several of these coal handling plants are well illustrated. The catalogue is an interesting one.

National Electric Light and Street Railway Associations.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

President, C. H. Wilmerding, Chicago, Ill.; 1st Vice-President, Frederic Nicholls, Toronto, Canada; 2d Vice-President, E. F. Peck, Brooklyn, N. Y. Members of Executive Committee: E. H. Davis, Williamsport, Pa., (one year); W. R. Gardiner, Pittsfield, Mass.; George A. Redman, Rochester, N. Y.; J. J. Burleigh, Camden, N. J. Next meeting, New York, May or June, 1896.

AMERICAN STREET RAILWAY ASSOCIATION.

Next meeting, Montreal, Que., October, 16, 17 and 18, 1895.

President, Joel Hurt, Atlanta, Ga.; Vice-President, W. Worth Bean, St., Joseph, Mich.; 2d Vice-President, John M. Cunningham, Boston, Mass.; 3d Vice-President, Russell B. Harrison, Terre Haute, Ind., Secretary and Treasurer, William J. Richardson, Brooklyn, N. Y.; Executive Committee, Henry C. Payne, Milwaukee, Wis.; W. H. Jackson, Nashville, Tenn.; D. G. Hamilton, St. Louis, Mo., C. C. Cunningham, Montreal, Canada; J. N. Partridge, Brooklyn, N. Y.

NEW YORK STATE STREET RAILWAY ASSOCIATION.

Next meeting, Albany, N. Y., third Tuesday in September. 1895.

President, G. Tracy Rogers, Binghamton; First Vice-President, John H. Moffitt, Syracuse; Second Vice-President, W. W. Cole, Elmira; Secretary and Treasurer, William J. Richardson; Brooklyn; Executive Committee, D. B. Hasbrouck, New York; John N. Beckley, Rochester; Daniel F. Lewis, Brooklyn.

OHIO STATE TRAMWAY ASSOCIATION.

Next meeting, fourth Wednesday in September, 1895.

President, Albion E. Lang, Toledo; Vice-President, W. J. Kelly, Columbus; Secretary and Treasurer, J. B. Hanna, Cleveland; Chairman Executive Committee, W. A. Lynch, Canton.

MASSACHUSETTS STATE STREET RAILWAY ASSOCIATION.

President, T. H. Cunningham, Boston; Secretary and Treasurer, A. S. Butler, Lawrence; Executive Committee, Samuel Winslow, Alfred A. Glazier, Boston; P. F. Sullivan, Lowell; E. C. Foster, Revere; Horace B. Rogers, Brockton; A. E. Smith, Springfield; Prentiss Cummings, Boston.

THE TEXAS STREET RAILWAY ASSOCIATION.

President, W. H. Sinclair, Galveston; vice-president, C. A. McKinney, Houston; Secretary and Treasurer, C. L. Wakefield, Dallas. Directory: The officers and W. H. Weiss, San Antonio and George B. Hendricks, Fort Worth.

Next meeting, Galveston, third Wednesday in March, 1896.

PENNSYLVANIA STATE STREET RAILWAY ASSOCIATION.

Next meeting, first Wednesday in September, 1895.

President, John A. Rigg, Reading; First Vice-President, Robert E. Wright; Secretary, S. P. Light, Lebanon; Treasurer, W. H. Lanius, York.

THE MAINE STREET RAILWAY ASSOCIATION.

President, W. R. Wood, Portland; Secretary and Treasurer, E. A. Newman, Portland; Executive Committee, W. R. Wood, Portland; George E. Macomber, Augusta; F. M. Laughton, Bangor; Frank W. Dana, Lewiston; Amos F. Gerald, Fairfield.

MICHIGAN STATE STREET RAILWAY ASSOCIATION.

President, W. L. Jenks, Port Huron; Vice-President, W. Worth Bean, St. Joseph; Secretary and Treasurer, B. S. Hanchett, Jr., Grand Rapids; Executive Committee, the Officers and David H. Jerome, Saginaw, and Strathern Hendrie, Detroit.

THE STREET RAILWAY ASSOCIATION OF THE STATE OF NEW JERSEY.

President, Thos. C. Barr, Newark, Vice-President, W. S. Scull, Camden; Secretary and Treasurer, Charles Y. Bamford, Trenton; Executive Committee, Officers and C. B. Thurston, Jersey City; H. Romaine, Paterson S. B. Dod, Hoboken.

ELECTRICAL and STREET RAILWAY PATENTS

Issued August 27, 1895.

545,047. Street-Car Fender. Richard A. Breul, Bridgeport, Conn. Filed Nov. 5, 1894.

545,069. Electric Annunciator. George J. Galbraith, Boston, Mass. assignor to the Electric Gas Lighting Company, same place. Filed Apr. 27, 1895.

545,070. Underground Electric Railway. David F. Graham, Springfield, Ohio, and William P. Allen. Chicago, Ill, assignors of one-third to Oliver S. Kelly, Springfield, Ohio. Filed June 21, 1894.

545,073. Trolley. Julius I. Hanson, Omaha, Neb. Filed June 4, 1895.

545,076. Thermostat. George Hill, New Brunswick, N. J. Filed Jan. 3, 1895.

545,091. Electric Gas-Lighting Apparatus. James W. Palmer, Nashua, N. H., assignor to the Electric Gas Lighting Company of Maine. Filed Jan. 9, 1895.

545,111. Means for Synchronizing Electric Motors. Elihu Thomson and Edwin W. Rice, Jr., Swampscott, assignors to the General Electric Company, Boston, Mass. Filed Mar. 8, 1893.

545,141. Fire-Alarm Box. Thomas Walsh, Montreal, Canada. Filed Apr. 12, 1895.

545,142. Car-Fender. Alfred B. Watson, Paterson, N. J. Filed May 24, 1895.

545,149. Electro-magnetic Tool. Charles F. Carpenter, Louisville, Ky. Filed August 20, 1894.

545,151. Insulated Support for Trolley Lines. Frank X. Cicott, New York, N. Y., and Warren J. Belcher and Frederic C. Billings, Hartford, Conn., assignors to the Billings & Spencer Company, Hartford, Conn. Filed Apr. 22, 1895.

545,158. Electric Railway. John C. Henry, Westfield, N. J. Filed Apr. 20, 1895.

545,186. Car-Fender. Charles S. Andrews, New York, N. Y. Filed Apr. 23, 1895.

545,187. Trolley-Line Clamp. Warren J. Belcher, Hartford, Conn. Filed Apr. 11, 1895.

545,191. Telephone Holder and Cut-Out. Arthur F. Boardman, Somerville, assignor of one-half to James D. Letherbee, South Braintree, Mass. Filed Jan. 2, 1894.

545,204. Conduit Electric Railway. Charles H. Johnson, San José, Cal. Filed Feb. 29, 1894.

545,208. Underground Electric Railway. Emma E. Moore, Chicago, Ill. Filed Nov. 16, 1894.

545,230. Automatic Switch for Electric or Cable Railways. Geo. T. Janvrin and Frank J. Conlon, Brooklyn, N. Y. Filed Dec. 12, 1894.

545,253. Combined Telephone-Receiver Support and Switch. George F. Shaver, Yonkers, N. Y., assignor to Amy R. Shaver, same place. Filed Dec. 6, 1894.

545,263. Car-Fender. William H. Bigler, Philadelphia, Pa. Filed Nov. 27, 1894.

545,290. Automatic Car-Fender. John D. Hodges, Ellendale, assignor of two-thirds to William Beinker and John Shaw, St. Louis, Mo. Filed July 1, 1895.

545,296. Electric Conduit. Charles J. Kintner, New York, N. Y. Filed Mar. 16, 1893.

545,327. Electric Target. Milton T. Weston, Kenton, Ohio, assignor to the Halcyon Cycle Company, same place. Filed Dec. 8, 1894.

545,339. Automatic Car-Fender. Frederick A. Bragg, North Adams, Mass., assignor of one-half to John Boyd Thacher, Albany, N. Y. Filed Aug 10, 1893.

545,357. Electric Signaling Device. Webster Gillette, New York, N. Y., assignor to Alexander S. Williams, same place. Filed July 5, 1894.

545,358. Trolley-Controller for Electric Railways. Leonidas W. P. Gray and Philip G. Doescher, New Orleans, La. Filed May 23, 1895.

545,359. Electric-Arc Lamp. Haydn T. Harrison, London, England. Filed Nov. 19, 1892.

545,368. Valve for Motors. Allen T. Miller, Dayton, Ohio, assignor to Kuhns Brothers, same place. Filed Mar. 21, 1895.

545,390. Secondary Battery. Illius A. Timmis, London, England. Filed Feb. 28, 1895.

545,393. Guard and Guide for Electric Trolleys. John R. Trisler, Westwood, assignor of one-half to John H. Moore, Cincinnati, Ohio. Filed June 1, 1895.

545,402. Telephone and Return-Call System. Thomas R. Brimner, Baltimore, Md., assignor, by direct and mesne assignments, to the North American Interior Telephone Company, of Baltimore City. Filed Aug. 16, 1894.

545,404. Electrically-Operated Mine-Car. Henry B. Dierdorff, Columbus, Ohio. Filed Dec. 24, 1889.

545,405. System of Electrical Distribution. Thomas A. Edison, Llewellyn Park, N. J. Original application filed Dec. 6, 1886. Divided and this application filed Aug. 29, 1887.

545,416. Telephone. George F. Shaver, Yonkers, N. Y., assignor to Amy R. Shaver, same place. Filed June 8, 1895.

545,426. Burglar-Alarm. Isaiah L. Hauser, Chicago, Ill. Filed May 7, 1895.

ELECTRICAL AGE

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CONTENTS.

TELEGRAPH OFFICE ON THE ATLANTIC OCEAN.

The question of establishing telegraph ships on the Atlantic ocean for the transmission of intelligence from the sea to land is, and always will be, an interesting one. To a limited extent the idea was carried into practice by an American company—the Commercial Cable Company—during the international yacht races off Sandy Hook during last and this week, and the experiment was attended with most satisfactory results. American enterprise will yet cause the word "impossible" to disappear from the dictionary to become classed as obsolete. This splendid achievement is recorded in considerable detail on another page in this issue.

COST OF STEAM-POWER.

We conclude in this issue the paper read by Dr. C. E. Emery at the Niagara Falls meeting of the American Institute of Electrical Engineers on "The Cost of Steam-Power." This interesting subject was handled in considerable detail, and the paper was a valuable addition to available literature on this important topic. The efficiency of all mechanical operations depends upon this one thing—the cost of steam-power being the basis of all calculations. Therefore the subject is one of the most interesting and important to all producers of steam-power, and will always hold attention unless some, as yet unborn, electrical invention shall revolutionize existing principles of mechanical operations. There is no telling what electricity will do during the transition period from "infancy" to manhood, but the genius of the world will yet produce wonderful results by its aid.

THE GOVERNMENT SUIT AGAINST THE BELL CO.

The government officials at Washington are not disposed to let the Bell Telephone Company take advantage of the present condition of the Berliner patent case, and are seeking some way to continue the suit for the repeal of the patent.

What they propose to do is best told in a despatch that came from Washington a few days ago. The despatch says: The law officers of the government have under consideration the question how further to proceed with the case against the Bell Telephone Company for the repeal of the Berliner patent. As the case now stands, the bill of the government has been dismissed by the Court of Appeals for the First Circuit, and under that judgment the Bell Company has begun proceedings against several of the corporations which entered the telephone field after the expiration of the Bell patent, in 1893. The validity of the Berliner patent is essential to the further control of the telephone business by the Bell Company, and the present situation is of additional interest, from a legal or judicial point of view, because the case involves a consideration of the act of 1891, establishing circuit courts of appeal.

By the terms of the act creating circuit courts of appeal the judgments of those courts are final in all cases arising under the patent laws, except where the Judges certify a case to the Supreme Court, or where the Supreme Court directs the case to be brought before it for review on a writ of certiorari. The telephone company is evidently inclined to accept the decree of the Court of Appeals as final, and is proceeding to enforce its claims under the patent. But the government representatives are by no means disposed to let the case rest here. They say that a case involving the question whether or not the United States has the right to sue for cancellation of a patent is vastly different from a controversy between two private parties over a patent right, and that upon that point an appeal will lie to the Supreme Court from the judgment of the Court of Appeals. And even if that ground should fail them, they can sue for a review of the case on a writ of certiorari, as provided in the law itself. Which method of procedure will be followed has not yet been finally settled, but it is asserted that the case will not be permitted to rest in its present condition.

ELECTRIC RAILWAYS IN MARYLAND.

The idea of utilizing electricity to supply means for local transportation has taken a strong hold upon the people of Maryland. In many parts of the state farmers, fruit-growers and quarrymen are remote from the railroads, and are practically without facilities for sending produce quickly to the market. Within a brief period these people have seen the city of Baltimore leap suddenly forward a quarter of a century through the agency of rapid transit. Before their astonished gaze the problem of connecting the business centre with the distant suburbs has been worked out, whereby the value of property is enhanced and the circle of possible residence for city people vastly widened. They have seen popular resorts spring up 10 miles from the city, inviting crowds daily to the enjoyment of cool breezes and delightful shade. Moreover, this spectacle has created a profound impression upon practical men in the counties, and they have begun to ask why electric railroads running along the turnpikes should not do for rural communities what they have done for the territory immediately surrounding Baltimore.

The evolution of electric railroads in Maryland exhibits three successive stages, two of which have been passed. After a few unsuccessful experiments with electricity as a motive-power for street cars, its use was abandoned, and the first lines to introduce rapid transit employed the cable motor. But the expense of construction soon put an end to that, and the several street-car companies in Baltimore took up the trolley system and set about making the necessary changes to put it into use. Within three years all the old horse-car lines have been fitted out with the new appliances, requiring 275 miles of track to be replaced, and calling for an expenditure of $10,000,000 in the way of improvements. This constituted the first stage.

The second step was to expand these city systems by building roads into the suburbs. With a single exception the corporations owning street railways in the city have extended their tracks greater or less distances into the adjoining counties. Lines are now in operation to Curtis Bay, across the Patapsco River; to Catonsville, six miles southwest of the city; to Powhatan and Gwynn Oak Park, forming an extension loop nearly ten miles in the circuit; to Pikesville and Arlington, each seven miles from Baltimore; to Lakeside Park; to Towson, the county-seat of Baltimore county; to Highlandtown and Point Breeze, three miles down the river; while a company has been formed to build a trolley line to Mt. Washington, twelve miles from the City Hall, and the road-bed is being graded for the new line to Ellicott City, which will be 11 miles in length. These suburban roads are legitimate extensions of the city systems, and are operated by the same companies. They have been built to satisfy the demands of local traffic, and the success of the experiment may be judged from the results achieved on the Pikesville branch of the Traction Company. This line starts near Druid Hill Park, in Northwest Baltimore, and follows the turnpike to Pimlico and thence by separate tracks to Pikesville and West Arlington, the road deriving its patronage largely from the people who go daily to the racing grounds at Pimlico and Arlington. The property is capitalized at $500,000, earning 6 per cent. on that amount, and it may be taken as a fair illustration of the income received on other suburban lines.

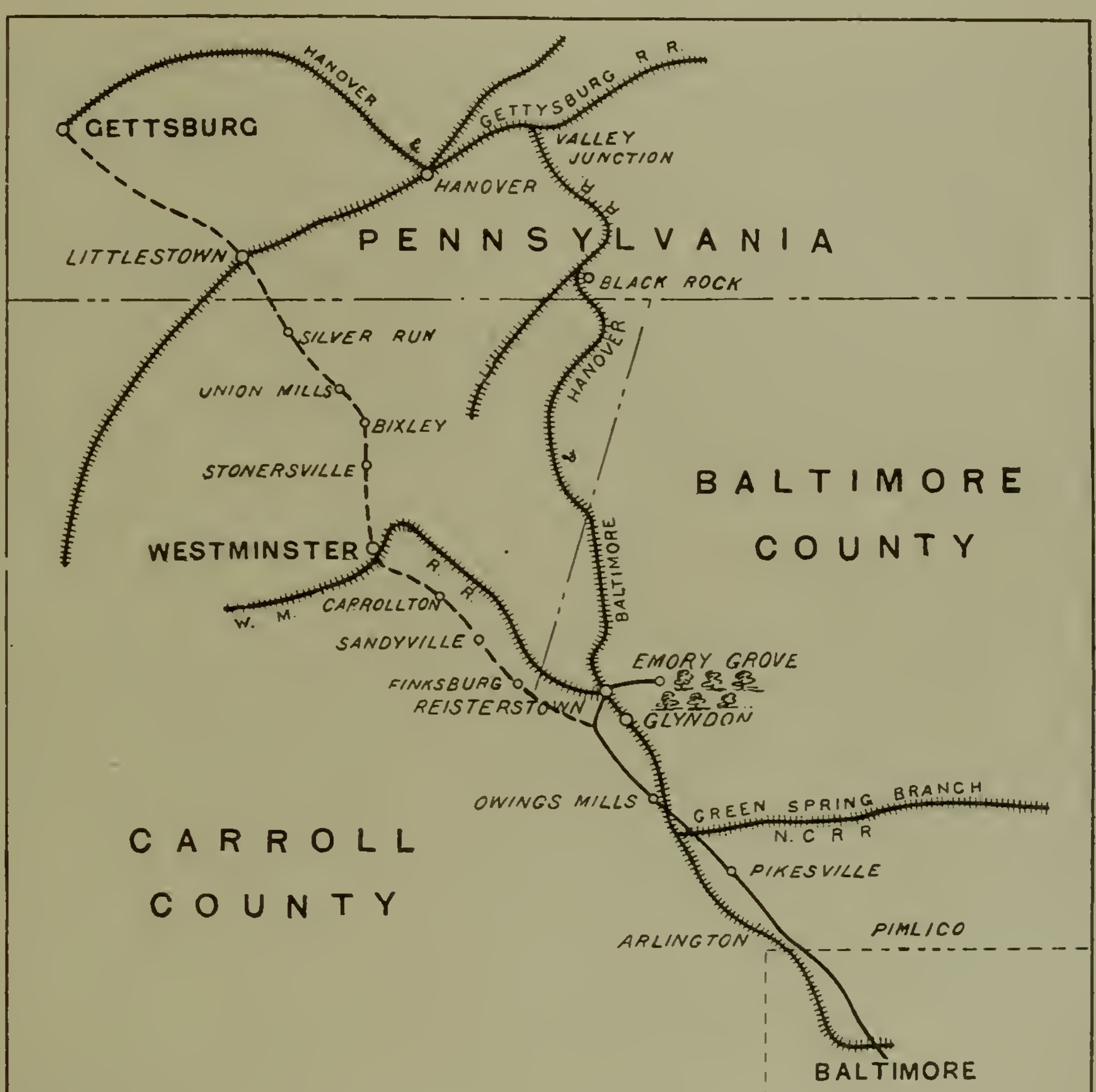
ELECTRIC AND OTHER RAILROADS RUNNING OUT OF BALTIMORE.

The third stage in the development of electric railroads in Maryland is yet in its beginning, Thousands of people annually attend the gatherings at Emory Grove and Glyndon, points about 20 miles from Baltimore. The Western Maryland Railroad passes in front of both camp grounds, and has been hitherto the chief source of communication between them and the city. But a company was formed last year, independent of the city railway corporations, to build a trolley road from Pikesville to Reisterstown, with a branch running up to Emory Grove. This line was opened to traffic in the month of May, the fare being 50 cents for the round trip, or $1\frac{4}{10}$ cents a mile. The road is practically an extension of the Pikesville branch of the Traction Company's system, except that it is owned and operated by a separate company, passengers being obliged to transfer from one line to the other on the platform in

Pikesville. However, by a traffic arrangement between the two companies it is possible to purchase tickets from conductors on any of the Traction Company's lines in the city and ride to Emory Grove by making the necessary transfers. By this means is realized not only a cheaper form of transportation, but, in open cars, a more delightful mode of travel between Baltimore and the two most popular camp grounds in Maryland. It will be seen that the chief inspiration of building this railroad lies in the fact that a large volume of traffic was ready to make use of it as soon as completed.

Operations also have begun on what has been called the Baltimore-Washington Boulevard. This magnificent scheme has been reduced somewhat in dimensions until it consists of nothing more than the construction of a double-track electric railway between Baltimore and the national capital. Present indications point to the early completion of the road, possibly by instalments, and the establishment of a line of communication in competition with the steam railways. A sufficient motive also exists for the construction of this line. People pass between built, the way will then be opened to an extension of the line to Gettysburg, when a system of electric transit will have been inaugurated in Maryland which will settle for ever certain questions regarding this new mode of transportation.

It will be seen, however, that in constructing the proposed electric railway beyond Reisterstown the chief object sought is not the same which has prompted the investment of capital in the other lines. To that point the management looks only to the carrying of a very large number of passengers to and from the camp grounds at Glyndon and Emory Grove, the connecting of Reisterstown with Baltimore being only incidental to that object; but at Reisterstown conditions change. A railway built to Westminster and Union Mills must depend as much upon carrying freight for revenue as upon carrying passengers. One of these towns is already connected with Baltimore by rail, and passenger traffic alone is not sufficient to warrant the introduction of competition over an electric line, without resort also to the handling of freight. But Carroll County is a dairy region, large quantities of milk



ELECTRIC RAILROADS OF MARYLAND.

Baltimore and Washington by the hundred thousand every year. Having a monopoly of the means of communication, the railroads have never reduced the regular fare below \$2 for the round trip, and a trolley road between the two cities, passing through several of the growing towns along the way, would open up facilities for travel which would not only be popular, but exceedingly profitable on a basis of \$1 for the round trip.

A proposition has been made also to extend the Pikeville & Reisterstown Railway to Westminster and Union Mills, and for the promotion of this scheme a company was organized last fall in Westminster. The managers met a serious difficulty on the threshold of the undertaking by the turnpike company demanding a half interest in the road as a concession for the right of way. But means will be found ultimately to bring the turnpike company to terms, or to take the road into Westminster along some other route, and it is quite likely that the enterprise will develop during the present year. Should this road be being transported at all seasons of the year to Baltimore. It is proposed, therefore, if the line is built, to run milk trains by electricity, and it is possible also that the lighter forms of truck would soon move over the electric road. This constitutes a new departure in the application of trolley roads to local traffic, and it represents the logical outcome of the third stage in the development of this form of transportation.

On September 6 people up-town were surprised to witness a horseless carriage passing along the streets. It was an electric Victoria, and was driven by the inventor, M. Roger. The vehicle carries four persons, and is easily controlled. It is capable of a speed of 15 miles an hour, and will run one hundred miles on one charge of the batteries. It is claimed that it can be operated at a cost of 1 cent a mile.

We are indebted to the *American Engineer and Railroad Journal* for the facts and cuts used in the above article.

SELLER'S 100-TON TRAVELLING CRANE.

In The Electrical Age of August 17, last, was published an article describing the use of electric power in the immense establishment of the Baldwin Locomotive Works in Philadelphia. Particular reference was made therein to two 100-ton Seller's electric travelling cranes, which are now used with most satisfactory results.

The accompanying illustration shows the practical work of one of these powerful cranes, which has suspended to it, in mid-air, an immense freight locomotive.

The erecting shop in which these two cranes are operated consists of two spans, each having a crane. Each span is 75 feet, 4 inches, and each crane has two independent trolleys operated from constant-speed motors.

The cranes are supported on an elevated track, each having two motions in a horizontal plane, viz : a longitudinal motion along the runway rails, and a transverse motion within or upon the bridge itself. Electric motors are provided for each motion, there being three motions in all, one for travelling the bridge, another for traversing the carriage within the bridge, and the third for hoisting the load.

In this connection it will be of interest to note that William Sellers & Co., of Philadelphia, have built 150-ton travelling cranes for the Carnegie Steel Company, of Pittsburgh, for use in their armor department. It is of 50 feet span, with 30 feet clear lift. The bridge is carried upon eight 37-inch steel tired wheels, arranged in pairs. Two of the wheels at each end are driven and two electric motors of the street-car type are used for the purpose of travelling the crane. Like motors are used for operating the hoist. The hoisting motors and those for the bridge travel are controlled by the series-multiple system of control.

—The combination of the elements with one another and in different proportions form hundreds of compounds.

LONG DISTANCE TRANSMISSION AT 10,000 VOLTS.

The Pomona Plant.

BY GEORGE HERBERT WINSLOW.

(*Continued from page* 102.)

It was at first proposed to use oil-insulators. The reason they were not used was because the glass companies which had undertaken to furnish them found on trial that they could not make them without considerable experimenting, which would have delayed the installation of the plant. This was no doubt fortunate, as the country through which the line passes is subjected to hot, dry winds which not only blow dust onto the insulators, but also inside them, and during the day the sun beats on the insulators until they become so hot that they nearly blister one's hands. If oil were used under these conditions it would soon evaporate and thicken, and become filled with dust. It would therefore seem undesirable to have used oil insulators in this case, or to use them in any other until an increased voltage makes them necessary, and the transmission of greater amounts of energy over the circuits justifies the additional expense necessary to keep the insulators in good condition.

The inside pair of pins was used for the circuit to Pomona and the outside pair for that to San Bernardino, until after the acceptance of the plant, but in anticipation of the installation of another generator the Pomona circuit was changed to the right-hand pair of pins, and the San Bernardino circuit to the left-hand pair, to avoid the fluctuation in lights which would result from inductive interference between two independent circuits.

Commercial lighting in Pomona was begun November 28, 1892, and a telegraphic order was at once sent for another set of reducing transformers, to be used at San Ber-

100-TON SELLER'S CRANE AT BALDWIN LOCOMOTIVE WORKS.

nardino, where the local circuits were already nearly completed. It was a condition of the franchise for the latter place that lighting should be begun before January 1, and work was pushed rapidly on the transmission line, over 28 miles long, until it was finished. The order for transformers had, however, been given too late for them to be delivered in time, and it was decided to reduce the pressure at Pomona to 5,000 volts and to take to San Bernardino the halt of the Pomona bank thus made available. In order to avoid the reheating which would have been required had the transformers been dismounted for shipment, the latter were hauled to San Bernardino on wagons without springs, after the lids had been packed so that the oil could not splash out. The transformers reached their destination after midnight, and the next day, December 31, they were connected to the transmission line for a few moments to see that the latter was all right, after which all the lights on the circuit were thrown on for the night.

When the new transformers arrived they were set up and heated in the same way as the others. The heating was continued night and day until complete, without interrupting the regular lighting service The change of both circuits to 10,000 volts was made February 16, 1893.

The sub-stations at Pomona and San Bernardino are small brick buildings, one story high, with tin roofs and numerous windows. The Pomona building contains two rooms connected by a door near the switchboard. The front room is used as the office of the company, and the other as a transformer room. The 10,000-volt circuit en-

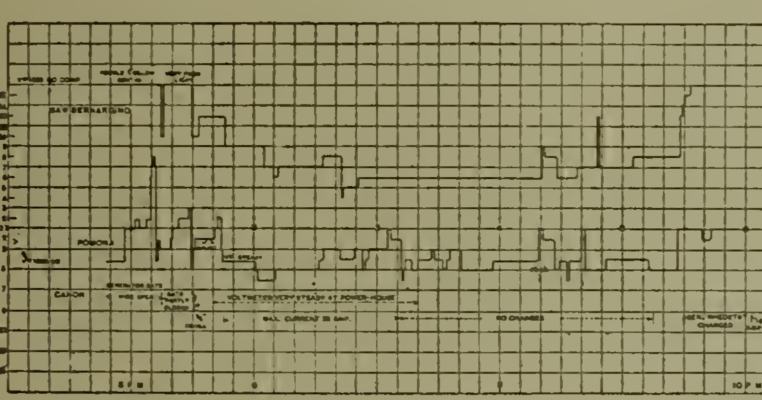


FIG. 5.

ters over the door, and is connected directly to the bank of lowering transformers, no switches or other appliances being used on the high tension lines either there or at San Bernardino. The switchboard appliances are a Stillwell regulator, two 100-amp. marble fuse-blocks, with double plugs and fuses, 100-amp. jaw-switch, 150-amp. ammeter, compensating voltmeter, compensator and converter.

The San Bernardino sub-station is longer than at Pomona, and is not divided by a wall. The transformers are placed in a row along a side wall, and along part of the end wall next the switchboard. The transformers near the switchboard heat the most. This is probably due to the slight drop in wiring between them and the more distant converters. During the first year of operation a little new oil was put into the converters about every four months to make up for that evaporated, but none of the old oil was drawn off. The switchboard apparatus is like that at Pomona.

The Stillwell regulator has long been recognized as a valuable adjunct to the central station operating a nnmber of feeders of different lengths from a single dynamo. Its utility is still greater in a system of long-distance transmission in which, as was the case in this plant during its first year of operation, the transmission circuits are supplied from one dynamo, since it is not practicable to install such a system so as to operate with small line loss, and therefore means must be provided to compensate for the large differences in the pressure at the ends of the lines. The use of regulators at the power-house was impossible while but one bank of raising transformers was used for the two circuits. Even when it became possible by the use of separate banks of transformers it was still undesirable, because the attendant at the power-house would often have to work both the regulators simultaneously to properly compensate for changes in load, and his attention would be required by the regulators at exactly the time he should be free to attend to the generators and water-wheels. A regulator was therefore placed at each sub-station, as already stated. These are each of 2000 lights capacity, and have a range of 10 per cent. up and 10 per cent. down. This variation of 10 per cent. (100 volts) is divided into 14 equal parts, so that each step corresponds to 7.1 volts. The diagram (Fig. 5) is taken from the station records for Sunday, January 22nd, 1893, and shows the number of changes required during the evening at each station. The line marked "off" is the base line, and the divisions above and below correspond to the steps on the dial and show to what an extent the regulators were used to increase or decrease the pressure. This diagram shows how impossible it would be to furnish lights without using regulators, even on Sunday, when the load is smaller than on other days.

The distribution from both sub stations is effected in the usual manner at 1000-volts for incandescent lighting, the only point of interest being that a considerable number of Helios arc lamps are successfully used on the circuits.

While in use the transformers in the sub-stations give forth a continuous hum, which depends for its tone on the number of alternations. This is an excellent indicator for the attendant, whose attention is instantly called to any change in the running conditions of the plant by the resulting change of tone. Its indications not only mark changes which are taking place and which can be detected on the voltmeter, but also give notice of coming changes before there is any other indication of them. It is thus possible to foretell a coming drop in voltage in time to use the regulator and thus keep the voltmeter needle perfectly still, though the voltmeter is a very sensitive instrument, and the regulator is often moved four or five notches. The hum often changes, however, without any corresponding movement of the voltmeter, but the sound is then somewhat different. At rare intervals the switchboard lights will suddenly change slightly in candle-power before any change is noticeable on the voltmeter.

It is noticeable that the needle will often stand for a time perfectly still on the centre, and, on a slight rise in the hum, will start gently rising, never more than three quarters of an inch, and then as the tone gradually be-becomes lower, slowly fall back to the centre and stop without passing it. At other times the variation in hum is more sudden and the needle will rise and oscillate above the centre. Again, the needle will oscillate equally about the centre during a regular rise and fall of hum, its movement being apparently due to one impulse and not seeming to be modified by subsequent variations. There is no apparent change in candle-power of the lamps during the voltmeter changes noted. These notes were made while the plant was running at only 5,000 volts, but they were later confirmed when using 10,000. During dry weather there is considerable intermittent oscillation of the voltmeter-needle without there being any change in load or any other apparent cause, while in wet weather the needle remains perfectly still for many minutes at a time, often for as much as half an hour. A possible explanation of this oscillation may be found in the presence of static changes on the line, due to atmospheric electricity. That the line is often heavily charged from the air is shown by a number of observations. One afternoon a painful shock was obtained on touching the line at the canon end, drifting clouds and a strong wind being noticed in the valley. Again, while using the telephone a report was heard in it so sharp as to cause momentary deafness. Later, after a moderate wind had been blowing for some time, loud reports were noticed on the telephone at long intervals. As the wind became higher the reports became shorter. It was evident that there was a discharge from the lines through the telephone (which was on a metallic circuit) and that it depended on the rate at which the wind blew. In order to get the strongest effect the two wires were connected in the usual way to the raising and lowering transformers, and one side of the telephone connected to one wire. On connecting the other side of the telephone to ground a sharp report was heard, and on maintaining the connection there was a sound as of steam escaping af a distance, with intermittent and very faint crackling. It the ground contact was made slowly there was a bright spark before the metals touched, and a loud report. If the fingers were interposed a smart shock was received. By making and breaking the ground connection rapidly, the line was prevented from accumulating a heavy charge, and no spark was visible, though a faint crack was heard. It a slight space was left between the telephone wire and the ground, a spark occurred at fairly regular intervals, and when the space was lessened the sparks became smaller and more frequent. When the wind lessened the sparks and reports became almost imperceptible, but on the wind becoming strong and blustery a large spark was again obtained. When one line wire was disconnected from the transformers at Pomona the effect obtained from grounding that wire was less, owing to the reduction in capacity.

(*To be Continued.*)

THE AGE OF THE EARTH.

BY NEWTON HARRISON.

Evolution is another word for time. Things change as they become older—as the dark shadow of impending years leaves its touch and banishes the present and the past. The earth is old. Thousands of years ago its strange appearance and still stranger living types would have surprised the most sceptical into a most confirmed belief in its veritable antiquity.

As all things live and die, so the earth in common with myriads of planets, has passed through its early stages and now slowly approaches the grand finale—the period of impending dissolution. It is said that matter is indestructible, and therefore we simply view the inexplicable changes to which it is subjected. When the froth of space was whirled into its ancient orbit, the earth as a shining nebula contained the future possibilities of a struggling race. Time cannot be measured by years when the age of a world is thus considered. Man alone recedes into the prehistoric past as a frightful growth—a thing as yet unborn. The sweeping floods, the continents of solid ice, the rending of earthquakes, were but incidents that like the fleeting memories of a half forgotten dream are still dimly remembered. If basalt took one million years to cool, we can look back into the corridors of time and safely imagine that interval to be small as compared with the age of this planet. A cooling mass takes a time proportional to its bulk to cool. It has all of space to radiate into when its immensity is that of the earth's.

And before the nucleus—the centre of condensation appeared—the countless ages of purely nebulous life of undestroyed uniformity calls for aeons of years. Those were the immeasurable spans of time wherein the potential forces fought for supremacy—when the world matter all but merged into the infinite void from which it was created. These phases of pre-terrestrial existence border upon the shores of philosophy. Did space evolve this phantom-like growth, or was it an unrealizable emanation? Perhaps the cause of all evolutionary developments but begins here with the very ether of space and by unknowable processes creates and throws into activity the impalpable atoms of the universe.

Shall we inquire into the age of the earth? Rather let us inquire into the age of all worlds, for earth and worlds are but separated by a pitiful interval, beside which the eternity of endless time yawns in its fearful infinity.

To try to tabulate the periods of earthly growth is a problem beyond our powers—yet with all these stretches of time and flights of earlier years there are still traces of value and importance which may teach us, if not the age of the world, at least how the world has aged.

—The properties that give platinum its great value for incandescent lamps are its high fusible point, freedom from oxidization, ductility and rate of expansion the same as that of glass.

RECENT ADVANCES IN ELECTRO-CHEMISTRY.*

BY JOSEPH W. RICHARDS.

Calcium Carbide.—This is another recent product of the electric furnace. T. M. Wilson, of Spray, N. C., in the course of experiments to produce alloys of calcium and aluminum, succeeded in forming a black, brittle, fusible substance, which chemical analysis showed to be calcium carbide (CaC_2). From a mixture of

Burnt lime	2,000 pounds.
Fine coal dust	1,200 "

and with the use of 180 electric horse-power for twelve hours, Mr. Wilson claims to be able to produce 2,000 pounds of calcium carbide, at a cost approximating $20. This substance promises to be of great industrial value from the curious reaction it gives with water:

$$CaC_2 + 2H_2O = C_2H_2 + Ca\ (OH)2.$$

In other words, it is converted into calcium hydrate, giving off acetylene gas in the proportion of 100 parts of gas to 247 of calcium carbide, which would mean, approximately, 10,000 cubic feet of gas per ton of carbide. This gas has the highest illuminating power of any known hydrocarbon, and, when mixed with half its volume of air, can be burned without smoking, giving a flame five or six times as brilliant as ordinary illuminating gas. It has been claimed that this gas, equal in illuminating power to coal gas of 25-candle power per five-foot burner, can be made at a cost of 30 cents per 1,000 cubic feet.

Other and even more important uses for this gas may be found in the field of technical chemistry. For example, by passing electric sparks through a mixture of acetylene and nitrogen, hydrocyanic acid is formed, from which cyanides can be made. By heating in a sealed tube, it passes into benzine. By an indirect process it can be made to yield alcohol. The difficulties which the projectors are now seeking to overcome are: the danger of the explosion of the gas mixed with the air, and the decomposition of the carbide by the action of the atmospheric moisture.

Aluminum.—No very recent improvements have been made in the electrical processes for extracting this new metal. It is now made exclusively by the electrolysis of alumina dissolved in a bath of the fused fluorides of aluminum and sodium, the dissolved aluminum being decomposed while the solvent salts are unaffected by the current. The principal works are those at the Rhine Falls, in Switzerland, using 4,000 horse-power, and making three tons daily by Heroult's process; and the Pittsburgh Reduction Company, making one ton daily by Hall's process. The latter company will probably start a new and much larger plant at Niagara Falls, beginning with a daily output of two tons, which within a year may be increased to four tons. The total output of aluminum in the world, in 1894, was 1,020 metric tons; the present selling price is thirty-five cents per pound in Europe and fifty cents in the United States. The Swiss works intend extending to 15,000 horse power within the next five years. when the European price will probably fall to twenty-five cents per pound. The wonderful development of the electro-metallurgy of aluminum is one of the most striking achievements of modern electro-chemical science.

In the utilization of this metal, Mr. J. D. Darling, of Philadelphia, has gained celebrity by electro-plating 100,000 square feet of ornamental iron work on the tower of the new public buildings of that city. The queston as to whether aluminum could be electro-plated on another metal at all was a doubtful one until Mr. Darling began work on this *tour de force.* The chemical composition of the bath used is kept as a trade secret. The columns, etc., to be plated are first coated heavily with copper, in the ordinary way, and then coated over with aluminum one-sixteenth of an inch thick. This last operation takes seventy-two hours, the current used averaging ten amperes per square foot of anode surface, and seventeen am-

* Abstract from Lecture read before the Franklin Institute, Philadelphia.

peres at the depositing surface, an electromotive force of eight to ten volts being used to each bath. Specimens of the work which I have seen are very well done, and reflect great credit on the skill of this Philadelphia electrometallurgist.

Copper.—The electrolytic refining of copper is now carried on commercially on an immense scale. There are two single plants in the United States, at Baltimore, Md., and Butte, Montana, which have a daily capacity of fifty tons each. In 1894, over 50,000 tons of copper were refined in the United States, and the time is probably not far distant when the whole copper production will be electrolytically refined. The cost of refining at the new Anaconda plant at Butte, Montana, under the direction of Mr. Thofehrn, is said to be only 0.6 per pound. An innovation in the practice of these works is the removal of ferrous sulphate from the solution by warming it and blowing air through, when the iron precipitates as basic sulphate. It is stated that Lake Superior copper is not of as good quality as formerly, because of poorer ores and closer working, and that the Calumet and Hecla Company contemplates changing its smelting plant at Buffalo into an electrolytic plant located at Niagara Falls, where power can be rented at $7 to $10 per horse-power per year. The copper thus refined will command a higher pice, and, at the same time, the silver contained in it can be extracted.

Gold.—Münster claims that he has found in the sea-water of Christiana Fjord, twenty milligrams of silver and six milligrams of gold to every 100 cubic meters of water. He proposes to extract these by immersing galvanized iron electrodes in the channel, and passing through them an electric current of feeble tension.

In the cyanide process of treating gold ores, the gold is dissolved in a solution of potassium cyanide. To extract it from this solution, an electrolytic process has been found advantageous The electrodes must have a large surface; lead is used for the cathodes and iron for anodes; carbon anodes disintegrate too quickly. To precipitate the metal from 100 tons of cyanide solution carrying five dwts. of gold per ton in twenty-four hours, requires 10,000 square feet of cathode surface, and a current of 600 amperes at four volts tension. The iron plates form Prussian blue, but they last a long time. The anodes are placed vertically, and are covered with canvas to keep the Prussian blue out of the liquid. The lead sheets stand between, with 1.5-inch space between the electrodes. The electrolyzing boxes are covered and kept locked, being opened once a month, when the lead plates are lifted out and melted down. They carry two to twelve per cent. of gold and are cupelled. The expenses are three shillings per ton of liquor treated, and on a large scale it can be reduced to 2 5 shillings, whereas, the ordinary method of precipitating by zinc costs four shillings.

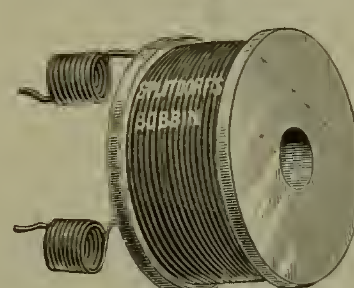
Parting Gold and Silver.—The Moebius electrolytic process is used by the Pennsylvania Lead Company, near Pittsburgh, and by the St. Louis Smelting Company. The alloy of gold and silver is cast into anodes, and used in a ten per cent. solution of nitric acid. A current of 1.4 volts per cell is used, and a current density of twenty-six amperes per square foot. The plant at Pittsburgh consists of forty-two cells, run by a current of 180 amperes by sixty volts, there being seven square feet of anode surface in each cell. The output is 20,000 ounces of silver per day. The anodes contain 987 parts silver, 6.3 parts gold, 6.7 parts copper. The slimes are melted down with silica and borax to an alloy averaging 650 parts of silver and 300 parts gold, the remainder being lead and copper. This rich alloy is melted with more pure silver and parted with nitric acid. It is said that this process is cheaper than the ordinary parting process, but one would hardly judge so from the description given.

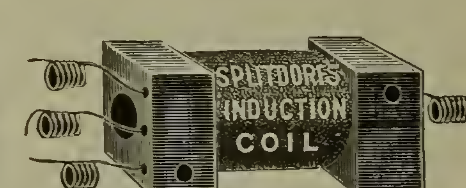
Zinc.—Cassel and Kjellin, of Stockkolm, propose the following process of extracting zinc from its sulphide ores. The ore is roasted as far as possible to soluble zinc sulphate, which is leached out. The electrolyzing vessel has a porous partition; around an iron anode is placed a solution of sulphate of iron, while the zinc sulphate solution surrounds the cathode. On passing the current, zinc is deposited from the latter solution, while its equivalent quantity of acid is separated at the iron anodes and dissolves it to sulphate. The electromotive force of decomposition, under these circumstances, is the difference between that required to decompose zinc sulphate and that of the iron sulphate, or about one-third of a volt, thus allowing the separation of zinc without decomposing the water of the solution. The process is very pretty in theory, but the porous partitions will be likely to give trouble in practical working, and the question of the cost of the iron used and the market for the copperas produced form large factors in deciding the economy of the process.

SPLITDORF COILS.

We illustrate herewith some of the specialties manufactured by C. F. Splitdorf, Nos. 17–27 Vandewater street, New York city.

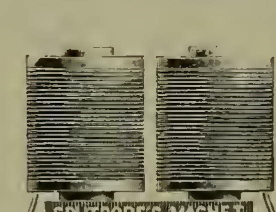
Mr. Splitdorf is well known in the general electrical trades through the excellence and reliability of his magnet and induction coils, which he manufactures for various purposes. He makes coils for arc lamps, telephones, telegraph instruments, electric bells, annunciators and electric motors, and, in addition, manufactures fine wire for fine instruments, spark coils and Rhumkorff coils. His specialties, however, are telephone magnet and induction coils.





These goods are wound with Splitdorf's patented magnet wire, which is insulated with the very finest Sea Island cotton, and treated with a coating of a patented adhesive solution which is in itself a non-conductor of electricity. On top of this adhesive substance the cotton is woven, and when dry the insulation is perfectly hard and firm and not easily injured.

The various kinds of coils made by Mr. Splitdorf are very carefully made and guaranteed to be perfect, both as to insulation and resistance, and any correspondence in regard to coils for any purpose whatever will receive Mr. Splitdorf's cheerful and prompt attention. He employs



only the most skilful mechanics and winders, which, together with the use of the best obtainable materials, insures first-class products.

The largest telephone and other electrical companies use Mr. Splitdorf's goods exclusively, and he has a steady trade from these alone.

The various cuts show the Splitdorf induction coil, spark coil, bobbin and electro-magnet.

The best of satisfaction is given to the users of these coils, and Mr. Splitdorf has built up a very large trade in these specialties.

A. I. E. E.

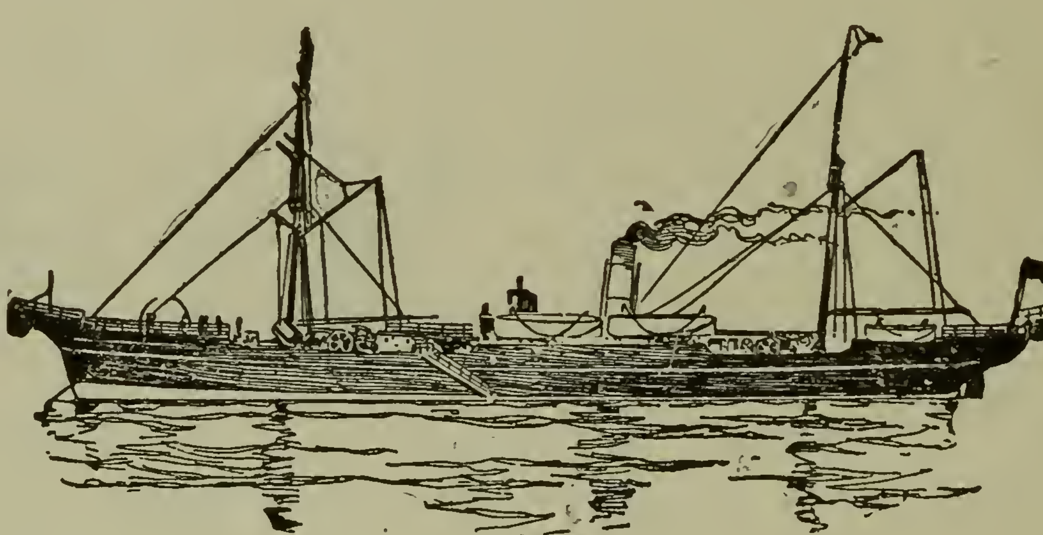
The 99th meeting of the Institute will be held on Wednesday, September 25, the date having been changed from September 18 by the committee. A paper will be presented by Mr. Charles S. Bradley on "Phasing Transformers."

AN OCEAN TELEGRAPH STATION.

A noteworthy enterprise was that of the Commercial Cable Company and Postal-Telegraph Company in affording means for reporting the international yacht races by telegraph direct from the scene of contest.

This unparalleled feat was accomplished by stationing the Commercial Cable Company's steamer "Mackay-Bennett" near the Sandy Hook lightship and maintaining communication with land through a submarine cable laid down especially for the purpose. The "Mackay-Bennett" had a fully equipped telegraph office on board, and this excellent vantage ground was utilized by representatives of the press in sending their reports of the races to their individual papers and press associations. The steamer was for the time being a public telegraph office, and such enterprise in the public interest on the part of the two companies deserves the highest commendation. Nothing of the kind has ever been attempted before, and it is especially noteworthy that the most satisfactory results attended the undertaking.

The "Mackay-Bennett" last week laid a two-conductor submarine cable, 1½ inches in diameter, from the cable hut above the Oriental Hotel on Coney Island to a point near the Sandy Hook lightship, and there anchored as the first ocean telegraph office ever established.



COMMERCIAL CABLE CO.'S STEAMER "MACKEY-BENNETT."

The distance between the lightship and Coney Island is between nine and ten miles. At the Coney Island hut the cable was connected with the land lines of the Commercial Cable Company, which run underground through Brooklyn to New York, and thus communication was established and maintained between the city and the cable steamer, far out to sea.

Under the supervision of Mr. F. W. Jones, the Postal Telegraph Company's electrical engineer, each of the two conductors of the cable were quadruplexed, in this way giving the facilities of eight wires—four in and four out.

This novel marine telegraph office was located on the port quarter deck under the cover of an awning, and the instruments were kept humming all day. The instruments used were Jones quadruplexes, which device is used by the Postal Telegraph Company on its land lines. They worked with the utmost satisfaction, and it is a fact worth special note that never before, as far as known, has such a length of submarine cable been worked on the Morse quadruplex system.

The current for the marine end of the circuit was supplied by four small dynamotors installed on board the "Mackay-Bennett" by Mr. Jones, especially for the work. The armature of each of these machines has two windings, one for the motor section and the other for the generation of current at reduced potential. As motors, the machines were driven by a 100-volt current supplied by one of the ship's dynamos. Two of the machines delivered a current of 40 volts—one plus and the other minus—and two 120 volts plus and minus, these currents being combined in the manner usually employed in quadruplex telegraphy.

This unique generating plant was remarkable for its compactness, the four machines occupying a space on a bench four feet long. The entire telegraph plant was installed on board within 24 hours, and was indeed a remarkable piece of work, and reflects great credit upon those directly concerned.

After each day's race was over the cable end was buoyed and the Mackay-Bennett ran in and anchored inside the Hook for the night. In the morning of each race day the cable was picked up and communication with land re-established.

Mr. Charles Cuttriss, the electrician of the Commercial Cable Company, and Mr. Charles Priest, the steamer's electrician, looked after the Commercial Cable Company's electrical interests, while those of the Postal Telegraph Company were in charge of Mr. F. W. Jones.

The conception of the enterprise and successful accomplishment of the same will no doubt mark a new era in telegraph affairs, and it is not too rash to venture the prediction that this will likely lead eventually to the establishment of ocean telegraph stations.

Among those on board during the races, in addition to those already mentioned, were George G. Ward, general manager of the Commercial Cable Company, W. H. Baker, vice-president of the Postal Telegraph Company, G. H. Usher, assistant superintendent of the Postal Telegraph Company, Thos. R. Taltavall, of The Electrical Age, and a large number of representatives of the press.

CANADIAN ELECTRICAL ASSOCIATION.

The fifth convention of the Canadian Electrical Association will be held at the Russell House, Ottawa, on September 17, 18 and 19.

The meeting will be opened in the Railway Committee room of the House of Parliament and the Mayor of Ottawa will read an address of welcome.

Following is a list of the papers to be read during the convention: "Some Notes on the Consolidation of Two Systems of Electric Supply," by A. A. Dixon, of Ottawa; "The Telegraph in Canada, by Chas. P. Dwight of Toronto; "Suggested Forms for Electric Light Accounting," by D. R. Street, Ottawa; "From the Coal Pile to the Meter," by Jas. Milne, Toronto; "Some Alternating Current Apparatus," by H. T. Hartman, Peterborough; "Non interference Diplex Relay;" "A Percentage Method for Circuit Measurements," by D. H. Keeley, Toronto. Mr. J. J. Wright will also read a paper.

The social features include a visit to the Chaudiere Falls, the lumber mills, electric power houses and Rockliffe Park. A banquet will be held at the Russell House on the night of September 18.

CONSTRUCTION AND MAINTENANCE OF TELEGRAPH LINES.*

BY W. F. TAYLOR.

Telegraph lines in this country are in most cases constructed along railway routes, whether they are for railway or commercial purposes; therefore, the question of standard construction is important to railway companies, both as to the durability of their own lines and the effect any line has upon the general appearance of the company's property. It is difficult to speak favorably of telegraph lines, æsthetically considered, for they are always more or less unsightly,—but their extreme unsightliness in many cases is due to careless construction and indifferent maintenance.

The best looking line, and as a rule the most durable, is one that is well formed and symmetrical. These characteristics are largely dependent upon geographical and local conditions, but in no case are the natural obstacles such as to prevent the construction of reasonably strong structures.

The telegraph line is essentially a mechanical structure, and should be so considered in preparing specifications for its construction and maintenance. I am inclined to think that, heretofore, we have not given sufficient thought to the physical conditions and requirements of our telegraph lines, and as a result our companies annually suffer great inconvenience and loss of money by reason of the lines giving way under the pressure of severe storms.

It does not seem unreasonable to assume that, with an ideal construction, our telegraph lines should not yield to wind and sleet storms more easily than other structures of a similar character.

The strength and durability of the line depends somewhat upon the character of material used, as well as the method of construction. Owing to the abundance and cheapness of suitable timber, the use of iron poles has not received serious consideration in this country. Iron poles are used to some extent in European countries as well as in Asia and South America.

There are, no doubt, exceptional cases where it would be economical to use metallic poles in this country, and in time may be generally used in consequence of their great durability, as they are estimated to last much longer than wooden poles, and in addition to this they possess the advantage of greater permanence and elegance of form.

Perhaps the principal reason that the metallic poles are not generally used today is that of their excessive cost, which is probably three or four times that of wooden poles; this objection, however, may regulate itself after the matter has been duly considered by manufacturers.

In the event of the introduction of metallic poles, the position of lineman would be much more hazardous, for if the telegraph lines get foul of a wire carrying a dangerous current, his only protection against a severe shock would be his gloves and other clothing.

Another very serious objection to the use of metallic poles is the danger of having wires grounded by the poles in case they become detached from the insulator. Perhaps the most serious objection, as already intimated, is the danger to linemen, for instance: the high potential alternating current used in operating quadruplex circuits might be sufficient to cause an accident to a repairman; he would always be, while on the pole, a ready medium for conducting any current through himself to the earth.

Poles as a rule are either chestnut, white or red cedar, cypress, red wood, Oregon pine, and in some cases where an exceptionally high pole is desired, Norway pine is used Maver, in his book "American Telegraphy," states that "the average life of Norway pine may be placed at six years; that of chestnut, fifteen years; cypress, twelve years; cedar, ten years."

The life of any pole is more or less dependent upon climatic influences. Poles should be of the best quality, live, green wood, but cuts, squared at both ends, reasonably straight, well proportioned from but to top of pole, peeled, knots trimmed close, thoroughly seasoned, free from sap, and should be cut between November and March.

If the wood is painted or set into the ground when green with the sap in it, dry rot is sure to set in, and the pole, although presenting a perfect exterior, may have lost its strength In single pole line construction the circumference of the pole, regardless of its length, should not be less than twenty-two inches at the top. The circumference six feet from but for a pole twenty feet long should be thirty inches, increasing from one to three inches for each additional five feet in length.

General practice as well as experience would indicate that poles should be set at a depth about as follows:—

LENGTH OF POLES.	DEPTH.
20 and 25 feet	5 feet.
30 " 35 "	5½ "
40 " 45 "	6 "
50 " 55 "	7 "
60 "	8 "

As a rule poles first begin to decay at a point close to the ground, at a point termed the "wind and water" line. To prevent the effects of "wind and water" it is sometimes customary in this country to coat the but end of pole with pitch or coal tar. In European countries it is a common practice to prepare the poles by impregnating them with various preservative compounds. In some cases the preservative substance is poured over the poles in large quantities and left for a long time in contact with them. In other cases it is forced into the pores of the wood by hydraulic pressure, or the impregnation is effected in closed boilers, a vacuum and a heavy pressure being alternately produced by means of pumps.

The principal preservative substances employed are: sulphate of copper, chloride of zinc, creosote, etc.

These expedients are more or less expensive, and so long as the price of poles does not much exceed the present figures, we would hardly be justified in resorting to these measures; however, a rather inexpensive means of preserving wood is suggested by a recent experiment made upon the hemlock sills of a shop building. In this instance at certain intervals the sills are saturated with kerosene oil, and as a result the average life of hemlock under such conditions has been doubled and the sills are still in good condition.

(*To be Continued.*)

* Paper read at the convention of the Association of Railway Telegraph Superintendents, Montreal, Que., June 12 and 13, 1895.

NEW ELECTRIC FORGING COMPANY.

The Empire State Electric Forging Company, of Syracuse, N. Y., was recently organized with a capital of $300,000 to exploit the Geo. D. Burton Liquid System of electric forging and metal heating in the State of New York.

The officers of the company are: J. O. Adsit, president; D. E. Mosley, vice-president; General J. A. Reynolds, treasurer; E. D. Woodruff, general manager; S. R. Gridley, secretary.

The company is organizing local sub-companies throughout the state to introduce the apparatus. Severe tests have been made of the system, which is said to be 40 per cent. superior to the present system of forging.

KERITE CABLES AT THE YACHT RACE.

During the races for the America's cup between the American yacht "Defender" and the English challenger "Valkyrie," the Western Union Telegraph Company had a telegraph office anchored near the Sandy Hook lightship, which was in communication with shore through a submarine cable. The cable was of the well-known Kerite make, and was 7½ miles long. The connection with the land lines was made at Sandy Hook.

ELECTROMOTIVE FORCE AND DIFFERENCE OF POTENTIAL.

The distinction to be drawn between the use of two such expressions may be briefly outlined. The term electromotive force relates to that potential force which establishes the difference of potential so frequently mistaken for the former. The E. M. F. is capable of bringing into existence a difference of potential which falls in value as the current flow increases; so that, if the generated E. M. F. is to be known, the loss of pressure or drop must be added to the measured potential difference. In a dynamo the internal characteristic is obtained by adding to the observed voltage the loss in volts due to the resistance and current of the armature. By that means the regulation of the machine may be compensated by the proper means in case it proves to be poor.

If that difference be appreciated, then the confusion of terms is impossible and a clear understanding of its proper application becomes a simple matter.

THE ELECTRIC STORAGE BATTERY CO.

The Electric Storage Battery Company of Philadelphia (Chloride Accumulator) has acquired a controlling interest in the Eastern Electric Light and Storage Battery Company of Lowell, Mass., the manufacturers of the Sorley type of storage battery, well known throughout the United States. In the future. the manufacture of storage batteries will be carried on at the extensive works of The Electric Storage Battery Company in Philadelphia. Mr. Alfred Clarke, formerly general manager of The Western Electric Light and Storage Battery, has been appointed agent of The Electric Storage Battery Company, with offices at 333 Exchange Building, Boston, and Arthur E. Childs, manager of the New England District.

ELECTRIC LIGHT IN THE SUEZ CANAL.

The percentage of ships using the electric light to pass through the canal have been as follows: 1890, 83 per cent.; 1891, 88 per cent.; 1892, 90 per cent.; 1893, 92 per cent., and 1894, 94 per cent. The average time in passing through the canal was in 1894, with the electric light, 19 hours 18 minutes; without the electric light, 31 hours, 17 minutes.

ELECTRICAL PROGRESS IN JAPAN.

FROM OUR OWN CORRESPONDENT.

The utilization of water power for the generation of electric current for street railway and other purposes is receiving considerable attention in Japan at the present time, and several undertakings of this character are now being developed.

There is already one such plant in operation, and it is working very successfully. It is the street railway in Kyoto. The line is 12 miles in length and is operated on the single trolley system. It has given such excellent results that in other cities, including Tokyo, Yokohama and Osaka, permission is being sought for building roads on the same system. The authorities of Osaka and Tokyo, however, hesitate about granting the permission desired on account of the possible damage to water pipes, which are being now laid down.

Being aware of the corrosion of underground pipes in Brooklyn, Boston and other American cities, where single trolley roads are in operation, the authorities in our cities are inclined to go rather slow in permitting the use of that system, and before definite action is taken a special committee has been appointed to carefully investigate the subject of the action of stray currents upon underground pipes and the prevention of the same.

What makes it so much harder to push the single trolley enterprise in Tokyo is the efforts of another syndicate to introduce the double-trolley system. This syndicate represents a capital of $1,900,000, and proposes to build 84 miles of road. Upon the settlement of the question in Tokyo the result of the agitation in other Japanese cities will much depend, and in all places everything is ready for active operations as soon as the matter is settled and the desired permission obtained.

Eight mines in Japan are worked by electric power and lighted by electricity, all the generators, motors and incandescent lamps being manufactured in Japan.

Excepting a special form of telephone and the agglomerate carbon for the Leclanché battery, all of the instruments and battery materials used in the Japanese telegraph and telephone services are manufactured and supplied by native concerns.

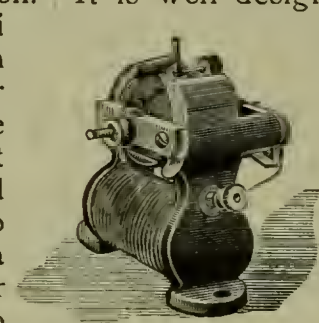
The following statistics concerning electric lighting in the three largest cities of Japan will be of interest to your readers:

	Population.	No. Incandescent Lamps, 8 c.-p.	Arc Lamps, 1,200 c.-p.
Tokyo,	1,303,876	34,436	160
Osaka,	484,409	22,203	140
Kyoto,	328,403	12,638	19

A preliminary survey has been made by the Japanese authorities for the laying of a submarine cable to Formosa, which is a part of the territory recently acquired by Japan as a result of the war between this country and China. The cable will be quite a long one and will be laid down before long, a cable ship having gone to England to procure the cable, which will be supplied by Siemens Bros. & Co.

The outlook for electrical enterprise in general in this country is very favorable, and we are rapidly following in the footsteps of your great country in the use of electrical apparatus.

THE BABY PREMIER MOTOR.



This little motor is one of the most complete machines we have ever seen. It is well designed and excellently finished, and evidently has received as much attention as to constructional details as larger machines do.

It is only three inches in height and weighs eight ounces. The best of material is used in its construction and it has the appearance of being a serviceable machine.

With the motor come zinc and carbon elements properly mounted to set in a tumbler. One such cell runs the motor at nearly 2,500 revolutions a minute.

The shaft of the motor is provided with a brass pulley for driving toys, etc.

With each outfit comes sufficient premier power for five charges of the tumbler battery, with full directions.

LAMPS LIGHTED BY ELECTRICAL FISH.

M. d'Arsonval has been interesting the members of the Académie des Sciences, says the *Electrical Engineer*, of London, with a description of the experiments which he has recently made in connection with the electric discharge of the torpedo fish. He used several special instruments for recording the phases of the discharge. One of them, which he calls a galvanograph, is a modification of the movable-circuit galvanometer which he devised in 1880 in conjunction with M. Marcel Deprez. It consists essentially of a very light aluminium coil, upon which is wound the circuit traversed by the piscinal current. This coil is fixed to the centre of an india-rubber diaghragm, stretched on a Marey air-drum. This primary drum is connected by an india-rubber tube to a second smaller drum, carrying a short recording needle moving on a smoked cylinder. Another is composed of a silver wire a tenth of a millimeter in diameter and 40cm. or 50cm. long. This wire is stretched horizontally between two rigid supports. In its centre it connects with a second wire held by an india-rubber spring and carrying a needle moving on the recording cylinder. The torpedo is placed on a plate with a metallic bottom, on which is left about ½in. of sea water to enable the fish to breathe during the experiments. Out of a sheet of tinfoil two electrodes are cut in the shape of the electric organs of the animal, and these two strips are placed on the dorsal surface of these organs and joined by a band of tinfoil 5cm. long. The lower metallic plate constitutes the negative electrode, and the tin strips form the positive electrode of this living electromotor. The electrodes are then united to the various apparatus for measuring or rendering visible the discharge of the organs To provoke the discharge it is only necessary to pinch with a pair of dissection tweezers the edge of the fins of the fish. As a rule the torpedo contents himself with one discharge of his electrical artillery, but if he be pinched hard he loses his temper and fires rapidly. The curve inscribed by the galvanograph shows that the discharge is not continuous, as M. Marey has asserted that it is ; it is composed of from six to ten successive discharges. The back of the fish is always positive and the belly always negative. With torpedoes of about a foot in diameter, which had been kept for about a week in the Laboratoire de Zoologie et Physiologie Maritimes de Concarneau, M. d'Arsonval found that the E.M.F. alternated between eight and seventeen volts, and the intensity between one and seven amperes. He took an incandescent lamp, consuming four volts and one ampere, and connected it to one of the electrical organs. When the fish was tweezed this lamp became brilliantly lighted for an instant. He counsels the experimenter, by the way, to connect the lamp with only one of the organs, and to pinch the fish very lightly, otherwise the lamp will inevitably be destroyed, as happened to him at his initial attempt. He was able to get three lamps—all he had—running. The action of the organs is synergetic and homergetic. Lamps placed on each organ lighted at the same time and showed the same intensity, although on different circuits. The organ, however, rapidly exhausted itself.

THE COST OF STEAM-POWER II.*

BY CHAS. F. EMERY, PH. D.

(*Concluded from Page 137.*)

TABLE III.

SHOWING THE COST OF STEAM-POWER ON THE BASIS OF GENERATING 20,000 H. P. CONTINUOUSLY FOR 10 HOURS PER DAY FOR 309 DAYS IN THE YEAR.

			Per cent. of total cost.
1.	Yearly cost of coal, § 30............	$92,056	30.6
2.	Estimated cost of labor, § 14........	27,198	9.1
3.	Estimate cost of supplies and regular repairs, § 32..........	37,080	12.3
4.	Estimated interest, insurance, taxes, and cost of renewal. § 33............	144,0CO	48 0
5.	Total..............	$300,334	100 0
	which divided by 20,000 gives the following :		
6.	Cost of steam-power per H. P. per year on the basis of delivering 20,000 H. P. continuously for 10 hours per day for 309 days in the year..........	15.17	
7.	Cost of steam-power per H. P. per year on above basis if 5 per cent. of the original cost of plant be charged for dividends and $0.75 per H. P. added for general business expenses, § 18.......15.17 + 3.60 = 18.77; 18.77 + 0,75 = ...	19 52	
8.	Cost of steam-power per H.P. per year on above basis if 10 per cent of the original cost of plant be charged for dividends, and $0.75 per H. P. added for general business expenses, § 19....15.17 + 7.20 = 22.37; 22.37 + .75 = ...	23.12.	

§ 30. The yearly cost of coal, line 1, above, is obtained by computing the coal for 11 hours per day, for reasons explained in § 22, and making the calculations explained in the latter part of § 12 for 309 × 11 = 3399 hours in the year.

§ 31. The labor would be occupied 309 working days, and, say, one-half the holidays, § 20. The cost of labor for 337 days, 10 hours, or 3370 hours, at $5.40 per hour, § 13 = $18,198. Two assistant engineers could be dispensed with, compared with § 13, thus reducing the cost of superintendence to, say, $9,000 per year. The second of these two quantities is written in the line 2 of Table III.

§ 32. The cost of supplies and repairs is estimated at the rate of 0.6 mile per H. P. hour as per § 14, 20,000 × 3090 × $0.0006 = $38,080, as written in line 3, Table III.

§ 33. The amount written in line 4, Table III, is the same as for the two other cases. The cost of renewals should apparently be reduced as the machinery operates less hours, but the percentage allowed for renewals is very small and should be increased for the other cases rather than reduced for this. Moreover, renewals are made more frequently on account of new discoveries or changes in business than from the actual wearing out of the apparatus.

§ 34. The prices given in lines 6, 7 and 8 of Table III., § 29, will best compare with those carried familiarly in the mind. The minimum cost derivable from the paper in Transactions for 1893. above referred to, is for coal at $2.24 per ton and ten hours per day, $22.31 per H. P. per year. This should be compared with $18.77 in line 7, of Table III., as the previous calculations provided for 10 per cent. interest and dividends, as is provided in lines 4 and 7 jointly in Table III., but not for general business expenses. The difference is $3.54 per H. P., corresponding to a saving of 15.87 per cent. by generating the power on the larger scale.

§ 35. The quantities in the paper above mentioned were augmented here and there so as by judgment to try and approximate the various losses incident to average practice, though insufficiently to show the results of such practice in some locations. The prices herein given are as low as it would be safe to expect with very careful management of a very large plant. The comparatively small difference in result is due to the influence of the constant cost shown in line 4 of the several tables. It forms 26.4 per cent. of the total cost for 20,000 H. P. every hour in the year, Table I., § 8 ; 34 per cent. for variable power, 20,000 H. P. maximum, 12,760 H. P. average day and night, and rises to 48 per cent. for 20,000 H. P. during 10 hours of the ordinary working days in a year. The cost of coal is respectively 43.4 per cent., 37.3 per cent. and 30.6 per cent. of the total cost for the same three conditions. The fixed charges also increase greatly the cost of water-power, as the writer has had occasion to call to the attention of parties engaged in these large hydraulic enterprises.

§ 36. It should be borne in mind that if water-power or power derived from water be sold on a 24-hour basis, but can only be utilized during 10 hours per day, the cost of the water-power direct or derived should be compared, not with the cost of steam-power on a 24-hour basis in Tables I. or II., but with that of steam-power on a 10 hour basis in Table III.

§ 37. It should also be borne in mind that all these estimates provide for fixed expenses, such as interest, insurance, taxes and cost of renewal, and that in comparing the prices above given with the cost of water-power, similar fixed expenses should be added to the price of such power, based on the cost to consumer of installing the water-power or the mechanism through which the power is derived. For instance, manufacturers located on the canals of large water-power companies necessarily build their own head and tail races and wheel-pits and install the gates, screens, turbines and means of transmission for utilizing the power. This when well done in many locations costs as much as to install a steam plant, so the fixed annual charges for this item alone would be $5.00 to $7.00 per H. P., which together with cost of labor and supplies, must be added to the cost to be paid for the water-power in order to compare with the cost of steam-power as presented in the tables of the writer.

§ 38. When power is electrically transmitted, the consumer is generally required to pay for the electric motor, the general means of transmission therefrom and some incidentals. The cost of this work, together with the portion of the building and even of the real estate occupied should be considered in the same way as has been done above, and at least 10 per cent. of such cost, together with actual costs of labor and supplies, added to the tendered price of net power delivered, in order to compare the cost of power obtained in this way with the cost of steam-power shown in the various papers of the writer, which are written on the basis that a manufacturer should receive a profit on the money expended in plant as well as that expended in his business. If interest is left out in one case it should be in the other, and it is already included in the tables.

§ 39. The last column of the several tables furnishes a ready means of eliminating either of the items of cost desired. For instance, in Table III., which is on a 10-hour basis, we find in line four that the "estimated interest, taxes and cost of renewal" is 48 per cent. of the total cost, which cost to the parties using the power is in such table $15.17 per year, line six. The cost of steam-power per H. P. per year from large units for 10 hours per day, without considering the above items, is therefore only $0.52 \times \$15.17 =$ .... $7.89 which is the cost to be compared with the price of power from an external source when the items above referred to are excluded in each case as they are in the popular discussion of the subjects. The similar cost from the estimate in the "Transactions of American Institute of Electrical Engineers" above referred to is $22 31, § 35, less $(3.31 + 7.17) = 22.31 - 1048 =$ $11.83

Hello Louisville.—The American Telephone and Telegraph Company, on September 6, opened its Louisville, Ky., office. The company gave a reception in the afternoon of the same date, and Louisville is now accessible by the long distance lines. Mr W. A. Vail, of the New York office, had charge of the work of bringing Louisville into the Long Distance Company's family.

New York Notes.

Office of the Electrical Age,
World Building, New York,
September 9, 1895.

Mr. J. E. Way, New York manager of the R. Thomas & Sons Company, of East Liverpool, Ohio, was among the callers on The Electrical Age last week.

Street Railway Notes.

The South Fifth Street electric line, Atchison, Kan., is to be extended. Work will be commenced immediately.

A syndicate proposes to build an electric railway from Bagnell to Lebanon, Mo., by way of Gunter's Spring, in Camden County.

Pueblo Electric Street Railway Company, Pueblo, Colo., incorporated by A. D. Pattison, Elmer E. Whitted, Anthony G. Bell, Irving Hall and others. Capital stock, $500,000.

The Knoxville Street Railway Co., Knoxville, Tenn., will make several extensions to its lines.

The Richmond Traction Co., Richmond, Va., is inviting bids for the construction of its Broad Street line.

It is proposed to introduce the trolley system on the Charleston, S. C., street railways. A Toledo, O, syndicate is at the head of the scheme. The negotiations are being carried on by J. K. Tillotson.

Columbia County Electric Railway Company, Greenport (Columbia County), N. Y., by Hiram McGonegal, of New York city; Walter S. Wales, of Syracuse; A. J. Rowles, E J. Hodge, Charles S. Rogers, William H. Van Tassell, Henry H. Smith, and William J. Phillips, and others, of Hudson, to operate a street surface electric road a distance of 15 miles, between Hudson, Philmont and Stockport Station. Capital stock, $400,000.

The Wooster, Medica & Cleveland Street Railway Company, Wooster, Ohio, has been incorporated by L. P. Ohliger, J. R. Zimmerman, A. Cunningham, C. V. Hard, and others.

The Electric Railway Construction Company, Kansas City, Mo., has been incorporated by M. B. Abell, Willard E. Winner, Ella S. Young, James Scammon, and others. Capital stock, $100,000.

The Lewiston & Youngstown Frontier Railway Company, Buffalo, N. Y., by O. P. Letchworth, Frank M. Hayes, Henry C. Howard, and others, to operate a street surface road by means of horses, electricity or any other motive power than steam. Capital stock, $60,000.

An electric railway line is to be constructed to connect Dayton and Cincinnati.

The Nevada Electric Railway and Park Line Company has been organized in Nevada, Mo., with a capital stock of $130,000.

The Bryan, Hicksville, Maysville & Fort Wayne Electric Railroad has been incorporated in Bryan, O., by P. A. Randall, Stephen A. Heath and others, for the purpose of building an electric railroad to connect the towns named. Capital stock, $200,000.

Theo. McClellan and others, Richmond, Ind., are interested in the construction of an electric railroad from that city to Connersville. Subscriptions are now being raised for that purpose.

The Central Railway & Electric Company, New Britain, Conn., will extend its line towards Hartford.

The St. Joseph Street Railway lines, St. Joseph, Mo., were sold at auction recently for $300,000, to satisfy mortgages held by the Central Trust Company of New York. The system will be reorganized.

Telephone Notes.

W. B. Rice, of Baltimore, has applied for a telephone franchise in Macon, Ga.

W. H. Powell, Jr., of Tarboro, N. C., is interested in the proposed telephone company in that place.

The Standard Telephone Company, Waukon, Ia., incorporated with B. H. Stevens, president; Herman Boeckeh, vice-president, and J. J. Dunleavy, secretary. Capital stock, $25,000.

Possible Contracts.

The projectors of the Greenwood electric road, Greenwood, Ind., have decided it will be built, and contracts will be let and work commenced within a few days.

W. R. Brown and J. A. Helvin, of Norfolk, Va., have secured an electric light franchise in that city.

There is talk in Dublin, Ga., of establishing an electric light plant and water works. Address James B. Sanders, mayor.

Cynthiana Electric Light Company, Cynthiana, Ky., has been incorporated with a capital stock of $10,000.

The Osceola Electric Light Company, Osceola, Iowa, has been incorporated with a capital stock of $20,000, to operate electric light and power plants at Osceola.

Steps are being taken to establish an electrical street railway in Keene, N. H.

Steps are being taken to establish an electric light plant in Gallatin, Mo.

The franchises for electric and gas lights and telephone system in Brookfield, Mo , have been sold. The franchises are for twenty years, and the purchaser is to pay one-half of one per cent. of the gross income of the plants for the first fifteen years, and two per cent. for the following five years.

Steps are being taken to establish an electric light plant in Sweet Springs, Mo.

L. J. Hutchinson is now in charge of the Northampton Electric Light plant, Northampton, Mass., and he will make some important improvements.

New Corporations.

H. F. Kearscher has applied for a franchise to construct an electric plant in Youngstown, O.

The International Electric Co., St. Louis, capital stock $15,000, has been incorporated for the purpose of manufacturing incandescent lamps. by J. M. Davey, St. Louis; George DeLilse, St. Charles, Mo.; H. B. Russell, H. E. Chandler and H. G. Ferguson, St. Louis.

The Butler Light, Heat and Power Co., Mahanoy City, Pa., is being incorporated by Hon D. D. Phillips, of Gordon, Dr. S. C. Schomo, of Ashland, and Andrew Comrey, Ephraim Barlow.

The Danville and Northwestern Electrical Light Company, Terre Haute, Ind., has been incorporated to build an electrical road from Danville to Paxton, through Potomac.

Hillsdale Electric Light Works, Hillsdale, Ill., incorporated by Henry L. Gardner and Arthur Morgan. Capital stock, $5.000.

Trade Notes.

The Belknap Motor Company, of Portland, Me., has received the contract to furnish an electric light plant of 150 lights for the Ocean View Hotel, Block Island, R. I.

ELECTRICAL and STREET RAILWAY PATENTS

Issued September 3, 1895.

545,469. Electrical Signaling Apparatus. John H. Fildes, Chicago, Ill. Filed June 12, 1895.

545,485. Adjustable Support for Electric or Other Lamps. Louis Goddu, Winchester, assignor to James W. Brooks,

National Electric Light and Street Railway Associations.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

President, C. H. Wilmerding, Chicago, Ill.; 1st Vice-President, Frederic Nicholls, Toronto, Canada; 2d Vice-President, E F. Peck, Brooklyn. N. Y.

Members of Executive Committee: E. H. Davis, Williamsport, Pa, (one year); W. R. Gardiner, Pittsfield, Mass.; George A. Redman, Rochester. N. Y.; J. J. Burleigh, Camden, N. J. Next meeting, New York, May or June, 1896.

AMERICAN STREET RAILWAY ASSOCIATION.

Next meeting, Montreal, Que., October, 16, 17 and 18, 1895.

President, Joel Hurt, Atlanta, Ga.; Vice-President, W. Worth Bean, St., Joseph, Mich.; 2d Vice-President, John M. Cunningham, Boston, Mass.; 3d Vice-President, Russell B. Harrison, Terre Haute, Ind., Secretary and Treasurer, William J. Richardson, Brooklyn, N. Y.; Executive Committee, Henry C. Payne, Milwaukee, Wis.; W. H. Jackson, Nashville, Tenn.; D. G. Hamilton, St. Louis, Mo., C. C. Cunningham, Montreal, Canada; J. N. Partridge, Brooklyn, N. Y.

NEW YORK STATE STREET RAILWAY ASSOCIATION.

Next meeting, Albany, N. Y., third Tuesday in September, 1895.

President, G. Tracy Rogers, Binghamton; First Vice-President, John H. Moffitt, Syracuse; Second Vice-President, W. W. Cole, Elmira; Secretary and Treasurer, William J. Richardson; Brooklyn; Executive Committee, D. B. Hasbrouck, New York; John N. Beckley, Rochester; Daniel F. Lewis, Brooklyn.

OHIO STATE TRAMWAY ASSOCIATION.

Next meeting, fourth Wednesday in September, 1895.

President, Albion E. Lang, Toledo; Vice-President, W. J. Kelly, Columbus; Secretary and Treasurer, J. B. Hanna, Cleveland; Chairman Executive Committee, W. A. Lynch, Canton.

MASSACHUSETTS STATE STREET RAILWAY ASSOCIATION.

President, T. H. Cunningham, Boston; Secretary and Treasurer, A. S. Butler, Lawrence; Executive Committee, Samuel Winslow, Alfred A. Glazier, Boston; P. F. Sullivan, Lowell; E. C. Foster, Revere; Horace B. Rogers, Brockton; A. E. Smith, Springfield; Prentiss Cummings, Boston.

THE TEXAS STREET RAILWAY ASSOCIATION.

President, W. H. Sinclair, Galveston; vice-president, C. A. McKinney, Houston; Secretary and Treasurer, C. L. Wakefield, Dallas. Directory: The officers and W. H. Weiss, San Antonio and George B. Hendricks, Fort Worth.

Next meeting, Galveston, third Wednesday in March, 1896.

PENNSYLVANIA STATE STREET RAILWAY ASSOCIATION.

Next meeting, first Wednesday in September, 1895.

President, John A. Rigg, Reading; First Vice-President, Robert E. Wright; Secretary S. P. Light, Lebanon; Treasurer, W. H. Lanius, York.

THE MAINE STREET RAILWAY ASSOCIATION.

President, W. R. Wood, Portland; Secretary and Treasurer, E. A. Newman Portland; Executive Committee, W. R. Wood, Portland; George E. Macomber, Augusta; F. M. Laughton, Bangor; Frank W. Dana, Lewiston; Amos F. Gerald, Fairfield.

MICHIGAN STATE STREET RAILWAY ASSOCIATION.

President, W. L. Jenks, Port Huron; Vice-President, W. Worth Bean, St. Joseph; Secretary and Treasurer, B. S. Hanchett, Jr., Grand Rapids; Executive Committee, the Officers and David H. Jerome, Saginaw, and Strathern Hendrie, Detroit.

THE STREET RAILWAY ASSOCIATION OF THE STATE OF NEW JERSEY.

President, Thos. C. Barr, Newark, Vice-President, W. S. Scull, Camden; Secretary and Treasurer, Charles Y. Bamford, Trenton; Executive Committee, Officers and C. B. Thurston, Jersey City; H. Romaine, Paterson S. B. Dod, Hoboken.

Petersham and Frank F. Stanley, Swampscott, Mass., trustees. Filed Mar 30, 1894.

545.494. Railway Block-Signal System. Alvah W. Hall, New York, N. Y., assignor of one-half to Alfred M. Collett, same place. Filed June 15, 1895.

545.495. Support for Overhead Electric Conductors Melancthon Hanford, Malden, assignor to Charles J. Goodwin, Springfield, Mass. Filed Apr. 25, 1894.

545.498. Electric Brake. William L. Hedenberg, New York, N. Y. Filed May 7, 1894

545,520. Trolley-Guard. James T. Moody, Wm Shawd, and Adam J Baker, Springfield, Ohio. Filed Feb. 23, 1895.

545.524. Electric Motor. John O'Neil, New York, N. Y. Filed June 22, 1894.

545,532. Telegraph-Key. George F. Philbrook, Lisbon, Falls, Me. Filed Jan. 19, 1895.

545,553. Electric Igniting Apparatus for Gas-Engines. Henry Thau, New York, N. Y., assignor to James W. Irwin, same place. Filed Oct. 20, 1894.

545,554. Alternating-Current Generator or Motor. Elihu Thomson, Swampscott, Mass. Filed Sept. 29, 1891.

545.569. Electric Tool and Machine, Henry H. Bliss, Washington, D. C., assignor to Joseph A Jeffrey, Columbus, Ohio. Filed Dec. 24, 1886.

545,570. Electric Coal or Rock Drill. Henry H Bliss, Washington, D. C., assignor to Joseph A. Jeffrey, Columbus, Ohio. Filed Sept. 6, 1888.

545,579. Car-Fender. Robert Bustin, Boston. Mass., assignor of two-thirds to Wesley Vanwart, Fredericton, and John R. McConnell, Marysville, Canada. Filed Dec. 5, 1894.

545,591. Electric Motor. Otto E. H. Kramer, St. Louis, Mo. Filed Apr. 23, 1894.

545,592. Eleciric Moror. Otto E. H. Kramer, St. Louis, Mo. Filed May 10, 1894.

545,620. Cleat for Electric Wires. Montraville M. Wood, Chicago, Ill. Filed Jan. 11, 1895.

545,629. Safety Appliance for Electric Conductors. Adelbert E. Hutchins, Detroit, Mich. Filed May 5, 1893.

545,637. Teletyper. Charles Spiro, New York, N. Y. Filed Dec. 18, 1894.

545,694. Trolley-Arrester. Henry F. Hildebrandt, Rochester, N. Y., assignor of one-half to Martin C. Rutherford, same place. Filed May 6, 1895.

545,653. Electric Alarm. William S. Hull, Dallas, Tex. Filed Nov. 26, 1894.

545,664. Method of and Apparatus for Controlling Current for Electric Motors. Thorston von Zweigbergk, Cleveland, assignor of one-half to George C. Worthington, Elyria, Ohio. Filed Nov. 1, 1894.

545,670. Electric Transformer. William F. Brittin, Allegan, assignor of one-half to Edwin N. Howe, Coldwater, Mich. Filed Nov. 16, 1894.

545,686. Trolley. Zachry T. Furbish, Augusta, Me. Filed July 12, 1895.

545,693. Asynchronous Motor. Maurice Hutin and Maurice Leblanc, Paris, France, assignors to the Societé Anonyme pour la Transmission de la Force par l'Electricité, same place. Filed Apr. 19, 1895. Patented in France, May 12, 1894, No. 238,502; in Germany, May 26, 1894, No. 79,588; in Austria, June 4, 1894, No. 44/5,477, and in Belgium, Sept. 29, 1894, No. 112,045.

545 694. Electric-Arc Lamp. Rudolf H. Jahr, Opladen, Germany. Filed Nov 26, 1894. Patented in Belgium, Sept. 10, 1894, No. 111,772.

545,696. Electric Time-Check Receiver. Charles K. Jardine, Georgetown, British Guiana. Filed Mar. 26, 1895.

545,699. Electrical Annunciating-Target. Otto Kauffmann, Sacramento, Cal. Filed Nov. 15, 1894.

545 704. Safety-Fender for Street-Cars. Jay B. Lyford, Bridgeport, Conn., assignor to the Lyford Car Fender Company, Boston, Mass. Filed Aug. 29, 1894. Renewed July 20, 1895.

545,736. Electric-Arc Lamp. Rudolp Segerdahl, Chicago, Ill. Filed Apr. 26, 1894.

545,771. Safety Attachment or Fender for Cable, Electric, or Other Cars. Robert Bustin, Boston, Mass., assignor of two-thirds to Wesley Vanwart, Fredericton, and John R. McConnell, Marysville, Canada. Filed Feb. 9, 1895.

545,781. Car-Fender. William H. H. Diffenbaugh, New York, N. Y. Filed June 3, 1895.

545,806. Trolley-Wire Support. John W. Meaker, Evanston, Ill. Filed Nov. 17, 1894.

545,815. Electric Signaling Apparatus. Benjamin Price, Baltimore, Md., assignor to the Electric Selector and Signal Company, of West Virginia. Filed Apr. 24, 1894.

545,819. Electric Insulator. Daniel M. Rothenberger, Lancaster, Pa., assignor of two-thirds to Charles A. Inglis and Edward D. Reilly, same place. Filed Mar. 8, 1895.

545,833. Bond for Electric Railways. Elonzo S. Wheeler, Saugatuck, Conn., assignor of one-half to Clarence L. Wheeler, Marion, Ind. Filed Jan. 14, 1895.

545,835. Electrical Burglar-Alarm. John R. Alexander, New Albany, Ind. Filed Mar. 20, 1895.

ELECTRICAL AGE

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NEW YORK, SEPTEMBER 21, 1895.

CONTENTS.

ELECTRICITY ON THE BROOKLYN BRIDGE.

At a recent meeting of the trustees of the Brooklyn Bridge a resolution was passed instructing the chief engineer to investigate the subject of "electric motive power for the propulsion and switching of trains on the bridge." This is the first positive action taken by the trustees looking to the adoption of the electric system. The bridge presents most favorable conditions for its introduction and operation, and about three years ago THE ELECTRICAL AGE drew particular attention to the subject and printed interviews with Mr. Frank J. Sprague and other prominent electrical authorities. These gentlemen agreed as to the feasibility of using electric power for propelling the bridge cars.

A NEW IDEA.

A correspondent asks if it is not practicable for a person to carry enough stored electricity and use it for the purpose of heating the body by means of a system of electric heating apparatus placed under the clothing? We presume it is. A few 200 ampere-hour cells scattered among the pockets, connected in series, ought to do the business. They would probably weigh 500 pounds or more; and to this must be added the weight of heat apparatus. The latter need not necessarily be in the form of a street-car heater; it could be spread out on a flat surface. It would not look well, for instance, to carry a box-shaped heater across the stomach. Care must be taken to prevent short-circuiting, which might result in roasting to death.

ELECTRIC POWER ON STEAM ROADS.

According to a reported statement made by a prominent official of the New York, New Haven and Hartford Railway Company, the experiment of operating the Nantasket Beach branch of that road by electric power has given complete satisfaction. The fact is already well established that the greater the travelling facilities the greater is the travel, and it has been practically demonstrated in the case of the Nantasket Beach experiment. Cheap and frequent trains created so much more traffic during the past season that the company's statistics for the summer just closed show an increase of three hundred per cent. over the business of last year, when the steam system was in operation. It is hinted that the company may adopt electric power for the movement of its freight trains, recent experiments in that direction having resulted with entire satisfaction. It is also reported that the company will further adopt the electric system, and introduce it on the link line between Nantasket Junction and Braintree, and on a portion of the Providence division. This augurs well for the future of this application of electric power.

ELECTRICAL EFFECTS.

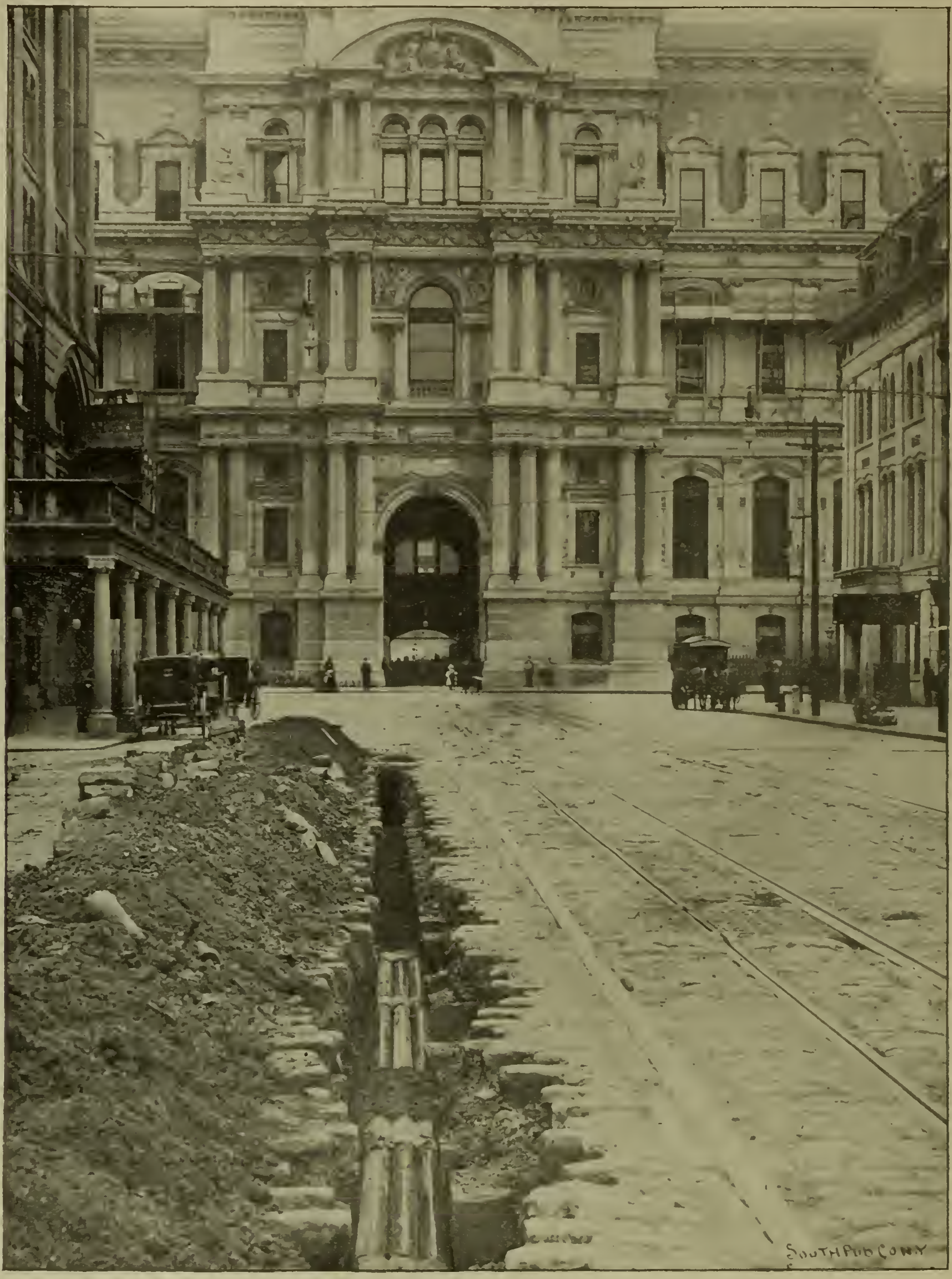
Without the aid of electricity celebrations of important public events would be comparatively tame and lifeless affairs; the brilliancy and splendor of the electric light and the artistic effects produced by it would not charm the eyes of the beholders, and glittering beauty would not stir the soul. But with electricity all things are possible. Darkness gives way to its power, and effects are produced that surpass anything in nature for brilliancy and beauty. During the Columbus celebration in this city in 1893 some of the floats in the night parade were marvels of beauty and art, rendered so by the aid of electric light, and many other prominent events since owe their great success to electricity. The electrical decorations in Boston during the recent conclave of the Knights Templar were superb in conception and execution, and just a few days ago Sacramento, California, celebrated an important public event in a most brilliant and successful manner through the instrumentality of electricity. In June next Cleveland, Ohio, will celebrate its 100th anniversary, and it is promised that the electrical features on the occasion will surpass anything ever before attempted. A new idea will be introduced in the shape of a parade of illuminated trolley cars, and floats illustrative of the city's industries will constitute marked features of the celebration.

THE NATIONAL UNDERGROUND CONDUIT SYSTEM.

The wrought iron cement-lined tubes for electric subways manufactured by the National Conduit Manufacturing Company, of New York, have been so thoroughly subjected to the test of time that the system can now be classed among the leaders of underground conduits.

This company is probably the oldest conduit manufacturing company in that line of business, its first conduits having been laid in New York City in 1887. The National Company has been continuously in the business ever since, and has the record of having furnished over 85 per cent. of all the conduits that have been laid in this country and Canada, the majority of which was constructed as well by the company.

The tubes used by the National Conduit Manufacturing Company are made of the toughest wrought iron, lined with pure hydraulic cement, and are laid in the ground in a mass of hydraulic concrete, thus making a subway practically out of solid rock, leaving smoothly finished holes or ducts for the drawing in of the cables.



FEED-WIRE SUBWAY, PHILADELPHIA TRACTION CO.

Conduits thus constructed are said to be absolutely indestructible, have no injurious effect upon any style of cable that may be desirable to use, and when once laid are good for all time.

The standard manhole is a square or oblong chamber built of brick, at maximum distances of 400 feet apart, preferably at the intersecting streets. A heavy cast-iron frame, having a removable cover, gives access to the manhole from the street. The company has laid down in Philadelphia alone no less than 5,000,000 feet of ducts (about 946 miles) for the Philadelphia Traction Company, whose lines ramify the city. This great work was begun on March 1, 1893, and is still being carried on. The contract for this work is the largest ever taken, and the subway for four miles of its length is the largest in existence, having no less than 65 ducts.

The conduits cover 210 miles of streets, and the number of ducts vary from three to 70, excepting in the section above mentioned, where there are 65

We give on the opposite page a view of the feed-wire subway built for the Philadelphia Traction Company in Market street, near the city hall, Philadelphia, and in another illustration is shown the method of drawing in the cable in the conduits of the Philadelphia Traction Company. All of the feeders used by the Philadelphia Traction Company in their conduits were made by the Standard Underground and Cable Company, of Pittsburgh, Pa , some of the largest cables ever constructed being among the number.

DRAWING IN UNDERGROUND CABLES, PHILADELPHIA TRACTION CO.

THE MONTREAL CONVENTION OF THE A. S. R. A.

As the time approaches for holding the next convention of the American Street Railway Association interest grows rapidly.

The meeting will be held, as already noted in The Electrical Age, at the Windsor Hotel, Montreal, on October 15, 16, 17 and 18, next, and judging from the demand for rooms there is a promise of a very large attendance.

The Victoria Rink, at the rear of the hotel, has been engaged as an exhibition hall, and much activity is displayed in the supply trade in this regard. There will likely be a very large display of street railway appliances, and it is the purpose of all concerned to make this exhibition the most interesting of any ever held at previous conventions. A cordial invitation is extended to all manufacturers and producers of street railway supplies to exhibit their machinery and wares, and many of the most prominent manufacturers of electrical apparatus and supply dealers have signified their intention of making a display of goods that will be worthy of the occasion.

The customs regulations will be complied with in a special arrangement, which was fully described in our issue of July 20, last.

A special train will be run from New York to Montreal, over the New York Central and Hudson River Railroad Company's lines, for the accommodation of delegates.

The train will leave the Grand Central station, Forty-second street, New York, Monday, October 14, at 6 P. M., arriving in Montreal Tuesday morning, October 15, in time for breakfast. A dining car will be attached to the train leaving New York.

Passengers from all points West can connect with the special at Utica, N. Y., Monday night by leaving the following cities at the hours mentioned :

St. Louis, 7:55 P. M., October 13 ; Cincinnati, 8:25 P. M., October 13, *via* "Big Four."

Toledo, 9 A. M., October 14 ; Cleveland, 12:50 P. M., October 14, *via* Lake Shore.

Detroit, 9:40 A. M., October 14, *via* Michigan Central.

Buffalo, 6:50 P. M , October 14 ; Rochester, 8:43 P. M., October 14 ; Syracuse, 10:50 P. M., October 14, *via* New York Central.

Arrangements are being made for a daylight return trip through the beautiful Adirondack scenery, including a stop at Lake Saranac.

The special rate of a fare and a third for the round trip has been granted, making the cost of a ticket from New York city to Montreal and return $13.35. Tickets should be bought from all points on the certificate plan, the purchaser taking a delegate's certificate from the ticket agent, which, when properly countersigned at Montreal, will entitle the holder to a return trip at one-third the regular fare. Wagner sleeping car accommodations will be provided at the usual rate of $2 per berth from New York city to Montreal.

The committee in charge would respectfully urge all who intend to take this special train to reply at once, in order that ample accommodations may be provided and proper assignments made.

Inquiries relating to the reservation of berths, tickets, etc., should be addressed to M. C. Roach, General Eastern Passenger Agent, 413 Broadway, New York, or any member of the committee.

John N. Partridge, Chairman, Secretary American Street Railway Association, Brooklyn, N. Y.

Jas. H. McGraw. Havemeyer Building, New York.

Charles W. Price, 13 Park Row, New York.— *Committee.*

LONG DISTANCE TRANSMISSION AT 10,000 VOLTS.

The Pomona Plant.

BY GEORGE HERBERT WINSLOW.

(*Continued from page 146.*)

These observations, which were made on the Pomona circuit during hot, dry and cloudless weather, show conclusively that the lines were heavily charged by the action of the wind. The wind no doubt blows electrified air and dust against the wires, the latter thereby accumulating a static charge with a rapidity which we have seen depended on the speed of the wind.

Some curious conditions met with in the operation of the plant are shown in the ampere curves in Fig. 6, which were taken during very wet weather. Taking the maximum load measurements at 7 P. M. for March 14th and 8th, we note that the total apparent energy delivered by the substations is 73 per cent. and 75 per cent., respectively, of that delivered by the generator, while for a smaller load at 9 P. M. the respective percentages decrease to 47.6 per cent. and 48.6 per cent., in spite of the fact that the apparent energy delivered by the generator is in the latter case only half as great as in the former. The results are due to

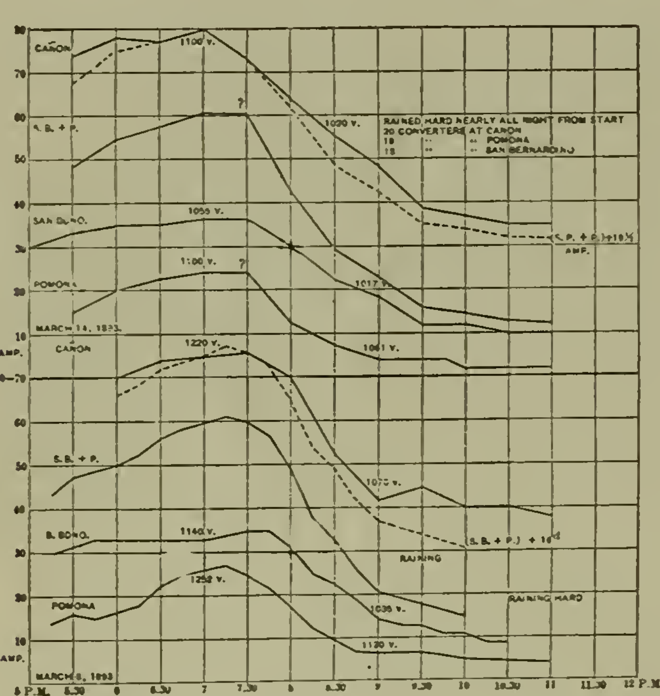


FIG. 6.—Ampere Curves. Showing Excess of Canon Load and also Decrease in Difference between Canon Load and the sum of Pomona and San Bernardino Loads as the Canon Load Increases.

Note increase due to rain. Raining in afternoon and nearly all night at Pomona. Snowing throughout canon and a mile or so outside of mouth of canon. 8 inches of snow at power-house. covering insulators and cross-arms completely. 1 inch of snow on wires. Snow damp and clinging. No wind. 20 conductors at Canon. 19 at Pomona and San Bernardino. 12 P. M.

changes in the angle of lag caused by changing the load.

In the canon curve of March 8th, the load at 9.30 P. M. is seen to have increased considerably, although the substation loads were decreasing. This increase was due to the fact that the rain, which had previously ceased to fall at Pomona, began again.

The electrical resistance of the Pomona circuit is 74.9 ohms and that of San Bernardino 156.4 ohms at about 90 degrees F.

The insulation resistance of the circuits varies from far beyond the limits of an 11-megohm bridge in dry, hot summer weather to as low as 0.65 megohm during light rain. The latter value is that obtained with the two San Bernardino wires in series, and represents an insulation-resistance per mile of over 37 megohms. On a clear, sunny day the insulation-resistances of one Pomona wire and of one San Bernardino wire were respectively 11 megohms and 5½ megohms, which are in the exact relation which would be expected.

The lines cannot be tested for grounds or for continuity with a magneto bell, as their capacity is such that the bell will ring loudly when the wire is perfectly insulated and the circuit open. This capacity also prevents the use of the ordinary converter test for line leakage, as the lamp on the secondary will burn as though there were a ground even when the line is perfectly clear. By adding lamps, however, the light may be cut down until the last lamp added extinguishes them all. This would not occur if the light of the first lamp was due to a difference of potential on the primary caused by a ground, as then the added lamps would become as bright as the first. The primary

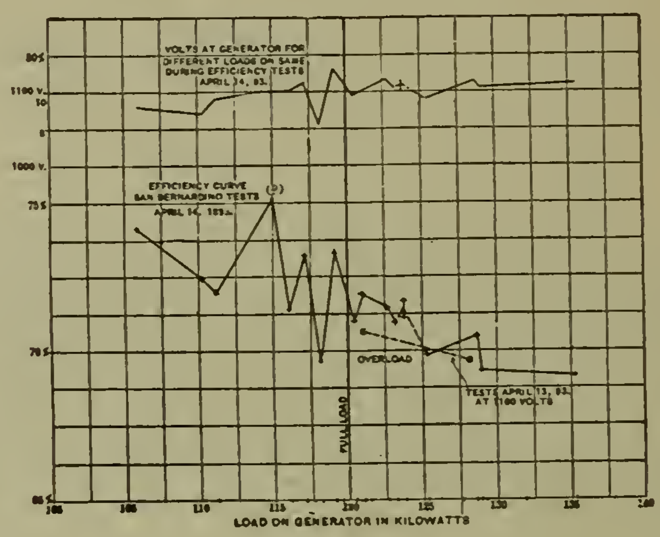


FIG. 7.

current is thus seen to be limited, and to be due to the capacity of the line. If the proper number of lamps has been added to just secure darkness when the line is known to be free from grounds the converter may be used to show grounds on that line, since the presence of a ground will cause all the lamps to brighten. The line test should only be made after ascertaining with one lamp that the generator is not grounded, as otherwise the leakage current for the greater number of lamps might burn the insulation of the generator. A very good example of Prof. Fleming's "condenser effect" was met with in the summer of 1893, while the engineer was trying this converter test for measuring line leakage. The primary of a 1000–100-volt converter was connected between the ground and one terminal of the generator, the other terminal of the latter being connected to one wire of the Pomona circuit. The resulting secondary pressure was 30 volts. which made one lamp burn dimly. When ten lamps were turned on, the pressure dropped to 14 volts. When all lamps were turned off the pressure became ten times as great, or 140 volts, One generator brush was then raised, and the second leg of the circuit was connected to the first. On completing the circuit again there was a sudden flash of the armature, followed by a crackling noise and a brush discharge which lasted until the circuit was broken. The Pomona wires were then disconnected from the dynamo terminal, which was left free. With this arrangement faint sparks and a glow were noticed, as though the armature winding were grounded on the core, but a Wheatstone bridge test showed an insulation resistance of over ten megohms. Since then the machine has been used regularly and has not broken down, so it is evident the spark must have resulted from a sudden increase of the potential of the armature winding above that of its core, which latter was permanently connected to earth.

This sudden increase may be explained as follows: On closing the circuit the condenser formed by the line and the earth began to discharge through the metallic circuit afforded by the armature and converter windings, but the inductance of this circuit checked the discharge so quickly as to produce an excessive pressure, which could only be relieved by the discharge taking place through the insulation of the armature-winding to the grounded core, which is what happened.

A similar test was made on the San Bernardino wires in the previous January during dry weather, the only change being that the single lamp was not turned off. With only one wire connected, one 16 C. P. lamp came nearly to candle-power. On connecting the second wire to the first (at

San B.) the lamp burned at full candle-power. Ten lamps (the full load) were then put on the converter and burned dimly. As they were turned off one by one, the others brightened until the last lamp lighted up as before. This test did not canse any discharge on the armature, in spite of the fact that the circuit was twice as long and the capacity thus twice as great. The probable explanation of this is that the inductive resistance of the converter was not so great as in the other case, on account of the single lamp being left burning. It is also possible that the break-down in the other test was assisted by the presence of copper dust on the winding.

A comparison of the San Bernardino switchboard voltmeter was made with a Weston instrument and gave important results.

1st. With *no load* the San Bernardino instrument was about 14 volts (11.2 per cent.) low at 125 volts, while at 97 volts it was only 11.7 volts (12 per cent.) low.

2nd. With a *city load* (inductive, consisting of lightly loaded converters) of 7½ amperes it was 11 volts low between 107 and 96 volts, while for 15 amperes it was only 8.5 volts low. Further increase in load caused further reduction in the difference, until for 40 amperes the instrument was only five volts low.

3rd. With a *tank load* (non-inductive) of nine amperes it was only nine volts low at 99 volts, and as the load was increased the difference decreased until for 97 amperes the instrument read the same as the Weston.

It is evident from these observations that a voltmeter which consists essentially of a solenoid and a movable core, is not the proper type of instrument for circuits such as those used in the present case, in which transmission circuits of great length are used in conjunction with transformers. The voltage at San Bernardino during the tests was therefore measured with a Weston portable voltmeter.

A comparison between the ammeters used at Pomona and San Bernardino showed that for readings above 67½ amperes the San Bernardino instrument read higher than the other. As there was no reason for considering one instrument more accurate than the other and no way of telling which was right, the San Bernardino readings taken during the test were reduced to the average of simultaneous readings on the two instruments.

A short test of the Pomona circuit was made on April 11th, the results of which are given in Table I.

A preliminary efficiency test on the San Bernardino circuit was made April 13, 1893, with the results shown in curve in Fig. 7. In this, as in all the other tests, a variable load was obtained by the use of a water resistance.

An efficiency test of the San Bernardino circuit lasting five hours, during which the generator was kept at full load or overload, was made April 14, 1893. Readings were taken every fifteen minutes, and the efficiencies and the corresponding voltages for different loads are plotted in Fig. 7. The most prominent feature of this efficiency curve is its irregularity. This is, however, satisfactorily explained by referring to the curve of generator voltage, on which it is seen that the high efficiencies correspond to high voltages and vice-versa.

It will be noted that the apparent efficiencies shown by the preliminary test at San Bernardino agree very closely with the results of the long efficiency test there. On calculating the apparent efficiencies for different loads from data obtained by laboratory tests, and comparing them with the measured apparent efficiencies, it is found that they agree within three or four per cent. This very close agreement is exceedingly gratifying, particularly when we consider that the tests of the plant were made with ordinary commercial instruments, and that the laboratory tests were made about a year before the commercial tests.

An interesting and unique test was made May 2, 1893, by connecting the Pomona line wires in series with the San Bernardino circuit, and transmitting about 100 H. P. to San Bernardino by way of Pomona. The length of the circuit was 85 miles, and the distance of transmission 42½ miles. This is the greatest distance yet covered by any transmission since the Frankfort experiments. The measurements are given in Table II. The apparent efficiencies are much lower than those indicated by calculations, as in the latter no account was taken of the capacity and inductance of the circuit. The voltage of the generator as measured is about five per cent. above that calculated, and the amperes measured notably exceed the amperes calculated. These results are attributable to the introduction of the Pomona loop, which added both capacity and inductance.

In order to reduce the cost of operation, the San Antonio Company first dispensed with the sub-station attendant at Pomona after 11 P. M. This they did sometime before the acceptance of the plant, after assuming the responsibility for any damage which might result. No trouble occurred and, after the acceptance (May 6, 1893), the same plan was put in operation at San Bernardino. After working in this way for several months, the Pomona station was started in the afternoon and then locked up until the next morning. This arrangement was made possible by running the generator so that the lights should not be too high at Pomona, the lights at San Bernardino being kept right by the attendant with the Stillwell regulator.

In January, 1894, another 120 K.W. generator was installed with an equal capacity of oil transformers, and the Pomona and San Bernardino circuits are now each operated from separate generators with separate banks of transformers of 10,000 volts. Since this change the San Bernardino attendant has also been dispensed with, and the bookkeeper starts up in the afternoon and then locks up the station for the night, as at Pomona. The voltage of the lamps on each circuit is regulated by the engineer at the power-house, the generator pressure necessary at different loads to keep the lamps at the proper brilliancy being automatically indicated by the compensating voltmeter on each circuit. Thus after the plant is started the engineer has sole charge.

TABLE I.

EFFICIENCY TESTS. POMONA CIRCUIT.

April 11, 1893.

Canon (20 Converters).			Pomona (18 Converters).			
Amperes.	Volts.	K. W.	Amperes.	Volts.	K. W.	Efficiency per cent.
120	1100	132	105.85	919	97.28	73.7
118.5	1100	130.35	105.85	945	100.01	76.73
119.5	1100	131.45	107.4	929	99.78	75.9

TABLE II.

42½ MILE TRANSMISSION TEST. CIRCUIT TO SAN BERNARDINO, BY WAY OF POMONA, 85 MILES.

May 2, 1893.

Canon (20 Converters).			San Bernardino (18 Converters).			
Amperes.	Volts.	K. W.	Amperes.	Volts.	K. W.	Efficiency per cent.
95	1120	106.4	80.75	847	68.4	64.28
96	1130	108.5	78.8	865	68.16	62.82
100	1200	120.0	81.7	893	72.96	60.8

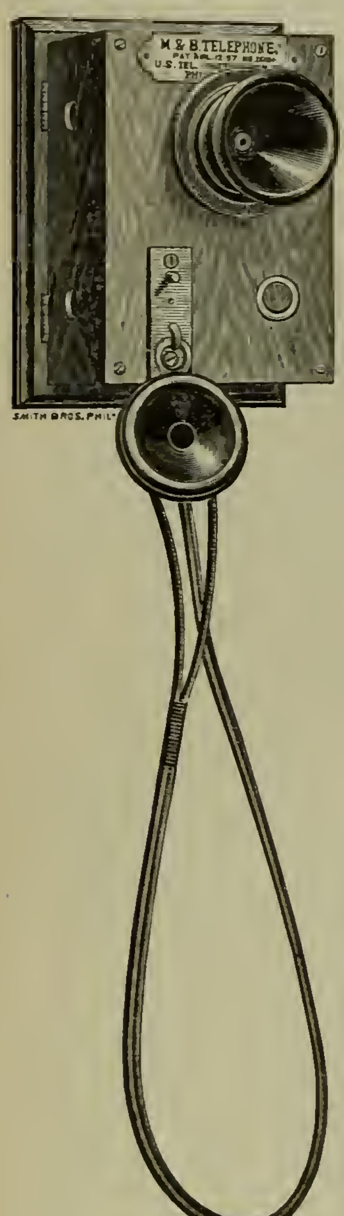
THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

A meeting of the executive committee of the National Electric Light Association was held at the Murray Hill Hotel Tuesday evening, September 10, with the following members present: C. H. Wilmerding, president; E. F. Peck, vice-president; C. O. Baker, Jr., master of transportation; Charles R. Huntley, E H. Davis, A. Markle, W. R. Gardener, G. A. Redman, J. J. Burleigh, John A. Seely.

A committee composed of John A. Seely, E. F. Peck and A. J. DeCamp was appointed to consider the matter of holding an electrical exhibition in connection with the nineteenth convention of the association, to be held in May, 1896, in New York. This committee was clothed with power to act, and will report as soon as possible to the full board.

THE M. & B. TELEPHONE IN THE MANUFACTURERS' CLUB, PHILADELPHIA.

Since the United States Telephone Construction Co. has had the M. & B. telephone on the market they have gotten up a good many designs and instruments for interior use. The accompanying illustration shows one type known as style E, which is in use in the Manufacturers' Club, Philadelphia. This club has recently acquired property adjoining its club house and fitted it up into parlors and bachelors' apartments. There are 17 rooms, each of which is supplied with one of these style E, M. & B. telephones. In the cashier's office downstairs there is a needle annunciator manufactured by the Partrick & Carter Co., to which are added telephone connections and a fire-alarm system. In each of the style E telephones is placed a fire-alarm bell. The telephone measures 4½ by 6½ and is 3½ inches deep. It is made of polished oak finished with a



M. & B. TELEPHONE.

black rubber face and nickel trimmings. All the batteries of this system are in the basement, and the arrangement is such that any of the rooms can communicate with the office, or intercommunication can be effected between any points desired. The annunciator is in the hallway, by the cashier's desk, where there is always some one in attendance. The service given by this arrangement is extremely satisfactory, and combining as it does a fire-alarm system with the telephone system, makes it doubly valuable. In case fire should be discovered any employé can go to the annunciator, open a little door in front and pull out a plug which releases the clock-work mechanism and starts the fire-alarm going. This rings all the bells throughout the house, so that the system insures both convenience and safety to the occupants of the club.

Train-Lighting.—Electric lighting for railway carriages, which has for some time been in use on a few of the leading Russian railways, is now, it is said, to be adopted for the express and mail trains on them all.

HORSELESS CARRIAGES.

Horseless carriages are attracting universal attention just now in Europe and America, and it looks as if these vehicles will become as common on our streets as ordinary horse carriages.

Considerable interest is taken in horseless carriages at the present time through the Chicago *Times-Herald* prize contest for all horseless carriages to run from Milwaukee, Wis., to Chicago, on November 2 next, and machines of this class will then have an opportunity to have their merits tested. One of these vehicles which will enter the contest is illustrated herewith. It is made by the Horseless Carriage and Oarless Boat Co., 1616 Masonic Temple, Chicago.

The chief features claimed for the motors used in propelling these carriages are:—Perfect practicability, simplicity, strength and durability of construction, and adaptability to any style of conveyance; lightness combined with force, weight decreased and horse-power doubled, the motor being the smallest, most compact and powerful known; ease of starting, stopping, turning and running,

HORSELESS CARRIAGE.

backward or forward, the same being governed by a new device; the motor is central and direct-acting, and the driving-wheel is central with the weight; the mechanical arrangements are most effective, and always reliable; can be run fast or slow, and brake is applied instantly; broad tires, ball bearings and all modern improvements used; the small amount of oil and water to be carried and the unusual lightness of the entire outfit insures the greatest possible speed; perfect safety in every particular and freedom from any objectionable feature, while the ease with which it is managed enables anyone to control it; smallest cost to buyer; least expensive to run, but strong and practical in every point.

The distinctive points of this Motocycle were invented by Wilber S. Salisbury, the inventor of a Street-Car Motor, "Portable Propellers" for Boats and many other successful electrical devices.

—It has been laid down as a general rule that, for the transmission of any given current, the size of the conductor most economical to employ is one offering such a resistance that the cost of the energy wasted per annum, in heating the conductors, should be equal to the interest per annum on the original outlay upon them.

LOSSES OF EFFICIENCY.

W. F. C. HASSON.

In THE ELECTRICAL AGE of July 6, 13 and 20 appears a series of articles concerning the electric transmission plant at Bodie, California, by F. M. F. Cazin, of Hoboken, N. J.

The subject matter of these articles is so full of error as to render them unworthy of consideration, excepting for the fact that the Editor of THE ELECTRICAL AGE has evidently taken them seriously, and been led into writing an editorial, in the issue of July 20, which casts discredit upon Mr. Leggett, and also upon the Institute of Mining Engineers.

Mr. Leggett having left the United States, the writer, being thoroughly conversant with the facts concerning the Bodie plant, desires to put the subject in its true light to THE ELECTRICAL AGE.

Mr. Cazin's whole argument is based upon the following statement in Mr. Leggett's article :

"The pipe leads into a receiver, 40 inches in diameter and 9½ feet long, from which four taper pipes lead the water on, under pressure of 152 pounds per square inch, to as many 21-inch Pelton water-wheels, each wheel being fitted with two nozzles and *rated* at 60 horse-power under the largest sized tips of 1⅓ inch diameter."

Mr. Cazin then assumes that the largest sized nozzles were used, and that the wheels were continually supplied with sufficient power to develop this rated capacity, independent of the load on the motor.

On this basis the efficiencies are estimated. Further comment is unnecessary, and it is a waste of time to endeavor to find any logical reasoning in the mixture of c. g. s. and f. p s. units that follow.

It so happened that when Mr. Leggett contracted for the machinery for the Standard Consolidated Mine, in July of 1892, he decided to operate the mill machinery only by electricity, and to leave the steam plant for the pumping and hoisting machinery at the mine in operation for the time being. However, on investigation, he decided to install a water-wheel plant sufficiently large to meet future demands.

Additional motor capacity amounting to 100 H. P. has been installed during the past few months, and is now in successful operation.

Nozzles of various sizes have been used to meet the varying demands.

The efficiency, or inefficiency, if one pleases, of water-wheels, has been recognized and accepted.

The vital question has been what efficiency of transmission from water-wheel axle to motor axle could be attained. To this question was Mr. Leggett's article devoted.

He frankly states the difficulties that were met, how they were overcome, and the manner in which the measurements were made.

The paper being the first independent account of many of the difficulties met in the electric transmission of power long distances, has been of considerable interest and value.

In taking the efficiency of generator and motor at 90 per cent., Mr. Leggett has been entirely too conservative, as the higher efficiencies stated by Mr. F. H. Davis can unquestionably be attained.

There is one chance for misapprehension in Mr. Leggett's article. Under the heading of "Approximate Efficiency of the Transmission," is a column "Approximate per cent. of Water-Power obtained at Motor Pulley." A brief inspection of the table shows that "Water-Power" refers to "Horse-power given out by water-wheels."

Any chance of a misunderstanding is removed by the final paragraph of the article, which states, "......the final efficiency of the transmission, from the water-wheel shaft to the motor pulley driving the mill, results as follows :" etc.

—By a decision of the Congregation of Bishops in Rome the telephone is to be admitted into Italian nunneries. A strict censorship will, however, be maintained over the service.

PRINCIPLES OF DYNAMO DESIGN.

BY

Newton Harrison E.E.

(*Continued from Page* 136.)

The importance of carrying out the principle of having the coil about to be commutated rotating in the magnetic fringe of the pole-piece is not to be neglected. With a sparkless machine and easily running bearings there is but little cause for anxiety to the engineer. Remarks have already been made regarding the effect of a change in the air-gap upon the action of the dynamo. Unless the necessary compensation be made, when it is either increased or diminished, in the ampere-turns, there will be a rise or fall of E. M. F. of a startling nature. By widening the gap more ampere-turns are required to supply the necessary M. M. F., but at the same time the increased resistance to cross-magnetization ameliorates, to a large extent, this loss and makes the machine smoother running from an electrical standpoint. The intimate relations existing between the parts of a machine can thus be realized and the necessity for their careful consideration and perfect adjustment become evident.

To approach that condition of sparklessness so much to be desired in all machines, so that at normal load the commutator is not affected, the radius of the armature, length of the air-gap and length of the arc of embrace of the pole-pieces must be of the correct dimensions.

The circumflux, by limiting the diameter, gives a means of proportioning the air-gap and polar-face in the proper manner ; the value for the circumflux for ring armatures is

d = cms. $\quad Q = 400d$ for safe loads (rings),
and for drums $\quad Q = 600d$ " " (drums).

Other authorities have different ways of expressing the same thing. In a two-pole machine Gisbert Kapp allows 1,000 ampere-turns on the armature for each inch in excess of a diameter of one foot. In the formula by Esson the same for inches would be

for rings $Q = 1000d''$ $\quad d''$ = diam. in inches.
for drums $Q = 1500d''$

Therefore, with an armature of a diameter of two feet of the ring type the safe load is $1000 \times 24 = 24{,}000$ = circumflux, and if 12″ diameter of the drum-type the circumflux = 18,000.

Pole-pieces.—The excellence of this system of Esson, of considering *the current circulating under each pole*, has removed many of the difficulties of design hitherto experienced. The circumflux of a dynamo depends upon certain factors already given, which determine the depth of the air-gap. They are capable of such change as the requirements of the case demands. That is to say, the specific induction in the air-gap, the radial depth of the air-gap and number of degrees of polar-face can be modified to change the output of the machine. As the specific induction in the air-gap is limited by the conditions of practice, in many cases, its average value can be assumed and specifically given. Usually B = 5000 lines of force per sq. cm. or 31,250 per sq. inch, but it can be safely taken as from 35,000 to 40,000 per sq. inch for practical purposes. These conditions enable certain limitations to be expressed regarding the ratio between the length of the air-gap and the diameter of the armature when either drum or ring. With the angle of the polar-face varying in its size from 120° to 130°, for two-pole machines the value of l_2 is as follows :

Rings	for	pole-piece	130°,	gap space,	$\frac{1}{28}$	diameter.
Drums	"	"	"	"	$\frac{1}{18}$	"
Rings	"	"	120°,	"	$\frac{1}{29}$	"
Drums	"	"	"	"	$\frac{1}{19}$	"

Thus any span of pole-piece determines the air-gap depth with a limited circumflux. The formula of Thompson

$$Q = \frac{277\ B\ l_2}{\Psi}$$

B = field strength in air-gap,
Ψ = angle of pole-piece span,

takes into consideration the field strength in the air-gap, thus showing that any increase in the polar span or arc of embrace necessitates an increase either in B, the field, or in l_2, the radial depth of the gap, because the preceding formulas have shown the limits to which Q can be carried in terms of the diameter. To illustrate the method

$$Q = \frac{277\ B\ l_2}{\Psi}$$

if B = 5000 in gap,
Ψ = 120°,
Q = 400 d (cms.) ring arm.

$$\text{but } Q = 400\ d = \frac{277\ B\ l_2}{\Psi} = \frac{277 \times 5000 \times l_2}{120^\circ}$$

$$l_2 = \frac{120 \times 400}{277 \times 5000}\ d = \frac{1}{29}\ d,$$

therefore in the design of armatures the harmony of conditions must exist between the circumflux, span of pole-piece, depth of air-gap and magnetic field in gap.

The circumflux or load on the armature can be increased if the field be bored out further or the polar-face reduced in length. The utilization of any of these methods will mean a greater consumption of energy for the support of the field. The use of large armatures simply gives an added facility for radiation in the shape of greater surfaces. Some idea of the advantages of larger diameter armatures can be gained by the consideration of a fairly large multipolar machine, which, by its great radiative power, smallness of air-gap and more efficient use of field is able to produce a greater output in watts than a bipolar machine of equal weight.

(*To be Continued.*)

OLD-TIME TELEGRAPHERS ENJOY THEMSELVES IN NEW YORK.

The Old-Time Telegraphers' and Historical Association and the Society of the United States Military Telegraph Corps held their 15th annual reunion at the Broadway Central Hotel, New York City, on September 11, 12 and 13. There was a very large attendance, and a most enjoyable time was had by all.

At 10 A. M., September 11, the Old-Timers' Association held its business meeting, and at 2 P. M. the Military Telegraph Corps held theirs.

In the evening an entertainment was given in honor of the visitors at Chickering Hall. An interesting programme was provided by Mr. M. H. Kerner, the director, a well-known Old-Timer.

On Thursday, the 12th, an excursion to and banquet at Long Branch was the feature of the day. One of the Iron Steamboats was chartered for the occasion, and on the way down the party had a good view of the yacht race. At Long Branch an elegant dinner was served at Jaeger's and the visitors got an idea of the hospitality of the New York telegraphers.

The banquet was a very enjoyable, and the day's outing was an unqualified success in every respect.

The rest of the week was spent by many of the delegates in visiting the points of interest in and about the city, including the main telegraph offices of the Western Union and Postal-Telegraph Companies and the Cable offices.

The election of officers of the Old-Timers Association resulted as follows: President, S. A. Duncan, of Pittsburgh; vice-president, J. D. Flynn; secretary and treasurer, W. J. Dealy, New York. Executive Committee: Robert Pitcairn, J. Campbell, M. W. Mead, S. P. Peabody and L. A. Somers.

The U. S. Military Telegraph Corps re-elected its old officers.

TELEGRAPHING 2,000 MILES FOR A CHEW OF TOBACCO.

Telegraph operators as a class are wide-awake sort of fellows, and in their fertile brains are often hatched ideas and schemes that excite wonder in the minds of the uninitiated. Naturally they utilize the electric current for the accomplishment of their purpose, and some funny pranks are sometimes played upon each other.

Two operators in the New York office were sitting side by side, at one of the Chicago duplexes, one sending to and the other receiving from Chicago.

There was a rush of business. Jack Johnson, the sending operator, wanted a chew of tobacco. Jim Hickey, the receiver, was also a chewer of the weed. Jack had no tobacco, but Jim had and Jack knew it. Business and the eagle-eyed traffic chief would not admit of any interruption to the steady flow of messages for a chew of tobacco, so Jack hit upon a scheme that would bring him a chew without any interference with business.

When he had finished sending the message on which he was engaged the yearning for the chew came over him. He thought out a message in his mind and sent it to Chicago thus: "Jim Hickey, N Y. Hand over your tobacco. (Signed) 'Jack,'" telling the receiver at Chicago to pass it over to his partner who was sending to New York. In a few moments Jim received the message, and without taking his eyes off his work he put his left hand in his hip-pocket and hauled forth the coveted tobacco, handed it over to Jack, at his left, and Jack was happy.

A PHENOMENON.

There has always been an inclination to believe in the existence of a fund of nervous energy in the body that resembles the flow of a current of electricity, both in its intangible aspect and its remarkable physiological effects. The nerve centres of the body, or nerve ganglions, all start from the brain as a distinct focus. From here radiate the nerves proper as a complex system with minute tendrils that give rise to sensations of the most agonizing as well as of the most exquisite nature—the blow of a cudgel or the tickle of a straw being equally and as readily perceptible. Although no determinations of a positive character have ever been made, the gymnotus, or electric fish, is a type of organism in which the two functions seem closely allied. The discharge areas are controlled and owe their lasting qualities to the nervous system to such an extent that the fish falls into an exhausted condition if so irritated that its reserve fund of material for electrical phenomena becomes too quickly used.

In South America the eel, which is eaten by the Indians, used to be caught by driving a number of horses into the river and allowing them to receive the discharges from the fish which, when thus weakened, were drawn from the water. In cases of locomotor ataxia the nervous energy is so lacking that the irritation of any part arouses only after a deliberate interval the sensation expected. The gradual transmission of nervous force is forcibly illustrated when a needle is inserted in the flesh; frequently ten seconds elapse before the impression is conveyed to the brain. There is no doubt that the mysterious adjunct of nerve tissue is of a most perplexing nature. Let a nerve centre of the brain be affected and the part of the body controlled by it loses movement and sensation. The almost structureless composition of the brain hides within it the secret of all sensation. The slightest thrill of its particles may mean a thought that will shake the earth with its importance—its quietude means either sleep or eternal peace.

NEW YORK STATE STREET-RAILWAY ASSOCIATION.

The annual convention of the Street-Railway Association of the State of New York was held at the Hotel Kenmore, Albany, N. Y., on September 17, with a large number of delegates and supply men in attendance.

The following-named officers were elected for the ensuing year: president, G. Tracy Rogers, Binghamton, N. Y.; 1st vice-president, W. W. Cole, Elmira, N. Y.; 2nd vice-president, John H. Moffatt, Syracuse, N. Y.; secretary and treasurer, Benjamin Frick, Brooklyn, N. Y.

Executive Committee: H. H. Vreeland, New York: John H. McNamara, Albany, N. Y.; H. M. Watson, Buffalo, N. Y.

The Albany Street-Railway Company took the delegates on a ride over its lines in Albany and then up to Troy and back, and in the evening an elegant banquet was given at the Kenmore.

On the way to Troy the party stopped at the Jones Car Works and were shown all through the great plant by Mr. J. M. Jones, jr. Twelve cars in the shop attracted attention. They are for Providence, R. I. They are piano finish, and in every way superb specimens of car building.

There were a large number of exhibits.

R. W. Rose represented the Hughes Fare Register, 35 Warren street, New York, and showed a sample register.

Mr. H. J. Medbery, of the Medbery Insulation Co., Mechanicsville, N. Y., was on hand with samples of their well-known street-railway appliances.

The Peckham Motor Truck and Wheel Company, of New York, was represented by Mr. E. G. Lang, who exhibited a beautiful model of one of this company's celebrated car trucks.

The Robinson Radial Truck Company, of Boston, showed a model of a truck, and their interests were looked after by J. M. Ripley.

Geo. C. Ewing, of Boston, had a display of a headlight and other car specialties.

The R. D. Nuttall Company, of Pittsburgh, was represented by F. A. Estep

The Consolidated Car-Heating Company, of Albany, had a full line of electric car-heaters in charge of Mr. J. F. McElroy.

R. L. McDuffie, of the firm of Wendel & McDuffie, New York, showed photographs of their street railway sprinklers and snow plows.

The Johnson Company, of Lorain, Ohio, was represented by L. E. Robert. One of their Dupont trucks was shown.

Mr. G. S. Allison, of the St. Louis Register Company, exhibited one of their car registers.

The Stever Rail-Joint Company, Cleveland, Ohio, exhibited a model of their rail-joint, and their affairs were looked after by L. B. Collins.

A. McPherson sand box was shown by Henry McPherson, of Troy, N. Y.

COMPRESSED AIR FOR CAR PROPULSION.

Michael Murphy, president of the Van Brunt Street-Railway, Brooklyn, and Daniel E. Sullivan, superintendent of the Coney Island and Brooklyn Railroad, intend to visit Rome (N. Y.) to investigate the compressed-air system of street-railway now in operation there.

Robert E. Hardie, chief engineer and patentee of the compressed-air system of street-railway car propulsion, is always ready and glad to show the operation of his invention, which can be seen in Rome, N. Y. Street-railway men are looking into the merits of the compressed-air system, and many of them regard it as the coming power for surface and elevated cars. It is stated that the cost of the system is much less than the cable or electric systems. The Hardie motors look something like locomotives. The cylinders hang from the centre of trucks, with 7′, 6″ wheel base, the piston rods connecting with the axles by cranks. There are two motors to each truck. The trucks and motors are built by the Rome Locomotive Works, who are stockholders in the Compressed-Air Company.

The Compressed Air and Construction Company has been organized in Chicago to introduce the compressed-air system of street railways in the West and on the Pacific Slope. A street-railway company in Los Angeles, Cal., is considering an order of 100 cars on this system, and street railway men in Oakland are regarding the system with much favor.

ELECTRIC LOCOMOTIVES IN PERU.

According to a dispatch from Philadelphia a representative of the Baldwin Locomotive works and an electrical engineer from the Westinghouse Company, together with Sir Henry Tyler ex-president of the Grand Trunk Railway, sailed from New York on September 10 for Peru, where it is said a test of the feasibilty of the electric locomotive is to be made on a railroad 15,000 feet above the sea level. Should the report of the experts be favorable it will probably result in a large order for electric locomotives. Mr. Arthur Church is the Baldwin representative, and J. Blunt will act as the Westinghouse Company's representative.

To Be Sold at Auction. — The road of the Suburban Traction Company will be sold at auction at Orange, N. J., on October 14, to satisfy a mortgage of $1,500,000 held by the American Loan and Trust Company of Boston, on which bonds were issued. The proceeds of this sale will be subject to all of Receiver Whittlesey's certificates, and to the underlying mortgage of $60,000 held by the Orange National Bank.

PENNSYLVANIA STREET RAILWAY ASSOCIATION.

The fourth annual meeting of the Pennsylvania Street Railway Association was held in Wilkesbarre on September 4th and 5th. Mayor Nickols, of Wilksbarre, Pa, preceded the regular work with an address of welcome.

On Wednesday, the 4th, Mr. A. K. Baylor, of the General Electric Company, read a paper on "Power Consumption of Electric Railways."

During the afternoon the following-named subjects were discussed: "Laws of Street Railways;" "The Prevention of Accidents and the Adjustment of Damages;" "Belt Lines in Inland Cities;" and "State and Municipal Taxation of Street Railways."

After the reading of the secretary's report the election of officers for the ensuing year was proceeded with and resulted as follows: B. F. Meyers, of the Wilkesbarre & Wyoming Railroad, president; Jno. Lloyd, of the City Passenger Railroad, of Altoona, vice-president; Robert E. Wright, of the Allentown & Bethlehem Railway, second vice-president; S. P. Light, Lebanon & Annville Street Railway, secretary; W. H. Lanius, York Street Railway, treasurer. Altoona was decided upon as the next place of meeting.

In the evening the Wilkesbarre and Wyoming Railroad Company entertained the delegates at Hanover Park.

On Thursday the exhibits were visited in the morning, and in the afternoon a ride was taken of the lines of the Wilkesbarre and Wyoming Valley Traction Co., which was followed by a collation at Hanover Park.

The following named delegates and others interested were present: F. B Musser and F. Bent, of the East Harrisburg Street Railway Company and Harrisburg Traction Company; A. Markle and G. W. Thompson, of Lehigh Traction Company; S. P. Light, of Lebanon and Annville Railway; J. F. Ostrom, of Middletown and Highspire Street Railway; John G. Riggs, Jas. R. Kenney, A. B. Arrowsmith, Reading Traction Company; E. W. Ash, Schuylkill Traction Company; W. S. Duckett, City Passenger Railway, Altoona; B. F. Meyers, John Graham, A.

W. Hollenback, W. J. Eno, J. C. Meixell, James Fagan, John Clifford, of Wilkesbarre and Wyoming Traction Company; Wm. H. Hayes, West Chester Street Railway; E. H. Davis and J. W. Cochran, of Williamsport Street Railway; W. H. Lanius, York Street Railway; J. W. Bonnell, Carbon County Electric Railway. The associate members present were: W. H. Henlings, of the J. G. Brill Company, Philadelphia; R. E. Moore, of the Philadelphia General Electric Company; H. J. Crowley and A. K. Baylor, of the General Electric Company, New York; Wm. Fulling, of the Peckham Truck and Motor Company; J. F. Ostrom, of Pennsylvania Steel Works; Arthur H. Allen, of Westinghouse Electric and Manufacturing Company; E. M. French, Quaker City Rubber Company; W. T. Dixon and J. W. Perry, of the Philadelphia branch H. W. Johns Manufacturing Company; Frank Mansfield, of Breese & Mansfield, Philadelphia; John Howard Yardly, of the Philadelphia Wheel Company; F. A. Lex, of A. Whitney & Sons, Philadelphia; F. W. Darlington, Philadelphia, of the John A. Roebling's Sons Company, Trenton, N. J.; S. L Nicholson, of James Boyd & Brothers, Philadelphia; Chas J. Mayer, of R. D. Nuttall & Co., Allegheny City, Pa; F. D. Russell, Rochester Car Wheel Works; John S. Pugh, John Stephenson Co., New York; J. A. Hanna, McGuire Mfg. Co.; F. A. McGee, The E. S. Greeley & Co., New York; A. C. Vosburgh, New Process Rawhide Company, Syracuse, N. Y., and many others.

The exhibits included a display of packing and belting by the Quaker City Rubber Co., of Philadelphia, in charge of Mr. E. M. French.

The Peckham Motor, Truck and Wheel Co, of New York, had a model of one of their trucks on exhibition.

The H. W. Johns Co., of New York, showed a full line of their products for street railways. The exhibition was in charge of T. D. Dixon and Jas. W. Perry, of the Philadelphia office.

A. Whitney & Sons Car Wheel Works, of Philadelphia, showed a pair of 33-inch car wheels on an axle all ready for use. Brake shoes and wheels were also shown separately.

The Consolidated Car Heating Co., of Albany, N. Y., showed several samples of its electrical heating devices; Mr. H. N. Ransom representing the company.

Mr. John C. Dolph represented the Forest City Electric Works, of Cleveland, Ohio, and exhibited a line of that company's well-known commutator bars.

SUCCESS OF THE NANTASKET BEACH ELECTRIC ROAD.

Mr. J. R. Kendrick, third vice-president of the New York, New Haven & Hartford Railroad Company, in an interview a few days ago said, regarding the electrical equipment of the Nantasket Beach line:

"We are entirely satisfied with our experiment on the Nantasket Beach business, the season having demonstrated the fact that the cheap and frequent trains create traffic. The passenger statistics for the summer just closed show an increase of three hundred per cent. over those for the season of 1894, and next year we expect these figures will be beaten. The tests made the other day in the matter of demonstrating the practicability of electricity in its relation to the freighting business were also eminently satisfactory, and mean a great deal in the application of the current to all branches of rail transportation. In regard to the report that our company was taking steps looking to the equipment of the link between Nantasket Junction and Braintree with electricity, I am at liberty to say that it is in every way correct. The plan that will be carried out provides for four tracks, the two outer for trolley cars, and the inner for steam. The centre tracks will be fenced in, so that there will be no possibility of injury to passengers when taking the electrics. We expect to have the line in full working order and running in connection with the Nantasket Beach branch by the first of next season.

"Other roads are keeping a close watch on whatever we do. It has been practically decided to use the current, in connection with steam, as far out as Readville and Dedham on the Providence division. There will be four tracks on the elevation, the outer ones being for trolley cars.

ELECTRIC RAILWAYS IN EUROPE.

In a recent number of *L'Industrie Electrique* is given details of the electric railways and electric tramways in operation, in course of construction, or projected, in England and European countries on January 1, 1895. These statistics show that the number of lines worked has increased from 43 in January, 1894, to 70 on the first day of the same month of the present year; that the total length has increased from 189 miles to 434 miles in the same period; that the power of the generating stations has advanced from 10,650 kilowatts to 18,150 kilowatts, and that the number of cars and locomotives has risen from 538 to 1,236.

The accompanying table indicates the total lengths of the lines at work in various countries, together with the number of cars in service, and the kilometrage now being constructed in those countries

Country.	Lines in operation. Length in kilometers.	Number of cars.	Lines in construction. Length in kilometers.
Germany	366.17	632	94.59
England	68.80	125	34.20
Austro-Hungary	44.90	129	3.75
Belgium	21.70	48	....
Bosnia	.....	...	5.60
Spain	14 00	12	....
France	96.26	152	46.00
Italy	18 85	33	22.80
Sweden and Norway	6.50	11	.....
Portugal	....	..	12.80
Roumania	5.43	15	.....
Russia	10 00	32	.....
Servia	10.00	7	.....
Switzerland	37.40	40	2.74
Totals	700.01	1,236	222.48

It will be seen from the above figures that Germany heads the list with 366 kilometers of lines; France comes second with 96 kilometers and England is a bad third with 68 kilometers. It is noteworthy that of the 70 lines worked, no less than 55 are operated on the trolley system, eight on the central rail method, four with accumulators and three on the underground conductor system. The maximum gradients are as great as 10.5 per cent., and up to 35 per cent. where rack rails are also used.

At present 28 lines are being constructed, with a total length exceeding 200 kilometers.

PHOSPHORESCENCE.

BY NEWTON HARRISON, E. E.

There are many problems of importance with which the world is daily wrestling.

The efforts of man to imitate nature in the economy of her methods might be the result of an unconscious yet overpowering tendency. When the great edict went forth—"Let there be Light," the words pulsated through space to infinite realms and unclothed voids. To-day the inertia still prevails—and dreamer and scientist have both echoed the cry in their strivings to create the cold and non-consuming light of phosphorescence. The period of absolute necessity is slowing passing away and the log cabins are about to become stately homes. The crude methods employed for the production of an illuminant which was always welcome if it was but light are about to be dispensed with, because a spirit of economy has developed and more is demanded from that which is utilized.

More—because the possibility exists in a surer sense than ever before—more, because we stand on the threshold that leads to success.

There is hardly any need of reviewing the many methods by which illumination has been produced. All have had their day and heralded the progress that leads to further advance. To frame an opinion in which there is the foundation for even a tenable theory, a basis of some intrinsic value must be adopted. The phenomenon of phosphorescence has in a way supplied a fund of suggestiveness from which has sprung some interesting experiments. The glow of the lightning-bug was not the cause of wonder to any but children not so many years ago. At present the processes by which this marvellous light is produced has excited the deepest interest and made the oldest and most experienced savants long for its explanation.

There is no heat to the light thus produced. Some chemical composition of so peculiar a nature that its entire energy is productive of light is secreted by this remarkable insect. The employment of the most subtle processes has not nearly approached in refinement those by which organic creatures combine and secrete the constituents of any product; and much less so that which produces the cold rays of pure phosphorescence.

There are theories in science which combat old-established notions and sweep aside as myths the traditional tendencies that brought forth alchemy and astrology. Yet without these somewhat purposeless efforts the world would have lost the central hub of all scientific aspirations. Tubes in which the soft effulgent glow appears with an almost sepulchral light have been invented by Geissler and used once more in experiments by Hertz and Tesla.

There is too much of the laboratory and too little of the world attached to these experiments so far, to admit of positive importance to-day. Yet in this field, trodden by so very few, anticipation absorbs all their energies and encourages them to make unparalleled attempts.

Can some substance like calcium sulphide, capable of absorbing light, be used as a reservoir at day and in it be stored the energy of sunlight?

Or shall the finer products of the laboratory, by their inherent nature, send out the ethereal waves of mysterious light? None can speak advisedly of the future in this respect; yet we know that the trembling of an atom is all that is required, for light is but energy of vibration transmitted in infinitesimal waves to the ether. In all cases the effect to be produced is the same, and although the mechanism employed in each case varies, the final plane reached is that in which these minute impulses are propagated with an unequalled velocity through the surrounding space.

The perpetual discharges of a molecular condenser was thought by Clerk Maxwell to be the cause of light—whatever may be its cause, we are striving to understand and control those forces by which it can be brought into being as cold and isolated light.

THE TELEPHOTOGRAPH.

The telephotograph is the name of a new Swedish invention, which claims to do for the eye something like what the telephone does for the ear. It is based upon the peculiarity of selenium, that its resistance to the transmission of electricity to a great extent depends upon the strength of the light to which it is exposed. The construction of the telephotograph is simple enough. A fine point of selenium is made to move in a plane by a mechanical arrangement in such a manner that it, moving within a limited compass of this plane repeatedly forward and backwards, describes a spiral consisting of very close windings. An electric current passes through the selenium point, and the power of this current will vary according to the light to which the point at any given moment is exposed. The receiver is constructed in a similar manner to the above, except that a very susceptible incandescent light has been substituted for the selenium point. The intensity of this light varies in harmony with the light to which the selenium point is exposed. When the incandescent light is made to move in a similar manner to the movements of the selenium point, it will produce lights and shadows on the plane similar to those through which the selenium point passes in its plane. The despatching apparatus is enclosed in a case, something like a photographic camera, fitted with an objective, which can be so adjusted that the picture of the subject to be telephotographed is formed in the movement plane of the selenium point. The lights and shadows produced by the incandescent light of the receiving apparatus will then produce a picture identical with the one at the despatching station. This picture can be made visible in various manners, either through photography or by being directly looked at through some magnifier, or in a similar manner to the one used in a magic lantern. The rapidity of the movements of the selenium point through any one point of the picture must not allow of a greater interval than about one-eighth of a second, so that the corresponding impressions upon the eye of the beholder form a continuous complete picture.

ROCKING AND DUMPING GRATES.

One of the points of chief importance about a steam boiler is to use a first-class grate bar—one that is durable, will not warp, and will allow easy and complete dumping of cinders and ashes, in order to keep up a good fire.

There are many grate bars on the market, but none are better known than those made by W. W. Tupper & Co., 39 and 41 Cortlandt street, New York. These grates are made for any kind of fuel, and are said to be the best and cheapest, and fulfil all of the essential requirements of a first-class grate bar.

The dumping grates made by this firm, as well as the rocking grates, are well-known for their lasting qualities and freedom from warping. Tupper's grates are largely used by the leading mills in the United States, and many central station plants are deriving much satisfaction in their use. They are very economical grates.

THE WADDELL-ENTZ CO.'S AFFAIRS.

Virgil H. Hewes, receiver of the Waddell-Entz Company, has given notice that he will on September 30 sell the property of the company named at public auction in Bridgeport, Conn. The property consists of Letters-Patent, drawings and patterns; electrical test instruments, switches, etc.; shop and office furniture; machinery, consisting of lathes, planers, cutting tools, jigs, line shafting and pulleys; finished and unfinished product, raw material and miscellaneous merchandise.

MacCURDY & SMITH.

Mr. D. D. Smith has bought out the interest of E. P. Morris in the firm and business of Morris & MacCurdy, Indianapolis, Ind. The business will hereafter be conducted by William MacCurdy and D. D. Smith under the firm name of MacCurdy & Smith. The new firm takes over all of the assets of the old and assumes all of its liabilities.

Industrial Premiums.—The Italian Minister of Agriculture and Commerce offers for competition, up to December 31, 1895, a large number of medals and diplomas for various industrial and art work, including an electrical long-distance power-transmission plant.

—The term "hard drawn" as applied to copper wire is intended to distinguish the unannealed wire from the annealed, the only difference between soft and hard copper wire being that one is annealed after drawing while the other is not.

New York Notes.

The Brooklyn Heights Railroad Company has established eleven new transfer stations, and it is now possible to ride over almost the entire system for a single fare.

The jury in the Sea Beach Railroad accident inquest found that the railroad company was criminally negligent in failing to provide a proper signal system and telephone and telegraph communication along the route as safeguards against such accidents.

The Municipal Electric Light Company of Brooklyn on September 12 certified to the Secretary of State in Albany that its capital had been increased from $500,000 to $1,000,000. The amount of the company's capital actually paid in is $500,000, and the whole amount of its debts and liabilities does not exceed $10,000.

The Lenox Avenue underground trolley road has proved so successful in operation that it is stated that the Metropolitan Traction Company has decided to immediately transform the Twenty-third street road into an underground trolley, and, beginning next spring, all its other horse-car roads in the city will be converted into roads of this description. W. T. H.

Telephone Notes.

The Harrison International Telephone Co., of Chicago, proposes to organize a company in Pine Bluff, Ark., with a capital of $14,000.

W. N. Shine and A. H. King, of Jacksonville, Fla., have secured a telephone franchise in that city.

The Phœnix Telephone Company, Des Moines, Iowa, has been incorporated by Charles M. Waterbury, John W. Paris, Noah J. Cladfelter and others. Capital stock, $1,000,000.

South Bend Telephone Company, South Bend, Ind., has been incorporated by Corwin B. Van Pelt and others. Capital stock, $50,000.

P. E. Blumer will establish a telephone system in Ellisville, Miss.

A telephone line is to be built in Douglas, Ga., by E. A. Buck.

Stephen B. Kinard will build a telephone line from Jackson to McDonough, Ga.

TELEPHONE PATENTS ISSUED SEPTEMBER 10, 1895.

Telephone Exchange Apparatus. Alfred Stromberg, Andrew Carlson and Herbert L. Knight, Chicago, Ill. (No. 545,921.)

Telephone Apparatus. Alfred Stromberg and Andrew Carlson, Chicago, Ill. (No. 545,922.)

Telephone. Edgar C. Parker, London, England. (No. 546,027.)

Possible Contracts.

Steps are being taken to establish an electric light plant in Lyndonville, Vt.

Steps are being taken to establish an electric light plant in Stowe, Vt.

The Southern Electric Supply Co., of New Orleans, has secured the contract to build an electric light plant and water-works in Canton, Miss.

An electric light plant is to be established in Smithville, Texas.

The Buena Vista Electric Light and Power Co., Buena Vista, Va., will remodel its plant.

New Corporations.

The Punta Gorda Ice and Power Co., of Punta Gorda, Fla., has been organized by J. H. Farrington, Wm. S. Stetson and L. T. Blackson, for the purpose of establishing an ice and electric light and power plant. Capital, $10,000.

The Charlotte Railway Company, New Orleans, La., has been organized with Henry T. Beauregard, president; R. C. Ducros, vice-president, and J. D. Alexander, secretary. Capital stock, $100,000.

The Union Traction Company, Philadelphia, Pa., has been organized by Jas. Hollanes, Peter A. B. Widener, William L. Elkins, Thomas Dolan and others. Charles C. Kruger is treasurer of the company. Capital stock, $100,000.

Elmira Safety Appliance Company, Elmira, N. Y., has been incorporated by Charles Langdon, George M. Divan and W. N. Easterbrook, to manufacture electrical engine stops, etc. Capital stock, $5,000.

Newark Electric Developing Company, Newark, N. J., has been incorporated by Chas. A. Demarest, Eugene Eagles, Chas. H. Madison and James H. Reinhardt, to manufacture magnetizing boxes, etc. Capital stock, $100,000.

Dickinson Electric Supply Company, New York, N. Y., has been incorporated by Henry S. Ritter, Henry H. Dickinson, Allen S Goodacre. Capital stock, $10,000.

Salt Lake Citizens' Electric Light Company, Leadville, Col., incorporated by Charles Boettcher, John F. Campion and George W. Trimble, with a capital stock of $500,000.

Manhattan General Construction Company, New York, N. Y., incorporated by Charles D. Hill, Benjamin J. Gould, Jr. and others, to manufacture electrical appliances. Capital stock, $100,000.

Gates Electric Manufacturing Company, Chicago, Ill., has been incorporated by J. Holt Gates, William F. Camp, Jr., Adolph Lissen and D. B. Samuels. Capital stock, $25,000.

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

Fort Wayne and Hicksville Electric Railway Company, Fort Wayne, Ind., has been incorporated. Capital stock, $50,000.

Ulster County Electric Railway Company, Kingston, N. Y., has been incorporated by Charles A. Johnson, Frederick A. Reed, Raymond C. Johnson and others, of New York, and W. T. Tiers, of Philadelphia. Capital stock, $100,000.

The Morristown Electric Light Company, Morristown. Tenn., has been incorporated by John K. Shields, R. E. L, Mountcastle, George A. Crouch and W. H. Faine, Jr.

The Alice, Wade City and Corpus Christi Telephone Co. has been organized in Alice, Texas, with a capital of $5,000. Incorporators: George Hobbs, Thos. C. Wright and J. T. Elliott.

Street Railway Notes.

The "Trolley Party" idea has struck Chicago, and the people of some of the suburban towns invaded the city a few nights ago on a train of gaily decorated and illuminated cars. Music and fog-horns aroused the emotions to a high degree of enthusiasm or a low degree of dejection, according to the condition of the stomach of each individual who chanced to hear the racket.

The Park & Falls Electric Railway Company, of Youngstown, O., is said to have acquired 5,000 acres of coal lands along the line of an electric road it has been constructing toward North Lima, thereby opening up for itself a field reached by no other transportation line. About 1,000 tons of coal per day are to be delivered into Youngstown, it is said.

A proposition has been made to build an electric railroad in Bedford City, Va. C. A. Ruffin, of Charlottesville, Va., is interested.

J. M. Wigginton, J. N. Lilly and others, Fairfield, Ky., will incorporate a company for the purpose of building an electric railroad between that place and Louisville.

J. C. Robertson, of Manchester, Va., is interested in the proposed electric railway between Manchester and Petersburg.

The Mobile (Ala.) Railroad Company will extend its electric lines into the western suburbs of the city.

The Suburban and West End Railway Co., Savannah, Ga , will build an extension of one mile.

Surveys are being made for an electric railroad between St. Louis and Ferguson, Mo., a distance of ten miles.

The Greenwood electric road, Indianapolis, Ind., is to be constructed. Contracts will be let, and work will commence af once. Arrangements have been made to enter the city at Shelby street and cross the viaduct.

A movement is on foot to establish a street railway line from Dedham Centre up High street as far as the Cook street station in Dedham, Mass.

The Canton and Wooster Railway Company, Canton, O., will build an electric line between Massillon and Canton.

There is a movement on foot providing for the consolidation of all the street railways in Pittsburgh. If carried through, over 200 miles of street railways will be under one management, and will involve a capitalization of about $25,000,000.

$25,000 has been subscribed for the construction of the Bennington Street Electric Railway in Bennington, Vt.

The Keene (N. H.) Electric Railway Company have authorized a committee to make a contract for the construction of an electric road in Keene.

R. W. Evans and A. Patterson, of Newark, Ohio, have been granted a franchise to build an electric road to Hebron.

An electric railroad is to be built between Zanesville and Columbus, Ohio.

An electric road is to be built from Cohasset to Braintree, Mass.

Trade Notes.

The Shawmut Fuse Wire Company, Boston, has moved its office and factory from 161 High street to 93 Federal street.

The Union Electric Equipment Company, 136 Liberty street, city, has just issued an illustrated circular of its porcelain cut-outs. These goods include main line and branch cut-outs, porcelain wall-sockets and ceiling rosettes. These cut-outs have several excellent distinctive features which make them nigh perfect.

National Electric Light and Street Railway Associations.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

President, C. H. Wilmerding, Chicago, Ill.; 1st Vice-President, Frederic Nicholls, Toronto, Canada; 2d Vice-President, E. F. Peck, Brooklyn, N. Y. Members of Executive Committee: E. H. Davis, Williamsport, Pa., (one year); W. R. Gardiner, Pittsfield, Mass.; George A. Redman, Rochester, N. Y.; J. J. Burleigh, Camden, N. J. Next meeting, New York, May or June, 1896.

AMERICAN STREET RAILWAY ASSOCIATION.

Next meeting, Montreal, Que., October, 15, 16, 17 and 18, 1895.

President, Joel Hurt, Atlanta, Ga.; Vice-President, W. Worth Bean, St., Joseph, Mich.; 2d Vice-President, John M. Cunningham, Boston, Mass.; 3d Vice-President, Russell B. Harrison, Terre Haute, Ind., Secretary and Treasurer, William J. Richardson, Brooklyn, N. Y.; Executive Committee, Henry C. Payne, Milwaukee, Wis.; W. H. Jackson, Nashville, Tenn.; D. G. Hamilton, St. Louis, Mo., C.C. Cunningham, Montreal, Canada; J. N. Partridge, Brooklyn, N. Y.

NEW YORK STATE STREET RAILWAY ASSOCIATION.

Next meeting, Binghamton, N. Y., third Tuesday in September, 1896.

President, G. Tracy Rogers, Binghamton; First Vice-President, W. W. Cole, Elmira; Second Vice-President, John H. Moffitt, Syracuse; Secretary and Treasurer, Benjamin Frick, Brooklyn; Executive Committee, D. B. Hasbrouck, New York; John N. Beckley, Rochester; Daniel F. Lewis, Brooklyn.

OHIO STATE TRAMWAY ASSOCIATION.

Next meeting, fourth Wednesday in September, 1895.

President, Albion E. Lang, Toledo; Vice-President, W. J. Kelly, Columbus; Secretary and Treasurer, J. B. Hanna, Cleveland; Chairman Executive Committee, W. A. Lynch, Canton.

MASSACHUSETTS STATE STREET RAILWAY ASSOCIATION.

President, T. H. Cunningham, Boston; Secretary and Treasurer, A. S. Butler, Lawrence; Executive Committee, Samuel Winslow, Alfred A. Glazier, Boston; P. F. Sullivan, Lowell; E. C. Foster, Revere; Horace B. Rogers, Brockton; A. E. Smith, Springfield; Prentiss Cummings, Boston.

THE TEXAS STREET RAILWAY ASSOCIATION.

President, W. H. Sinclair, Galveston; vice-president, C. A. McKinney, Houston; Secretary and Treasurer, C. L. Wakefield, Dallas. Directory: The officers and W. H. Weiss, San Antonio and George B. Hendricks, Fort Worth.

Next meeting, Galveston, third Wednesday in March, 1896.

PENNSYLVANIA STATE STREET RAILWAY ASSOCIATION.

Next meeting, first Wednesday in September, 1895.

President, John A. Rigg, Reading; First Vice-President, Robert E. Wright; Secretary, S. P. Light, Lebanon; Treasurer, W. H. Lanius, York.

THE MAINE STREET RAILWAY ASSOCIATION.

President, W. R. Wood, Portland; Secretary and Treasurer, E. A. Newman Portland; Executive Committee, W. R. Wood, Portland; George E. Macomber, Augusta; F. M. Laughton, Bangor; Frank W. Dana, Lewiston; Amos F. Gerald, Fairfield.

MICHIGAN STATE STREET RAILWAY ASSOCIATION.

President, W. L. Jenks, Port Huron; Vice-President, W. Worth Bean, St. Joseph; Secretary and Treasurer, B. S. Hanchett, Jr., Grand Rapids; Executive Committee, the Officers and David H. Jerome, Saginaw, and Strathern Hendrie, Detroit.

THE STREET RAILWAY ASSOCIATION OF THE STATE OF NEW JERSEY.

President, Thos. C. Barr, Newark, Vice-President, W. S. Scull, Camden; Secretary and Treasurer, Charles Y. Bamford, Trenton; Executive Committee, Officers and C. B. Thurston, Jersey City; H. Romaine, Paterson S. B. Dod, Hoboken.

ELECTRICAL and STREET RAILWAY PATENTS

Issued September 10, 1895.

545,870. Electric-Railway Switch. Rollin A Baldwin, South Norwalk, Conn. Filed Jan. 4, 1895.

545,872. Car-Fender. James Bowen, Philadelphia, Pa. Filed June 22, 1895.

545,901. Tubular Pole for Telegraph or Other Purposes. Reinhard Mannesmann, New York, N. Y., assignor to the Mannesmann Tube Company, Jersey City, N. J. Filed Feb. 9, 1895.

545,903. Electric Signaling Apparatus. George E. Miller, Boston, Mass., assignor to the American Electric Train and Switch Signal Company, same place. Filed Aug. 1, 1894.

545,904. Electric Signaling. George E. Miller, Stoneham, assignor to the American Electric Train and Switch Signal Company, Boston, Mass. Filed Sept. 6, 1894.

545,921. Telephone-Exchange Apparatus. Alfred Stromberg, Androv Carlson and Herbert L Knight, Chicago, Ill.; said Knight assignor to said Stromberg and Carlson. Filed Feb. 28, 1895.

545,922. Telephone Apparatus. Alfred Stromberg and Androv Carlson, Chicago, Ill. Filed Mar. 29, 1895.

545,938. Telegraph-Receiver. Orlando P. Briggs and William R. Patterson, Chicago, Ill., assignors to the Western Electric Company, same place. Filed Oct. 11, 1893.

545,962. Motor for Traction-Engines. George W. Lewis, Chicago, Ill. Filed June 20, 1894.

545,976. Manufacture of Electric or Other Conduits. Ernest L. Ransome, Chicago, Ill. Filed Nov 23, 1894.

546,002. Electric Drill. Charles S. Bradley, Avon, N. Y. Filed Aug. 20, 1892.

546,005. Flexible Conductor and Inclosed Conduit Therefor. Leon Dion, Natick, Mass. Filed Feb. 20, 1895.

546,016. Electric Alarm Clock. William Kist, Hoboken, N. J. Filed Feb. 6, 1895.

546,027. Telephone. Edgar C. Parker, London, England, assignor of one-half to James Ronald Watson, same place. Filed Feb. 14, 1895.

546,036. Signal-Box. Nathan H. Suren, New York, N.Y., assignor to the Gamewell Fire-Alarm Telegraph Company, same place. Filed Aug. 22, 1893.

546,037. Signal-Box. Nathan H. Suren, New York, N. Y., assignor to The Gamewell Fire-Alarm Telegraph Company, same place. Filed Jan. 25, 1894.

546 059. Electric Railway. William M Schlesinger, Philadelphia, Pa., assignor to John I. McDuffee, trustee, same place. Filed Nov. 24, 1895.

546,062. Speed-Regulator for Electric Cars. Isaac D. Aikin, New York, N. Y. Filed May 4, 1895.

546,090. Cut-Off-Actuating Mechanism for Gas or Electric Light Systems Frederick W. Cotton, Dedham, assignor of one-half to Charles M. Reed, Boston, Mass. Filed Nov. 12, 1894.

546,120. Electric Brake. William Koedding, St. Louis, Mo. Filed June 13, 1894.

546,130. Closed-Conduit Electric Railway. John M. Deal, Fernwood, assignor, by direct and mesne assignments, to himself, and Samuel Wadworth, Clifton, and William Bartram, Lansdowne, Pa. Filed Nov. 26, 1894.

546,143. Electric-Railway System. Henry A. Fry, Portland, Ore. Filed June 13, 1894. Renewed May 9, 1895.

546,190. Regulator for Alternating-Current Dynamos. Edwin W. Rice, Jr., Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Mar. 16, 1888.

546,191. Electric Locomotive. Edwin W. Rice, Jr., Schenectady, N. Y., assignor to the General Electric Company, of New York. Filed Mar. 16, 1895.

546,232. Insulator, Conductor, and Conduit for Electrical Wires and Cables. Wilber R. Hitchcock, Cornwall, Canada, assignor of one-half to A. W. Andrews and John D. Miller, Wallingford, Vt. Filed Oct. 12, 1894.

546,233. Automatic Electrical Cut-Out. Charles C. Kritzer, Grand Rapids, assignor to the Automatic Circuit Breaker Company, Newaygo, Mich. Filed Oct. 31, 1894.

546,238. Electric Igniter for Gas-Engines. Frank S. Mead, Montreal, Canada. Filed Feb. 26, 1895.

546,247. Electric Brake. William B. Potter, Schenectady, N. Y., assignor, by mesne assignments, to the General Electric Company, of New York. Filed Jan 19, 1895.

546,257. Protector-Guard for Street-Railway Cars. Michael Sullivan and Thomas J. Bond, Newport, R. I. Filed Mar. 17, 1894. Renewed Feb. 9, 1895.

546,261. Automatic Electric Fire-Alarm. Charles D. Tisdale, Boston, Mass., assignor by direct and mesne assignments, of two-thirds to John D. Gould, Brooklyn, and Charles A. Hanson, New York, N. Y. Filed Feb. 12, 1895.

546,262. Automatic Electric Fire-Alarm. Charles D. Tisdale, Boston, Mass., assignor, by direct and mesne assignments, of two-thirds to John D. Gould, Brooklyn, and Charles A. Hanson, New York, N. Y. Filed Mar. 25, 1895

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CONTENTS.

THE MONTREAL CONVENTION.

We give elsewhere in this issue considerable timely information regarding the Montreal Convention of the American Street-Railway Association. This matter includes the general programme, just issued by the association, and directions as to how to reach Montreal from New York. A fine map is also given showing the route of one of the principal lines. The trip between New York and Montreal is unrivalled for variety and beauty of scenery, and that feature alone is sufficiently attractive to take a large number of persons to Montreal on this occasion. There will unquestionably be an extensive and fine exhibit of large and small electrical manufactures in the street-railway line, and this feature of the convention will be a brilliant affair. Active preparations for the meeting are now under way and there promises to be a very large attendance. October 15, 16, 17 and 18 are the dates.

ELECTRIC RAILROAD STATISTICS.

President G. Tracy Rogers, of the New York Street Railway Association, in his address before the annual meeting of that body, in Albany, on the 17th instant, gave some exceedingly interesting statistics, showing the great magnitude of the electric railway interests in this state. There are about 1,400 miles of track in the state, and an investment of upwards of 200,000,000 of dollars in electric railway property. These railways carry in one year over 500,000,000 of people, about seven times the population of the entire United States, and over one third of that of the world. The gross receipts from this street railroad traffic are about $25,000,000 per annum. Speaking of the number of persons carried on these roads, it is interesting to compare this traffic with that on the steam roads in the state. The latter, according to Mr. Rogers, carry but 160,000,000 passengers—a little less than one-third of the number carried over electric lines. When it is considered that it is scarcely a dozen years since the first electric railroad was opened the growth of the industry in this one state alone is indeed marvelous.

SCIENTIFIC TRUTHS.

In our issue of July 20 we referred editorially, under the above heading, to the articles of Mr. Cazin on the subject of "Efficiency Losses." In that article were made statements that have been criticised by Mr. W. F. C. Hasson, of San Francisco. What Mr. Hasson takes exception to was the statement that "it seems strange that a body of professional engineers [the American Institute of Mining Engineers] should allow itself to be used as the medium to advertise apparatus without challenging any of the claims put forth." This statement was based on the fact that such a challenge had been suppressed in an offensive manner, by the secretary of the association, on most trivial grounds; therefore we deny the accusation of Mr. Hasson that we did in any manner cast "discredit upon the Institute of Mining Engineers." For our own part, we simply wish to state that the columns of THE ELECTRICAL AGE are always open to a free discussion of any subject that comes within our line of work, and, as far as Mr. Cazin's discussion of the particular question at issue is concerned—which discussion Mr. Hasson criticises—Mr. Cazin himself has, in another column in this issue, made a suitable reply. We wish to say, further, that we know of no body of professional men deserving of higher respect than does the American Institute of Mining Engineers. As a society it represents American thrift, ingenuity, knowledge, true honor and manhood, and it is a source of regret that such a body should have no practical influence over its own affairs, and no way of expressing an opinion on any question save through the censorship of one of its officials.

HOW SHALL WE HEAT OUR CARS.*

BY J. F. MC ELROY.

I show you today samples of electric heaters with which many of you are familiar. In these heaters there is such an enlargement of heating surface, and this surface is so exposed to the air, that the heat may be carried from this surface as fast as generated, and the temperature of the conductor is maintained at such a point that no apparent oxidization results from its use. These heaters are made by the Consolidated Car-Heating Company, and are shown in different forms adapted to the different kinds of construction of cars to which electric heaters are applied. In the construction of these heaters cylindrical porcelain tubes are threaded upon a 5/8″ square iron rod. These tubes are provided on their surface with a spiral groove which runs continuously from end to end. A porcelain disk is placed at each end of the heater, and when desired one is placed at the center for the purpose of furnishing supports for the binding screws to which the ends of the resisting conductors are attached. We then coil a No. 20 B. & S. galvanized wire in the form of a close and continuous coil. As this wire is wound by machine in the form of a continuous coil, just so much of the wire is separated in forming a coil as gives us just the proper resistance. These coils are then placed in the groove, which runs spirally around the porcelain insulators. Care is taken to stretch out the coil sufficiently to prevent adjacent spirals of the coil from coming in contact with each other, and contact with that part of the coil in neighboring grooves is prevented by ridges separating the grooves on the porcelain. The result is that this wire is thoroughly insulated and short-circuiting within the heater itself is prevented, and still it is wound open so as to present its whole surface to the air. It is so arranged, too, by its even pressure upon the porcelain insulator that no part of this coil can vibrate, and hence there is no danger from crystallization of the iron while hot from

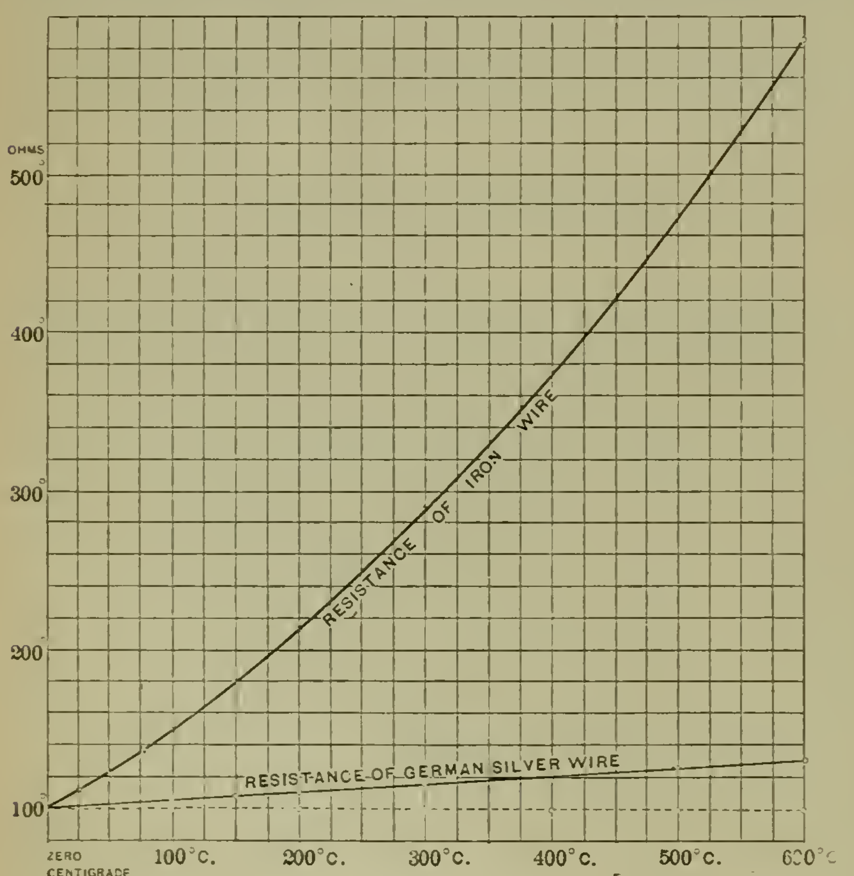


FIG. I.

tremor or vibration of the heated wire. This feature of the heater is a very important one, as it absolutely prevents the crystallization and hence breaking of the resisting conductor. These coils have now been operated for over three years and not one coil has given out or has shown any oxidizing effect in the substance of the wire. The use of iron as a resisting conductor frees us from the difficulties of crystallization to which German silver is especially liable. The melting point of iron is at a temperature of nearly 3000 degrees, F., so that the temperature of fusion is so far above the normal temperature of the resisting conductor, and as vibration of the conductor is prevented by the method of winding it on the insulator, no danger occurs from oxidization, fusion or crystallization.

* * * *

The change of temperature in resisting conductors is attended with other phenomena, which should be considered in the construction of electric heaters. For example, it is well known that the resistance of a wire of a given

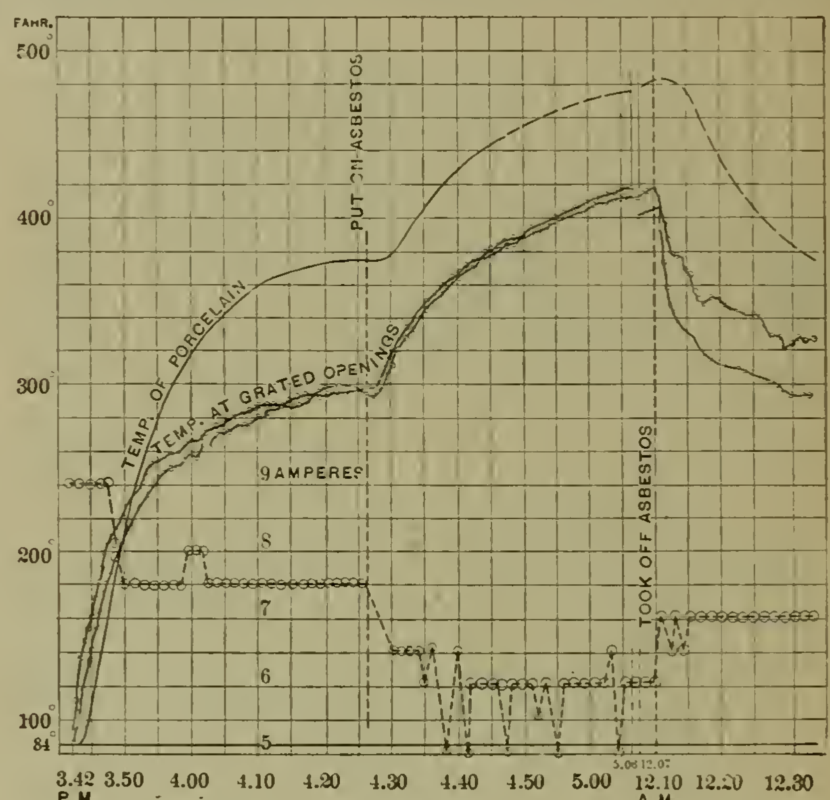


FIG. 2.

material of given length and cross-section depends upon the temperature at which the resistance is measured. Iron wire possesses certain qualities in its variation of resistance with temperature which I think admirably fits it for use in electric heaters. I show a diagram, Fig. 1, in which the upper curve shows the change of resistance in a coil of iron wire having a resistance of 100 ohms due to the different temperatures of iron, as indicated on the horizontal line. From this it will be seen that an iron wire having a resistance at zero centigrade of 100 ohms, has its resistance doubled when the temperature is increased to 180 degrees centigrade, and that its resistance becomes 300 ohms when its temperature is 315 degrees centigrade. This same resistance is increased to 500 ohms when its temperature is 525 degrees centigrade. In other words, a rise in temperature of the resisting conductor is always attended with an increase of resistance, and conversely, a lowering of temperature is always attended by an increase of conductive power.

The expansion of German silver is shown in the lower curve of the same diagram. It will be here seen that change of resistance in German silver is but a mere fraction of the change of resistance of iron wire.

The use of the variable resistance so marked in our iron wire is apparent, as its effect is to reduce the amount of current flowing through the heater and hence to reduce the amount of heat generated. By referring to our diagram we will see that the two electric heaters, one of iron wire and the other of German silver, both having the same resistance at zero centigrade and both being covered with a non-conducting hood which prevents the escape of heat, would as the temperature rises act very differently.

* * * *

A heater, therefore, provided with an iron resisting conductor has this peculiarity over that equipped with German silver, that if for any reason the escape of heat from an electric heater is prevented either purposely or accidentally the action of the rise of temperature upon the heater itself is to so throttle down the amount of current passing through it, and hence the amount of heat generated, as to prevent such a high temperature of heat that might prove dangerous.

*Abstract of paper read at the meeting of the Street-Railway Association of the State of New York, Albany, September 17, 1895.

This throttling action of the electric heaters with iron-resisting conductors is best illustrated in Fig. 2. This diagram shows the principle which we have just been discussing applied to electric heaters. The upper curve is a curve of temperature obtained from a thermometer placed within the porcelain insulator itself. The two lower curves are curves of temperature obtained by two thermometers placed within the heater casings and about one-half an inch above the coils of the heater proper. An idea of the rise of the temperature of the air in the upper part of the heater casing may be obtained from these curves. The time is laid out on the horizontal lines, the vertical lines being lines of temperature. After the heater had been in operation until the temperature within the porcelain and the temperature within the heater casing, as indicated by the two lower lines, had become practically constant, we then covered up the discharge opening of the heater with a close-fitting sheet of asbestos, which would prevent the escape of heated air. The effect upon the temperature within the heater casing was at once apparent, and the upward movement of the curve indicates the rate and amount of that rise in temperature. As I have already pointed out, this rise of temperature must mean a lowering in the amount of heat generated. The throttling action of this can be

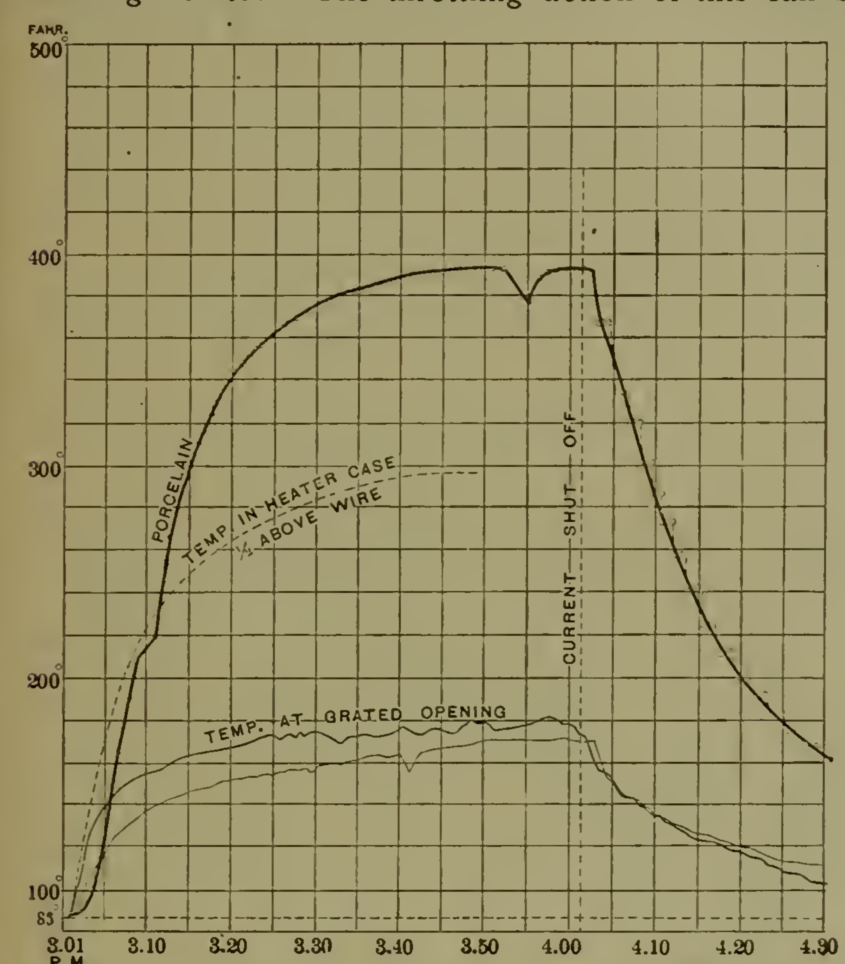


FIG. 3.

seen in the fourth curve, to which I call your attention. This fourth curve represents the amount of current passing through the heaters, and also represents the amount of heat generated. In the first place, when the current is first closed through the heater, you will see that a large flow of current takes place until the heater itself becomes heated up, when the amount of current is automatically throttled down. This of itself is of advantage in more quickly bringing the heater to its maximum temperature. This curve remains nearly horizontal, indicating a nearly steady flow of electricity until it reaches the point where the discharge opening of the heater was closed. You will see at once that the current drops and the amount of this drop indicates the amount of the throttling action of the resisting conductor itself. This also means, and this point I desire to emphasize, that anything which interferes with the discharge of the heat into a car also acts to cut off the amount of heat generated in that heater, and hence to prevent, in a measure, the rise of temperature which would otherwise take place within the heater itself. At the point indicated in these curves the asbestos damper was removed from the discharge of the heater, and the curves then indicate the fall in the temperature of the space above the heater, while the curve showing the amperes rises in a very short time to its normal height, indicating that when the heat is free to discharge from the heater more heat is generated. This action will take place in any heater in a car, and will take place in one heater independent of other heaters. This curve, however, may give a wrong impression as to the temperature at the discharge of the opening of the heater itself.

The diagram, Fig. 3, has been made from tests in which the temperature at the grated openings has been taken very carefully with thermometers placed against the grated openings, but not within the heater case. This would indicate the temperature in front of the heater openings and at points where the clothing of the passengers might possibly touch. I introduce this to simply show that the highest temperature in the air that is reached is about 160 degrees F. This being the temperature of heated air, it is evident that its effects upon either the clothing or limbs of passengers could not be in any way dangerous or disagreeable. This is due to the free discharge of air up through the heater by which the heat, as fast as it is generated, is carried into the car. A curve is also shown, which is not the curve of temperature of the air discharged from the heater, but is the temperature recorded by thermometers placed within the heater case and within one-half inch above the wire coils. The upper curve indicates the curve of temperature of the porcelain itself, and is obtained from the readings of the thermometer placed within the hollow openings of the porcelain. I desire to call your attention to the form of these curves, both when the temperature rises when heat is first applied, and to the temperature of the curve obtained when heat is shut off. It is seen that the temperature of the porcelain rises rapidly and the temperature also descends rapidly when the circuit is open.

* * * * * *

The cost of operating electric heaters will depend upon the kind of engine employed and the cost of coal. For example, if coal costs $2 a ton of 2,000 pounds, and if the average consumption of current in cold weather is seven amperes, and if we take a compound low-speed condensing as the average type of engine in point of economy in consumption of fuel, we will find that seven amperes for one hour will cost 1.17 cents.

From the reports which we have received I find the average length of time a car is in service per day in the winter-time is 15 hours. The cost of operating electric heaters with the average consumption of current in cold weather would, therefore, be 15 times 1 17 cents, which equals 17.55 cents for 15 hours. This cost does not allow for any depreciation in heaters, as the three years of service of these heaters does not appear to have any effect upon the life of the conductors and not a single coil in any heater has ever been renewed in this length of time. So far as an examination of the coils that have seen three years of service can determine, absolutely no oxidation has been produced upon the wires.

CONVENTION OF THE NEW YORK STREET-RAILWAY ASSOCIATION.

In our last issue we gave the names of the new officers of the Street-Railway Association of the State of New York, which were elected at the annual convention of that association in Albany, on September 17. We also gave brief notes of some of the exhibits. We are now able to give further details of the proceedings.

The meeting was called to order by President G. Tracy Rogers, who made an address. He spoke feelingly of the death of the late William J. Richardson, of Brooklyn, secretary and treasurer of the association, and stated that the excellent results attained by the association were largely due to Mr. Richardson's executive ability, interest and enthusiasm.

The condition of the association was prosperous, several new roads having become members during the past year.

A great deal has been said and written, continued Mr

Rogers, regarding the substitution of electricity for steam for through traffic, and some of these articles have been severely criticised. The fact that electric traction is being considered by steam railroad people makes it a subject of general interest. They may adopt electricity on some of their suburban lines to protect their local travel, which we have taken from them whenever and wherever we have gone after it, but the results cannot materially affect the interests of street railways. We carry our patrons to their door-steps, the public streets are our depots, we have no expensive stations to maintain, our traffic is more certain, less affected by business depressions and more capable of development than that of the steam railroad. These are advantages that the steam railroads are unable to overcome, and together with the paralleling of steam railroads by electric railways have forced a number of railroad companies into purchasing electric lines, and there is evidence of increased activity in that direction.

The adoption of an electric motor in Chicago to propel a cable road; the Westinghouse-Baldwin combine; the ninety ton freight engine on the Baltimore & Ohio road; the building of the electric railway at Nantasket Beach by the N. Y., N. H. & H. R. R. Company, as a part of their system over which electric cars and locomotives are run intermingled, and the electrical construction of the Mount Holly Branch of the Pennsylvania Railroad, all point to an endorsement of electricity as a motive power.

We now have in this State about fourteen hundred miles of track and an investment of upwards of two hundred millions of dollars. We carry every year seven times the population of the entire United States and over one-third the population of the entire world—over five hundred millions of passengers annually—while the steam roads carry but one hundred and sixty millions. The gross receipts of this street railroad traffic are about twenty-five millions of dollars.

The best and most reliable financial papers now seek and publish such statistics as are attainable regarding street railways. The financial world demands this information and we are compelled to furnished the figures, favorable or unfavorable. Street railroad securities, as permanent investments, are in better favor than ever before.

At the conclusion of the president's address, the reports of the executive committee and of the treasurer were read and approved, and then Mr. W. W. Cole, of Elmira, read a paper entitled "Are we Laying too Many Miles of Track to Reach a Few People?"

This paper was followed by one on "Economical Equipment and Operation of Power House," by H. S. Newton, of Syracuse. The latter paper was discussed by Messrs. Ostrom, Newton, McNamara, Rogers, Barnard, Cahoon and Clark.

The next business was the reading of a paper by Benjamin Norton, of Newburgh, entitled "Is Freight or Mail Service Profitable or Unprofitable on Street Railways."

An interesting discussion followed Mr. Norton's paper, and then Mr. J. F. McElroy read a paper on "Car-Heating by Electricity."

Other papers read were on "General Track Construction," by C. Loomis Allen, of Syracuse; and "Signals on Electric Railroads," by J. H. Barnard, of New York.

There was an animated discussion on the subject of the admission of supply men as associate members, in which a number of representatives of supply houses participated, some opposing the idea on the ground that it would not tend to the welfare of the association. The matter came up in the form of a proposed amendment to the constitution, which was not adopted.

Votes of thanks were tendered to President Rogers for his work in behalf of the association during the past year, and to J. P. E. Clark, of Binghamton, for his services as temporary secretary; and after the election of officers for the ensuing year, the convention adjourned to meet in Binghampton on the second Tuesday in September, 1896.

The names of the new officers were given in our last issue, Mr. Rogers being re-elected president.

The following is a list of members and others who attended the meeting:

Allen, C. L., Civil Engineer, Syracuse Street-Railway Company, Syracuse; Charles J. Bissell, Counsel, Rochester Railway Company, Rochester; Cahoon, J. B, Superintendent, Elmira and Horseheads Railway Company, Elmira; Cole, W. W., Superintendent, Elmira Street-Railway Company, Elmira; Clark, J. P., General Manager, Binghamton Street-Railway Company, Binghamton; Cleminshaw, Charles, President, Troy City Railway Company, Troy; Cooper, H. S., Superintendent, Schenectady Street-Railway Company, Schenectady; Frick, Benjamin, Secretary and Treasurer, Atlantic Avenue Railroad Company, Brooklyn; Havens, William E., Superintendent, Fishkill Street-Railway Company, Fishkill; McKeever, R. T., Superintendent, Johnstown Street-Railway Company, Johnstown; McNamara, John W., Treasurer, Albany Railway, Albany; Meiklehan, T. M. R., Superintendent, Broadway, Queens County and Suburban Railway Company, Brooklyn; Morgan, Godfrey, Manager, Amsterdam Street-Railway Company, Amsterdam; Norton, Benjamin, President, Newburg Railway Company, Newburg; Newton, H. S, Electrical Engineer, Syracuse Street-Railway, Syracuse; Rogers, G. Tracy, President, Binghamton Street-Railway Company, Binghamton; Rusling, F. O., Superintendent, Buffalo Railway Company, Buffalo; Smith, Charles H., Superintendent, Troy City Railway, Troy; Stedman, J. H., Transfer Department, Rochester Railway Company, Rochester; Story, C. B., Secretary, Hoosick Falls Street-Railway Company, Hoosick Falls; Vickers, Albert, Electrician, Syracuse Consolidated Street-Railway Company, Syracuse; Wardwell, John S., President, Rome City Street-Railway Company, Rome.

Supply houses were represented as follows:

Allison, Giles C., St. Louis Register Company, St. Louis; Barnard, J. H., Interior Telephone Company, New York; Barrett, Charles R., Hale and Kilburn Manufacturing Company, Philadelphia; Everts, Frank L., Superintendent, Utica and Mohawk Railway Company, Utica; Brady, Paul T., Westinghouse Company, Syracuse; Cockey, Marston. R, Roebling Sons' Co., New York; Delaney, William H., New York; Dutton, W. S., Dorner & Dutton, Cleveland; Estep, F. A., Nuttall Co., Allegheny; Evans, H. C., Johnson Co., New York; Everts, D. T., Simplex Co., Boston; Ewing, Geo. C., Electrical Specialties, Boston; Fowler, F. H., Bemis, Car-Box Co., Springfield; Ham, W. F., Johnson Co., New York; Hanna, J. A., McGuire Car Truck, New York; Issertel, H. G., H. W. Johns Co., New York; Lawless, E. J., American Car Co., St. Louis; Long, E. G., Peckham Motor Truck & Wheel Co., New York; MacDuffie, R. L., Taunton Locomotive Manufacturing Co, Taunton; McElroy, J. F., Constructor, Car-Heating Co., Albany; Medbery, H. J., Overhead Equipment, Mechanicville; Mercur, R. J., New York Car-Wheel Co., Buffalo; Morse, Geo. C., Rochester Car-Wheel Co., Rochester; Newkirk, H. R., Hoefgen, Moxham & Co., New York; Ostrom John F., Pennsylvania Steel Co., Philadelphia; Packer, E., St. Louis Register Co., New York; Pugh, D. W., Stephenson Co., New York; Pugh, John S,. Stephenson Co., New York; Robert, Louis E., Johnson Co.; New York; Rose, R. M., Hughes Register Co., New York; Russell, F. D., Rochester Car-Wheel Co, Rochester; Sharpe, D. W., Newark, N. J.; Silver, William S, Graduated Car-Spring Co.; New York; Vosburgh, A. C., New Process Raw Hide Co., Syracuse; Wallace, J. E., Smith & Wallace, Boston; Wardwell, F. S., Electric Railway Construction, Danbury; Wardwell, V. P., Electric Railway Construction, Danbury; Washburne, William A., Cambria Iron Co., New York; Wood, Charles N., Nuttall Co., Boston; Yates, F. A., Trendley Brake Co., St. Louis.

The Press was represented by:

Beard, W. K., *The Car*, New York; Crossman, T. E., Official Stenographer, Brooklyn; Dickerson, J. W., *Electric Railway Gazette*, New York; Goddard, Stephen H., *Electrical Review*, New York; Greene, B. E., *Electricity*, New York Hunt, W. T., Electrical Age, New York; Martin, T. C., *Electrical Engineer*, New York; McGraw, J. H., *Street-Railway Journal*, New York.

NOTES.

Mr. K. R. Newkirk, of Hoefgen Moxham & Company, 80 William street, New York, was in attendance at the convention.

George M. Haskell, New Haven representative of the J. G. Brill Company, Philadelphia, was present during the meeting.

John A. Roeblings' Sons' Company was represented by Marston R. Cockey and G. W. Swan.

Fred. S. Wardwell represented Wardwell Bros., electric railway builders, of Danbury, Conn.

Mr. Henry G. Issertel, of the H. W. John's Manufacturing Company, 87 Maiden Lane, New York, showed a full line of trolley-wire hangers and Vulcabeston goods.

The New Haven Car Register Company, New Haven, Conn., showed one of its double registers for street-cars.

The R. D. Nuttall Company, of Pittsburgh, was represented by F. A Estep, of Pittsburgh ; C. N. Wood, Boston ; C. J. Mayer, Philadelphia, and F. B. Sharp, of Buffalo. A display was made of a malleable steel babbitted axle bearing, a model of a trolley and a trolley wheel.

Bernard Schmidt, Jr , dealer in dental and electrical supplies, 462 Broadway, Albany, N Y., carries a large and fine stock of these goods. He has the cream of the Albany trade.

Major H. C. Evans, the New York manager of the Johnson Company, of Johnstown, Pa., was much in evidence as usual. No convention would be finished and complete without his presence; he is one of the most popular men in the trade and has many friends. Besides the Major, W. F. Ham and L. E. Roberts, of the Johnson Company, were on deck. Mr. Roberts looks after the Dupont truck which is manufactured by the Johnson Company, of Lorain, Ohio.

LOSSES OF EFFICIENCY.

BY F. M. F. CAZIN.

Editor of The Electrical Age :—Mr. W. F. C. Hasson, of San Francisco, in his article in The Electrical Age of September 21, criticises the subject matter of my articles published in The Electrical Age of July 6, 13 and 20, concerning the efficiency of the Bodie plant. He asserts that "the subject matter of these articles are so full of error as to render them unworthy of consideration," and declares it "a waste of time to endeavor to find any logical reasoning in the mixture of c. g. s. and f. p. s. units that follow." The quotations given by him as the basis for these criticisms are, with one exception, not to be found in my articles.

As to my logical or illogical reasoning I challenge Mr. Hasson to produce proof of it in the articles referred to, and I further agree to compensate him to the amount of $100 if he succeeds in the task.

What Mr. Hasson attempts to prove in his criticism is, not that there is any illogical reasoning or error in conclusions, but purely and simply that, while Mr. Leggett speaks of 1⅓" nozzles, he in fact used other nozzles, thus denying a stated fact, and at the same time admitting that "there is one chance for misapprehension in Mr Leggett's article." Mr. Hasson claims, however, that "any chance of misunderstanding is removed by the final paragraph of the article which states"—what he then quotes as a statement of Mr. Leggett does not appear in Mr. Leggett's paper at all, and although it does appear in the discussion of the paper, it has no reference whatever to the point under present consideration, but to the electric efficiency as between dynamo and motor. My articles deal exclusively with the "vital question" of Mr. Leggett's paper, namely : "What efficiency of transmission can be attained from the water-wheel axle to the motor—or more correctly, the dynamo—axle?"

It is true that Mr. Leggett's paper was devoted to this question, but the paper does not in any way contribute to the final answer, and it is true, also, that Mr. Hasson failed to get an insight into the real meaning of this question, or of the symbols I made proper use of in its discussion. Therefore, there is absolutely nothing in Mr. Hasson's criticism that calls for any other expression than that of surprise that petty-fogging should be resorted to for the purpose of discrediting scientific discussion.

It is, therefore, not as an antidote of so unfair criticism, but in deference to the judgment of the readers of the Electrical Age that the matter is further discussed.

All of the observations made and facts stated by Mr. Leggett were directly connected with his other statement as to the nozzles employed. He never mentioned that "nozzles of various sizes had been used," as Mr. Hasson declares, because he is well aware that such an assertion would have exposed him to ridicule. Where there are four wheels on one shaft and eight nozzles applied, the only rational and practical way of shutting off surplus power is to cut off the water-supply from one nozzle after the other, until the remainder adapts the power to the requirement.

Before writing my articles, in view of a possible doubt, I advised Mr. Leggett of my intention to write on the Bodie plant for publication, and inquired specifically as to this point. Then was the opportunity for correcting or supplementing the statements made in his paper; but in his answer he omitted or evaded the information demanded as to nozzles used, thereby admitting the facts as stated in his paper.

Mr. Hasson was not at Bodie then, and can, therefore, only speak from hearsay.

As set forth in my articles the case at Bodie is simply this : 1. The Pelton Water-Wheel Co., when coming in contact with electricians who desire to properly account for the mechanical power received by their apparatus, applies a rating to their wheels which by their own faulty reckoning is at an efficiency rate of 50.84 per cent., and by correct reckoning by water ejected of 55.43 per cent., while per circular and testimonials they claim 85 per cent. of efficiency.

2 But the electricians do not even acknowledge the availability of 55 43 per cent. ; they admit getting from 28.96 per cent. to 33.89 per cent., and are willing to concede a loss in their dynamo of 10 per cent. of what it receives, but not of 39 per cent., thus leaving a discrepancy between the water-wheel and dynamo of 29 per cent.

Let us have the facts, naked and complete. As far as they are given by Mr. Leggett, they are analyzed in my articles with the results above stated.

In conclusion, I will repeat the closing paragraph of my articles, the subject matter of which Mr. Hasson takes exceptions to :

"The actual performance by either hydraulic or electrical apparatus in transmitting mechanical power is the question at issue. The report quoted gives no straight answer to this question. The plant at Bodie furnishes an opportunity for the final solution of questions that are of much interest to both science and industry, but the data furnished by Mr. Leggett do not solve them.

F. M. F. Cazin.

Hoboken, N. J., September 21, 1895.

PERSONAL.

Mr. A. P. Doddridge, superintendent of the Montmorency Electric Power Co., Quebec, gave The Electrical Age a call last week.

Mr H. T. Richards, who was for five years connected with the *Electrical Review*, is now with the Safety Insulated Wire and Cable Company, of this city. The Safety Company got a good man.

Mr. Allen R. Foote, well known to the electrical trades and profession through his former connection as secretary of the National Electric Light Association, and his works on "The Laws of Incorporated Companies Under Municipal Franchises," and on economic subjects, has been appointed to the position of editor of *The American Exporter*, of this city. The September number of that publication bears the impress of Mr. Foote's work. We extend to Mr. Foote the right hand of fraternal fellowship. The ranks of trade journalism have been benefited by this acquisition, and we trust that success will follow Mr. Foote's new venture.

Frank Judson Pope, son of Ralph W. Pope, secretary of the American Institute of Electrical Engineers, has entered the field of journalism and is now on the staff of the *Evening Sun*, New York. The young man graduated from Columbia College, class of '95, and is well equipped with the knowledge necessary for his chosen profession.

ARE WE LAYING TOO MANY MILES OF TRACK TO REACH A FEW PEOPLE?*

BY W. W. COLE.

It is an established fact that as the mountain would not go to Mohammed, he had to go to the mountain. The fact is just as self-evident in the location of track, that if you stop one block from where the dividing line comes, between the settled district and the open field, the people will walk that one block to the cars, and the maintenance and operation of 1500 feet of track for one year on a fifteen minutes' headway, at nine cents per car mile, means the interest at five per cent. on $26,864.00, or $3.68 per day. It can be readily seen that with many lines extended just beyond the line of population, that the road has extended just beyond the line of dividend. It is conceded by all that when a new line is constructed we have to educate the people to ride, as they have become accustomed to depend on their horse or bicycle, or to walk. Now, if we extend our lines beyond the population, we immediately become a professor of education, as we must not only educate the existing population to ride, but must educate the people to build on the open territory and educate people to move into the houses built. Now, if we keep within the lines of existing population, we have the advantage of a general located on an eminence—we can wait and see which way the population army moves, and then we make no mistake in our extension. In other words, the railroad is practically the army sutler, and there is no instance where the sutler led the army.

There is no denying that a railroad extended into open territory will increase the value of real estate, and eventually build it up; but, in the meantime, we are wearing out rolling stock and track for the owners of real estate, and should receive a bonus sufficient to carry the road until the open territory is sufficiently populated to support a road.

It is the general experience that by the time the fields become populated the rolling stock must be replaced and the track repaired, or we practically build a new road to suit the new conditions, and, outside of the benefit to the real estate owners, we only get our returns when the road is built for the actual needs of the existing population.

A road built in an unpopulated district has to contend with more dust and mud upon its rails, which means wear and tear; and without sewers there is bound to be places where the track is covered with water, which is deleterious to both motors, track and car bodies.

We will cite as an illustration a city of forty thousand inhabitants, which has twenty miles of track; five of the city lines extend 2112 feet beyond the settled territory, or two miles of track with but little traffic. Taking an average of ten cities of forty thousand population, the riding per capita is forty-six times per year. This would give in gross receipts $92,000; operating expenses 70% of gross receipts, or $64,000, and $27,600 net receipts. The average road is bonded at the rate of $30,000 per mile, or $600,000 for twenty miles of track. The interest at 5% would be $30,000. This would show a deficit of $2,400 on interest. Now, in this city of forty thousand inhabitants, we have two miles of track operated and bonded that for the present we get no return from, as it was built to promote the building of the city at different points; and like the man who has lived a good life on earth, we are looking forward to a future reward, but the man is invariably dead when he receives it, and the results in street-railroading show that they are waiting for the sound of the horn in the hands of the receiver.

In this city of forty thousand, if but eighteen miles had been built and bonded for $540,000, with an annual interest of $27,000, we could have shown at least $600 surplus, and with the modern modes of increasing traffic, this surplus could undoubtedly be increased to pay the stockholders a fair rate of interest, if eighteen miles were built instead of the twenty.

If for obvious reasons it becomes necessary to extend the track beyond the populated limits, care should be taken to focus the promoting energy upon one line, and to extend no other lines until the one so extended has been so populated that that line shall be self-supporting, as with the extension of several lines in different parts of the city the various interests become separated, and each line so extended only receives a very widely scattered population that must take years to promote into a paying territory.

*Abstract of paper read at the meeting of the Street-Railway Association of the State of New York, Albany, September 17, 1895.

THE HARDY COMPRESSED-AIR SYSTEM.

Seven cars are being built by James Trimble, of New York, to be fitted out with Hardy Compressed-Air motors, similar to those which are now being used in Rome, N. Y. The new cars are 20 feet long in body and 28 feet over all, and equipped with Pintsch gas. The Rome Locomotive Works, Rome, N. Y., are building the trucks for these cars.

The General Compressed-Air Company controls the Hardy patents for the use of compressed-air.

Six cars of this system are being built for a test on the Ninth Avenue surface road, New York City. The cars are to be delivered complete, with a temporary compressed-air plant to operate the cars. In addition to these six cars, one car of the same style will be sent to Chicago to be run on the South Chicago Railroad Company's tracks.

The General Compressed-Air Company expect an order for 100 cars from South Chicago, and a complete compressed-air plant. These cars will be fitted out with air chambers of 46 cubic feet capacity each. One charge of air will run a car 20 miles.

The railroad commissioners of the State of New York have very carefully examined the system at Rome, N. Y., and were so well pleased with the tests that they granted a franchise to the Rome Street Railway Company to run their cars with air in place of electricity.

The cars for this system are being built by James Trimble, of New York, and are well constructed and handsomely finished.

CAPT. W. WOLCOTT MARKS.

Captain W. Wolcott Marks, superintendent of the Bishop Gutta Percha Co., of New York, and Captain of the Ninth Regiment, N. G. S. N. Y., recently entertained some of the workmen from the Bishop Works, at New Dorp, Staten Island. Captain Marks is very popular in the works and is a prominent member in many societies. His record is an excellent one, and all who know him know a man of sterling worth.

GREAT CHANGES IN FIFTY YEARS.

"Fifty years ago on all Manhattan Island there was only one telegraph office, and that one was located in Jersey City."—From the *Electrical Review* of September 18, 1895.

Will Brother Price please explain this geographical freak?

Principles of Dynamo Design.—Owing to the crowded condition of our columns this week we have been compelled to omit Mr. Harrison's article on Dynamo Design. The subject will be continued in next week's issue, however.

HANDY FIRE-ALARM BOX.

This device is designed to furnish a quick method of sending a fire alarm throughout a building, so as to give the quickest notice possible to the occupants.

By bringing the glass front of the case with the hammer provided for the purpose, the proper connection is made and the alarm rung.

The case is only three inches in diameter and one and a half inch deep, and is made in wood or metal to suit the woodwork and finish of the room or building. It is neat, compact and of low cost and fulfils every requirement in an alarm.

It is particularly adapted to hotels, office buildings,

JONES FIRE-ALARM BOX.

schools, etc., where a large number of persons are brought together under one roof. This apparatus is made by J. Jones & Son, wholesale dealers in electrical supplies, 67 Cortlandt street, New York city, and its convenience and simplicity are creating a big demand for it.

PRESIDENT CLEVELAND PRESSED THE BUTTON.

On September 18 the Atlanta Exposition opened with appropriate ceremonies and amid much enthusiasm. The machinery was set in motion by the electric impulse sent forth from Gray Gables by President Cleveland, who pressed a button specially placed in his cottage for the purpose. This interesting event took place at 6:56 P. M. Every precaution had been taken to insure the success of the programme as respects the feature of transmitting the president's energetic push on the button, and hardly had contact been made when word came right back from Atlanta that the machinery was in motion.

President Cleveland was surrounded by his family when he exerted the pressure that accomplished so much hundreds of miles away.

Fire at the Bordeaux Exhibition on the night of September 19 destroyed the building devoted to the display of electrical apparatus. The fire was confined to this building and ruined the contents.

THE MONTREAL CONVENTION.

As the time for holding the next convention of the American Street-Railway Association draws nigh interest increases.

The supply men who intend to exhibit their goods are hard at work planning, and it is likely that there will be a big display of electrical apparatus.

The railroads are offering excellent facilities for the transportation of delegates to and from Montreal, and this feature of the occasion will be a pleasant one. The famous Delaware & Hudson Railroad Company will place at the disposal of the members and other attendants the best the business can command. This road is well known to all travellers of the North as one of the best equipped lines in the country. The road-bed itself is smooth and easy riding and the cars are of superior make and finish.

The scenery along the Delaware & Hudson line is famous for its variety and beauty. The road skirts the edge of historic Lake Champlain, and the Adirondack mountains flank it on the west. The ride over this line through this section of the country is a charming one, and all who contemplate visiting Montreal should take it and enjoy the beauties which nature so abundantly affords. Elsewhere in this issue is given a schedule of trains and other timely information.

The following is the official general programme of the fourteenth annual meeting of the American Street Railway Association, which will be held in the Windsor Hotel, Montreal, Canada, October 15, 16, 17 and 18, 1895:

Special Committees will report on the following subjects:—"Transfers;" "Municipal Ordinances;" "Labor Question—Wages Paid to Employés;" "Experience of Roads in Furnishing Free Music and other Entertainments to the Public;" and "Physical Operation of Roads."

Exposition of Street Railway Supplies.—The executive committee has secured Victoria Rink, Montreal, Canada, for the exhibition of supplies of every nature used in the street-railway business. The building has been engaged for two entire weeks, beginning October 9 and ending October 22; thereby giving ample time for the setting up and removal of the largest exhibits The hall for the meeting is adjacent to the exhibition building, and delegates will therefore be enabled to examine the exhibits to the best advantage and with the least possible loss of time. The exposition will be in charge of Mr. Stonewall Jackson, 27 St. Sacrament street, Montreal.

Reduced Rates of Fare.—The Traffic Associations have authorized the sale of tickets at reduced rates—namely, a fare and one-third for the round trip. This concession applies to all attending the meeting—delegates, supply dealers and accompanying friends. The Traffic Associations that have extended this courtesy are the Trunk Line Association, the Canadian Pacific Company, the Central Traffic Association and the Boston Passenger Association.

The Banquet.—The annual dinner will take place on Thursday evening, October 17. Each company that is a member is entitled to the free admission to the banquet of two of its officers. Each additional officer, or any other gentleman in attendance at the meeting not an officer of a member-company will be charged ten dollars; ladies' tickets, five dollars each.

Hotel Accommodations.—There will be ample hotel accommodations for all who attend the meeting. The headquarters of the association will be at the Windsor Hotel. The rates at the hotels are as follows:

Windsor	$3 50	to	$5 00	per day.
St. Lawrence Hall	2 50	"	4 00	"
Queen's	2 00	"	3 50	"
Balmoral	2 00	"	3 50	"
Cadillac	1 50	"	2 00	"

All hotels are on the American plan, and rates according to location of rooms. Rooms will be assigned in the order of applications received, and as far as possible in accordance with the expressed wishes of the applicants.

NEW YORK ELECTRICAL SOCIETY.

The opening meeting of the society for the season 1895–96 will be held at Columbia College on Friday, September 27, at 8 P. M.

Mr. T. C. Martin will deliver a lecture entitled "Niagara on Tap." The lecture will deal with the great engineering enterprise at Niagara, by which the energy of the cataract is now being utilized electrically for light and power. The development of the work will be traced step by step, in a popular manner, and an idea will be given of the ultimate scope of the transmission of the current generated at the falls. Illustrations will be given by lantern slides made from photographs taken specially for the lecture.

YOUNG MEN'S INSTITUTE.

This institution, Nos. 222 and 224 Bowery, New York City, is a fine example of practical Christianity, and for the past ten years has been doing most commendable work. It is the Young Men's Institute of the Y. M. C. A. Last season 463 men, between the ages of 17 and 35, were enrolled in the evening educational classes, which embrace all practical subjects, mechanical and professional, including electricity. The institute has an excellent circulating library, and scientific lectures and musical and literary entertainments weekly. The fees charged for these privileges vary from $4 to $7.50 per year. There will be a grand opening on the evening of October 1.

BROOKLYN INSTITUTE OF ARTS AND SCIENCES.

The prospectus for 1895–96 of the Brooklyn Institute of Arts and Sciences has just been issued. In the Department of Electricity eight illustrated lectures on current topics of interest in electricity will be given, the meetings being held on the first Friday evening of each month. The subjects and authors of the lectures are as follows .

Oct. 4. Lecture by Mr. T. Commerford Martin on "The Electrical Use of the Niagara Water-Power Plant," or "Niagara on Tap."

Nov. 4. (Mon). Lecture by Prof. William A. Anthony, Ph.D.

Dec. 6. Mr. Gano S. Dunn has been invited to lecture on "The Principles of the Dynamo, and Recent Improvements in the Application of the Same."

Jan. 3, 1896. Lecture by Prof. Harris J. Ryan, M.E., on "The Properties of Paraphase Currents."

Feb. 7. Prof. M. I. Pupin, Ph.D., has been invited to lecture on "Electrical Resonance and Alternating Currents."

Mar. 6. Lecture by Mr. A. E. Kennelly on "The Electrical Transmission of Energy from the Niagara Electric Power Plant."

Apr. 3. Lecture by Mr. William S. Barstow on "New Problems in Electric Lighting for Large Cities."

May 1. Annual meeting. Lecture by Prof. George W. Plympton, M.E., on "The Action of Electricity Escaping from Trolley Lines on Water and Gas Pipes, and the Remedy."

A course of six illustrated lectures on "The Applications of Electricity in the Arts and Sciences." Prof. William A. Anthony, Ph D., has been invited to give the lectures on successive Monday evenings, beginning in November. The course will be given in the lecture room of the Edison Electric Illuminating Company, 360 Pearl street, where excellent facilities for illustrating lectures are provided.

Mr. James Hamblet is president of the department, and Henry J. Weed secretary.

HENRY ELECTRICAL CLUB.

The Henry Electrical Club will hold its first meeting on Friday, October 4, at the rooms of the American Institute of the City of New York, 111-115 West 38th street. Hereafter lectures will be delivered on every Friday night, on the following subjects :

1. Principles of Dynamos 2. Shunt Dynamo. 3. Series Dynamo. 4. Compound Dynamo. 5. Alternators. 6. Armature. 7. Field. 8. Design. 9. Tests on Iron and Steel. 10. Testing of Dynamos. 11. Running and Handling. 12. Methods of Driving Dynamos. 13. Transformers. 14. Switchboards. 15. The Line. 16. Subways. 17. Systems of Regulation. 18. Interior Wiring, Conduits, etc. 19 Safety and Distributing Devices (Cut-Outs, Fuse Blocks, Panel Boards). 20. Circuit Wiring, Sockets, Lamps. 21. Principles of Motors. 22. Shunt Motors. 23. Series Motors. 24. Alternating Motors. 25. Testing of Motors. 26. Troubles in Dynamos and Motors and Their Remedies.

One other night in the week, Tuesday, will be devoted to class work, where the members are allowed to ask questions, and such questions are discussed by an instructor. This part of the club is under the supervision of the University Extension of the State of New York, which is of direct advantage to the members, inasmuch as they are allowed to undergo examinations, in lieu of which they receive, if their knowledge is sufficient, a regent's diploma in due time.

The executive committee has thought it advisable that the members of the club should be given a chance to study elementary mathematics, and arrangements have accordingly been completed to have 15 lectures on algebra delivered every second Tuesday, in addition to the class work of that night. It was only after careful consideration that Tuesday was selected for the two kinds of work, but after careful investigation it was found to be inadvisable to have three nights a week devoted to educational work in one club, since the members, mostly workmen, cannot well stand the strain.

For further particulars, people are requested to address Mr. Geo. W. Whitefield, the secretary of the Institute, 111-115 West 38th street.

ANOTHER BLOW AT THE TELEPHONE MONOPOLY.

A dispatch from Chicago a few days ago stated that the United States District Attorney had been requested to bring suit in behalf of the people against the Bell Telephone Company for violation of the anti-trust laws. A similar request will be made to Attorney-General Moloney, of Illinois, to prosecute the same company for violation of similar state laws.

James E. Keelyn, president of the National Telephone Protective Association, has submitted evidence to U. S. District Attorney Black bearing on the case. Since Mr. Keelyn's first move in the case other evidence has accumulated, which, it is claimed, proves a violation of the laws above referred to, and the federal and state authorities are certain to act thereupon.

In the agreement between the Bell Company and the Western Union, the former agreed to pay the Western Union Company 20 per cent. of all royalties on its telephone rentals, and the Western Union Company agreed to abandon its existing exchanges and abstain from all telephone business. The contract expires nominally in November, 1896, but contains a provision for renewal. In 16 years the Western Union Company is said to have collected about $5,000,000 of the Bell Company's royalties.

Because the Bell Company manufactures its telephones through the Western Electric Company, of Chicago, that city is thought by those at the head of this movement to be the best place in which to bring the proceedings

Western Union Office Burned Out. — A large fire in Indianapolis, Ind., on September 18, destroyed the Western Union Telegraph Company's office, which was located in the Condit Building. Several other buildings were destroyed.

ECONOMIC MOTORS AND DYNAMOS.

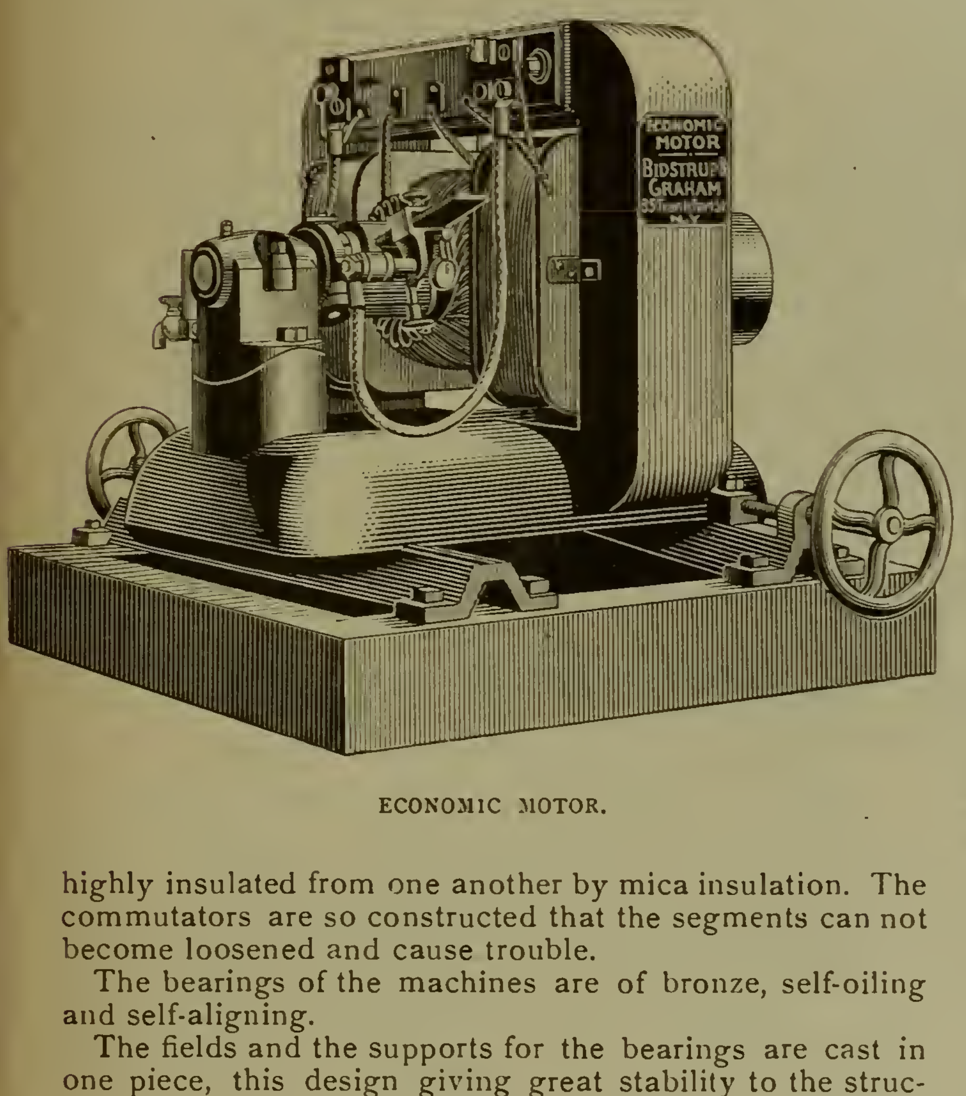
The accompanying illustration is of one of the Economic motors of Bidstrup & Graham, 35 Frankfort street, New York, for which machines Mr. J. L. Flagg is the special agent.

These machines are designed for operating elevators, printing-presses, or any other purpose requiring power, especially in manufacturing work.

The standard motors are shunt wound and made in seven sizes, varying from 1 to 20 horse-power, and the generators, which are compound-wound, vary in capacities from 1 to 18 kilowatts. These machines are wound for 110, 220 and 500 volts, and all the motors are provided with starting boxes, the dynamos having rheostats for the fields.

The economic machines are unsurpassed in design, material, workmanship and finish. The parts requiring stiffness are made large and heavy, and the field and armatures are so proportioned that the machines carry the greatest loads without sparking.

The commutator segments are made of the best quality of rolled copper bars, free from spots and blow-holes and



ECONOMIC MOTOR.

highly insulated from one another by mica insulation. The commutators are so constructed that the segments can not become loosened and cause trouble.

The bearings of the machines are of bronze, self-oiling and self-aligning.

The fields and the supports for the bearings are cast in one piece, this design giving great stability to the structure, and insuring an easy running machine. Only the best quality of iron is used in these parts. The poles, which are of the salient type, give a powerful magnetic field with a minimum expenditure of energy.

The armature is of the Gramme ring type, having a large radiating surface, which insures cool running on any load.

The brush-holders are substantially made and are designed for carbon and gauze or sheet-copper brushes. They automatically adjust the brushes as the latter are worn away, and this greatly reduces the labor and attention of keeping the brushes in adjustment. This self-adjusting feature is a very important one, and of great value for motors.

The insulation, which is one of the important points of a machine, is carefully attended to in the construction of these dynamos and motors. The very best of insulating material is used, and it is claimed by the manufacturers that no superior insulation can be obtained with available materials.

The Economic machines are compactly built and pleasing in appearance.

New York Notes.

Mr. Charles M. Proctor, vice-president of the Proctor-Raymond Co., of 444 Niagara Street, Buffalo, N. Y., was in town last week.

The McE. cut-outs, made by Edward J. McEvoy, of the Thames Building, are having a healthy sale. All users of cut-outs should look into the merits of these particular goods.

Frederick Pearce, 79 John street, the manufacturing electrician, lately equipped the Brooklyn Police headquarters with a fine switchboard, complete, for the telegraph police call system. Mr. Frank C. Mason, the chief of this department, is well pleased with these improvements.

The Metropolitan Street-Railway Company has asked for a franchise to extend its present Ninth Avenue lines from 125th Street at Amsterdam Avenue, to and up the Boulevard to 145th Street, and east on that street to the Harlem River. It also asked for permission to extend its Seventh Avenue lines on certain downtown streets. The Ninth Avenue extension will be operated on either the cable or underground trolley systems.

I get it all over in the trade, "Are you going to Montreal?" Of course we are, and we want to get up a big party to join us and go up to the Canadian metropolis on the night of October 14. Take the train that leaves the Grand Central station at 7 o'clock; it goes direct to Montreal over the Delaware & Hudson Railroad. It arrives at Montreal on Tuesday morning in time for breakfast and all the preliminaries for breakfast That is the quickest train up there, and you get a good night's rest—if you want one.

J. Jones & Son, 67 Cortlandt street, manufacturers of, and dealers in electrical apparatus and supplies of all kinds, are among the busiest dealers in the trade. It makes no difference when you go in you will find some electrical engineer, contractor or manufacturer dickering with either Mr. Jones or Mr. Lowe, the manager; some after bids on a large supply of electric light apparatus or railway supplies; others are after incandescent fittings, switches, cut-outs, etc., and others after big lots of wire for some large isolated plant The firm has a "bargain counter," on which can always be found some real bargains. The ladies haven't "got onto the racket yet." When they do there will be a tremendous rush for these bargains.

Reform is needed in one branch of the electrical trade. In talking with several of the best electrical engineers and contractors I find that they can tell some interesting stories about the tricks of architects of large buildings. For instance, a contractor will get an order for the installation of a simple burglar alarm and annunciator plant for some prominent building. A burglar alarm is a very simple thing to install, but the architect who imagines himself away up in electrical matters advises the owner to employ an "expert" to supervise the work. The expert generally gets more money to see that the burglar alarm is installed than does the experienced man who puts it in. The same thing is frequent in the case of electric light installations. In many instances the expert is so zealous in the owner's behalf that he will take advantage of any little mistake a poor contractor may make in figuring. Many contractors have been practically ruined in this way. In many cases contractors in consulting with architects have been requested by the latter to recommend some expert to supervise their work. The expert frequently ignores entirely the interests of the contractor who recommended him in the first place, even when the contractor's bid is equal, and sometimes less, than that of his competitor's. Why should contractors be so shamefully treated? Many "expert" electrical engineers are enjoying the luxuries of life. How did they come into possession of the means? Ask some poor suffering contractor; he can tell.

W. T. H.

THE LAW BATTERY COMPANY.

The new factory of the Law Battery Company at Cranford, N. J., which was completed some time ago, is working at its fullest capacity producing the celebrated Law Battery and other electrical apparatus. The company has its own carbon manufacturing plant, and the quality of this material turned out is said to be superior to any open-circuit battery carb on made.

The Law Battery Company manufactures a great variety of electrical apparatus. The Law Double Cylinder cell is classed among the best open-circuit batteries in the world. The negative (carbon) element has about 145 square inches of surface and the jar holds 2½ pints of solution, these two features assuring great holding-up power. The cell has high electromotive force and low internal resistance.

A recent invention of the company is the "Law Honeycomb Cell" It has for the negative element a block of carbon, which is perforated by a number of holes running through from one side of the block to the other—hence its name "Honeycomb." It is a cheaper cell than the one first referred to, but the best obtainable for the money asked for it, and bound to "take."

The Law Carbon Porous Cup cell continues to grow in favor, and its use is rapidly increasing.

The Law Battery Company has built up a large reputation among the medical fraternity through its well-known medical apparatus, The Law Medical Cabinet outfit is one of the best made, and highly thought of in the medical profession. The instruments consist of a Bailey Current Controller, milli-ammeter, Faradic Coil, and all the necessary switches, besides 60 cells of Law Double Cylinder battery.

The cabinet has a roll top, and the battery stands on 15 drawers, each holding 4 cells.

This outfit is superior in design, construction and material.

The medical table outfit is similar to the cabinet as far as the instruments are concerned, the battery, however, being placed in any convenient place away from the table.

Then there is the Law Medical Shelf outfit, which may rest on brackets or on a table, if preferred.

The Law Company carries a large stock of accessories, including cautery instruments, cautery batteries, etc., etc., all of the best make and material.

Mr. Charles Shaw, treasurer, and Mr. Willard P. Jones, secretary of the company, have entered personally into drumming up trade, and have met with remarkable success. This, however, is not surprising, as they are "Old Timers" and consequently have a large circle of friends in the electrical field.

All communications should be addressed to the office, 39 Cortlandt street, New York.

Architects' Directory.—William T. Comstock, 23 Warren street, New York, has just issued his Architects' Directory for 1895–96. This directory contains a list of the architects in the United States and Canada, classified by states and towns; also a classified index of prominent dealers and manufacturers of building materials and appliances. This directory is published annually.

WASHINGTON NOTES.

The Metropolitan Street-Railroad Company will, on October 10, commence the work of equipping their entire road with the Connett electric system, now in operation on Ninth street. Everything is now in readiness for the work.

The road will be 13½ miles long, an increase of 1½ miles over the present length. It is expected that the work will be completed and the road running by August 1, 1896. The system has met with unprecedented success on the Ninth street line now in operation by this company.

After much deliberation the Secretary of the Interior has awarded to the General Electric Company the contract to erect an electric plant at the Government Hospital for the Insane, at their bid of $11,454.

The Western Telephone Construction Co., of Chicago, Ill., was the only company to put in a bid for furnishing telephone systems for the various navy yards. Their bid was $2,000 for the entire work.

Recent reports from San Juan del Norte, Nicaragua, state that the telegraph line that has for some time been in course of construction connecting Acoyapa and Rama has been completed.

There will be a telegraph line constructed between Bluefields and Rama. The lowest bid made for construction of same was $24,700, Nicaragua currency, or about $12,700 in United States currency.

It is stated that if some of our American contractors would correspond with the government officials at Managua regarding the Rama-Bluefields line, they might find it decidedly to their advantage.

ELEGANT LIGHTING FIXTURES IN BROOKLYN'S NEW THEATRE.

The lighting fixtures in the new Montauk Theatre, Brooklyn, attract marked attention through their beauty of design and finish, and they are a source of pride to the concern that furnished them as well as to the owners of the building.

The theatre is one of the finest in the country. The decorations are rich and elaborate in the Rococo style, and the W. C. Vosburgh Mfg. Co., Lmtd., who had the contract to furnish the fixtures, made them to correspond with the artistic surroundings.

The W. C. Vosburgh Mfg. Co. invites the trade, architects and others interested, to inspect these elegant examples of their work. The company's headquarters, factory and show-rooms are at No. 269 to 281 State street, Brooklyn, and they maintain a large Western branch at 114 and 116 Wabash avenue, Chicago.

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.

OLD-TIMERS' SOUVENIR.

The Old-Timers' souvenir number of the *Telegraph Age* is a splendid piece of journalistic work. It contains 64 pages of appropriate and interesting reading matter, embellished with half-tone cuts of famous telegraph men, many of whom contribute reminiscences of the early telegraph days. Every telegraph and electrical man will find this a valuable number for preservation, and Mr. J. B. Taltavall, the editor and publisher, deserves the hearty commendation of the craft for his enterprise in their behalf.

CHARLES J. FIELD, SKIPPER.

Mr. Charles J. Field, the well-known electrical engineer and railway contractor of this city, is the owner and skipper of the half-rater "Ethelwynn" which sailed against "Spruce IV," on Saturday last, for an international challenge cup offered by Seawanhaka-Corinthian Yacht Club.

Financial.

The Westinghouse Electric and Manufacturing Company has declared a quarterly dividend of 1¾ per cent. on its preferred stock, payable October 1.

The Edison Electric Illuminating Company of Brooklyn has declared a quarterly dividend of 1½ per cent., payable October 15.

Possible Contracts.

Henry H. Frick, Fricks, Pa., is making preparations to erect a large printing-office.

Plans for the new building to be erected by Frank A. Phelps, Wilkesbarre, Pa, have been drawn by Architect Bruce Price, 150 Fifth avenue, New York City. It will be lighted by gas and electricity.

The Pennsylvania Railroad Co. is considering the advisability of erecting a new depot in Pittsburgh.

Parfitt Bros., Brooklyn, N. Y., have prepared, for the Little Sisters of the Poor, plans for a two-story and basement brick laundry building, to cost $10,000.

T. Englehardt, of Brooklyn, has prepared plans after which Oster L. Schwanke, 9 Bleecker street, New York City, will have built on Avenue C, between East 37th and East 38th streets, a brick lithographic printing establishment, to cost $10,000.

The city of Gladstone, Mich., will issue $12,000 in bonds for the construction of an electric plant.

The Lee, Mass., Electric Company will furnish power for manufacturing purposes if enough subscribers can be secured to make the additional plant pay.

John P. Loomis, Kansas City, Mo., has applied for franchise for an electric light plant.

Peabody and Stearns, of Boston, will erect a brick and iron storage building for the Metropolitan Storage Warehouse Company, in Cambridge. Builders, Cutting, Bardwell & Company.

Baths will be placed in Bellevue Hospital, New York City, to cost $10,000, and will be lighted by electricity.

The Wilmington Light, Heat and Power Company, Wilmington, Del., are preparing plans for erecting a plant.

The Belfield Manufacturing Company, Emporia, Va., will put an electric light plant in their factory.

The town of Union Springs, Ala., desires to grant the franchise to responsible parties, to erect and to operate electric light system of modern style. D. A. Sissiuns is mayor.

H. E. Rhenbottom and York A. Woodard, of New Orleans, are arranging to erect an electric light and power plant in Hammond, La.

New York City.—Wm. H. Hall, jr., 128 West 122nd street, will erect four brick dwellings on 142nd street, to cost $60,000. Architects, Neville & Bagge, 215 West 125th street.

Leith & Glenn, 217 West 125th street, will erect eight brick dwellings on 130th street, to cost $100,000. Architects, Neville & Bagge, 215 West 125th street.

G. A. Schellenger, 128 Broadway, is making plans for a residence for Spencer Aldrich, corner of 72nd street and West End avenue, to be heated by hot water and lighted by electricity.

Robert T. Hopenit, of Williamsbridge, will erect a seven-story brick factory, 25x96, on east side of West Broadway, north of Grand street, to cost $40,000. Architects Neville & Bagge, 215 West 125th street.

Architect George S. Drew, jr., 215 West 125th street, has prepared plans for two four-story brick dwellings to be erected on 152nd street.

The Capworth, Buckhart & Hall Moulding Co., Syracuse, N. Y., will erect a four-story brick building, 150x60, on Spencer street, to be of slow burning construction. Cost, when complete, $25,000. Work will be begun at once. The company has been doing business in West Onondaga street, in the Cook Building.

It is reported that S. B. Loomis, of Walton, N. Y., will erect a shore hotel at Woodmont, Conn., next spring.

New Corporations.

The Hoboken Railroad Warehouse & Steamship Connecting Company, Hoboken, N. J., has been incorporated by Edwin A. Stevens, C. Albert Stevens, Edwin A. S. Lewis, William A. Macy, and Palmer Campbell, to build an electric railway. Capital stock, $300,000.

Huntington Gas Company, Huntington, L. I., N. Y., incorporated to supply gas and electricity. Capital, $60,000. Directors, L. B. Gleason, 44 Wall street, and W. D. Hard, both of New York city, and Victor Cumberson, of Brooklyn.

Delaware River Telephone & Telegraph Company, Liberty, N. Y., has been incorporated by Charles Homer and E. H. Pinney, of Jeffersonville; George Christians, Wallace M. Kilburn, and others, of Liberty, and George H. Schofield. Capital stock, $25,000.

The Nevada Electric Railway, Light & Park Company, Nevada, Mo., has been incorporated by George W. Dudley, Henry C. Moore, E. Mills, and others. Capital stock, $130,000.

The Clifton Storage & Power Company, Baltimore, Md., has been incorporated by Edward D. Onion, and others, to conduct a storage business and to manufacture hot water, steam or electricity for motive power. Capital stock, $2,000.

Grier-Young Electric Company, Camden, N. J., has been incorporated by Alfred S. Hattle, H. G. Grier, Mahlon D. Young and A. T. Lovett, with a capital stock of $10,000.

The People's Electric Company, Madison, Wis., has been incorporated by L. E. Kerns, F. H. Ford and L. W. Kroncke. Capital stock, $10,000.

Asbury Park & Belmar Street-Railway Company, Asbury Park, N. J., has filed articles of incorporation with the secretary of state for a double track electric railway from Asbury Park to Belmar.

The Reading and Lowell Street-Railway Company, Boston, Mass., has been incorporated by Charles F. Woodward, Henry H. Savage, Silas W. Flint, of Wakefield, and others, to build an electric railway to connect Boston and Lowell. Capital stock, $50,000.

The New Britain Electric Construction Supply Company, New Britain, Conn., has been organized by H. C. Williams, G. W. Fisk and Harry Horn. Capital stock, $5,000.

The Great Western Light & Heating Company, Des Moines, Iowa, has been incorporated by A. E. Johnson, E. P. Thompson and G. W. Benedict. Capital stock, $250,000.

The Pueblo Electric Street-Railway Company, Pueblo, Colo., has been incorporated by A. E. Pattison, Elmer E. Whitted, Anthony G Campbell, Irving Hall and Frank B. Gibson, for the purpose of acquiring and operating an electric street-car line in Pueblo. Capital stock, $500,oco.

The Joliet Light, Heat & Power Company, Joliet, Ill., has been incorporated by J. E. Sutherland, L. J. Highlands and J. S. Ward. Capital stock, $100,000.

Telephone Notes.

J. W. Scribner, F. B. McCully and W. W. Reinman are the incorporators of a telephone company in La Grande, Ore., to build and operate telephone lines from La Grande to Elgin. Capital, $3,coo.

The Baraboo Telephone Company, Baraboo, Wis , will be incorporated with a capital stock of $3,600. Officers, Dr. Charles Gorst, president ; E. P. McFetridge, vice-president ; A F. Fisher, secretary ; Henry Mariott, treasurer.

The Carolina Mutual Telephone & Telegraph Co., Charleston, S. C., has been organized to establish a new telephone system in Charleston. E M. Bailey is interested.

An ordinance granting permission to the Standard Telephone Company, of Washington and Baltimore, to erect and operate electric telephone and telegraph wires in the streets has been offered in the council.

The Bellefontaine Telephone Co., of Bellefontaine, Ohio, has been organized with a capital stock of $10,000.

There is talk of organizing a local telephone company in Marlboro, N. Y.

Street Railway Notes.

The conductors of the Gloucester, Essex and Beverly Street-Railroad, Massachusetts, are to be armed for night service. The fear of meeting with highwaymen at lonely spots along the line is the cause of this action, so it is said. The company should run double turreted cars, armored with Harveyized plates and carrying modern high power guns. This would be the most effective means of terrorizing the brigands of the Bay state.

The North New York City Traction Company has been incorporated at Albany, with a capital of $21,000. Directors: Henry Siebert, Frederick H. Benedict, James H. Haslin, William T. Ryan, Thomas L. Hughes, and Edward J. McGoldrick, of New York City ; John A. Hamilton, U. S. Grant, and C. Tag, of Brooklyn.

The Southern Boulevard Railroad Company of New York City has filed with the Secretary of State a certificate of the extension of its route.

The Athens Street Railway Company, Athens, Ga., has awarded J. W. Taylor the contract for the erection of its electric power plant, to be completed before Dec. 1.

The directors of the West Chicago Railroad Company, Chicago, Ill., authorized the issue of $1,000.000 six per cent. certificates of indebtedness. The issue of the bonds is to pay for electrical equipments.

The Merrill Electric Railway Co., Merrill, Wis., will enlarge their power plant. E. S. King is purchasing agent.

There is a movement in progress to connect Niagara Falls and Toronto, Can., by an electric road. The Hamilton Radial Railroad Co. has been formed with that end in view.

C. R. Ruffin, of Charlottesville, has applied to the council of Bedford City, Va., for a franchise to construct a street railway to be operated by horse-power.

It is understood that the West End Street-Railway Co., Boston, Mass., intends to erect a power house on land recently purchased.

The directors of the Trumbull Electric Railroad Co., Warren, O., decided to begin work on the extension to West Warren. Dr. F. W. Dakin, of Cleveland, is one of the directors.

The Bennington Electric Railroad, Bennington, Vt., was organized by the election of the following directors : A. B. Valentine, E. E. Larrabee, I. E. Gibson, J. A. Powers, E. L. Sibley.

A movement is on foot to build an electric railroad from Mansfield to Plymouth, Ohio.

An electric road is to be built from Toledo, Ohio, into Michigan. The right of way has been secured, and $50,000 subscribed.

The stockholders of the Buffalo, North Main Street & Towanda Railroad Company, Buffalo, N. Y., have filed with the county clerk notice of their consent to mortgage the company's property for $75,000. The money is to be obtained by issuing 75 30-year bonds. It is to be used to cancel a floating debt and to provide for future extensions and additions to the company's equipments.

The Belvidere City Railway Company has been organized in Belvidere, Ill., with a capital of $25,000. Incorporators, John M. Roach, James B. Canterbury and Chas. E. Fuller.

Bids will be received until Oct. 1 at 304 East Baltimore street, Baltimore, Md., for the power plant for the Baltimore, Middle River & Sparrow's Point Railway. Plans and specifications at above-mentioned office. Charles B. McLean is chief engineer.

Trade Notes.

P. & B. tape is acknowledged by street-railway companies as the very best article for their use. The recent heavy sales by the Metropolitan Electric Company, general western agents for P. & B. Tape, Compound and Varnish, warrant this statement. The imitations made on these standard articles in the past ten years have proven worthless, the P. & B. still holding its old-time record of superiority.

The Metropolitan incandescent lamp, handled exclusively by the Metropolitan Electric Company of Chicago, has gained for itself an enviable reputation. It has not been on the market two years, but it stands at the head for long life, brilliant illumination, and at an economical cost. The lamp season is now upon us and the Metropolitan Company are receivfng large orders daily from old customers, as well as making many new friends.

Mr. James G. Biddle, sales agent for the Western Electrical Instrument Company, has just issued a very complete and convenient illustrated price list of voltmeters, ammeters and wattmeters. Diagrams and formulas are given that will prove most valuable to the station manager and engineer, explaining how insulation and other kinds of resistance are determined by methods much simpler and better than those which prevailed a few years back. Interested parties should write immediately to Mr. Biddle at 525 Drexel Building, Philadelphia, to secure a copy of this catalogue, No. 115.

ELECTRICAL and STREET RAILWAY PATENTS

Issued September 17, 1895.

546,299. Apparatus for Indicating Telepathic Messages. Colin E. Campbell, London, England. Filed Jan 23, 1895.

546,303. Trolley-Pole for Railway-Cars. Robert Crommer, Philadelphia, Pa., assignor of one-half to James Stewart, jr., same place. Filed Jan 29, 1895.

546,324. Dynamo-Telegraphy. Albert S. Harris, Minneapolis, Minn. Filed Feb. 13, 1895.

546,328. Anode for Electrolytical Apparatus. Carl Hoepfner, Giessen, Germany. Filed Mar. 26, 1894.

546,348 Electrolytic Apparatus. William A. Rosenbaum, Montclair, N. J., assignor to the Mathieson Alkali Works, of Virginia. Filed Dec. 20, 1894.

546,353. Electrolytic Apparatus. Alf Sinding-Larsen, Christiania, Norway. Filed July 9, 1894.

546,355. Truss. James M Smith, Galt, Canada. Filed Mar. 10, 1894.

546,361. Pliers for Trimming Electric-Arc Lamps. Robert D. Tackaberry, Lewiston, Me. Filed Sept. 26, 1894.

546,364 Apparatus for Extracting, Separating, and Refining Metals by Electrolysis. Donato Tommasi, Paris, France. Filed Sept. 24, 1892. Patented in France Apr. 1, 1892, No. 220,580; in England Apr 1, 1892, No. 16,892, and May 21, 1892, No. 16,893; in Belgium Aug. 19, 1892, No. 101,006; in Austria-Hungary May 3, 1893, No. 55,418 and No. 88,065, and in Spain Sept. 16, 1893, No. 14,798.

546,383. Insulator. Gottleib Gerstenlauer, Williamsport, Pa. Filed Mar. 27, 1895.

545,388. Electric-Arc Lamp. Samuel P. Parmly, Chicago, Ill., assignor, by mesne assignments, to the Standard Electric Company, same place. Original application filed Oct. 26, 1891. Divided and this application filed Dec. 24, 1894.

546,389. Underground Conduit for Electric Railways. Herluf A. F. Petersen, Milwaukee, Wis. Filed Mar. 19, 1894.

546,403. Arc-Lamp Mechanism. Karl A. Lantau and Carl J. Anderson, Chicago, Ill.; said Anderson assignor to said Lantau. Filed Feb. 28, 1895.

546,407. Trolley-Wire Bracket. Leroy S. Pfouts, Canton, Ohio. Filed Oct. 20, 1894.

546,417. Thermo-Electric Generator. Harry B. Cox, Hartford, Conn. Filed Oct. 4, 1894.

546,442. Electric Motor. Frank H. Williams, Greene, N. Y. Filed Mar. 11, 1895.

546,471. Connector for Terminals of Electric Circuits. Jules E. Neher, Pittsburgh, Pa., assignor to the Westinghouse Electric and Manufacturing Company, same place. Filed July 30, 1894.

546,476. Electric Converter. Charles F. Scott, Pittsburgh, Pa., assignor to the Westinghouse Electric and Manufacturing Company, same place. Filed Jan. 12, 1895.

546,483. Electro-depositing Apparatus. Henry L. Bridgman, Blue Island, Ill. Filed Dec. 22, 1894.

546,494. Insulating Railroad-Joints for Electrical Signals. Thomas O'Brien, Jr., Philadelphia, Pa. Filed July 18, 1895.

546,524. Car-Fender. John F. Girtler, Brooklyn, N. Y., assignor to himself and Gaston E. Constantin, Adolf Glaus and Friedrich Heinemann, same place. Filed June 5, 1895.

546,534. Electric-Arc Lamp. Daniel Higham, Boston, Mass., assignor to the Higham Electric Company, Portland, Me. Filed June 4, 1895.

546,546. Electric Railway. Harry M. Montgomery, New York, N. Y., assignor, by mesne assignments, to Leon Dion, Boston, Mass. Filed June 14, 1892.

546,551. Thermometric Circuit Closer. Richard Pearson, London, England, Filed May 2, 1895.

546,553. Electric Calculator. William C. Porter, Arlington, Minn., assignor of one-half to Aug. G. Obernolte, same place. Filed Dec. 1, 1894.

546,560. Electric Locomotive. Sidney H. Short, Cleveland, Ohio. Filed Apr. 23, 1894.

546,579. Insulated Electric Conductor. Franz Clouth, Cologne, Germany. Filed June 26, 1895. Patented in England, Dec. 14, 1894, No. 24,374.

546,582. Electrical Piano. George H. Davis, New York, N. Y., assignor, by mesne assignments, to the Electric Self-Playing Piano Company, of New Jersey. Filed June 17, 1895.

546,585. Insulator. William Dibb and Albert Vickers, Syracuse, N. Y. Filed Mar. 12, 1895.

546,613. Electric Fusible Cut-Out. Duane N. Gleason, Brooklyn, N. Y. Filed July 19, 1892.

546,625 Electric-Arc Lamp. Henry A. Seymour, Washington, D. C., assignor to the Jandus Electric Company, Cleveland, Ohio. Filed July 20, 1895.

ELECTRICAL AGE

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CONTENTS.

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.

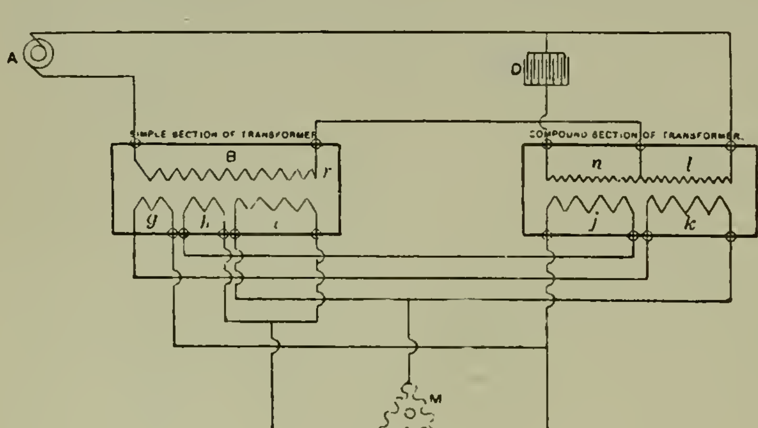
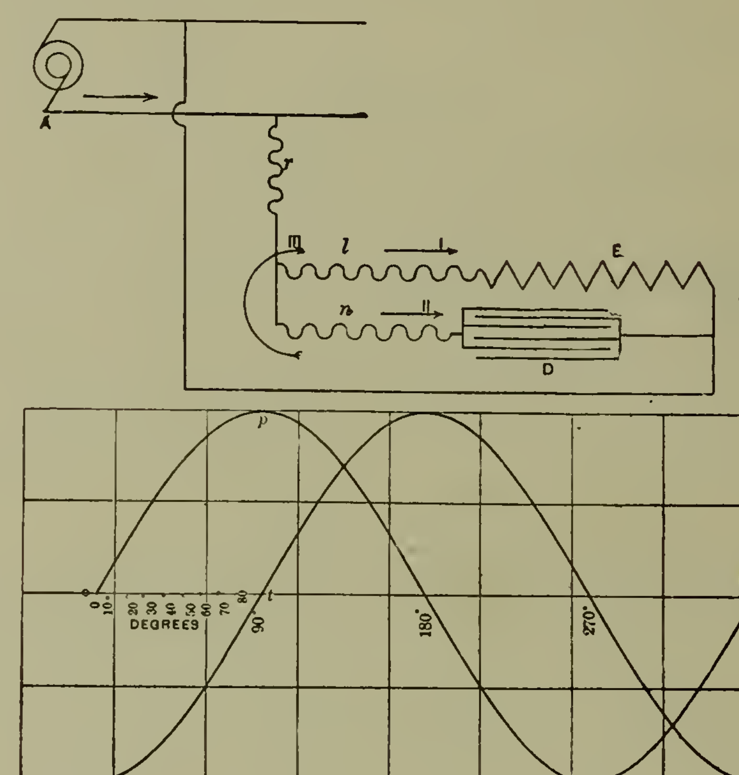


FIG. 1.

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 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 inductance 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



FIGS. 2 AND 3.

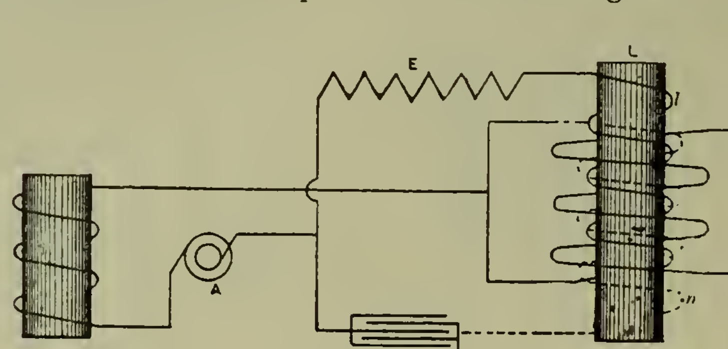


FIG. 4.

* 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

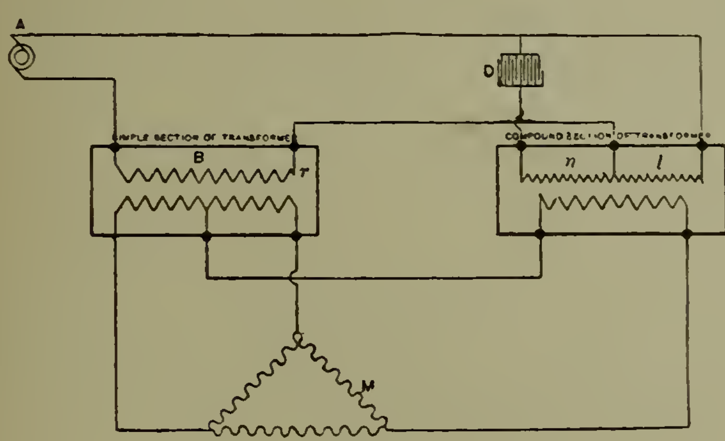


FIG. 5.

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

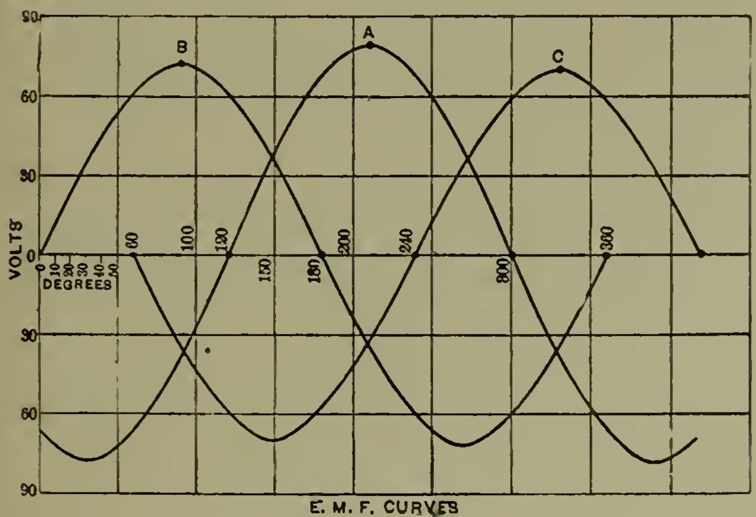


FIG. 6.

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,

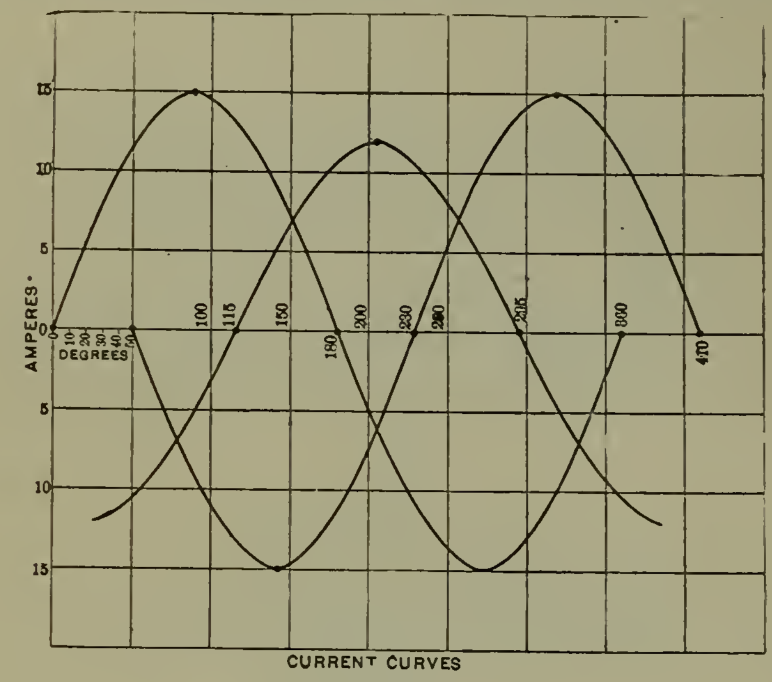


FIG. 7.

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.

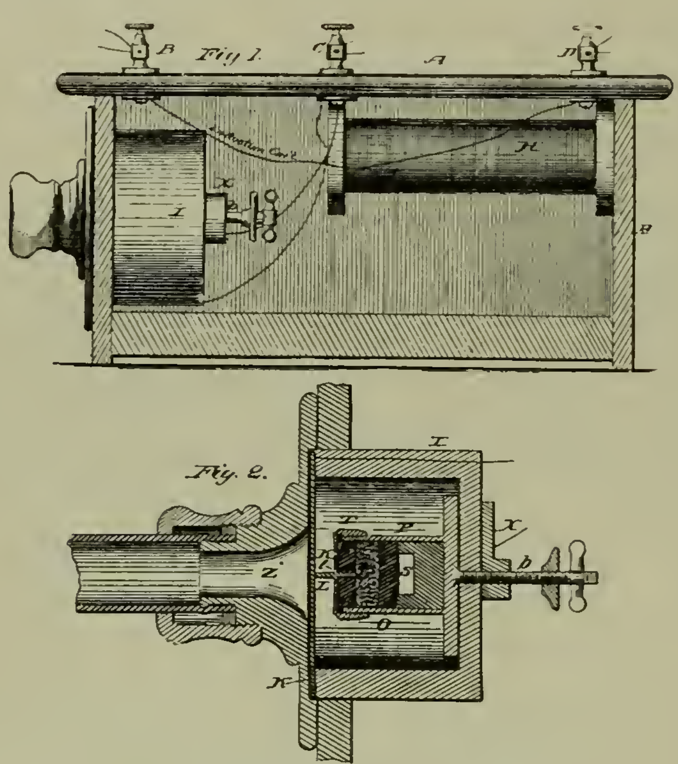
Occasionally it is urged that there is no need for insurance when an engine is of ample strength and very carefully looked after, while immunity from breakdowns in the past is also adduced as a reason for expecting similar fortune in the future. The experience of insurance companies, however, shows that 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.

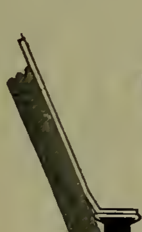
Having first introduced one of the machines referred to as a 10-pole shunt with drum armature designed to give 500 amperes and 230 volts at 120 revolutions, with a commutator of diameter three feet and width seven inches, I will proceed to enumerate the various combinations of copper and carbon which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



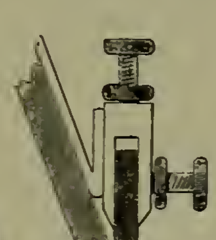


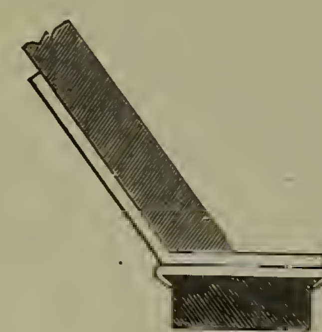
FIG. 1. FIG. 2. FIG. 3 FIG. 4.

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



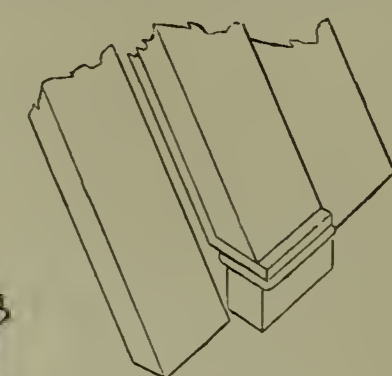


FIG. 5. FIG. 6.

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.

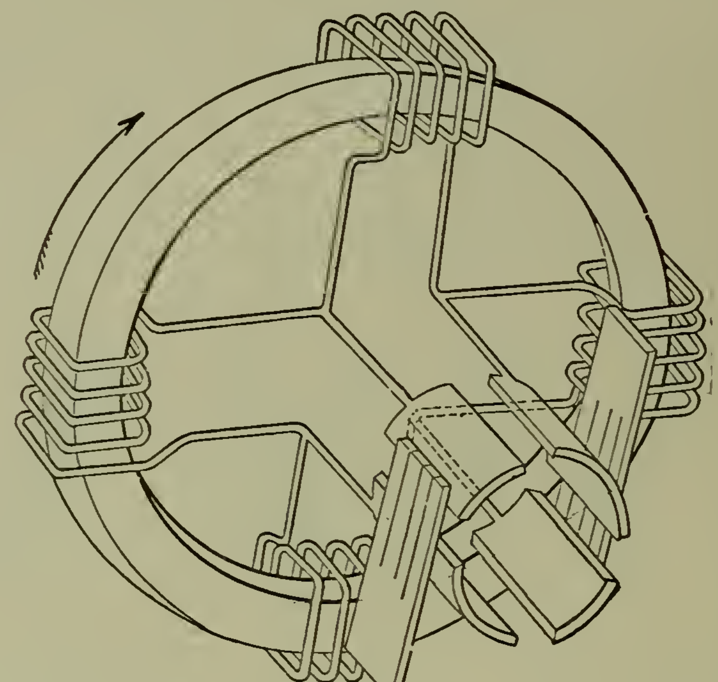
PRINCIPLES OF DYNAMO DESIGN.

by

Newton Harrison 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

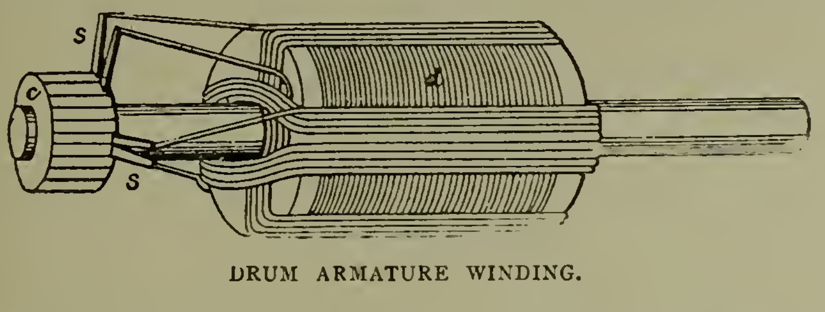


Gramme Winding.

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 p actice, 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



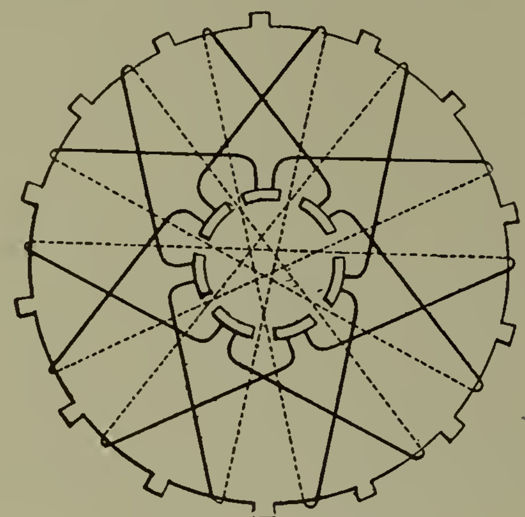
DRUM ARMATURE WINDING.

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 " "
Per cent. of cut	$7.\frac{21}{100}$
Gain 1½ in. deep	area 6 530 sq. in.
Per cent. of cut	13.
Gain 2 in deep	area 9 8272 sq. in.
Per cent. of cut	$19\frac{55}{100}$
Gain 3 in. deep	area 17.211 sq in.
Per cent. of cut	$34\frac{24}{100}$

Pins should be of the best qua ity, 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 roundhouse. 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 desiable 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.

"P. & B." means highest quality of insulating materials. The same trade-mark is also used on certain compounds that are used by all the leading manufacturers of insulated wires and cables; also by all wiremen in painting joints, etc. "P. & B." insulating tape is universally used by electricians and wiremen in construction work, and "P. & B." insulating papers are used extensively in dynamo and motor construction, and the armatures and field coils of these machines are treated liberally with "P. & B." varnish, which is an excellent insulating substance. Thus P. & B. pervades the electrical industry everywhere. P. & B. goods are used by all central stations and electric street-railway companies, and electrical apparatus, switchboards, woodwork, connections, etc., treated with P. & B. preservative paints, are perfectly insulated and fire-proof. The Standard Paint Company, 2 Liberty street, can tell more about these goods. W. T. H.

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.

Cable to Hayti. — The Commercial Cable Company's steamer Mackay-Bennett is engaged in laying a submarine cable from New York to Hayti, West Indies. The heavy-shore end was laid a few days ago The cable terminus is near that of the Commercial Cable Co. on Coney Island.

ELECTRICAL and STREET RAILWAY PATENTS

Issued September 24, 1895.

546,666. Means for Varying Light for Incandescent Electric Lamps. Charles A. Hussey, New York, N. Y., assignor, by mesne assignments, to the Electric Company, same place. Filed Sept. 29, 1893.

546,674. Electric Time-Switch. James F. McLaughlin, Philadelphia, Pa., assignor to James W. Difenderfer, same place, and Theodore H. Gehly, York, Pa. Filed Apr. 11, 1893.

546,689. Electric-Arc Lamp. Conrad Weber, Friedrich Goellner and Albert Schweitzer, Allegheny, Pa. Filed Nov. 19, 1894.

546,691. Continuous-Current Rectilinear Motor. Clinton E. Woods, Chicago, Ill., assignor, by direct and mesne assignments, to the C. E. Woods Company, same place. Filed Apr. 6, 1895.

546,724. Electric System. Merle J. Wightman, Johnstown, Pa. Filed Apr. 3, 1895.

546,725. Self-Acting Commutator for Telephones. Salomon Berditschewsky dit Apostoloff and Moise Freudenberg, Paris, France. Filed Mar. 27, 1895.

546,731. Telephone System. William W. Dean, St. Louis, Mo., assignor to the Bell Telephone Company of Missouri, same place. Filed May 18, 1895.

546,739. Method of Making Porous Plates or Electrodes John Johnson and James H. Robertson, Brooklyn, N. Y. Filed Apr. 2, 1895.

546,797. Car-Fender. William E. Woodbridge, Washington, D. C. Filed Dec. 1, 1894.

546,798. Car-Fender. William E. Woodbridge, Washington, D. C. Filed May 17, 1895.

546,799. Electric-Light Display System. Jonathan A. Woodbridge, Duluth, Minn., assignor to the Electrical Advertising and Sign Company, of Maine. Filed July 8, 1895.

546,802. Screening Electrical or Other Instruments and Apparatus. William E. Ayrton and Thomas Mather, London, England. Filed July 3, 1893. Patented in England, May 16, 1893, No. 9,753

546,820. Electric Switch. George E. Linton, Worcester, Mass. Filed Jan. 4. 1895.

546,821. Electric Switch. George E. Linton, Worcester, Mass. Filed Jan. 4, 1895.

546,826. Electric-Arc Lamp. Rupert Schefbauer, Paterson, N. J., assignor to the Auerbach-Woolverton Electric Company, New York, N. Y. Filed Nov. 16, 1894.

546,827. Electric Arc Lamp. Rupert Schefbauer, Paterson, N. J., assignor to the Auerbach-Woolverton Electric Company. New York, N. Y. Filed Mar. 5, 1895.

546,828. Electric-Arc Lamp. Rupert Schefbauer, Paterson, N. J., assignor to the Auerbach-Woolverton Electric Company, New York, N. Y. Filed Mar. 5, 1895.

546,834. Electromagnet for Pipe-Organs Edwin S Votey, Detroit, Mich., assignor to the Farrand & Votey Organ Company, same place. Filed Jan. 21, 1895.

546,837. Insulating-Support for Electric Wires. Jos. M. Bulkley, Ridgway, Pa., assignor, by mesne assignments, to the General Electric Company, of New York. Filed Mar. 4, 1895.

546,892. Telegraphic Vibrator. Paul La Cour, Askovshus, Denmark, assignor to Karsten Viborg Tuxen, Brooklyn, and Peter Hoykendorf, New York, N. Y. Filed May 7, 1895. Patented in England Aug. 4, 1893, No. 14,997.

546,901. Attachment for Electric Generators. Geo. W. Pickett, Denver, Colo., assignor of nine-sixteenths to Samuel Lesem, same place. Filed Jan. 12, 1895.

546,904. Combined District Telegraph and Telephone System. Edgar E. Salisbury and Albert E. Dean, Tacoma, Wash. Filed Aug. 21, 1894.

546,917. Electric Meter. Jules A. Déjardin, Paris, France. Filed Apr. 20, 1895. Patented in France Apr. 8, 1892, No. 220,769 ; in Belgium Oct. 8, 1892, No 101,674, and in England Oct. 10, 1892, No. 18,066.

546,962. Car-Fender. Eben J. McLaughlin, Essington, Pa., assignor of one-half to Irwin D. Duncan, same place. Filed Jan. 5, 1895.

546,965. Telephone. George A. Tower, Maurice Hunter, and Joseph P. Eastwood, Richmond, Va., assignors of one-fourth to Maurice W. Thomas, same place. Filed Dec. 20, 1894.

546,966. Electrical System of Motor Regulation. Merle J. Wightman, Johnstown, Pa. Filed Mar. 27, 1895.

546,972. Telephonic Attachment. Louis J. Gerson, Philadelphia, Pa., assignor of one-half to Charles Heritage, same place. Filed Jan. 14, 1895.

ELECTRICAL AGE

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NEW YORK, OCTOBER 12, 1895.

CONTENTS.

NEW SUBMARINE CABLE.

A Paris despatch reports that another submarine telegraph cable is to be laid down between Brest and New York. Nothing definite can be learned on this side as to the project, any more than that the report is probably true, since the laying of a new cable by the French company had been in contemplation.

TICKETS TO MONTREAL.

Get your Montreal tickets at 21 Cortlandt street, over the Delaware and Hudson line, the shortest and quickest; and be sure you get a certificate, which will entitle you to a return ticket at one-third the usual rate. The Electrical Age's special train over this line will leave the Grand Central station at seven o'clock on the night of October 14, reaching Montreal at breakfast time on Tuesday, the 15th. A large crowd is going by this train.

POWER FROM ARTESIAN WELLS.

The Lehigh Valley Railroad Company proposes to drill several artesian wells along its lines in the coal regions for the purpose of supplying water to its engines and collieries. Several artesian wells in the West are utilized for power work, and there is no reason why the Lehigh Valley Company should not use the power of the proposed wells for driving coal-drilling and hauling-machinery, and lighting the mines by electricity. They would still have the water, after making it do some useful work.

THE SECRETS OF THE TELEPHONE.

Last month a new law went into effect in New York State which is intended to prevent the divulging of the contents of telephonic as well as telegraphic messages. The law amends section 641 of the Penal Code by adding the words "or telephonic messages" to the present section, making it a misdemeanor to divulge or attempt to obtain the contents of a telegraphic message. The crime is punishable by a fine of not more than $1,000, or by imprisonment for not more than six months, or both.

CHINA AS A FIELD FOR ELECTRICAL DEVELOPMENT.

One of the good results of the recent war between China and Japan is, that China has had her eyes opened to the fact that she cannot maintain her position as one of the powers of the earth and conduct her affairs as they have been conducted for the past two or three thousand years. She has discovered, to her very great cost and humiliation, that in a contest between modern and ancient ideas, the latter are bound to be routed at every point. Hence the spectacle of this nation yielding to the pressure of modern civilization. China is now considering the adoption of modern ideas, and, since electricity heads the march of progress, there would seem to be a splendid field here for the introduction of electrical apparatus.

TO THE NORTH POLE BY ELECTRICITY.

A correspondent of the New York *Sun* has great faith in the power of electricity as a means to enable man to reach the North Pole. He suggests building an electrical generating plant at a point as far north as possible. Using this as a basis of operations he would run electric sledge trains to the North Pole, and open up a route for excursionists. Such an enterprise, he thinks, would accomplish what Peary, Greely and a host of other daring Arctic explorers have failed to do. While this sounds very much like a Jules Verne idea, we should not be surprised to witness an attempt to reveal nature's great secret in some such manner. The attractions of such a trip for excursionists might not be strong enough to make such an enterprise pay, but some wealthy American might consider the honor of being the first human being to reach the North Pole sufficient compensation for any outlay that this correspondent's suggestion implies. If this great feat is to be performed let it be performed by an American.

THE WINDSOR HOTEL, MONTREAL.

HEADQUARTERS OF THE AMERICAN STREET RAILWAY ASSOCIATION.

The accompanying illustration of the Windsor Hotel shows it to be an imposing edifice, as such it is. It occupies an entire block, bounded by Peel, Dorchester, Stanley and Cypress streets, and faces on Dominion Square, the largest and most beautiful in the city. It is built of light-

WINDSOR HOTEL, MONTREAL.

colored stone and has accommodations for about 800 guests.

The Windsor is one of the finest hotels on the American continent, and its location is one of the most charming in the city; being centrally located, it is within easy reach of the business section and only a few minutes' walk from the main railroad station.

The appointments of the Windsor are of the most elegant character, and no efforts nor money have been spared to keep it up to its high standard of excellence. The rooms are luxuriously furnished, and every convenience is provided for the comfort and enjoyment of the sojourner.

The Grand Rotunda is the first feature to attract attention on entering the hotel at the Dominion Square entrance. Here are situated the hotel office, backed by a magnificent stained glass window, ticket and telegraph offices, and the cigar and book and newspaper stands. The rotunda has a dome roof which is lighted by skylights. The rotunda has recently been refrescoed, giving it a magnificent appearance. The floor is of square marble slabs.

The steps of the grand staircase, which leads from the rotunda, are solid slabs of white marble. At the foot of the stairs are two large bronze figures of Iroquois indians, each bearing jets of electric light, which illuminate the staircase.

The Grand Promenade, on the first floor above the ground, is 180 feet in length by 40 in width, and is carpeted with the softest of Wilton carpets of rich design. Running down the centre of the promenade are beautiful columns, around the top of which are circles of electric light. The promenade is furnished with comfortable lounges and chairs.

The dining-room of the Windsor is a magnificent hall. It is 112 feet long by 52 feet wide, and is 27 feet high, and has an elegant marble floor. The room is lighted by three large domes, around each of which is a circle of electric lights, and when the lights are turned on the effect is truly beautiful. This dining-room has a seating capacity of 500, and it is said to be one of the largest and best frescoed dining-rooms on the American continent.

The hotel is six stories in height and amply provided with elevators and wide staircases, to afford easy access to the different floors.

The Windsor Hall, where the meetings of the association are to be held, is a recent addition to the main building, being in harmony therewith in the matter of architecture. The new building was especially erected for balls, banquets, concerts, etc. It is 136 feet long, 60 feet wide, and 60 feet high. The stage is situated at one end, and at the other end is a balcony with a seating capacity of 150. It is well lighted by electricity.

The Windsor Hotel is very ably managed by Mr. H. S. Dunning, who is an experienced hotel keeper and knows how to promote the comfort and happiness of his guests.

GRAND PROMENADE, WINDSOR HOTEL.

CONVENTION HALL, WINDSOR HOTEL, MONTREAL.

INTERIOR OF EXHIBITION HALL, MONTREAL.

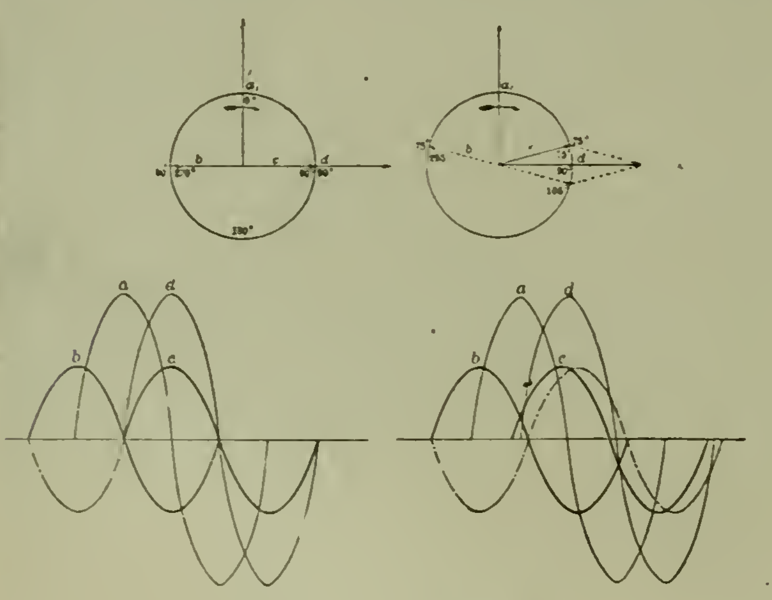
The Victoria Rink, where the exhibition of electrical appliances will be held, is at the rear of the Windsor Hotel, and fronts on Drummond street. It is about 200 feet long and 100 feet wide. There is a floor space of 15,000 square feet, which will probably be all well utilized during the exhibition.

PHASING TRANSFORMERS.

BY CHARLES S. BRADLEY.

(*Concluded from page* 185.)

I want to bring to your attention one feature of the compound coil used in combination with the condenser, which will be found in Figs. 8 and 9. If we suppose a direction of motion as shown by the arrow and the current in the condenser branch leads by 90 degrees, which is represented at *b*, and the current in the inductance branch lags by 90 degrees as indicated at *c*, and the wires carrying these currents are wound in opposite directions upon the core, we will have a resultant current, which is represented by extension *d*. Increase of load changes the phase relation of the individual branches, but not the resultant secondary, and this is explained by reference to Fig. 9, where a 75 degree lead, and a 75 degree lag are represented by the respective branches, and as the branches are wound in opposite directions we find that when *b* is turned over it becomes a lag of 105 degrees, and the resultant of 75 degrees and 105 degrees again produce 90 degrees lag, and the value again represented by the extension *d*, the value of the current is slightly less, but its resultant phase is the same as is represented in Fig. 8. This explains the steadiness of phasing which we are able to obtain. This may be explained by another method of diagramming, as is shown in Figs. 10 and 11, where curve *a* represents the fundamental current; curve *b*, Fig. 10, a lead of 90 degrees; curve *c* a lag of 90 degrees, and then *b*, being turned over, unites with *c* to produce the resultant *d*, which is 90 degrees in lag of fundamental curve *a*. Now, in referring to Fig. 11, where the fundamental current is again represented by *a*; curve *b* represents a lead of 75 degrees, and full line curve *c* represents a lag of 75 degrees; then, when curve *b* is turned over in the windings, as shown in the dotted line, the coils being wonnd



FIGS. 8, 9, 10 AND 11.

upon the same core, a resultant effect is represented by the curve *d*, which is 90 degrees in phase from fundamental curve *a*. Thus we see by increase of load, which tends to decrease the lead of the condenser circuit, and also decreases the lag of inductance circuit, our resultant is still in the same phase relation to the fundamental current.

The power factor is found to be very good. The current in the main line, feeding the transformer varying from 10 degrees lead at full load to 35 degrees lag at no load, and the motor at starting produces the same effect as when working at full load, so that we have very good phasing for starting and full load, as well as a good power factor, it being 82 per cent. even at light loads, and the probability is that we will have very much better results upon larger sized transformers.

The condenser in this combination fills two very important functions—first, assists in the phasing and second, prevents the lag upon the line. This arrangement does not prevent the idle currents flowing in the motor circuits and the secondaries in the phasing transformer, and we find in small motors with the high period of 140 cycles that the apparent energy in the motor circuits is sometimes two and one-half times the apparent energy in the main line. The

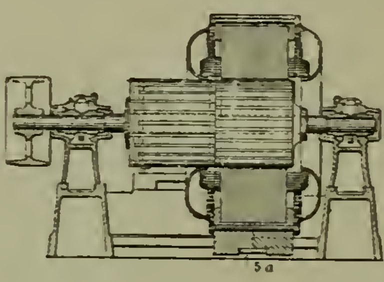


FIG. 12.

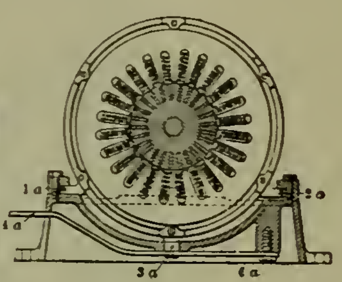


FIG. 13.

capacity of condenser for a one-half horse-power motor when 1,000 volts are supplied to the transformer is about 2.4 microfarads. Our condenser for this size, without connections, occupies a space of a cube four inches on each side, and capable of enduring 3,000 volts, or a factor of safety of four, as the voltage on the condenser is about 700. Of course, it will be understood by those familiar with the designs of induction motors, that it is impossible to design a small motor with small power factor, as the air-gap necessary for mechanical construction has to be so large in proportion to the size of the motor.

Many attempts have been made by placing the condenser in direct connection with motors to produce rotary fields, but have so far been attended with little success; as the trade requires the motor to be of comparatively low voltage, which calls for a large capacity in the condenser, and as the output of the condenser of a given capacity is proportional to the square of the voltage, it will be seen how advantageous it is to place the condenser in combination with the primary of the step-down transformer.

It may seem trite to call your attention to the fact that the transformer reduces the voltage at the same time it does the phasing, but I think it is so important that I wish particularly to emphasize the fact. It is also of great importance that the device has no moving parts.

Upon reference to the cuts showing the curves obtained of the electromotive force and current, it will be readily seen that they are all of true sine form. The current for this work was obtained from a 75 K. W. Slattery alternating machine. This machine has a surface winding on the armature, and, therefore, gives practically a sine wave. Just what the transformer may do on all the various dynamos that are in the market, giving all sorts of complex waves, it is difficult to say, with our present experience, but, so far as we know now, the transformer tends to smooth out all the irregularities.

While the principal use for this device at present seems to be the application of polyphase motors to single-phase lighting-systems, many new ones, undoubtedly, will be found. It may seem bold to think of applying this to long-distance trolley railroads, but I am hoping to have it done.

It is much more simple to have one trolley wire with track return than to have two trolley wires, which would be required by the direct application of polyphase systems. A large amount of power requires either a large current or high voltage, in order that the resistance of contact of whatever device is used to make connection to line need not be too great. As viewed at present, it seems as if the alternating current must be used for this work. If so, and unless the traffic is extremely frequent, it will take many more transformers, if they be placed along the line, than if the transformation is made upon the car or locomotive; because the transformers along the line having no trains or cars near them, would be idle.

If the voltage is stepped down on the car or locomotive, it is just as economical to do it by the phasing transformer, with the exception of the added weight of condensers, which for a 1,200 H. P. locomotive will be about two tons, and this is not of consequence on so large a power.

These condensers are very compact and efficient, and will stand from three to four times their working voltage, without puncturing the dielectric. I am sorry I cannot show you the condenser in all its details, but for certain reasons I cannot do so at present, but will present it to the Institute at the first opportunity.

A brief description of the motor may be in order, although it does not belong strictly to this subject. We met with much difficulty in developing a motor for so high a periodicity as 140 cycles. It is necessary to keep the density so low, and it is always such a temptation to try to get all the power from a given piece of apparatus, that they are always heating much more than they should.

With a large number of poles and slots, we found that any use of wide bars in the armature was out of the question, for the eddying currents in the copper were too serious. *We also looked for difficulties which we never found.* At times we thought the heating was due to higher harmonics produced from the phasing transformer; but the fact is, we never found any, unless it was in the experiments upon the two-phase motor. As mentioned before, the waves are all of the true sine form.

Cuts of the motor are shown in Figs. 12 and 13, the rotary field being the exterior or stationary part, and the secondary or induced constituting the armature. The armature is composed of two sections, or practically two armatures end to end upon the same shaft, one of the armatures having a low resistance winding and the other a comparatively high resistance; the field is placed over a high resistance for starting, and shifted by means of a lever over the low resistance, when it has nearly attained speed. Of course, this arrangement is for securing the starting up of the motor, and has nothing to do with the phasing transformer, and the motor might have rings for connecting the starting resistance to the armature and operate quite as well. The sliding of the field gave trouble, as the air gap has to be small, and the play at the sides (noted *1a* and *2a*) allowed the armature to strike against the field, and when a tight fit was made, which would work easily when cold, it would stick fast when the motor rose in temperature; the writer therefore decided to give it quite a clearance at these points, and give it a guide at the bottom of the field shown at *3a*. This being central and comparatively thin, the expansion is not sufficient to cause sticking; also the guides at *1a* and *2a*, being thin vertically, they may fit close and still slide easily. The lever for moving crown back and forth is shown at *4a* Fig. 13, and *5a* Fig 12. It fits loosely, having a fulcrum at *6a*.

COSTLY TELEGRAMS.

Telegrams are expensive luxuries sometimes, depending, of course, upon where they are going. For instance, to telegraph to Tasmania it costs $3.23 per word, beyond London. Some other high-priced rates are (all beyond London) New South Wales, $3.12; Japan, via Eastern Company's cables, $2.61; Java, via Siberia route, $2.14. The highest charges at the present time are $6.78 per word. This is for messages to La Libertad, San Salvador. The rates to Central American countries vary from $6.49 to $6.78 per word. From New York to London the rate is 25 cents per word.

A GREEN IRISH BULL.

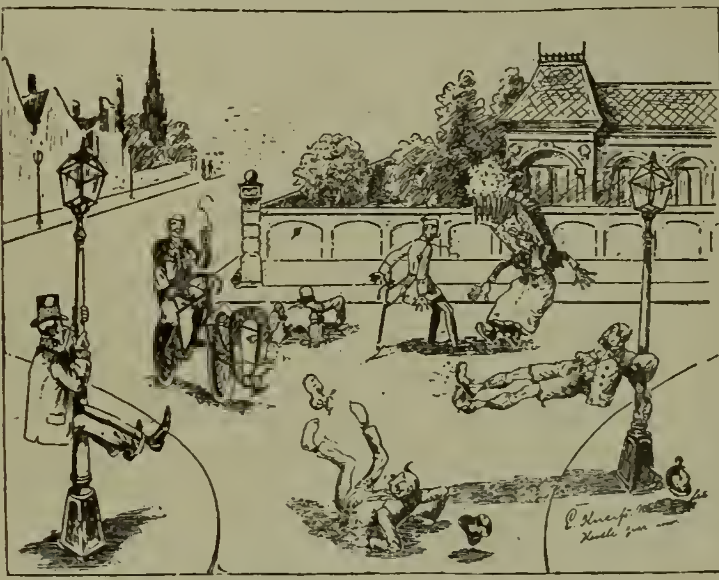
A good story is told by Mr. J. W. Lattig, superintendent of Telegraph of the Lehigh Valley Railroad, which brings out prominently the universal habit of associating anything of green color with Ireland and her inhabitants.

On the Lehigh Valley road, at the entrance to one of the tunnels, was a signal known officially as the "Ireland" signal. It was one of the last of its race, and it was desired to have it removed, as its functions had been substituted by a new signal which was painted green, and erected at considerable cost. Orders were given to remove the Ireland signal, and the section men, not knowing any signal by that name, consulted together and finally came to the conclusion that the Ireland signal must be the one painted green. The section foreman, when called upon for an explanation, stated that because the removed signal was painted green he supposed it was the Ireland signal.

A GREAT INVENTION.

City streets and country roadways are the last places on earth where one would expect to find carpet tacks, but they are found in more or less profusion along these highways. This astonishing fact was revealed by the introduction of pneumatic tire bicycles and many a wheelman has discovered the same fact, much to his sorrow.

An enthusiastic lover of the sport has devised a method of removing these insidious little creatures from his pathway as he advances, by the use of a strong magnet attached to the front of his wheel. The idea is a good one and the rider has nothing to fear, as may be inferred from a glance at the accompanying illustration. While he is evidently enjoying blissful peace of mind his contriv-



A MAGNETIC BICYCLE.

ance is working disaster in other directions. The artist has portrayed a magnet so strong as to make a powerful attack upon all metallic substances in its neighborhood, and the effect is well illustrated. One fellow has been bereft of both shoes on account of the iron pegs in the soles, and for the same reason two others are compelled to hug lamp posts to avoid being drawn into the maelstrom. The inventor of lamp posts should be immortalized. These useful objects, besides lighting the way to belated travellers, are admirable supports for those who are under the influence of any powerful agent.

A NEW CONSTANT BATTERY.

M. Morisot, professor of the Faculté des Sciences in Bordeaux, has recently brought before the meeting of the Association Française pour l'Avancement des Sciences a new type of battery. An outer vessel contains the positive pole, a plate of retort carbon, which is immersed in the depolarizing liquid, composed of one part of sulphuric acid and three parts of a saturated solution of potassium bichromate. The bichromate must be dissolved before the acid is added, and the saturation is kept up by crystals of bichromate contained in a short funnel in the upper portion of the liquid. A porous pot standing in the depolarizing liquid contains a weak solution of caustic soda (specific gravity about 1.05). The plate of amalgamated zinc which forms the negative pole is in a second porous pot inside the first, and filled with a strong solution of caustic soda (specific gravity about 1.25). The E.M.F. of the cell is 2.5 volts at the outset, and remains above 2.4

volts for at least 10 hours. The interior resistance is about 0.8 ohm, but it varies according to the thickness and quality of the porous pots. M. Morisot attributes the increase of 0.4 volt of E.M.F., compared with the ordinary bichromate cell, to the substitution of the alkaline solution for the ordinary acid.

THE ELECTRIC PLOW IN FARMING.

The Department of State, Washington, has received from Otto Doederlein, U. S. Consul at Leipsic, a detailed account of an electric plow manufactured by Messrs. Zimmermann & Co.

As the subject of using electric power for farming purposes is receiving considerable attention in this country, some extracts and illustrations from this report will be of general interest.

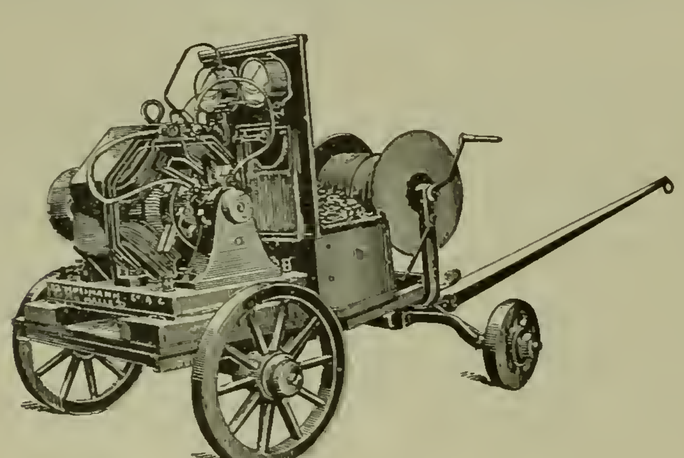
Although steam plows, in conjunction with locomobiles, have in the last thirty years shown great advantages over manual and animal labor, several objections thereto are irremediable, notably (1) their cost, (2) the expense of fuel and attendance, (3) the necessary water supply, (4) their size and weight, and (5) their inapplicability to small farms for the first four reasons, and small farms form an important part in this question of national economy.

Locomobiles, owing to their long periods of inaction during the year, waste an immense amount of motive power. Moreover, the rate of payment is, for such reason, very high.

Electromotors, on the other hand, are (1) far less expensive to make; (2) far lighter in their construction, and, consequently, more portable; (3) they can be used at a far greater distance from the actual source of power, thus saving much haulage.

A stationary engine or locomobile for farming on a large scale transfers its elementary power through an electromotor to the seesaw, tilting, or balance plow, the motor being mounted on the plow itself, thus avoiding wire-rope traction. The anchor shaft of the motor sets in motion a double-spur wheel, which, in turn, drives a pinioned shaft.

A chain extended over the field and held taut at both



ELECTRIC GENERATOR FOR PLOWING WORK.

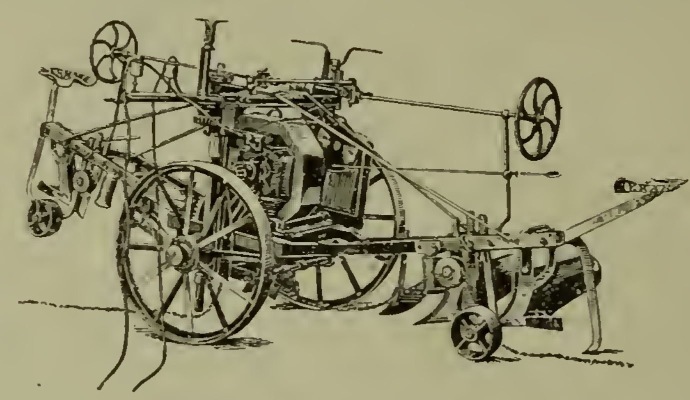
ends by triple ground anchors is worked by this pinioned shaft, which draws the plow along the chain across the field. On reaching the end of the chain, the plow is tilted to the other side and the simple reversal of the current sets the plow in motion in the opposite direction. In returning, it deposits the chain sideways ready for the next row of furrows. A laborer, by turning a lever, draws up the three ground anchors, and, by this simple action, sets the travelling wheels affixed to the anchor axles in motion, so that the anchors are easily moved to the next furrow. The motor tightens the chain before starting; the slack length of chain thus deposited behind the plow allows for any inequalities of length resulting from the shifting of the anchors, which are also provided with a spare length of loose chain for use in case of need.

THE ELECTRIC PLOW IN SMALL HUSBANDRY.

There are three factors to be considered, viz.: (1) the source of power or primary station; (2) the transmission of such power; (3) the tilting plow, with its electromotor.

(1) *The source of power.*—This may be any ordinary agricultural locomobile of from eight to twelve horse-power, but special care must be taken to furnish it with as sensitive a regulator as possible, in order to be able to surmount the irregularities liable to occur in switching the electromotor on and off, and also to prevent the occurrence of too great fluctuations in the number of revolutions. The locomobile may stand on any solid ground at the edge of the field to be plowed. It drives the dynamo machine (electricity generator), which is placed on a car.

This car also serves to transport the gauging apparatus for measuring the strength of current and tension, a reel or windle for the cable, as well as for bringing the plow



ELECTRIC PLOW.

to the field. One end of the tipping plow is fastened behind this primary-station car by means of a cramp iron, while the guiding roller in the rear is placed so far downwards as to rest on the ground and thus guide the plow. Locomobile and primary station together are thus brought to the desired spot with one team. As soon as the locomobile is set up accurately by means of brake blocks, the dynamo car is placed straight before it, fastened into the ground by means of an anchor placed opposite to the belt tension; the driving belt is placed over the driving wheel of the locomobile and the disk of the pulley of the dynamo machine, and the primary station is then in working order.

(2) *The transmission of power.*—Two cables, corresponding with the two poles, serves to transfer the electric power from the dynamo machine to the electromotor. One end of this pair of cables is affixed to a projecting bar of the plow and moves backward and forward with it, like a pendulum, while the other pair of ends is secured to the dynamo machine.

The friction of the cable on the ground is avoided by means of light cable carriages fitted with insulating nippers. These carriages follow each motion of the plow automatically, as the wheels are fitted into forks which, pivoting in every direction, answer to all the movements of the plow. (See illustration).

Five or six such cable carriages, according to the length of the area to be plowed, are easily watched by a boy, who has to take care that, in reversing the motion of the plow, they follow such motion.

(3) *The tilting plow, with electromotor.*—A tilting plow for small husbandry is fitted with two shares on each side. In front of each of these is a forecutter to prepare the ground. The frame and body, as also all other parts of the plow, are of iron and steel, and so strongly made that it is powerful enough to cut furrows to the depth of from 25 to 28 centimeters (10 to 11 inches), even in heavy, clogging ground. The plow may also be fitted with underground looseners, which follow the plow and loosen the subsoil to as much as 40 centimeters (15¾ inches) in depth, but do not turn it over.

The iron frame of the tipping plow bears in the centre shaft an arrangement on which are two main wheels of different diameters; these are adjustable perpendicularly and turnable sideways. The adjusting, or placing of the wheels, is easily effected from the driver's seat by means of a spiral and wheel, so that the driver has the plow under thorough control. An electromotor is mounted on the plow frame. A spur wheel is wedged on to the motor's anchor shaft. The motion of the electromotor is transmitted from this spur wheel with the aid of an intermediate appliance to a roller with a chain wheel. The dimensions of this appliance, which is made of cast steel, are so determined that the compass of the chain wheel receives a lineal speed of 70 meters per minute. The plow is, therefore, moved at this rate of speed across the field by means of the stretched-out chain, the links of which are 11 millimeters (seven-sixteenths of an inch) thick.

The chain is directed on to the chain wheel by guiding rollers in such manner that the tautly stretched chain end is constantly striving to raise the forward end of the plow as well as to press the rear end into the soil. This results in a steady and certain progression of the plow, enabling one with this implement to throw stubble from 10 to 15 centimeters (four to six inches) in height flat down, and to cut seed ridges.

To this end, special peeling or shelling apparatus are constructed, which, after removal of the plowing arrangement, are affixed to the frame of the tipping plow in the simplest manner, the operation being easily performed in a short time by any plow driver.

The mode of proceeding to the next row of furrows and reversing the motion of the plow have already been explained.

THE ELECTRIC PLOW IN HUSBANDRY ON A LARGE SCALE.

For extensive farming operations, the aim was to produce an electric plow capable of plowing 4 to 5 hectares (1 hectare = 2.47 acres) to a depth of 35 centimeters (13¾ inches) in ten hours. As this requires about 35 horse-power, the ordinary locomobiles at hand are not available. But, on the other hand, any ordinary stationary engine is capable of supplying the elementary power necessary to run the dynamo machine under specially advantageous conditions. In fact, a properly fitted stationary engine will always work more economically than a portable engine, which will frequently burn up to 10 kilograms (22.046 pounds) of coal per hour per square meter of heated surface. The expense of water carting is also dispensed with.

As in the case of small farming, the operation is comprised under three headings, viz., (1) the primary station, (2) the transmission of power, and (3) the plow, with electromotor.

WORKING EXPENSES OF THE ELECTRIC TILTING PLOW.

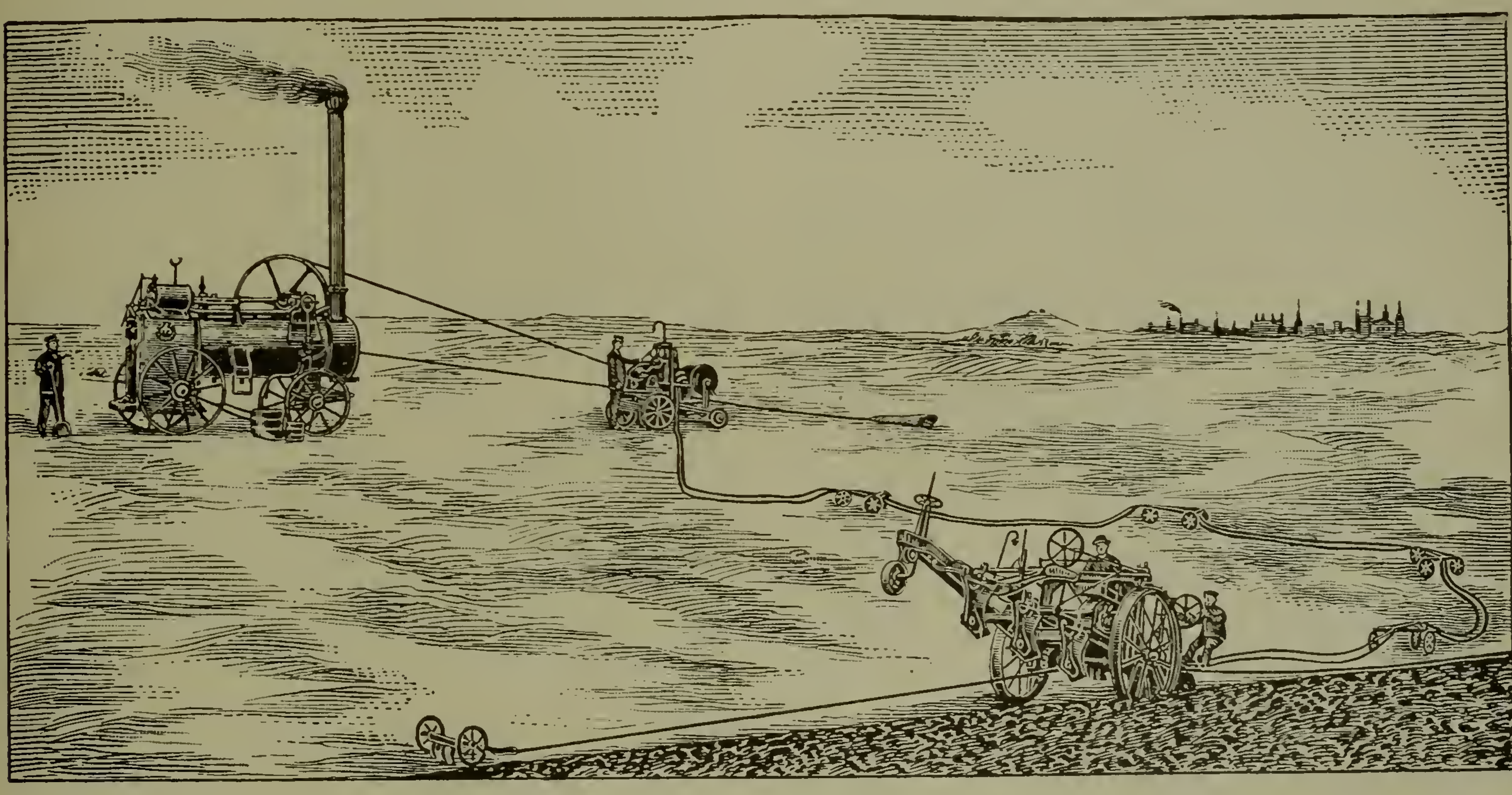
(1) *Two-share plow in small farming.*—The experiments were made on heavy, binding, loamy clay soil near Halle-on-the-Saale. A 10 horse-power locomobile, fitted with a very exact regulator, was used, with the following result: Gauges showed a current tension of 110 volts and a current force of 60 to 80 amperes, an average of 8,000 volt-amperes (watts), this being equal to the capacity of the locomobile up to 11 horse-power. Two furrows 60 centimeters broad by 24 centimeters deep (23⅝ by 9½ inches) at each plowing. Power gauge varied between 600 and 700 kilograms (1,344 and 1,568 pounds), giving a mean of 650 kilograms (1,456 pounds) a resistance of from 45 to 48 kilograms (100.8 to 107½ pounds) per square decimeter (3.937 inches) of the cross section of a furrow.

At a progression of 0.9 meter per second, 7.8 horse-power was made really useful, so that the loss of power between locomobile (11 electric horse-power) and plowing (7.8 horse-power, arising from transmission of power and tooth and chain friction, was 3.2 horse-power. Compared with the loss shown by steam plows, this is exceedingly small.

Ignoring the purchase money for the locomobile, as most farms have one for thrashing purposes, the cost of working was:

	Marks.
1 fireman, ten hours	3.50
1 driver, ten hours	3.50
2 boys, ten hours	3.00
Interest and sinking fund for working capital and repairs, excluding electromotor, on 6,750 marks, 20 per cent. per 100 days	13.50
On 1,750 marks (motor complete), 15 per cent. per 100 days	2.62
On chain, 50 per cent. on 480 marks, 100 days	2.40
Fuel, 400 kilograms at 2.35 marks	9.00
Lubrication of locomobile, dynamo machine, electromotor, and plow	2.00
Two loads of water	4.00
Total	43.52

With eight acres in ten hours, on heavy soil, with a depth of 24 centimeters (9.24 inches), the cost would be 5.44 marks ($1.29) per acre, as against 12 marks ($2.74), the cost of doing the work with oxen. In comparing with the cost of the latter, even with a depth of furrow of from 30 to 35 centimeters (11.8 to 13.8 inches), the electric plow is still by far the cheaper.



GENERAL VIEW OF METHOD OF PLOWING BY ELECTRIC POWER.

One boy drilled to the work would suffice.

In many positions, the locomobile could feed the boiler from an automatic pump. These two items would reduce the daily cost by 5.50 marks ($1.31), bringing it down to 4.80 marks ($1.14) per acre.

The economy effected is so self-evident as to render argument superfluous.

(2) *In large farming.*—A comparison with the steam plow is necessary in order to make the following statistics intelligible:

The cost of steam plowing to a depth of 35 centimeters (13.8 inches), evidently with variety in character of soil, is stated by two German authorities at 39.36 marks ($9.37) and 46.72 marks ($11.12), respectively, per hectare (2.47) acres, whereas both give the cost of plowing with oxen at 50 marks ($11.90) per hectare. And, moreover, a steam plow costs 60,000 marks ($14,280), as capital to be provided for.

As against this, the large electric plow shows: (1) Cost of stationary steam-engine (semi-locomobile), complete, 40 to 45 horse-power, 13,000 marks ($3.094); (2) dynamo machine, including foundations and driving belts to produce 33.000 watts per hour, together with the necessary gauges, 5 000 marks ($1,190); (3) electric conduits, complete, including labor, etc., 3 kilometers (1.86 miles) in length (in many districts poles would be cheaper), 4,500 marks ($1,190). Making the expenses (sinking fund, interest, wages, coal, etc.) 34.94 marks per day of 10 hours, or 3,494 marks (83 cents) per hour for 3,300 watts, not including transmission loss, which brings the cost up to 11.7 pfennigs (2.8 cents) per 100 watts.

The results hitherto show that, with a motive power of 33,000 watts, it may be guaranteed that four square hectares can be plowed 35 centimeters deep in ten hours. This would show:

	Marks.
30. × 11,7010	35.10
Wages, two hands	10.00
Sinking fund, interest and repairs, 20 per cent. on the fitting up of the complete plowing gear, without the chain, capital sum 10,000 marks	2,060.00
Chain, 50 per cent. on 830 marks, its cost	415.00
Total	2,475.00
Taking an average of 100 working days of ten hours per annum this would show, per day	24.75
Total cost per day	69.85

Or, in round figures—four hectares in ten hours—per day, 70 marks.

It is thus evident that the working expenses of the electric plow for extensive husbandry amount to less than half of those incurred in working the steam plow. This contrast is readily explained, for (1) the capital sunk in plant is only one-third of that required for the steam plow; (2) the expenses connected with the generating of power are materially lower than is the case with the steam plow, in which a very considerable surplus power has to be raised in order to work the pulleys and brakes and to overcome the stiffness of the rope; (3) the expensive transport of water is herein entirely done away with.

I have been informed by the director of the Haale factory that electricity will shortly also be used in digging out potatoes and sugar beets.

Aluminium Conductors.—M. E. C. Grammont has erected an overhead line made of aluminium for the transmission of electric energy between his two factories at La Plaine and Ponte de Chérin, in the Isère Department, France. In order to avoid joints, M. Grammont has satisfactorily soldered the wires end to end with a blowpipe.

Monroe, Mich.—The Monroe Electric Railroad Company has been organized with W. H. Cowles, of Monroe, president and general manager; E. G. Strong, secretary; L. W. Watkins, treasurer. Capital stock, $50,000.

PLEASURE RESORTS ON STREET RAILWAYS.

The question of locating and maintaining pleasure resorts on the lines of street railways is always interesting to street-railway men, and it is still an open one as to whether it pays to make this feature a branch of the business. In some instances the enterprise pays; but success in one case does not necessarily imply equally good results in others.

This subject was discussed by Mr. W. W. Cole in a paper read at the convention of the Street-Railway Association of the State of New York, recently held in Albany. The title of Mr. Cole's paper was "Are We Laying Too Many miles of Track to Reach a Few People?" and the greater part of the paper was published in our issue of September 28. The portion referring to the location of summer resorts, which is interesting and suggestive, is given below separately.

"Precaution must be observed," says Mr. Cole, "in running out suburban lines for parks and pleasure resorts, as we can only count on three months of pleasure travel, and a line built for pleasure travel only is apt to prove a problem with an unknown quantity. On the other hand, all parks and pleasure resorts introduced along existing lines, even though built at a considerable expense, if properly managed, will prove a booster to the net receipts of the lines favored.

"In locating pleasure resorts, if possible, they should be placed on lines connecting two towns, as then you promote traffic in both directions, and are not to a large extent paying for an empty mileage in one direction; and you are also promoting traffic to the thinly populated section of your road. To clinch my argument I will quote from an editorial in the Street-Railway *Journal*: 'That the total street-railway mileage of the United States is approximately six per cent. of the steam-railroad mileage. About six per cent. only of this mileage is at present in the hands of receivers, as against about 25 per cent. of the steam-railroad mileage. The gross earnings of all American street-railway properties are probably slightly less than 15 per cent. of the combined freight and passenger earnings, but are nearly 50 per cent. of the passenger earnings alone of the steam-railroad properties, while the net income applicable to dividends on capital stock is hardly less than 35 per cent. of the steam-railway income. These results are surprising, indeed. That 14,000 miles of street-railway track should be able to earn half as much gross on passenger traffic, and one-third as much net (for dividends) on combined passenger and freight traffic, as it earned on 234,000 miles of steam-railroad track; this is certainly a remarkable showing, and one which points to a very reasonable cause for a capitalization per mile of track larger for the street-railway than for the steam-railway properties."

"When we have carefully considered the subject of this paper, 'Are we laying too many miles of track to reach a few people,' the results of a comparison between the steam and street railroads are not surprising, as there is no doubt if the cities could all be moved within a few miles of one another along the lines of the steam railroads, their passenger receipts would show an immense increase, and a corresponding decrease in operating expenses.

"Even though the steam road charges three cents per mile, and the street railways often get less than one cent per mile, we find that the receivers' hands and pockets are being filled by the steam road, because, even at three cents a mile, enough passengers must be carried to support a lengthy mileage through the unpopulated country."

An Enterprising German Paper.—The *Deutscher Anzeiger*, of Schenectady, N. Y., which is printed weekly in the German language, is publishing a series of articles written by Alfred E. Weiner, entitled "Electricity and its Application." As far as we know the *Deutscher Anzeiger* is the only weekly German paper in the United States that prints technical articles of this class.

THE STORAGE CELL FROM A POINT OF ECONOMY.

BY MEYER CUSHNER.

In the age in which we now exist no question appeals more strongly to man than that of money. The artist, musician, actor and inventor rarely work for the advancement of their art, but for money. This fact alone, perhaps, has added more to the list of inventions, paintings, operas and also to the number of inventors, painters and artists than could ever have been hoped in this century.

We are apt to come to the conclusion that the experiments that have resulted in a new chloride battery were not made, like Faraday's experiment, purely for science, but for money. Economy tempted Faure to make his improvement on Planté's cell, and it was economy again that produced the chloride cell which is showing itself to be of vast commercial importance.

The electrical engineers of this period are never satisfied with one invention until it has been brought as near to perfection as their fertile minds can make it. Every slight defect must be remedied, and the constant perseverance with which they work is the one great reason for the latest development in storage batteries.

Gaston Planté invented a storage cell in which he was enabled to store up electricity for future use by a forming process which is very expensive; but economy and Faure's active brain show to the world that the forming process was unnecessary; that the active materials, red lead and litharge, may be substituted.

Men, seeing the economical point readily gained, invested their money in this venture; for common sense has clearly shown that, by means of the storage cell, science, the world, the capitalist himself would be benefited and made more wealthy by the modern chloride storage cell than by the older method.

Since it is conceded that this cell has come into use and is generally popular, either commercial or scientific reasoning must answer the question why and how it has received recognition. When a company is organized it is for the purpose of gain, and if the storage system did not have any advantages over the others, if it had not proven itself more convenient, we can scarcely believe that so much investigation and trouble would have been taken for nothing.

Answering the question from both the commercial and the economical point of view it can truly be said that the chloride cell is the best of any yet invented. Its advantage lies in the fact that the active substance is cast with the leaden plates, and is, therefore, less liable to fall and cause short circuits in the battery, for "the active material is obtained, not as in the old way, by cementing lead oxide paste into a frame, but in a manner purely chemical."

A combination of chloride of lead and zinc in certain proportions is fused and cast into pastilles, which are then placed into suitable moulds. Molten lead is then cast around them under high pressure, thus insuring good contact between the active surface and inclosing frame. This is a great point gained in electro-economics, as most of the money formerly spent was wasted in a method of obtaining good solid contact and for keeping the activities of the cell in position, so that the slightest jostling would in no way affect them. From the commercial view, therefore, we have a storage cell of great durability, which promises well for the future.

From the electrical side we derive greater advantages, as the chloride-cell has greater efficiency. In a recent test at the electrical laboratory, by my partner, of the chloride and the pasted forms, the storage cells were compared, and the comparison showed that by treating the two in the same manner, one was by far the better. The curve of discharge indicated that for the fifty-five ampere-hours put in, we obtained more current from the chloride than the Faure cell. The efficiency of each cell was then determined, and the former showed itself the better.

This fact alone should raise the cell to a higher plane in the esteem of electricians. We use the mechanical power of the steam-engine to generate the electrical power, which, passing through the cell, produces chemical action, and thus, from the electrical power expended, we obtain more current, consequently more work.

In the use of the storage battery in electric generating stations for regulating the power, it is known that, owing to fluctuations and variations, it is necessary to employ generating machinery of greater capacity than would be necessary if it were operated at a regular load. Ten to fifteen per cent. more steam is necessary for the larger engines in order to overcome the load. The storage cell and the dynamo, however, may be made to work together, the one always balancing the other.

PRINCIPLES OF DYNAMO DESIGN.

BY

Newton Harrison E.E.

(*Continued from Page* 189.)

Multipolar Armatures.—There are certain essential points that must be clearly understood before going much further in this subject. The E.M.F. generated by either a drum or Gramme armature is due to the inductors on its outer surface and its field. Although the two halves of the armature in each case are in multiple, yet the E.M.F. produced in each inductor is due to its passing each pole in turn, so that in one complete revolution an inductor cuts twice the lines of force produced by one pole-piece. Thus half the inductors cutting twice the field is equivalent to all the inductors cutting one-half the field. In other words, to calculate the E.M.F. produced by either Gramme or drum armature, multiply its entire number of inductors by the flux, by the speed per second, and divide by 10^8. The two halves of the armature feed in multiple at equal E.M.F. in either case.

The armature of a multipolar machine is governed by the very same principles. The field divided into either four, six, or eight poles is really a collection of dynamos with a common armature and commutator. They may be thrown into series or multiple at the will of the designer, and thus make it possible to build multipolar machines of either very heavy currents or high voltages. The alternator is a multipolar machine, but of a design intended only for a varying E.M.F. that continually changes its direction and strength. If a multipolar machine be thus considered as capable of developing a great current, or great E.M.F., according to the winding and connections involved, the armature must be placed under two different headings

$$\text{Multipolar Windings} \begin{cases} \text{Multiple} \\ \text{Series.} \end{cases}$$

Multiple Winding.—Taking a four-pole field, an inductor revolving in such a field would in each revolution cut the lines of force four times. There would be four distinct reversals of current. The windings would compose four multiple circuits. This will be easily understood by remembering that a bipolar machine has two multiple circuits; therefore a double bipolar machine, or a four-pole machine, would have the conditions exactly doubled, or two circuits of two circuits each. Thus we can say that all multipolar armatures with multiple windings have one multiple circuit to each pole; a four-pole machine having four distinct circuits, two having a positive and two having a negative direction of flow. Therefore it is necessary to have four brushes in order to collect from the two positive and two negative ends of the armature. In calculating the E.M.F. of a multipolar machine the entire number of inductors are considered as acting at once to produce the pressure required. Therefore each inductor cutting the lines of force four times in its transit round the gap develops an E. M. F. four times as great as it would by cutting the lines of the field once. Or, one-quarter of the inductors cutting the field four times is equivalent to all of the inductors cutting the field of one pole once; in other words we take into consideration, in calculating the volts developed, all of the inductors, but only the flux issuing from one pole. Our formula therefore becomes, for multiple-wound multi-polar armatures,

$$\text{E.M.F.} = \frac{\text{Revs. per sec.} \times \text{total No. inductors} \times \text{flux from one pole.}}{10^8.}$$

As an illustration of its direct application, take the case of a multipolar machine having the following conditions imposed:

Speed, 1200 revs. minute or 20 per second.
Inductors, 110
Flux, 5,000,000 lines of force from each pole.

$$E = \frac{20 \times 110 \times 5{,}000{,}000}{100{,}000{,}000} = 110 \text{ volts.}$$

Series Winding—The second case to be considered is that of a multipolar machine having an armature so wound that it sums up the voltage developed and thus requires only two brushes. In that case the E M.F. at the terminals is of a greater value. To calculate it by a rule of equal simplicity it is but necessary to consider it as the result of connecting up two armatures in direct series. A four-pole machine, for instance, would be one in which the two multiple windings would carry but one-half the current to the point of distribution. The E.M.F. and current developed by each individual inductor does not change, but is carried to a point where it adds its potential to another section of the winding and thus increases the E.M.F. delivered.

The current due to such an armature is twice that of one inductor, and the E.M.F. twice as great as that due to a multiple winding. The two halves of the armature having been thrown in series by the system of winding, in a four-pole machine, the current is one-half and the E.M.F. twice that delivered by a multiple-wound armature. Instead of discussing the increase or decrease of either current or E.M.F., the frequency per second will be more explanatory. The entrance of this factor into the calculations instead of revolutions per second will be the simplest method advisable. The number of times a second an inductor passes two poles is called the frequency. In a four-pole machine the frequency per revolution is two, in a six-pole three, an eight-pole four; therefore at 20 revolutions per second the frequencies in multipolar machines of the above type would be 40, 60, or 80. The E.M.F. developed by a series-wound armature is therefore

$$\text{E.M.F.} = \frac{\text{frequency} \times \text{flux from one pole} \times \text{total number of inductors.}}{10^8}$$

As an example, if a six-pole machine with series-wound armature be considered:

speed = 480 per minute or 8 per second
inductors = 100 Freq. = $8 \times 3 = 24$
flux = 4,166,667 per pole

$$E = \frac{100 \times 4{,}166{,}667 \times 24}{10^8} = 100 \text{ volts.}$$

Thus, by the two methods described and illustrated by specific examples, the calculation of multipolar armatures of both series and multipolar winding is but a simple matter.

(*To be Continued.*)

Conductor—Did I get your fare?

Passenger—I guess so; I didn't see you ring it up for the company.—*Roxbury Gazette.*

NEW BOOKS.

ALTERNATING ELECTRIC CURRENTS. By Edwin J. Houston, Ph.D. and A. E. Kennelly, Sc.D. New York: The W. J. Johnston Company. 225 pages, 77 illustrations. Price, $1.00.

This is the first of ten volumes of an "Elementary Electro-Technical Series," designed to give concise and authoritative information concerning those branches of electro-technical science having a general interest.

In the first chapter, the principles of alternating currents are explained with reference to mechanical analogies, and the following chapter takes up the subject of alternating electromotive forces and currents, the phenomena of impedances and reactances being very clearly and simply treated. Next are five chapters devoted respectively to single-phase alternators, the generation of alternating current in central stations, transformers, simple alternating motors, and incandescent and arc lamps. In these chapters will be found such a description of the working of an alternating central station, the operation of generators, motors, transformers and lamps generally, as will enable non technical readers to obtain a comprehensive knowledge of the subject. The remaining chapters consider the subject of multiphase currents and motors, the principles of which are explained in extremely simple language.

Although the book is primarily designed for the general public, yet it should not fail to prove useful to electricians generally and to elementary electro-technical students, and even of interest to engineers, as disproving the prevalent belief that it is impossible to treat of alternating electric currents without the use of higher mathematics.

BURSTING OF A FLY-WHEEL.

A fly-wheel of one of the big engines in the station of the Hudson County Electric Light Company, Hoboken, N. J., early on the morning of October 5, burst into several pieces, killing Carl Anderson, the engineer, and doing considerable damage to the building. It is not known what caused the wheel to collapse, and a searching investigation is being made to determine the cause. The accident deprived the street railway lines of their current, and the thousands of citizens of that section of Hoboken who depend upon the electric cars were compelled to walk. The damage was repaired sufficiently by Saturday night to resume full electric service on the railways and lighting circuits, the latter having also been affected by the accident.

The damage to the property is estimated by Superintendent A. K. Bonta to be about $25,000. None of the other engines was damaged.

New York Notes.

Mr. W. J. Morrison, of the United States Electric Forging Company. was in town last week.

E. T. Barberie, E. E., has opened an office at Room 1119, Downing Building, 108 Fulton street. He is conducting a general electrical engineering business; makes estimates on such work, examinations and reports. He also makes electrical measurements.

The Manhattan Fire-Alarm Telegraph Company has received the permission of the Board of Fire Commissioners to put its boxes in buildings and factories in this city. The Manhattan Company has agreed to give to the Firemen's Relief Fund 50 cents a year for each box used here.

George Putnam Smith has been appointed by Judge Barrett. of the Supreme Court, receiver of the United States Electric Forging Company, of 40 Wall street, in a suit brought by George D. Burton, of Boston. The company was incorporated in July, 1894, with a capital stock of $1,000,000, under West Virginia laws. W. T. H.

POWER FROM ARTESIAN WELLS.

Generally speaking, the artesian waters are used for all purposes of city supply and also for irrigating work. In several noteworthy instances, however, the water, coming as it does from the wells under high pressure, is used as a source of power, and a number of manufacturing establishments are now being driven by it through the intervention, principally, of Pelton water-wheels. It is only within the past few years, however, that artesian well power has been thus brought into service, though with the better appreciation of its importance a much wider application of it seems definitely assured.

Among the more noteworthy of the wells is the famous one at Woonsocket, S. D., in the United States—the most powerful in the world. It is 775 feet deep, seven inches in diameter all the way, and has a flow of 5,000 gallons per minute, with a pressure of 165 pounds to the square inch when closed, 62 pounds with a 4-inch opening and 75 pounds with a 3-inch opening. The temperature of the water is 61.0° F. The power from this well is used to operate the Woonsocket Roller Mill. The mill has a 3 foot Pelton wheel, which is kept at a speed of 275 revolutions per minute with a 1¾-inch stream. The mill turns out 90 barrels of flour and 40 tons of feed every 24 hours, at a saving of $20 or about £4 per day as compared with steam power of equal service.

The well at Springfield, S. D., is 593 feet deep and eight inches in diameter all the way. The pressure there is 130 pounds. The power from this well is used to operate the Springfield Roller Mill, with a capacity of 80 barrels of flour per day. The wheel used is a 16-foot turbine, making 800 revolutions per minute. The proprietors of this mill figure on a saving of $15 or about £3 in feed per day.

At Yankton there is another well, 500 feet deep, with a pipe eight inches in diameter to the bottom, and affording a pressure of 125 pounds to the square inch. A Pelton wheel, six feet in diameter is used, with a 2¾-inch nozzle, the wheel making 125 revolutions per minute. The power is sufficient to run the mill with 40 barrels capacity, and also to operate an elevator raising 500 bushels of wheat per hour, to shell 100 bushels of corn and grind 4,000 pounds of feed per hour. The cost of the well was $4,000, or about £800. Splendid systems of water supply also are maintained by these wells. The water is pure and free from organic contamination.—A. L. Baumgartner, in *Cassier's Magazine*, October, 1895.

FRANKLIN ELECTRICAL SOCIETY.

The opening lecture of the Franklin Electrical Society will be held in the lecture room of the New York College of Veterinary Surgeons, 154 East 57th street, between Third and Lexington avenues, on Saturday evening, October 12, 1895, at 8 p. m. Subject: "Alternating Current," by W. W. Ker. This lecture will be thoroughly practical as well as interesting.

Telephone Notes.

Barnesville, Ga.—A telephone exchange is to be established. G. E. Hugeley, Mayor of the town.

Elizabethtown, Pa.—A movement is in progress to start a line of telephone in Elizabethtown.

Mankato, Minn.—The Northwestern Telephone Co. has decided to extend their line to Lake Crystal.

Hartford, Conn.—The Southern New England Telephone Co. intend to lay pipes and conduits for their wires in certain streets of the city.

Joplin, Mo.—The Missouri and Kansas Telephone Co. has decided to build a new system in Joplin, and to extend it to Galena, Webb City and Carthage. An entire new system is to be put in, consisting of copper, wires, new poles, etc.

Kiethsburg, Ill.—The officers of the Mercer County Telephone Co. have decided to extend their line from Reynolds to Rock Island.

Huntsville, Tex.—The Huntsville-Madisonville Telephone Line has been organized under the style of the Commercial Telephone Company. The line is to be built to Madisonville and Midway. Capital, $2,500. Directors, J. F. Randolph and J. R. Burtis, of Madisonville; F. L. Young, of Midway; R. S. Rather, C. C. Barrett, L. C. Eastham and J. G. Ashford, of Huntsville.

Pittsburgh, Pa.—The National Standard Co., composed of leading capitalists, which is to compete with the Bell Telephone Co., may build a telephone factory at this place. Col. Conger, of Akron, O.; General Clarkson, of New York, and General McNaught, of Philadelphia, have been in this city to make arrangements for the deal.

Philadelphia, Pa.—The Bell Telephone Co. has secured permission to place its wires underground on St. John street. The Brush Electric Light Co. is to be allowed the privilege to open the streets and lay conduits on Vine street.

Rensselaer, Ind.—The Rensselaer telephone line will be extended at once from Remington to Lafayette.

TELEPHONE PATENTS ISSUED OCTOBER 1, 1895.

Telephone. Harry T. Johnson, Elizabeth, N. J. (No. 547,265.)

Telephone Exchange System. Ernest E. Yaxley and John H. Riley, Chicago. (No. 547,388.)

Telephone-Toll Apparatus. George K. Thompson, Malden, Mass. (No. 547,405.)

Street Railway Notes.

Chester, Pa.—A trolley line will probably be built along the river road, from Lazaretto to Philadelphia. Joseph H. Hinkson is interested.

Irondequoit, N. Y.—The Irondequoit & Lake Shore Railroad, incorporated to construct a street surface road. Capital, $100,000. Directors: A. J. Johnson, Joseph C. Tone, Joseph A. Johnson, Frank W. Elwood and Edward S. Ellwanger of Rochester; E. O. McNair and David W. McNair of Warsaw.

East St. Louis, Ill.—The citizens residing near Gross Park have signed a petition, requesting the management of the East St. Louis Electric Railway Co. to extend the lines to that section.

Oswego, N. Y.—The directors of the Oswego Street Railroad have increased the capital stock from $125,000 to $200,000. Improvements will be made.

Albert Lea, Minn.—George E. Edwards, of Bridgeport, Conn., has been in this city negotiating for the putting in of a line of street cars to run in connection with the electric light plant, if an exclusive franchise for a long enough number of years can be secured.

Huntington, Ind.—The Huntington, Columbia City and Ligonier Electric Railway Company have applied for corporation. Valorous Brown will be president of the new company; Hon. F. W. McNagny, vice president; T. R. Marshall, secretary, and George Ruch, general manager.

Chattanooga, Tenn.—The Chattanooga Light and Power Company has an option on a new site. If water can be found the new electric plant will be erected at this point. The entire plant will cost fully $50,000.

Danville, Ill.—An electric railroad will probably be constructed from Danville to Paxton. Funds are now being raised.

Detroit, Mich.—A new electric road will be constructed from Detroit to Ann Arbor.

Madison, Wis.—The Chicago and Wisconsin Inland Lake Line, which was recently incorporated, will be an electric road, and may be extended to Milwaukee.

Hagerstown, Md.—The Hagerstown and Potomac Electric Railway Company has been organized by E. E. Sponseller, of Harrisburg, Pa.; J. Clarence Lane, of Hagerstown, and Hon. G. M. Culp, of Shamokin, Pa., to build trolley lines from Hagerstown to Funkstown, Pen-Mar and Waynesboro.

Holliston, Mass.—The Milford, Holliston and Framingham Electric Railroad Company has applied for a franchise to construct an electric road.

Kansas City, Mo.—The Metropolitan Street Railway, of which C. F. Holmes is general superintendent, will change its motive power to electricity.

Salt Lake City, Utah.—The Big Cottonwood Power Company will erect a new $15,000 electric power house.

Derry, N. H.—B. W. Burgett, of Boston, offers to build and equip the proposed Derry and Chester Electric Railroad for $60,000.

Asbury Park, N. J.—The Asbury Park, Bradley Beach and Belmar Spring, Lake Street Railway Company, incorporated by Henry C. King, New York; Alexander Bogey, Brooklyn, N. Y.; N. E. Buchanan and John Hubbard, Asbury Park, and Chas. H. Seaman, Bradley Beach, to construct an electric railway in Neptune and Wall townships, and in Asbury Park and Belmar. Capital stock, $75,000.

Stoneham, Mass.—The Mystic Valley Electric Street Railway is the name of a new electric railway that is to be built from Winchester Centre to Stoneham. It will be operated by the Wakefield and Stoneham Electric Railway Company. and among the subscribers are Col. Charles F. Woodward, of Wakefield; James F. Shaw, of Newburyport; Hon. S. W. McCall, and A. B. Coffin, of Winchester, and others. Capital stock, $40,000.

Pekin, Ill.—The Richwoods Railway Company, incorporated by Robert M. Cox, James M. Morse, and Theo. J. Miller, to construct a street railway through the counties of Peoria, Tazwell and Woodford. Capital stock, $50,000.

Youngstown, Ohio.—The Park and Falls Electric Railway Company will increase its capital stock from $50,000 to $200,000.

Sullivan, N. Y.—The Chittenango and White Sulphur Springs Railway Company has been incorporated by Charles F. Pennock, George Walrath, George C. Clark and others, to construct and operate a street railway about six miles long in Madison County. Capital stock, $150,000.

Chester, Pa.—The Media, Middletown, Aston and Chester Electric Company will increase their capital stock from $50,000 to $150,000, for the immediate construction of the road, plans for which are now being considered.

Possible Contracts.

Brooklyn, N. Y.—Public school buildings will be erected as follows: Public School on Sterling place, corner Vanderbilt avenue, and an addition to Public School No. 72, on New Lots Road, cor. Schenck ave. An electric bell system will be put in Public School No. 2, on 47th street, near Third ave., Public School No. 46, on Union, near Henry street, and Public School No. 110, on Monitor street, near Driggs ave. John McNamee, Chairman of Committee on School-houses, 131 Livingston street.

New York City.—St. Nicholas Skating and Ice Co., 35 Wall street, will erect a three-story and basement brick skating rink, 225x100, on north side of 86th street, east of Amsterdam, to cost $75,000. John Jacob Astor, 23 West 26th street, is one of the incorporators of the company Architects are Ernest Flagg. 54 Broad street, and Walter B. Chambers, 54 Broad street.

Philadelphia, Pa.—Estimates are being received by Charles Anchter for the erection of the proposed new hall for the Labor Lyceum, to be built at Second and Cambria streets. Four stories, 76x90, of terra-cotta and fancy brick, to contain a gymnasium and other improvements essential.

New York City.—Architect John H. Thomas, 160 Broadway, is preparing plans for an eighteen-story fire-proof building of skeleton steel construction, to be erected on the old clearing house site, north-west corner of Nassau and Pine streets, on property recently purchased from the Clearing House Association by Donald Mackay.

Architect George Hill and Thornton F. Turler are preparing plans for John B. Ireland, 170 Broadway, for an eight-story warehouse building, to be erected north-east corner West Broadway and Third street, to cost $100,000.

New York City.—Plans prepared by John De Bais, 337 Fourth avenue, for the new police station, prison and stable, for the ninth precinct in Charles street were adopted by the Sinking Fund Commission, September 27. The structure is to cost $100,000.

Branford, Conn.—The Branford Electric Company, new corporation, will establish an electric light plant which will supply lights to Branford, Stony Creek, Guilford, and Pine Orchard.

Cottonwood, Idaho.—Samuel Dunham, of the Cotton Packing Co., expects to add an electric plant to his business.

Fresno, Cal.—Electric Power Co. is seeking a franchise and proposes to introduce a 10,000 H. P. electric current from the North Fork of the San Joaquin.

New Orleans, La.—The Council has adopted the ordinance for placing electric wires underground.

Pittsburgh, Pa.—Contract for the building of the Knoxville, Fair Haven and Mt. Lebanon Street Railway has been let to J. J. Houghton, of Allegheny, at $161,000. The new line will be operated by the Pittsburgh and Birmingham Traction Co.

Bloomfield, N. J.—John P. Conklin has made a proposition to the Council's Committee, of Bloomfield, to erect an electric-lighting plant in the town and furnish arc-lights of 2,000 candle-power.

Brooklyn, N. Y.—Ground has been broken for a series of extensive warehouses, to be known as the "Independent Stores," on the property of The Busch Co., Ltd., at foot 41st, 42d and 43d sts., South Brooklyn. Irving T. Busch, President.

Buffalo, N. Y.—The New York Central Railroad Co. will build a large brick warehouse, northeast corner of Exchange and Michigan street. Estimated cost, $80,000.

Minneapolis, Minn.—The Minneapolis Chamber of Commerce will be rebuilt and enlarged to cost $130,000.

Brooklyn, N. Y.—B. Bello will erect a two-story brick store, 100 x 100, southwest corner of 51st street and Third avenue, to cost $22,500.

Kingston, N. Y.—Adolph Eichler, proprietor of Hotel Eichler, on Railroad ave., opposite the Union depot, is making arrangements to erect a hotel, northeast corner of Broadway and Dederick street, for which plans are being prepared. The structure will contain all improvements, including gas, electric lights, steam heating, baths, etc.

Newark, N. J.—The Misses Charlotte M. & Alice J. Gommersall have decided to make the business building at 197 Market street a six-story structure, which will cost about $30,000. Architect, Charles Alling Gifford.

New York City.—Schenk & Schlichts will erect a six-story factory from plans prepared by John P. Woelker, at 22-24 Jones street, which will be heated by steam and lighted by electricity.

Flatbush, (Brooklyn) N. Y.—The buildings to be erected at the Flatbush Asylum are to be lighted by electricity.

Hoboken, N. J.—L. Beyer, of Hoboken, has prepared the plans for the public library building, which has been accepted by the Library Commission. Cost, $50,000. The structure will be three stories and basement, specifications include steam-heating plant, electric wiring and fixtures, etc.

Marion, O.—The council has voted to purchase an electric fire-alarm.

Bronson, Mich.—The citizens will vote on the question of establishing electric lights.

Philadelphia, Pa.—It is probable that in the near future a twelve-story store and office building will be erected on the Freeman estate property, southeast corner of Broad and Chestnut streets.

Philadelphia, Pa.—Charles McCaul will erect a six-story brick and iron store at 41 North 10th street.

Orange, N. J.—The Suburban Traction Company is about to construct a new storage-house for open cars.

New York City.—William Main is to erect a four-story brick and stone stable on West 17th street, to cost $30,000.

New York City.—The Hudson Building Company has been incorporated, with a view to erecting an office building at 32 and 34 Broadway, extending through to 69 and 71 New street. Title has been secured by this company from Edward Fielder, 32 Broadway, from Richard T. Wilson, for 34 Broadway and 69 New street, and from Louis H. Neilson for 71 New street.

Philadelphia, Pa.—Doyle & Doak will begin the erection of a four-story brick and stone front warehouse on Winfield Place, east of 8th street.

New York City.—Thomas J. Brady has the general contract for the erection at 40 Wooster street for a six-story brick and stone fire-proof warehouse, for which Architects Buchman & Deisler, 9 East 59th street, have made plans.

H. C. Raynor has commissioned Architects Webster & Thompson, 215 West 125th street, to make the plans for a row of mercantile buildings, to be erected on north side of 125th street, west of 5th avenue, to cost $10,000.

Catherine Balheimer, 60 Forsyth street, will erect a six-story brick store and tenement at 33 Norfolk street, to cost $22,000.

Chester, N. Y.—The trustees have purchased a lot of Guy Miller, on which they expect to erect the new corporation building.

Brooklyn, N. Y.—The Bushwick Company, Limited, will erect three four-story brick storage-houses, corner of 41st street and the water front, to cost $87,000.

New Corporations.

Columbus, O.—The Troy, Tippecanoe & Dayton Interurban Railway Company has been incorporated by Theodore Sullivan, George S. Long, George W. Scott, J. T. Knopp, Phil J. Gates, and others, to build and operate an electric railway between Troy and Dayton. Capital stock, $25 000.

Cleveland, O.—The Warwick Electric Manufacturing Co.; capital, $20,000; to manufacture storage batteries, dynamos, etc., and erect and maintain isolated electric lighting establishment. Incorporators, Percy B. Warwick, Dan. M. Ridgeway, George F. Ridgeway, Michael Phalen and C. W. Cunningham.

The Globe Electric Co.; capital stock, $25,000; to manufacture electric telephones, etc. Incorporators, C. E. Collins, L. W. Bradley, Donald McKenzie, T. W. Larwood, Jr., and J. D. Burron.

Boulder, Col.—The Mexican Industrial Railway Co., to construct telephone and telegraph lines and electric railways, from the city of Mexico in any direction. Offices will be in Boulder. Capital, $100,000. Benjamin T. Cheney, of Boston, Mass.; Stephen W. Reynolds and Walter S. Wait, of Newton, Mass.; James H. George, of Plaiston, N. H., and Arthur P. Cushing, of Boston, are its incorporators.

Camden, N. J.—Articles of incorporation have been filed in the Camden County Clerk's office by the Shuttleworth Electric Co., with $100,000 capital. Incorporators' names not given.

Detroit, Mich.—Articles of incorporation of the Automatic Telephone Exchange have been filed in the County Clerk's office. Stockholders: Charles A. Gates, of Saginaw, chairman; Wm. Rebec, of Saginaw, vice chairman; Charles P. Calvin, of Saginaw, treasurer; Arthur B. Harvard, of Detroit, secretary and general manager.

Knoxville, Tenn.—Tennessee Electric Light and Power Co.; W. S. Shields, W. A. Park, James Jennings, C. E. Howell and H. L. McClung.

Vacaville, Cal.—The Vacaville & Winters Telephone Co. has been incorporated with a capital of $5,000; Directors: B. R. R. Thurber, T. K. Buck, Wm. H. Buck, E. D. McKevitt, Vacaville; Henry Bruick, Winters.

Oneida, N. Y.—The Central New York Light and Power Co., incorporated to supply electricity in Oneida and Canandaigua. Capital, $100,000. Directors: N. Walter Webb and Wm. H. Celshennen of New York City; Wm. J. Arkell of Canajoharie; Judson M. Warner of Oneida, and Alden N. Young of Waterbury, Conn.

Apollo, Pa.—A charter has been granted to the Vandergrift Gas, Fuel, Telephone, Electric & Power Company. Capital, $8,000. The new company is to operate in the new town of Vandergrift, near Apollo, and will build at once. Directors, T. K. Vandergrift, J. L. Buchanan, D. I. Rhodes, George Mercer and V. Preston, of Pittsburgh.

ONE HUNDRED YEARS OF AMERICAN COMMERCE.

This is the title of a book to be published as a special centennial edition of the Shipping and Commercial List and New York Price Current, which was established on December 19, 1795.

The work will contain 100 articles and commercial topics illustrating the practical development of the various branches of trade in the United States during the past century, and showing the present magnitude of our financial and commercial transactions.

The article on "The Telegraph" will be contributed by General Thomas T. Eckert, president of the Western Union Telegraph Company; "The Telephone" will be presented by John E. Hudson, president of the American Bell Telephone Co., and "The Street Railways of America," by H. H. Vreeland, president of the Metropolitan Street Railway Co., New York.

Hon. Chauncey M. Depew is editor of the work, and D. O. Haynes & Co., 106 Fulton street, New York, are the publishers.

Trade Notes.

The fall season opens very brilliantly for the Boudreaux Dynamo Brush Co. All their agents report very brisk business, and there is hardly any town in the United States which has not been supplied with some of their new foliated anti-friction metal brushes. Mr. Hugo Benedix, general manager of the company, feels very happy to see his efforts rewarded after one year's work (up the hill), to find that the Boudreaux dynamo brush has become a decided favorite with all the electricians.

ELECTRICAL and STREET RAILWAY PATENTS

Issued October 1, 1895.

546,996. Armature for Electric Motorsand Dynamo-Electric Machines. Henry Chitty, London, England. Filed July 26, 1892.

547,031. Contact for Electrically-Propelled Vehicles. Emil B. W. Reichel, Charlottenburg, Germany, assignor, by mesne assignments, to the Siemens & Halske Electric Company of America, Chicago, Ill. Filed Apr. 4, 1894. Patented in Italy Dec. 18, 1893.

547,034. Electric Vibrator Mechanism. Frank J. Russell, New York, N. Y., assignor of one-half to Horace See, same place. Filed Apr. 15, 1895.

547,035. Electrical Indicating Mechanism. Frank J. Russell, New York, N. Y., assignor of one-half to Horace See, same place. Filed Apr. 15, 1895.

547,043 Rectifier for Electrical Currents. William J. Still, Toronto, Canada, assignor to William Burrows Close, same place. Filed Dec. 24, 1894.

547,068. Electric-Motor Truck. William G. Gaither and William R. Gaither, Chicago, Ill. Filed Nov. 10, 1894.

547,072. Electric Device for Controlling Actions of Musical Instruments. Frederick W. Hedgeland, Chicago, Ill., assignor to the W. W. Kimball Company, same place. Filed Feb. 23, 1894.

547,077. Electric-Railway Repair-Wagon. Anthony Iske and Albert Iske, Lancaster, Pa. Filed Dec. 18, 1894.

547,078. Electrical Junction-Box. Warren S. Johnson, Milwaukee, Wis. Filed Jan. 21, 1895.

547,106. Hanger-Board for Electric-Arc Lamps. Thos. E Adams, Cleveland, Ohio, assignor to the Adams-Bagnall Electric Company, same place. Filed July 17, 1895

547,127. Electric-Arc Lamp. Johan W. T. Olán, New York, N. Y. Filed Apr. 8, 1893.

547,149. Electric Switch. Norman Marshall, Boston, Mass., assignor to the Anchor Electric Company, same place. Filed June 8, 1895.,

547,215. Portable Electric Drill. John W. Jaimison, Vallejo, and John M. Edmunds, Napa, Cal. Filed Dec. 26, 1894.

547,218. Street-Car Fender. James D. Lamb and James E. Chapman, Montreal, Canada, assignors of one-twentieth to John James Durack, same place. Filed Nov. 17, 1894.

547,230. Automatic Electric Switch. George W. Russell, jr., and Alexander V. Officer, Denver, Colo. Filed Mar. 18, 1895.

547,240. Electrical Safety Apparatus for Railways. Lewis W. Briggs, Chicago, Ill., assignor of one-half to William F. Cody, North Platte, Nebr., and Nathan Salsbury, New York, N. Y. Filed Aug. 24, 1893.

547,246. Mast-Arm for Electric Lamps. John I. Drake, Providence, R. I. Filed Feb. 21, 1895.

547,249. Incandescent Lamp. Henry Green, Hartford, Conn., assignor to the Ætna Electric Company, same place. Filed Jan. 24, 1895.

547,265. Telephone. Harry T. Johnson, Elizabeth, N. J. Filed June 18, 1894.

547,283. Trolley and Trolley-Pole. Wilbur L. Pepper, Philadelphia, Pa. Filed Dec. 29, 1894.

547,300. Railroad-Car Lamp. Charles G. Smith, Brooklyn, and Alonzo French, New York, N. Y.; said French assignor to said Smith. Filed Aug. 11, 1894.

547,302. Electric Motor for Street-Cars. William Stine, Omaha, Nebr. Filed Jan. 11, 1895.

547,304. Conduit Supply System for Electric Railways. George Tolmie, Carbon, Wyo. Filed July 10, 1894.

547,312. Car-Fender. Alexander S. Williams, Long Island City, N. Y. Filed Oct, 12, 1894.

547,321. Car Fender. Horatio N. Black and John W. Keeler, Philadelphia, Pa. Filed Dec. 21, 1894.

547,323. Electric Motor. Addison E. Boggs, Allegheny, and Fremont J. Cleaver, Beltzhoover, Pa. Filed Jan. 4, 1895.

547,358. Electric Synchronizer for Clocks. Henry S. Prentiss, Elizabeth, N J., assignor to the Prentiss Clock Improvement Company, New York, N. Y., and Jersey City, N. J. Filed Aug. 10, 1892.

547,366. Car-Fender. William Wossoff, Philadelphia, Pa. Filed Jan. 18, 1895.

547,369. Device for Controlling Speed of Electric Cars. James Brady, Brooklyn, N. Y. Filed June 24, 1895.

547,383. Reciprocating Electric Engine. Frank B. Rae, Detroit, Mich. Filed May 31, 1892.

547,388. Telephone-Exchange System. Ernest E. Yaxley and John H. Riley, Chicago, Ill., assignors of one-half to Le Roy Brown, same place. Filed Jan 14, 1895.

547,405. Telephone-Toll Apparatus. George K. Thompson, Malden, Mass., assignor to the American Bell Telephone Company, of Massachusetts. Filed May 13, 1895.

ELECTRICAL AGE

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CONTENTS.

THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

On account of conflicting dates the monthly meeting of the American Institute of Electrical Engineers at New York and Chicago has been postponed, by direction of President Duncan, from October 16 until October 23, the week following the Montreal Convention of the American Street-Railway Association. The following-named papers will then be presented: "The Local Annealing of Hard-Faced Armor Plates," by Hermann Lemp, jr., of Lynn, Mass.; and "The Rotary and Behavior of Fuse Wires," by Prof. W. M. Stone, of Chicago.

THE PROGRAMME OF THE CONVENTION.

For the benefit of the delegates and others at the Convention we give an outline of the programme, as far as it has been arranged up to the present time.

Special committees will report on the following named subjects: "Transfers;" "Municipal Ordinances; "Labor Question—Wages Paid to Employés;" "Experience of Roads in Furnishing Free Music and other Entertainments to the Public;" and "Physical Operation of Roads."

The annual dinner will take place on Thursday evening, October 17. Each company that is a member is entitled to the free admission to the banquet of two of its officers. Each additional officer, or any other gentleman in attendance at the meeting not an officer of a member-company, will be charged ten dollars; ladies' tickets, five dollars each.

The Exhibition of Street-Railway Supplies will be held in the Victoria Skating Rink, back of the Windsor Hotel. The building has been engaged for two weeks, beginning with October 9, and ending October 22.

THE AMERICAN STREET-RAILWAY ASSOCIATION.

HISTORICAL SKETCH.

The Montreal meeting is the fourteenth held by the association. The association was organized in Boston, Mass., in 1882.

The following table gives the names of the places of meeting of every convention since the organization of the association, and the name of the president during each year. The organization meeting is counted as the first.

MEETING.	YEAR.	PLACE OF MEETING.	PRESIDENT.
2.	1883.	Chicago.	H. H. Littell.
3.	1884.	New York.	Wm. H. Hazzard.
4.	1885.	St. Louis.	Calvin A. Richards.
5.	1886.	Cincinnati.	Julius S. Walsh.
6.	1887.	Philadelphia.	Thomas W. Ackley.
7.	1888.	Washington.	Charles B. Holmes.
8.	1889.	Minneapolis.	George B. Kerper.
9.	1890.	Buffalo.	Thomas Lowry.
10.	1891.	Pittsburgh.	Henry M. Watson.
11.	1892.	Cleveland.	John G. Holmes.
12.	1893.	Milwaukee.	D. F. Longstreet.
13.	1894.	Atlanta.	Henry C. Payne.
14.	1895.	Montreal.	Joel Hurt.

FREIGHT AND MAIL SERVICE ON ELECTRIC ROADS.

Many interurban and suburban electric railways are now doing a freight business that, in many cases, is the source of a considerable revenue to the operating company. This is perfectly legitimate business, and in almost every instance could not be controlled by steam roads in the region, for the reason that the trolley lines are more conveniently reached and the cars are run oftener. Farmers, especially, appreciate these advantages and are greatly benefitted by them. The subject was discussed in a paper by Mr. Benjamin Norton at the Albany meeting of the New York State Street-Railway Association, which was held on September 17, last. He asked in the title of his paper if a freight and mail service on street railways was profitable or unprofitable, but proved in his discussion of the subject that it was decidedly profitable to carry freight on his road. The subject no doubt will receive some consideration at the Montreal convention, and for the benefit of those particularly interested we publish Mr. Norton's paper on another page in this issue.

THE CITY OF MONTREAL.

ITS PAST AND PRESENT.

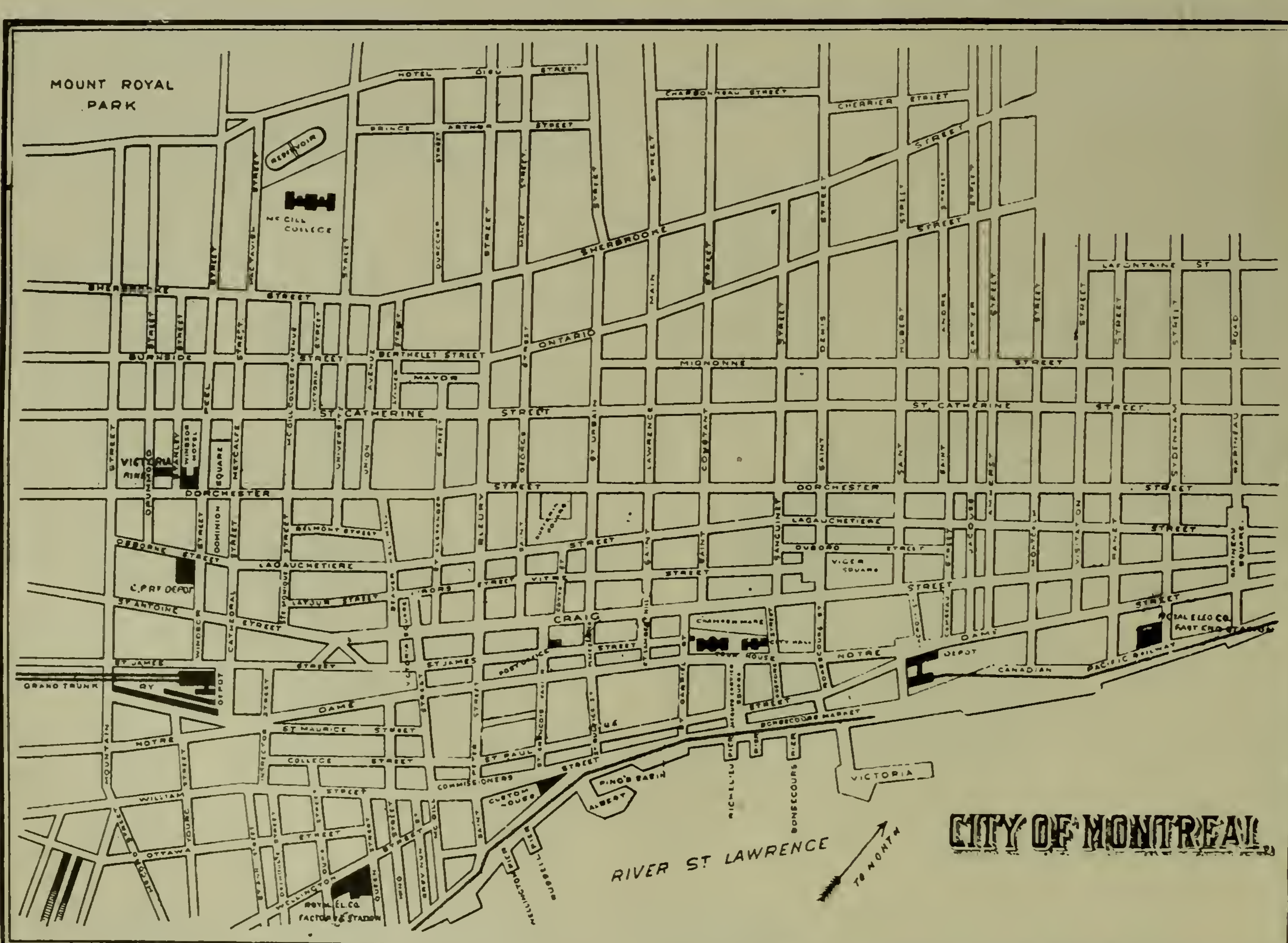
Montreal occupies the site of an Indian village named Hochelaga, which Jacques Cartier found on his arrival in 1535. In 1642 the town was founded; in 1758 it was fortified, and in 1779 it contained 1,200 houses. It was, however, merely an outpost of Quebec, both under French and British rule, until 1832, when it was made an independent port. Since then its growth has been rapid.

The city is 600 miles from the mouth of the St. Lawrence river, and 335 miles north of New York, and is situated on an island at the base of Mount Royal, which gives the city its name. The population is about 225,000, of whom nearly three-fourths are Roman Catholics. The drive around the mountain is delightful. This mountain, possessing wonderful natural advantages, is being converted into a magnificent park, which, when completed, will not be excelled in size and beauty.

The island is 30 miles long and 10 broad, and owing to the wonderful fertility of the soil it is justly called the Garden of Canada. Montreal is destined to be one of the most important cities fo the world. With the several ocean steam ship lines making this city their American terminus, and the extensive system of railway lines centring here, Montreal has direct and independent communication with all parts of the world. The following brief notice of some of Montreal's principal attractions may be of interest to visitors: The French Parish Church of "Notre Dame" is the largest church in America, and is capable of seating 10,000 people. Its two large towers are 220 feet high, and an ascent of the right tower will well repay the visitor by the magnificent view it commands of the entire city and surrounding country, the vista extending for miles in all directions. This tower contains an immense bell, weighing nearly 30,000 pounds, which is one of the five largest bells in the world. The left tower contains a musical chime of bells. The interior

WINDSOR HOTEL, MONTREAL, HEADQUARTERS OF THE A. S. R. A.

decorations of the church are exceedingly fine, and include numerous valuable paintings and statues. The other churches in Montreal noted for beauty of design and decoration are the Church of Gésu, the English Cathedral and several Presbyterian churches. The new Roman Catholic Cathedral, recently erected, is after the style of the St. Peter's, at Rome, and next to St. Peter's it will be the largest and most elegant in the world.



MAP OF THE CITY OF MONTREAL.

The principal buildings of Montreal are noted for the substantial manner in which they are constructed and for their architectural beauty.

Montreal has many places and objects of interest to visitors, among which are : McGill College Musum, etc.; the Art Gallery, Phillips' Square ; Christ Church Cathedral and Methodist Church, St. Catherine street ; St. Peter's Cathedral, opposite the Windsor ; Church of Gesu, which is exquisitely frescoed ; Chapel of Notre Dame de Lourdes, and Chapel of the Nazareth Asylum ; Church of Notre Dame, elevator to tower, greatest bell in America, Chapel of Notre Dame in rear of the Grand Altar ; Victoria Hospital, Pine avenue ; Y. M. C. A. Building, Dominion Square ; Board of Trade Building ; Bonsecours Church, (oldest in city.); Grey Nunnery Chapel, Bonsecours Market, Victoria Bridge, City Hall, Nelson's Monument, Court House; Kennels, Montreal Hunt Club; Bank of Montreal; Post-Office, St. James street ; La Salle Museum—Wax Tableau; Academy of Music, Queen's Theatre and Sohmer Park—places of amusement ; St. Helen's Island.

CONVENTION HALL, WINDSOR HOTEL, MONTREAL.

Among the other objects of interest may be placed the Bonsecours Market, the Government House, Hotel Dieu Hospital, McGill College, and various other institutions of learning; the different nunneries, the statue of Queen Victoria, Nelson's Monument, the Young Men's Christian Association Building, Mount Royal Cemetery and the wonderful reservoirs, excavated out of solid rock, located 206 feet above the river, and being 25 feet deep. The supply of water for these reservoirs comes from above the Lachine Rapids, and their cost, with machinery, was over $2,000,000. The Lachine Canal is one of the principal public works.

The drives around Montreal are exceedingly pleasant, the enjoyment of the beautiful scenery being enchanced by the splendid carriage roads. The wharves of the city of Montreal are not equalled in America. They are constructed in the most substantial manner.

The Victoria bridge. which connects the city with its opposite shore, was built and is owned by the Grand Trunk Railway, and is used for railway transit exclusively.

Do not fail to register your name at the Electrical Age's headquarters, Montreal.

MONTREAL STREET RAILWAYS.

THE MONTREAL STREET RAILWAY COMPANY.

In 1891, when the National Electric Light Association held its convention in Montreal, the street-car lines in that city were operated by horse-power. Since that time, however, a great change has taken place in the matter of street transportation facilities. Montreal now stands among the leading cities in which the trolley system is operated, and it is noticeable that the system has injected the spirit of progress and enterprise among the people—a result that never fails to follow the introduction of the trolley system everywhere.

There are two street-railway companies in Montreal, and these control all the lines in the city and its suburbs. These companies are the Montreal Street-Railway Company, and the Montreal Park and Island Railway Company. Up to the present time the two companies have equipped 95 miles of their lines on the trolley system. Of this trackage the Montreal Street-Railway Company own 78.85 miles, which includes sidings, shops, barns, etc. This company's lines cover the business and residential sections of the city and afford excellent service in all directions.

The company's rolling stock consists of 163 motor cars and 104 trailers. Some of the car bodies are of Canadian manufacture, the others coming from "the States." The electrical equipment of the motor cars represents both United States and Canadian manufacture—the Royal Electric, the Westinghouse and General Electric Companies being represented in this regard.

The power station of the company is located on William street, corner of McCord s reet. This location is very convenient to coal-yards, and as the Lachine Canal runs close by, fresh water in abundance is obtained for steaming purposes. The building has a frontage on William street of 350 feet, and is a substantial brick structure The section devoted to the engine room is 80 x 200 feet. It is well lighted by large side windows and by windows in the roof.

The steam-power plant consists of six cross-compound Corliss engines of 600 H. P. each, which run at about 70 revolutions per minute. Three of the engines are belted to two 300-K. W. General Electric multipolar generators. Two of the generators are set on one bed plate, and by means of a friction clutch one or the other or both may be operated. The other three engines are belted to four 200-K. W. General Electric bipolar generators.

The switchboard, which is located at one end of the building, is very attractive and complete. It stands ten feet above the gallery floor and runs the entire length of the building. The board is built up of terra-cotta bricks and covered with a coating of adamantine plaster. Westinghouse instruments are used for the different circuits, the face of each being illuminated by an incandescent lamp. The board is 62 feet long, 11 feet high and nine inches thick, the gallery being reached by two short flights of stairs. A very complete annunciator system is provided for intercommunication between the switchboard and the engines.

The boiler plant consists of 16 double-flue Lancashire boilers, made in Manchester, England. The boilers are rated at 250 H-P. each and are designed to carry a working pressure of 125 lbs.

The overhead construction along the lines is of the standard type, Morris Tasker & Co.'s sectional iron poles being used. The trolley wire is No. 00 B. & S. gauge, and is supported by "West End" hangers with mechanical clips; span and guard wires are of No. 9 galvanized iron wire. Both solid and stranded No. 0000 feeders are used on the line, and the rails are bonded with No. 4 copper wires soldered to rivets driven in the rails and interconnected at short intervals.

The track rails are of English make, and are of the grooved girder type, 6½ inches high and weighing 72 lbs. to the yard.

The company's main repair shop is located on Coté street, and is a brick structure two stories high, and 150x

SAULT-AU-RECOLLET TERMINUS MONTREAL PARK AND ISLAND RAILWAY.

115 feet. Most of the upper floor is devoted to repairing of car bodies, a section being used for armature winding and repairing. On the ground floor is the machine shop and car shed, the power for the shop being supplied by an electric motor taking its current from the trolley line, and the car shed having a capacity of 16 cars. Under each track in the car house is a pit 100 feet long and five feet deep.

Each pit is provided with a truck and hydraulic lift for handling the heavy parts of the motors. Adjoining the repair shop is a brick car barn with a capacity of 20 cars, and an emergency station with an emergency wagon and comfortable quarters for the men, who are always on duty ready to respond to fire-alarms and other emergencies in connection with the operation of the road. There are besides this shop three others in different parts of the city.

The company's records show that the cars run 650,000 car-miles per month, carrying 2,600,000 passengers.

The Montreal Street-Railway Company has a capital of $3,000,000. It obtained its franchise on July 19, 1892, for 30 years, agreeing to pay therefor to the city annually four per cent. on its receipts up to $1,000,000; six per cent. on amounts from $1,000,000 to $1,500,000; eight per cent. on $1,500,000 to $2,000,000; ten per cent. on $2,000,000 to $2,500,000; 12 per cent. on $2,500,000 to $3,000,000 and 15 per cent. on all amounts above $3,000,000.

The officers of the company are: L. J. Forget, president; J. Ross, vice-president and managing director; E. Lueher, secretary and treasurer; G. C. Cunningham, manager and chief engineer; D. McDonald, superintendent.

MONTREAL PARK AND ISLAND RAILWAY CO.

The Montreal Park and Island Railway Company is essentially a suburban system, though under a working arrangement with the Montreal Street Railway it has rights over its tracks to the central parts of the city, and at the present time is running cars to Craig street, which is one of the principal business streets of the city, thus bringing suburban passengers without change of cars to the centre of the city.

At present two lines are in operation. (1) The Back River line, cars for which leave the corner of St. Lawrence and Craig streets, continuing up St. Lawrence and St. Dominique street to Mount Royal avenue, the northerly limits of the City of Montreal; at the corner of Mount Royal avenue and St. Lawrence street, the Montreal Park and Island Railway begins, and from this point to the present terminus at Sault au Recollet is a distance of 6.55 miles. This line is single track. An extension of this line is in contemplation that will extend to St Vincent de Paul, which will render the line a greatly increased traffic.

(2) The Mountain Division, cars for which leave the corner of Craig and Bleury street, continuing up Bleury street and Park avenue to Mount Royal avenue, where the Montreal Park and Island Railway commences; thence northward and westward, through Outremont, Cote des Neiges, and Notre Dame de Grace to the Town of Westmount, where a junction is made with the Montreal Street Railway. The length of the Mountain line is six miles, half of which is double track and half single track.

In addition to these lines there is an extension of about a mile into the "Annex," a growing section of the municipality of St. Louis du Mile End along Park Avenue, which bids fair to become a favorite residential locality at an early date.

During the summer months the lines do a very large business, the routes being chosen so as not only to afford easy and quick transportation to the suburbs for business men, but also to carry pleasure seekers to and through most delightful places, affording fresh air and lovely scenery, such as few places in America can boast of; and to make the circuit of Mount Royal in one of the M. P. & I. cars is something every visitor tries to do before leaving the city.

The line is all laid with 56 lb. Cammell steel rails of T section, the joint fastenings are angle bars, plain fish plates, and some Stever rail joints; the last named are promising very well. The ties are nearly all hard white

WINTER SCENE ON MONTREAL PARK AND ISLAND RAILWAY.

cedar, and Fox tie plates are used on curves and on some tangents.

The overhead construction is of the West End type. The double-track work is nearly all centre construction, the remainder being span construction. The poles are cedar, 30 feet long, and eight inches diameter at top. The feeder system is overhead and is chiefly of 0000 wire; it and the trolley wire were made by the Dominion Wire Co., of Montreal.

The equipment consists of 17 motor cars and seven trailers. Seven of the motor cars are open. The motors are 30-K. W., some of the Westinghouse No. 3 and some No. 12. The remainder are Royal electric equipments with No. 28 Westinghouse controllers; these motors are really 37½-K. W., and are well suited to the needs of the road. The quality of work in the "Royal" equipments is excellent, which easily accounts for the good results obtained. There are two motors on each car.

The cars are of various makes, mostly from local firms.

BACK RIVER STATION MONTREAL PARK AND ISLAND RAILWAY.

The speed of cars is, outside of the towns, about 12 miles per hour, and in the town seven miles per hour. The various franchises extend for 30 years, and are exclusive in their privileges, also including in some instances electric lighting powers.

The power house is located temporarily in the Exposition Company's building on Park Avenue, but preparations are being made for constructing a new power house on the Lachine Canal, and transmitting by high tension current to sub-stations to be located in various parts of the territory covered.

There are two four-pole generators in use, one 200-K. W. and one 100-K. W. rated capacity, both made by the Royal Electric Co. The switchboard is not of a permanent character, and in fact, pending the construction of a new power house, there are many things about the power house of a temporary nature which serve very well the purpose under the existing circumstances.

The engines are two in number; the larger one has 22x48 cylinder and the smaller one has 16x42 cylinder, both of the Corliss non-condensing type, belted direct to the generators.

The boilers are four in number, 60 inches diameter and 14 feet long, with 80 tubes 3½ inches diameter.

The officers of the company are: Hon. Louis Beaubien, president; Hon. J. Rosaire Thibaudeau, vice president; R. L. Gault, treasurer; Henry Holgate, manager and engineer; Alfred Roy, accountant; Henry Harper, electrician.

THE WINDSOR HOTEL, MONTREAL.

HEADQUARTERS OF THE AMERICAN STREET RAILWAY ASSOCIATION.

The Windsor is one of the finest hotels on the American continent, and its location is one of the most charming in the city; being centrally located, it is within easy reach of the business section and only a few minutes' walk from the main railroad station.

The appointments of the Windsor are of the most elegant character, and no efforts nor money have been spared to keep it up to its high standard of excellence. The rooms are luxuriously furnished, and every convenience is provided for the comfort and enjoyment of the sojourner.

The Grand Rotunda is the first feature to attract attention on entering the hotel at the Dominion Square entrance. Here are situated the hotel office, backed by a magnificent stained glass window, ticket and telegraph offices, and the cigar and book and newspaper stands The rotunda has a dome roof which is lighted by skylights. The rotunda has recently been refrescoed, giving it a magnificent appearance. The floor is of square marble slabs.

The Grand Promenade, on the first floor above the ground, is 180 feet in length by 40 in width, and is carpeted with the softest of Wilton carpets of rich design. Running down the centre of the promenade are beautiful columns, around he top of which are circles of electric light. The promenade is furnished with comfortable lounges and chairs.

GRAND PROMENADE, WINDSOR HOTEL.

The dining-room of the Windsor is a magnificent hall. It is 112 feet long by 52 feet wide, and is 27 feet high, and has an elegant marble floor. The room is lighted by three large domes, around each of which is a circle of electric lights, and when the lights are turned on the effect is truly beautiful. This dining-room has a seating capacity of 500, and it is said to be one of the largest and best frescoed dining-rooms on the American continent.

OFFICERS OF THE AMERICAN STREET RAILWAY ASSOCIATION.

JOEL HURT, PRESIDENT A. S. R. A.

COL. J. N. PARTRIDGE, SECRETARY PRO. TEM. A. S. R. A.

W. WORTH BEAN, ST. JOSEPH, MICH.
FIRST VICE PRESIDENT A. S. R. A.

COL. J. H. CUNNINGHAM, BOSTON.
SECOND VICE PRESIDENT A. S. R. A.

RUSSELL B. HARRISON, TERRE HAUTE, IND.
THIRD VICE PRESIDENT A. S. R. A.

JOEL HURT, PRESIDENT A. S. R. A.

The extreme South, represented by President Joel Hurt, and the extreme North, represented by the fair city of Montreal, this year clasp hands, and the warm-hearted people of the Canadian Metropolis welcome the association of which Mr. Hurt is the head.

Mr. Hurt is one of the most widely known street-railway men in the United States. He symbolizes energy and progress, and is one of the association's staunchest advocates. He is, besides, one of the most prominent citizens of Atlanta, Ga., where all his interests are.

Mr. Hurt is a Southerner by birth, being born in Russell county, Ala., in 1850. Through his own efforts, backed by a determination to shine in the world, he secured a good education, which culminated in his graduation in 1871, from the University of Georgia, with the degree of civil engineer. He at once entered the practice of his profession, and spent some time in building new railroads in Arizona and Colorado. He afterwards returned to Georgia and was engaged for a couple of years in the building of the North-Western Railroad of Georgia. On the completion of this work he began a commercial career as an insurance and real-estate broker. He materially aided in the upbuilding of Atlanta through various business and financial companies which he organized. In 1882 he became secretary for the Atlanta Home Insurance Company. He was the organizer of the East Atlanta Land Company, which has been so successful in developing what is now the finest section of the city.

In 1891 Mr. Hurt was elected president of the Atlanta Consolidated Street-Railway Company, and at once undertook the task of bringing all the city street-railway companies under one management and equipping them with electricity. The results of his efforts in this direction is that Atlanta has, today, the best managed and equipped street-railway system in the South.

Mr. Hurt was elected president of the Street Railway Association at the convention last year, which was held in Atlanta, and a more popular and intelligent gentleman never filled the chair.

COL. JOHN N. PARTRIDGE.

Col. Partridge, president of the Brooklyn City and Newtown Railroad Co., Brooklyn, N. Y., and secretary *pro tem* of the American Street-Railway Association, is one of the best known street-railway men in the country.

He was born in Worcester County, Massachusetts, in 1838, and began his mercantile career in Boston. Col. Partridge was in active service during the war, serving three years of that awful period of strife in a Massachusetts regiment. Since the war he has resided in Brooklyn and become prominently identified with the street-railway interests in that city. He was at first in the mercantile business in Brooklyn, and was afterwards Fire Commissioner for one term, than Police Commissioner for one term, both terms under Mayor Low.

Col. Partridge has been president of the Brooklyn City and Newtown Railroad Co. for nearly ten years.

COL. J. H. CUNNINGHAM.

Col. Cunningham, second vice-president of the American Street-Railway Association, is one of the busy men that the street-railway business has produced. He was president of the Massachusetts Street-Railway Association for three years; president of the Norwich (Conn.) Street-Railway Co. for nine years, and president of the Plymouth and Kingston Street-Railway Co., Plymouth, Mass., for five years.

At the present time he fills several important positions, and the interests with which he is associated are all prosperous under his counsel and capable and careful management.

Col. Cunningham is the vice-president of the Gloucester, Street-Railway Co., Gloucester, Mass., and president of the Boston Construction Co., which has built several street railways in New England. He is besides a large owner, or director in the following named street-railway companies: Lynn and Boston Street-Railway Co.; Gloucester Street-Railway Co.; Worcester and Suburban Street-Railway Co.; Haverhill and Amesbury Street-Railway Co.; Gloucester and Rockport Street-Railway Co.; Athol and Orange Street-Railway Co., and Reading and Lowell Street-Railway Co. He is interested in several other non-electrical industries, being the largest owner and a director in the Chelsea Ferry Co., which line runs between Boston and Chelsea, and president of the Winnisimett National Bank, of Chelsea, Mass.

Col. Cunningham was in the state military service for 12 years, three of which he was assistant adjutant general of the State, with the rank of colonel. He has a host of friends, and is highly esteemed by all who know him.

RUSSELL B. HARRISON.

Mr. Russell B. Harrison, 2d vice-president of the American Street Railway Association, is known to all street railway men as one of the most progressive spirits in the electric street-railway business. Mr. Harrison is president of the Terre Haute Electric Railway Company, of Terre Haute, Ind., and through his capable management he has brought the condition of his road up to such a point that it is now generally regarded as a model of electric railway construction, both as regards roadbed and equipment.

Mr. Harrison is a firm believer in doing things well, and that he practices what he preaches is evidenced by the excellence of the Terre Haute system. At the last meeting of the association—in Atlanta, Ga., last October—he read an interesting paper entitled "The Rail Construction of the Terre Haute Street-Railway Company," which was the means of elevating that company's system to the dignity of a standard, and the road has ever since been referred to, comparatively, in connection with other new street-railway undertakings.

Mr. Harrison is quite a young man yet, full of energy and determination, and was engaged in several successful enterprises prior to his appearance in the electric railway field. He is a mining and electrical engineer by profession, and spent several years in Montana in the mint service of the government and in mining and stock raising. He was also engaged in the newspaper business in the West, and later, in New York City, as one of the owners of Frank Leslie's Illustrated Newspaper.

The wonderful development of the electrical business attracted Mr. Harrison's attention, and he decided to cast his fortune in that direction. He disposed of his New York newspaper interests and has, ever since, been engaged in the electric railway and electric lighting business. He has established for the Terre Haute road a national reputation for solidity of construction, particularly heavy track construction, and has introduced many novel and interesting improvements in the electric railway, electric lighting and the steam-heating business.

The Terre Haute Electric Railway Company, in connection with its railway operations, does the public and commercial lighting and steam heating of Terre Haute.

Mr. Harrison, it may be noted, is the son of Ex-President Benjamin Harrison.

D. G. HAMILTON.

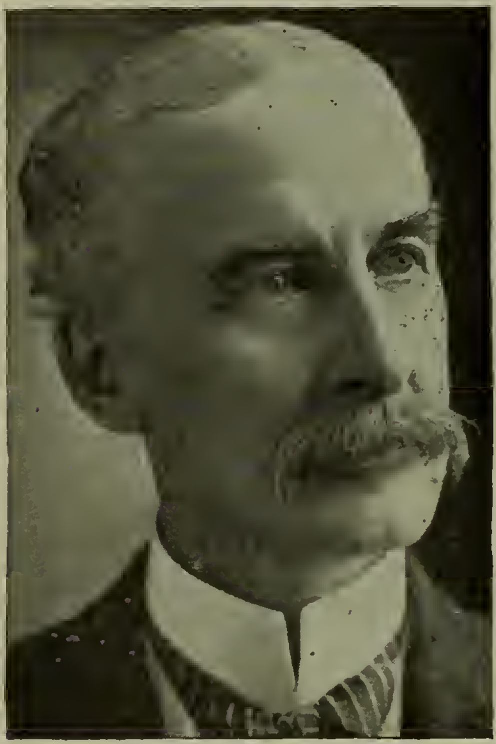
D. G. Hamilton, member of the Executive Committee of the American Street-Railway Association, was born in Chicago. He received his education in the schools of that city and afterwards attended Asbury University (now De Pauw) from which institution he was graduated in 1865. He then took up a course of law and graduated from the University of Chicago.

Mr. Hamilton is a man of great business capacity, and is actively interested in many large enterprises. He was for many years a director in the Chicago City Railway Company, and is now president of the National Railway Company, which controls and operates five of the lines in St. Louis, of each of which he is also the president These roads are the St. Louis Railroad Company, Cass Avenue and Fair Grounds Railway Company; Baden & St. Louis Railway Company; Citizens Railway Company, and the Southwestern Railway Company—the last named having been in operation since August 1, last. The Cass Avenue & Fair Grounds Railway Company was created by the consolidation of the Cass Avenue Railway, the Northern Central Railway and Union Railroad Companies.

Besides these large interests Mr. Hamilton is the manager of the Utica Cement Manufacturing Company, a director of the Union Mutual Life Insurance Company, of Maine, and a member of the Board of Trustees of the University of Chicago.

HENRY C. PAYNE.

Henry C. Payne was born in Ashfield, Mass., on November 23, 1843. The early years of his life were spent in his native town, where he attended the country school. He afterwards went to the Shelburn Falls Academy, where he was graduated at the age of sixteen. After this he went into business in Northampton, Mass. At the breaking out of the civil war he enlisted in the 10th Massachusetts Volunteers, but owing to his youth he was not mustered in. In October, 1863, he moved to Milwaukee, and started life as clerk in a dry-goods house, in which business he was engaged for four years. During this period he became interested in the Young Men's Library Association, and was elected its president. He afterwards became interested in politics and, in 1872, became leader in the organization of the Young Men's Republican Club. Under his guidance the association became a power, and is now known as the Republican Central Committee of Milwaukee county. In 1876 he was appointed postmaster of Milwaukee by President Grant, which office he held for ten years.



D G. HAMILTON, ST. LOUIS.
Member Executive Committee A. S. R. A.

HENRY C. PAYNE, MILWAUKEE.
Ex-Pres. and Member Exec. Com. A. S. R. A.

GEN'L W. H JACKSON, NASHVILLE, TENN.
Member Executive Committee A. S. R. A.

Mr. Payne is a man of extended business interests, and in 1885 became president of the Wisconsin Telephone Company, which office he still holds. He is also a director of the First National Bank, and holds official positions in various railroads and other concerns in that section of the country.

He became interested in street-railway work, and was president of the Milwaukee and Cream City Street-Railway Company until this line became a part of the Villard system. He was afterwards vice-president and general manager, and is now one of the receivers of the Milwaukee Street-Railway Company. Mr. Payne is very popular and universally liked by street-railway men and others who are acquainted with him. He was president of the American Street-Railway Association during 1893–94.

CONSOLIDATION IN PHILADELPHIA.

The Philadelphia, the Electric and the People's Traction Companies were consolidated on October 7, under the title of the Union Traction Company of Philadelphia. The combined companies form the greatest single system of street roads in existence, with about 425 miles of road now operated and a combined capitalization in stock and bonds, including that of all the subsidiary companies, of more than $108,000,000.

IS A FREIGHT OR MAIL SERVICE PROFITABLE OR UNPROFITABLE ON STREET-RAILWAYS.*

BY BENJAMIN NORTON.

The simplest answer to this question is yes, if it can be performed at a profit, and no, if it must be performed at a loss. Now, apparently, the question is solved, and I have no further need to discuss it; but, as this is a subject which will eventually be taken up seriously by most electric railway companies, it is worthy of very careful consideration.

In the case of a street-railway which has no suburban outlet and no direct or close connection with some other line which operates, or can conveniently operate, a freight service, it might be a very unprofitable venture to undertake this class of traffic. Today, however, there is hardly an electric railway (and we will speak of electric roads only now, since horse power is a thing of the past) which does not have suburban outlets or chances for them. Therefore, we may safely say that a freight service as a general rule ought to pay. Very few electric railroads thus far have branched out into this field, and as I happen to be interested heavily in a line which has gone vigorously into the matter, I can tell briefly our experience and can show you what a successful feature of our business the freight branch of it is; so much so, that we have a regularly organized freight department, way-billing merchandise in regular steam railroad fashion, and running regularly scheduled freight trains, all of which pays, and pays handsomely. This line grew out of a tumble-down horse railroad in the City of Newburgh, and, after being rebuilt and extended and equipped electrically, we found ourselves tapping the rich Walkill Valley at Walden, twelve miles away, and terminating at the front door of one of the largest cutlery works in this country, running by all the stores and shops in town, and giving an opportunity besides to the dairymen of Orange County to get their milk, butter and cheese to boats on the Hudson river at Newburgh inside of an hour, when formerly they had carted it the distance over the rough country roads, the teamster spending pretty much the day at it and returning home at night with their mule teams tired out and often a broken-down wagon.

This line today, because it is a short cut in the first place,

(*Continued on Page 223.*)

* Paper read before the Convention of the Street-Railway Association of the State of New York, Albany, September 17, 1895.

SOME FAMILIAR FACES THAT WILL BE SEEN AT THE MONTREAL CONVENTION.

EDGAR PECKHAM,
President Peckham Motor Truck & Wheel Co.,
New York.

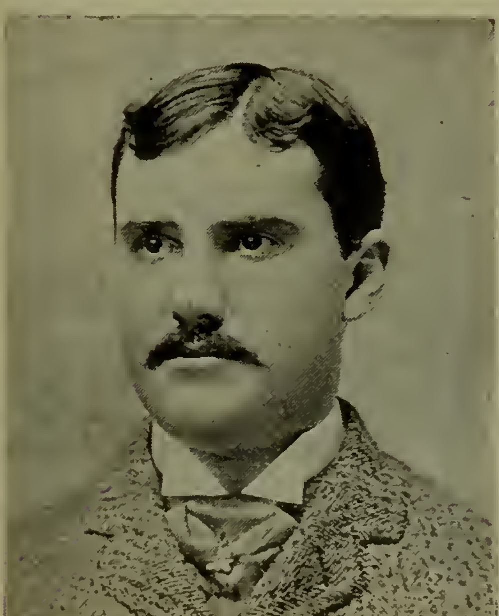
H. L. SHIPPY,
Manager J. A. Roebling's Sons Co.,
New York.

FRANK S. DE RONDE,
Manager Standard Paint Co.,
New York.

ANDREW RADEL,
Pres't and Gen'l Mgr. Bridgeport Traction Co.,
Bridgeport, Conn.

HENRY SETZER, JR.,
Director Bridgeport Traction Co.,
Bridgeport, Conn.

JOHN C. DOLPH,
Eastern Manager Forest City Electric Works
of Cleveland, Ohio.



THE CONDUIT KING J. P. MCQUAIDE,
Sec'y and Treas. National Conduit Mfg. Co., N. Y.

MAJOR H. C. EVANS,
The Johnson Co., New York,

A. J. CORRIVEAU,
Montreal Park and Island Ry., Montreal.

CAPT. WILLARD L CANDEE,
The Okonite Co., Limited, New York.

JOHN A. BRILL, OF J. G. BRILL & CO.,
Car Builders and Trucks, Philadelphia.

JOHN A. SEELY, OF BELDEN & SEELY,
Electrical Contractors, New York and Syracuse.

J. S. SPEER, SECRETARY
Partridge Carbon Co., Sandusky, Ohio.

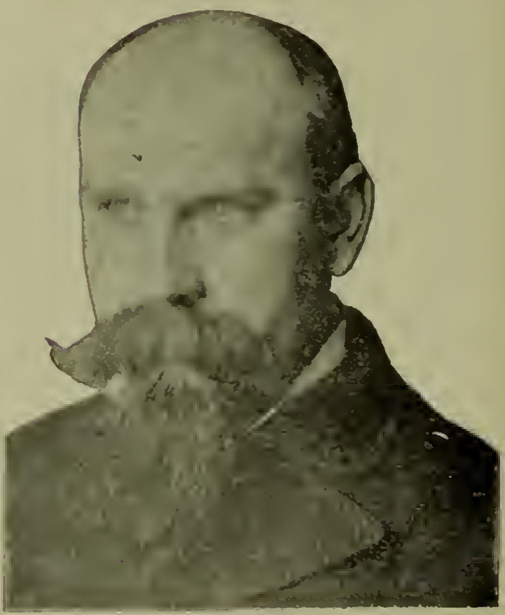
THE MEN WHO MAKE PARTRIDGE BRUSHES.

The two pictures, on the right and on the left, are of the faces of two gentlemen well-known to street-railway men. They are those of James Partridge and J. S. Speer, of the Partridge Carbon Co., Sandusky, Ohio. Every electric railroad man is familiar with the excellence of the Partridge Company's brushes for railway motors. A great majority of these railways use these brushes with the best of results, and Messrs. Speer and Partridge will endeavor to satisfy all others at the convention that the Partridge brushes are the best and most economical to use.

JAS. PARTRIDGE, MANAGER
Partridge Carbon Co., Sandusky, Ohio.

H. M. WATSON, PRESIDENT
Buffalo Railway Co., Buffalo, N. Y.

JAMES W. GODFREY, MANAGER
India Rubber and Gutta-Percha Insulating Co., N. Y.



FRANK BROWNELL,
Brownell Car Co., St. Louis, Mo.

(*Concluded from page* 220.)

and because goods can be transported at low rates, in the second place, is handling the dry goods and other merchandise for Walden merchants, shipped from New York by boat to Newburgh; the raw material for the cutlery works, in the way of steel, brass and wood and other supplies, and bringing back manufactured material in cases; hay, straw and fruit; and condensed milk in cans from the Borden condensery only two miles from our terminus at Walden. The road runs along the highway in some portions, and at other points the line is set back from the roadway on independent property; but we run near to many large farms, and the men on these places hustle their hay and straw in bales out the side gate to the track and stop the freight car handily, saving (besides 50 cents to $1.00 per ton freight) a long drive to the steam road freight house.

In the month of August the operating cost for handling our freight was a trifle over 40 per cent of the gross receipts.

CAPT. W. WOLCOTT MARKS, Bishop Gutta-Percha Co., New York.

WILLIAM S. SILVER, Of William S. Silver & Co., Car Springs, New York.

We ran three motor freight cars, carrying from 8 to 12 tons each, and four flat or gondola cars as trailers, carrying from 6 to 8 tons each. At Newburgh the line runs alongside the string-piece of the steamboat dock, so that everything can be easily skidded between the boats and cars. We also run close to the Erie and West Shore freight houses and tracks, insuring an all year round New York connection, although as a rule the Ramsdell line of boats is out of service but one month of the year.

Some of our Walden friends remarked the other day that the Walkill Valley Railroad people had soured on the trolley, because their freight trains in both directions were running through Walden without stopping, and they were discussing the notion of discharging their freight agent at that point altogether. I may add that the past week we have hauled from Walden to the Hudson river, among other kinds of freight, about 75 tons of grapes, and the coming week we will do the same. The rate of 13 cents per hundred pounds net to us makes $2.60 per ton, which is a good rate, and requires but one trip per day of a motor freight car and trailer to get it. To earn the same amount of money with a passenger car would take the entire day, and a regular full day crew besides.

The experiments now being made by the New Haven railroad people on their Nantasket Beach road are probably not new to you, and it looks very much as though freight business on electric railroads would not only be profitable in the near future but generally be adopted as a means of revenue by a large percentage of such companies.

As to mail contracts, while the government compensation is comparatively small, the actual cost to a company for performing the service is so little that they must be profitable, to a certain extent; but aside from this no large corporation in a large city where the circumstances call for such a contract, should overlook a special safeguard in time of strikes. During my presidency of the Atlantic Avenue Company in Brooklyn we undertook to serve the government in this regard and prepared special cars. Part of these cars were devoted to the mail and the mail clerks, and part to regular passengers, so that when they were on the line they were earning money from passengers for the company, the same as other cars, while the U. S. Mail signs always insured a clear track in crowded streets.

Our experience during the great strike of last winter proved conclusively the value of a government contract for carrying the mails. The 19 cars on our Fifth Avenue line, which, by the contract, were permitted to carry the legend, U. S. Mail, were not molested, and we were able to keep that particular line opened throughout the whole trouble. In view of all the circumstances, I believe a mail contract for a street railway is one of the most profitable things for a small one that they can undertake.

GENERAL TRACK CONSTRUCTION.*

BY C. LOOMIS ALLEN.

The evolution of track construction for electric service from that of horse-cars has been very rapid, when considered with the length of time it has taken the steam roads to reach the point of excellency which many of them have attained. In fact, some of our electric roads can show permanent way equalled by but few of the steam roads.

The days of stringer-box girders, three-point or butterfly light girder and light tee-rail sections have passed away, to make place for the deep girder or deep tee-rail sections; the former being used in cities and villages of some size, the latter in country roads and small towns. In the transformation of motive power of a railroad system from horses to electricity or cable, the last department — generally speaking — to receive any outlay of money is the track department; and then only when the car-repair bills and track maintenance are so costly as to demand an investigation and its consequent repairs. Many of you who have passed through this experience can remember how heavier rails and stronger joints alone was the prescribed remedy, which when applied were found to be only temporary, and poor track the results after a few months of operation. It has been only recently and after very costly experience that any attention has been given by street-railroad officials to the matter of foundations, or to the conditions of the sub-grade upon which is placed the ballast, and I am sure that experience will bear me out in my statement that economy in track maintemance begins with the making of firm foundations.

A great many obstacles are encountered in finding firm foundations for electric roads, with which the steam roads do not have to cope. Let me cite a case which in cities is very common. A street is about to be paved with permanent pavement, and the street-railroad officials having secured the best of track material, propose to lay permanent track. Having decided upon the plans of construction, they enter upon their execution. The first work is the matter of excavation of the material in the street to subgrade; as is generally the case, the sewers, water-mains, gas-mains, electric conduits or sub-ways have been previously constructed a sufficient length of of time to allow the trenches to settle—the popular idea is that one winter will settle trenches—the surface of the street seems firm and fairly solid; excavation progresses to such depth as is desired, and the rolling of the sub-grade with a heavy roller to make thoroughly firm has begun. Then appears the conditions of improperly filled trenches, vexing the engineer in charge of construction and making him thoroughly disgusted with the manner in which the construction of underground structures is conducted; and well he has a right to be; with sewers in the centre of the street, gas, water and sub-ways on either side, very little of the undisturbed ground can be found. The only remedy is to properly fill all the trenches and make them firm foundations. It is enough to discourage the intentions of any railroad company from constructing permanent way, in the face of just one difficulty the size of this. It makes men feel as if they were at their own expense

* Paper read at the Convention of the Street-Railway Association of the State of New York, Albany, September 17, 1895.

making good the poor work of municipal authorities, and in some cases this is true.

Back-filling of trenches in a general clause is always provided for in the specifications for underground structure. This clause is supposed to cover the treatment of all classes of soil, but, in actual practice, each type of soil requires a very different treatment. I do not propose to discuss the manner or methods of trench filling, but I do suggest that railroad companies co-operate with city officials in placing in specifications for underground structures clauses pertaining to the proper filling of trenches. Post the bidding contractors on such work that these clauses are for the purpose of properly filling the trench, and to the successful contractor in obtaining such a contract, by all means see that the conditions of this clause are fully carried out. The question of back-filling has never been given the amount of attention that should have been given it by engineers, the universal belief being that the concrete foundations of pavements will bridge these settlements. How many poor pavements have we in cities, and how many pieces of poor track can be seen from this erroneous practice. Some few railroad companies have become so thoroughly discouraged in attempts to obtain firm foundations that they have been to the great expense of placing concrete foundations six inches thick under the ties to support them, thus bridging the various settlements. This method may be practical in some cases where firm foundations are not obtainable, but beyond these extreme cases, its cost removes it beyond practical use. I maintain that trenches can be properly filled and by the aid of sufficient rolling a firm sub-grade can be obtained, permiting the use of broken stone ballast and lessening the cost of concrete foundations by two-thirds. Remove all soft and spongy places in the sub-grade; lay tile drains connected to sewers to such points as seem at all springy, and have the line of the sub-grade, after it has been thoroughly rolled, conform in line and section to the finished grade.

(*To be continued.*)

HANDSOME ELECTRIC LIGHT NOVELTY.

The accompanying illustration is of a very handsome electric light novelty recently brought out by L. D. Hatton & Company, 11 Warren street, New York. It represents a cluster of grapes, and is intended to fit over an

ELECTRIC GRAPE CLUSTER.

incandescent lamp. The electric light shining through gives a very beautiful effect, strongly imitating a cluster of natural grapes

These grape clusters are tinted in various shades to correspond with the colors of the fruit they are intended to represent, and the large California wine producers are using a great many of them, giving them away to their favored customers.

They are durable and can be washed without danger of breaking. They are nine inches high, eight inches in diameter, and weigh only eight ounces. They are provided with 3¼ inch fittings.

These grape bunches will no doubt meet with a large demand from cafés, wine rooms, and other places where decorative lighting is wanted.

Telephone Notes.

Jacksonville, Fla —Jacksonville Telephone Co. incorporated. Capital $100,000. W. N. Shine, of Tallahassee; A. H. King, of Jacksonville and C. B. Collins of Tallahassee.

TELEPHONE PATENTS ISSUED OCTOBER 8, 1895.

Telephone System.—Frederic D. Shepard, Milwaukee, Wis. (No. 547,460.)

Telephone Switch.—Willard M. Miner, Plainfield, N. J. (No. 547,613.)

Automatic Telephone System.—George K. Hutchins, Baltimore, Md. (No. 547,755.)

Street Railway Notes.

Cromwell, Conn.—The Selectmen of Cromwell have granted the Middletown Electric Railway the privilege of a trolley system through that town.

Frederick, Md.—The Frederick Aldermen have granted a franchise to the Frederick and Middletown Electric Railway Co. The road must be built within two years, under the franchise.

Jacksonville, Fla.—It is said that an electric road between Jacksonville and St. Augustine will be built this winter. The capital stock of the company is placed at $2,000,000.

Waverly, Ia.—J. N. Bowman, president of the First National Bank, is interested in the company to be incorporated to construct an electric road between Cedar Falls and Waverly.

Saginaw, Mich.—At a meeting of the Township Board of Bridgeport, a 30-year franchise was granted to the Saginaw Street-Railway Co. to run a line along the Genesee Plank Road, from the city limits to Bridgeport.

New Corporations.

Milwaukee, Wis —The Chicago and Wisconsin Inland Lakes Railroad Company has been incorporated by A. E. Case, Frank Boden, S. Marcus Rothschild, A. J. Toolin and G. D. Green, to build an electric railway from Chicago, Ill., to Madison, Wis., and branch lines to the lake resorts. Capital stock, $10,000,000.

San Francisco, Cal.—Merced Falls Electric Power and Manufacturing Company has been incorporated by R. H. Dunham, Herman Jahn, J. T. Fleming, Augustus Laved, Alameda, Ga.; Basil Owen, London, England. Capital stock, $1,000,000.

Baltimore, Md.—The Equitable Electric Light Company has been incorporated by Henry A. Parr, John Cowan, George R. Webb, J. William Middendorf and Richard R. Culbreth, for the purpose of supplying electric light and power. Capital stock, $50,000.

Los Angeles, Cal.—E. E. Peck has organized an electric light company with a capital stock of $80,000.

New York City.—Croton Valley Electric Railway Company, incorporated to construct a narrow guage street surface railroad about four miles long, from the New York Central station in Croton-on-the-Hudson to the new Cornell dam. Capital, $10,000. Directors, Charles E. Grattan, Edward White and Robert B. White, all of Croton-on-the-Hudson.

Columbus, O.—The Citizens Light, Heat & Power Company, of Columbus. Capital, $200,000. Incorporators, Charles S. Knight, R. T. McDonald, of Fort Wayne, Ind., and Thomas Cooper, B. C. Beggs, and R. R. Rickly, of Columbus. It is proposed to establish an electric plant, and it is understood that the project is backed by the Fort Wayne Electric Corporation, of Fort Wayne, Ind.

Niagara Falls, N. Y.—Niagara Falls Street-Railway Co., incorporated, to construct a street surface railroad. Capital, $50,000. Directors: Arthur G. Denniston, Charles H. Hinchman, George L. Estabrook, Jr., Joseph S. Clark and Robert L. Byron, of Philadelphia, Pa.; James S. Simmons, E. H. Stewart, Walter P. Horn and Spencer J. Lawrence, of Niagara Falls.

Towson, Md.—The Wetheredville, Franklintown and Edmondson Avenue Electric Railway Co. has been incorporated. Capital, $25,000. Incorporators, Wm. Ferguson, Joseph Henry Judic, Charles W. Dorsey, Dr. Joseph C. Monmonier and Levy Z. Condon.

New York City.—The Wilson-Bates Electric Company of New York city, incorporated to manufacture telephones and all kinds of electrical or magnetic machinery. Capital, $1,500. Directors, William C. Wilson, George B. Bates and Henry G. Issertel.

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

Cincinnati, O.—Simplex Interior Telephone Co. of Cincinnati incorporated Capital $5,000. Incorporators, Walter L. Bradshaw, John Seymour, Emil Koll, Robert G. Stevenson and James McClain.

South Haven, Mich.—The Oak Telephone Co. incorporated. Capital $20,000. Officers, C. J. Monroe, president; B. E. Harmon, treasurer; A. T. Dewer, secretary and manager.

Possible Contracts.

New York City.—Blake & Nally will erect five five-story flats on 88th street, west of Amsterdam avenue, to cost $120,000, from plans prepared by Architects Webster and Thompson, 215 West 125th street. Specifications include steam-heating appliances, electric bells, etc.

La Porte, Ind.—Plans and specifications are being prepared for the erection of a water and light plant, for which bids will be received. A. Van Balkenburg, secretary.

Pittsburgh, Pa.—Presbyterian Board of Colportage have had plans made by architects for a ten-story structure, which they propose to erect on Wood street. Cost $150,000.

Bayport, L. I., N. Y.—Architect Cummings of Long Island City is engaged on plans for brick passenger and freight depot buildings, for the Long Island Railroad Co., at Bayport.

Tottenville, S. I., N. Y.—Staten Island Rapid Transit Co. will erect a two-story building with a double track trestle 338 feet in length, at Bentley street, to cost $67,000. Contractor Colin McLean.

Johnstown, N. Y.—George A. Streeter of Johnstown and parties from New York, will soon erect an electric plant, which is calculated to furnish the city of Johnstown, its business places and private residences with light and power.

New York City.—R. S. Ely will erect a four-story and basement brick store and salesroom at 373 5th avenue, to cost $10,000. Architect, John Downey.

Brooklyn, N. Y.—McLaughlin Bros. will erect an eight-story printing-house on South 11th street, to cost $60,000.

New Haven, Conn.—T. G. W. Jefferson & Son contemplate the erection of a new block on their property on Grand avenue, from plans made by Architect L. W. Robinson.

Dunbar, Pa.—A business block containing opera-house and hotel is to be erected in Dunbar, at a cost of $50,000 or $60,000.

Boston, Mass.—J. Pickering Putnam, architect, has prepared plans for a hotel to be erected on Commonwealth avenue, beyond the Three Roads. Work will be begun at once. Charles Francis Adams and others, trustees.

Hot Springs, Va.—President Ingalls of the Big Four and Chesapeake and Ohio, has received plans for a $100,000 hotel to be built at the Hot Springs.

Grafton, Wis.—A $10,000 hotel will be erected by Edward Mueller.

Brooklyn, N. Y.—At a meeting of the Brooklyn Diet Dispensary, 21 De Kalb Avenue, Mrs. J. F. Langstaff, second vice-president, stated that the officers of the dispensary had decided to lay before the Board of Trustees a plan to build a memorial home.

New York City.—The Bohemian Gymnastic Association, "Sokel" 536 East 5th street, will erect a four-story brick club house, at 420-424 East 71st street, to cost $55,000. Architect Julius Franke, 287 4th Avenve.

Peconic, L. I., N. Y.—A club house is to be erected on Robins Island, in Peconic Bay, by the Robins Island Gun Club. The Harlem Wheelmen have appointed a committee to procure a site on the west side of the city for a club house, to be erected after plans prepared by Robert D. Morrison.

Jersey City, N. Y.—The site committee of the Palestine Building Association held a meeting September 26, and virtually agreed on a site.

Buffalo, N. Y.—Mr. White of the architectural firm of McKim, Mead & White, 160 5th Avenue, New York city, has been in Buffalo, looking at the Academy of Music property and figuring on the work of planning for the new music hall to be built.

Brooklyn, N. Y.—The plans and specifications of the new building for the Brooklyn Institute of Arts and Sciences were approved October 3, by Building Inspector Wesley C. Busch. Architects McKim, Mead & White, 160 5th Avenue, New York city. Builders, P. J. Carlin & Co.

New York City.—Horace S. Ely & Co., 64 Cedar street, will erect a modern business building.

David L. Newborg has sold to Jere C. Lyons, 81 East 125th street, property at 491-493 Broadway and 446 Broome street, fronting on Broadway. The old buildings on the site will be torn down on February 1, and a modern 12-story business building erected on the site.

Syracuse, N. Y.—Ground has been broken for the new Saul block in James street, adjoining the Klein property. The building to be constructed will be five-stories, brown stone, brick, with cut-stone trimmings.

Nanticoke, Pa.—Evan J. Williams intends building a business block on Market street.

Philadelphia, Pa.—Preliminary plans are being made for a new fire station at Sixth and Sansom streets, on the site of the old Board of Health office, and also one on Belmont avenue, below Girard avenue. A new police and patrol station is to be built on Trenton avenue, below Dauphin street, to replace present structure. The new police and patrol and fire station of the 11th district, at Montgomery avenue and McClelland street, is to be built by Contractor McManus.

New York City.—John T. Williams, purchaser of the property at Broadway and White street, will, next spring, erect a modern fire-proof and commercial building on the site.

ELECTRICAL SOCIETIES.

The Brooklyn Electrical Society held its regular meeting in the Edison Assembly Rooms, 360 Pearl street, on the night of October 8. M. E. Desnouee gave a lecture on "Submarine Cables and their Possibilities."

Journalistic.— *The American Engineer and Railroad Journal,* which has been published monthly by M. N. Forney, 47 Cedar street, New York, will after November 1 next, appear bi-weekly. This is a wise move and we expect to see our contemporary appear weekly before long.

Trade Notes.

The Stationary Engineers' Gazetteer Association, 159 La Salle Street, Chicago, has recently issued its Stationary Engineers' Gazetteer of Illinois. It is very complete, and contains a list of Chief Engineers of all steam plants in Illinois; names, locations, and meeting nights of all stationary engineers' associations in Illinois, and much other valuable and special information.

The Okonite Company, Ltd., make a specialty of feeder wires for street-railway use. They are tough and tenacious and are not affected by extreme changes in temperature. Okonite has made an enviable record both in this country and abroad, and is deservedly the most popular insulation known to the electrical fraternity. It is strictly high-grade and "never disappoints."

Mr. John C. Dolph, 126 Liberty street, eastern manager of the Forest City Electric Company, of Cleveland, Ohio, is securing many large orders for his company's roll-drop commutator segments. He is making a special bid on railway work. All manufacturers and repairers of commutators are using these bars, and electric railway companies are deriving the greatest of satisfaction from their use. In addition to the standard railway and motor dynamo bars which Mr. Dolph carries in stock at New York, he can supply at short notice many of the various sizes of motor and dynamo bars of standard manufacture. Prompt delivery of goods is one of the Forest City Electric Company's strong points.

ELECTRICAL and STREET RAILWAY PATENTS

Issued October 8, 1895.

547,441. Electric Bicycle. Hosea W. Libbey, Boston, Mass. Filed Oct. 9, 1894.

547,457. Trolley-Track. Antony Schumacher, Millington, N. J. Filed Mar. 21, 1895.

547,460. Telephone System. Frederic D. Shepard, Milwaukee, Wis., assignor to Frederick S. Ilsley and James Sawyer, same place. Filed Feb. 18, 1895.

547,476. Motor-Truck. John A. Brill and Walter S. Adams, Philadelphia, Pa. Filed Jan. 3, 1894.

547,482. Wheel-Fender. Herbert Claud, Annapolis, Md. Filed May 8, 1893.

547,483. Cut-Off. James H. Dousman, Milwaukee, Wis. Filed Dec. 19, 1894.

547,522. Car-Fender. James W. McKinnon, New York, N. Y. Filed Dec. 21, 1894.

547,536. Electric Car-Lighting Apparatus. William Biddle, Brooklyn, N. Y. Filed Dec. 24, 1894.

547,537. Electric Car-Lighting. William Biddle and Harry E. Dey, Brooklyn, N. Y., assignors to said Biddle. Filed Jan 9, 1895.

547,564. Current-Motor. Oscar A. Petterson, Contention, Oreg. Filed Mar. 16, 1895.

547,566. Car-Fender. Earl Sherwood, Honesdale, Pa., and George B. Parsons, Shawneetown, Ill. Filed July 13, 1895.

547,568. Electric Key-Action for Pipe-Organs. Edwin S. Votey, William B. Fleming and William D. Wood, Detroit, Mich., assignors to the Farrand & Votey Organ Company, same place. Filed Jan. 21, 1895.

547,578. Car-Fender. James W. Hentz, Baltimore, Md. Filed Oct. 16, 1894.

547,613. Telephone-Switch. Willard M. Miner, Plainfield, N. J. Filed June 4, 1895.

547,628. Car-Fender. Frank B. Crooker, Fitchburg, Mass. Filed Apr. 3, 1895.

547,659. Electric-Arc Lamp. Harold E. Bradley, Pawtucket, R. I. Filed July 1, 1895.

547,660. Insulator-Pin and Insulator. Charles F. Carroll, Manistee, Mich., assignor of one-half to Thomas Scott, same place. Filed June 6, 1895.

547,707. Street-Car Fender. Richard A. Breul, Bridgeport, Conn. Filed Mar. 23, 1895.

547,714. Time-Controlled Electric Heater. Levitt E. Custer, Dayton, Ohio. Filed Dec. 22, 1894.

547,753. Cut-Out for Arc Lamps. Daniel Higham, Boston, Mass., assignor to the Higham Electric Company, Portland, Me. Filed June 27, 1895.

547,755. Automatic Telephone System. George K. Hutchins, Baltimore, Md. Filed May 6, 1893.

ELECTRICAL AGE

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NEW YORK, OCTOBER 26, 1895.

CONTENTS.

FRANKLIN LEONARD POPE.

In the death of Mr. Pope one of America's foremost electrical experts passes away, and the sad ending of this life will leave a shadow that will long impress us with the uncertainty of life. It is, indeed, a remarkable fact that the very agency that he introduced in this country should be the cause of his death. His achievements in the electrical profession will stand for years to come as a monument to his memory. His knowledge on electrical subjects were always accepted as authoritative. The electrical world does not possess many such minds as his, and his absence therefrom will be missed. His devotion to his profession brought him face to face with death with startling suddeness, and his life was blotted out in an instant.

DEATH OF J. W. MACKAY, JR.

This estimable young man, the son of J. W. Mackay, of the Commercial Cable Company and Postal Telegraph-Cable Co., met a violent death last Sunday in Paris, by being thrown from his horse. The electrical fraternity sincerely sympathize with Mr. Mackay in his profound bereavement.

THE MONTREAL CONVENTION.

The convention of the American Street Railway Association in Montreal, last week, was in most respects the most successful ever held by the association. Custom House red tape and the cold weather stood in the way of the complete fruition of what was calculated to be an extensive exhibition of supplies. Notwithstanding the special efforts to facilitate the display of apparatus and supplies, considerable difficulty and petty annoyances were experienced by exhibitors in the effort to conform to the Custom House regulations. Some goods did not reach the rink until the last day, and some, we understand, did not get through at all. Apart from these annoying features, however, the exhibition, as a whole, was an excellent one, and those who helped to make it so deserve considerable praise for their enterprise and determination. The cold atmosphere of the rink rendered a protracted stay within the building rather uncomfortable, and heavy coats and constant motion were necessary to maintain a comfortable degree of heat in the body. In the evening this discomfort was forgotten in the melody of the music of a half a dozen bagpipers who marched around the aisles, and the band of music in the balcony. The scene at night was a lively one, the people of Montreal availing themselves in large numbers of the opportunity to see some of the wonders of electricity. The meetings of the association were well attended and considerable interest was taken by the members in the proceedings. On one occasion the debate on the question of admitting the supply-men as associate members became rather warm and personal. The proposition was finally defeated, mainly on the argument that to admit these persons would practically defeat the objects of the association, on account of the greater numerical strength of the supply men. It was actually proposed to admit them as associate members, take their dues, and deprive them voting power in the association. Such a proposition was, on its face, absurd; the supply men certainly would not pay out their money to maintain the association without deriving some benefits in return. They are better off in their present relations. The association already charges them for the privilege of making exhibitions in connection with the annual conventions, and as the relations of the two interests are interdependent the present methods are preferable to the one that was seriously proposed. The crowning feature of the convention was the banquet on Thursday night. It was a brilliant success and was largely rendered so by the presence of the fair sex. It is not good for man to be alone in this world, not even at banquets! Taking it altogether, the Montreal meeting was a great success, and the visit to the Canadian metropolis will long be remembered by those who were fortunate enough to attend.

TRAGIC DEATH OF FRANK L. POPE.

On October 14 the electrical world was profoundly shocked by the sad news from Pittsfield, Mass., that Franklin Leonard Pope, one of America's foremost electrical engineers and experts, had met his death accidentally by electric shock, at his home in Great Barrington, Mass. Mr. Pope was general manager of the Great Barrington Electric Light Company, and in order to test the lines and observe the working of the plant he had permitted the location in his cellar of a converter, which necessitated the leading in of the primary wires of the system, carrying a normal voltage of 2,100. On the evening of Sunday, October 13, Mr. Pope went to the cellar with a lighted lamp. A few moments afterwards his family heard a heavy fall, and his dead body was found on the floor near the converter.

A physician was immediately summoned and attempted to resuscitate the unfortunate man by the artificial respiration method, but without success. The doctors say that Mr. Pope was instantly killed by the powerful shock, and although a doctor was on the spot within three minutes after the accident happened, life had gone from the body forever.

Just in what manner Mr. Pope received the fatal shock will probably never be known, but in the light thrown on the case by the position of the body, the burns on the hand and other circumstantial evidence, Mr. Ralph W. Pope, the unfortunate man's older surviving brother, is inclined to believe that his brother Frank, on entering the cellar, found the draught of air too strong for the lamp which he carried in his hand and fastened down the window. He succeeded in turning the button that kept the window closed, and it is thought that in drawing back his hand it accidentally came in contact with one of the primary wires, and the current passed through his body to the concrete floor, thence to earth. The converter, it should be explained, was only two feet from the cellar window. It is possible, Mr. Ralph W. Pope thinks, that the lamp held in his brother's hand might have been blown out just as he was fastening the window, and in the darkness his hand came in contact with the wires. There was a long burn on the fleshy part of the dead man's right thumb, and from its shape it is supposed that it could only have been received by drawing that part of the hand across the projecting end of a wire. The character of the burn supports the theory that Mr. Pope received his death stroke while in the act of drawing his arm towards his body, after being outstretched in the act of fastening the window. There was also a circular-shaped burn about the size of a cent-piece just below the second joint of the right thumb, and another on one of the fingers.

Ralph W. Pope states that "there was a twisted joint in each wire about midway between the entrance of the primaries and the converter, to which they were connected. One of the joints stuck up, and although both were supposed to be covered with so-called insulating tape, it is quite possible that one of the points of these joints was bare, owing to the difficulty of covering such a joint unless extreme care is used. The tape from these joints had been removed after the accident and the wire adjacent to the joints themselves broken on one side and cut with pliers on the others. The joints had beed cut out and were found on the floor behind the cold-air box on Thursday."

The day on which the accident occurred was rainy, and as Mr. Pope had walked to church and back his shoes were doubtless damp. Under these conditions a current would find a comparatively easy path to ground by an accidental touch of an uninsulated spot with the flesh.

The converter, wires, etc., were carefully examined by Mr. Edward Weston, Wm. Stanley, jr., and George A. Hamilton, and these gentlemen will soon make a report of their investigations.

Mr. Pope was born in Great Barrington in 1840, and was among the earliest electrical engineers in the country. During the draft riots in New York city in 1862, while he was in the engineer's office of the American Telegraph Company, he helped join together the New York and Boston wires that had been broken by a mob. In 1865 he explored the Stickeen River country of British Columbia and Alaska and surveyed a route for the Collins overland telegraph, which was subsequently partly built and then abandoned. Mr. Pope made many important inventions in the fields of the printing telegraph and the electric block railroad signals. He was one of the earliest patent solicitors, making electrical inventions a specialty, and for several years he held the office of patent attorney for the Western Union Telegraph Company. He was well known as a writer on electrical subjects. For several years past he was retained as an expert in some of the most important patent suits brought before various courts. In 1886 he was elected President of the American Institute of Electrical Engineers, of which he was a charter member, succeeding in that office the late Dr. Norvin Green. The reconstruction of the Great Barrington Electric plant was one of his recent undertakings and the work embodied many interesting features, which were described in a paper read by him at the June meeting of the institute at Niagara Falls.

Mr. Pope leaves a widow and three children. His elder brother, Ralph W. Pope, is Secretary of the American In-

THE LATE FRANKLIN L. POPE.

stitute of Electrical Engineers, and his younger brother, Henry W. Pope, is with the American Telephone and Telegraph Company in New York city.

Mr. Pope, for twenty-five years prior to his removal to Massachusetts, was a resident of Elizabeth, N. J.

The funeral took place from the family residence in Great Barrington, on Wednesday, October 16, and was largely attended by prominent electrical people.

At a meeting of the Brooklyn Electrical Society, held in the Edison Assembly Rooms, Brooklyn, October 15, the following preamble and resolutions were adopted:

Whereas, The members of the Brooklyn Electrical Society have heard with profound regret of the removal from our midst of our worthy and esteemed co laborer in the scientific field, Franklin Leonard Pope, and

Whereas, The intimate relations held by him with the science of electricity, during his life, makes it fitting that we record our appreciation of him; therefore be it

Resolved, That the wisdom and ability which he has exercised in aid of the advancement of the science of electricity by counsel, service and research, will be held in grateful remembrance;

Resolved, That the sudden removal of such a man from our profession leaves a vacancy and shadow that will be deeply realized by all members of the electrical fraternity, and his name will ever remain as a martyr to the science in which he met his death;

Resolved, That with deep sympathy with the afflicted relatives and friends of the deceased, we express an earnest hope that even so great a bereavement may be overruled for their highest good.

A copy of the resolutions was sent to Mrs. Pope.

CONVENTION OF THE AMERICAN STREET RAILWAY ASSOCIATION.

The fourteenth annual convention of this association was called to order at Windsor Hall, Montreal, Canada, at 11:30 A. M. Tuesday, October 15, by President Joel Hurt, of Atlanta.

Mayor J. A. Villeneuve, of Montreal, was introduced and cordially welcomed the delegates to Montreal. He spoke of the brilliant achievements of electric power as applied to the propulsion of street cars.

The Mayor's address was appropriately replied to by President Hurt, after which Col. A. A. Stevenson, of Montreal, was introduced and made a few remarks. President Hurt then read his address to the association. He said among other things:

"There are in operation today in the United States about 179,300 miles of steam roads and about 13,500 miles of street railways. The passenger receipts on the steam roads the past year were $276,031,000. The gross receipts of street railways in the United States were between $125,000,000 and $140,000,000. The street railway mileage is about 7½ per cent. of the steam railway mileage, and passenger receipts of street railways about 45 per cent. of the passenger receipts of steam roads. The total capitalization, bonds and stocks of steam roads in the United States is about $11,000,000,000, and of the street railways about $1,300,000,000 The latter is about 11 per cent. of the former, while the profits of the steam roads were $322,000,000, and on the street railways about $43,000,000, the latter being about 13½ per cent. of the former. From these figures an idea may be gathered of the magnitude of the business.

"The companies will need to lend a mutual aid to each other through the national association for the purpose of defeating hostile legislation in national, state and municipal governments, and to conduct a work all along the line which will tend to implant in the minds of the patrons of the roads the fundamental idea that the public interests demands friendly legislation for transportation companies, since this will tend to enable the companies to furnish the best and most rapid transportation, while harmful legislation will tend to bring about the opposite result.

"The relation of street railroads to steam roads is growing more interesting and in some localities even perplexing, until the question is now being asked, what will be the solution of the extension of electric lines which are cutting so rapidly into the business of the steam roads A partial consideration of this question brings forth the inquiry—will not the interests of these two systems of transportation force an amalgamation of the systems, having thereby the main lines connecting distant points, which will be operated into stations at convenient points in municipalities from which passengers will be transported over various street railway lines to their destination.

"The steam roads of the country are organized, the territory being subdivided into several sections for the purpose of promoting harmony and mutual protection. While it is true that street railways do not now come into competition with each other, except to a limited extent, yet it is a question if their interests do not demand an organization with sufficient strength and facilities to keep a constant watch over the business throughout the country. It is believed that the time has come when a larger revenue must be raised either upon the assessment plan or by increasing the membership dues."

At the afternoon session Mr. E. J. Wessels read a paper on "Air-Brakes," which provoked an interesting discussion.

The convention then adjourned until Wednesday.

WEDNESDAY'S SESSION.

The convention was called to order by President Hurt at 10.45 A. M., and went into executive session.

The first topic on the programme for discussion, "The Labor Question," was taken up, the discussion being opened by Mr. Wyman, who was followed by General Jackson.

The discussion was suspended to admit of the reading of a communication from Mr. Baumhoff, of St. Louis, enclosing a paper on transfers. Both letter and paper were read.

The discussion on the subject of transfers was opened by Mr. Sargeant, who was followed by Messrs. Charlton, McCulloch, Jackson and Hurt.

The discussion of the Labor Question was then resumed, Messrs Sargeant, Wyman, McCulloch, McClary, Charlton, Hurt, McLean and Connette taking part, after which an adjournment was taken until 2 P. M.

At the afternoon session Mr. Hamilton read the report of the executive committee together with the amended constitution and by-laws proposed by the executive committee.

An adjournment was then taken until 4.30 P. M., to enable the members to attend the reception given by McGill University.

On reassembling at 4.50 P. M., the chair accorded to Mr. Harrison the opportunity of making an explanation, which he desired to make respecting his non-concurrence with the report of the majority of the executive committee upon some items embraced in their report This was followed by a discussion in which Messrs. Harrison, Hamilton, Jackson. McCulloch, Thompson, Hurt, Cunningham, Wyman and Fairchild took part. Finally, it was agreed that the report as read by the executive committee be spread in full on the minutes, that it be printed, and a copy thereof sent to each member of the association, and that action thereon be deferred until the next regular meeting of the association.

Mr. Harrison moved that a committee of ten be appointed by the chair to devise ways and means for raising the deficit. The motion was carried.

Adjourned until ten o'clock Thursday morning.

THURSDAY'S SESSION.

The convention met in executive session at 10:45 A. M.

The Secretary read a letter inviting the delegates of the association to hold the next meeting at Saratoga Springs, N. Y.

Mr. McCullough of St. Louis extended an invitation to hold the next meeting in St. Louis, and a letter was read from Frank R. Greene, secretary of the Chicago City Railway Co., inviting the association to meet in that city next time. A letter was then read from Wm. J. Hammer, chairman of the Committee on Standard Rules for Electrical Construction and Operation, of the National Electric Light Association, enclosing a copy of that committee's resolutions soliciting the co-operation of the American Street Railway Association in the work of codifying, promulgating and enforcing one standard set of rules, which shall meet as fully as possible the conditions that now exist and be acceptable to all electrical, insurance and allied interests.

At the conclusion of the executive session, the paper by Mr. N. W. L Brown, of Atlanta, on Ties and Poles was read and was followed by the report of the Committee on Patents, which was read by Mr. Frank R. Greene of Chicago.

Mr. J. A. Seely offered the following resolution:

WHEREAS, It is the purpose of the National Electric Light Association to hold in New York city next spring, at its annual convention, a comprehensive exhibit of modern electrical inventions and applications depending on the use of central-station and power-house current, with the object of increasing popular interest in electric lighting and allied arts, and

WHEREAS, It is the desire of the American Street-Railway Association to promote on the part of the public, particularly in all large cities, a fuller and more intelligent appreciation of the great benefits that accrue from electric light, heat, locomotion and other modern triumphs of civilization;

Resolved, That this association hereby expresses its cordial sympathy with and approval of this plan for the furtherance of electrical development, and for the enlargement of the sphere within which electricity is to perform its beneficent work.

The resolution was adopted and the meeting then adjourned until 2 p. m.

At the afternoon session Mr. Russell B. Harrison read the report of the committee on ways and means appointed to consider the question of disposing of the deficit of $4,087 in the association's funds, and stated further that voluntary subscriptions had been canvassed, and that nearly $2,000 had been subscribed.

Mr. Thompson, of Camden, N. J., in plain language objected to the report. He did not want to see "outsiders" (meaning the supply men) come and run the association—(the report providing for an associate membership). The association had the greatest amount of respect for the material men, he said, "but we do not want them as members of this association."

Mr. Harrison stated that it was not intended to let the supply men run the association; they would have no vote. "We cannot exist without the supply men," he said, "and they cannot exist without us, and why erect a barrier between us, and say that they cannot come to our meetings, when we are taking a thousand dollars from them for the space in the exhibition hall. Is it right or fair?"

After a very heated and lengthy debate on the question of admitting supply men as associate members, as recommended by the committee, the report was laid upon the table and thus its object was defeated.

The nominating committee then made its report and recommended the following-named gentlemen as the officers for the ensuing year:

For President: H. M. Littell, Brooklyn, N. Y.

First Vice-President: Granville C. Cunningham, Montreal.

Second Vice-President: William H. Jackson, Nashville, Tenn.

Third Vice-President: J. Willard Morgan, Camden, N. J.

Secretary and Treasurer: T. C. Penington, Chicago, Ill.

Executive Committee: Joel Hurt, Atlanta, Ga.; Prentiss Cummings, Boston, Mass.; C. G. Goodrich, St. Paul, Minn.; A. Markel, Hazelton, Pa.; W. F. Kelly, Columbus, O.

Place of next annual meeting, St. Louis, Mo.

The report was accepted and the secretary ordered to cast a ballot for the association, which was done, and the officers were declared duly elected.

The next business was the reading of the report of the Committee on the Use of Salt and Sand on Street Railway Tracks. The committee, consisting of D. G. Hamilton and Robert McCulloch, reported as follows:

The use of salt on the rails, at certain times and during certain conditions of weather, is absolutely necessary in order to clear the rails of a film of ice that will otherwise form on them. Without the use of salt it would be very unsafe to operate cars on a hilly system during winter, and your committee is of the opinion that no road can afford to dispense with its use. Salt has been used on street railways throughout the United States constantly while horse cars were in vogue, and now more than before is its use imperative in the operation of electric cars.

In like manner sand is a necessity on the rails in order to give the wheel a "proper grip" on the track.

In the city of St. Louis, Mo., the quantities of salt dumped on the tracks is in excess of three thousand tons in the course of one winter. There is no objection on the part of the local authorities or health board to its use, and but for the use of this salt it would be impossible to operate our cars. The use of sand is also absolutely necessary, and its use is not interfered with in any manner any more than is the use of salt.

FRIDAY'S SESSION.

The meeting was called to order at 11 A. M., the first business being the topic of "Furnishing Free Music and other Entertainments by Street Railway Companies to the public."

Mr. Thos. H. McLean, of Indianapolis, made some remarks on this subject. He found it very profitable to give entertainments in the park in his city, particularly in the way of band concerts.

Mr. McClary, of Birmingham, also reported success in similar forms of entertainment in the park on his line. A short discussion ensued, after which Mr. James F. McElroy, of Albany, addressed the meeting on the subject of "Electric Heaters for Street Railway Cars," illustrating his remarks with a number of diagrams.

The Committee on Resolutions then made its report, expressive of the heartfelt appreciation of the association "of the many acts of hospitality and courtesies extended them by the citizens of Montreal, and by the officials of the Montreal Street Railway, and that we give assurances to both of a grateful remembrance." The report was unanimously adopted. Mr. H. M. Littell, the newly-elected president, and Mr. T. C. Penington, the new secretary, were then escorted to the chair and thanked the members for the honors conferred upon them, pledging their best efforts in behalf of the association.

The convention then adjourned to meet in St. Louis, Mo., on the third Tuesday in October, 1896.

EXHIBITS.

The Peckham Motor Truck and Wheel Co., of New York, had a very large and attractive display of its celebrated trucks. The exhibit included a new Excelsior truck, a Standard extension truck, axles and wheels, and a beautiful aluminum model of a Standard truck. The company was represented by Mr. Edgar Peckham, president; Arthur W. Field, eastern manager, Boston; Wm. E. Cook, general sales agent, New York; C. E. Lang, of the New York office, and Wm. H. Wilkinson, superintendent of the Kingston works. Mr. Peckham presented the delegates with small aluminum models of wheels and Russia leather bill books.

The Charles Scott Spring Co., Philadelphia, made a fine display of samples of coil car springs, and gave away pocket bill cases. The company was represented by Wm. H. Haskell, manager of the street railway department, and Harry A. Johnston, eastern agent.

The Standard Underground Cable Company's interests were well looked after by Mr. G. L. Wiley, the New York manager. He had a fine exhibit of samples of his company's cables, including one of their 750,000 c. m underground feeder cables, of which they have sold 800,000 feet to the Philadelphia Traction Co. Mr. Wiley had also some pertinent literature. He also showed a section of his company's 950,000 c. m. underground feeder cable, which is used by the Philadelphia Traction Co.; also samples of their various sizes of feeders, wires with different sizes of insulation, all lead-covered. The H. M. & F. Passenger Railway Co., Philadelphia, purchased 100,000 feet of the Standard Underground 300,000 c. m. feeders with $\frac{6}{32}$ insulation, and 100,000 feet 500,000 c.m., same insulation, went to the West End Railway Co., Boston.

Gen'l J. W. Godfrey and Frank W. Harrington represented the India Rubber and Gutta Percha Co., of New York, makers of the popular Habirshaw wires. They had room 52, at the Windsor, where they showed a sample of the bus bars made for the Cataract Construction Co., Niagara Falls, which are carrying 2,000 H. P. These bars are hollow tubes of copper, insulated and finely finished, and were designed by Wm. Habirshaw.

The Standard Paint Co., No. 2 Liberty Street, New York, and of Chicago and London, had an attractive display of the P & B goods. Mr. Frank S. DeRonde, whose name is synonymous with P & B goods, J. C. Shainwald, the Western Agent, Chicago, and H. F. Gillespie, of the New York Office, were constantly on hand extolling the virtues of P & B armature varnish, P & B insulating compounds, P & B paints, P & B insulating tapes and papers, and P & B Ruberoid roofing. The P & B Havana cigars, which were generously distributed, told of their own virtues. A fine pocket-book, made of Bermuda sea-grass, was presented to callers as a souvenir. The display of the P & B goods was designed in an artistic manner. The awards from the Chicago World's Fair, the San Francisco Mid-Winter Exhibition, the Paris Exhibition of 1885, and of the American Institute, New York, were shown on a neat oak easel.

One of the prettiest and most unique exhibits was that of Mr. A. Roy MacDonald, jr., of Montreal, who is a large dealer in mica for electrical insulation purposes. The exhibit consisted of a representation of a mica mine, and it attracted much attention. Mica blocks of all sizes and cut into all shapes were artistically displayed about the booth.

Mr. H. H. Harrison, of Corey & Harrison, Havemeyer Building, New York, represented the firm, who handle the well-known lamps of the General Incandescent Arc Lamp Company of New York.

The Taylor Electric Truck Co., Troy, N. Y., was represented by John Taylor and A. T. Reynolds. They had on exhibition two single and two double trucks. Mr. Taylor is the inventor of these trucks.

The Chapman Valve Co., of Indian Orchard, Mass., was represented by Mr. Edw. L. Ross, mechanical engineer. Mr. Ross exhibited a full line of valves of various sizes.

The Badger Mfg. Co., 189 Fifth Street, Milwaukee, Wis., showed samples of overhead materials, fuse box, rail bonds and trolley hose. They gave away, as souvenirs, sample spools of magnet wire, trolley bells and a Lineman's Hand-Book.

John A. Roebling's Sons' Co., Trenton, N. J., were represented by Marston R. Cockey, of the New York office, and W. R. Doyle, of Trenton. They had a fine exhibit of cables and wires, and standard and special trolley wires. The display was very attractive, and among the samples were 1,000,000 c. m. cables and some special underground feeder cables, 650,000 c. m., of which 200 miles were sold to the Philadelphia Traction Co. Samples of the special trolley wire made for the Nantasket Beach line were also shown.

The American Railway Supply Co., 24 Park Place, New York, showed a full line of samples of conductors' and motormen's badges made of aluminum, brass and other metals. Samples of handsome uniform buttons were also shown. These goods were very attractive and bore the impress of first quality in material and finish. Mr. Walter Chur, general manager of the company, looked after his company's interests and distributed, as a souvenir, a neat hand-baggage check of aluminum.

The Coleman Fare Box Co., of Tottenham, Ont., was represented by J. H. Coleman, the inventor of the fare box, a sample of which he exhibited.

Mr. J. C. Dolph, eastern manager of the Forest City Electric Co., Cleveland, O., showed to excellent advantage a full line of samples of this company's celebrated roll drop commutator bars. Mr. Dolph presented the delegates with a diminutive copper commutator segment as a souvenir. Mr. W. D. Cleveland, president of the company, was also in attendance.

The Saint Louis Register Co., of Saint Louis, Mo., had a good display of its well-known Security Fare Registers.

The E. T. Burrowes Co., of Portland, Me., makers of fine car curtains and materials, had a full line of automatic curtains for open and closed cars, and of samples of materials including "Oakette."

Mr. Chas. E. Coleman represented the Mica Insulator Co., 218 Water Street, New York, sole manufacturers of "Micanite." One of the features of the exhibit was an electric sign with the words "Perfect Micanite Insulator." A full line of samples of these well-known goods were tastefully arranged in a large booth, and samples of the various Micanite goods were distributed, together with some literature on the subject.

A. W. Glassford, 784 Craig Street, Montreal, showed a complete set of fittings for open and closed cars; electric fixtures for the same; trolley wheels, head-lights, etc.

L. B. Collins, secretary of the Stever Rail Joint Co., Garfield Building, Cleveland, O., looked after the interests of his company, and showed samples of this well-known joint, which is so rapidly growing in favor. These joints are made for steam, electric and cable railways, of malleable iron or cast steel.

N. L. Piper & Son, 314 Front Street, West, Toronto, showed a portable electric bracket lamp, electric desk lamps, head lamps for cars, and Piper's patent electric switch lamp.

Mr. Elmer P. Morris showed what Phœnix rubber insulating paint was, and demonstrated its fireproof and waterproof qualities. Indianapolis is the home of this celebrated paint.

Darling Bros., 12 Queen Street, Montreal, manufacturers of the Webster vacuum feed-water heater and purifier, Webster oil extractor, and Webster live-steam separator, showed a line of these devices. They also had a Morse valve reseating machine.

The Stirling Boiler Co. was represented by F. A. Scheffler, of New York.

The Carter Brake Co., 133 Monadnock Building, Chicago, showed in the Rink a model of their remarkable brake, and had two cars on the Montreal Railway lines equipped with the brake. The company was represented by Geo. M. Carter, president, and C. W. Carter, the inventor. The operation of the brake, and the efficiency of the same, attracted much attention.

The Walker Mfg. Co., of Cleveland, O., had a notable exhibit at the Rink. It consisted of a Peckham extra-long extension truck, fitted with two 50-H. P. motors; one Dorner & Dutton truck, with two 25-H. P. Motors; a marble switchboard, with Weston instruments, and a Cutter Elec. Mfg. Co. circuit breaker, which instrument, by the way, the Walker Co. has adopted as its standard. The company was represented by H. McL. Harding, the New York manager, R. A. Baylis, Mr. Atkinson and Chas. W. Kent, of the construction department. Mr. Kent won much praise for the attractive fitting up of the exhibit. Besides the apparatus mentioned there were also exhibited the two half-sections of a motor, showing the internal construction; an armature in section, and one 25-H. P. and one 50-H. P. controller.

The McPherson Sand Box Co., Troy, N. Y., showed a sample of the McPherson sand box. Henry McPherson and J. F. Hart, general agent, were in attendance.

Capt. Willard L. Candee represented the Okonite Co., of New York, and his many friends were glad to see him again. Among the literature distributed by the Okonite Co. was the report on the insulating qualities of Okonite Cable by Lord Kelvin, Dr. John Hopkinson and Dr. J. A. Fleming. This report is indeed highly commendatory of Okonite, and should be read by all interested in wires and cables. Capt. Candee's souvenir this year was an ornamental tin box containing a small roll of Manson tape.

The Sclater Asbeston Mfg. Co., 35 St. Peter Street, Montreal, gave away neat wooden foot rules.

The Hazelton Boiler Co., 716 E. 13th Street, N. Y., exhibited pictures of their boilers and distributed printed matter relating thereto.

C. C. Sibley & Co., Postal Telegraph Building, New York, sole agents for the General Electric Co. for New York City, had a noteworthy exhibit in the Barnard Selector-Signal Telephone System. Several stations were installed throughout the Rink to practically demonstrate the operation of the system. This system is devised for street railway and other purposes. It has some very ingenious features and no undesirable ones, and attracted much attention.

The Cambria Iron Works, Johnstown, Pa., was represented by W. A. Washburne, the New York sales agent, 33 Wall Street. Mr. Washburne had sections of T, girder, groove and other rails, varying in weight from 8 to 107 lbs. His company is now rolling rails in 60-foot lengths. These long rails are giving excellent satisfaction.

A. Jackson Reynolds & Co., Worcester, Mass., exhibited a novelty in street railway appliances. It consisted of a model of a sweeper, designed to take up the dirt from the streets as they are swept, thus loading itself and carting away the refuse. Mr. Reynolds explained the operation of the machine.

W. E. Haycox represented the Fulton Truck and Foundry Co., of Mansfield, O., and showed a nickel-plated model of an Imperial standard truck, also a model of a track cleaner. He showed, besides, a Troy sand box, and a differential tripod for lifting armatures and other heavy machinery.

A. L. Daniels represented the Akron Insulator and Marble Co., Akron, O., and the H. B. Camp Co., of Aultman, Ohio. He had a large line of samples of the Akron Company's tubes, insulators and underground conduits. The company is now making a specialty of conduits. They have laid 80,000 feet of it in Utica, N. Y., this summer, and the Chicago City Railway, and the Metropolitan Railway, of Washington, D. C., are now laying these conduits.

Mr. C. C. Kaufman, of Kingston, N. Y., demonstrated practically the operation of the Kaltenbeck street-car fender.

D. C. Sweet, 51 Taylor Street, Springfield, Mass., had one of his bronze sand and salt boxes on exhibition. It is a very simple device, yet very effective and reliable.

The Graham Equipment Co., Boston, Mass., had on exhibition a low-down, all-steel truck. This company makes steel cars, steel snow-plows, and steel trucks. Mr. P. Baumgartner, superintendent of the Massachusetts Car Co., represented the Graham Company's interests.

The Robinson Electric Truck and Supply Co., 620 Atlantic Ave., Boston, showed a model of a Robinson radial truck. Wm. Robinson, general manager, was in charge.

The Whittingham Electric Car Heating Co., 703 Equitable Building, Baltimore, Md., had a car-heater in operation in the Rink, in charge of Mr. Whittingham.

G. E. Smith, Sherbrooke, Can., showed one of his shop machines for bending rails. It performed its labor on a 70-lb. rail.

Samples of the Weber rail joint were shown by the Weber Railway Joint Mfg. Co., Cotton Exchange Building, New York. These joints provide a fastening for the ends of rails which permanently maintains surface and alignment.

The Pennsylvania Steel Co., of Steelton, Pa., exhibited a Harveyized steel frog.

The Skeen Electric Switch and Signal Co., 919 N. 6th Street, St. Louis, Mo., had an attractive display of Skeen's automatic semaphore signal, which is designed for preventing collisions at intersecting railways, corners, or other dangerous points on electric, cable, or steam roads. This exhibit, which was in charge of Robert Skeen and H. O. Rockwell, attracted much favorable attention. It seems to be just the thing for electric and other street railroads.

The St. Lawrence Machinery Supply Co., 361a St. James Street, Montreal, showed a full line of samples of packing, oil cans, asbestos covering, etc.

Oscar L. Whitney, Brattle Square, Cambridge, Mass., the inventor of the Whitney automatic car fender and wheel guard attachment, showed a model of his invention. It can be attached to any flat fender and is simple in its operation, and, best of all, is reliable in protection. All contingencies have been provided for, and there seems no possible chance for a body to be run over by a car with the Whitney fender and guard. A secondary fender is tripped by any body striking the guard, the fender dropping so close to the rails and roadway that it is impossible for anything to escape it.

The Taunton Locomotive Mfg. Co., Taunton, Mass., had two heavy exhibits, consisting of a fully-equipped ear with heavy share plow, and another ear with a heavy nose plow. The former machine is designed for double-track roads. The company also had a Taunton Sprinkler in operation on the line of the Montreal Street Railway. Mr. Wm. R. Billings, treasurer of the Taunton Company, was present.

The Canada Switch and Spring Company, of Montreal, showed on a piece of track a standard truck for open ears, with Meneely Tubular bearings. The truck was loaded with six tons of girder rails to represent the equivalent weight of a fully loaded ear. The excellent balancing of the truck and its easy running was proved by the fact that the truck, with its great weight, could be readily moved along the track and stopped with one hand.

Walter E. Harrington represented the Cutter Electrical and Mfg. Co., 1112 Sansom Street, Philadelphia. Mr. Harrington showed a double-pole magnetic circuit breaker of 500 amperes capacity, made for the new Congressional Library Building, Washington, after the designs of Dr. Cary T. Hutchinson. Twenty of these circuit breakers will be installed in this one building. He also showed samples of the standard car circuit breaker, a single-pole circuit breaker, a circuit breaker of rough finish for factories and such places, and one of fine finish for station switchboard work. Mr. Harrington also, together with S. W. Fenner, representend the Camden Horse Railway Co., of Camden, N. J.

Theopile Euphrat, of Darien, Conn., showed samples of his improved trolley ice-cutter, trolley wheels, etc. These devices are of automatic lubrication.

The Scarritt Furniture Co., St. Louis, Mo., was represented by an exhibit of four car seats of different styles and finish.

The American Rail Joint & Mfg. Co., Cleveland, O., had a line of samples of its rail joints. These joints are easily put on and have no bolts.

The Ohio Brass Co., Mansfield, Ohio, had an attractive exhibit of its lines of trolley wheels, overhead switches, hangers, cross-overs, etc., etc. The exhibit was displayed on a pyramid with steps, and covered with black cloth, which set off the articles to good advantage.

The Meaker Mfg. Co., of North Chicago, Ill., was represented by Mr. J. W. Meaker, the president. Mr. Meaker had samples of his portable and stationary registers and a new trolley hanger and clip. The hanger is made of wrought brass and does not kink the wire. One turn of the cap releases everything.

The Benedict & Burnham Mfg. Co., of Waterbury, Conn., was represented by J. H. Woodward and E. L. Rugg, the Boston representative. These two well-known gentlemen showed a full line of Benedict & Burnham's solid one-piece rail bonds, which bond is the most popular among street railway men, and the only one made in one solid piece. These bonds are made from pure Lake Superior copper. Samples of feeder, trolley and magnet wires were also exhibited, but the solid bonds attracted the most attention. The principal electric railways are using it with the best of satisfaction, as indicated by the long list of testimonials in possession of the company, which are printed in pamphlet form. The booth occupied by Messrs. Woodward and Rugg was tastily draped with the American and English flags, and a handsome carpet was laid on the floor.

The Bushnell Co., Ltd., of Montreal, had an attractive exhibit of a full line of the Standard Oil Company's lubricating oils in large vials, arranged in semicircular tiers and lighted from behind by electric lamps. The illuminated oils gave a very pretty effect. Mr. F. J. Greene represented the company at the Rink.

The Partridge Carbon Co., of Sandusky, Ohio, makers of the celebrated self-lubricating motor brushes, represented by Secretary J. S. Speer, had a line of motor brushes of all sizes and for all machines. These brushes are used by most all the electric railroads in the U. S., and seem to be monopolizing the business. As evidence of their excellence, Mr. Speer showed a lot of old, worn-out brushes, which told their own story of their worth. They were smooth and even. One brush had a record of 8,000 miles, and was good for 8,000 miles more when taken out. It was worn only about one-third its original length. It was used on the Council Bluffs, Iowa, road.

The Fiberite Company, of Mechanicville, N. Y., had a very large and fine display of Medbery insulation, overhead trolley equipment. The exhibit included insulators of all kinds, single and double pull-offs, guard wire hangers, turnbuckles, straight line insulators, bracket arm hangers, anchor or strain ears, splicing ears, feeder ears, etc. Besides these there were aluminum bronze trolley wheels and harps, frogs, crossings, cross-overs, etc. The exhibit was a very popular one and well arranged. Medbery insulation is largely used on electric railroads and is constantly growing in favor.

The U. S. Projectile Co., 53d Street and First Avenve, Brooklyn, was represented by Mr. C. E. Porter, who showed a line of his company's patent hot-pressed steel motor pinions. These pinions are pressed into form in dies, under enormous hydraulic pressure and greatly outlast pinions cut in the ordinary manner. The pressing process makes the metal very much tougher. Hot-pressed pinions are made for all electric systems.

Mr. G. A. Hurd represented the Crane Co., of Chicago, and had a line of steam specialties for street railway plants. These included high-pressure wedge gates, globe check, angle and pop valves, from 1 to 12 inches, and a line of fittings from 4 to 12 inches. A similar line of these goods was installed in the plant of the Citizen's Railway Co., of Detroit, Mich. The wedge gates are made up to 14 inches in diameter of the openings and an indicator shows the area of any opening within the full limits of the valve. The Crane Company did all the steam fitting for the World's Fair in the Machinery and Transportation Buildings.

The Consolidated Car-Heating Co., of Albany, N. Y., had a fine display of its car-heating apparatus. There was a car-seat with different styles of heaters in operation, a panel heater and switches for regulating the heat, a bank of incandescent lamps visibly showing the different degrees of heat resulting from the operation of the switches. The company was ably represented by J. F. McElroy, H. N. Ransom, and W. P. Cosper.

The Hale & Kilburn Mfg. Co., of Philadelphia, was represented by Charles E. Barrett and H. T. Bigelow, of Chicago. The exhibit consisted of a Walk-over car seat.

The Wakefield Rattan Co., of Boston, showed samples of car seats and was represented by Fred. H. Henry.

A model of the Edwards automatic life-saving car fender, manufactured by the Albert Edwards Car Fender Co., 26 Court Street, Brooklyn, N. Y., attracted a great deal of favorable attention. Its operation was shown by Mr. Edwards himself, and the opinion seemed to be unanimous that the Edwards fender solved the fender problem completely. A full description of this fender was given in the Electrical Age a few weeks ago. Several detail improvements have been made in the fender, and now it is regarded as the *ne plus ultra*. The company is doing a rushing business and the fender is receiving praises from everywhere. Mr. Edwards deserves great credit for the ingenuity and perfection of his invention.

The Adams & Westlake Company, of Chicago, showed samples of their A. & W. "Acme" automatic car shades. The display was a fine one.

W. T. VanDorn, manager of the Fitzgerald-Van Dorn Co., 1336 Monadnock Block, Chicago, exhibited a nickel-plated Van Dorn automatic draw-bar for elevated, cable and electric street railways.

D. L. Winters, 5 Lexington Street, Chicago, showed a model of the Winters automatic brake attachment. This brake attachment is simple and powerful.

The New York Fare Register and Supplies Co., manufacturers of Hughes fare registers and street car supplies, 35 Warren Street, New York, exhibited a line of their registers. Mr R M. Rose represented the company.

The Roll Slipless Car Wheel Co, Wilkesbarre, Pa., had a sample of their Slipless car wheel. This wheel is particularly adapted for electric railways troubled with ice and snow.

C. W. Henderson, 44 Bleury Street, Montreal, manufacturer of electrical supplies, had a very handsome exhibit of his goods. His booth was one of the most attractive in the Rink, and was tastily draped with flags and illuminated by electric lights.

The American Electrical Works, of Providence, R, I., was represented by W. A. Hathaway, treasurer; John Carroll, secretary and treasurer of the Phillips Electrical Works, Montreal: P. C Ackerman, the New York representative, and F. E. Donohoe, the Chicago agent. Mr. Hathaway showed a sample of the American Rail Bond made by the American Electrical Works.

The H. W. Johns Mfg. Co. occupied parlors 10 and 12 at the Windsor, with a full line of overhead trolley devices, including the H. W. J. clip, giant strain insulators, J-P hangers with steel stub insulated with moulded mica; also sectional samples of Vulcabeston ears, crosses, frogs, etc. The company was represented by H. G. Issertel; J. W. Perry, of Philadelphia; Sam. E Estes, of the Boston branch, and Messrs. Hatch and Luscum, of the Johns-Pratt Co., of Hartford, Conn.

The J. G. Brill Co, of Philadelphia, was represented by a large contingent of representatives, and occupied parlor 4 at the Windsor. They had on exhibition in the parlor beautiful bronze models of a 21c truck; the latest type of pivotal truck and of the maximum traction truck. The company was represented by Mr. J. A Brill, Saml. M. Curwen, F. C. Randall, Wm. H. Heulings, Jr., Geo. M. Haskell and M. E. Curwen.

The Babcock & Wilcox Co. and the Goubert Mfg. Co., of New York, occupied the same stall in the Rink, with photographs of their respective apparatus. The Babcock & Wilcox Company showed parts of boilers and pictures of boilers complete. The Goubert Mfg, Co. had a model of a feed-water heater and a separator, and pictures of their several devices. The joint exhibit was in charge of W. T. Bonner, the general agent for Canada.

The Sterling Supply and Mfg. Co., 97 Bank Street, New York, was represented by its superintendent, Mr. J. J. Kennelly, and had an exhibit of a full line of overhead material, numeral dials, registers, clock face registers, sand boxes, pick-up fenders, and a safety brake.

The clock-face registers are of the simplest construction, cannot be manipulated, and totalize to 100,000.

The New York Car Wheel Works, of Buffalo, N. Y., the St. Thomas Car Wheel Works, St. Thomas, Ont., the Montreal Car Wheel Co., of Montreal, were represented by A. E. Domville, of St. Thomas, Ont.. and T. J. Drummond, of Montreal, These gentlemen had samples of machine wheels and axles of different sizes for motor cars and trailers.

The Westinghouse Electric and Mfg. Co., of Pittsburgh, had no exhibit, but were represented by 14 gentlemen who did some fine missionary work in the interest of their company. Mr. E. H. Heinrichs was one of the most ubiquitous persons at the convention. The Westinghouse Company's interests were backed up by able argument if not by a visible display of apparatus.

Morris, Tasker & Co., manufacturers of the well-known sectional trolley poles, were ably represented by the affable secretary and treasurer, Mr. H. C. Van Sant, and the jovial Charles Yerkes Flanders. These gentlemen occupied parlor 60, and showed pictures of English electric lines using Morris Tasker poles. They distributed a handsome glass paper-weight as a souvenir and a reminder that Morris, Tasker & Co.'s poles were the best.

The Hogan Boiler Co., of Middletown, N. Y., exhibited some of the principal parts of the Hogan water-tube boiler. Among these were the mechanical steam extractor by which the passage of all entrained water with the steam is entirely prevented. The feed-water inductor shown readily explained the manner of distributing the feed-water as it enters the boiler and causes the precipitation of all foreign matter in the lower drums not exposed to heat, thus preventing the formation of scale on the heating surfaces. The manhole copper gasket joints are designed for the highest pressures and need no renewal of gaskets when opened. These boilers evaporate from eight to eleven pounds of water per pound of anthracite buckwheat and good bituminous coals. An all-year-round saving of fuel is equal to 20 per cent. For each 1000 horse-power in a steam plant with coal at $3.00 per ton a saving of $3,000 yearly is attained. This boiler differs radically in design from any other boiler in use. It is simple in its design, occupies half the floor space and needs no steam separators, water heaters or water purifiers—thus radically simplifying a steam plant and reducing numerous pipes and joints. Photographs of several boilers in use were also exhibited. The claims made for the Hogan boiler are based on actual practice, and the makers are prepared to back them up without causing any loss to the users of these boilers The large saving of fuel offered attracts the attention of the managers of all electric railway companies.

The exhibit of the General Electric Company was made in one of the stores of the Windsor. In the centre of the large room stood a Peckham truck equipped with two G. E. 800 motors, and upon each axle was an electric brake. Current was brought to the motors from the lines of the Montreal Street-Railway and the brake was shown in operation. The street-railway men found this of considerable interest to them, and readily conceded its effectiveness. Down one aisle of the room were shown the trio of General Electric motors, the G.E. 800, the G. E. 1200, and the G. E. 2000. The other side of the room was occupied by a table upon which was displayed a full line of overhead appliances. Dividing the exhibit from the reception parlor, where delegates found the usual genial welcome, was a fine example of switchboard work. This consisted of a switchboard built up with General Electric panels for generators and feeders. The extreme left was occupied by one of the large 5000-ampere generator panels constructed for the West End Road of Boston. Above the motors and appliances were hung a set of Thomson arc lamps for railway circuits. The controllers shown were the familiar K2, and that used in the operation of the Nantasket Beach Road, a massive and effective-looking piece of apparatus. The miniature lamp department of the company was represented by two revolving devices in the windows, and a crescent moon hanging from the centre of the ceiling over the exhibit, with a little witch, broom and all, sitting on the horn. A large illuminated sign over the doorway told the visitors where the General Electric Company's representatives could be found, and innumerable incandescent lamps served to light the room and give it an air of warmth, sadly lacking at the rink. Messrs. F. M. Kimball, P. L. Saltonstall, C. C. Pearce, P. Hodges, of Boston; G. B. Potter, L. Dunbar Tandy, A. S. Heywood, of Schenectady; R. H. Beach, A. K. Baylor, W. G. Bushnell, Elmer P. Morris, of New York; H. L. Crawley, of Philadelphia; S. W. Trawick, of Atlanta; F. H. Stricby, of Cincinnati; F. C. Todd, of Baltimore; T. H. Fearey, of Buffalo; S. D. Rosenthal, of St. Louis, represented the factory and district offices east of the Mississippi.

The Consolidated Car-Fender Co., 181 Canal Street, Providence, R. I., was represented by A. C. Woodworth, the general manager, who showed a sample of the Providence car-fender and guard.

F. A. Yates, 1302 Havemeyer Building, New York, manager of the eastern department for Gleyre Bros., St. Louis, manufacturers of the Trendley automatic hand brake, had one of the brakes on exhibition af the Rink. The brake stops a car quickly without locking the wheels, and is used on the principal lines in St. Louis.

The New Haven Fare Register Co., New Haven, Conn., had an artistically arranged stall and a fine exhibit of its celebrated registers. The display consisted of a line of single, double and triple registers; register fixtures and ringing devices. The double registers record two classes of fares—transfers and cash, for instance. The triple registers provide for three classes of fares. The samples shown were finished in nickel, antique copper and bronze, and were handsome in appearance. A full line of bronze register fixtures and fittings were tastefully arranged on a panel show-board. This company's registers have been adopted on the Nantasket Beach division of the New York, New Haven and Hartford R. R.; by the Philadelphia Traction Co., the Baltimore Traction Co., the Metropolitan Street-Railway Co., of New York, and many other roads. They are also in use on several Canadian lines, including those in London and Ottawa, and are to be introduced on the lines in Montreal and Toronto. These registers are in use in every State in the Union, and in every foreign country where street railways are operated, including Trinidad, South Africa, Australia, etc., etc. The interests of the company at the exhibition were looked after by J. S Bradley, secretary and treasurer of the company; F. C. Boyd, Frank A. Mosell and A. N. Loper.

The Falk Mfg. Co., of Milwaukee, was represented by an exhibit of cast. welded rail joints. These joints are perfect.

A novel test of a car fender was made every day during the convention in front of the Windsor Hotel A car on the Montreal Street Railway was equipped with a Dittricks automatic car-fender; and to demonstrate the reliability of the fender as a life-saving device a man lay prostrate in front of the rapidly advancing car and was each time picked up with unerring certainty. A great crowd collected in front of the hotel and held their breath with fear when the man calmly laid himself down between the rails to be picked up—unharmed. These tests were made repeatedly, and seemed to create a very favorable impression upon the street-railway men. This fender is made by R. Dittricks, of Cleveland, Ohio. Its operation is thus: when the body on the track strikes the "trip," underneath the front platform of the car, the trip causes the "apron" to drop on the track and pick up the body. The apron in dropping causes a reversal of the motor. The fender is entirely automatic, and its action does not depend upon the quickness of the motorman in a moment of danger.

The Lombard hydraulic brake was practically tested on one of the Montreal street-railway cars. H. M. Daggett, Jr., of Boston, represented the brake company.

Ahearn & Soper, of Ottawa, brought down to Montreal one of the cars of the Ottawa Street Railway to show their system of electric heating in practical operation.

NOTES.

Mr. H. C. Adams, president of the Phillips Insulated Wire Co., of 39 Cortlandt street, New York, was in attendance at the convention.

Mr. Elmer P. Morris, of the General Electric Co., was very popular at the convention. His old friends were glad to see him. He feels quite at home again.

Mr. J. S. Pugh, of the John Stephenson Co., New York, gave a handsome and serviceable souvenir in the shape of a pocket memorandum book, elegantly bound in leather, with removable pad.

J. A. Hanna, New York agent of the McGuire Mfg. Co., Chicago, had no exhibit, but supplied his friends with McGuire lead pencils with which to note the valuable points of the McGuire electric trucks.

Frank X. Cicott, 39 Cortlandt street, N. Y., manager of the railway department of the Pettingell-Andrews Co., Boston, was one of the most popular men at the convention.

Mr. Edgar Peckham, president of the Peckham Motor Truck and Wheel Co., of New York, presented Prof. H. T. Bovey, of McGill University, Montreal, with the quarter size aluminum model of the Peckham standard truck which attracted so much attention at this and previous conventions.

H. C. Adams, Jr., of the Phillips Insulated Wire Co., 39 Cortlandt street, New York, was always on duty, and judging from his reception O. K. wires were in great demand.

Waterloo, Ia.—Articles of incorporation of the Waterloo and Cedar Falls Rapid Transit Co. have been filed. Capital stock, $600,000. Incorporators, C. F. Fosselman, J. H. Bowman of Waverly, L S. Case of Sumner and J. F. Rafferty of Waterloo.

H. M. LITTELL.

PRESIDENT OF THE AMERICAN STREET RAILWAY ASSOCIATION.

Harvey Mitchell Littell, the newly elected president of the American Street Railway Association, was born in Corydon, Harrison County, Indiana, in 1856. In early life he moved to Louisville, Ky., and attended the public schools in that city and embarked in the street railway business as a clerk in the office of the Louisville City Railway Company about 1874; the president at that time being C. G. Davidson, now of Brooklyn, N. Y., and H. H. Littell, his brother, superintendent. He filled various positions as clerk in the office, starter, timekeeper, track foreman and almost every position known to the street railway business.

He afterwards entered the steam railroad business with the Louisville and Nashville Railroad Company. He worked himself up until he reached the position of general freight and passenger agent of what is known now as the Chicago, St. Paul and Kansas City Railroad Company. In the interim, however, he filled the position of general

H. M. LITTELL, PRES'T AMERICAN STREET RAILWAY ASSOCIATION.

manager of the St. Paul City Railway Company for a period of three years, from 1883 to 1885, during which time he superintended the reconstruction and extension of the horse railroad system in that city, covering a territory of thirty miles of road. The road then changed hands and he accepted the position of general freight and passenger agent with the Chicago, St. Paul and Kansas City Railroad Company.

In 1888 he left the steam railroad business to take charge of the Cincinnati Inclined Plane Railway, which road was changed from horse to electricity under his administration in the years 1888-1889. He remained here until January, 1893, when he was made president of the New Orleans City and Lake Railroad Company and Crescent City Railroad Company, and general manager of the New Orleans Traction Company at New Orleans, La. These lines embraced about 120 miles of horse railroad, the changing of which to electric lines he superintended, completing the same in June, 1895.

On July 1, 1895, he was made the president and general manager of the Atlantic Avenue Railroad Company, of Brooklyn, which position he now holds.

Upon his retirement from the control of the New Orleans roads he was presented by the directors of the company with a solid silver dinner service as a testimony of their appreciation of his "character and ability as a railroad manager in the development of the property."

Mr. Littell married Miss Prawl, of Lexington, Ky., in 1882, and has two sons. He now resides with his family in Brooklyn.

LIST OF ATTENDANTS AT THE MONTREAL CONVENTION.

Atkinson, J. M., Chicago, Ill.
Amable, N. W., Grand Rapids, Mich.
Armstrong, Jr., W. A., Lancaster, Pa.
Adams, Jr., H. C., New York.
Acton, W. J., North Adams, Mass.
Ackerman, P. C., Amer. Elec. Wks., New York.
Allen, T. H., New York.
Allison, Giles S., St. Louis Register Co., St. Louis.
Allen, R. D., Philadelphia. Pa.
Auchemole, J., " "
Ahearn, T., Ahearn & Soper, Ottawa, Ont.
Arthurs, B, Pittsburgh, Pa.
Allyn, Chas, Stamford, Conn.
Avery, E. P., " "
Allen, W. B., St. Louis, Mo.
Allen, J. C., " "
Aitkin, J. W., Carbondale, Pa.
Ash, E., St. Girardville, Pa.

Baker, J. Paul, Baltimore, Md.
Beard, W. W, Boston, Mass.
Benedict, W. G., " "
Brown, R. S., Westinghouse Elec. and Mfg. Co., Boston, Mass.
Baumgartner, S., Boston, Mass.
Burnett, J. A., Buffalo, N. Y.
Browning, G. G., Camden, N. J.
Bailey, Geo. C., Chicago, Ill.
Bailey, Theo P., Gen'l Elec. Co., Chicago, Ill.
Bennett, John B, Chicago, Ill.
Boyer, F. N., Gen'l Elec. Co., Chicago, Ill.
Boyd, James, Chicago, Ill.
Barr, B. M., Walker Mfg. Co., Cleveland, O.
Baylis, R. N., " " " "
Billings, Frank, Cleveland, O.
Bone, W. H., Walker Mfg. Co., Cleveland, O.
Bimm, E., Dayton, O.
Billingham, W., Montreal, Que.
Biggar, E. B., " "
Blackwell, E. W., " "
Bonner, W. T., " "
Bulmer, J. E., " "
Boyd, F. C, N. H. Car Register Co., New Haven, Conn.
Bradley, J. S., " " " " "
Baker, Jr., C. O., Newark, N. J.
Barber, A. G., New York.
Barnard, J. H., "
Baylor, A. K., Gen'l Elec. Co., New York.
Beach, R. H., " " " "
Beadle, Edw., New York.
Beard, W K, New York, N. Y.
Beran, T., Gen'l Elec. Co., New York, N. Y.
Brown, H. P., New York, N. Y.
Bushe, J. F., " "
Barrett, C. E., Philadelphia, Pa.
Bragg, C. A., Westinghouse Elec. and Mfg. Co., Philadelphia, Pa.
Brill, John A., J. G. Brill Co., Philadelphia, Pa.
Burns, C. F, Rochester, N. Y.
Bean, W. W., St. Joseph, Mich.
Brownell, F. B, Brownell Car Co., St. Louis, Mo.
Bruckman, S. C., St. Louis, Mo.
Billings, W. R., Taunton Loco. Works, Taunton, Mass.
Blackburn, A. H., Matteawan, N. Y.
Burch, E. P., Minneapolis, Minn.
Breed, E. S., New Britain, Conn.
Bender, W. G., Norwich, Conn.
Barnes, C. E., Plymouth, Mass.
Benedict, W. E., Revere, Mass.
Burnstine, A., East Berlin, Conn.
Bossan, A. D., Gloucester, Mass.
Billings, Frank, Walker Mfg. Co., Cleveland, O.

Caldwell, E., *Street Railway Journal*, New York.
Carson, J. H., Sterling Supply Co. New York.
Chur, W., American Railway Supply Co., New York.
Clark, W., J., New York.
Candee, W. L, Okonite Co., New York.
Cook, A. C., New York.
Cooke, C. E., Peckham Motor, Truck and Wheel Co., New York.
Cockey, M. R., John Roeblings Sons' Co., New York.
Craigin, E. F., Westinghouse Elec. and Mfg. Co, New York.
Coleman, C. E., Mica Insulator Co., New York.
Crowley, H. J., Gen'l Elec. Co., Philadelphia, Pa.
Curwen, S., J. G. Brill Co., " "
Curwen, M. E., J. G. Brill Co., " "

Christie, W. E., Ottawa, Ont.
Cochran, Jos. W., Williamsport, Pa.
Curley, T. P., Camden, N. J.
Chambers, Geo , Long Island City, N. Y.
Campbell, J. M. Kingston, Ont.
Chapman, W. D., Akron, O.
Carpenter, C. E , Carpenter Enam. Rheo Co., Bridgeport, Conn.
Cicott, F. X., Pettingell-Andrews Co., New York.
Clark, Chas. S., Boston.
Condit, Sears B., "
Cunningham, J. H , Boston.
Cannon, D. B., Brooklyn, N. Y.
Crossman, T. E., Stenographer, Brooklyn, N. Y.
Carter, C. W., Chicago. Ill.
Carter, G. M., " "
Collins, W. F., *Western Electrician*, Chicago, Ill.
Cooke, W. J., Chicago, Ill.
Casper, W. P., " "
Claflin, Jr., Geo. D., Cleveland, O.
Cleveland, W. B., Forest City Elec. Co., Cleveland, O.
Charlton, B. E., Hamilton, Ont.
Clark, Chas. S., Lawrence, Mass.
Carroll, John, Montreal, Que.
Cass, J. H., " "
Corriveau, A. J., " "
Cunningham. G. C., Montreal, Que.
Connette, E. G., Nashville, Tenn.
Clark, Wm. P., Newburyport, Mass.

Daniels, A L., Akron Ins. and Marble Co., Akron, O
Danforth, R. E., Buffalo, N. Y.
Davies, W N., Chicago, Ill.
Dean, D. B , " "
Deland, Fred., *Electrical Engineering*, Chicago, Ill.
Donohoe, C. E., American Elec. Works, Chicago, Ill.
Du Bois, E. D.
Dutton, W. F., Dorner & Dutton, Cleveland, O.
Dean, W. F., Montreal, Que.
Dodge, G. A. W., New Haven, Conn.
Downing, Oliver, Union Grease Co., Boston.
Dolph, J. C , Forest City Elec. Co., New York.
Davis, H. M., *Electric Power*, New York.
Dickerson, J. W , *Electric Railway Gazette*, New York.
De Ronde, F. S., Standard Paint Co., New York.
Downs, Wm., New York.
Dingman, A. W., Toronto, Ont.
Daggett, Jr., H. M , Attleboro, Mass.
Doyle, W. L., J. A. Roeblings Sons' Co , Trenton, N. J.
De Witt, E. F., Lansingburg, N. Y.
Duggan, J. A., Cottage City, Mass.
Dimmock, W. S., Council Bluffs, Neb.
Davis, E. H., Williamsport, Pa.

Estep, F. A., Pittsburgh, Pa.
Elkins, Wm., " "
Evans, H. C., Johnson Co., New York.
Entwisle, E. B , Johnstown, Pa.
Eldredge, F , Portsmouth, N H.
Estes, S. C., Boston, Mass.
Edwards, A., Brooklyn, N. Y.
Englund, A. H., International Register Co., Chicago, Ill.
Euphrat, Theo., Darien, Conn.
Eldridge, H F., Newburyport, Mass.

Field, A. W., Peckham Motor, Truck and Wheel Co , Boston, Mass.
Fearey, T. H., Gen'l Elec. Co., Buffalo, N. Y.
Fenner, S. W., Camden, N. J.
Field, C. J., New York.
Fairchild, C B., New York.
Fairchild, Jr., C. B., New York.
Fork, F. R., New York.
Flanders, C. G., Philadelphia, Pa.
Fraser, J. D., Ottawa, Ont.
Ferguson, W. P., Lowell, Mass.
Ferguson, W. L , Decatur, Ill.
Fuller, C. M., Union Grease Co., Boston.

Gorham, R H., Boston, Mass.
Graham, J. H., " "
Griffin, P. H., N. Y. Car Wheel Works, Buffalo, N. Y.
Gray, Louis, Adams & Westlake Co., Chicago, Ill.
Green, Stanley, Chicago, Ill.
Greene, F. R., " "
Goodman, N. W., Detroit, Mich.
Granten, Wm., Hartford, Conn.
Goodrich, E. S , " "
Green, F. J., Bushnell Co , Montreal, Que.
Gardiner, A. C., New Bedford, Mass.
Gaazlead. A. M., New Brighton, N. Y.
Graham, Chas. A., New Haven, Conn.
Goff, R. F., Fall River, Mass.
Green, Chas , St. Louis, Mo.
Green, Robert, " "
Graham, J., Wilkesbarre, Pa.
Greene, B. E., *Electricity*, New York.
Godfrey, H. N., New York.
Godfrey, Jas. W., India Rubber and Gutta Percha Ins. Co., N. Y.
Gillespie, H. F., New York.

Harrison, R. B , Terra Haute, Ind,
Hurley, T. H., Waterbury, Conn.
Hogan, J. J., Hogan Boiler Co., Middletown, N. Y.
Hyde, Louis C , Springfield, Mass.
Hensler, H , St. Louis, Mo.
Hart, J. F., Troy, N. Y.
Hicks, J., Rochester, N. Y.
Hanchett, G. T., *Electric Railway Gazette*, New York.
Haskell, G. M., New York.
Hodges, P., Gen'l Elec. Co., New York.
Hogan, N. F , New York.
Higgins, E. E., *Street Railway Journal*, New York.
Hover, P. H., New York.
Hanna, J. A., McGuire Mfg. Co., New York.
Harrison, H. H., Corey & Harrison, "
Harding, H. M. L., Walker Mfg. Co., New York.
Harrington, F. W., Ind. Rub. and Gutta Percha Ins. Co., New York.
Hunt, W. T , Electrical Age, New York.
Hammer, W. J., New York.
Harrington, W. E., Cutter Elec. and Mfg. Co., Philadelphia, Pa.
Heulings, Jr., W. H., J. G. Brill Co., Philadelphia, Pa.
Hansell, Wm H., Chas. Scott Spring Co., Philadelphia, Pa.
Heinrichs, E. H., Westinghouse Elec. and Mfg. Co., Pittsburgh, Pa.
Hutcheson, J. E., Ottawa, Ont.
Hathaway, W. A., American Elec. Works, Providence, R. I.
Hurt, Joel, Atlanta St. Ry. Co., Atlanta, Ga.
Heft, N. H., Bridgeport Trac. Co., Bridgeport, Conn.
Hoadley, G. M., Boston, Mass.
Hilton, G. A., " "
Hamilton, D. G., Chicago, Ill.
Henry, Geo. W., " "
Hill, R. J., Chicago, Ill.
Hurd, G. A., Crane Co., Chicago, Ill.
Henry, Geo W., Cleveland, O.
Holley, S. C., Danbury, Conn.
Hipple, G. B., Des Moines, Ia.
Hatch, E. B., Hartford, Conn.
Hulsezer, J., Joliet, Ill.
Holmes. C. F., Kansas City, Kan.
Haddox, J. O., Louisville, Ky.
Haycox, W. E., Mansfield, O.
Hoffman, A., Milwaukee, Wis.
Henderson, C. W., Montreal, Que.
Hewitt, E. A., " "
Hill, J. F., " "
Hinphy, W. J., " "
Hunt, Geo., " "
Handell, C. F., New Bedford, Mass.
Hill, E. J., North Adams. Mass.
Issertel. H. G., H. W. Johns Co., New York.

Jones, B. J., Chicago, Ill.
Jones, F. B., " "
Johnson, G. S., Grand Rapids, Mich.
Jackson, Stonewall, Montreal, Que.
Julius, E. D., " "
Jackson, W. H , Nashville, Tenn.
Johnson, W. J., New York, *Electrical World*.
Johnston, H. C., Philadelphia, Pa., Chas. Scott Spring Co.
Johnston, A. L., Richmond, Va.
Jackson, E. E., Wilmington, Del.
Jones, J. H., Troy, N. Y.
Jenkes, J. M., Sherbrooke, Ont.

Kimball, F. M., General Electric Co., Boston, Mass.
Kenfield, H. J. Chicago.
Kenfield, F. S., *Street Railway Review*, Chicago, Ill.
Keeran, N. C., " "
Knickerbocker, C. K., " "
Kent, Chas. W., Cleveland, O.
Kauffman, C. C., Kingston, N. Y.
King, C. K., Mansfield, O.
Kemper, J. M. de Bosch, Montreal, Que.
Kilpin, Geo. J., Bushnell Co., " "
Kelsey, I. A., New Haven, Conn.
Kent, Jas., C. P. R'y, Montreal.
Kinsman, F. E., New York.
Kennelly, J. J., " Sterling Supply Mfg. Co.
Kissam, Geo., "
Keyes, F. A., Worcester, Mass.
Kelly, W. J., Columbus, O.

Lombard, N., Boston, Mass.
Littell, H. M., Altantic Ave. R. R. Co., Brooklyn, N. Y.
Littlefield, A. S., Chicago, Ill.
Lilley, L. G., Cincinnati, O.
Liggitt, J. C., Detroit, Mich.
Luscomb, H. H., Hartford, Conn.
Leyden, H. R., Montreal, Que.
Lesher, E. " "
Loper, A. N., N. H. Car Register Co., New Haven, Conn.
Little E. W., New York, Interior Con. & Ins. Co.
Long, E. G., " Peckham Motor Truck and Wheel Co.
Lawless, E. J., "
Loudon, E. T., "
Lex F. A. Philadelphia, Pa.
Lodge, Geo., " "

Longmore, W. J., Pittsburgh, Pa., Westinghouse Elec. Co.
Lewars, G. W., " " Westinghouse Elec. and Mfg. Co.
Lovejoy, J. R., Schenectady, N. Y., Gen'l Elec. Co.
Lozier, T. C., Belleville, Ont.
Luther, H. B., Cambridge, Mass, Barbour Stockwell Co.
Lee, R. P., Newport, R. I.
McCulloch, R., St. Louis, Mo.
Muir, E D., " "
McLaughlin, J. F., Philadelphia, Pa.
Maver, C. J., " "
Medbury, Chas. F., Ottawa, Ont.
Meiklehan, T. M. R., New York, C. C. Sibley & Co.
Macartney, J. F., " "
Magee, F. A. " " The E. S. Greeley & Co.
McDuffie, R. I., " " Taunton Loco. Works.
McOmber, G. C. " " Drummond Detective Agency.
McQuaide, J P., " " National Conduit M'f'g Co.
McLaren, P. M., " "
McGhie, J., " " General Electric Co.
Mills, E. R., " "
Martin, T. C. " " *Electrical Engineer.*
Millen, G. S., " "
Meyerson, E., " "
Montgomery, H. M., " "
Morse, G. C., " "
McLean, T. H., Indianapolis, Ind.
McAdoo, M. R., Paterson, N. J.
Morris, Elmer P., General Electric Co., New York.
McElroy, J. F., Cons. Car-Heating Co., Albany, N. Y.
Morse, C. B., Boston, Mrss.
Morrison, W. M., Brooklyn, N. Y.
Morse, J. P. Brockton, Mass.
Mercur, R. J., N. Y. Car-Wheel Works, Buffalo, N. Y.
Mason, W. R., Chicago, Ill.
Meaker, J. W., " " Meaker M'f'g Co.
Millar, J., " "
Myers, L. E., " "
Mulhern, Geo. C., Cleveland, O.
Markle, Alvin, Hazleton, Pa.
McDowell, Geo., Joliet, Ill.
Minary, T. J., Louisville, Ky.
Macpherson, Alex., Montreal, Que.
McDonald, D. A. " "
McDonnell, Alex., " "
Morrell, F. A., N. H. Car Register Co., New Haven, Conn.
Mackenzie, Ross, Niagara Falls, Ont.
Medbery, H. J., Mechanicville, N. Y., Medbery Insulation.
McLeod, A., Wilmington, Del.
McClary, J. B., Birmingham, Ala.
Musser, F. B., Harrisburg, Pa.
McPherson, H., Troy, N. Y.
Milbank, L. A., " "
Moore, H. C., Trenton, N. J.
Meixell, J C., Wilkesbarre, Pa.
Morse, G. C., Taunton, Mass.
Mason, H. C., St. Joseph, Mich.
Nethercut, E. F., Chicago, Ill.
Newbert, W. F., " "
Noble, E. J., " "
Noe, Chas. C., " "
Newkirk, H. R., New York.
Nicholls, F., Brantford, Ont.
Owens, W. G., DesMoines, Ia.
Odell, Chas, Newburyport, Mass
Osborne, W. F., New York, *Western Electrician.*
Ostrom, J. F., Philadelphia, Pa., Penna. Steel Co.
Pierce, C. C., General Electric Co., Boston, Mass.
Price, C. B., Boston, Mass.
Pringle, R. E. T., Boston, Mass.
Porter, Chas. E., Brooklyn, N. Y.
Paige, A. W. Chicago, Ill.
Pennington, T. C., Chicago, Ill.
Perry, Chas. C., Darien, Conn.
Porter, D. U., Denver, Col.
Park, H. H., DesMoines, Ia.
Preble, G. H. R., Fitchburg, Mass.
Patterson, John, Hamilton, Ont.
Potter, E. E., New Bedford, Mass.
Pond, A. E., New Haven, Conn.
Phillips, W., Niagara Falls, Ont.
Parrott, F. W., North Adams, Mass.
Peckham, E. New York, Peckham Motor Truck & Wheel Co.
Pugh, D. W., " " John Stephenson Co.
Pugh, J. S., " "
Porter, G. F, " " National Electric Light Association.
Peavey, M.V., " "
Poole, C. P., " " *Electrical World.*
Price, C. W., " " *Electrical Review.*
Perry, J. W. Philadelphia, Pa.
Powell, W. F., Ottawa, Ont.
Partridge, A. S., St. Louis, Mo.
Piper, E. S., Toronto, Ont.
Potter, W. B., Schenectady, N. Y., General Electric Co.
Pratt, G. E., Wilmington, Del.
Perrine, L., Trenton, N. J., J. A. Roeblings' Sons Co.
Page, A. D., Harrison, N. J., Edison Lamp Works.
Perrine, L., Orange, N. J.
Pratt, M. D., Steelton, Pa.
Powell, G. A., Warren, O.
Ransom, H. N., Consolidated Car Heating Co., Albany, N. Y.
Radel, Andrew, Bridgeport Traction Co., Bridgeport, Conn.
Record, F. A., Boston, Mass.
Robinson, J. C., " "
Robinson, Wm., " "
Rogers, H. B, Brockton, Mass.
Rusling, F. A., Buffalo, N. Y.
Rowand, L G., Camden, N. J.
Randall, F. C., J. G. Brill Co, Chicago, Ill.
Routzhan, N., Dayton, O.
Royal, H. M., Gloucester, N. J.
Richardson, C. A, Lawrence, Mass.
Ridgway, J. T., Trenton, N. J.
Rugg, E. L., Waterbury, Conn.
Reynolds, A. T. Troy, N. Y., Taylor Electric Truck Co.
Reynolds, A. J., Worcester, Mass.
Richardson, C. A., " "
Russell, H. H., Portland, Me, E. T. Burrows Co.
Rigg, J. A., Reading, Pa.
Ross, E. L., Indian Orchard, Mass., Chapman Valve Co.
Rathenau, E., Berlin, Germany.
Rise, R. M., New York.
Robert, L. E., " "
Richards, H. T., New York, Safety Insulated Wire and Cable Co.
Rumrill, G. " " Sterling Supply Mfg. Co.
Ryan, R. W., " " Stenographer.
Robinson, J. C., Philadelphia, Pa.
Reagan, J., " "
Rutherford, J. A., Pittsburgh, Pa., Westinghouse Co.
Russell, F. D., Rochester, N. Y., Rochester Car Wheel Works.
Range, F. D. Providence, R. I., Consolidated Car Fender Co.
Rosenthal, G. D., St. Louis, Mo.
Rhotehamel, J. H., St. Louis, Mo., Columbia Lamp Co.
Ratheman, E., " "
Robinson, E. I., " "
Rockwell, H. O., " "
Reed, G. F., Springfield, Mass.
Sanderson, E. N., Pittsburgh, Pa., Westinghouse Co.
Schmid, Albert, Pittsburgh, Pa., Westinghouse Electric Co.
Scott, Chas. F., Pittsburgh, Pa.
Stedman, J. H., Rochester, N. Y.
Scarritt, S. G., St. Louis, Mo.
Scullin, Henry, St. Louis, Mo.
Shelton, T. W., " " "
Silliman, jr., Frank, Scranton, Pa.
Siebel, Geo. F., Taunton, Mass.
Smith, C. H., Troy, N. Y.
Shepardson, A. O., Waterbury, Conn.
Sharp, E. P., Allegheny, Pa.
Sclater, Wm., Ambler, Pa.
Smith, John T., Fishkill, N. Y.
Smith, W. A., Omaha, Neb
Sylvester, John E., Somerville, Mass.
Speer, J. S., Partridge Carbon Co., Sandusky, O.
Setzer, Henry, Bridgeport Traction Co., Bridgeport, Conn.
Saltonstall P. L., General Electric Co., Boston, Mass.
Sergeant, C. S., Boston, Mass.
Shaw, Jos. F., " "
Sylvester, S. E., " "
Schieren, jr., C. A, C. A. Schieren & Co., New York.
Sharp, Edward P., Buffalo, N. Y.
Smith, G. T., N. Y. Car Wheel Works, Buffalo, N. Y.
Seebee, C. J., Chicago, Ill.
Shainwald J. C., Standard Paint Co., Chicago, Ill.
Stewart, T. S., Westinghouse Electric and Mfg. Co., Chicago, Ill.
Strieby, F. H., General Electric Co., Cincinnati, O.
Short, S. H., Walker Mfg. Co., Cleveland, O.
Sperry, E. A., Cleveland, O.
Starr, D. A, " "
Swift, C. M., Detroit, Mich.
Satterlee, Wm. A., Kansas City, Kan.
Smith, Geo. D., Montreal, Que.
Shaw, J. F., Newburyport, Mass.
Shaw, Warren, " "
Sheif, W. N., New Brighton, N. Y.
Silver, Wm., North Adams, Mass.
Scheffler, F. A., New York.
Seely, J. A., Belden & Seely, New York.
Shaw, A. C., *Electrical Engineer*, New York,
Silver, Wm. S, W. S. Silver & Co., New York.
Simmons, E. A., New York.
Swain, Henry S., New York.
Soper, W. Y., Ahearn & Soper, Ottawa, Ont.
Scott, jr., Chas., Chas. Scott Spring Co., Philadelphia.
Trawick, S. W., General Electric Co., Atlanta, Ga.
Thompson, S. B., Baltimore, Md.
Todd, F. C., General Electric Co., Baltimore, Md.

Townley, C., Westinghouse, Electric Mfg. Co., Boston, Mass.
Tebbitts, J. S., Westinghouse Electric Co, Chicago, Ill.
Thompson, W. J., Gloucester, N. J.
Thompson, W. J., jr., " "
Tolles, C. L., Jewell Belting Co, Hartford, Conn.
Thompson, Geo., Hazleton, Pa.
Tremper, W J., Lancaster, Pa.
Taltavall, T. R., Electrical Age, New York.
Taylor, Wm., New York, *Electric Railway Gazette.*
Taylor, Wm. H., New York, *Street Railway Journal.*
Thayer, Frank A, New York.
Trimble, James, " "
Turner, Wm S., " "
Traggardh, J. G., Philadelphia.
Thompson, A. C., St. Louis, Mo., Missouri R. R.
Thomas, O J. T., St. Thomas, Ont.
Taylor, John, Taylor Truck Co., Troy, N. Y.
Taylor, J. W., Ottawa Porcelain and Carbon Co, Ottawa.
Van Dorn, W. T., Van Dorn-Fitzgerald Co., Chicago, Ill.
Voss, Wm., Dayton, O.
Van Sant, H. C., Morris, Tasker & Co., Philadelphia.
Vosburg, A. C., Syracuse, N. Y.
Wattles, Jas. F., Boston, Mass.
Wood, Chas. N., " "
Wood, Y. C., Brooklyn, N. Y.
Watson, H. M., Buffalo Rly. Co., Buffalo, N. Y.
Williard, M. J., Camden, N. J.
Wellington, A. G., Chicago, Ill.
Whitmore, C. E, " "
Whyte, Geo. S., " "
Wiley, J. R., Standard Underground Cable Co., Chicago, Ill.
Windsor, H. H, Chicago, Ill.
Winter, D. L., " "
Wise, Clift, " "
Wardell, F. S., Danbury, Conn.
Wood, H. H., Denver, Col.
Wallis, R. N., Fitchburg, Mass.
West, H. J., Gloucester, Mass
Wilkinson, W. H, Peckham Truck Co., Kingston, N. Y.
Wunster, E. A., Falk Mfg. Co., Milwaukee, Wis.
Wyman, C. D., Milwaukee, Wis
Washburme, Wm. A., New York, Cambria Iron Co.
Weber, G. A., New York.
Wendell, Jr, Jacob, New York, Taunton Loco. Works.
Wessels, E. J., New York.
Whipp, G. S, " " Sterling Supply Mfg. Co.
Wiley, G. L., " " Standard Underground Cab'e Co.
Wyman, E. B, Tandem Brake Co., New York.
Wilson, Geo. A., New York.
Wood, E. E., *Electrical Industries*, New York.
Woodbridge, J L., New York.
Watts, Edw. T., Philadelphia.
Wilkinson, E. T., Philadelphia.
Wightmam, Geo. H., Pittsburgh, Pa.
Webb, H. E., Pittsburgh, Pa.
Williams C. A., Rochester, N. Y.
Wirt, H. C., Gen'l Elec. Co., Schenectady, N. Y.
Wightman, H. J., Scranton, Pa.
Woodward, J. H., Benedict & Burnham, Waterbury, Conn.
Walter, Franklin, Brookline, Mass.
Wethy, J. S., Butte, Mont.
White, D. Waldo, Concord, N. H.
Wain, W. Caruthers, London, Eng.
Weeks, B. J., Quincy, Mass.
Yardley, J. H., Philadelphia.
Yates, F. A., St. Louis, Gleyre Bros.
Young, A. M., Waterbury, Conn.

LADIES.

Barnes, Mrs. C. E.
Beach, Mrs. R. H.
Bennett, Mrs. J. B.
Breed, Mrs. E. S.
Bristol, Mrs. H A.
Brown, Mrs. R. S.
Candee, Mrs. Willard L.
Chambers, Mrs. George.
Chapman, Mrs. W. D.
Connette, Mrs E. G.
Cunningham, Mrs. J. H.
Curley, Mrs. Thomas P.
Daggett, Mrs. H. M., Jr.
Dodge, Mrs. G. A. W.
Dimmock, Mrs W. S.
Eldredge, Mrs. F.
Farwell, Mrs. H. C.
Green, Mrs. Frank A.
Harrison, Mrs. Russell B.
Hogan, Mrs John J.
Johnson, Mrs. G J.
Johnston, Mrs. W. J.
Kimball, Mrs. F. M.
Lodge, Miss Mabel.
Lodge, Mrs. George.
McAdoo, Mrs. M. R.
Medbery, Mrs. H. J.
Medbery, Miss.
Mulhern, Mrs. George C.
Price, Mrs. Chas. W.
Price, Mrs. C. B. Price.
Richardson, Mrs. C. A.
Richardson, Miss Mabel.
Robinson, Mrs. J. C.
Scheffler, Mrs. Frederick A.
Shaw, Mrs. Jos. F.
Silliman, Mrs. Frank.
Simmons, Mrs. E. A.
Sylvester, Mrs S. E.
Thompson, Mrs A. C.
Thompson, Miss Birdie.
Wattles, Mrs. J. F.
Wightman, Mrs. Geo H.
Young, Mrs. A. M.

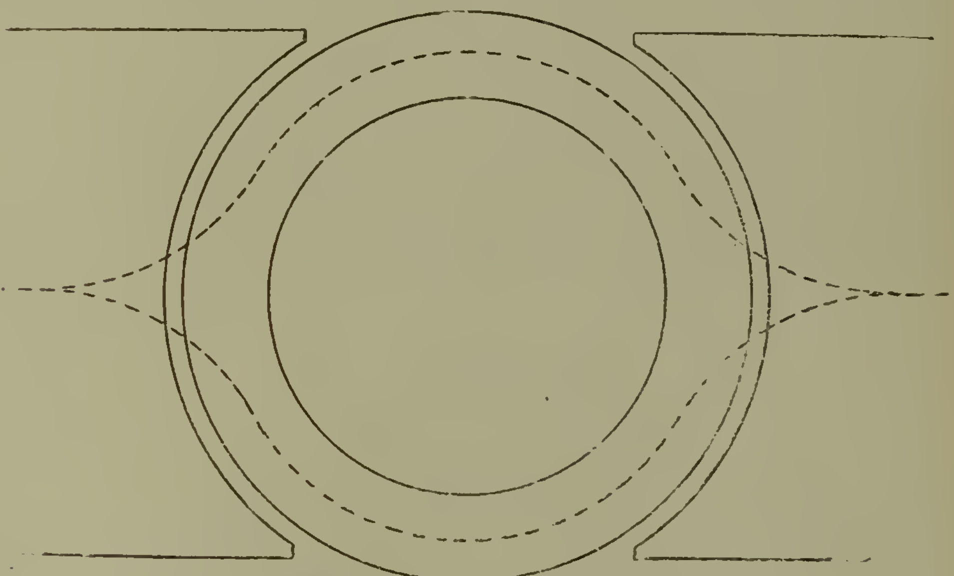
PRINCIPLES OF DYNAMO DESIGN.

BY

Newton Harrison E.E.

(*Continued from Page* 208.)

As a rule, armatures are classified according to their shape of core; either as Gramme, drum or disk, sometimes known as discoidal armatures. A drum winding may be carried over a Gramme ring and sometimes is, in practice, but as a general rule the lines of demarcation are very distinct. A type of machine designed by Louis Breguet, of France, has a disk armature without any iron in the core at all, yet its classification is undoubted. In the early types of drum invented by Siemens the core remained stationary, while the winding revolved around it on a sleeve and thus cut the lines of force. It is not necessary



MAGNETIC CIRCUIT OF A RING CORE.

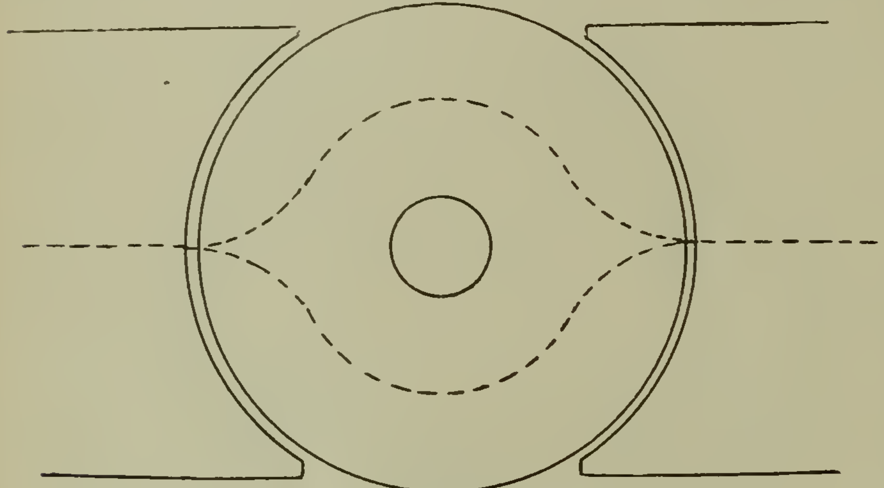
to enumerate such cases in order to classify, as the average of cases makes the headings clearly evident.

The winding of a Gramme armature does not require a lengthy explanation; the continuity of the windings is observed, and the beginning and end of each successive coil twisted together, soldered and joined either by screw or further soldering to the commutator segments. There are usually as many commutator sectors as armature sections, although several sections may be fed in parallel into the commutator bars and a brush, wide enough to cover the segments all at once, applied. If each section or coil is connected to two separate segments and thus becomes independent, the armature is called an open coil armature, thus giving two further divisions—

Open coil armatures,
Closed " "

Closed coil armatures are generally employed for arc lighting; the fluctuations of current developed by them has, on account of its singular character, been called a "pulsating current." The Brush machine is a pioneer of that type. These separate coils developed a direct current which could be compared to waves of electricity all passing in the same direction along the wire. In the closed coil armature the sudden surges of current are smoothed away by subdividing the sections and using many commutator bars. This brings it to a more uniform basis and makes the waves still less distinct. Both Gramme and drum armatures, if wound with an equal number of inductors will, in the same field, generate the same E M.F. Thus it becomes evident that the point of importance to be observed is the proportioning of the cross-section of their cores, is to have them large enough to successfully carry the lines of force supposed to enter them.

A Gramme armature, it must not be forgotten, has two separate magnetic circuits; therefore its cross-section is just half that required for a drum armature. If a Gramme armature core is supplied with 1,000,000 lines of force and requires a cross-section of five square inches to carry them, the double path provided, five square inches in the upper and five square inches in the lower half of the ring, would make it in total equal to ten square inches. A drum core, however, would have ten square inches in cross-section, otherwise the flux would not all pass through and leakage would result. In calculating the cross-section of the Gramme armature it is inadvisable to have it at less than a stated induction. According to the data obtained from a variety of cases, the induction in the core varies from 14,000 to 16,000 per square cm. or an average of 80,000 per square inches. This is not always the case, as it seems as though Gramme armatures were more highly saturated than drums, the self-induction of the former being responsible for this, being more severe and injurious in rings than in drums By an examination into the conditions necessary for severe self-induction it is seen to depend upon the number of turns, permeability of the magnetic circuit, and strength of current. If a coil has its circuit opened or closed and no iron be present, the self-



MAGNETIC CIRCUIT OF A DRUM CORE.

induction is not very great. But if a bar of iron be inserted thus increasing the permeability, the self-induction becomes very great and evinces its presence by a bright flash when the circuit is opened. Consider the bar saturated up to a high induction, kept in that condition and inserted within the coil; its permeability is very low on account of its saturated condition, and any change occurring in the coil by the opening or closing of the circuit affects it very little; the result is, that the coil acts as though all iron were absent from its vicinity and sparks but little; in fact, as though only air were within it. The saturation, therefore, of the core of an armature would on this basis tend to greatly reduce the sparking at the commutator due to self-induction. By either reducing the permeability of the circuit or generating an E. M. F. equal and opposite in direction, sparking at the commutator may be diminished. The surface of an armature that is covered by a pole-piece receives the lines of force that cut the moving inductors. The air-gap being generally magnetized up to an induction of 5,000 to 8 000 lines of force per square cm. requires an area of pole face such that the lines issue at the rate of from 30,000 to 50 000 per square inch If the core be magnetized with an induction of 80,000 per square inch, the ratio of the areas of pole-face to cross-section of core would be, with the lines from pole-face at 50,000 square inches as 80,000:50,000. or 8:5; every square inch of core, therefore, would mean 1.6 square inches of pole-face.

(*To be Continued.*)

ELECTRICAL SOCIETIES.

NEW YORK ELECTRICAL SOCIETY.

The next meeting of the New York Electrical Society will be held at Columbia College on Monday evening, October 28, when Mr. P. B. Delany will lecture on "High-Speed Commercial Telegraphy,"

New York Notes.

Office of the Electrical Age,
World Building, New York,
October 19, 1895.

Walter R. Wood and Alexander Thompson, of the firm of Walter R. Wood & Co., 136 Liberty street, New York, eastern representatives of the National Elevator and Machine Co., of Scranton, Pa., are practical and mechanical electrical engineers of high repute. Both gentlemen have been engineers and installers of some of the most prominent railway and power plants in the country. Mr. Thompson was connected with the old United Edison Mfg. Co. at 65 Fifth avenue, back in the Eighties. In the present business they make a specialty of installing elevators, Mr. Wood having charge of the mechanical department of the business, while Mr. Thompson looks after the electrical part. They are getting up an electrical attachment which will render electric elevators more practical than ever.

Telephone Notes.

Marysville, Cal.—G. L. Jones is contemplating the erection of a telephone line from Kent to Meridian and thence to Marysville.

Red Bud, Ill.—The City Council granted permission at last meeting to the Home Telephone Co. to come into the city with its lines.

Tallahassee, Fla.—Jacksonville Telephone Co. Incorporated. Capital, $100,000. W. N. Shine of Tallahassee, A. H. King of Jacksonville and C. B. Collins of Tallahassee.

Cairo, Ill.—Cairo Telephone Co., incorporated; capital, $5,000 Incorporators, Thomas W. Gannon, Angus Leek, and Francis J. Fitzgerald.

Evansburg, Pa.—The District and Printing Telegraph Co. will erect telegraph and telephone poles in the borough of Evansburg, for the purpose of establishing an exchange at that place.

Atchison, Kan.——Another attempt will be made to put in a telephone plant in Atchison, in opposition to the Bell Company.

Ionia, Mich.—Chase Bros., of Grand Rapids, have been granted a franchise for a telephone exchange in this place.

Jersey City, N. J.—Home Telephone Co., incorporated; capital, $300,000. Incorporators, P. Justus Atkinson and George N. Atkinson.

Waldoboro, Me.—Lincoln and Knox Telegraph and Telephone Co. organized at Waldoboro. Capital, $3,000; Officers: President, George Bliss; Treasurer, Lincoln N. Kennedy, both of Waldoboro.

Richmond, O.—The Eastern Ohio Telephone Co., incorporated. Capital, $5,000.

Street Railway Notes.

Brooklyn, N. Y.—The Brooklyn Heights Railway Co. has decided to extend its Flatbush route to Bergen Beach, a distance of about 11½ miles.

It is officially announced that the Nassau Railroad will shortly extend to West Brighton.

Pittston, Pa.—The Pittston, Jenkins and Avoca Street Railway Co. proposes to construct an electric road from Moosic to Pittston.

New Corporations.

Lexington, Mo.—Lexington Electric Co. Capital, $80,000, to furnish electric light, heat and power for the town of Lexington. E. R. Kimball, of Kansas City, principal stockholder.

Springfield, O.—The Dayton, Springfield & Urbana Railroad Co. Incorporated. Capital, $10,000. Incorporators' names not given.

Eastport, Me. — Eastport Lighting Co. Incorporated, Capital, $50,000 ; President, W. A. Carey, of Malden, Mass. ; Treasurer, W. H. Whitney.

Corry, Pa.—The Corry Electric Street Railway Co. has been formed with a capital stock of $18,000. President, R. N. Seaver ; Secretary, C. T. Rogers, jr. ; Treasurer, D. L. Backon.

Oakland, Cal.—Pacific Transmission Co. Incorporated for the purpose of supplying electricity to Oakland, San Jose and other places. Capital, $3,000,000. S. E. Kearney, A. H. Babcock, W. A. Richardson, O. K. McMurray and W. H. Henry are the projectors.

Avalon, Pa.—The Ohio Valley Electric Railway Co. has been chartered. The line will run from Avalon, Allegheny County, to Clenfield Borough. Capital, $175,000. President, W. B. Carson, of Pittsburgh. Directors, W. B. Howay, Wm. Hageman, Wm. T. Lindsay, H. E. Lineweather and Edward C. Gerwig.

Minneapolis, Minn.—The Marine Electric Propeller Co., incorporated; capital, $27,500. J. Frank Conklin, S. N. Smith, Frank F. Davis, Ary E. Zonne, and others.

Bordentown, N. J.—The Bordentown Electric Light and Motor Co., incorporated at Mt. Holly; capital, $50,000. Incorporators, James S. Gilbert, Wm. C. Steele, George B. Gilbert, Thomas Bennett and Amos L. Little.

Possible Contracts.

Honesdale, Pa.—Honesdale Electric Light Co. will enlarge their plant and put in more powerful boilers and larger dynamos.

Philadelphia, Pa.—The Pennsylvania Heat, Light and Power Co., which recently acquired the old traction power house on Market street, has purchased more property, upon which a large plant will be erected.

Plans have been drawn by Bailey & Truscott for the proposed new building for Cyrus H. K. Curtis, to be erected at Sixth and Walnut sts.

Philadelphia, Pa. — J. Frank Stuckert has completed plans for an 11-story building.

New York City. — Castle Garden Hotel Co. Capital, $104,000. Directors, Sebastian Stockert, Max Stockert, 9 Battery place, and C. Stockert, all of New York city.

J. Bockel & Son, 54 Bond street, have prepared plans for J. Searle Barclay, who will construct a seven-story loft building at 47 Ann street, to cost $60,000.

Emil Block has sold the Condit property, 37 East 12th street, to Jacob Hirsch, who will erect a nine-story fire-proof business building.

Henry Corn, who purchased the northeast corner of Sixth avenue and 58th street, is reported as saying that a 12-story fire-proof hotel is lkely to be built on the plot.

Pocantico Hills, N. Y.—John D. Rockefeller, 26 Broadway, New York city, will build a chateau which will be lighted by electricity.

New York City.—Silas J. McGinness will build a seven-story brick warehouse at 481 Washington street.

New Berlin, N. Y.—The electric plant in New Berlin has been burned. Loss, $15,000. Building and machinery total loss.

Brooklyn, N Y.—Manufacturers National Bank will erect a four-story brick bank building, corner of Broadway and Berry street, to cost $60,000.

Brunswick, Mo.—The city has voted to issue $15,000 in bonds for water-works and an electric plant.

Financial.

The Erie Telegraph and Telephone Company reports gross earnings for August of $88,744, an increase of $3,070 as compared with the same month of last year, and net $38,397, an increase of $3,065. For the eight months ending August 31 the gross earnings were $699,555, an increase of $24,724 as compared with the corresponding period of last year, and net $298,086, an increase of $32,854.

The Edison Electric Illuminating Company of New York reports gross earnings for September of $136,983, an increase of $11,378 as compared with the same month of last year, and net $61,462, an increase of 4,899 For the nine months ending Sept 30 the gross earnings were $1,331,157, an increase of $159,273 as compared with the corresponding period of last year, and net $645,717, an increase of $90,395.

A NEW IDEA IN TAPE.

The Okonite Company, Ltd., brought a new idea in tape to the Montreal convention which created a genuine sensation and caused any amount of favorable comment. The novelty consis's of a new form in which the company is putting out the celebrated Manson tape, and was shown by Capt. Willard L. Candee, who was to be found here, there and everywhere surrounded by an interested group of the electrical fraternity eager to get points of the 'good thing." Captain Candee showed the Manson tape packed in round tin boxes of two colors—red and white—both very attractive and neat in appearance, and containing one ounce of the tape. This, nine times out of ten, is sufficient quantity for any ordinary repair, and if there be any left over it may be put back into the box, which is conveniently small (about the size of a silver dollar), where it will be kept fresh and clean and ready for use at any time. The new form of packing meets an evident want, and will unquestionably mean a considerable saving to the companies and prove a great convenience to linemen. The Manson tape is furnished in two colors ; the black tape will be put in red boxes lettered in black, the white tape in white boxes also lettered in black. Captain Candee returned from the convention with a large number of valuable souvenirs in the shape of substantial orders for the novelty.

ELECTRICAL and STREET RAILWAY PATENTS

Issued October 15, 1895.

547,783. Conduit System for Electric Railways. John Hartman, Philadelphia, Pa. Filed Apr. 7, 1893.

547,784. Supply System for Electric Railways. John Hartman, Philadelphia, Pa. Filed Aug. 7, 1893.

547,834. Electrical Transmission of Power. William D. Baldwin, Yonkers, N. Y. Filed July 3, 1894.

547,835. Electric Car-Lighting Apparatus. William Biddle, Brooklyn, N. Y. Filed Jan. 16, 1895.

547,847. Combined Electrical and Mechanical Brake. James R. Cravath, Chicago, Ill. Filed Aug. 10, 1895.

547,873. Switch or Cross-Over System for Electric Railways. Henry M. Brinckerhoff, Chicago, Ill., assignor to Carter H. Fitzhugh, same place. Filed June 13, 1895.

547,891. Apparatus for Placing Electric Cables. Edwin S. Reid, New York, N. Y., assignor to the Standard Underground Cable Company, of Philadelphia. Filed June 18, 1892.

547,897. Electrical Succession Signaling or Calling System. James G. Smith, New York, N. Y., assignor of one-half to Robert G. Vassar, same place. Original application filed Jan. 14, 1895. Divided and this application filed Feb. 23, 1895.

547,900. Fire-Alarm. Edwin A. Speer, Toledo, Ohio. Filed May 20, 1895.

547,914. Series Electric Railway. Oliver B. Finn, Philadelphia, Pa. Filed Mar. 29, 1894.

547,930. Coupling for Electromotors. Franz Marburg, Jr., Buffalo, N. Y. Filed May 14, 1895.

547,931. Insulator for Trolley-Wire Supports. John W. Meaker, Evanston, Ill. Filed Nov. 19, 1894.

547,942. Electrical Succession Signaling or Calling System. James G. Smith, New York, N. Y., assignor of one-half to Robert G Vassar, same place. Filed Jan. 14, 1895.

547,960. Telephone System and Cable. Joseph W. Marsh, Pittsburgh, Pa., assignor to the Standard Underground Cable Company, of Pennsylvania. Filed May 6, 1895.

547,979 Electric Heater. George H. Whittingham, Baltimore, Md., assignor to The Whittingham Electric Car Heating Company, same place. Filed July 15, 1895.

547,992. Car-Fender. Henry Hiestand, Philadelphia, Pa. Filed May 8, 1895.

548,011. Trolley-Wheel. Henry Schmidt, Moline, Ill. Filed Jan. 5, 1895.

548,019. Car-Fender. Albert J. Thornley, Pawtucket, assignor to the Consolidated Car Fender Company, Providence, R. I. Filed June 26, 1895.

548,027. Telephone Attachment. Charles H. Bernhard, Cleveland, Ohio. Filed Mar. 15, 1894.

548,028. Electric-Arc Lamp. Charles Beseler, Jersey City, N. J. Filed May 4, 1895.

548,032. Supply System for Electric Railways. Henry V. Brown, Brooklyn, N. Y. Filed Nov 21, 1894.

548 036. Incandescent Electric Lamp Samuel E. Cox, Cleveland, Ohio, assignor to the Adams-Bagnall Electric Company, same place. Filed July 18 1895.

548,038. Thermo-Electric Generator. Harry B. Cox, Hartford, Conn. Filed Jan. 31, 1894.

548,070. Electric-Railway System. John La Burt, Brooklyn, assignor, by mesne assignments, to the La Burt Electric Railway Company, New York, N. Y. Filed June 26, 1894.

548,071. Car-Fender. John Landau, Brooklyn, N. Y. Filed May 21, 1895.

548,074. Trolley Rope and Pole Controller Charles A. Lord, San Francisco, Cal, assignor of one half to T. A. Kirkpatrick, same place. Filed Jan 9, 1893. Renewed Aug. 9, 1895.

548,102. Safety-Guard for Railway-Cars. William Watkins, San Francisco, Cal. Filed July 5, 1895.

548,126. Electrical Illumination. Daniel McF. Moore, New York, N. Y. Filed Oct. 13, 1895.

548,127. Electric-Lighting System. Daniel McF. Moore, East Orange, N. J. Filed July 19, 1895.

548,128. Electric-Lighting System. Daniel McF. Moore, New York, N. Y. Filed Apr. 10, 1895.

548,129. Method of Electrical Illumination. Daniel McF. Moore, New York, N. Y. Filed Dec. 4, 1894.

548,130. Regulation of Electrical Phosphorescent Illumination by Magnetic Induction. Daniel McF. Moore, New York, N. Y. Filed Jan. 3, 1895.

548,131. Apparatus for Generating Phosphorescent Electric Light. Daniel McF. Moore, New York, N. Y. Filed Jan. 7, 1895.

548,132. Phosphorescent Electrical Illumination by Oscillation. Daniel McF. Moore, New York, N. Y. Filed Jan. 9, 1895

548,133. Phosphorescent Electric Illumination by Intermittent and Permanent Interruption in Vacuum Daniel McF. Moore, New York, N. Y. Filed Jan. 24, 1895.

548,134. Electrical Illumination by Phosphorescent Flame. Daniel McF. Moore, New York, N. Y. Filed Jan 25, 1895.

548,150. Electrical Gold and Silver Extractor. Alfred Williams and William R. Phillips, Seattle, Wash, assignors of one-third to Fred Everett, same place. Filed Jan. 24, 1895.

548,162. Combined Diaphragm and Electrode. James Hargreaves, Farnworth-in-Widnes, and Thomas Bird, Cressington, near Liverpool, England. Filed Dec. 31, 1894. Patented in England Oct. 10, 1892, No 18,039; in Belgium Oct. 7, 1893, No. 106,662; in France Oct. 9, 1893, No. 233,292, and in Canada Nov. 11, 1893, No. 44,677.

548,164. Car-Fender. Charles H. Hofmeister, St. Louis, Mo. Filed Aug. 15, 1895.

ELECTRICAL AGE

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CONTENTS.

PROFITS FROM TROLLEY PARTIES.

That the "trolley party" fad, which is so popular in many cities where electric railroads are plenty, is profitable to the railroad companies is shown by the experience of the Philadelphia lines. The receipts of the four companies in that city from this source up to October 1 amount to $70,000. This pleasant form of diversion has been in vogue in the Quaker City only a couple of months, yet about 700,000 persons have in that time experienced the delight of "trolley party" rides.

ELECTRIC LIGHT AT THE NATIONAL CAPITOL.

The wheels of government are proverbially slow in revolving, but at last our great chief, Uncle Sam, has been brought to realize the fact that electric light will promote better laws for the American people. This very desirable result is to be attained by the substitution of electric light for gas in the illumination of the halls of the National Senate and House of Representatives. A fine electric plant has been installed in the capitol for the purpose, and the American people hope that the electric light will bring about desirable improvements in law-making by curing all tendency to indigestion among the law-makers.

THE GOVERNMENT TELEPHONE SUIT.

The Bell Telephone Company is leaving no stone unturned or loop-hole unguarded to defend its last but uncertain hold upon the telephone. The Berliner patent is now the company's main support, but as it rests on very shaky foundation the fate of the Bell monopoly is stiil in the balance. The last move of the Bell Company to protect itself against the overwhelming tide of public opinion and the prevalence of right and justice was made in Washington on October 28. The Bell Company then submitted a motion in the United States Supreme Court to dismiss the appeal of the United States from the judgment of the Court of Appeals of the First Circuit in the Berliner patent case. The ground upon which the motion is based is that the proceeding, being one arising under the patent laws of the United States, the judgment of the Court of Appeals sustaining the patent is final.

STREET RAILWAY PATENTS.

The report of the Committee on Patents, of the American Street-Railway Association, which was submitted at the recent Montreal Convention, reveals a state of affairs in electric railroading that will surprise a great many. The plea for an organization for mutual protection against imposition and unlawful exactions on account of alleged patents is based on good reason. The committee's investigation reveals the fact that many of the alleged patents on street-railway apparatus are utterly worthless, and that many street-railway companies are paying out thousands of dollars in royalties on alleged inventions that have no legal standing. The main purpose of the proposed association is to employ competent legal counsel to pass upon the validity of alleged patents, and determine for the good of all the members which inventions are entitled to the payment of a royalty and which are not. Judging from the report on the investigations of the committee it would not require very deep probing to find an abundance of worthless patents on which inventors, or alleged inventors, are deriving a considerable income. Many railroad companies are mulcted a few hundred dollars here and there by unscrupulous persons, which amounts are paid in order to avoid going to the expense of hiring legal counsel to pass upon the validity of such claims for royalty. Thus, partially through the fault of the railroad companies themselves, and through the avidity with which interested parties take advantage of such negligence, a practice has grown up which is a disgrace to the business. An association such as that proposed would weed out the tares and protect those who are legally entitled to protection and profit. The combined effort and influence of such a body would be of the greatest benefit to street-railway interests.

LOCAL ANNEALING OF HARD-FACED ARMOR PLATES.*

BY HERMANN LEMP, JR.

One of the latest advances in the making of protective armor for battle-ships, or even forts, has been the introduction of what is known as the Harvey process. For those not conversant with the latter, I will briefly state that it consists in taking an ordinary low carbon steel plate and introducing an additional percentage of carbon into the surface metal, thus changing the crust to the depth of about an inch, into a steel resembling tool steel. A plate thus treated is lastly water-hardened, similarly to an

FIG. 1.

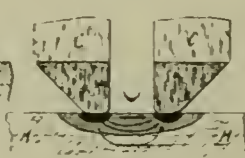


FIG. 2.

FIG. 3.

ordinary tool, and by experience has shown to offer, under equal conditions, more resistance to the impact of a projectile than any other armor known. And therefore we will take this as an illustration of hard-faced armor. The extreme hardness of the surface of a Harvey plate, while exceedingly valuable in preventing projectiles from piercing it, has a disadvantage when it is required to be pierced by a drill and tap. Such holes may be required either for fastening ladders, swivels or other appliances to the hull of the vessel, or to fasten T-flanges supporting the deck to barbettes or turrets.

The methods heretofore used to produce these holes were principally two :

1. To protect the surface of the plate in patches or strips, to prevent carburation, wherever holes were expected to be drilled.

2. To make accurate drawings and patterns of each plate beforehand, to which all holes are drilled before plate is hardened.

* * * * * * *

From the above it seems clear that there has existed a need for a process by means of which isolated spots, regardless of location, might be annealed so as to permit drilling and tapping.

If, by sending a current of large volume through any spot thus to be treated, the spot is brought to a temperature of approximately 1,000° F., there can be no doubt that the temper has been withdrawn. Experiments carried out to that effect at once showed, however, that upon taking off the heating current the heat was so rapidly conducted away by the surrounding metal masses as to cause the heated spot to become chilled just as effectually as if it had been plunged into cold water. No method of outside protection of the heated spot would prevent this, and the *gradual* cooling of the spot had to be attained by different means : namely, a gradual and slow withdrawing of the heating current. The method of introducing the annealing current is best shown in Fig. 2.

C C are two copper contacts cooled by water circulating inside. The current enters the plate by one end and leaves it by the other. Right under the contact the metal comes to a bright cherry heat (shown in black), while the portion intervening and partly surrounding the contacts acquires a temperature of just a visible red. Line H H indicates where the influence of the Harvey treatment stops.

The shaded portion in Fig. 2 and 3 shows the zone softened and ready to be machined, while the dotted line shows how far the heat radiation would cause the metal to turn blue. When cooled, the annealed portion shows a chocolate color, while the place where the contacts have been resting is scaled and hard, and cannot be touched by a tool to a depth of about one-fourth of an inch. These places can again be annealed later on, if required.

The apparatus necessary to carry out this process consists of the generator, the annealer proper (transformer) and the regulating apparatus.

The generator is commonly a separately excited alternator of variable potential, of a maximum of 300 volts and 100 amperes. The frequency, preferably, should be low, 50 cycles per second being used. When more than one annealer is to be run simultaneously from one generator, constant E.M.F. of the latter should be used and each annealer regulated separately by a reactive coil. The annealer proper is a transformer similar to the well-known welding transformers. As the apparatus is to be operated out-doors, on board of vessels during construction, it is important that the same may be handled with immunity from electric shocks, even when operated in mist and rain.

To meet these conditions a copper-clad type of transformer is used, one in which the secondary is composed of two copper castings each having a rectangular groove, which two halves, when bolted together, form a closed rectangular frame in which the primary is held enclosed. The hollow space intervening between primary and secondary is moreover filled with a heavy oil, which acts both as the insulator and conductor of heat from primary to secondary. The secondary, by completely surrounding the primary, affords an excellent mechanical protection, and prevents electric as well as magnetic leakage. The primary is a copper ribbon insulated with asbestos, and the ratio of conversion is 100 to 1. The transformer has two trunnions fastened to its sides, in a line a little above the centre of gravity, which trunnions swing in bearings, part of a yoke which straddles the whole. The yoke in its turn has a hook which may be secured to the latter at any place of the arch, thus allowing the transformer to be suspended, like a compass in gimbals, in any position desired.

It goes without saying that the copper castings which compose the secondary are cut through at one place in the circuit. On either side of the cut, two short platforms form the base for copper contacts of various shapes and sizes, by means of which the currents are made to enter and leave the plate to be annealed. These copper contacts are of forged copper, hollowed out to receive water

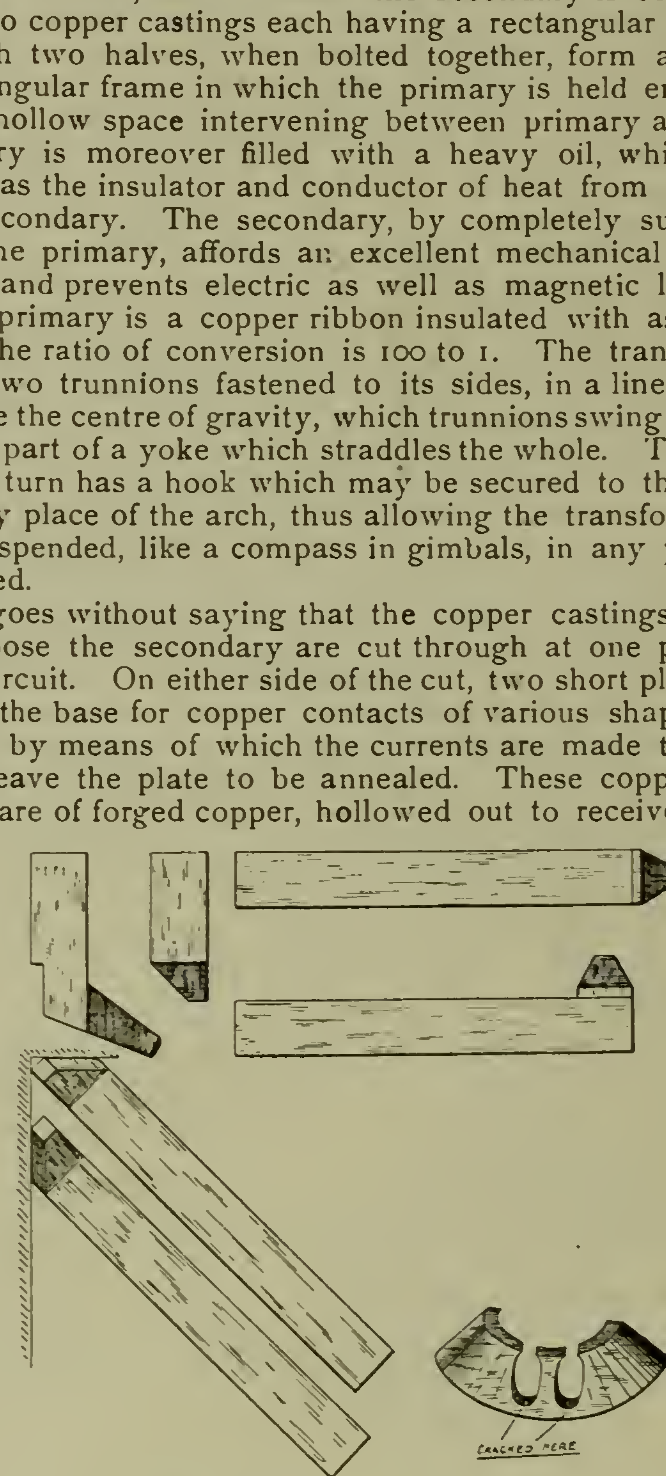


FIG. 4. FIG. 5.

circulation for cooling purposes, and terminate in narrow tips rounded at the end.

The weight of the whole annealer, being approximately 1,000 pounds, is sufficient to give proper contact pressure for all work on a horizontal plate. When inclined surfaces, vertical or otherwise, are to be worked upon, the transformer is suspended so that its weight shall not interfere with the contact pressure, which is obtained for work by bracing the contacts directly with wooden wedges against any object near by. On the outside of a hull it is proposed to use a pair of electromagnets, which are made to hold themselves against the iron hull, and form a support for the annealer. Fig. 4 shows some of the various shapes of contacts that are used in various positions.

* A paper presented at the one-hundredth meeting of the American Institute of Electrical Engineers, New York and Chicago, Oct. 23, 1895.

The remarkable thing is the great amount of current that is being carried by the copper contacts into the plate. The contact surface is seldom more than about one-half inch square, and yet 10,000 amperes are made to flow through it continually. This is equivalent to 40,000 amperes per square inch, a density which is only possible on account of the thorough cooling by the water circulation.

The regulating apparatus is in most cases simply a rheostat in series with the field of the generator. When more annealers than one are run simultaneously from one generator, as mentioned before, a reactive coil is interposed between the two, and this latter has been made automatic; that is to say, provided with a dash-pot, which permits the current to be reduced uniformly and at any given rate it is set for.

This reactive coil is composed of a solenoid coil of cable, well insulated, having a movable laminated iron core which is raised out of the coil by means of a leather strap and winch. The core is composed of thin iron strips placed side by side around a circle and projecting radially from the same, and being held on top and bottom by a slate disk, in a manner similar to the securing of the copper segments of a commutator. No insulation of the core is necessary and good ventilation is obtained. The core once raised out of the coil tends to return by gravity and the attraction of the solenoid, but is checked in its descent by a pair of dash-pots, one on each side of coil. These latter communicate with each other, top and bottom, and have one of the pistons provided with a valve which opens when the core is raised and closes when the core descends. The dash-pot cylinders are filled with a light mineral oil, which does not freeze nor clog under any ordinary conditions of temperature. An adjustable by-pass valve allows the oil to flow from the tube to the top side opposite. By opening or closing this valve more or less, any rate of descent and, consequently, diminution of current, can be uniformly obtained, without requiring any skill on the part of the operator.

The annealing operation is carried out as follows: The transformer is placed in position, the contacts touching the plate either side of the place marked to be annealed, and the primary current brought up by means of a rheostat to from 75 amperes to 90 amperes for about two minutes, according to the size of spot to be annealed, which will bring the metal to a dull red heat, a temperature at which a pine stick catches fire when held in contact with the plate. If no reactive coil is used, the current is now diminished by turning the rheostat one point every minute. If the reactive coil is used, the core is now raised by winch, the coil put in circuit by opening a short-circuiting switch, and then is allowed to descend on its own account. The operation generally takes *seven minutes* all told. The annealing of individual spots was, however, only the stepping-stone to a more important work of a similar nature, work which was about to be given up, owing to what was considered insurmountable difficulties.

In the construction of a modern man-of-war there are many armor plates which act as shields to the guns, and have to be perforated to allow the gun muzzle to pass through and to be either raised or lowered. Some of these shields are circular or oval, with narrow edges around the ports, in the case of Harveyed plate. To perforate these shields after carburation, and before being water-hardened, was the only possible way, since previous experiments had shown that prevention of carburation could not be relied on, and no process was known to anneal the plate locally after hardening. The hardening of a plate once perforated showed itself to be, however, almost impossible; in fact, a matter of chance. In most cases the plate cracked in two, as shown in Fig. 5, or the whole plate became distorted in such a way that it could not be used. As individual spots for holes could be annealed, there could be no doubt that a series of annealed spots could be likewise obtained by the electric process, following a line along which a cutting tool was expected to be run. The first attempt, therefore, and made in England, was to anneal a number of spots in proximity to each other in such a way that the annealed zones should overlap each other.

As described above, it is very important that the temperature of any individual part should be gradually and slowly withdrawn; and while for individual spots the only possible way was to do this by gradually diminishing the current, it was obvious that when a line was to be annealed, instead of annealing a number of spots side by side, the same effect of withdrawing the heat gradually from one portion could be obtained by moving the apparatus itself relatively to the plate to be treated. The rate of this movement, of course, depended upon the rate at which the temperature should be allowed to fall in any particular spot to prevent chilling. The apparatus was therefore arranged to be moved along a line to be annealed, the motion being obtained by an ordinary screw and nut held in a bracket, the nut being turned at a predetermined rate controlled by a watch. It was found that a speed of about one-quarter inch per minute was sufficiently slow to ensure thorough annealing.

The copper contacts were of the simplest kind, as described above, bedding themselves partially in the surface, and when being dragged along by the screw and nut, raised in front of themselves a burr or chip similar to a planing tool. After a whole day's continuous use the copper contacts were found intact, while a number of chips from the steel surface were lying about. We thus had the peculiar phenomenon of a hard steel chip cut with a copper tool.

Upon the completion of the work it was found that a strip of two and one-quarter inches wide, throughout the length over which the machine had been moved, could be operated upon by drills or a shaper, in a manner as easily as if it had never been hardened before.

In the work just described the apparatus was moved about, but in regular practice it would be better to construct a machine consisting of a large bed, on which the plate to be treated may be fastened and moved in any direction automatically at a predetermined speed, while the annealer proper is suspended in a given position above plate. The annealing operation occupies but a small percentage of the time required for the cutting.

It is unnecessary to state that when the apparatus is used for continuous annealing, the primary current is kept at a nearly constant value, the diminishing of heat at any individual spot being obtained solely by the moving of the apparatus from it.

As mentioned before, the places where the contacts are passing over the plate, being brought to a higher temperature than any other, remain hard. Experience has demonstrated, however, that they may be re-annealed later on, by treating the spots in the same way as any other hard spots on the plate. By this means we are therefore able to anneal any shaded portions, not merely lines. The hardfaced surface is then removed on such places by a planer and drill; the machine is then run a second time over the annealed strips, resting it this time on the bottom of the groove and on the softer metal, thns annealing the ridges c left between the annealed strips, on which ridges the contacts were running previously. When all these strips are annealed they may be removed by machine tools without any further difficulty. In a similar manner a large round place may be annealed.

The apparatus may also be used for the reversal of the annealing process; that is to say, for creating isolated hard spots in soft-tool steel by sending a current through the spot to be hardened until it reaches a bright cherry heat, and then suddenly removing the current or machine.

Various other applications will suggest themselves in the operation of this process, already adopted by the United States Government. It may be used in the construction of burglar-proof safes, for dies and punches, for projectiles, and other articles of a similar nature.

Albany, N. Y.—The Railroad Commissioners have approved of the use of electricity as a motive power on the New York, Elmsford and White Plains Street Railroad.

THE ELECTRIC BRAKE FOR STREET-RAILWAY SERVICE.

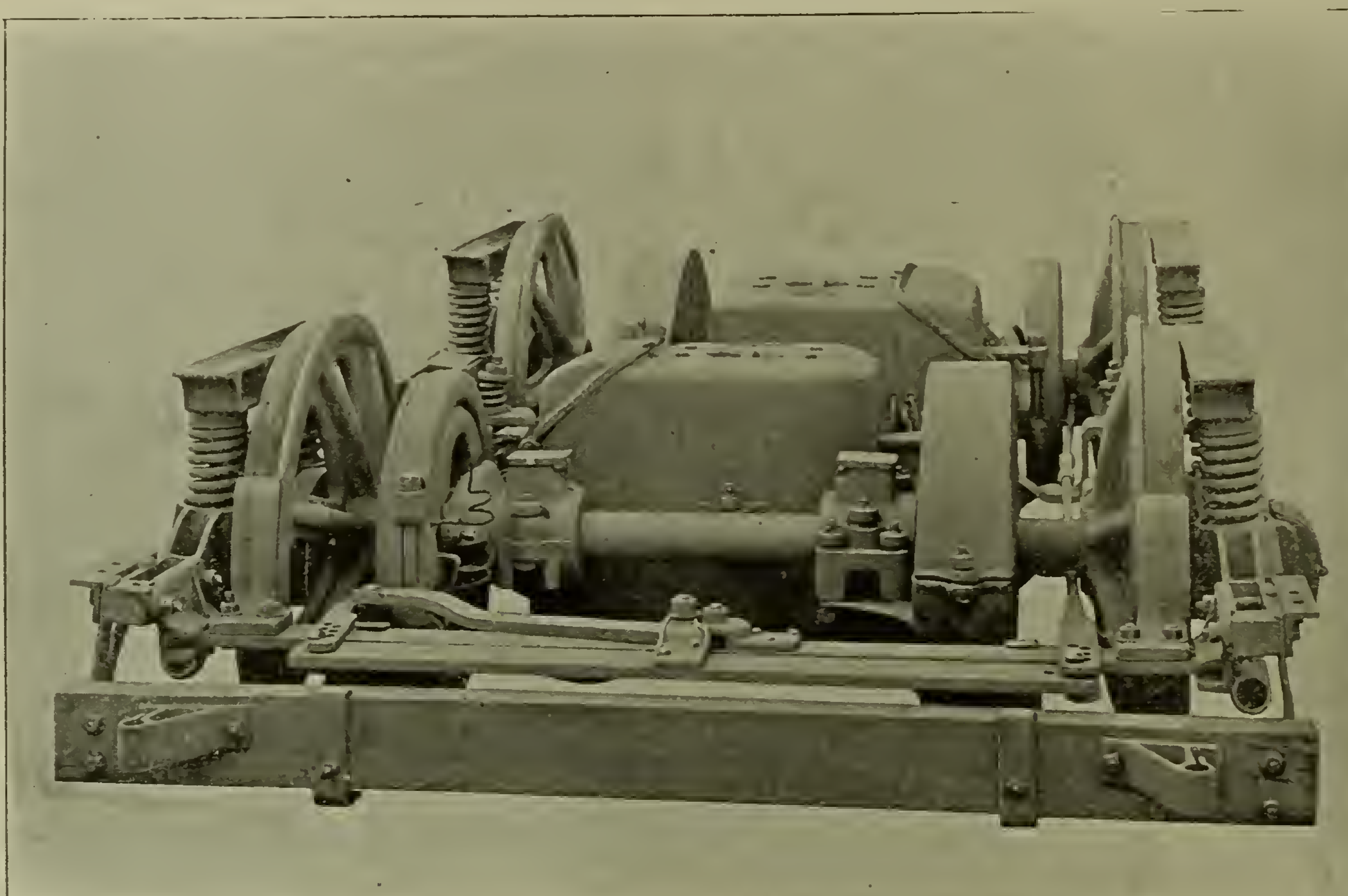
The General Electric Company having realized for some time the necessity for better braking appliances on the cars of electric street railways than the ordinary hand brake, or even the various forms of air brakes which have been proposed, has turned its attention to the development of a thoroughly practical and economical brake.

This important new device was shown in service at the Montreal Convention, in connection with two G. E. 800 motors. It contains all the good features of the Sperry brake and has been developed to perform all the duties of mechanical brakes without their complications and faults. It operates equally well whether the trolley is on or off; in fact, the braking power is not derived from the central station, but is produced by the moving power itself.

The brake places the car under the absolute control of the motorman, and its operation is no more complicated than the operation of the ordinary controller. Indeed, the controller not only controls the motors, but at the same time operates the brake, starting, accelerating, retarding and braking the car. When making a stop, the controller handle is simply thrown from running to braking position and electricity does the rest. The operations are, the cutting of all connection with the trolley current, the conversion of the motors into special dynamos for generating current at very low speeds and the instant application of the brakes. The rheostats and contacts used to control the motors in running the car also control the current generated by the motors and needed to apply the brake. The braking action is two-fold and especially efficient. The rotating armature of the motor, instead of tugging ahead with its fly-wheel action by its momentum, is itself pulling back and more or less powerfully braking the car through the gears by the retarding effort of its magnetic field while generating the braking current. The power, therefore, required to perform this work is taken from the energy of the moving car. Not only is the car thus retarded, but the brakes arrest the motion of the wheels directly with a powerful force under perfect control of the motorman. No new and strange device is introduced to the motorman, the combined electric brake and series parallel controller is the K2 controller slightly enlarged and provided with the necessary contacts to perform the operation described above. The brake mechanism is readily attached to the motor and axles. The installation connections of this mechanism are extremely simple.

The company is owner of many fundamental patents on electric brakes, notably those of Vandepoele and Sprague, and has recently acquired the patents of Elmer A. Sperry.

The advantages of the electric brake will be patent to all street-railway operators. It can be applied to any axle without removing the wheels, and the wear and tear of the brake does not come upon the tread of the wheel. The wheels of the car cannot skid, and this fact alone should render the electric brake especially popular with street-railway men, as it eliminates the possibility of flat wheels and consequent rapid depreciation of rails and rolling stock. It is tested and repaired by the same means as the other electrical devices, and its comparatively low cost will undoubtedly insure for it wide-spread adoption.



GENERAL ELECTRIC CO.'S ELECTRIC BRAKE.

THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

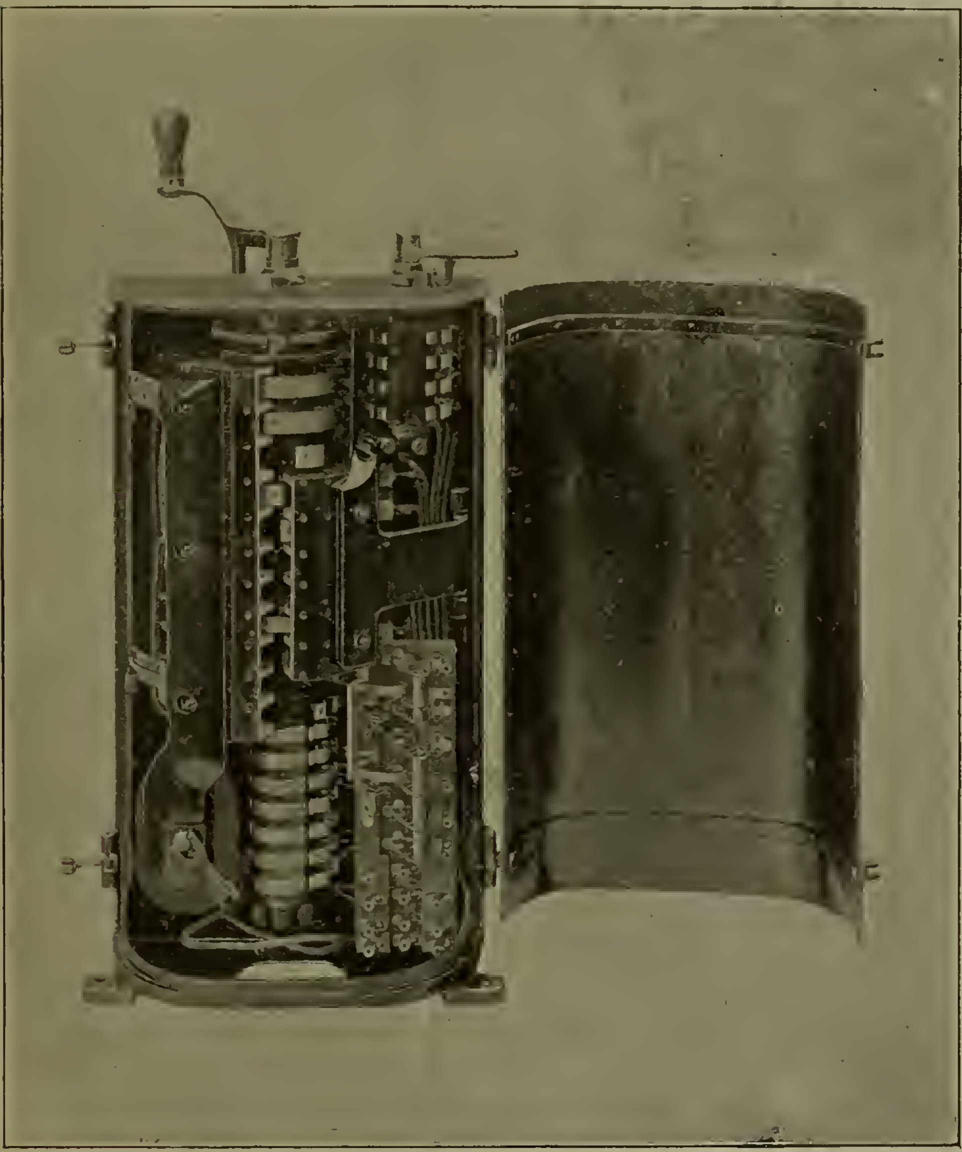
The regular monthly meeting of the institute was held at 12 West 31st street, New York City, October 23. Vice-President Crocker presided, and after having officially announced the death of Past-President Franklin Leonard Pope, stated that by the special request of President Duncan Mr. Thomas D. Lockwood had prepared for presentation the following resolutions, which were adopted:

Whereas, The American Institute of Electrical Engineers has heard with heartfelt sorrow the sudden death, by a lamentable accident, of its Past-President, Franklin Leonard Pope; and

Whereas, We, the members, council and officers of the institute desire to express our profound realization of the bereavement we have sustained and the sincere grief we experienced; and to record in fitting terms our keen appreciation of the great worth and high qualities of our late fellow member, his eminent services to our organization, and his able, unwearying and successful work in applying electrical energy to many useful purposes, it is therefore

Resolved, That by the death of Mr. Pope, called away in the full fruition of manhood and the meridian of intellectual vigor, the profession at large has suffered an incalculable loss, and the institute has been deprived of a most distinguished and valued member and a wise and sagacious counsellor. He was endeared to many members by long, pleasant and affectionate intercourse, and esteemed and respected by all, no less for his kindly and warm-hearted nature and dignified simplicity of character, than for his universally acknowledged genius and great ability.

Resolved, That we hereby express the poignant grief wherewith we contemplate the sad event which has taken from us one, who, whether in the earliest days of our association co-operating in its successful establishment; urbanely and efficiently presiding as our chief executive officer at business and social meetings; discreetly and judiciously performing the unassuming duties of a member of the committee on editing or in the capacity of an individual member, conserving the interests of harmony and stability, has uniformly had the dignity of the institute at heart, and has assiduously, cheerfully and faithfully labored for its welfare. And while we sincerely mourn the loss of an associate so eminent and useful, thus suddenly withdrawn from the activities of this present life, we most earnestly grieve for the parting from a friend so sincere, faithful and true.



G. E. K2 CONTROLLER, SHOWING BRAKE CONTROLLING MECHANISM.

Resolved, That we extend to his stricken family our tenderest sympathy, in this, the hour of their affliction, and that in testimony thereof, a copy of these resolutions be forwarded to them.

Resolved, That these resolutions be appended to the minutes of the council and be published in the Transactions of the Institute.

The regular business of the evening was then taken up, a paper being read by Mr. Hermann Lemp, Jr., of Lynn, on "Local Annealing of Hard-Faced Armor Plates." This was followed by a paper on "The Rating and Behavior of Fuse Wires," by Prof. W. M. Stine, H. E. Gaytes and C. E. Freeman, of Chicago. In the absence of the authors, this paper was read by the secretary.

At the council meeting in the afternoon the following associate members were elected:

Harry Byrne, 5620 Drexel avenue, Chicago; Edmund P. Coles, General Electric Co., Schenectady, N. Y.: George W. Colles, Jr., Westinghouse Electric and Manufacturing Co., Pittsburgh, Pa.; L. G. Crawford, General Electric Co., Chicago, Ill.; Harold W. Shonnard, The Electric Self-Playing Piano Co., 333 W. 36th street, New York City; Arthur F. Walker, Edison Light Co., Grand Rapids, Mich.

ELECTRIC POWER FOR LONG-DISTANCE TRANSMISSION.

For periods of time ranging from two years down to a few months, not less than fifty power transmission plants have been working regularly in different parts of the world, ranging in magnitude from Niagara down to fifty horse-power, and in distance from the Folsom-Sacramento transmission, in the United States, having an extreme length of about twenty-five miles, down to a mile or two. All these plants have been singularly free from trouble and have done their work well.

Admitting that distances up to twenty or twenty-five miles can be successfully overcome, is there a reasonable probability that the transmission of power can be extended over distances much greater? Yes, if necessary. We have no plants over twenty-five miles, but the methods and apparatus for longer transmissions have already been thoroughly tested, and up to at least fifty miles we are sure of our ground—perhaps up to a hundred miles. The transmitting and receiving machinery would be quite identical whether the line between them were twenty or fifty miles long, so that, as regards apparatus, the ground is well trodden.

For very long transmissions high electrical pressure is necessary to keep down the cost of the line, since the amount of copper required to meet given conditions decreases with the square of the voltage. And we have already experience with the voltage just as with the apparatus—at least with voltages ample for a fifty-mile transmission. For example, without counting the famous Lauffen-Frankfort experimental plant, with a line 108 miles long, and operated part of the time at a pressure of nearly 30,000 volts, there are now in commercial service four plants, running steadily and successfully at pressures of 10,000 voltsand more. Chief among them is the Oerlikon installation in Switzerland, working at over 14,000 volts; then come Folsom-Sacramento, in the United States, and Guadalajara, in Mexico, at 11,000 each, and, finally, the San Antonio canyon plant, in the United States, at 10,000. The first and last mentioned have been in operation nearly three years without having encountered any appreciable difficulty from the very high pressure. The other two have been operated some months without a trace of trouble. From these experiences there is the best of reason to believe that voltages up to 14,000 or 15,000 are entirely justified by present practice.

Concerning distances of 100 miles or more, and pressures exceeding 15,000 volts, we have only the results at Lauffen by way of data. While these make no pretense of representing commercial practice, they still are good evidence that, as an engineering feat, a transmission of a hundred miles at 25,000 or 30,000 volts is quite practicable. While the feasibility of covering far greater distances at much greater voltage is more or less a matter of speculation, those who know most about the difficulties to be met fear them the least.

Dr. Louis Bell,

in *Cassier's Magazine* for November.

THE "POROUS-PLANTÉ" STORAGE BATTERY.

The perfection obtained now in the generation and the distribution of the electric current for lighting and other purposes has been brought about by the combined efforts of thousands of indefatigable experimenters, the majority of whom admit that the next great step forward will be to provide a suitable and economical reservoir for the storage of the current. This fact, together with the continually increasing uses to which accumulators are adapted, has served to bring about the general interest now exhibited on the subject and to stimulate experimenters to greater efforts in overcoming the defects inherent in many of the old types of batteries and in striving to devise new methods of accumulation.

SECTIONAL VIEW OF BROKEN PLATE.

Generally speaking, accumulators now in use are divided into two classes—the Planté, in which the lead is coated with active material by electrolysis, and the Fauré, in which the active material is applied mechanically.

In the Electrical Age of July 27, last, was given a description of a new storage battery of the Planté type, which had some very meritorious and promising features. We are now able to give more particulars regarding the battery itself and its performance.

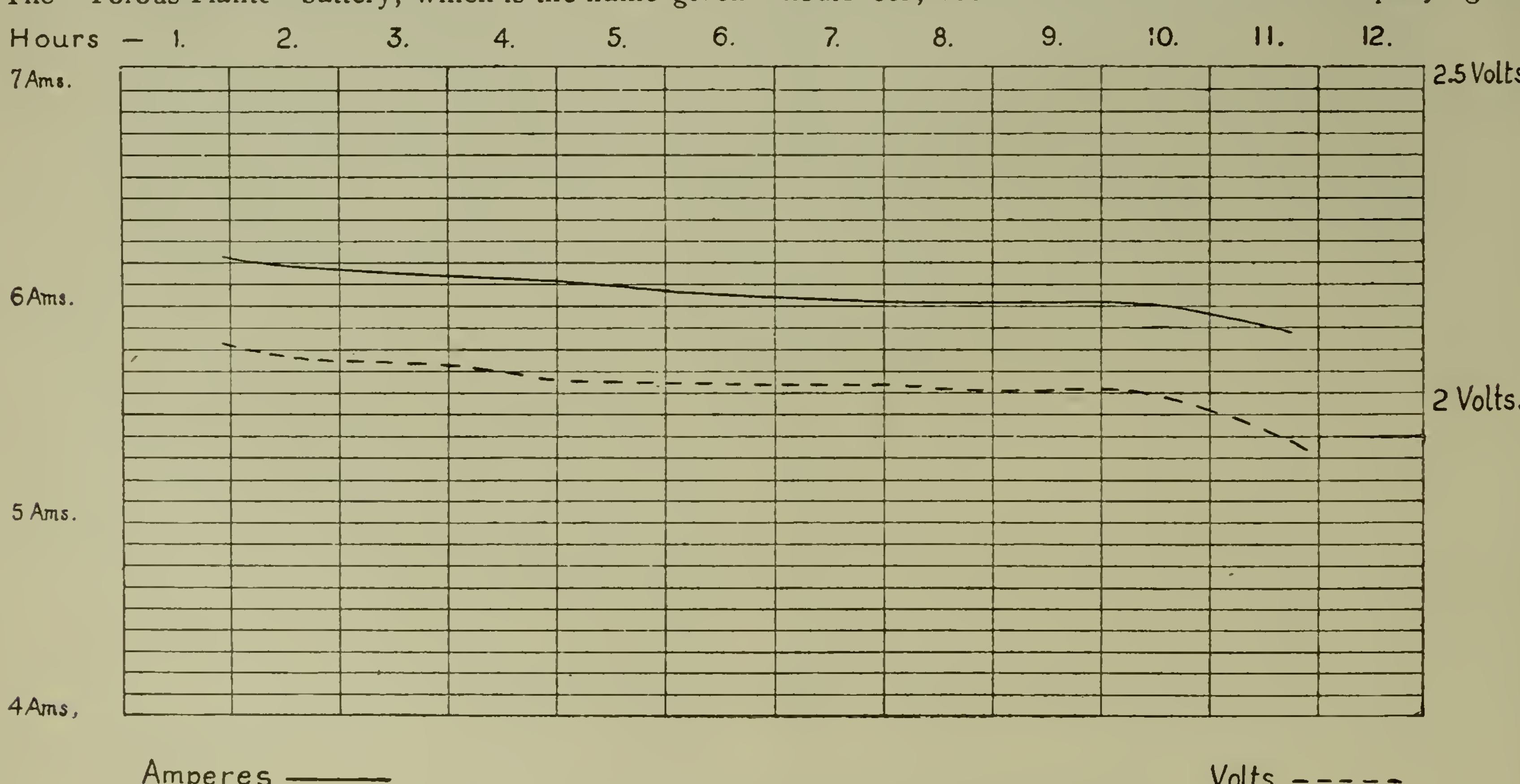
The "Porous-Planté" battery, which is the name given this new cell, is said to be entirely free from the faults of other accumulators, and the process of manufacture is so simple that the cost of obtaining a similar amount of surface to that of thin lead strip electrodes is so small that they can be sold at a price to cause their general adoption.

Each plate consists of one *continuous mass of lead* with a sponge-like formation, which gives a very large surface whether the plate be *thick or thin*. The active material that is formed from the lead by electrolytic action is held securely in the innumerable irregularly shaped cells and corrugations throughout the body of the plate.

The method of making the plates will be briefly described. Pumice-stone is used in a granulated state and is mixed with the lead when the same is in a pasty condition, which it is brought to by heat, and kept in that condition by proper heat regulators until the mass is well kneaded, when it is pressed into a form or mold of the required shape and left for a minute to cool. In the act of mixing the heat expands the air in the pores of the pumice-stone, which expansion causes the multitude of cells to form throughout the lead. An examination of a section of a plate with a microscope will show that for every particle of pumice-stone seen, there are hundreds of thousands of minute cells formed by the tendency of the heated air to force its way out. The porosity of these plates is such that a plate 9x7x½ inches will absorb 5½ ounces of water.

The particles of pumice-stone can be eaten out of the lead by a simple process, if desired, but as there is only 10 per cent. of solid matter in it, and being electrically inert, it makes no difference whether it is left in or is taken out. It is obvious that this method allows of great variations in the porosity, and therefore in the weight of the plates, but it is found that 50 per cent. in bulk of pumice-stone (the weight of the pumice-stone is practically nothing) is a fair average amount to use.

A cross-section view of the plate is shown in one of the illustrations, also a chart of discharge of a 15-pound cell which was formed in 140 hours with a current of one ampere per pound of lead. This is sold as a 50-ampere hours' cell, but an examination of the accompanying chart will show that it gives considerably over that amount.



DISCHARGE CURVE OF A 50-AMPERE-HOUR POROUS PLANTE CELL.

It has been mentioned that plates of this kind can be made either thick or thin, and have an equal amount of porosity.

While the porosity is the same in thick or thin plates, it has been found advisable, after a long series of comparative tests, to discard very thick plates for those ⅛ to ¼ of an inch in thickness. Plates one inch thick, although of the same porosity as the thinner ones, take longer to form, and also have a much lower rate of charge and discharge per pound of lead.

It is obvious that, in special cases, where lightness of weight is of paramount importance, even at the sacrifice of a part of the life of the battery, this can be now obtained with the same high efficiency by reducing the thickness of the plates to the required extent, or increasing the porosity, or both.

For ordinary purposes, where a light battery is desired, it is deemed desirable to have the plates ⅛ of an inch in thickness; and for stationary plants ¼ of an inch in thickness; the former giving the length of life of any other battery, and the latter a *longer* life.

The Standard Storage Battery Co., No. 50 Exchange Place, New York, owns the United States Patents for this invention, which is also patented throughout the world.

It naturally follows, if the above showing is correct, that at least a great stride has been made in obtaining the best form of storing power for traction purposes, where the stored energy is carried, as well as for stationary plants, in the reduction of both weight and cost.

A NEW ELECTRIC CAR HEATER.

The Interior Conduit and Insulation Company of New York have introduced this season an electric car heater which embodies great improvements in this class of apparatus.

A much higher efficiency has been obtained in these heaters over other machines which have heretofore made their appearance, and this economy of operation is by far the most important factor which is considered by any railway company. All the electric energy absorbed by any electric heater is converted into heat units, and it has in consequence been assumed by many that electric heaters are of necessity of equal efficiency, but this is not the case. It is not sufficient merely to create heat, but to utilize it to

NEW ELECTRIC CAR HEATER.

the best advantage as well, and in order to do this, it is imperative that the heat should be distributed and circulated where it is needed, and as fast as it is generated. In many other heaters a large proportion of the heat produced has been non-effective for any useful purpose owing to lack of proper distribution, as most of the air current passes around the coils, leaving the heat dormant. Such machines require from six to twelve amperes at five hundred volts to sufficiently warm the car.

In the heater manufactured by the Interior Conduit and Insulation Company a continual circulation of air is maintained. All the air passes through the coils, and all the heat generated is carried off and distributed into the body of the car, the case of the heater remaining perfectly cool. There is absolutely no waste, and consequently a much higher degree of efficiency is obtained than has hitherto been practicable. These heaters are thoroughly well made, neat in appearance, easily installed, and are amply guaranteed.

STREET RAILWAY PATENTS.*

Among the many perplexing problems that have demanded the attention of some of our Western street railways is the question of "worthless patents," and it being evident to several gentlemen of the street-railway fraternity that an association to handle all matters pertaining to patents, as affecting street railways, would be highly beneficial to all concerned, a committee was appointed at Atlanta to take up the matter and submit a plan of organization.

This committee, working on the lines suggested, has investigated the matter, as far as it has been within their power, looking up facts and matters pertaining thereto, and desire to submit to you the following report for your careful consideration.

The majority of street railways have, at one time or another in their history, been sued for using or making some device, which was an alleged infringement on some patent. These cases were either fought out in the courts or settled by the railway company, rather than go to the expense of court costs and attorney's fees. A large proportion of railways have paid and are now paying royalties, either directly to the patentee or indirectly to the manufacturer (the royalty in the latter case being included in the price of the article paid by the purchaser), on certain articles in use on their systems. These direct royalties are often paid when exacted, to avoid going to the expense of hiring an attorney to look up the patent papers to see if the claimant has a good patent and a valid claim to his royalty. The writer knows this to be the case with the company with which he is connected. The expense of investigating such matters is often more than the amount involved, hence the matter is settled upon the payment of a few hundred dollars The manufacturer should stand the burden of infringement suits, and not the purchaser, and the advantage of an association of this kind would be to influence or compel the claimant to direct his suits against the manufacturer and not the railways. Since the adoption of electricity as a motive power we find that the number of patented articles in use on street railways has increased wonderfully. We are confident that a large number of these patents are worthless and will not "hold water."

Were these alleged patents to be investigated a great number would become common property, on account of the patent feature becoming eliminated, and hence the patentee would be deprived of his royalty and the manufacturer would at once reduce his price in consequence. We do not mean to say that the honest inventor is not entitled to his royalty, provided he has a good, bona-fide invention. It is clearly evident that if the street-railway companies were combined together in an association of this character that the expense to each would be small, while the advantages will be manifold. Another important item will be the assistance of the association in advising its members concerning new inventions of their own employés, whether said articles are patentable, or whether infringements on other inventions; said assistance to be furnished free to said railway companies which are members of the association. This will serve to encourage employés to work out improvements in devices in use on street railways and protect them in their rights. The advantage to the company presenting such new invention will be that they will be permitted to use said device free of royalty.

A great many devices in use on our system are common property at the present time from the fact that the patent has expired, yet how many members of this association know the expiration of the patent limit on a single device in use on their road, and in ignorance of such facts are still paying the same old price?

The idea of such an organization of this kind was prompted by the fact that two similar ones have been in existence for over twenty-four years for the benefit of the

* Report of committee on patents presented at the Convention of the American Street Railway Association, Montreal, October 16, 1895.

steam railroads, and have been highly successful in every detail. One of these associations is located in the East and the other is located in Chicago, and the two include as members all the important railroads of the country and a large number of the smaller roads.

The object of the Western Railroad Association, as stated in its by-laws (from which I quote) is as follows: "The object of this association is the investigation of all patents and improvements affecting the interests of railroad companies, members thereof, and their mutual protection against the unjust and unreasonable claims and demands of patentees and their representatives, and the procuring of other information which may appear to be of value to the association."

We have had several conferences with the general counsel of this association, and he has been very kind in giving us information regarding the working of his association. He also declared that an association of like nature for street railways will be highly beneficial to all concerned, and recommended it. I have with me a copy of their constitution and by-laws, also a copy of their annual report for the year 1894, which is worthy of inspection and a valuable guide to the street-railway interests.

This association is maintained by an annual assessment of its members based on the gross earnings of the several railroads, payable in quarterly instalments. The expenses of the association consist of the salary of an attorney, office help, rent, travelling expenses, court expenses, patent-office books, pamphlets, etc., and is conducted on a more expensive scale than would be necessary in a like organization for street railways. For instance in the beginning our association might not feel like hiring an attorney to give his entire time, but only pay him for actual work, on fixed rates. The expenses for the first year would, of course, be larger in proportion than the following.

The Western Railroad Association have won four-fifths, about, of its suits, and stands all expenses connected with said suits but does not, of course, pay any judgments, the defendant road paying any judgment entered against them. The entire membership, however, obtains the benefit of all such trials. The work performed by the Western Railroad Association in 1894, if done through the regular channels by the roads themselves, would have cost about ten times as much as was paid to the association during the year for same. It is the practice of the roads belonging to the association not to put on any new device without first referring same to the association for advice. The number of suits against the railroads have been reduced very materially since this association was started, and $60,000,000 in judgments were defeated in one year. One of the large trunk lines paid $10,000 for using a patented article that was afterwards found to be worthless so far as the patent feature was concerned. Since then they refer all such matters to the Western Railroad Association before adopting devices or settling claims of this character.

A certain street railway, so we are informed, paid $1,500 to prevent suit on an alleged infringement, and the patent was worthless, as was afterwards learned; this might have been saved if an organization of this kind was in existence.

One of the roads represented at this convention is negotiating at the present time with two different firms on matters that could properly be referred to an association of this character. One of the articles in question is used by all electric railways in large quantities, and the inventor is receiving large royalties from the manufacturer. A patent attorney informed the road that he thought the patent worthless, but it would take a law suit to convince the manufacturer. If this be true, this road would have saved ten to fifteen thousand dollars by having this matter investigated at the start, saying nothing about what others would have saved that are using this article today and are paying the manufacturer whatever he chooses to ask.

The other device referred to can be manufactured by the companies themselves, which is also true of the former article, and has recently come into use and is being used by several companies in large quantities. The patentee is willing that the street-car companies manufacture said devices themselves, providing they will pay him a large sum of money for the privilege of so doing—the company already having paid him many thousands of dollars for furnishing said article up to this time. We understand that a similar device has been used by another manufacturer in the past, though for some reason it was not patented. This being true the patent is worthless, and his demand for royalty would fall flat were the same taken to the courts for settlement. These two matters are still unsettled and are very important to the roads in question, as well as to others who are members of this association and are using the same device.

Another road, a few years ago, paid over $1,000 in royalties on a truck that was invented by a former employé while working for the road, simply to prevent a law suit, as it would cost more than this amount to have defended the suit. Other cases could be mentioned, but I will not take up your valuable time.

Another important feature in this connection would be the collecting of different patented devices in use on our system, the same to be preserved and open to the inspection at all times of the members of the association. In short, we might sum up the most important points, as follows:

1. Lessening total expenses in fighting patent suits, etc., as a suit affecting one road would affect all.
2. Uniformity of action.
3. Additional safety in putting on new devices.
4. Greater facility in defending suits.
5. Decrease in number of suits and claims on account of the existence of such an association.
6. Advantage in settling suits.
7. Contending and avoiding unfair and unjust royalties.
8. Reduction of prices on all patented articles.
9. By members refusing to buy articles where suits are brought against any of its members, thus shifting suits to the manufacturer.
10. The dissemination of valuable information to its members of all matters relative to any suit, etc., in which one or more members are the interested parties.
11. Advantage of employés of street-railway companies in getting valuable information and assistance on their own inventions, whether patentable or infringement of other devices, without cost to said railway or employé.
12. The acquiring of a full and authentic report of all devices, that are commonly found in use on all street railways, such as fare registers, brakes, rail bonds and numerous other articles, giving the expiration of all such patents, opinion on the validity of same, etc., and to be followed up by like reports from time to time, giving list and opinion of new patents, and list of expired patents.
13. The acquiring of models, devices, etc., for permanent exhibition.

In conclusion, your committee desires to express two plans of carrying into effect the above scheme, and recommends that the association adopt one of the following methods:

1. Provided the members vote to increase the scope of the association, we recommend that a bureau be established to handle all matters pertaining to patents as outlined in this report.

2. Provided it is not deemed best to enlarge the scope of the association at this time, we recommend that the association pass a resolution providing: That the annual dues be divided into two classes, regular and special (or if necessary the by-laws be amended to that effect). That all members be required to pay the regular dues as already provided in the by-laws and that it be optional with members to pay the additional or special dues. That members paying special dues will be entitled to all the benefits to be derived through the agency of a patent bureau to be established under the direct control of the American Street-Railway Association. That the special dues be based upon the gross earnings of the several roads. That the

association elect a board of control consisting of three members, whose term shall expire in one, two and three years respectively, and hereafter electing one member each year. Said board of control to be established and carry on a patent bureau as outlined in this paper, with the funds paid into the A. S. R. A. as "special dues." Provided further that no street-railway company be entitled to the benefits and privileges of said patent bureau except they are regular members of the A S. R. A.

Respectfully submitted,
F. R. Greene } Committee.
J. W. McNamara, }

THE INCANDESCENT LIGHT AT HOME.

BY NEWTON HARRISON.

It seems highly possible that, in cases where expense is of no consequence in comparison with the derived comfort and convenience, the primary battery may take a more prominent position than was ever expected.

Economy is the offset against the introduction of an uncountable number of schemes for the illumination of homes, yet there is no greater pleasure than the satisfaction of having individual control of that feature in domestic life. The early days in which our ancestors depended upon the flickering light of a huge log fire for evening illumination has passed away; the candle and oil lamp have practically followed. There are but two systems still extant—gas and electricity. To choose in such a way as to satisfy the instinct of comfort and economy is the object of most men. Unless the home be of large size, such that the installation of a plant would mean a small station system, any tendency toward primary batteries would be treated with deserved contempt. The old song would arise from all sides: "zinc must be consumed, acids must be used; the whole thing is too troublesome and expensive." There is no denial of a fact so well known, yet from another standpoint the problem is not so overshadowed with expense.

There are batteries in the market to day which require but a minimum of attention. The most popular type is the bichromate cell, which in the Fuller form is greatly used because of its constancy, not only here but in France, for telegraphic service.

There then remains the blue-stone cell, with its inevitable zinc and copper sulphate and corresponding elements. Of course some that have dabbled in the subject have a certain affection for specal combinations of their own design—but of this little need be said. The main object of this reference to so old a means of generating electricity is for the purpose of calling into view the lamp itself, which thus far has met with but little consideration. There are a variety of lamps of various wattages. The 4-watt lamp and 3-watt seem to have almost owned the field for a most definite reason. By the use of lamps of this description regulation was not required to so fine a degree as would otherwise be called for, and the life of the lamp is greater. A 4-watt lamp requires 64 watts for 16 c.-p.; a 3-watt lamp 48; were lamps used of one-half the watts per candle-power, the consumption of energy would become likewise decreased to one-half. There is, therefore, a new standpoint to be assumed when the application of batteries to home lighting is considered. If lamps are installed for temporary use and a 1 or 1½-watt lamp per c. p. is used, the call made upon the battery is but little for the amount of light produced.

The regulation is of the best order, and for that reason the safety of the lamp is more assured. The consumption of from 8 to 16 watts for the production of 8 c. p. is tempting even to those fully aware of the expense of dissolving zinc. In this respect, therefore, the use of low-watt lamps is—although to a great extent prohibitory for station use—within the limits of practical use for small primary battery installations at home. The requirements, of course, may be well understood from the start. A cell with a good depolarizer and a self-amalgamating zinc, and a relay cell to keep the pressure constant when it falls, due to constant use in the others. It is practical to take four bichromate cells with a large carbon surface and keep it lighted for eight hours steadily a one-watt, eight-volt, eight-candle-power lamp. The great convenience of a light like this for occasional use, and its easy adaptability to dark corners of a house, makes it when once introduced almost indispensable. A cell composed of outer jar and porous pot is sometimes employed, as follows:

For carbon sol.	Porous pot; 2 volumes sulph. acid. " 3 " water. nitrate soda to excess.
For zinc sol.	water, 19 parts. sulph. acid, 1 part.

THE AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION.

The fifth annual meeting of The American Electro-Therapeutic Association was held in Toronto, Canada, on Tuesday, Wednesday and Thursday, September third, fourth and fifth, 1895. The sessions were well attended.

The president read his address on "Electro-Therapeutics in General Practice." This was followed by the reading of the reports of the committees on scientific questions. Then followed the reading of the papers in their regular order.

In the evening the members were invited by the president of the Toronto Street Railway to a ride around the city in his private car. Mr. James Gunn, the superintendent, showed the members the power house of the company.

The second day's programme was carried out as per schedule. The executive session was held in the afternoon; the election resulted in the selection of the following officers for the year 1895-1896, viz.: President, Dr. Robert Newman, of New York City. Vice-presidents, Dr. Holford Walker, of Toronto, Canada, Dr. D. B D. Beaver, of Reading, Pa.; treasurer, Dr. R. J. Nunn, of Savannah, Ga.; secretary, Dr. Emil Heuel, of New York City; executive council, Dr. W. J. Morton, of New York City; Dr. G. Betton Massey, of Philadelphia, Pa.; Dr. W. J. Herdman, of Ann Arbor, Mich.; Dr. Emil Heuel, of New York City; Dr. Wendell C. Phillips, of New York City.

The third day was devoted to the transaction of unfinished business.

In the evening the members were the guests at dinner of the Board of Directors of the Toronto Exposition. This was followed by a visit to the Fall of Lucknow, and the pyrotechnic exhibition.

The president has appointed the following committees for the year 1895-96, viz.:

Committee on induction coils and alternators, Dr. A. H. Goelet, chairman; Dr. G. Betton Massey, Mr. A. E. Kennelly. Committee on meters, Dr. M. A. Cleaves, chairman; Dr. O. B. Douglass, Mr. W. J. Jenks. Committee on static machines and condensers, Dr. W. J. Morton, chairman; Dr. W. J. Herdman, Dr. J. H. Kellog. Committee on constant generators and controllers, Dr. W. J. Herdman, chairman; Dr. Robert Newman, Mr. R. G. Brown. Committee on electrodes, Dr. C. R. Dickson, chairman; Dr. Lucy Hall-Brown, Dr. E. C. Riggs. Committee on electric-light apparatus for diagnosis and therapy, Dr. J. H. Kellogg, chairman; Dr. E. C. Riggs, Mr. J. J. Carty.

It was decided to hold the next. the sixth annual meeting of the association, in Boston, Mass., in the latter part of September, 1896.

CARBORUNDUM AT NIAGARA FALLS.

A press despatch from Niagara Falls, on October 19, announces that one of the furnaces of the Carborundum Company is now in operation, the electric current being obtained from the Cataract Company's power house. A

2,200-volt current comes into the carborundum factory, which current is transformed into one of 7,000 amperes at a pressure of 185 volts. The transformer in which this conversion takes place is said to be the largest in the world. The furnaces in which carborundum is made are built of brick, and are each about 15 feet long, seven feet wide and six feet high. In the centre of each end wall of the furnace is a large bronze plate, to which are connected four large copper cables, carrying the current from the transformer to the furnace. Connected to each of the bronze plates are 60 carbon rods, each about two feet long and three inches in diameter. These rods, which project through the walls, form the terminals of the conductors. The furnace is charged with the proper substance (sand, salt, coke and sawdust), and through the centre of the mixture a core, formed of fine grains of coke, is built up, which serves as a conductor of high resistance between the terminals. When the current is turned on it raises the contents of the furnace to an enormously high temperature, at which the chemical change that produces carborundum takes place.

Carborundum was discovered in 1891 by Edward G. Acheson, president of the Carborundum Company. On account of the exceeding hardness of the substance it is a far more valuable material than either emery or corundum as an abrasive and cutting substance, and does work much quicker than either.

WASHINGTON NOTES.

The American Graphophone Company of this city has filed suit in the United States Circuit Court for the District of New Jersey, against John R. Hardin, receiver of the North American Phonograph Company, Newark, N. J., asking for an injunction and accounting, because of alleged infringements of the graphophone patents in the sale of the Edison phonograph and supplies.

The work of equipping the "F" Street branch of the Metropolitan Railroad has been begun. The Connett underground system will be used, and the same system of construction that characterized the Ninth Street Line, which is running so successfully, will be followed in every particular. The contractor, Edward Saxton, says that the new track will be put down at the rate of from 600 to 1000 feet per day.

The grading on the Washington and Maryland electric line, with which the Eckington line will have connection, has been almost completed to the District of Columbia, and the road will soon be ready for the laying of track and ballasting.

Following the completion of the "F" Street line, work will be begun on both the Belt and Eckington lines as soon as sufficient workmen can be secured.

The citizens of Mount Pleasant are agitating the question of street railways, and have applied to the commissioners to recommend a suitable plan. The Metropolitan Traction Company and the Eckington road all have plans to offer.

It is now settled that the new electric road between Washington and Baltimore will touch Laurel, Md., and it is expected that a power house will be erected in that vicinity.

The Maryland and Washington Railroad Company (the line mentioned above) has filed a mortgage in Washington on all its property, rights and franchises, for the sum of $430,000, in favor of the Central Trust Company of New York. The mortgage is to run fifty years, with interest at five per cent. per annum, payable semi-annually. This money will be used in the construction of the road.

It has been rumored that the Capital Traction Company, an amalgamation of the Washington and Georgetown and Rock Creek Railroads, were about to buy the Kensington line and equip that branch with a double track, but at present it would seem to be without foundation. But several improvements are contemplated on the Kensington line; among others a new station and car house at Kensington, and the heating of the cars by electricity.

The Cheasapeake and Ohio Telephone Company are extending their line from Garrett Park to Kensington; connections will also be made with Forest Glen and Chevy Chase; this will give all the above-named points direct connection with Washington.

Kensington, Md., is making arrangements with the Chevy Chase Electric road officials looking to the lighting of that town by electricity.

The Metropolitan Railroad Company has purchased nine lots of land on the north side of East Capitol Street for the sum of $14,000. This will be used for its new power house when the underground system is completed.

A. F. T.

Financial.—The Brooklyn Traction Railroad reports gross earnings for September of $102,907, a decrease of $562 as compared with the same month of last year, and net $41,037, a decrease of $1,534.

New York Notes.

Office of the Electrical Age,
World Building, New York,
October 28, 1895.

W. J. Clark, consulting electrical engineer, of Trenton, Canada, is in the city investigating various electrical specialties.

The Crodus Battery Co. is exhibiting its new dental outfit in the new office of the Electric Boat Co., Room 209, No. 136 Liberty street. The outfit consists of a small, finely-made motor, with automatic attachments, flexible shaft and drill, and a foot regulator for three speeds. The motor is suspended from a bracket.

The various Maritime Associations of New York have submitted a proposition to the National Lighthouse Board looking to the establishment of a lightship off Fire Island, on the Long Island coast. Communication is to be maintained by telephone between the lightship and land for the purpose of reporting the sighting of vessels. A submarine cable will be laid for the telephone service.

The Twenty-third Street Branch of the Young Men's Christian Association of this city is very fortunate in securing as instructor of electrical engineering in its educational department, Frederick M. Pedersen, E. E., assistant engineer of the Crocker-Wheeler Electric Company. A course of fifty lectures will be given on Wednesday and Saturday evenings throughout the winter. The lectures will be grouped under four general divisions as follows: 1. Introduction; fundamental units. 2. Sources of electricity. 3. Electrical measurements. 4. Chief commercial applications of electricity. All young men interested in such a course may obtain full information by applying in person, or by letter, to the Educational Director, No. 52, East 23d Street, New York City.

Bagnall & Hilles, who went out from New York eight years ago to carry on a general electrical supply business at Yokahama, with an office at 15 Cortlandt street, made an assignment last week without preference to James W. Godfrey. The partners are Albert J. Bagnall and Ladonis D. Hilles. Both reside in Yokahama, but Mr. Bagnall is in New York now. Mr. Godfrey said that the failure is principally due to the shrinkage in silver and to the cost of exchange whereby they made heavy losses on contracts, amounting probably to $75,000. The liabilities of the firm are not yet known, and are due chiefly in this city and England for supplies which they purchased. The assets are all in Japan. Mr. Godfrey thought the firm would be able to make a satisfactory settlement with their creditors here.

W. T. H.

Street Railway Notes.

Cleveland, O.—The Cuyahoga Suburban Railway Co. is ready to accept the franchise for its South End Road, which was recommended by the Board of Control to the City Council. Crosby Thompson, secretary of the company.

Detroit, Mich.—Citizens Street Railway Co. will probably double-track all of Trumble Avenue.

Ottawa, Ont.—Application is being made for the incorporation of the Canada Electric Railway and Power Co. to build an electric railway from Montreal to Windsor, Ont., via Brockville, Kingston, Dolleville, Toronto and London, with power to build branch lines to Suspension Bridge and elsewhere.

Owosso, Mich.—City Council granted a thirty-year franchise to the Owosso and Corunna Traction Co. The road will be extended over several streets in Owosso and new cars and electrical equipments used. Work will be begun at once.

Watkins, N. Y.—The directors of the Watkins & Havana Railroad Company have decided to continue the proposed electric road from Havana to Horseheads, to connect with the Elmira & Horseheads Road.

Allegan, Mich.—Saugatuck, Holland & Southeastern Railway will build electric road from Otsego to Holland. About $75,000 has already been expended in the work.

Jeffersonville, Ind.—Mr. Williams, for a southern syndicate, has purchased the Ohio Falls Street Car Co., of this city, and will at once convert it into an electric line.

Kansas City, Kan.—Kansas City and Leavenworth Railway Co. Incorporated to build an electric line between those two cities. Capital, $500,000. Incorporators, H. A. Banker, H. A. Keefer, of Kansas City; James C. Stone, Jr., John Hannon and others.

St. Catherines, Ont.—The city council have passed a resolution asking the government to grant letters-patent to the Lincoln Street Railway Traction and Light Company. It is supposed to be the intention of the company to convert the Niagara Central Railway into an electric road and extend it to Beamsville, there to connect with the H. G. and B. line. The parties asking incorporation are Messrs. William Wilson, George Palmer, R. H. Hill, H. A. King, George E. Patterson and Dr. Oille.

St. Thomas, Ont.—The directors of the St. Thomas Street Railway Co., last week, went over the proposed routes of the electric railway with a committee of the city council. It is hoped to commence construction in the near future.

Possible Contracts.

New York City.—Emma J. Kellar, 2117 Fifth avenue, will erect a seven-story brick warehouse at 117 Walker street, to cost $20,000. Architect George Chappel, 24 State street..

Rome, N. Y.—Notice is given that sealed proposals for lighting the streets of Rome with electric lights will be received until Nov. 18, 5 p. m. Proposals must be for one, three or six years, for 150 arc lights, more or less, of 2,000 candle-power, to be lighted every night from sunset to sunrise. A preliminary bond of $2,000 must accompany each proposal. The right is reserved. For further particulars address Alderman John F. Atkinson, Chairman of Lamp Committee.

Rockville Center, L. I., N. Y.—A petition has been presented to the Board of Trustees of this village for a franchise for electric lighting privileges. The petition asks that the privilege be granted to the Town of Hempstead Electric Light and Power Co,

New York City.—There is a prospect that within a couple of years the New York Chamber of Commerce may occupy a building of its own. The matter is in charge of the Chamber's Charter Committee on Real Estate, composed of John S. Kennedy, Samuel D. Babcock, James M. Constable, A. D. Juilliard, with President Alexander E. Orr, chairman *ex-officio.*

New York City.—Harry C. Raynor, 217 West 125th St., will erect a two-story brick club-room and stores on north side of 125th Street, west of Fifth Avenue, to cost $11,000.

Pittsburgh, Pa.—Masonic County Club contemplates the erection of a club-house. Committee in charge of the affair is composed of Eli Edmundson, Jr., M. Mawhinney, and E. R. Dowler.

New York City.—The members of the Washington Irving Union will probably erect a club-house in the vicinity of 19th Street, between Madison and 5th Avenues.

New York City.—The property at 534 Broadway is reported sold by the heirs of Benjamin H Lilly to a firm of builders, who will demolish the present building when they get possession, February 1, and erect a modern business structure on site.

New York City.—The Barrington Building Association will erect a two-story building northwest corner of Broadway and 49th Street, for its own occupancy.

Architect A. V. Porter, 621 Broadway, has prepared plans for a brick storage house, Lenox Avenue and 147th street, for the Metropolitan Street Railway. Cost, $20,000.

New York City.—The American Society of Civil Engineers have purchased a plot on 57th street for a club-house.

Brooklyn, N. Y.—President Rossiter of the Brooklyn Traction Co. gave out the plans, October 17, for the erection of a new depot, corner Box and Clay Streets, Eastern District.

Hollister, Cal —A contract for the construction of a $50,000 system of water-works, pipe water for domestic use, twelve miles from Pescadero Creek to Hollister. A fall of 700 feet will develop electric current for lighting and power sufficient for large manufacturing plant. The improvements are being made for the Hollister Water Co., which will also construct an immense reservoir on Park Hill.

Ithaca, N. Y.—The erection of a catholic church at Ithaca is contemplated. Cost, $50,000.

Brooklyn, N. Y.—A two-story brick telephone exchange will be erected on Hamilton Avenue, by the New York and New Jersey Telephone Co.

Sayre, Pa.—A large addition is to be made to the Waverly, Sayre and Athens Traction Co.'s power house.

New York City—The New York Athletic Club will erect a nine-story club house, corner of 6th avenue and West 58th street. Architect, Wm. A. Cable, 68 Broad street.

New York City.—H. Herrmann, 230 East 15th street, will erect a six-story brick store and lofts at 157 Elizabeth street. Cost, $18,000. Architect, Charles Renx, 153 4th avenue.

Newark, N. J.—There is a project now before the Board of Trade to erect a hotel. Major Samuel Klotz, chairman of committee on hotel.

Jersey City, N. J.—The corner-stone of public school No. 9, at Brunswick and Wayne streets, has been laid.

Syracuse, N. Y.—Oneida Electric Railway Company will construct an electric road to Sylvan Beach, on Oneida Lake.

Chicago, Ill.—The Illinois Central Railroad proposes to operate its suburban trains by electricity. No contracts have as yet been let.

Trenton, N. J,—The new electric light plant will probably be located at the foot of Farnsworth avenue. The incorporators of the company are James S. Gilbert, George

G. Gilbert, Amos L. Lyttle, Thomas Dennett and Wm. C. Steele. Capital stock, $50,000.

Bridgeport, Conn.—The power house, barn and stables of the Westport and Saugatuck Street-Railway Co. were burned a few days ago.

Buffalo, N. Y.—Architect H. H. Little is preparing plans for the new six-story building of the Buffalo Drug, Paint and Glass Co., to be erected on Swan street, to cost $300,000.

Syracuse, N. Y.—Work on the new train shed of the New York Central will be begun as soon as the tracks are in place.

Rochester, N. Y.—The officials of the Lehigh Valley Railroad are considering the advisability of erecting a new station in Rochester.

Cleveland, O.—The Hollenden Hotel Co. has secured plans for two additional stories for the Hollenden Hotel; C. H. Buckley, secretary.

Barrie, Ont.—The Barrie and Allandale Electric Street Railway Co. has been incorporated, with a capital stock of $50,000.

Rat Portage, Ont.—Mr. Rutherford, chief engineer of the Canadian General Electric Co., of Toronto, recently made an inspection of the electrical possibilities of this place, visiting the Keewatin Power Company's dam, the Citizens' electric power-house, the reduction works, for which an electrical transmission plant of 100 horse-power to run the mill is wanted, and the Sultana mine.

New Corporations.

Cleveland, O—Horton Electric Obtunding Company has been incorporated by W. B. Horton, M. C. Horton, John J. Shipherd, E. M. Radder and M. H. Solloway. Capital stock, $300,000.

Middletown, N. Y.—McBair Electric Heating Co. has been incorporated by Henry C McBair, Thos. E Hayes, Harry M. Hayes. Capital stock, $2,000.

Wildwood, N. J.—Five Mile Beach Electric Light, Heat and Power Company has been incorporated by Frank E. Smith, Chas. A. J. Johnson, John L. Busk, Holly Beach, N. J.; Augustus Hilton, Geo. J. Ent, Anglesea, N J; Wilson Banks, Wildwood; B. F. Bailey, Philadelphia, Pa. Capital stock, $50,000.

Ironton, Ohio.—Enclosed Carbon Lamp Co. has been incorporated by J. R. Cook, E. W. Bixby, C. H. Moore and J. W. Slater, to manufacture electrical machinery supplies, etc. Capital stock, $50,000.

Denver, Col—Jones-Waldo Heat and Light Co. has been incorporated by Harvey S. Waldo, Chas. A. Waldo, Hiram W. Jones. Capital stock, $10,000.

Bay City, Mich.—Doran Lighting Co. has been incorporated by Robert L Doran, John G. Meyer, Reuben G. Enger. Capital stock, $28,000.

Baltimore, Md—The Lucas Electric Construction Co., incorporated to deal in all kinds of electrical supplies. Capital, 2,000. Incorporators, J. Clarence Lucas, Ridgaway Moreman, Charles E. Burgan, William D. Wilson, Jr. and Wm. M. Burgan.

Lafayette, Col.—Lafayette Machine Electric Light and Power Co. Incorporated. Capital, $100,000. J. S. Spencer, F. E. Taggart and H. J. Mayham.

Philadelphia, Pa—Philadelphia Electric Storage Battery Renting Co. Capital $300,000.

Waterloo, Ia—The Cedar Valley Telephone Co., of Waterloo, has filed articles of incorporation. Capital, $100,000.

Newcomb, N. Y.—The North Creek, Newcomb & Long Lake Telephone Company, incorporated Capital, $3,000. Directors, John Anderson, jr., of Newcomb; John Donnelly, of Olmsteadville, and P. Monahan, of Glens Falls.

Lincoln, Ill.—The Logan County Electric Light Company. Capital, $10,000. John W. Lutz, D. H. Martz.

Xenia, Ohio.—The Rapid Transit Company has been incorporated by ex-Congressman John Little, S. M. Allison, Marcus Shoup and others, to build an electric railway. Capital stock, $300,000.

Corry, Pa.—Corry City Electric Street-Railway Company has been incorporated, with R. N. Seaver, president. Capital stock, $18,000.

Saco, Me.—Gray's Electric Railway Supply Co., incorporated to manufacture rails, cars, apparatus in electric and other railways. Capital, $500,000. Pres., Robert Johnson; Treas., James R. Powers, both of Boston, Mass.

Dansville, N. Y.—Dansville Gas and Electric Light Co. Capital, $25,000. Directors, W. W. Cramer, W. T. Spinning, Charles H. Rowe and others, of Dansville.

Ottawa, Ont.—The Ottawa Auer Light Co. has applied to the Toronto government for incorporation, the amount of the capital stock to be $30,000. The company proposes to erect and operate works in this city for generating and producing electric light and heat for illuminating and heating purposes, and among the promoters are Mr. Granger, manufacturer, of Montreal; W. S. Thompson, of Toronto, and W. T. Andrews, of Hamilton.

Telephone Notes.

Norfolk, Conn.—Norfolk Mutual Telephone Co. has been organized at Norfolk as a corporation without capital. George M. Coy, of Milford, is secretary.

Brockton, Mass—Southern Massachusetts Telephone Co. will accept the franchise for the building and obtaining of underground conduits for its wires.

Portland, Ore.—Willimette Valley Telephone Co. Incorporated. Capital, $5,000. Incorporators, John Bradley, Alexander Smeek and John W. Shafford.

New York City.—Smith-Vassar Telephone Co. Incorporated to manufacture and operate a signal and call station for telephone and telegraph purposes. Capital, $1 000,000. Directors, Frank S. Pusey, of Council Bluffs, Ia; Wm. L Beardsley, Frederick J. Winston, Joseph F. Darling, Augustus W. Hand, Charles W. Deland, 141 Reade street, and Edward Schmidt, of New York City.

East Liverpool, O.—Spencer F. Quick of Steubenville is in this city organizing a company of East Liverpool and Wellsville capital, with which to extend the lines of the Phœnix Telephone Co., which is now putting up its lines in Steubenville.

A test was made recently in Ravenna, Ohio, of new telephone apparatus of W. H. Butler, of that place. The object of the test was to illustrate the practicability of placing telephones in the homes of the various members of the fire department and in connection therewith a number of iron street boxes, in localities where there are few telephones located. The entire proposed system can be connected at once by simply pressing a lever, thus giving every fireman instantaneous notice of the exact location of the fire, in case of an alarm. Conversation from Kent, O., was heard all over the office of the Mayor of Ravenna, but the most interesting feature of the test was the reproduction of the Kent conversation on one of Mr. Butler's new instruments which was hung on the opposite wall. The reproduced conversation was very distinct, although there was a space of 12 feet between the two instruments. Mr. Butler's new transmitter employs adjustable carbon balls, and is said to be the only instrument in which the carbon balls are adjustable. A company has been organized, and upwards of 110 instruments have been subscribed for in Kent and Ravenna.

TELEPHONE PATENTS ISSUED OCTOBER 22, 1895.

TELEPHONE RECEIVER SUPPORT.—Isidor J. Kusel, St. Louis, Mo. (No. 548,210.)

TELEPHONE EXCHANGE APPARATUS.—Charles E. Scribner, Chicago, Ill. (No. 548,227.)

APPARATUS FOR TELEPHONE SWITCHBOARDS.—Charles E. Scribner, Chicago, Ill. (No. 548,228.)

KEYBOARD APPARATUS FOR TELEPHONE SWITCHBOARDS.—Charles E. Scribner, Chicago, Ill. (No. 548,229.)

PECKHAM TRUCKS IN PHILADELPHIA.

The following correspondence is self-explanatory:

THE ELECTRICAL AGE, World Building, New York.

GENTLEMEN:—Referring to the article which appeared in a so-called electrical journal distributed at the recent Railway Convention at Montreal, which referred to our trucks in use on the People's Passenger Railway of Philadelphia, I beg to call your attention to the enclosed letter, received today from the president of the People's Passenger Railway Co., regarding the article in question, and which explains itself.

This letter is our reply to the article mentioned, and we will thank you to give it a place in your columns.

Very truly yours,

E. PECKHAM, pt.

PEOPLE'S PASSENGER RAILWAY COMPANY,
EIGHTH AND DAUPHIN STREETS,
PHILADELPHIA, Oct. 22, 1895.

WM. H. SHELMERDINE, Pres.
D. C. GOLDEN, Sec. and Treas.
J. R. BEETEM, Gen. Mgr.

PECKHAM MOTOR TRUCK AND WHEEL CO., Kingston, N. Y.

DEAR SIRS:—We have seen the notice in *Electricity* relative to your sales to this company and our action in regard to the Brill trucks. The statement is made in *Electricity* that "At the end of ten (10) months not one dollar had been spent for repairs on the Brill trucks, and the Peckham trucks had cost this company nearly their original purchase price in rebuilding." *The situation is exactly reverse.* That is to say, the Peckham trucks cost us comparatively nothing, while the Brill trucks proved much more expensive in maintenance. Our second and third orders for your trucks—*amounting to 490*—were placed by us after carefully comparing them in service with the Brill and other trucks in use in Philadelphia, believing *your trucks to be the best in use*, and we are still of that opinion. We write you this in justice to the construction of your work and our experience with your trucks under severe conditions, as we think it is but justice to you.

Truly yours,
(Signed) WM. H. SHELMERDINE,
President.

ECONOMIC MOTORS AND DYNAMOS.

Bidstrup & Graham, 32 Frankfort street, New York, manufacturers of the Economic dynamos and motors described in THE ELECTRICAL AGE a few weeks ago, are doing a good trade in these machines. They have just installed a 10-H. P. motor for David Moffitt & Co., 9 Jacob street, New York, which is used for running elevators, exhaust fans, jacks for pressing hides, and other power work. The following letter testifies to the merits of the Economic motor:

THE EMPIRE STAY CO., 394 CANAL ST., N. Y.

BIDSTRUP & GRAHAM:

Gentlemen—In reply to yours of the 17th inst., would say the two-H. P. motor you installed for us this spring has given us entire satisfaction. It runs as smooth and nice as the day it was put in. The commutator shows no signs of wear yet, and the self-adjusting brushes seem to be perfection.

Very truly yours,
THE EMPIRE STAY CO.

SUIT AGAINST THE GENERAL ELECTRIC COMPANY.

A dispatch from Watertown, N. Y., says Charles Cohen, an Englishman who recently located in that city in the real estate business, has commenced a suit against the General Electric Company of Schenectady for $200,000, alleged to be due him as commission and for breach of contract in connection with his services for the company in electric power and electric lighting in the gold mining districts of South Africa.

Trade Notes.

We have received from Mr. Chas. Wirt, corner Ludlow and 31st Streets, Philadelphia, Pa., a copy of a catalogue of the Wirt brush, which contains practical information interesting to engineers, drawn from an extended experience and intimate acquaintance with the practical provisions under which dynamos are worked.

The Forest City Electric Co., Cleveland, Ohio, has just issued a very artistically designed catalogue of its celebrated roll drop commutator bars. The manufacture of these bars is described. Mr. J. C. Dolph, 126 Liberty street, New York, is the eastern manager for the Forest City Electric Co.

ELECTRICAL and STREET RAILWAY PATENTS

Issued October 22, 1895.

548,173. Life-Guard for Street-Cars. William Black, New York, N. Y., assignor of eleven-twentieths to Edward Hassett, same place, and John F. Couch, Brooklyn, N.Y. Filed Apr. 14, 1894.

548,210. Telephone-Receiver Support. Isidor J. Kusel, St. Louis, Mo. Filed Feb. 18, 1895.

548,227. Telephone-Exchange Apparatus. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Mar. 5, 1892.

548,228. Apparatus for Telephone-Switchboards. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Feb. 28, 1895.

548,229. Keyboard Apparatus for Telephone-Switchboards. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Feb. 7, 1893.

548,265. Hydrostatic Electric Amalgamator. James D. McKinnon, Portland, Oreg. Filed Dec. 14, 1894.

548,266. Automatic Switch for Electric Transformers. Anthony G. New, London, and Arthur J. Mayne, Woking, England, and Richard N. Lucas, Galway, Ireland. Filed June 25, 1894. Patented in England, June 1, 1892, No. 10,451; in France, Mar. 13, 1893, No. 228,582, and in Germany, Apr. 19, 1893, No. 74,411.

548,280. Electric Stop Mechanism. William M. Wood and James C. Miller, Elmira, N. Y. Filed June 7, 1894.

548,282. Electromechanical Lock. William W. Alexander, Kansas City, Mo., assignor to the Gill-Alexander Electric Manufacturing Company, same place. Filed Nov. 15, 1889.

548,286. Car-Fender. John Balmore, New York, N. Y., assignor of one-half to Edward E. Gold, same place. Filed Aug. 28, 1893.

548,300. Car-Fender. Lawrence Dulligan, Rochester, N. Y. Filed July 31, 1895.

548,339. Fender for Street-Railway Cars. Henry Wilson, Philadelphia, Pa. Filed July 11, 1895.

548,369. Electric Desk-Light. Walter R. Kinsman, Arlington, N. J., assignor to Thomas I. McLeod, New York, N. Y. Filed Oct. 14, 1893.

548,371. Electric Locomotive. Walter H. Knight, New York, N. Y. Filed June 15, 1888.

548,388. Regulating Electric Motors. William B. Potter, Schenectady, N. Y., assignor to the General Electric Company, of New York. Filed July 22, 1895.

548,389. Three-Wire Electric Railway. William B. Potter, Schenectady, N. Y., assignor to the General Electric Company, of New York. Filed Aug. 8, 1895.

548,396. Electric Cigar-Lighter. Friedrich W. Schindler-Jenn, Kennelbach, Austria Hungary. Filed Feb. 19, 1894. Patented in Austria-Hungary, June 7, 1893, No. 31,370 and No. 52,390; in Switzerland, June 16, 1893, No. 6,829; in France, Jan. 19, 1894, No. 235,637; in Belgium, Feb. 1, 1894, No. 108,351, and in Italy, Mar. 31, 1894, CXXVII, 35,706.

548,401. Electric Motor. Imle E. Storey, Hornellsville, N. Y., assignor to the Storey Electric Drill and Power Company, of Colorado. Filed Jan. 28, 1893.

548,402. Electric Motor. Imle E. Storey, Hornellsville, N. Y., assignor to the Storey Electric Drill and Power Company, of Colorado. Filed Jan. 28, 1893.

548,406. Dynamo-Electric Machine. Elihu Thomson, Swampscott, Mass., assignor to the General Electric Company, of New York. Filed Mar. 29, 1895.

548,413. Electric-Arc Lamp. Thomas E. Adams, Cleveland, Ohio, assignor to the Adams-Bagnall Electric Company, same place. Filed July 8, 1895.

548,414. Electric-Arc Lamp. Thomas E. Adams, Cleveland, Ohio, assignor to the Adams-Bagnall Electric Company, same place. Filed July 10, 1895.

548,415. Dry Battery. Frank M. Archer, New York, N. Y., assignor to Siegfried Silberberg, same place. Filed Dec. 15, 1890.

548,419. Electric Metering Apparatus. William S. Barstow, Brooklyn, N. Y. Filed Apr. 6, 1895.

548,435. Electric Block-Signaling Instrument for Railways. Arthur C. Fraser, Brooklyn, N. Y. Filed Feb. 26, 1891. Renewed Mar. 26, 1895.

548,448. Controller for Electric Motors. Daniel J. McLane and George W. McClintock, Quincy, Mass. Filed May 25, 1895.

548,467. Electric Meter. William H. Scott, Norwich, England, assignor to Laurence Scott & Co., Limited, same place. Filed Nov. 4, 1892. Patented in England, Nov. 15, 1888, No. 16,623; in Germany, Oct. 29, 1889, No. 56,088; in France, Oct. 29, 1889, No. 201,603; in Belgium, Oct. 29, 1889, No. 88,240, and in Austria-Hungary, Mar. 15, 1890, No 46,147 and No. 5,699.

548,481. Underground Conduit for Electric Railroads. Richard Uren, Hancock, Mich. Filed May 10, 1894.

548,504. Combined Electric and Cable Railway. Gardner E. Beach and Morris J. Kern, San Francisco, Cal. Filed Aug. 1, 1892.

548,509. Electromagnetic Brake. John L. Black, St. Louis, Mo., assignor to the St. Louis Electric Brake Company, East St. Louis, Ill. Filed May 9, 1894.

548,510. Electromagnetic Brake. John L. Black, St. Louis, Mo., assignor to the St. Louis Electric Brake Company, same place. Filed Apr. 13, 1895.

548,511 Method of Converting or Transforming Periodic Electric Currents to Obtain Constant Effective Intensity or Voltage. Paul Boucherot, Paris, France. Filed Dec. 10, 1892. Patented in France Nov. 4, 1890, No. 209,287, and in England May 5, 1891, No. 7,781.

548,514. Underground Conduit System. Hiram B. Burk, Cleveland, Ohio. Filed Feb. 28, 1893.

548,570. Street-Car Fender. Henry Meyer, Alton, Ill. Filed May 27, 1895.

548,574. Phosphorescent Electric Lamp. Daniel McF. Moore, New York, N. Y., assignor to the Moore Electrical Company, same place. Filed Jan. 3, 1895.

548,575. Phosphorescent-Electric-Light Condenser and Accumulator. Daniel McF. Moore, New York, N. Y., assignor to the Moore Electrical Company, same place. Filed Jan. 24, 1895.

548,576. Phosphorescent Electric Lighting by Interruptions. Daniel McF. Moore, New York, N. Y, assignor to the Moore Electrical Company, same place. Filed Jan. 24, 1895.

548,583. Electric Snap-Switch. Joseph H. McEvoy, Waterbury, Conn. Filed Feb. 18, 1893.

548,589. Electric Stop-Motion for Engines. Louis St. Peter, Springfield, Mass., assignor of two-thirds to John D. Millea and Thomas D. Millea, same place. Filed Mar. 1, 1895.

548,599. Electric Street-Car Controller. Gustaf Valley, Cleveland, Ohio, assignor to The Steel Motor Company, same place. Filed Dec. 5, 1894.

548,601. Electric Switch. John L. Black, St. Louis, Mo., assignor to the St. Louis Electric Brake Company, same place. Filed Apr. 13, 1895.

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NEW YORK.

NEW YORK, NOVEMBER 9, 1895.

CONTENTS.

TROLLEY DEAL IN BROOKLYN.

It is reported that the Nassau Electric Railroad Company, of Brooklyn, N. Y., will in all probability obtain control of the Brooklyn Traction Company, which operates the Atlantic Avenue Railroad Company and the Brooklyn, Bath and West End Railroad Company. Negotiations for the leasing of the traction system by the Nassau Company have been in progress for several weeks between Banker Henry Seligman, on the part of the former, and Albert Johnson, who represents the Nassau Company. It is understood that the Nassau Company will give a sum sufficient to pay all the fixed charges, amounting to $290,000 a year, and a dividend of four and a half on the preferred stock and of one or one and a half on the common stock. The Atlantic Avenue Company's lines include 56 miles of track, and is operated on the Westinghouse system.

WESTERN UNION'S CLAIM AGAINST THE GOVERNMENT.

The Court of Claims of the District of Columbia reassembled on October 28, and among the 10,000 cases now pending is that of the Western Union Telegraph Company against the United States Government for tolls on government messages under the rates fixed by Postmaster-General Wanamaker. It is claimed that these rates were far below the actual cost of the service. The rate at present paid is about one-third higher than that fixed by Mr. Wanamaker. The sum involved in this suit is about $200,000.

TELEGRAPH WIRES THROUGH THE HOOSAC TUNNEL.

Some weeks ago an article appeared in the *Scientific American* to the effect that it was impossible to work telegraph wires through the Hoosac Tunnel, for the supposed reason that iron-ore deposits existed along the line of the tunnel, and on this account the telegraph lines had to be carried nine miles across the mountain. We had some inquiries as to the correctness of this assertion, and in order to settle the matter we applied to the officials of the Fitchburg Railroad for light on the subject. In reply to our inquiry Mr. E. A. Smith, superintendent of telegraph of that road, says: "I do not know of any reason why a wire properly insulated and protected will not work through the tunnel as well as anywhere else. It is true that several experiments have been made in that direction which proved failures, but the failures were due to conditions which might easily be overcome with modern appliances and materials. The first experiment was made with common bare iron wire placed upon ordinary glass insulators, which were secured to the walls of the tunnel by iron brackets imbedded in the rock. The smoke and soot from the engines formed a coating over the insulators and brackets which was kept continually moist by the extreme dampness which pervades the atmosphere of the tunnel, making a pretty fair ground at each insulator. This experiment of course proved an utter failure. The next experiment was made with ordinary covered wire laid in a wooden box or trough beside the track. These wires were worked with moderate success for a time, but the gases from the engines seemed to have an unfavorable effect upon the covering, which was none too good to begin with, and then the blasting operations which were then going on in the tunnel smashed the box and rendered the insulation imperfect in several places. All further experimenting was then abandoned and a pole line was built over the mountain, a distance of eight miles. I have no doubt that a wire covered with water and gas-proof insulation strung on brackets, or a submarine cable laid in the central drain, could be worked successfully, but the cost of building and maintaining such a line would be great, and our mountain line gives us just as good service and costs us but little."

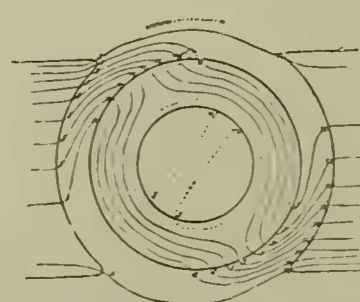
PRINCIPLES OF DYNAMO DESIGN.

BY

Newton Harrison E.E.

(*Continued from Page* 238.)

In the winding of armatures a certain limit is imposed by practice which prevents the use of an excess of conductors on the core. Not only are the conductors on the armature taken into consideration, but the length of air gap and shape of pole-pieces must be placed in the same important category. The traditional statement, "make the air gap as small as possible, get as many windings on the armature and as strong a field as possible," are now the subject of much adverse criticism. Of what length, then, shall the air gap be? To what extent shall the armature be covered with copper, and with what respect to the prevalent opinions shall the field be strengthened?



SATURATION OF POLE CORNERS.

The armature ampere-turns have been previously understood as being equal to the following:

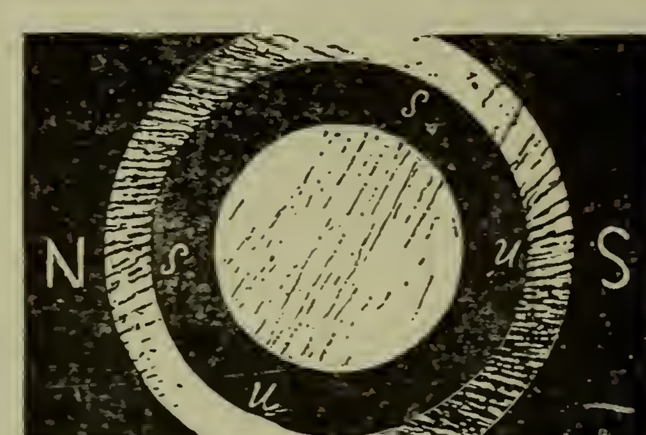
$$\text{Armature ampere turns} = \frac{\left\{\begin{array}{c}\text{The No. of conductors}\\\text{on the surface of}\\\text{the armature.}\end{array}\right\} \times \left\{\begin{array}{c}\text{Strength of current}\\\text{in the armature}\\\text{conductors.}\end{array}\right\}}{\text{Number of poles.}}$$

It is very evident that although the returns obtained by the use of every available pound of copper and iron should be as high as possible, still were sparking and heating to result by the misunderstanding of this fact, as is often the case, there would have to be a complete renovation of the machine in order to remove such objectionable features. Saturation of the pole corners is a common fault; that is to say, the pole corners near to the line of commutation become surcharged with magnetic lines, the result of which is that the armature and field force at this point either equal or overpower each other, respectively. It is proper to have a strong enough field at this point to not only overpower the lines of force reacting from the armature, but to still provide an addition strong enough for the purposes of sparkless commutation. To control these conditions it is necessary to have sufficient cross-section to the pole corners, so that saturation shall be impossible, and the original field shall prevail to the proper extent.

In both motor and dynamo the pole tips must be looked upon in this light, as the brushes simply become shifted when the machine is applied to motive power, when a sparkless position is desired. When teeth are employed on the armature core the air gap question is to some extent modified. When Pacinotti first employed slots or grooves in his armature core parallel to the axis, his object was to reduce the magnetic resistance. This can be efficiently performed if the proper ratio be established between the width of the slots and the air gap, or "entrefer," as the French call it. The teeth give rise to severe eddy currents in the polar face, unless the magnetic uniformity which hitherto existed be restored. It is evident that if the slots are very wide there will be portions of the polar face devoid of lines of force, and, therefore, as the teeth swing past, the lines of force which they carry will set up an electromotive force in the entire surface of the polar face. The narrower the slots become, however, the less the field lacks that proper and uniform distribution so essential to perfect design. Therefore in the design of toothed armatures it is the best of practice to have as many teeth as possible, making them narrow and deep. In practical dynamo construction the teeth are produced by milling out the slots from the complete core—after the plates have all been built up together. A die for this purpose can be used, but its use is very limited, because its expense for large stamped plates would be too great—although in the case of small-toothed armatures its use would not be prohibited by expense. Some writers claim an ability to use solid conductors of considerable diameter in a slotted armature with immunity from eddy currents, because of the fact that the lines snap across from tooth to tooth so rapidly as to prevent any but the generation of very weak currents.

While this is true with a narrow and deep slot it would not follow for one which was, although deep in proportion to its width, still too wide to pass the edge of the pole-piece without causing irregularities in the conductor of a parasitical nature. It seems, therefore, that not only must the teeth be proportioned so as to exclude the possibility of eddy currents on the polar face, but the conductor within it is limited in diameter also because of the same fault developing should its width be excessive. Of the many causes which disturb the field distribution, the teeth on an armature figure most conspicuously and are frequently least accounted for. A very wide conductor can be used in the manner first tried commercially by Wenstrom, that of inserting the conductors in holes drilled around the periphery of the armature but very close to the surface.

The ratio of space between the air gap and width of slot is rated from 1:4 to 1:2½, to insure steadiness of field. In very large multipolar machines the width of slot is about equal to the air gap. Sometimes the air gap is proportioned with respect to the distance between the magnet cores. This is only done, however, for the purpose of keeping magnetic leakage within limits. Alfred E. Wiener makes the distance apart of the cores from three to six times the distance between pole face and bottom of slot. For smooth rings the distance is from eight to twenty, and for smooth drum, from six to sixteen times the length of air gap between armature core and pole face. The size of the air gap is limited by other conditions beside the fact that teeth are present.



DISTRIBUTION OF LINES OF FORCE WITH RING ARMATURE.

The armature load must be so proportioned that the air gap and pole corners are not unduly affected by it. The armature load can cut down the field in gap and affect the pole corners, as already stated. With an induction in the gap of 31250 per square inch, the following table applies for drum armatures of bipolar and multipolar machines:

Density in gap, 31250 per sq. inch
or 5000 " " cm.

Single Air gap in ins.	Ampere stream Pole Face 20°.	Maximum Load for Bipolar and Multipolar Ring Armatures. 40°	60°	Ampere stream Pole Face 120°.	Single Air gap in ins.
$\frac{1}{16}$"	11250	5625	3750	1875	$\frac{1}{16}$'
$\frac{1}{8}$	22500	11250	7500	3750	$\frac{1}{8}$
$\frac{3}{16}$	33750	16875	11250	5625	$\frac{3}{16}$
$\frac{1}{4}$	45000	22500	15000	7500	$\frac{1}{4}$

½	90000	45000	30000	15000	½
1.00	180000	90000	60000	30000	1.00
.8	144000	72000	48000	24000	.8
.6	108000	54000	36000	18000	.6
.4	72000	36000	24000	12000	.4
.2	36000	18000	12000	6000	.2
.1	18000	9000	6000	3000	.1

Bg = lines per square inch in gap.
lg = length gap in inches.
φ = arc of pole-piece.

$$\text{Formula Ampere Stream} = \frac{115.2 \times Bg \times lg}{\varphi}$$

Density in gap, 31250 per sq. inch
5000 " " cm.

Maximum Load for Bipolar and Multipolar Drum Armatures.

Single Air gap in ins.	Ampere stream Pole Face 20°.	Pole Face 40°.	Pole Face 60°.	Ampere stream Pole Face 120°.	Single Air gap in ins.
1/16"	15000	7500	5000	2500	1/16"
1/8	30000	15000	10000	5000	1/8
3/16	45000	22500	15000	7500	3/16
¼	60000	30000	20000	10000	¼
½	120000	60000	40000	20000	½
1.0	240000	120000	80000	40000	1.0
.8	192000	96000	64000	32000	.8
.6	144000	72000	48000	24000	.6
.4	96000	48000	32000	16000	.4
.2	48000	24000	16000	8000	.2
.1	24000	12000	8000	4000	.1

Bg = lines per square inch in gap.
lg = length of gap in inches.
φ = arc of pole-piece.

$$\text{Formula Ampere Stream} = \frac{153.6 \times Bg \times lg}{\varphi}$$

It is observable that the increase of air gap immediately means an increase of permissible load on armature, as evinced by the growth in the ampere stream. This table proclaims limitations which embody certain essential facts regarding the style of armature and winding. Also, were the pole face reduced the ampere stream will increase in the same proportion.

Multipolar machines can therefore stand a much greater load on the armature, because of their small pole face and comparatively large air gap.

It is necessary to understand that the *ampere turns* on an armature and the *circumflux* or *ampere stream* are somewhat different, though apparently identical. In one case the magnetizing force of the armature is considered, as the first formula denotes, the product of ½ the armature current into ½ the number of inductors for a drum bipolar machine, or for any machine the ampere turns are equal to

$$\text{Amp. turns} = \frac{\text{No. of inductors} \times \text{current in inductor}}{\text{No. of poles.}} = \text{Magnetizing force.}$$

while the ampere stream entirely disregards the direction of flow or the magnetic conditions, but simply considers the sheet of current enveloping the armature.

Circumflux, or ampere stream = No. of inductors × current in inductor

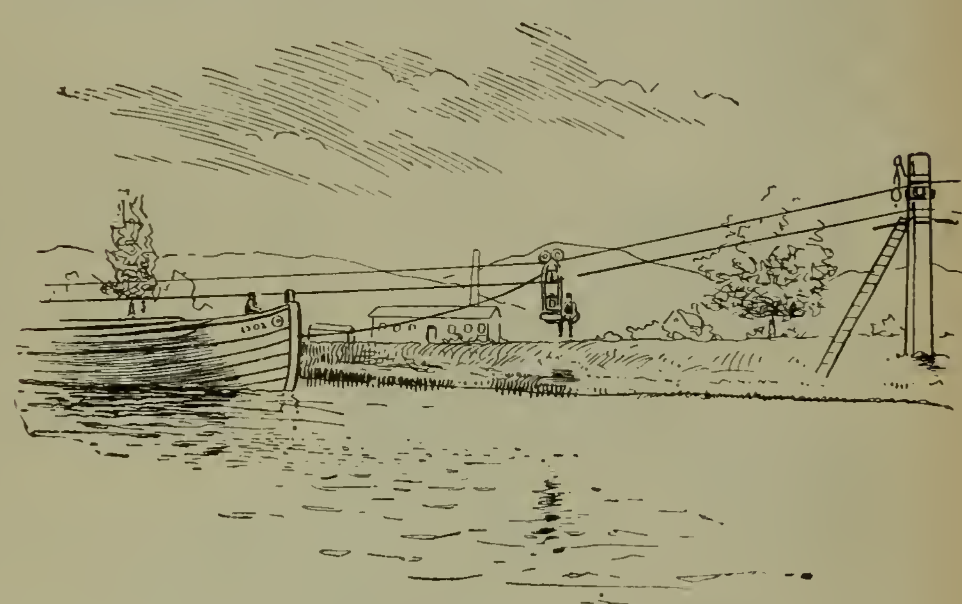
making the ampere turns just ½ of the ampere stream in a bipolar and ¼ or ⅙ the ampere stream in a four or six-pole machine.

It is often the practice to consider the ratio between the air gap and distance between pole-pieces instead of between magnet cores. Making the distance between pole tips about nine times the length of air gap in cases where a smooth core armature is employed; although this ratio may increase to as high as twelve times as great in smaller machines with many turns on armature and, therefore, greater gap. The diameter of commutation should never be under the pole tip, as the field at that point becomes sensitive to very small changes of load. The usual and better practice calls for an angle of lead of from 10° to 15° at the most. Therefore, if a pole-piece embraces an arc of 120° there are 60° of interpolar space, and, with a brush lead of 15° at the most there is 15° still to spare before the pole tip is reached.

(*To be Continued.*)

ELECTRIC HAULAGE.

An interesting test was made recently on the Erie Canal of a new system of electric haulage which gave very promising results. For the operation of the system a line of strong poles was erected on one bank of the canal, the poles being placed about 125 feet apart. They were 16 feet high above the ground. Upon them was strung a cable of great strength, upon which was a traveller carrying an electric motor and a motorman. Three feet below the upper cable was placed a smaller one, which made three turns about a horizontal shaft, operated by the electric motor. The whole burden of the traveller and motor, together with most of the strain exerted in towing a fleet of canal boats was upon the upper cable. The lower cable, together with the shaft, furnished the actual motive power. The motorman operated the equipment in very much the same way that a trolley car is operated. The electricity was communicated to the motor through the upper cable and was discharged from the motor through the medium of the lower one. The boatmen have only to throw their tow lines to the motorman, and they will be promptly carried to their destination. Any desirable rate of speed can be attained.



ELECTRIC POWER HAULAGE FOR CANAL BOATS.

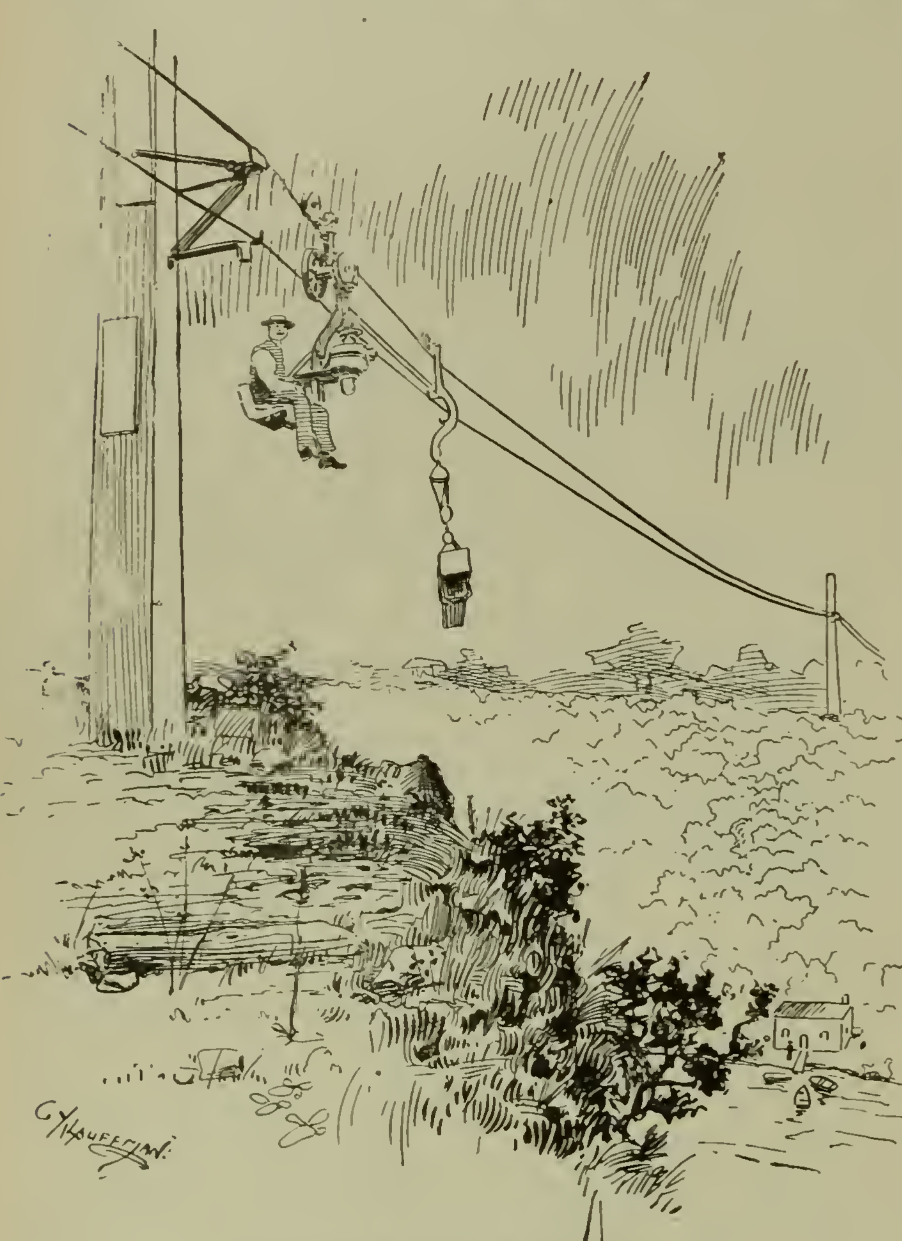
In speaking of the test Mr. Frank W. Hawley, vice-president of the Cataract General Electric Co., referred to the system as a very efficient one. While the device is not really new, the application in this case was novel. The system is in use in various places for haulage, among which Mr. Hawley mentioned an electric cable way 750 feet long, which crosses the Susquehanna River at Williamsport, Pa., and a 3 mile line at Syracuse, N. Y.

Similar lines are being extensively built in the forests of the South, where swamps interfere with the construction of tramways. By this cable huge logs are dragged bodily through the swamp. A line 1,200 feet long spans the Croton Valley, in Putnam County, N. Y., and another 2,700 feet long is running at Holyoke, Mass. They have been built in South America. In Hayti one runs for fourteen miles, carrying logwood out of the mountain districts. In Alaska one is operated to carry ore, buckets holding 500 pounds, each being attached to the cable.

The uses to which the cableway has already been put suggest something of the future that awaits it. Its rapid and safe operation at ferries will insure its adoption at those points. Wherever ravines, mountains or water courses obstruct the path of commerce or travel it will come into use. The difference between the vast outlay for the construction of bridges and the moderate cost of a cableway, answering every purpose, is so great that in many instances it will give preference to the latter. The cableway will also be of invaluable aid to the tourist, enabling him easily to make ascents now very difficult and affording a new and advantageous point of view.

In the construction of public works or the improvement of streets the device can be operated to great advantage. It can be used as a travelling crane, bearing to needed points pipe and tile, or removing excavated material. By its aid brick, stone and mortar could be carried to the upper floors of buildings. The power to operate it could be readily supplied from some central power station.

In the lumber districts it has heretofore been the custom to cut logs and haul them to water courses, making the rivers serve as carriers. But the same power that operates the sawmill could be used by the aid of the cableway to bring logs from the forest to the door of the mill. At the coal mines and iron mines it would be extremely service-



CROSSING VALLEYS BY ELECTRICITY.

able for the rapid and efficient handling of their products. It is available at docks for the loading or unshipping of merchandise. It would be specially valuable for the conveyance of passengers and freight to vessels compelled by shallow water to lie off shore.

Our illustrations show the application of the system to the haulage of canal boats, the crossing of valleys and hauling of logs in the forests.

PANIC IN PHILADELPHIA ELECTRIC STOCKS.

The Philadelphia Stock Market experienced a panic of the real old-fashioned kind on October 30, and the stocks controlled by the Widener-Elkins-Dolan syndicate caught the lambs to the extent of $5,000,000. Among these stocks are Electric Storage Battery, common and preferred, and the new Pennsylvania Heat. Light and Power Company. It is stated that a pool was organized some time ago to run lectric Storage up to 75 and then unload. It did go up nd the promoters unloaded according to programme with the result stated. It is stated that many fortunes were made by the manipulation—and likewise, some were lost. Welsbach Light and United Gas stocks shared in the operation.

GENERAL TRACK CONSTRUCTION.

BY C. LOOMIS ALLEN.

(*Continued from page* 224.)

You may then feel that you have at least striven to obtain solid foundation. Upon the sub-grade should be spread the ballast, and no better quality of ballast can be obtained than stones that have been broken in a crusher to a size that will pass through a two-inch ring. There should not be less than eight inches of broken stone ballast under the ties after the track has been surfaced and tamped. The broken stones should be evenly spread in the trench to such a depth that, having been thoroughly rolled, will be not less than six inches. The rolling should be done by a steam roller weighing not less than ten tons, and should be continued until the mass of stones should become thoroughly compact. Upon the broken stone then place the ties. The use of metal ties is bound to come, and with them the exit of the use of wooden ties; but as long as southern ties of standard size of the variety known as the long-leafed yellow pine can be delivered on the cars or wharves of any of our large cities for fifty cents each, the day for the use of steel ties is deferred. I believe thoroughly in the use of metal ties, and that they are the most economical remains only to be proven by the experience gained from their use. We will watch with great interest the results deduced by their experience of the New York Central Railroad; as a practical experiment, a short piece of track was constructed by them on the Hudson River division, near Garrison station, in 1889, using the type of metal tie known as the "Hartford." The results so far have been very satisfactory and the cost of maintenance reduced to the minimum. The use of wooden ties, however, is bound to be common at the present prices for first-class ties, and at these prices no one need buy poor or cheap ties. In drawing specifications for ties, do not place clauses in them which experience has taught you impossible to fulfil. Specify the kind or quality you know can be bought in the market and make the size not smaller than the standard size, *i.e.*, eight feet long, six inches deep and eight inches wide, and by all means see that the ties you buy are the same as the specifications call for. Do not place less than 120 lineal inches of ties in width to a rail length of 30 feet.

The rails to be used in streets of cities should weigh not less than 85 pounds to the yard, to a section 7 inches deep, and if the section you purchase is 9 inches in depth, it should weigh not less than 95 pounds to the yard. Select a section with a good, wide base not less than 5¾ inches, and have the width of the head not less than 2½ inches. Almost any standard section of the 9-inch rail offered by rolling-mills are good. There are differences in opinion as to the quality of the finish of the different sections of rail. Some maintain that the girder rail with the tram or "L" head is the better finished and more easily kept open to traffic than the half-grooved girder sections. I can speak from experience that the half-grooved girder sections we have received from the Johnson Company are better finished, make smoother riding track, but we have not yet had the opportunity to try them during the winter, to see if we can successfully maintain traffic; however, we can name the City of Buffalo, with its magnificent railroad system, as an example of successful operation for many winters.

The fish plates or channel bars should be at least 32 inches in length, and if for the 9-inch rail, should be punched for 12 one-inch bolts. I believe the corrugated plate manufactured by the Johnson Company is the best type yet presented, but with any channel bar or plate of the length of 32 inches, bolted tight with one-inch bolts, and the nuts held in place by nut locks, the joints should not give way sooner than the rail itself. In fact, the question of joints with fish plates of this size properly bolted, is transferred to a question of ties and what supports them.

Use combination brace-plates; do not use tie-rods. There are several types of combination plates manufactured. The Johnson Company make a single brace plate and tongue; the Mark Railway Equipment Company a double brace-plate. The use of either of these have many advantages over the tie-rods. I would use brace-plates on all deep rails, in preference to tie-rods, for the following reasons, if no other: Watch your track foreman, or, if your work is done by contract, your contractor laying track. If you are to use tie-rods, when the spiking is being done, see if the gauge bars are used, and I will venture to say that the chances are that the spiking gang do not try the gauge of the track more often than on every other tie, and some of the time they forget to do that. They trust to the tie-rod to spread or pull, whichever the case may need,

LOG HAULING BY ELECTRIC POWER.

the track to proper gauge. Now watch the spiking gang wherever the brace-plates are being used, and you will see quite a different use of the gauge-bar. At every single tie the spikers, in order to maintain the gauge of the track, must use the gauge-rod, for there is nothing to pull or push the rails to gauge after the rails are spiked. As a consequence you have a track laid with greater care, so far as gauging and spiking are concerned, than you will have with tie-rods, and that is very essential to first-class and easy riding track. Tie rods in a pavement tend to constantly help, by vibration, the disintegration of the pavement, to say nothing of the trouble encountered in paving around them.

In laying tracks in city streets, place the rails on the ties, making the joints alternate, and no matter what the temperature may be, be sure the joints are laid without open spaces between the rail lengths; butt the ends of the rails up tight and, when they are in that position, bolt the plates up, driving them home with a hammer. Do not spare the cost of inspection at this point, but be sure that the joint plates are all tight. With properly bolted plates and rail ends tight, you have approached as near continuous track as it is possible without welding the joints, and yet you have given a chance in extreme winter for contraction.

In driving the spikes, be sure that the gauge-bars are tried on every tie. Use $5\frac{1}{2} \times \frac{9}{16}$ spikes, four on every tie. When the rails are thoroughly spiked and bolted, the track is ready for surfacing and tamping. We have already provided for six inches of the ballast and only have two inches for tamping. Great care should be taken to properly tamp each tie firm. Ties tamped with broken-stone ballast do not sound as firm as ties tamped with gravel ballast, but broken stones will stay in place, while gravel ballast will wash down. Tamping with broken stone costs more, but firmer track is the result. The track now is ready to receive its final alignment, and with great pains and care see that all irregularities in line are taken out. Unless block-stone pavement is to be laid, fill to the top of the ties with broken stone, made thoroughly compact by the use of rammers, and you can rest assured that with a space of nine inches from the top of the ties to the surface of the pavement, in which space can be laid the pavement and its foundations, that there will be no objections from the municipal authorities of poor foundations. Once more try the bolts and fish plates to see that all are tight, and then place on the bolts the nut locks, to keep them tight. Your track is now ready for bonding. Use the type of bonds that will give the greatest contact with the rail, connected by a single No. 0000 wire. The use of single bonds of a larger size saves labor when compared with the use of double bonding with bonds of a smaller size. After your track has been thoroughly bonded, you can now turn the tracks over to the paving company.

VOICES OF THE DEEP.

How essential to human life the vast areas of water are which surround this and other continents is not difficult to realize.

Droughts would ensue all over the earth were the liquid proportion greatly reduced, and only those fortunate localities adjacent to the ocean's edge would enjoy the murmur and trickle of the falling rain-drops.

Yet this isolation from other continents by so vast a stretch of waters has not prevented us from breaking what threatened to be a perpetual silence. The cable was laid from continent to continent and the union of two worlds established by a copper wire.

Ideas commingled; foreign interests became interwoven, and the scene of each shore an exchange—with the ocean's bed a noiseless auditorium—is today a wonderful but familiar sight.

Beside the rotting bones of grim monstrosities, whose massive frames lie covered by the mildew of the ocean, the swift ebb and flow of human thought moves on from nation to nation. Unheard voices that fly with silent speed beneath the ocean's depth call to each other from shore to shore. Buried in the slime and encrusted with the larvæ of decay—the burning words of oratory still find their way through a fearful abyss to listening ears.

HELMHOLTZ MEMORIAL.—German papers announce that a memorial tablet in honor of Professor Helmholtz has been affixed to the house, No. 8 Hadizstrasse, at Potsdam, where he was born in 1821. It is also the intention to erect a joint monument in memory of Werner Siemens and Helmholtz in front of the Technische Hochschule at Charlottenburg.

—"Why should all men inform themselves about the tariff?" Because it is every man's duty.

PORTABLE ELECTRIC PROPELLER FOR BOATS.

The accompanying illustration gives a very clear idea of the *modus operandi* of the portable electric propeller for small boats, which apparatus is made by the Portable Electric Boat Propeller Company, 136 Liberty street, New York.

This apparatus combines propelling and steering features, and is so simple that little explanation is required. The steering propeller is hinged to the stern post of the boat, and is moved from one side to the other by a tiller, just like the ordinary rudder tiller.

The propeller-shaft consists of a tube, through which a flexible shaft is run. The outer end of the shaft is connected with the propeller, and the inboard end with the electric motor, by means of gearing. It is evident that the revolutions of the motor's armature are communicated to the propeller through the flexible shaft. The propeller-tube is provided with a fin-like arrangement which performs the function of a rudder.

The motor derives its power from storage batteries, the weight of which for an 18 or 20-foot boat may be from 100 to 275 pounds, according to the capacity carried at one time. The weight of the motor, rudder and propeller is only 35 pounds, and a boat of the length mentioned can be driven at a speed of three to five miles per hour.

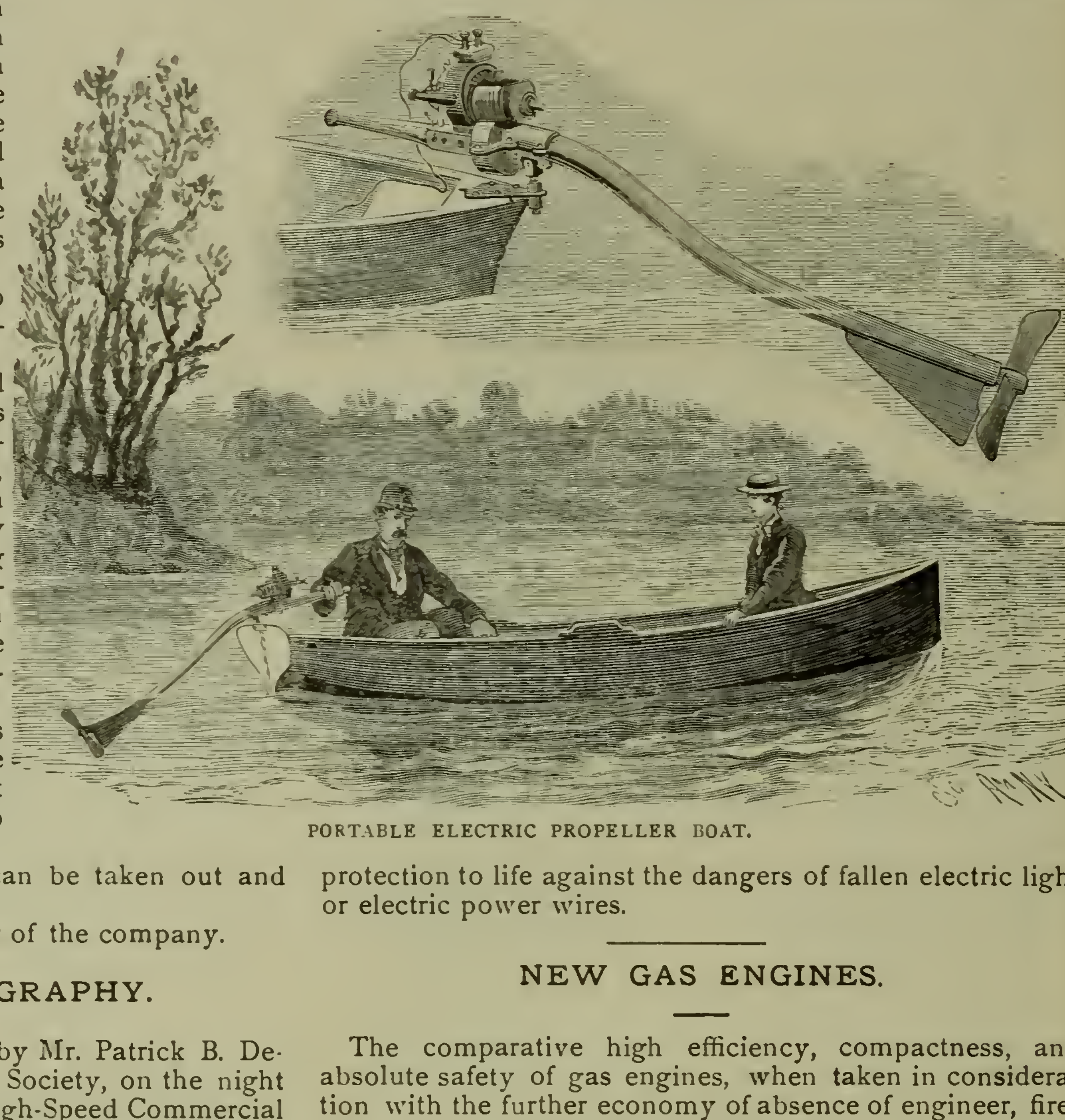
This apparatus can be attached to any boat without any special preparations.

For yacht tenders and fishing and hunting purposes this equipment is excellent. It gives the operator perfect and instant control of the boat, and the craft can be handled in much less space than by the ordinary methods. The boat moves along noiselessly, and this particular feature renders the apparatus a boon to hunters and fishermen, where stealth and quiet are essential elements to successful results.

The operation of the propeller is reversible, so that the boat can be run as readily either way. The cost to run the outfit is said to be five to seven cents an hour.

The battery used for the motor can be taken out and used for lighting the tent.

Mr. Frank S. Allen is the manager of the company.



PORTABLE ELECTRIC PROPELLER BOAT.

HIGH-SPEED TELEGRAPHY.

An interesting lecture was given by Mr. Patrick B. Delany before the New York Electrical Society, on the night of October 28, on the subject of "High-Speed Commercial Telegraphy." Quite recently Mr. Delany has worked out a system by means of which he believes he has rendered it possible to minimize the use of the mails as a means of transmitting correspondence, and brought it within the bounds of commercial possibility to send all letters of the slightest importance over the wires at a rate competing with letter postage, thus making the utilization of the telegraph equal to that of the telephone.

Mr. Delany showed his system in practical operation over an artificial circuit. A speed of 2,000 words per minute was attained. The apparatus is remarkably simple and ingenious, and the large audience was deeply interested in the demonstration.

New Cuban Cable.—A new submarine cable between Havana and Santiago de Cuba is now being laid, and the work will be completed about November 10. The cable company has its headquarters in London, and is, it is said, indirectly under the control of the Spanish Government.

HUTCHIN'S SAFETY APPLIANCE.

Mr. A. E. Hutchins, 719 Woodward avenue, Detroit, Mich., a well-known electrical engineer and contractor, is the inventor of a very simple and effective device for "deadening" electric wires of any class in case of accidental breakage.

Mr. Hutchins recently made a test of his invention at the station of the Peninsular Electric Light Company in Detroit. A wire carrying a 3,000-volt current was broken and Mr. Hutchins took hold of the loose end. He walked around with it on wet ground barefooted, and further proved the efficacy of his device by placing the end of the broken wire in his mouth.

The invention is exceedingly simple and consists of a wire or metallic loop placed around the wires to be protected at each cross-arm, the loop wire being run down the pole to earth. When a wire breaks the slack end makes a contact with the loop and thus becomes grounded and is rendered harmless.

This appliance apparently insures reliable and complete protection to life against the dangers of fallen electric light or electric power wires.

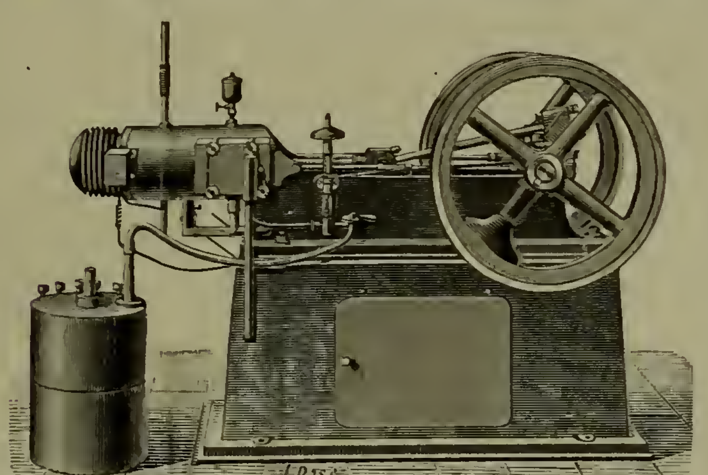
NEW GAS ENGINES.

The comparative high efficiency, compactness, and absolute safety of gas engines, when taken in consideration with the further economy of absence of engineer, fireman, or other high-priced attendants, has greatly increased the demand and use of such motors. Where power is intermittently required, even where coal gas at current prices is used, the cost is much lower than that of running a steam-engine. Where, however, gasoline is employed as a substitute for coal-gas the expense of running is quite halved, and, besides this economy, the motor is not limited in its use to locations where street service is obtainable, as a gasoline motor can be used anywhere, in any part of the country, and either stationary or on a moving vehicle.

The recent improvements in the gas motor enabling it to be employed with gasoline, has boomed its sale, and caused it to become practicable for many purposes. One use to which it has been applied has been the running of dynamos for isolated electric light plants. Up to the present time, however, its use for such purpose has been very limited. This is not for any lack of economy in cost of operation, but for the reason that a storage battery has been required as an adjunct whose first cost and maintenance has made such a plant too expensive for consideration other than as a luxury.

The necessity for the storage battery is due to the irregularity of motion of the gas engine, which, if coupled direct through the dynamo to the lights, produces a flickering and jumping of the same that is unbearable. The reason of the irregularity of motion is caused by the fact that all of the best gas engines on the market are constructed on the "four-cycle" principle, in which an impulse due to combustion of the mixed air and gas in the cylinder is only given at every other revolution, and then only for a part of one stroke. The "four-cycle" principle has been necessary in order to obtain the highest commercial efficiency.

A new engine has been lately patented in which this great objection is avoided; its peculiar construction permitting of the highest efficiency for the quantity of gas used, while the motive impulse is given at each revolution. At the same number of revolutions per minute, therefore, as compared with other engines, double the motive impulses are produced, reducing consequently the irregularity 50 per cent. For the same amount of power the engine is reduced almost one-half the size. The construction is of the simplest character, only two valves are employed, one a slide valve controlling the admission of air and gas, and the other a "tappet" for the exhaust. The simplicity of the construction permits of the manufacture at a low price.



NEW GAS ENGINE.

The engine can be used with either coal-gas or gasoline without any alteration or special preparation. A new form of carburetter, or gasoline vaporizer, is used with this engine, which, while of the simplest construction, permits of gasoline being used without pump or pressure of any kind equally well, however much the temperature of the atmosphere may vary below the normal.

Although the patent is issued in the United States, the inventor is a Frenchman. These engines have been put in use in Paris during the last six months, and have acquired a great celebrity for their successful operation.

We have witnessed one of these engines in operation in the factory of A. L. Bogart, 22 Union Square, New York City, which is operating a full-sized engine lathe, doing practical work every day, including buffing work, although the diameter of the cylinder is only 2¼ inches.

American patent rights for this engine are for sale, we understand.

MR. JOSEPH WETZLER.

The marriage is announced of Miss Pauline Gerson, of New York, to Mr. Joseph Wetzler, one of the editors of *The Electrical Engineer* of New York. The ceremony took place on Wednesday, October 30. We extend to Mr. Wetzler and his bride our sincerest congratulations, and wish them both a happy journey through life together.

The Yale Scientific Monthly for October contains a well-written article on "Electricity in Railroading," by Clarence Lyman Collins. The article relates to the recent advances in this branch of the science, and refers briefly to the Baltimore and Ohio tunnel, Nantasket Beach and Mount Holly roads.

SIGNALS ON ELECTRIC RAILROADS.*

BY J. H. BARNARD.

With the advent of mechanical power in the field of street-railways came a consequent change in the management and service. Within a short time we learned so positively the value of large, handsome, clean cars and good service that today an ill-kept, untidy car is no longer the rule, but the great exception. The higher speed of the mechanically moved car decreased the headway, but instead of that lessening the number of cars required, the improved service so stimulated travel as to demand even a greater number than before. But, while the acme of clean, neat cars can easily be reached and maintained by all who pay for their care, the acme of good service is—like perfection—*never* reached. Even a *high* character of service requires the unceasing efforts of all the executive force in maintaining a discipline adequate to meet with precision the most unexpected emergency, but in spite of the highest success in this direction, the lack of ability to promptly report trouble and to transmit instructions not only unduly tests the best organization, but robs it of much of its possible value. Railroads can afford telegraph operators at frequent intervals, as where their duties as operators are insufficient to warrant their salaries, they can fill various other duties, whereas this is not true of street railways. Signals, electric or mechanical, are too limited in their range, consequently the telephone is the instrument which can best replace the telegraph line in the hands of our class of employés. Over a two-wire telephone line any conductor or motorman can report in detail a trouble from any of as many stations as you desire to install, and prompt measures be dictated by the highest executive, if necessary.

This fills the want as far as communicating *from* an outlying point *to* the office where there is always someone to notice the call bell, but unless a separate wire be run from each station to the office, and that at a very considerable expense, there has not been heretofore, as far as I know, a means of setting a permanent signal at a desired point to arrest the attention of the next employé that may pass. This ability, however, even on a double tracked road, is a very important one. A trolley wire has broken and you want your linemen from some distant point with the least delay—a car is badly derailed and, unless you have a regular wrecking crew, you want your trackmen with their jacks, linemen with their tackles, or both, and you want them as quickly as possible.

But however badly this ability is needed on a double tracked line, it does not compare with its necessity on a single tracked line. Your cars from one cause or another—you that handle single tracked lines know how various are the causes and how frequently they can present themselves—get out of schedule, "out of phase," you may call it, and no man living can get them back into phase by the easy methods that are usually apparent, *because* of your inability to give to distant crews orders complementary to those you would give those near by. Consequently, the requirements of a single tracked road are: That from *any* station, wherever you may be, you must have the ability to call and instruct the men at such points as the particular need demands *without* calling (and so detaining) the men at other points.

If this be rendered possible you have gained yet another most important power. If a station be located at each turnout, a man at any one of them can set a signal or communicate with another at the next turnout; and herein lies the greatest and only means of reducing to a minimum loss of phase, because, in 99 cases out of a 100, you might say always, *general* disarrangement begins in *localized* disarrangements. A car has an unusual number of stops to make, blows a fuse in starting on a grade, is blocked for a few minutes by a wagon across the track unloading, by a thousand and one insignificant things, consequently is late in reaching the next passing point. The car due to pass

* Paper read before the convention of the Street-Railway Association o New York, Albany, September 17, 1895.

it there waits—how long? Well, it waits. Probably all its passengers are in high dudgeon, criticise the management and vow (and to a certain extent keep their vows) not to patronize such a line in future. This is all bad enough, but this is only the beginning of the trouble. Each one of these cars is due to meet another car at its next turnout ahead, consequently a few minutes later two cars are awaiting *two* delayed *cars*, and again a little later at the second turnout ahead two more cars are waiting and so it multiplies. If travel at the time be light your cars may be able to pick up again their lost time, but usually a serious disarrangement occurs from the frequent stops of more than an individual car due to heavy travel. Then, when it is of every importance that your cars should move like clock-work to earn every possible nickel as well as to maintain your reputation, your car crews are utterly at a loss. Through ignorance of the opposing car's position they will lose valuable time at a turnout, when, had they only known it, they might have proceeded to the next, or, after waiting a due length of time, they proceed only to meet the other cars between turnouts and one had to run back.

It is not that a single track road is, as many assert, not worth building. Many a route will support comfortably the investment required for a single track which would not pay the interest on the bonded debt of a double track construction. Indeed, with the means of instructing the car crews when to wait and when not to wait, I assert that under ordinarily good management a single track road may handle smoothly an amount of travel that few will think possible. With such means at your command, or at the command of your men, the loss of schedule by one car can be easily kept to nothing worse. If you have extra turnouts to allow the employment on days of heavy travel a larger number of cars than ordinarily, you may in the case of a sudden increase put out some extra cars to meet it, as one would do on a double track road without previous warning to the men beyond the reach of your voice and that without delaying their cars. Should travel not develop as prepared for, you may at pleasure withdraw your extra cars as they arrive without the remainder waiting at turnouts for cars that would never come.

Nor to do this do you require, except where the road can afford it, anyone in the nature of a train dispatcher. If a car is late at a turnout, its crew does one of two things. If it is so much behind its schedule time that the rules forbid its proceeding, one of them drops the signal at the next turnout where it is due to meet a car, and when one of the crew of that car answers at the telephone it is told to come on, thereby limiting any loss of time to only that car which is already out of phase. As for itself, it simply falls back upon the schedule of the car following it, and on this car's right of way precedes it to the last turnout, where, transferring to the car behind any passengers it may still have, it turns back on its own schedule. Such a course entails a slight further delay to the passengers on that car alone, but none to any of the others.

If it is behind its time less than the limit established in the rules it continues its way, first dropping the signal at the next turnout. Should it fail to reach that turnout on time, the opposing car will have waited for it, because when one of its crew went to the telephone he was not answered, showing that it must have been set to hold his car, presumably by the crew of the car due to meet them there.

This much towards keeping the cars informed of each others, movements is an immense assistance, and to this extent an ordinary signal system, either automatic or otherwise, is a great aid ; but here a signal system has reached the limit of its possibilities, and still there is another common and the most prolific source of general disarrangement, and that is where both of two approaching cars are that late that the rules forbid their proceeding ; consequently, one lies at No. 6 turnout and the other at No. 8, when each might proceed to No. 7 without delaying any car and possibly finding themselves able to make up enough time not to delay other cars at No. 5 and No. 9, thus ending the trouble at its source. In this case the crew at No. 6 would have set No. 7 signal, as would also the crew at No. 8. Anyone near the office instrument (an extension to the engine-room can be cut-in when at any time the office may be vacated so that the engineer may hear calls) noticing the repetition, would understand the situation and calling up both cars tell them to proceed.

Then, too, after every precaution has been taken to prevent general disarrangement, should one occur, and in spite of all it will occasionally, with the means of talking from whatever station you may be to such crews as you desire, loss of phase loses much of its sting and trouble much of its victory.

ECONOMICAL EQUIPMENT AND OPERATION OF POWER-HOUSE.*

BY H. S. NEWTON.

I am going to ask the Association's attention to a few of the details connected with the economical equipment and operation of a power-house which, ordinarily, do not get farther than the engine-room, but which might profitably, in a great many cases, be considered in the office.

A modern electric street-railway station, to deserve the name in these advanced days, should embrace in the details of its construction those features which experience has shown to be best adapted to the service required. These details, I take it, are such as would be included by all engineers in a compound condensing station. A preference has been shown by some engineers for certain additional features, by others for features differing considerably in the means towards the end. It is not my intention to enter into a discussion of the relative merits of different apparatus, or the wisdom of different methods, but I shall confine my remarks to the ways and means which we have considered and have adopted in our power-house lately constructed at Syracuse.

The Syracuse Street-Railway Company's plant is made up of three double compound engines of the upright, marine type, having cylinder dimensions 16½ x 31 inches with a 24-inch stroke. These are belted direct to multipolar generators of 300 kilowatt capacity, and exhaust each into an independent surface condenser. The condensed steam from the condensers is pumped through an oil filter or separator into a hot well, from which the boiler feed-pumps convey it through a pipe heater to the boilers. By this arrangement, not to exceed ten per cent. of the boiler feed-water is taken from the outside water supply, and all difficulty with scale is practically overcome.

The boiler-house contains five 90-inch return tubular boilers 16 feet long each, made up of 118 4-inch tubes. These are fed by a pair of pumps, one acting as a relay to the other.

The whole plant has been in operation only a few months, and it has been impossible as yet for us to make an accurate test as to its economy. Our coal and water bills have demonstrated the fact, however, that we are making power at a low rate, and this with the additional fact that we are having an entire absence of trouble are all that I can urge as an excuse for this paper.

The feed-water is introduced into our boilers through a line of 2½-inch piping connected to duplicate pumps through a pipe heater. We have found two objections to hold against the arrangement as adopted, the correcting of which, I feel, will influence somewhat the economy of the station.

The first of these is the fact that, in covering the live steam-pipes, it was not deemed necessary to cover those carrying the warm water to the boilers. This leads to a difference of some five or ten degrees in the temperature of the water when leaving the heater and when entering the boiler, and is, consequently, a source of some little loss.

The second point is the absence, since remedied, from

*Paper read at the Convention of the Street-Railway Association of the State of New York, Albany, September 17, 1895.

the water line of a check valve beyond the pumps to relieve the check valves at the boilers. This would seem to be of small importance, if not absolutely unnecessary, but we have found it of decided advantage in prolonging the life of the valves and doing away with the rattle occasioned in these valves by the pulsations of the pumps. An air chamber over the pumps is also of prime importance in lending elasticity to the system.

In this connection I wish to call your attention to the importance of an injector of each of the boilers. There seems to be a growing tendency to rely entirely on a relay of pumps, thus allowing the operation of the station to hinge on the efficiency of a piece of apparatus which my experience goes to show has a decided tendency to get out of order.

Concerning the economy of using over and over again for boiler feed the condensed steam from the engine exhausts, a great deal may be said. The surface condenser, the necessary adjunct to this practice, is not a particularly rare piece of apparatus, but I find that a surface condenser which is called upon to perform this one of its functions is decidedly uncommon in street-railway practice. In numerous stations it is used to obtain a vacuum, but in very few is the water of condensation utilized. The character of the water around Syracuse made it very desirable that we should utilize the condensed steam if possible, and after what promised to be some very disastrous experience, we have at last succeeded and are running very successfully, as mentioned before, with over 90 per cent. of our feed from this source.

Our immediate result on starting this practice was oil in the boilers, or a mixture of oil and dark brown sediment which caked over the bottom seams. We removed this and tried it again, concluding that it might be shop grease and dirt. Again we had the same result. Examination of the old filter showed nothing out of order, and consultation with the engine builders evolved nothing new. After endless experimenting resulting in a leaky boiler or two and the consumption of a vast amount of chemicals, we have located and remedied the trouble to our entire satisfaction.

The accumulation noticed seems to have been the result of three causes.

1. The use of too much cylinder oil.
2. The use of the wrong kind of cylinder oil.
3. Insufficient filtration of the oil from the feed-water before going to the boiler.

The first of these causes was, of course, soon remedied, and the old-fashioned notions of our engineers were shocked with the order to use only three drops a minute for each engine.

The second cause we were longer in discovering the remedy for. Various expedients were tried for cutting up the grease in the boilers, such as carbonate of soda, soda ash, tri-sodium phosphate, and lastly kerosene oil. None of these expedients proved effective, however, and it was not until we changed our cylinder oil that we solved the problem. We purchased some oil of purely mineral stock, which has worked so well as to lead me to conclude that it must have been the animal fat in the other oil which was doing the mischief. We are using this oil today with remarkably good results, never more than a slight film being apparent in the boilers at the time of the weekly cleaning, and this readily succumbing to the action of a half pailful of soda ash pumped in with the feed-water before cooling off.

The third cause of trouble we have recently largely overcome by introducing a number of partitions in our oil filter, by means of which the water is caused to flow alternately over the top of one and under the next, in this way allowing the oil to settle from its water emulsion and be collected in the excelsior filling.

The factor that after all has seemed to be strongest in the solution of our problem in economy is the choice of fuel. Wh have done quite a good deal of experimenting in this line with various grades of coal, and the results obtained have been such as to lead me to very strong conclusions.

The best coal, and by that I mean the cheapest fuel, we have found to be anthracite buckwheat, costing on board cars at our station $2.25 a gross ton. The dust anthracite I find will sift through the bars. When mixed with an equal amount of soft coal it works very well, but necessitates the help of an extra man as a mixer, and is not so economically fired. We are using 13 tons of buckwheat a day, where it was necessary to use 17 or 18 of the mixture.

A great deal has been written and a great deal more said about the efficiency of special devices, such as high and low water alarms, automatic damper regulations, etc., in the boiler house. Our experience with them has been most satisfactory. We have found that the less responsibility you place on the man who shovels in your coal, the better off you are in the end; or, in other words, that as compared with human brains, the mechanical device is at a big premium. By making the engineer responsible for the operation of the devices and keeping them in repair, you are insuring yourself, beside a great deal better boiler house, economy that you could not otherwise expect to obtain.

The vertical marine type of engine has given us thus far very good service. The most serious objection that we can urge to them is that they are noisy. In order that the vertical cross-head guides may not be subjected to too serious wear, we have found it necessary to lower the compression below the point usually employed. The natural consequence is more wear in the cross-head and crank bearings and more noise. With more compression we get hot cross-heads and guides, and we consider that we have chosen the lesser of two evils.

Our engines are provided with piston valves for the high pressure, and grid-iron slide valves for the low pressure cylinders. They will govern to within three per cent., or about as well as the Corliss

I don't think the true importance of good engine government is recognized by street-railway men. One is apt to regard a badly governing engine merely as an inconvenience resulting in slower speed on the cars and dim lights. The additional loss of power on the line, viz., in the feed-wires, trolley wires and rail return resulting from the decreased voltage at the station is often entirely lost sight of. A few figures on this point might be interesting.

Given a station with generators compounded for a constant potential of 500 volts with constant speed on the engines, and a system of feeders allowing for an average loss on the line of ten per cent with full load on the machines. With our engines governing perfectly, ten per cent. is lost in transmission. If they slow down as the load comes on so that the dynamos show only 450 volts with the same watt output, over twelve per cent. of the total energy will be lost in transmission. With 400 volts on the machines, over fifteen per cent. will be lost. Therefore. when we couple with these facts the consideration of loss of light and decreased efficiency of motors at the lower voltage, it is plain that too much importance cannot be given to the government of prime movers.

In conclusion, I cannot refrain from adding one more voice to the cry against cheap labor in the power house. What help of that kind we do employ, and we are not extravagant, I assure you, is used in a subordinate capacity. Our present engineer in charge was employed by me after a very clear demonstration that a cheap man was not capable of handling the plant. A condensing station, with the volume of detail which must be always present in its construction, requires brains for its operation, and the man with brains commands good wages. The pressure which is brought to bear on the management for reduction of wages in the power house is often severe, as I can testify, but the moment the concession is made the trouble begins, and a shutting down for repairs on your road becomes a common occurrence.

Cleveland, O.—The Hafemeister Electric and Machine Co.; incorporated, and will manufacture machinery and electric goods. Capital, $5,000. Incorporators, F. C. Hafemeister, G. C. Spaller, Henry F. Stolte, Wm. Hafemeister and W. F. Cowley.

CALCULATIONS OF THE WEIGHT OF ACCUMULATORS REQUIRED FOR A TRAMWAY.

BY G. CHENET AND H. BOY DE LA TOUR.

We think it would be interesting to establish a very simple general formula enabling us to calculate rapidly the weight of accumulators required to draw a load, A, with a speed, v, along any track whatever.

The load, A, comprises the weight, A′, of the car with the motors and passengers, plus the weight, A″, of the accumulators.

$$A = A' + A''.$$

The necesssary power in kilogrammetres per second, at each point of the track, is determined by the known formula:

$$P = A\ (15 \pm r)\ v \qquad (1)$$

in which

A represents the total weight to be drawn, expressed in tons;

15, the coefficient of traction admitted for level ground expressed in kilogrammes per ton;

r, the gradient in per thousand;

v, the speed in metres per second.

Of course, r is positive in an ascent and negative in a descent. In the same way when an incline is equal to 15 in 1,000, the work to be furnished by the accumulators must be *nil* for the descent, for at each thousand the coefficient of traction per ton is diminished by 1 kilogramme per ton. Let us examine the two following cases:

1st. The track comprises inclines greater than 15 in 1,000.

2d. The track only contains inclines equal to or below 15 in 1,000.

1st. In this case the mean of the inclines, *i. e.*, the algebraic sum of the values $\pm r$ in a journey up and down, is not equal to 15, for the work furnished by the accumulators may be *nil*, but cannot be negative, as this would amount to a restitution of current to the battery. Therefore, the mean is above 15.

Let us take, for instance, an incline of 22 in 1,000, the coefficient of traction will be:

For the ascent: $15 + 22 = 37$ kg. per ton.
For the descent: $15 - 22 = 0$

The mean will be $\frac{37}{2} = 18.5$ kg. per ton. We see, therefore, that in every part of the line where the incline is above 15 in 1,000, the mean is:

$$\frac{15 + r}{2}$$

Therefore, in this first case, we must first get the sum of the products of the coefficients of traction by the lengths of the incline, for both the up and down journey (of course for the case of most general occurrence), and divide it by twice the total length. The coefficient, k, thus obtained, will be the mean coefficient to be considered. We shall thus get:

$$\frac{\Sigma (15 + r)\, l}{2\ L} = k,$$

and formula 1 becomes

$$P = A\, k\, v.$$

The E.M.F. of the accumulators at discharge being 1.85 volt per element, if we call I the density of current in ampères per kg. of accumulators (net weight or gross weight) under the rate of discharge adopted, we shall get

$$(A' + A')\, k\, v = A''\ 1.85\ \frac{1{,}000}{9.81}\ I.$$

Whence we deduce

$$A' = \left(\frac{1.85 + 1{,}000\ I}{9.81\ k\ v} - 1\right) A'' \qquad (2)$$

The efficiency of the motors, including gearing, being usually 75 per cent., and the losses due to startings and curves being about 10 per cent., formula 2 becomes:—

$$A' = \left(\frac{1.85 \times 1{,}000\ I \times 0.75 \times 0.9}{9.81\ k\ v} - 1\right) A'',$$

whence we get:

$$A'' = \cfrac{A'}{\cfrac{1.85 \times 1{,}000\ I \times 0.75 \times 0.9}{9.81\ k\ v} - 1};$$

but we see that:

$\frac{1.85 \times 1{,}000\ I \times 0.75 \times 0.9}{9.81}$ is a constant and $= 127.28$;

therefore it comes out finally

$$A'' = \cfrac{A'}{127.28\ \cfrac{I}{k\ v} - 1.}$$

Remark.—In a descent exceeding 15 in 1,000, the brakes have to be put on to the wheels to overcome the acceleration, which would make the speed dangerous.

The force that must be applied to the brakes can easily be calculated, for it is deduced from the theorems on inclined planes.

We can, in fact, write down, calling a the angle which the inclined plane makes with the horizontal:

$$F = A\ (\sin a - f \cos a),$$

but as:

$$\sin a = \frac{a}{\sqrt{a^2 + b^2}}\ ;\ \cos a = \frac{b}{\sqrt{a^2 + b^2}}$$

it comes out

$$F = \frac{A}{\sqrt{a^2 + b^2}}(a - f\, b)$$

in which:

A is the weight in kilogrammes;

a the difference of level;

b the length of the slope measured on level ground, *i.e.*, the projection on a horizontal plane of the slope;

f the coefficient of traction, which we have assumed to be 15 kg. per ton, but which becomes here .015.

The power in watts absorbed by the brakes will be:

$$P = \frac{v\ F}{75}\ 736 = 9.81\ v\ F.$$

2nd. When there is no incline above 15 in 1,000, the final formula is simpler still.

In fact, in this case, the algebraic sum of the values $\pm r$ is *nil*, we get therefore

$$P = 15\ A\ v = A''\ 1.85\ \frac{1{,}000}{9.81}\ I;$$

this formula becomes with additions:

$$A' = \left(\frac{1.85 \times 1{,}000\ I \times 0.75 \times 0.9}{9.81 \times 15\ v} - 1\right) A'',$$

whence we deduce

$$A'' = \cfrac{A'}{\cfrac{1.85 \times 1{,}000\, I + 0.75 \times 0.9}{9\ 81 \times 15\, v} - I},$$

but as

$$\frac{1.85 \times 1.000 \times 0.75 \times 0.9}{9\ 81 \times 15}$$ is a constant and $= 8.485$,

it comes out at last

$$A'' = \cfrac{A'}{\cfrac{8.485\ I}{v} - 1.}$$

We often get in the data of a particular case, the ampères per kg. of accumulators for three rates of discharge only. It happens, however, since the rate of discharge is a function of the speed and of the road to be traversed, that the rate which we are obliged to assume occurs between two of the given rates or outside the three rates.

It is, therefore, worth while to establish a simple formula enabling us to calculate rapidly the current per kg. of accumulator for any rate whatever.

The curve obtained by carrying out the hours of discharge t, as abscissæ, and the intensities, I, as ordinates, has an equation of the following form:

$$a + b\,t + \frac{c}{t} = \text{I}. \qquad (3)$$

The values of the constants, a, b, c, can be easily established for the type of accumulator chosen, for knowing I for the three rates of discharge, n, n', n'', we can write down:

$$a + n\ b + \frac{c}{n} = \text{X},$$

$$a + n'\,b + \frac{c}{n'} = \text{Y},$$

$$a + n''b + \frac{c}{n''} = \text{Z}.$$

We then at once get the numerical values of a, b, c, which on being inserted in formula 3, give the value of I for a known value of t.

The addition to be made for startings may be established by the following formual:

$$\text{in kgm.}: \text{W} = \frac{\text{A}\ v^2}{2\ g},$$

$$\text{in w. h.}: \text{W} = \frac{\text{A}\ v^2}{2},$$

in which

A is the total weight in kg.;
v the speed in m.: s.

This quantity multiplied by the total number of startings reckoned for during the time of discharge will represent the total energy required for the startings.

The addition due to curves can only be estimated approximately, and depends on the radius of the curve, on the state of the track, and the kind of rails used. The allowance made in our formulæ for startings and curves is sufficient for the requirements of ordinary practice. It can be increased when the stoppages are very numerous, and for unfavorable conditions as regards the radius of the curve and the state of the track.—*L'Industrie Electrique.*

—Many men aim to tell the truth but few hit the mark.

NEW BOOKS.

Electricity for Everybody—Its Nature and Uses Explained—By Philip Atkinson. With 100 illustrations and portrait of the author as a frontispiece. 12mo, 240 pages. New York: The Century Co. Price, $1.50.

Although electricity has invaded almost every department of human activity it is less understood than any other natural force. The object of Mr. Atkinson's book is to meet the public demand for information in regard to the nature and uses of electricity, and the various kinds of apparatus by which it is generated and employed. The author has kept constantly in mind the difficulty of his subject and has striven to divest his book of the confusing technicalities of the science. There is no sacrifice of strict scientific accuracy, but as little detail as possible has been included. Mr. Atkinson explains that his constant aim has been to make each topic so plain that any person having no previous knowledge of electricity or kindred sciences, who gives the book a careful perusal, can obtain a good general knowledge of electric science in all its principal details. That he has succeeded in doing this is the highest praise his work needs.

The Practical Application of Dynamo-Electric Machinery. By Carl K. MacFadden and Wm. D. Ray, Illustrated, Laird & Lee, Chicago. Price, $1.00.

The aim of the authors in producing this book is, in their own words, to reach a class of readers who, realizing the need of a general fundamental understanding of the application of electricity, will read with some benefit the descriptions given of the *modus operandi* of the most generally used class of electrical machinery. The book is written in a simple style, to enable those who have no knowledge on the various subjects to gain a good understanding of the topics described, and no doubt this class of readers will be greatly instructed and benefitted by a careful perusal of its pages. The book is of a conveniently small size, has 164 pages of descriptive matter, with many well-executed drawings and illustrations, and some tables at the back will be found of great convenience for reference.

Electricity for Students.—By Edward Trevert. Bubier Publishing Company, Lynn, Mass. Price, $1.00.

Mr. Trevert has added this work to his list of excellent books on electrical subjects, his object, in this instance, being to explain in brief and simple language the theory and practical application of electricity up to late. This work is intended as a popular treatise only. In considering the various subjects, he has given only such matter as has been advanced by the modern scientists. Experiments and descriptions are given that combine theory and practice, and demonstrate the practical application of the science. The book is well illustrated, and includes some original and very clearly designed diagrams of the different classes of apparatus. It contains much valuable data and is worth a place in every electrical library as a work of reference. The work has 128 pages, including a well-arranged index of subjects.

Polyphase Electric Currents and Alternate Current Motors.—By Silvanus P. Thompson, D. Sc. 250 pages; 171 illustrations; cloth. Spon & Chamberlain, New York. Price, $3.50.

This work is intended for the use of students and engineers. Its contents by chapters are as follows: I.—Polyphase Generators II.—Combinations of Polyphase Currents. III.—Properties of Rotating Magnetic Fields. IV.—Early Development of Rotary-Field Motors. V.—Structure of Polyphase Motors. VI. Elementary Theory of Polyphase Motors. VII.—Analytical Theory of Polyphase Motors. VIII.—Monophase Motors. IX. Miscellaneous Alternate Current Motors. X.—Polyphase Transformers. XI—Measurement of Polyphase Power. XII.—Notes on Design of Polyphase Motors. XIII.—Mechanical Performance of Polyphase Motors. XIV.—Some Examples of Modern Polyphase Motors. XV.—Distribution of Polyphase Currents from Central Stations. Index.

The *Century Magazine* celebrates its 25th anniversary in an extraordinary and beautiful number for November. Among the many exceedingly interesting articles in this attractive number are "Equality as the Basis of Good Society," by William Dean Howells; "The Issues of 1896"—a Republican view (By Hon. Theodore Roosevelt), a Democratic view (By Hon. William E. Russell), and "The Armenian Question," by James Bryce.

New York Notes.

Mr. E. B. Latham, 136 Liberty Street, special agent for New York City and Brooklyn of the Dayton Fan and Motor Co., of Dayton, Ohio, has one of his company's machines on exhibition at his office. Dayton motors are made in sizes from 1/6 H. P. to 50 H. P., and the dynamos from 1 K.W. to 50 K.W. They are very efficient machines.

The report of the Third Avenue Railroad Company, of New York City, for the quarter ending September 30, shows gross earnings, $725,719, an increase of 110,900 as compared with the same period last year; operating expenses, $366,957, an increase of $53,982; net earnings, $358,762, increase, $56,918.

Street Railway Notes.

Woonsocket, R. I.—The Woonsocket Street Railway Co. will commence on the Blackstone extension of the electric street-railway system at once.

Pottsville, Pa.—The citizens of Shafferstown and vicinity have subscribed nearly $45,000 for the extension of the Reading and Womelsdorf electric railway to said place. Estimated cost, $80,000.

St. Louis, Mo.—It is stated that Charles Green, president of the People's Railway, will change the cable system of that line to an underground trolley system within the next year.

Chester, Pa.—Surveyors are locating the line for the proposed extension of the Prospect Street Railway.

Doylestown, Pa.—The application for a charter for the Delaware and Schuylkill Traction Co. has been filed. Francis Fennimore, Wm. Jenks Fell, Marshall S. Lynch, Robert C. Fulton and Samuel A. Hamilton are the applicants.

Bristol, Pa.—Petitions are being signed by property owners from Torresdale to Bristol for the Holmesburg and Bristol Trolley Co. to be extended to Bristol.

New Corporations.

Lincoln, Ill.—Logan County Electric Light Co. has been incorporated by John W. Lutz, Charles C. Reed, John St. Gerny, T. A. Reynolds, Adam Denger, D. H. Harts, R. H. Cains and John A. Lutz. Capital stock, $10,000.

Denver, Colo.—Machine Electric Light and Power Co. has been incorporated by J. S. Spencer, F. D. Taggart, H. J. Mayhan. Capital stock, $100,000.

Washington, Pa.—The Washington and Canonsburg Railway Co. has been incorporated, with Arthur Kennedy president, Francis J. Forrauer, Thomas B. Hutchinson, L. H. Matthews and others, to construct an electric railway seven miles long. Capital stock, $75,000.

Sac City, Iowa.—Sac City Electric Co. has been incorporated by D. C. Early, Asa Platt, D. E. Hallett, E. N. Baily, J. E. Robbins, W. Cheney and J. Y. Campfield. Capital stock, $15,000.

Jersey City, N. J.—The Puerto Padre Co. has been incorporated by Edmund F. Harding, Thomas F. Lennon and Jos. J. Schmidt, to build steam and electric railways, etc., in Cuba.

Holton, Kas.—Holton Electric Co. has been incorporated by Clarence A. Ross and W. H. Blood, Jr., of Kansas City, and L. T. Bonebrake, of Holton. Capital stock, $10,000.

Monroe City, Mo.—Monroe City Electric Light Co., capital, $10,000. Wm. Wood, E. P. Nelson and W. T. Ragland.

Buffalo, N. Y.—Buffalo Traction Co., incorporated, to construct a street surface railroad 66 miles in length, to be operated by electricity. Capital, $3,000,000. Directors, E. G. S. Miller, Joseph B. Mayer, Leonard B. Croker, Washington Bullard and Herbert Bissell, of Buffalo; Tom L. Johnson, of Cleveland, O., Richard Ladenburg, John K. Page and Louis Kohn, 321 East 85th Street, New York City.

Possible Contracts.

Kalamazoo, Mich.—The City Council has granted a franchise to the American Telegraph and Telephone Co. to erect poles and lay wires in Kalamazoo. Mayor Ihling.

Oakdale, Pa.—A charter has been granted to the Oakdale Electric Light, Heat and Power Co., of Allegheny County. Capital, $8,000. Incorporators names not given.

St. Paul, Minn.—The 4th Street and Shelby Avenue Street Railway Co.'s line will change its motive power to electricity.

Georgetown, D. C.—The Georgetown Barge, Dock, Elevator and Railway Co. have been granted permission to build a double railroad track on Water Street, Georgetown, from Aqueduct Bridge to Rock Creek. Work will be begun at once.

Boston, Mass.—Preparations are being made for an extensive addition to the Adams House. Foundations are being put in on land on Mason Street, owned by Mr. Hall, but the plans for the superstructure are not completed.

Niagara Falls, N. Y.—W. W. Gibbs, president of the Electric Storage Battery Co., with headquarters in Philadelphia, Pa., has been in Niagara Falls and together with Vice-president Wickes, of the Power Co., looked over sites with a view of locating plant.

Niagara Falls, N. Y.—The Clifton Electric Light Co. will build a power house, in which new machinery to cost $25,000 will be placed.

Kansas City, Mo.—The Karnival Krewe Committee on Lighting propose to expend $15,000 for lighting the city during the carnival week. The committee on street illumination was appointed, consisting of John Sullivan, W. W. Cowan and George P. Gloss.

New York City.—Edward Kilpatrick, 50 West 67th street, will erect a ten-story brick hotel at 94th street and Central Park, West. Architect, Frederick Jacobson.

New York City.—S. Eiseman will erect a brick store and lofts at 24 Wooster street, to cost $10,000. Architect, M. C. Merritt, 1,267 Broadway.

Brooklyn, N. Y.—The West End Railroad will build a new station and waiting room at 27th street and 5th avenue.

Cleveland, O.—A project is on foot to erect a hotel on the site of the Weddell House, by the Weddell Bros.

Little Falls, N. Y.—Little Falls Street Railway has made application to the common council for consent to construct, maintain and operate a street-surface railroad upon certain streets of the city. H. W. Warren, city clerk.

Jeffersonville, Ind.—The Jeffersonville Street-Railway Company has sold its plant to a syndicate represented by C. H. Williams. The line is to be made electric and extended. Twenty-five miles of track will be laid.

Wooster, O.—The county commissioners granted the Wooster, Medina & Cleveland Electric Street-Railway Company a franchise through Wayne County.

New York City.—Lalor & Beringer have sold the Kent Building, 79 Nassau street, to Albert Wagner, the builder, who will demolish the present structure after May 1, next, and build a modern store building in its place.

Newark, N. J.—It is proposed to erect a public library in Newark. Public Library Trustees.

Paterson, N. J.—Passaic Lighting Co. will soon commence work on the new building in Passaic street and Columbia avenue, to cost $100,000.

Philadelphia, Pa.—Collins & Audenreith are drawing plans for a store building to be erected on Market street.

Albany, N. Y.—The Albany Insurance Co. will erect a building on the Gladding property, adjoining the Albany Savings Bank.

Paterson, N. J.—The building which is to be erected by Quackenbush & Co., on Main street, will be equipped with electrical appliances.

Washington, D. C.—The power-house for the operation of the F Street Electric Line has been located. The officials of the company purchased a site and the work will be commenced soon.

Skaneateles, N. Y.—The village trustees at a special meeting, October 28, granted to the Auburn Inter-Urban Railway Co. a franchise to lay and operate a surface railroad in said village.

Telephone Notes.

Jefferson, Ga.—A charter has been granted to a company to build a telephone line from Jefferson, Jackson County, to Athens, and work will be begun at once.

Bridgeport, Conn.—Articles of incorporation of the Bridgeport Mutual Telephone Co. have been filed. President, Frederick W. Tracy; secretary, Wm. C. Bowers.

Painesville, O.—The Painesville Telephone Co. is prepared to receive bids for the construction of its exchange.

Tyrone, Pa.—Phœnix Telephone Co., of Altoona, have been granted permission to establish wire lines and erect poles in Tyrone.

Cape May, N. J.—Wm. Boston, a government telephone expert, is at Cape May, completing a survey for a telephone circuit, which will extend from South Atlantic City to Cape May Point, connecting all of the life-saving stations.

Hot Springs, S. D.—The People's Telephone and Telegraph Co., with headquarters at Hot Springs, incorporated. Capital, $50,000.

Antigo, Wis.—J. T. Jansen, of Milwaukee, has been in this city in the interest of the Wisconsin Telephone Co., obtaining contracts from the citizens to insure the exchange. He secured enough and the line will be built immediately.

Springfield, Ill.—E. H. Brainerd is interested in the forming of a new telephone company.

La Grande, Ore.—La Grande Ronde Telephone Company is contemplating putting in a telephone system in La Grande.

Laramie, Wyo.—A movement is again in progress to establish a telegraph and telephone line between Laramie and Walden in North Park. The board of trade, of Laramie.

Youngstown, O.—J. W. Cherry, of Columbus, general manager of the Bell Telephone Company, has been in Youngstown conferring with the city commissioners regarding the granting of a franchise to the new telephone company.

Oconto, Wis.—Articles of incorporation have been filed by the Oconto Telephone Company. Capital, $7,500. Incorporators, A. H. Luchanback, C. W. Stooting and D. G. Classon.

Rockville, Md.—The officers of the Chesapeake & Potomac Telephone Company have made application to the mayor and council of Rockville for permission to erect poles and string wires from the southeastern limits of the town to the Montgomery Hotel.

Sycamore, Ill.—The De Kalb County Telephone Co. is planning to put in telephone lines from Syracuse to Sandwich.

Waynesburg, Pa.—C. Z. Suthers, s superintendent of the telephone company, has been in Waynesburg looking after the interest of the company. They expect to erect at once a new metallic circuit line between Waynesburg and Pittsburgh.

San Jose, Cal.—People's Telephone Co. Capital, $50,000. W. C. Andrews, Gus Lion, F. E. Spencer, H. O. Hikox, C. E. Severence, Nicholas Bowden. The object of the company is to build a complete telephone system of the Calfornia Telephone & Construction Co.'s system, now in operation in Sacramento and Santa Cruz, and wishes to be extended to all parts of the State.

TELEPHONE PATENTS ISSUED OCTOBER 29, 1895.

Telephone Switch. John E. Thomas, Cleveland, Ohio. (No. 548,897).

Trade Notes.

We have received from the Automatic Circuit Breaker Co., Newaygo, Mich., a copy of their new catalogue of automatic circuit breakers and electrical specialties manufactured by this concern. The Automatic Circuit Breaker Co. is the successor to the Sweet Electric and Manufacturing Co., of Grand Rapids, Mich.

W. N. Gray & Co., 200 Neave Building, Cincinnati, O., and 15 Reily Block, Hamilton, O., have issued a little pamphlet giving some valuable facts and suggestions for buyers of electric light and power plants. This firm carries on a business of electrical engineering and installs power plants of all kinds.

Roth Bros. & Co., manufacturers of high grade dynamos and electric motors, 30 to 34 Market street, Chicago, have issued their catalogue No. 3.

ELECTRICAL and STREET RAILWAY PATENTS

Issued October 22, 1895.

548,627. Electric Traction. Emile Chabeault, Marseilles, France. Filed Aug. 17, 1894.

548,631. Car-Fender. John H. Doerr, Camden, N. J., assignor of two-thirds to Jacob Lodge and Hanford C. Smith, Philadelphia, Pa. Filed Aug. 5, 1895.

548,682. Electric-Arc Lamp. Malone Wheless, Washington, D. C. Filed May 2, 1895.

548,683. Electric-Arc Lamp. Malone Wheless, Washington, D. C. Filed June 8, 1895.

548,700. Electrical Recording Apparatus. Albert C. Crehore, Hanover, N. H. Filed Apr. 8, 1895.

548,701. Indicator for Electric Currents. Albert C. Crehore, Hanover, N. H. Filed May 25, 1895.

548,704. Trolley-Wheel. Ferdinand J. Feldt, Peoria, Ill., assignor of one-half to Arthur Hoklas, same place. Filed Apr. 20, 1895.

548,744, Electric Switch. John C. Cassidy, East Orange, N. J. Filed July 19, 1895.

548,755. Electric Meter. Ralph O. Hood, Danvers, Mass. Filed Mar. 9, 1895.

548,777. Electrode for Applying Electric Currents. Edwin F. Davis, West Caton, assignor of one-half to Quincy W. Wellington, Corning, N. Y. Filed June 10, 1895.

548,786. Underground Electric Railway. Henry B. Nichols and Frederick H. Lincoln, Philadelphia, Pa. Filed Mar. 11, 1895.

548,789. Distribution System for Alternating Currents. Alva L. Searles, Brooklyn, N. Y. Filed Apr. 18, 1895.

548,805. Guard for Street-Cars. Henry A. Howe, Newark, N. J., assignor to Chas. S. Stockton, same place, and Joseph Livingston, New York, N. Y. Filed Aug. 8, 1895.

548,815. Car-Fender. James O'Donnell, San Francisco, Cal. Filed July 8, 1895.

548,819. Electric Switch. Hiram Ross, Providence, R. I. Filed July 17, 1895.

548,829. Device for Regulating Current Admitted to Electric Motors. Frank E. Herdman, Winnetka, Ill. Filed May 22, 1895.

548,830. Automatically Controlling Electric Motors. Frank E. Herdman, Winnetka, Ill. Filed June 29, 1895.

548,897. Telephone-Switch. John E. Thomas, Cleveland, Ohio, assignor to the Union Electric Company, same place. Filed Apr. 17, 1895.

548,899. Adjustable Incandescent-Lamp Holder. Edward Wade, Lawrence, Mass. Filed April 1, 1895.

548,904 Automatic Time Cut Out. Francis B. Badt, Chicago, Ill. Filed Sept. 24, 1894.

548,906. Car-Fender. Henry Brandt, Brooklyn, N. Y. Filed Apr. 25, 1895.

548,924. Electric Train-Signal. Myron W. Parrish, Detroit, Mich , assignor of three tenths to Stephen K. Stanton, J. H. Carstens and Frederick T. Sibley, same place. Filed Dec. 24, 1894.

548,930 Turbine Electric Generator. Charles E. Sargent, Cihcago, Ill. Filed Sept. 19, 1894.

548,949. Safety and Limit Switch for Electric Motors, George F. Card, Mansfield, Ohio. Filed Aug. 21, 1895.

548,952. Electric Brake. Frank E Case, Schenectad , N. Y., assignor to the General Electric Company, of New York. Filed June 29, 1894.

548,967 Car-Fender. Samuel A. Darrach, Newark, N J., assignor to the Darrach Car-Fender Company, same place. Filed Feb. 7, 1895.

548,968. Automatic Circuit-Breaker Alarm John H. Devine, Johnstown, Pa. Filed Nov. 13. 1894.

548,969. Telegraph-Instrument Orville A. Dickinson, Arverne, N. Y. Filed July 13, 1895.

548,974. Car-Fender. George I. Favorite, Washington, D. C. Filed May 24, 1895.

548,976. Closed-Conduit Electric Railway. Michael F. Flynn, Stamford, Conn. Filed Nov. 27, 1894.

548,997. Electric-Motor-Car Trolley. James M. Kennedy, Hollidaysburg, Pa , assignor of three-fourths to Thomas F. Johnston, same place, and William F. Gable and Galen Hemperly, Altoona, Pa. Filed May 31, 1895.

549,023. Secondary Battery Plate and Method of Preparing It. John J. Rooney, Brooklyn N. Y. Filed April 1, 1895.

549,038. Electric Programme-Clock. Leon H. Watters, Media, Pa. Filed Nov. 30, 1891.

549,045. Electric Burglar-Alarm Mark Anthony, Streator, Ill. Filed Feb. 14, 1895.

549,053. Telegraph-Pole. Albert A. Blow, Denver, Col. Filed Jan. 26, 1895.

549,061. Indirect Control of Motors. Gano S. Dunn, New York, N. Y., assignor to the Crocker-Wheeler Electric Company, of New Jersey. Filed Aug. 12, 1895.

549,068. Car-Fender. John Kerrigan, Philadelphia, Pa. Filed Aug. 2, 1895.

549,074. Electric-Arc Lamp. Regina Niewerth and Hermann Niewerth, Berlin, Germany, assignors to Niewerth & Co., same place. Filed April 25, 1895.

549,075. Electric-Arc Lamp. Regina Niewerth and Hermann Niewerth, Berlin, Germany, assignors to Niewerth & Co., same place Filed Apr. 30, 1895.

549,079. Secondary-Battery Grid and Plate and Method of preparing Grids. John J. Rooney, Brooklyn, N. Y. Filed July 22, 1895.

549,083. Electric Arc Lamp. Malone Wheless, Washington D. C., assignor to Edward W. Creecy. Filed March 6, 1895.

549,091. Trolley for Electric Railways. Jacob Hess, Scranton Pa. Filed May 13, 1895.

ELECTRICAL AGE

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NEW YORK, NOVEMBER 16, 1895.

CONTENTS.

THE LATEST TELEPHONE DECISION.

The Bell telephone monopoly is undoubtedly on the verge of i's grave; it has struck a snag in the United States Supreme Court, where justice is dispensed. On Monday last that court decided that it has jurisdiction over the case of the United States *vs.* the Bell Telephone Company, to cancel the Berliner patent, which case was decided against the government by the Court of Appeals. The Bell company argued that this latter decision was final, but the Supreme Court decided otherwise, which action will result in bringing the case to the Supreme Court for final decision. This decision is a substantial victory for the independent telephone interests, and there is much rejoicing in consequence.

AN EXPLANATION.

The *Pacific Electrician*, in its October number, makes a charge against the editor of this paper which requires some explanation. On July 6, July 13 and July 20, last, we published in as many parts an article written by Mr. F. M. F. Cazin, a well-known mining engineer, on the subject of "Losses of Efficiency" in water-power-electric plants, with special reference to the installation of this class at Bodie, Cal. Mr. W. F. C. Hasson, of San Francisco, by request, assumed the task of defending the water-wheel referred to by Mr. Cazin, and with that object in view sent us an article for publication, with the request, in an accompanying letter, that it be published in its entirety or not at all. The closing paragraph of the communication consisted entirely of a personal attack upon Mr. Cazin's integrity and motives, and was couched in language so offensive and so unbecoming for one member of a scientific profession to use toward another, that no reputable paper would have hesitated a moment in rejecting it. But, inasmuch as Mr. Cazin's side of the story had been given, we did not wish to create the impression that we were showing any partiality by refusing to print Mr. Hasson's article, so we omitted the last paragraph, which was entirely irrelevant, and printed word for word, in our issue of September 21, the essential portion—the portion relating to the facts under discussion. Because we did not submit to degrade ourselves and allow the use of our columns for the dissemination of vituperation and calumny, the *Pacific Electrician*, prompted no doubt by Mr. Hasson himself, takes us to do. It says in its October issue: "Nothing more has been heard from Mr. Cazin, of Hoboken, but the ELECTRICAL AGE finally published an emasculated version of Mr. Hasson's letter about the Bodie plant. As the letter was sent with the strict condition that it was not for publication unless it could appear as it was written, the action of the editor of the ELECTRICAL AGE was a violation of confidence that is in keeping with its usual policy of billy-goat journalism." We accord every man the right to defend his own character and interests, but we think it is his duty to do it honorably. In the case under consideration this was not done, and it was discreditable for our contemporary to make this statement, which is based entirely upon *ex-parte* evidence, without first ascertaining the facts on the other side. If the editor will ask Mr. Hasson to produce the letter-press copy of the communication sent to us and compare it with the article we published in our issue of September 21, he will see that they are both precisely alike, word for word, excepting of course the last paragraph in the original communication which we omitted. We do not consider it a "violation of confidence" at all to omit from a communication language of an abusive nature and print only that which bears upon the subject under consideration, even where there is a special request to print all or nothing. Our columns are wide open for free, legitimate discussion on any subject in our line of work, but are closed against abuse and personalities. In the East we base our actions on honor, and do not regard it a dishonor to shield personal character against unprovoked and ill-timed attacks.

THE INTERIOR CONDUIT AND INSULATION COMPANY.

The marvellously rapid development of electric lighting in the early days was the creative force of other industries,

PRESIDENT INTERIOR CONDUIT AND INSULATION CO.

the necessity for which had never before been dreamed of. New inventions imposed new necessities, but American

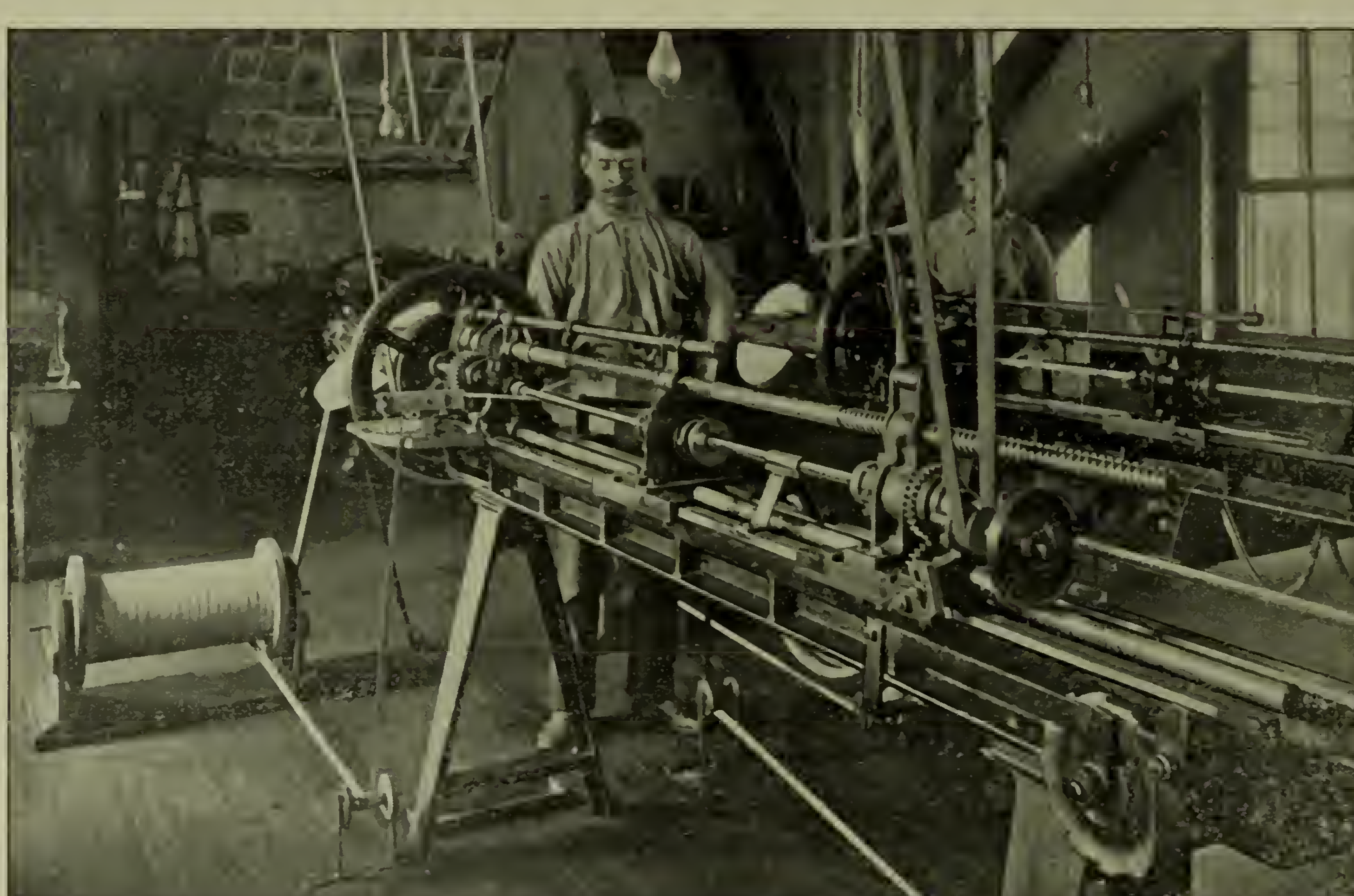


FIG. 2.—MACHINE FOR MAKING PAPER TUBES.

genius, which is always equal to any task, found a solution for every new problem that was presented, and in this way the development of electric lighting was promptly met with every want.

We all remember the alarming frequency of "electric fires" in the early days. Many pessimistic minds thought that this tendency of currents of high tension and large volume was an unsurmountable difficulty in the way of progress in electric lighting; but there were others who looked upon the subject in a diametrically opposite light and satisfied themselves that there was no obstacle that could not be overcome. True to their belief they set to

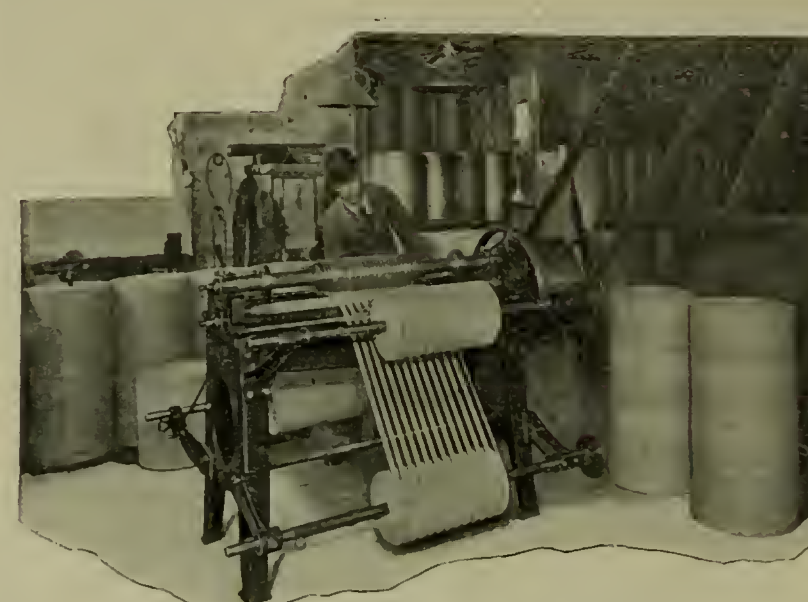


FIG. I.—PAPER CUTTING MACHINE.

work to solve the problems that then beset the way of the pioneers. They had no past experience to refer to; every undertaking was new and original, and their progress was one built up on patient experiment—trials, failures and successes.

Fortunately, however, whenever determination is back of an enterprise which has any semblance of promise, success inevitably is a result of the efforts put forth.

The electric-fire element was not long to hang over the head of the rapidly expanding industry, like the sword of Damocles, threatening to cut its career short before its full fruition. One bright mind in New York saw the importance of removing this element of danger from the pathway of the development of electric lighting and set to work—about ten years ago—to devise some way of accomplishing this most desirable result; we refer to Mr. E. H. Johnson, now the president of the Interior Conduit and Insulation Company, New York.

FIG. 3.—MAKING IRON-CLAD TUBES.

In the early days of electric lighting, when the public press was literally "jumping on" the great and powerful rival of gas on account of the many alleged "electric. fires," Mr. Johnson saw that something must be done to stop this torrent of criticism and turn the tide the other way. It was a herculean task, but he looked upon the situation in the light of stern necessity, and with that determination and enterprise for which he is well known he set to work to solve the problem. The result of his efforts is now known all over the civilized world. It was the means of robbing electric lighting of all its imaginary terrors, and today electric lighting is as safe, in every respect, as gas, and infinitely more so than any other class of illumination.

The vast business of the Interior Conduit and Insulation Company is the result of Mr. Johnson's work, and so important and necessary is its system of conduits in relation to electric light wiring that all fire underwriter boards require its adoption in such installations.

It is not our purpose at this time to describe the growth of the interior conduit system, but rather to look upon it as it is at the present time—in its perfection—and describe briefly the process of manufacture of the tubing, which is the essential element of the system. It may be remarked incidentally, however, that the Interior Conduit and Insulation Company does not now confine itself to the manufacture of interior conduits alone. Besides the many appliances that go toward making the system comprehensive and complete, the company makes dynamos and motors of the highest excellence, which are well known for their many meritorious features.

These machines are known in the trade as Lundell apparatus. In addition to this branch of the business the company has an underground conduit railroad system that is looked upon with much favor and which will be referred to more particularly later on.

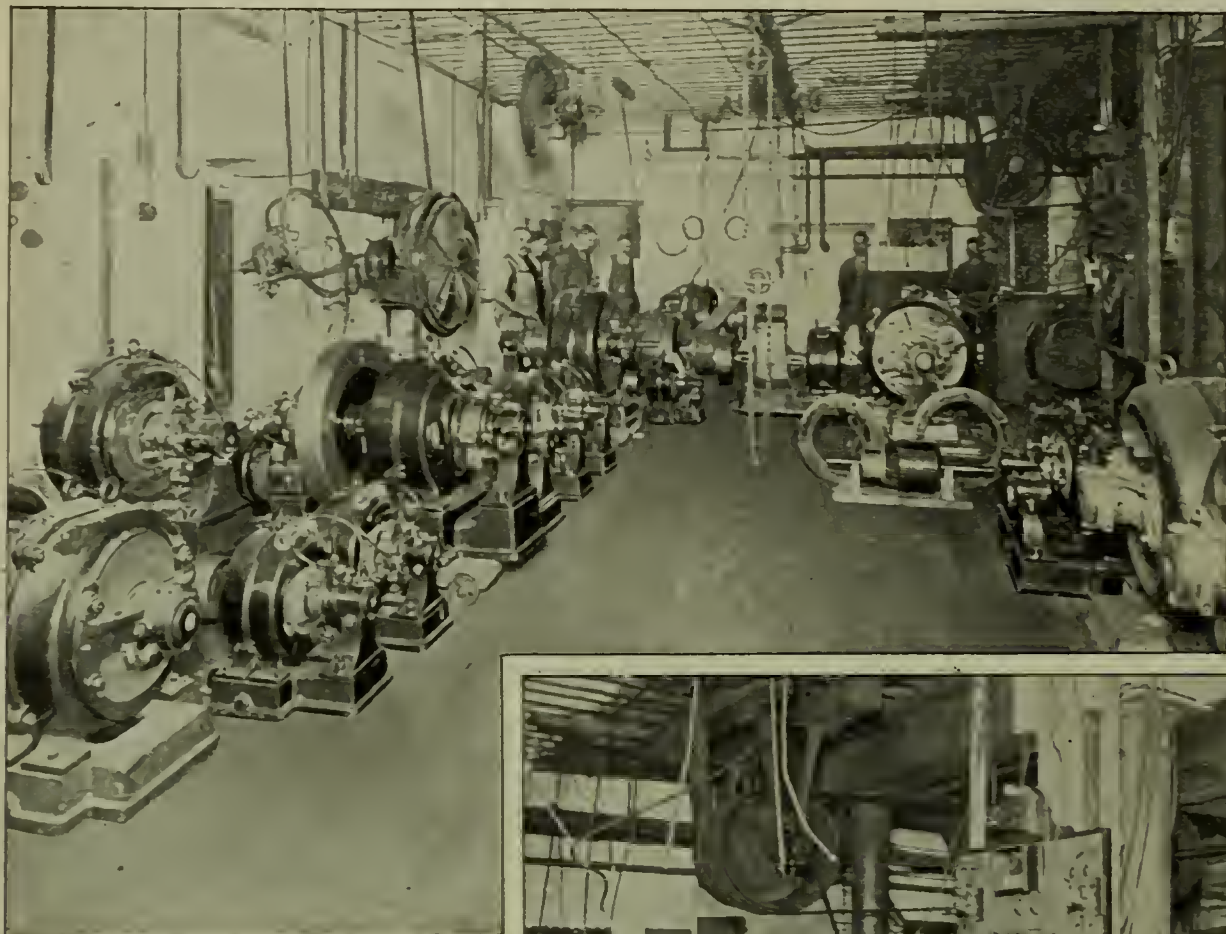
The factory and offices of the Interior Conduit and Insulation Company are located at 527 West 34th street, New York City. The main building is of brick, seven stories high above ground, with a full basement, and at the rear is an annex forming an L, of the same height as the main building. The power plant and testing room for heavy work are located in the basement in the front part of the building, just under the offices, which are situated on the first, or ground floor. On the floors above the manufacturing, assembling and finishing—from beginning to end—are carried on by the busy hands, and as one passes through the different departments a faint idea of the magnitude of the industry under the one roof may be had.

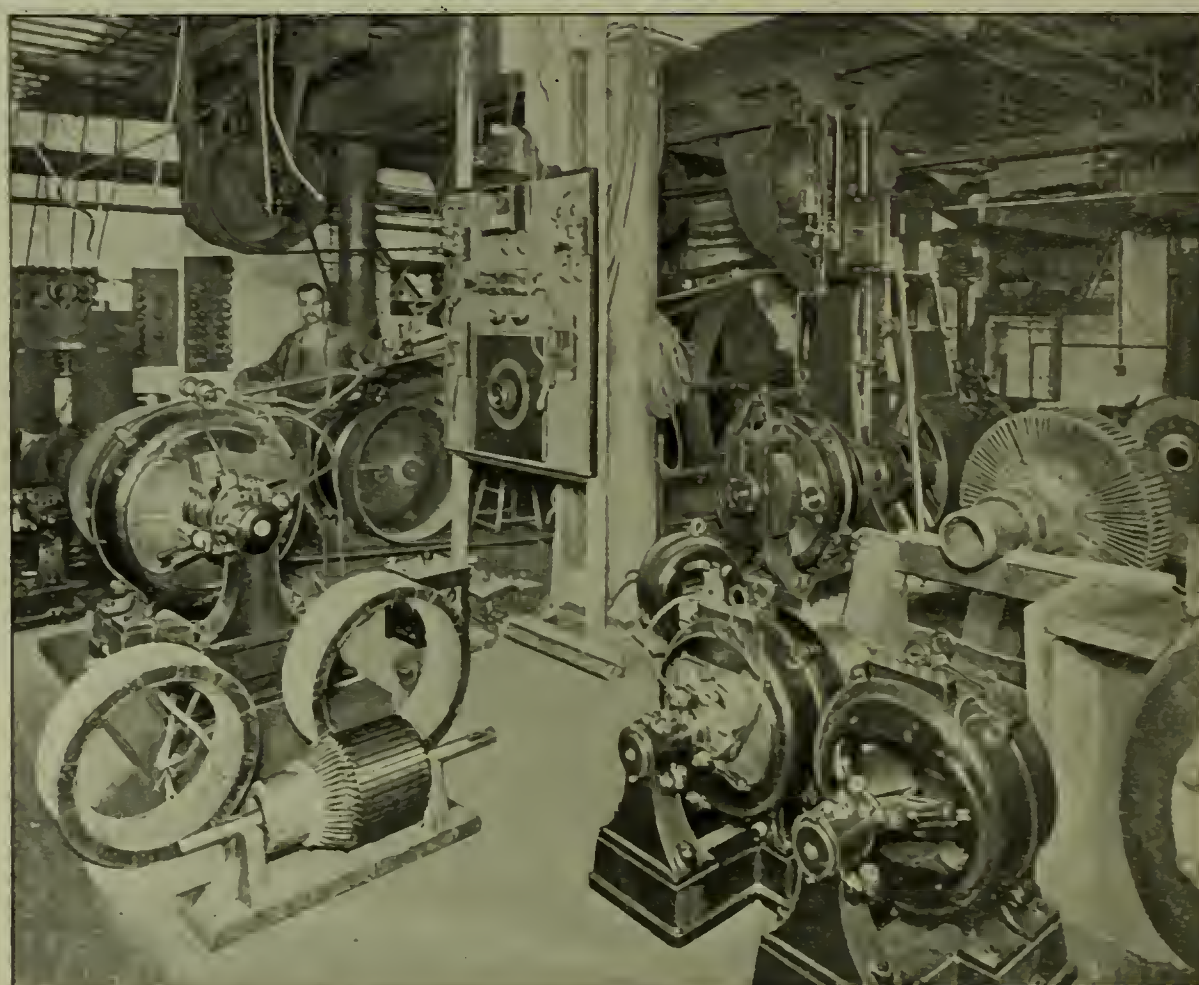
FIGS. 4 AND 5.—MAKING COUPLINGS, ELBOWS, JOINTS, ETC.

The tubing, which forms the raceways for electric wires, is made in about 12 standard sizes, ranging from one-fourth of an inch inside diameter to three inches. It is made up of a special quality of paper, known as "sheathing paper." The paper is very accurately cut on the premises into ribbons by specially devised machines (see Fig. 1), which cut the paper with mathematical accuracy. The paper ribbon is reeled on spools and then carried to the tubing machines, one of which is shown in Fig. 2. Four spools of paper are used on one machine in making tubing, two being twisted for the core and two abutting in an overlap—all four being wound spirally on the mandril. The machine automatically pastes the "overlap" and cuts off the tubing in 10-foot lengths as the product passes out. These machines are extremely ingenious, and each has a productive capacity of 15,000 feet of tubing a day, requiring little attention.

The green tubes are then taken to the drying room, where they are kept for a week in racks, so as to get rid of any moisture. At the end of the drying period they are placed in metal "cribs" or crates, and then taken to the curing house. This department is in the annex, and contains a series of large tanks built up vertically from the floor to a height of 32 feet. These tanks contain the curing compound, boiling at a temperature of 500° F., which temperature is maintained by superheated steam. When the cribs with their loads of green tubes arrive they are lowered into these yawning cavities, the cribs and their contents all disappearing beneath the surface of the boiling black compound. An hour's immersion is required for a thorough curing of the tubes. Specially designed crates are used for the curing of elbows and boxes.

After the crates have been raised from the hot liquid they and their contents are left hanging for a while in order to allow the surplus compound to drain off. After being thoroughly dried the tubes are taken out and delivered to the finishing room, where they are passed through a machine with a vat containing a mixture which renders the tubing alkali proof. The tubes are at the same time "rodded," which gives a smooth surface to the interior. After this operation they are ready for shipment or armoring.





FIGS. 7 AND 8.—INTERIOR CONDUIT AND INSULATION CO.'S GENERATORS.

Three styles of finish are given to these tubes—the plain, brass-armored and iron-armored. In the process of brass armoring the plain tube is fed into a machine, together with brass tape. As the tube advances the brass strip is brought around it and the edges folded together in such a way as to make a waterproof and very tight longitudinal joint. Each length of tube is then notched at the ends, so as to allow the removal of a small portion of the brass armor. The removal of the armor is for the purpose of providing continuous insulation, when the ends of separate lengths are brought together and fastened by means of the sleeve. This brass-armored conduit combines strength and lightness, and is designed for use in places where the plain tube or the iron-clad is not desirable—in private house-wiring, for instance, where tubing is laid on the outer surface of walls and ceiling.

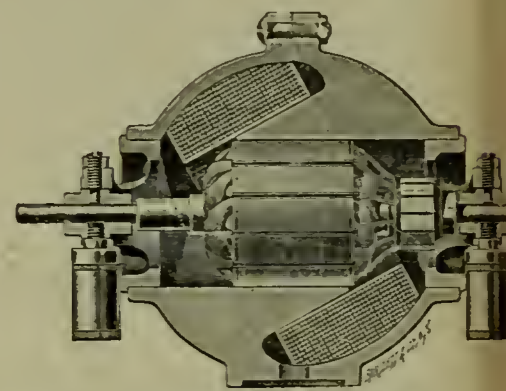


FIG. 6.—CROSS-SECTION LUNDELL FAN MOTOR.

The process of applying the iron pipe to tubes to form the iron-clad style of tubing is an interesting one. The plain tube is passed into a tank containing hot insulating compound (Fig. 3). As the tube emerges it goes into a hot iron pipe. As the pipe cools it contracts and forms a very intimate union with the paper tube, the two parts forming a practically homogeneous whole. The ends of the iron-clad tubes are then cut off, reamed and screw-threaded for the screw coupling. Proper precautions are of course taken to insure continuous insulation at the joints, as in the case of brass-armored tubing. The iron-armored tubes are then again rodded, to insure a smooth and clean interior, and the pipes are ready for shipment.

The supplementary devices of the tube system, such as couplings, elbows, joints, etc. (Figs. 4 and 5), are pro-

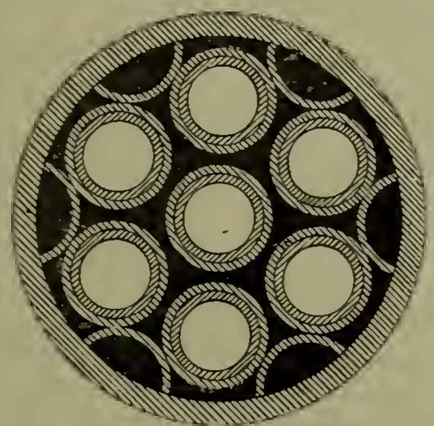


FIG. 9.—IRON-CLAD CONDUIT.

duced by experienced hands. The elbows are bent into shape by hand-power machines, very ingeniously devised, and the iron-armored elbows are formed by hydraulic pressure.

Iron-clad conduits are made as well for underground work for electric railroads, such tubing having given great satisfaction in practical use.

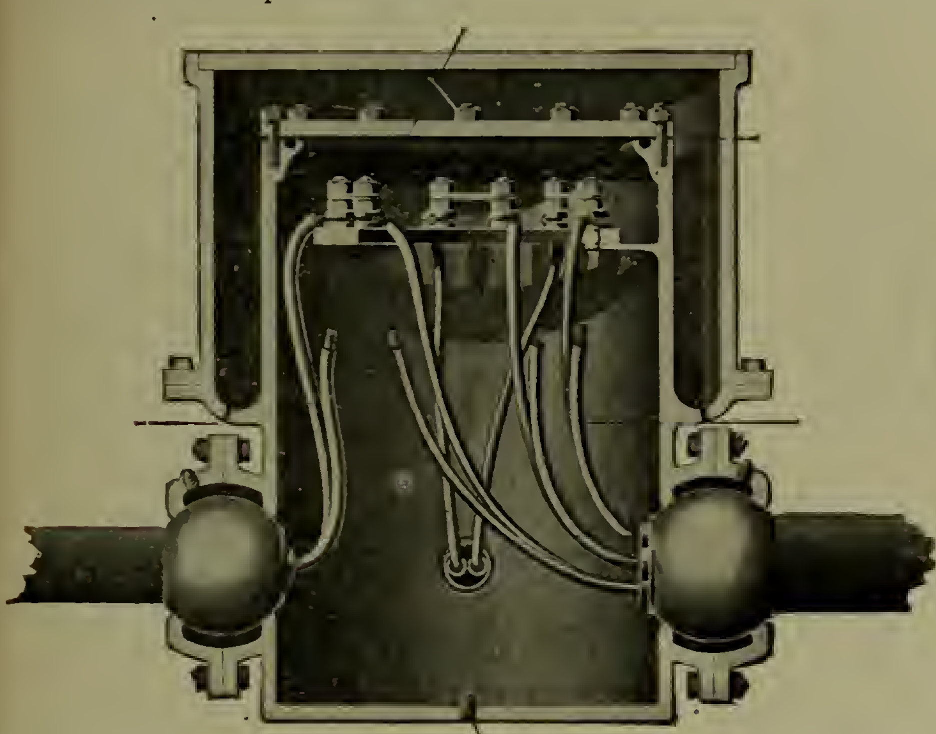


FIG. 10.—JUNCTION BOX.

This brief description of the different steps in the process of making interior conduits of all classes, together with the illustrations given, will enable the reader to gain a good idea of the manner in which this interesting work is carried on.

The next branch of the vast business that will interest all is that devoted to the manufacture of dynamos and motors. The Lundell motors and dynamos, manufactured by the Interior Conduit and Insulating Co., are so well and favorably known that an extended description of the same is hardly necessary, these machines having been already fully described in detail.

Several floors of the factory are given over to this branch of the business. Lundell fan motors, on account of their excellence and compactness of design and their efficiency, at once met with great popularity and favor. They have the shortest possible magnetic current (Fig. 6), and but one magnetizing coil. The armature is of the Pacinotti drum form, and so adjusted to the peculiarly shaped pole-pieces that the reactions leave the motor sparkless under all conditions. The point of commutation is unchangeable and the carbon-pencil brushes are held firmly to their duty by means of little spiral springs. The bearings of the machine are self-oiling, and the motor runs for months without any attention. Its spherical shape permits of its use in any position. The regulating switch in the base gives three speeds, namely, 800, 1200 and 1500 revolutions per minute. In operation this motor is practically noiseless, and for this reason alone it is deservedly popular.

The company is making Lundell motors for both direct and alternating currents. The alternating fan motor has a cylindrical-field magnet, and is built for high frequency. up to from 14,000 to 16,000 alternations per minute, as well as for low frequency, at about 7,200, at voltages of 52 and 104. These machines in their mechanical features, and finish, are similar to those of the direct-current type.

FIG. 11.—PLAN OF JUNCTION BOX.

The Interior Conduit and Insulation Company's generators (Figs. 7 and 8) are designed for use where space is limited, and some of its marine installations are proving very successful. Its slow-speed compound-wound generator for direct connection to high-speed engines is of recent production.

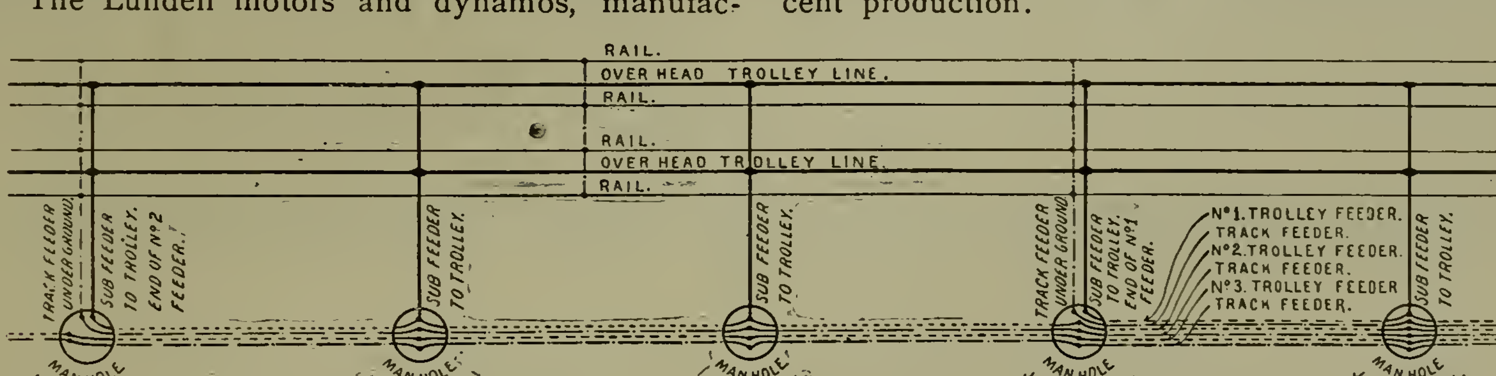


FIG. 12.—SYSTEM WITH MAIN CONDUCTOR PARALLELING THE TROLLEY WIRE.

THE NEW UNDERGROUND CONDUIT SYSTEM.

The successful use of iron-armored conduits under all conditions of previous application directed the company's attention to its possibilities for electric railway underground distribution. The result of the efforts thus put forth is the production of a system that possesses some excellent features and promises to meet with liberal consideration. A general description and illustration of the system are given herewith.

Fig. 9 shows a cross-sectional view of a seven-duct iron-clad conduit. In the process of laying, the sections are telescoped one within the other, thus affording a double

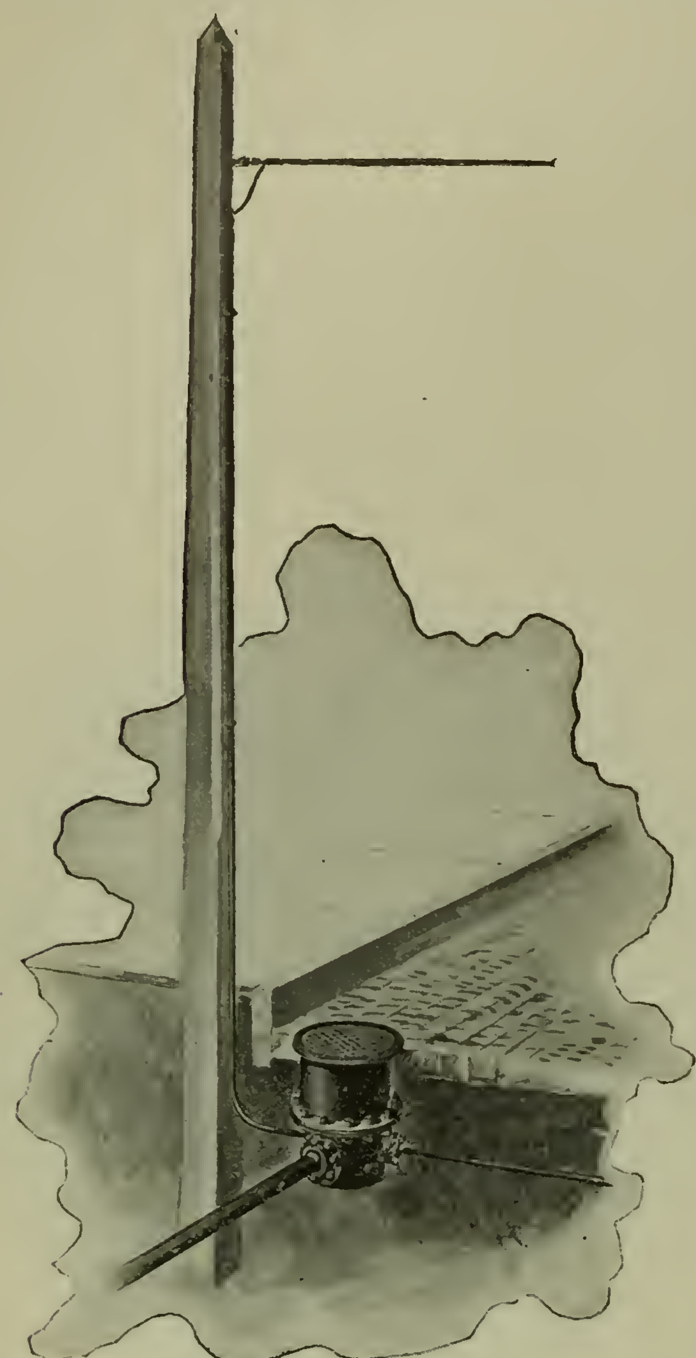


FIG. 13.—POLE TUBE AND CONNECTION WITH CONDUIT.

wall of insulation. At intervals averaging about 500 feet, or at intersections of streets, are used cast-iron junction boxes (Fig. 10). The box is provided with a double cover, the one on the inside making a joint as tight as is required in steam-fitting, and that on the outside being made extra heavy ribbed to give protection against damage from street traffic. The box is set on a substantial foundation of plank or masonry, according to the character of the soil, and surrounded with sand or fine gravel. The annular pocket about the upper part of the box affords abundant facility for carrying off all water drainage through the surrounding sand or gravel.

The application of this system to trolley lines is shown in Figs. 12, 13 and 14. Fig. 12 illustrates a system with a main conductor paralleling the trolley wire. The trolley wire, the main conductor paralleling the same, the feeders leading from the switchboard to the terminal points and from the switchboard to the track are all shown, the junction boxes being represented by the circles. All the conductors except the trolley wire may be placed in one underground conduit. At proper intervals a sub-feeder leads from the parallel main to the trolley wire, making a connection from the cables passing through the junction box through the medium of a pole-tube. Fig. 13 shows the method of setting a pole-tube and the connection with the junction-box.

A series of junction-boxes with flexible cables drawn through the conduit is shown in Fig. 14. This illustrates the method of forming a continuous conductor.

In closing this article it will be appropriate to mention the names of those gentlemen who direct the affairs of the Interior Conduit and Insulation Company. The president, Mr. Edward H. Johnson, is an old-time electric-light man, and one of the most progressive spirits in the electrical world ; Mr Everett W. Little is its vice-president and general manager; Mr. Charles P. Geddes is the secretary and treasurer ; Robert Lundell, electrician, and Charles S. Pease, superintendent.

ELECTRO-THERAPEUTICS.

Some interesting experiments have recently been made in the application of weak galvanic currents to the treatment of nervous disorders of the stomach, says the *London Electrical Review*. The galvanic currents are applied directly to the stomach by means of a specially designed electrode, which is swallowed by the patient. This electrode, invented by Dr. Einhorn and modified by Dr. Ewald, consists of an India-rubber tube 1 mm. thick, which terminates in a perforated vulcanite capsule, and contains the conducting wire. The conducting wire does not quite reach to the perforated capsule, but only goes far enough to dip into the water in the stomach. After the patient has drunk two glasses of luke-warm water, the electrode is introduced and connected with the negative pole of the galvanic battery. The strength of current employed is from 15 to 26 milliamperes, and the duration of the sitting five minutes. The success of these experiments was such as to secure a place for the method in the treatment of nervous disorders of the stomach and bowels.

MAGNETIC SURGERY.

A remarkable use of magnetism was made a few days ago at the New York Eye and Ear Infirmary. A piece of steel three-eighths by one-quarter inch in size had accidentally become imbedded in a man's eye, and the nature of the injury was such that a surgical operation was held to be inadvisable. A strong electro magnet was procured and placed before the patient's eyes. When the man's eyes were brought within a few inches of the poles of the magnet he uttered a cry of pain, and the piece of steel

FIG. 14.—METHOD OF FORMING A CONTINUOUS CONDUCTOR.

The method of connecting the cables is best shown in Fig. 11, which gives a plain view of the junction box connections.

With these boxes placed at the intervals referred to, the drawing-in or removal of cables can readily be accomplished without disturbing the remainder of the system, and great convenience for testing is afforded.

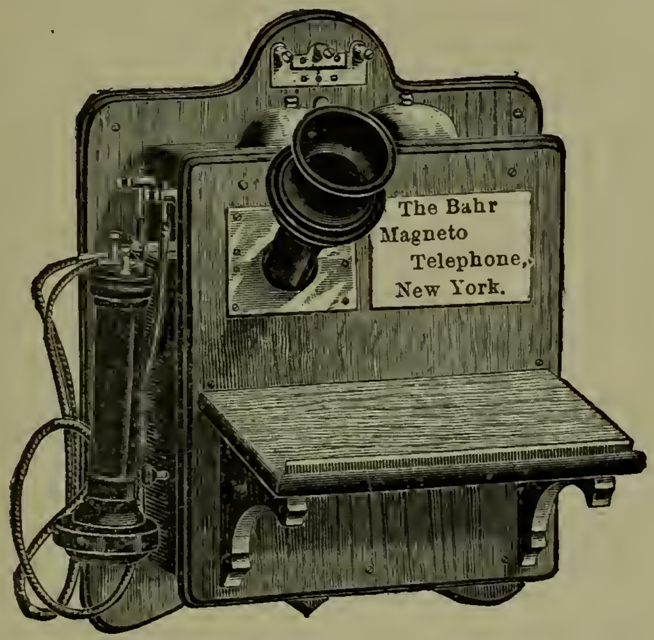
came to the surface of the eyeball, whence it was extracted. Such use of the power of magnetism is not rare, but the process followed heretofore has been to bring the magnet in contact with the metallic substance to be removed. In the case referred to the location of the piece of metal in the eye was uncertain and the method adopted was decided upon, with successful results, as stated.

BAHR MAGNETO TELEPHONE.

The Bahr non-infringing magneto telephone, which is made by John F. Bahr, the manufacturing electrician, 55 Dey street, New York city, is equally well adapted for long and short distances. The instruments are of special design and constructed in the best manner possible, and of the highest quality of materials. The core of the magneto transmitter consists of one piece of cast magnet-steel, 5½ inches long, tapering from one inch in diameter at one end to ⅜ of an inch at the other, the core being adjustable in relation to the diaphragm. The core of the electro-magnet is screwed to the small end of the main bar magnet. This bar is said to have double the power of the ordinary bar magnet used in telephones generally, and has 100 per cent. greater efficiency in actual operation. It transmits the voice in a clear manner, giving very distinct articulation on lines up to 100 miles in length.

The magneto call-bell used with this telephone is made especially for the instrument, and is guaranteed to ring bells on lines 100 miles in length.

The case of the telephone is provided with an arm-rest and tablet on which to write messages. The cases are made in light oak or cherry, and handsomely furnished. All the trimmings are nickel-plated, and every part of the instrument is first-class in material, design and finish.



BAHR'S MAGNETO TELEPHONE.

Mr. Bahr carries on a general telephone manufacturing business, and deals in electrical apparatus and supplies of all kinds. He makes a specialty of model and experimental work.

THE STEAM-ENGINE AND DYNAMO.

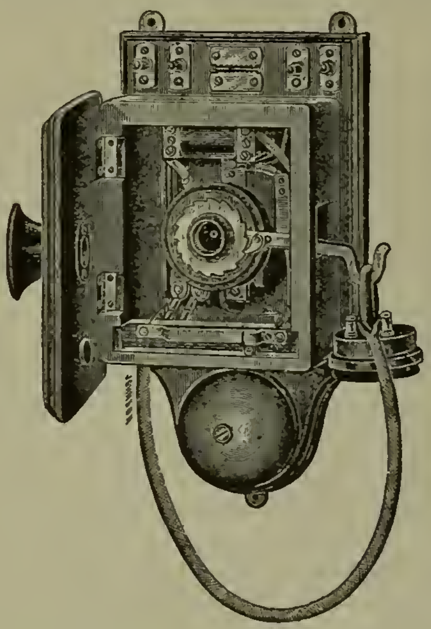
Prof. Unwin, in comparing the relative efficiencies of the steam-engine and dynamo, says it is not the fault of the steam-engine that only 10 or 12 per cent. of the theoretical amount of energy contained in coal is all that can be transformed into mechanical work. The reason for this, he says, is found in one of the fundamental laws of thermo-dynamics—that of the motivity of heat. Heat energy, he says, is undirected, or mob energy. "It lies in the nature of the terrestrial conditions in which use has to be made of it that only a fraction is converted into directed or mechanical energy. The task of the steam-engine is to do its best with the fraction which is convertible, and in that point of view it is not an inefficient machine.

The dynamo has a much easier task. Energy is supplied to it in its directed or wholly convertible form, and, naturally, in transforming one kind of directed energy into another kind of directed energy, only a small fraction need be wasted.

—Make yourself or somebody else a present by subscribing for THE ELECTRICAL AGE.

REVOLVING TELEPHONE TRANSMITTER.

Owing to the constant trouble experienced by users of even the best transmitters through the wedging or caking of the granulated carbon, Messrs. Gent & Co., of Leicester, have patented an arrangement by which the transmitter is partially revolved every time the instrument is used, thus causing a disturbance of the granulated carbon, and keeping the instrument always free. This is accom-



REVOLVING TELEPHONE TRANSMITTER.

plished by an attachment connected with the switch hook, or as is found preferable, by a connection with the ringing key. The arrangement is very simple, and can be fitted to existing telephones with granular transmitters at a comparatively small cost. In conjunction with their "Hunnings-Grid" transmitter, which they have recently perfected, Messrs. Gent & Co. claim that this is a perfect telephone instrument.—*London Electrical Review.*

THE AURORA BOREALIS.

The glorious light of the north, as seen by those that have ventured beyond the limits of human habitation, survives the memory of all else. The Aurora Borealis—now streaming across the heavens with ghastly flickerings, now blazing forth with the fury of a vast conflagration —undoubtedly has its origin in some electrical disturbance of a far-spreading nature. During the long dark days of blighting cold, when fearful storms rage with shriek and cry, and the ice-hut of the Esquimau sinks from sight beneath the heaping coverlid of snow, then the dreamer sleeps on, for the storm and rushing wind will pass away, the northern constellations gleam in the black sky, and the pale quivering flash of northern lights scintillate and fade above in the wide-spreading arch of heaven.

What is the cause of this wonderful light—this cold corona of the far north? It would be looked upon to-day as an unsolvable mystery were it not for a few facts with which we try to reason out its probable origin. It would seem strange to say that the sun plays its part in bringing into existence this earthly halo. Yet, by some means or other, at present entirely unknown, the storms that rage at the sun's surface, that cast out fiery waves thousands of miles in height, take effect upon this puny earth and make it thrill from pole to pole.

The magnetic needles are violently shaken, the pole appears to palpitate, and the waning light of the Aurora flames out anew with most transcendent glory.

Across millions of miles of space the sun has sent a touch of its own agony. The slumbering powers of the earth are awakened, and the ice fields relit by the cold fires of the north. The sun with its cyclonic storms, the centres of magnetic force, and the nimbus that crowns the snowy tracts are all united by some mysterious bond—some kinship that reaches across the very abyss of space. In these ice bound regions lies the body of John Franklin and his ill-fated crew. Beyond is seen the unfortunate ship Jeanette. On their all but forgotten graves, in the silence of death and desolation, the Aurora sheds its cold and ghastly beams.

EXISTING COMMERCIAL APPLICATIONS OF ELECTRICAL POWER FROM NIAGARA FALLS.*

BY W. L. R. EMMET.

The first arrangements which were made by the Niagara Falls Power Company for the commercial application of the electric power of Niagara Falls were with the Pittsburgh Reduction Company, for the delivery of direct current for the manufacture of aluminium by their electrical process. In this process the cost of power is an important factor, and it is therefore naturally one of the first industries which we would expect to find attracted by the great advantage offered by this town. The contract made with this company requires the continuous delivery of 1,500 electrical horse-power in direct current at 160 volts. The aluminium process is a continuous one, and cannot be interrupted without serious loss, since the product is not perfect while the furnaces are being started, or when they are not in their normal working condition. It is therefore necessary that spare apparatus be always held in reserve so that in case of accident the proper working conditions cannot be seriously interrupted. To fill these requirements the Cataract Construction Company has ordered from the General Electric Company the apparatus which is now installed in the Reduction Company's building.

This apparatus consists of four rotary converters, having capacity of 400 K. W. each, and eight transformers, each with a capacity of 200 K. W. The rotary converters are intended to be used three at once in parallel, the fourth being always in reserve. These machines transform two-phase currents at 115 volts into direct current at 160 volts, the output of the three being 7,000 amperes, which will be delivered continuously.

The stationary transformers are designed for a primary

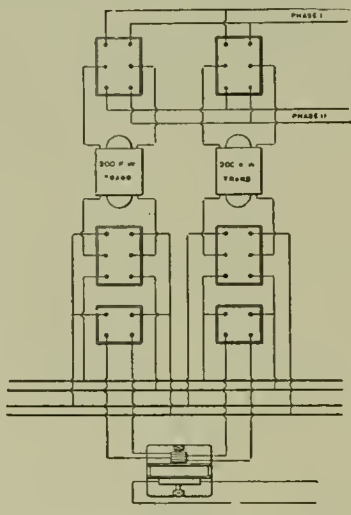


FIG. 1.—DISTRIBUTING SWITCHBOARD CONNECTIONS, PITTSBURGH REDUCTION CO.

voltage of 1,000 and a secondary voltage of 115, their function being to reduce the current generated in the main power station to a suitable pressure for conversion into the desired direct current. In addition to the rotary converters and transformers, the General Electric Company has furnished switchboards, conductors, cooling apparatus, cables to connect the plant to the generating station and all the necessary accessories.

ROTARY CONVERTERS.

The rotary converters installed are of 20 poles, and are operated at 150 revolutions per minute, giving a frequency of 25 cycles per second. The armature is of the smooth body type, having a cylindrical winding of conductors formed of pressed stranded cables. These cables are made up of small bare copper wires loosely twisted into a strand. This strand is then placed in a die under a powerful press and is pressed into a rectangular form, the wires being so pressed together that the cable has practically the same effective copper section as a solid bar of the same size. In spite of this pressing together of the wires, we find, by experiments, that parasitic currents are practically eliminated by this form of construction. On each side of the laminations of the armature there are cylindrical extensions for the crossings of the armature conductors. The whole winding is on a cylindrical surface,

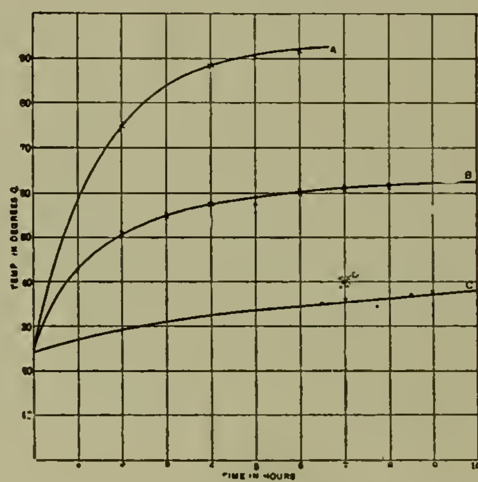


FIG. 2.

Heat Test of 200 K. W. Air Blast Transformer. Curve A, without blast. Curve B, blast 1040 feet per minute. Curve C, air issuing from Transformer. Point D, laminations after 7 hours with Air-Blast at 1040 cu. ft. per minute.

the ends of the stranded cables themselves being jointed together at the outer edges of the extensions. This machine has a small armature reaction, 5,500 ampere-turns per pole, and has an average potential difference between commutator bars of 3 6 volts. Copper gauze brushes are used, there being 20 studs with three brush-holders per stud. The brushes are shifted and raised from the commutator all at once by hand-wheels. The field frame of the machine is cast-iron, and the magnet cores and pole-pieces are of cast-steel. The cores are made in spool form, there being an enlargement at one end to form the pole-pieces and, at the other, to increase the area of contact with the cast-iron. The base is in a single casting with the pillow blocks, giving rigidity and alignment. The commercial efficiency of these machines is about 94 per cent. [See Fig. 1.]

The stationary transformers used in the plant are of 200-K. W. capacity each, eight being used in all. They are kept from injurious heating by currents of air delivered

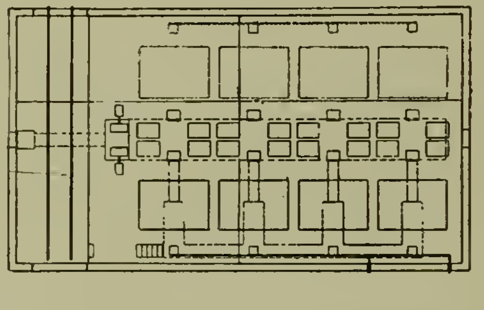


FIG. 3.—FLOOR PLAN, PITTSBURGH REDUCTION CO.

from below, which presses upward through the body of the transformer and over the surface of the coils. Both the laminations and the coils are built with spaces for the circulation of air, and the space pieces in the iron are so arranged that the air will follow the paths where it will do most good. The transformers are placed in the room without casing or covering, so that much of the heat is carried away by radiation, and by convection of the outside air. The construction of these transformers will be clearly understood when they are examined as they stand in the Pittsburgh Reduction Company's building. The laminations are held between two cast-iron frames by bolts and side frames, which hold the whole structure rigidly together. The weight of the laminations is borne by two pieces of "I" beam, held between the end frames, on

* A paper presented at the twelfth General Meeting of the American Institute of Electrical Engineers, Niagara Falls, N. Y., June 28, 1895.

which the edges of the punchings rest. These "I" beams also serve to form a compartment under the transformer into which the circulating air is delivered. There are four primary and five secondary coils in the transformer alternately placed with air spaces between them. This arrangement gives ample cooling surface, and freedom from magnetic leakage. The accompanying curve shows the temperature of one of these transformers when run at full load, with an air-blast of 1,040 cubic feet per minute, requiring a power of about one-quarter of one per cent. of the transformer. The temperatures here given are taken by resistance measurement of the coils. It will be observed that the effect of the air-blast is very great, the maximum temperature being practically reached in three hours. The curve also shows that if the air-blast was stopped when operating under normal conditions, about three hours would elapse before a dangerous temperature was reached. [See Fig. 2.]

The air for cooling transformers is conveyed to them through a large duct or covered trench, above which they are placed This space is formed by an excavation in the floor, with brick retaining walls, and is covered by iron plates flush with the floor, all being made practically air-tight. The plates on which the transformers stand are provided with openings in the form of grids, with slide valves, by which the admission of air to the transformer can be regulated at will, or shut off altogether. The air is supplied by a 60-inch Sturtevant blower, directly coupled to a five h. p. motor. Two of these are installed, one as a reserve. Either will give sufficient air to cool 3,000 h. p. in transformers.

The room in which this apparatus is placed is 48'x87', and is designed and arranged to receive apparatus to the amount of 4,000 h. p. Only half this capacity is now installed. This plan was laid out with a view to the occupation of a minimum space, and, although the machines are large for their output, it fairly illustrates the compactness attainable in a plant of this character. Figure 3 is a floor plan of the room.

The system of conductors and switches in this plant is so arranged that every piece of apparatus is readily interchangeable with every other, so that the spare pieces are always ready in case of trouble, no matter where the trouble may occur. This, as I have said, is made imperative by the nature of the reduction process in which a shut-down entails heavy loss. The arrangement of conductors and of apparatus is such as to require about the minimum amount of copper under the circumstances. The air spaces below the transformers contain all the conductors connecting the transformers together, and to the outside lines. The conductors from the switchboards on the alternating side of the machines lead downward into the air chamber, the conductors from these boards to the machines lead through open ducts covered by floor plates. On the direct current side of the machine an open passage is left under the floor, which serves as a means of getting at the lower brushes and also provides space for the cables and wiring. The direct current switchboards are placed above this passage, and the terminals from their backs are bolted directly to the 'bus bars which deliver the current to the Pittsburgh Reduction Company's furnaces.

With some machines of this class there is no difficulty whatever in starting, while with others it is impossible to start from the alternating current alone. The machines here installed will start from the alternating current and come up to synchronism promptly. After one machine is in motion the others will be started from the direct current side, a set of connections and a resistance box being installed for that purpose.

In throwing machines of this character into parallel, great care must be observed. We must be sure that they are exactly in synchronism, and also that the direct current polarity is the same. To accomplish this we have arranged a system of phase lamps, by which both these points are shown. Each machine is fitted with seven lamps which are required for lighting the room and the machine. Four of these are on the collector side of the machine and are so arranged by switches that they can be connected as phase lamps, two on each side of the two-phase system between the machine and the alternating 'bus bars. When all four lamps burn together and the fluctuations of the light become very low, the machine is ready to throw in. If through misplaced switches or wrong connections the polarity of the machine and alternating circuit do not agree, two of the phase lamps will burn while the others are out.

The General Electric Company has installed four 900,000 C. M. cables, which connect this plant with the main generating station. These cables are lead covered and insulated with rubber. They are jointed inside of the Reduction Company's building to small cables, which lead to the switchboards near the transformers.

Another of the important contracts closed by the Niagara Falls Power Company for the delivering of electric power from the falls is that with the company which manufactures the substance which has been given the name "carborundum." This substance is carbide of silicon ; it is of extreme hardness and is used as an abrasive in the same manner as corundum or emery.

This substance is manufactured from a mixture of sand and coke by the application of heat derived from an electric current. The ingredients are mixed together and piled in a furnace between two large carbon electrodes. A current is then passed through the mass, which gradually heats. After a high temperature is attained the carbon and silicon begin to combine, and the product collects in crystals on the cooler external surface of the mass. After the process has gone on for about 24 hours, the current is stopped and the mass allowed to cool.

The carborundum crystals are found in a loose crust on the surface. This process presents rather a peculiar electrical problem, since as the furnace heats, the resistance diminishes, and since it is desired to supply a given amount of power continuously to this falling resistance, the amount of power to be delivered in the present case is to be 1,000 h.-p. The pressure required at the beginning of the process is 250 volts, and at the end 100 volts. The current begins at 3,000 and ends at 7,500 amperes. The power is to be taken from one side of the 2,000-volt two-phase system.

(To be continued.)

RAILROAD TIES AND POLES.*

BY N. W. L. BROWN.

In 1890 the Fulton County Railroad Company (Georgia) built several miles of track in Atlanta, in which No. 40 and No. 45 rails were used. In suburban and unpaved tracks the rails were spiked directly to pine ties. In paved tracks they were supported on 4-inch chairs. This paving was of Belgian blocks, supported simply on three inches of sand and provided with a sand filling, and the ballast for the track would seem to have been about three inches of sand.

These tracks are now owned and operated by the Atlanta Consolidated Street-Railway Company, and it was fully two years ago that we were forced to make a few renewals of ties under them.

About one year ago the ties under the suburban tracks had to be almost entirely renewed, and the paved tracks began to develop serious defects from rotten ties. We considered the short life of these ties due to the use of inferior timber, and hence did not give the situation any serious consideration, but recently we have seen tracks going to pieces from rotten timber, which were built in 1891, and known to have been built of first-class pine, and a thorough examination has shown conclusively that six years is the longest life we may expect of select pine.

In tearing out horse-car and dummy tracks we have frequently found oak ties of which accurate records could be had, and from these we are led to believe that eight years is the longest life we may expect of oak. These

* Report of committee read at the Montreal Convention of the American Street-Railway Association, Oct. 15-18, 1895.

lives, which correspond closely with those met with in railroad experience here, and in many sections of the North, have caused us great disappointment, since we had expected the location of our ties beneath paved streets to have had a great preservative effect upon them, in accordance with the experience reported by many street-railway engineers.

As timber will not decay when frozen or constantly submerged in water, and as certain ingredients in different soils tend to hasten, while others tend to retard decay, it may be that our experience in an equable climate, in a well-drained city, and upon the red clays of Georgia, differs widely from those met with in some sections still; we cannot help thinking our conditions ought to differ greatly from those met with generally. In railroad experience, ties covered up and poorly drained decay more rapidly than those in a ballasted and well-drained track; and remembering that street-railway ties are poorly drained at best, and that they are, even with the best paving, liable to be wetted by every rain, and to be constantly shifting their state of dampness; and remembering too that the ties and rails vibrate even in the most solid construction, and hence are in contact with the air, we cannot see why street railway ties should ordinarily last longer than buried railroad ties. We have gone quite thoroughly into the question of the advisability and economy of using ties of greater first cost and longer life.

We have conferred with many street-railway engineers and find positively no uniformity of opinion or practice as to the best tie to use. One engineer prefers and uses oak, another tamarack, another chestnut, another cedar, another cypress, another Georgia pine, and very few engineers claim to have solved the problem of ultimately the most economical track construction by adopting metal ties.

It seems to be generally conceded that metal ties require for their proper foundation a thorough bedding in concrete, and if it is granted (as claimed by a few American and many English and Continental engineers) that a concrete foundation is necessary in any good track, then the selection of metal ties may bespeak good judgment in deep-rail construction, but most American engineers claim that concrete is not necessary in first-class track construction, and if this opinion (in which we heartily concur) is correct, then there can be few causes, if any, where metal ties would be most satisfactory and economical.

In New Orleans excellent results have been obtained under horse-car tracks with red cypress, which is reported to have been in good condition after twenty-eight years of service. Red cypress and especially black cypress are among our most durable woods, but their extreme softness and inability to properly hold spikes have been a serious hindrance to their extensive adoption for railroad ties. The extraordinary results reported in New Orleans are doubtless due to the light requirements of horse-car service, and the fact that these ties were always in very damp, marshy earth, if not actually submerged in water.

We have conferred with many members of the American Society of Civil Engineers connected with railroads in the South and West, and we find among them a great diversity of opinion as to the merits and life of cypress timber, both for trestles and ties. This is evidently due to the fact that cypress, like other timbers, lasts better under certain circumstances than under others, and apparently to the fact also that considerable confusion seems to exist as to the proper classification of the different grades of this timber, white cypress being worthless, and red cypress itself (which is perhaps most extensively used) being a little inferior to black cypress. It is claimed that even the most expert inspectors can seldom distinguish one variety from another of this timber, and that cypress dealers often classify the product of one tree as belonging to the three varieties. Reports of the life of black cypress in trestles vary from eight to twenty years, averaging perhaps twelve or fourteen years, while its life in railroad ties is variously reported between seven and twelve years, the average corresponding closely with that generally assumed, nine years.

A prominent timber expert of our city estimates that black cypress in our tracks ought to last about ten years, and the information before us leads us to believe that this estimate must be about correct.

After consulting all the few reports and treatises available upon the subject of timber preservation, we have conferred again with many members of the American Society Civil Engineers and other experts, and our opinion seems to be universally endorsed that efficiently creosoted ties are ultimately the most economical for use in street-railway work.

At present we omit the vulcanizing process, which has in a few cases given good resnlts, but whose merits are still in a measure in question, we can say that the preservation of timber in quantity is confined almost exclusively to two standards, and long-established processes, viz., burnettizing and creosoting. Burnettizing, or the treatment with zinc chloride, is the process (modified by patents in some cases) most extensively used in America for the preservation of railroad ties, mainly on account of its least cost, its resistance to being burnt, and on account also of its being simpler or safer than the treatments by the injections of other metallic salts.

Burnettizing is extensively used in the West, and it has given good results, especially in dry localities, but there are many conditions met with in street-railway construction which are unfavorable to its success.

1st. Zinc chloride is a salt, easily washed out when exposed in wet localities.

2d. Leakage currents from the rails might hasten its disappearance.

3d. It has a tendency to rust the rails and spikes.

The creosoting process was invented and established in 1838 by John Bethell, of England, and for many years past it has been almost universally used in England and France for the preservation of ties and telegraph poles.

The average life of creosoted beech ties on the Northern Railway of France is twenty-seven years. Properly creosoted spruce ties in England last from sixteen to twenty years. It is reported that the mile of track laid of different kinds of creosote ties on the M. N. O & T. R. R. near West Pascagoula, Mississippi, in 1869, showed when examined in 1886 that seven of these ties had been removed, one from rot, and six from being cut into by the rail.

Trestles built on the H. & T. C. R. R. twenty-two years ago were recently reported in good condition.

Many cases have been reported in this country where creosoted timber was sound after sixteen years of service.

Creosoted timber is in many respects peculiarly suited for street-railway ties.

Creosote cannot be washed out, and being a perfect insulator, is beyond the reach of the electrolytic action of leakage currents.

It might have an important bearing (especially in stringer tracks) on reducing the leakage from the rails to the water mains, etc. ; its tendency is to prevent iron and steel from rusting.

For a long time 6" x 8" x 7' were our standard dimensions for ties, but over a year ago we changed these to 5" x 9" x 7' and consider our present standard more satisfactory.

In railroad practice, where tremendous loads are carried upon low rails it has been found that too broad a tie would rock itself out of a proper foundation in ballasted track, and it is on this account that broad ties are objectionable in ballasted railroad work, 6" x 6" x 8' being the adopted standard. In street-railway work, however, where deep rails are used and where this "rocking" amounts to nothing, we think a broad tie has many advantages over the narrow ones sometimes used.

We have recently used three thousand sap-pine ties from the Fernandina Oil and Creosote Works, and are expecting good results from them. These ties, treated with 12 lbs. of dead oil of coal-tar (creosote) per cubic foot, can be delivered f. o. b. cars, Atlanta, for sixty cents each. First-class pine ties now cost us 26¼ cents each, oak in quantity 30 cents each, and black cypress about 40 cents each.

(To be Continued.)

DECISION AGAINST THE TELEPHONE MONOPOLY.

THE UNITED STATES SUPREME COURT DECIDES THAT IT HAS JURISDICTION OVER THE BERLINER CASE.

The Supreme Court of the United States, on November 11, decided that it has jurisdiction over the case of the United States versus the Bell Telephone Company to cancel the Berliner patent, which the Court of Appeals for the First Circuit decided against the government. The telephone company moved to dismiss the appeal for the reason that under the Courts of Appeals act the Supreme Court of the United States has no jurisdiction, because the case was one "arising under the patent laws of the United States," and judgments of the Courts of Appeals in such cases were made final. The United States opposed this on the ground that the act gave the right of appeal to the United States in cases where it was a party. The result of the decision is that the case must come before the court for the final decision.

Chief Justice Fuller read an opinion in disposing of the motion to dismiss the appeal, in which he discussed the question whether and to what extent the appellate jurisdiction of the Supreme Court of the United States over controversies to which the United States is a party has been circumscribed by Congress in respect to the right of appeal. The enumeration of cases wherein the Supreme Court of the United States has jurisdiction by the terms of the Court of Appeals act, was set forth by the chief justice, and he continued :

"Judgments of decrees in cases in which the ground of jurisdiction of the Circuit Court is that the United States are plaintiffs or petitioners are not made final in terms, and such cases would fall within the last paragraph unless restricted by the previous enumeration. And the contention is that the words, 'cases arising under the patent laws' must be held to operate as such restriction and to render the judgments and decrees of the Circuit Courts of Appeals final, notwithstanding the existence of another distinct ground of jurisdiction in the Circuit Court, and that there would consequently be a right of appeal from a decree of a Circuit Court of Appeals dismissing a bill by the United States to cancel a patent for land obtained by fraud, but none where the bill was one to repeal an invention patent so obtained.

"In United States vs. Telephone Company (128 U. S.), quoted by counsel for the telephone company in this case to sustain their contention that the case is one 'arising under the patent laws,' the question was 'whether the judicial power of the United States under the constitution extended to a suit by the United States to repeal a patent,' and in that view it was held that such a suit was a case arising under the laws of the United States, as had been previously adjudged many times by the court. We are of opinion that it is reasonable to assume that the attention of Congress was directed to this class of cases, and that the language was used as applicable only to them, and that there is nothing in the objects sought to be obtained and the mischiefs sought to be remedied by the act which furnishes foundation for the belief that Congress manifestly intended to place a limitation on the appellate jurisdiction of this court in a case such as this.

In this country where there is no kingly prerogative, but where patents for land or inventions are issued by the authority of the government and by officers appointed for that purpose, who may have been imposed upon by fraud or deceit, or may have erred as to their power, or made mistakes in the instrument itself, the appropriate remedy is by proceedings by the United States against the patentee. We cannot impute to congress the intention of narrowing the appellate jurisdiction of this court in a suit brought by the United States as a sovereign in respect of alleged miscarriage in the exercise of one of its functions as such, deeply concerning the public interests, and not falling within the reason of the limitations of the act."

The motion was then formally denied.

LAMP DECISION BY THE UNITED STATES SUPREME COURT.

The Supreme Court of the United States, on November 11, in an opinion read by Justice Brown, sustained the Edison incandescent light patent against the claim of the Consolidated Electric Light Company, using the Sawyer-Mann system, of which it was claimed that the Edison system was an infringement. The case came from the United States Court for the Western District of Pennsylvania, which gave judgment in favor of the Edison company.

The court below decided, first, that the Sawyer-Mann patent was invalid because of amendments to the application, which made it in effect a new application ; and, second, that the priority of invention was with Edison, the experiments of Sawyer and Mann never having resulted in a successful system of lighting.

The second point, Justice Brown said, had not been considered by the court because the conclusion on the first disposed of the case. It was their opinion that the claim of a conductor composed of carbonized fibrous and textile material is too broad to sustain the patent, and it must therefore be declared invalid. They could not by such a claim shut out all other investigators into the field of vegetable fibre. As a matter of fact, the justice said, Sawyer and Mann had confined their experiments to carbonized fibre and charcoal. Edison and his assistants had examined 6,000 articles in their search, and finally fixed upon the cuticle of a species of bamboo as the best thing for the conductor. Sawyer and Mann abandoned the materials they had used in their early experiments, and had adopted the material used by Edison. Yet they claimed that their patent was broad enough to exclude Edison's material and make his use of it an infringement. This could not be sustained, said Justice Brown; the claim was entirely too broad. The Sawyer-Mann patent was therefore invalid, and the judgment of the court below to that effect was affirmed.

The result of this decision, it is said, is to throw open both systems to the public. The Sawyer-Mann patent is invalid, and the Edison patent expired just a year ago under the operation of the decision in the Bate refrigerating patent case.

We have received from Morris W. Mead, superintendent Bureau of Electricity, of the City of Pittsburgh, Pa., a copy of the Manual of that bureau for 1895. It contains the code of laws, ordinances and regulations relating to the bureau of electricity, and the erection, construction and inspection of wires, etc. The wiring rules of the National Electric Light Association are also given, besides much other pertinent matter of value.

INDIA RUBBER.—The most important source of India rubber supply is Brazil, and the annual production of the best quality rubber derived from that country, and known as Pará, has risen from less than 17,000 tons in 1889 to rather more than 20,000 tons for the year 1894.

THE ADDITION OF LEAD TO COPPER.—The addition to copper of high conductivity of a small quantity of lead for increasing fluidity is the subject of a recent patent. It has been discovered that the addition of a certain proportion of pure lead, preferably from 0.5 to 1.5 per cent., detracts but very little from the conductivity of the metal, and, so far as experiments have been made, in a far less degree than the addition of either tin or zinc, which metals have hitherto generally been employed to improve the castings. It may be mentioned that this addition of lead has long been known to have this effect on gun-metal and brass. It has also been known that the addition of lead to molten cast-iron has a similar effect and produces cleaner castings.

HAMBURG.—A travelling bridge on the suspension principle across the Elbe at Hamburg is under contemplation. There will be three electric cars—two for carriages and horses and one for foot passengers. The span is 1,350 ft., and there will be a clear head of 130 ft. above the river.

ELECTRIC FERRY BOATS.

Electric ferry boats are in regular use at Bergen, Norway. The boats are about 26 feet long, 6½ feet beam, 2½ feet draught, with a displacement of about six tons. There is a propeller at each end of the boat, coupled to a common shaft. The motor (3-H. P. series-wound) is placed under the flooring in the middle of the boats, and storage batteries are arranged partly under the flooring and partly under the seats. The battery consists of 32 cells, weighing complete, 5,280 lbs, and having a capacity of 20,000 watt-hours. The average speed, with a power of 2,300 watts, is about five miles an hour. Each boat runs 37½ miles a day on one charge. At night the cells are charged for the next day's work.

Gutta-Percha.—A good substitute for gutta-percha is said to be prepared as follows : Tar, one part; paraffin, 10 parts ; dissolve together at 120 deg., and then add caoutchouc, two parts. Keep at this temperature until a homogeneous mass results.

THE SOLAR ELECTRIC CO., OF NEW YORK.

This company was organized last June, as the successor of the consolidated interests of the Solar Arc Lamp Co. and the Brooklyn Electric Mfg. Co., the former manufacturing incandescent arc lamps, and the latter switchboards, switches, etc. The business and plants of both companies were transferred by the new company to 65 and 67 Duane street, New York.

The management of the new company has recently been changed, with the result of material improvement in the efficiency of the plant and business. The company is now better prepared than ever before to undertake the production of special and standard switches and to do switchboard work for light and power stations. They have the facilities for turning out special apparatus for light or heavy work, from the drawings.

The company is now completing a large switchboard for the 5,000 light isolated plant in the new United States Printing Office, at Washington, for which several tons of copper are used in the construction of the extra large treble throw-switches, bus-bars, etc. The handsome board for the Vanderbilt mansion at Biltmore, N. C , is receiving its finishing touches. This board is equipped with specially designed switches which are operated by an electric motor, the motor being controlled by switches in different parts of the premises.

The Solar Company is now engaged on some special switches for the large plant of the United States Electric Light Co., on 29th street, New York City. This plant was designed by Mr. George Kirkegaard, electrical engineer of the United States Company. The Solar Company has just closed orders for boards varying in cost from $150 to $2200. Several hundred of the Solar Company's big switchboards are in use in some of the largest buildings in New York City and vicinity. Among these buildings may be mentioned the Presbyterian Hospital, the American Tract Society Building, and the Surety Building, all in the city. A fine board of 2200 amperes capacity is now being constructed for a large plant in Maryland, and boards for smaller plants in and about New York are being built. In addition to the switchboard work the Company has a large number of orders on hand for special switches, arc lamps, and other electrical apparatus. In their employ is one of the most expert electricians and designers of switchboards the country has produced, and the other employés are all skilled in their trades.

The company's incandescent lamp business is so well known that little need be said concerning it. A large number of their lamps are in use at the Atlanta Exposition, and several thousands of them furnish light in many of our large cities.

All the officers of the Solar Electric Co. are men of high standing in the mercantile world and the company is sufficiently capitalized to assume the responsibility of the largest and most exacting installations.

THE HENRY ELECTRICAL CLUB.

On Friday night, November 8, Mr. Joseph Sachs delivered a lecture on "Systems of Dynamo Regulation," before the Henry Electrical Club, at the rooms of the American Institute of the City of New York, Nos. 111 to 115 West 38th street.

New York Notes.

The Liberty Electric Company, No. 123 Liberty street, city, has been organized for the purpose of making a specialty of marine electrical work. The work will be under the supervision of Mr. E. J. McEvoy, whose knowledge in this particular branch of the business is rated at the highest degree. Mr. McEvoy was formerly connected with the marine department of the Edison General Electric Company, and was afterwards superintendent of the electrical engineering department of the Cramp Shipbuilding Company, Philadelphia. During this time he equipped some of the largest steamboats, steamships, steam yachts and United States men-of-war, including the crack cruisers New York, Columbia and Minneapolis. With the experience and knowledge possessed by Mr. McEvoy, the Liberty Electric Company may reasonably expect a successful career.

The employés of the Safety Insulated Wire and Cable Company will give their second grand annual ball at Murray Hill Lyceum, 160 to 164 East 34th street, on Tuesday, November 26.

The Phœnix Carbon Mgf. Co., of St. Louis, has a fine exhibit of its various manufactures at its New York office, Postal Telegraph Building, New York city. The display includes motor and dynamo brushes, carbon points, battery carbons, carbon cylinders for primary batteries, and a line of telephone specialties.

C. D. Bernsee, Vanderbilt Building, New York is handling the "Dey" Time Register. This register is claimed to be the best in use, and is used in a large number of manufacturing establishments throughout the country for recording the time of employés. W. T. H.

Telephone Notes.

Pawtucket, R. I.—Ground has been broken for the new telephone exchange building for the Providence Telephone Co. Cost, $60.000. The switchboard alone will cost $30,000. The site is on High street, next to the residence of Mr. Shattuck. Architect, F. Patterson Smith, of Boston.

Trenton, Mo.—The Trenton Telephone Co., which began business June 24 under the management of English and Haley, will improve plant. New 'phones and new switchboard, etc., will be put in.

Keithsburg, Ill.—Messrs. Marshall & Tobie have secured over fifty subscribers and work will be begun at once on a telephone exchange.

Grundy Center, Ia.—The Union Telephone Co. have decided to extend their lines from Traer to Dinsdale and Reinbeck, and possibly to Grundy Center.

Mason, Mich.—The common council of Mason has granted to the Co-operative Telephone Company permission to erect poles and wires on the streets.

Racine, Wis.—Northwestern Telephone Company, of Milwaukee, are seeking a franchise to operate an exchange in Racine.

Newberg, Ore.—General A. C. Parkinson and John Lamont are in Newberg organizing a company, which is putting in a telephone system.

West Bay City, Mich.—The Saginaw Valley Mutual Telephone Co. was granted a franchise at West Bay City.

Du Bois, Pa.—The town is being canvassed for subscribers for a telephone system to be erected by the Electric Telephone Co. The company is not as yet fully organized.

St. Joseph, Mo.—Plans for the new telephone building to be built on Seventh street by the Missouri & Kansas Telephone Co. have been accepted. Manager Burt, of Kansas City.

Crete, Ill.—The Village Board at its meeting passed an ordinance giving permission to Rohe Bros. to construct and maintain a telephone line in the town.

Westfield, N. J.—George B. Dresher, representing the New York & New Jersey Telephone Co., will appear before the Township Committee, relative to securing a franchise to establish a telephone exchange in town.

Fort Wayne, Ind.—The Western Telephone and Telegraph Co. has been organized at Fort Wayne. The company is composed of local and Lima, O., capitalists. G. W. Beers, president, and B. J. Cable of Lima, secretary.

Salamanca, N. Y.—There is talk of establishing a local telephone system in Salamanca.

The Willamette Valley Telephone Co. has been organized in Willamette, Oregon. Capital, $50,000. Incorporators, John Bradley, John W. Shafford and Alex. Smeek.

The telephone line between The Dalles and Dufur, Oregon, is now in successful operation.

Hello, Nashville!—The American Telephone and Telegraph Co. and the Cumberland Telephone and Telegraph Co. formally opened the Long Distance Exchange at Nashville, Tenn., on Tuesday, November 12. Nashville is now connected with New York, Chicago and all principal cities of the East and West.

TELEPHONE PATENTS ISSUED NOVEMBER 5, 1895.

Telephone. Samuel Alexander, Hartford, Conn. (No. 549,304.)

Local Transmitter-Circuit for Telephones. William W. Dean, St. Louis, Mo. (No. 549,417.)

New Corporations.

Dunmore, Pa.—A charter has been granted to the Dunmore Street-Railway Company. Capital, $30,000. John M. Burke, of Scranton, president; Frank Silliman, jr., Horace E. Hand, Robert T. Fox and Joseph H. Hiesland, of Scranton, directors.

St. Paul, Minn.—Standard Brass and Electric Company, incorporated to manufacture electrical and mechanical apparatus and supplies. Capital, $50,000. Incorporators, Jacob Heilbron, Theo. Grutting and Jehiel W. Jagger, all of St. Paul.

Buffalo, N. Y.—The Automatic Telephone Service Company, of Buffalo, incorporated to provide for the use of the Strowger Automatic Telephone. Capital, $300,000. Directors, Oliver Watson, Edward Mitchell, Henry Koons, Charles Eck and Tracy C. Decker, of Buffalo.

Canton, O.—Canton Light, Heat and Power Company, incorporated. Capital, $50,000.

St. Louis, Mo.—Camden Water, Light and Power Company. Capital, $50,000. Incorporators, F. W. Paramore, H. F. Mueller, E. E. Paramore, Charles Brown.

Cape Girardeau, Mo.—Citizens Street-Railway Company, incorporated, with a capital of $20,000. Incorporators, L. S. Joseph, W. S. Albert and J. L. Miller.

Jersey City, N. J.—The Newton Traction Company filed articles of incorporation in the county clerk's office. Capital, $1,000,000. Incorporators, Horace B. Parker, of Newton, Mass; Sheriff John J. Toffey, of Jersey City; Louis Bfingst, of Boston, Mass.; Mark P. Hillyer, of New York, and J. Otis Wardwell and J. S. Rusk, of Boston.

Philadelphia, Pa.—The Reed Electric Company, of Philadelphia, chartered. Capital, $500,000. Directors, Amos W. Bacon and Carl Hering, of Philadelphia, and Marcellus T. Morrill, of Camden, N. J.

Campbellford, Ont.—Northumberland Paper and Electric Company, incorporated. Capital stock, $100,000. To acquire the plant of the Northumberland Paper Company and Egg-case Company, and to manufacture pulp, paper, etc.

Lima, O.—The Western Telephone and Telegraph Company of Lima, incorporated. Capital, $25,000.

Possible Contracts.

Niagara Falls, N. Y.—The Cliff Paper Company, of Niagara Falls, have decided to adopt electricity as a motive power.

Boston, Mass.—The New York, New Haven & Hartford Railroad proposes to build an electric line between South Braintree and Boston.

Madison, Wis.—H. C. Adams and W. T. Fish secured a franchise from the town to construct and maintain a street-car line. Estimated cost, $20,000.

New York City.—Francis A. Clark, 1879 Second avenue, will build eight brick stores and flats on 1st avenue, between 95th and 96th streets. Cost, $130,000. Architect, Edward Wenz, 205 East 84th street.

Kansas City, Mo.—Alderman Wine introduced an ordinance providing for putting all telegraph and electric wires underground.

Richmond, Va.—The work of breaking ground for the line of the Traction Company has been commenced.

New Haven, Conn.—The New Haven Street Railway Company proposes to extend its Lake Whitney branch to Centreville.

Brooklyn, N. Y.—Architect Marshall L. Emery, 74 Bible House, New York City, has prepared plans for the proposed Polhemus Memorial. Estimated cost of the building and equipments, $250,000. Two electric elevators will be provided; heating plant, etc.

New Philadelphia, O.—The commissioners of Tuscarawas County awarded the franchise for the building of an electric railroad between said city and Uhrichsville, to Major Charles E. Mitchener, of New Philadelphia.

Millbury, Mass.—The petition of the Blackstone Valley Street-Railway Co. has been granted. E. W. Shedd, engineer of the road.

Chambly, Que.—The Richelieu River Hydraulic & Manufacturing Co., which is applying for incorporation, propose to construct dams, bridges, waterworks and establishments for the manufacture of electrical machinery and apparatus. Sicotte & Bernard, of Montreal, are the solicitors for the company.

Hull, Que.—Theophile Viau, of this town, who is the owner of the franchise for an electric railway between Hull and Aylmer, is negotiating with several New York capitalists to purchase the franchise and build the road, and it is probable the sale will take place, in which case construction will be commenced early in the spring.

Trenton, Ont.—The Wm. Hamilton Mfg. Co., and the Canadian General Electric Company, have been awarded the contract by this town for the water power and general machinery, electric light plant, etc., for a three-phase plant to be erected here. The contracts involve an expenditure of $50,000, and it is proposed to run electric wires to Belleville, twelve miles distant, for power transmission.

A DEFENSE OF THE ELECTRIC CHAIR.

In the November number of *The Commercial Travellers' Home Magazine* is an article from the pen of Dr. J. Mount Bleyer, of New York City, entitled "A Defence of the Electric Chair." An excellent half-tone illustration of the author is also given.

BARGAINS.

Cut-outs, branch cut-outs, ceiling plug cut-outs, storage batteries, fixture insulating joints, fixtures, switches (double and single pole), insulators, etc., etc. Big stock. Write list and make your own price. All goods new and perfect. J. Jones & Son, 67 Cortlandt street, New York.

Trade Notes.

We have received from the Standard Turning Works, Cambridgeport, Mass., a unique sample of their handiwork. It consists of an imitation pot of Boston baked beans, turned out of wood. Inside of the pot are several small specimens of wood turning. Among the large number of articles made by this company are electrical-instrument handles, tool handles, etc.

ELECTRICAL and STREET RAILWAY PATENTS

Issued November 5, 1895.

549,094. Brake for Electric or Other Cars. Edward S. Amrock, Waltham, assignor of one-half to James H. Walsh, Boston, Mass. Filed Mar. 16, 1892.

549,127. Fender for Street-Cars. Carl A. Hallqvist, Brooklyn, N. Y. Filed June 3, 1895.

549,132. Electric-Arc Lamp. Francis Jehl, Vienna, Austria-Hungary, assignor to F. Hardtmuth & Co., same place. Filed May 12, 1894.

549,152. Electric Heater for Curling-Irons. George D. Pogue, Jerseyville, Ill. Filed Mar. 29, 1895.

549,153. Controlling Electric Motors. William B. Potter, Schenectady, N. Y., assignor to the General Electric Company, of New York. Filed Aug. 8, 1895.

549,162. Electric Switch. Joseph B. Smith and Albert L. Clough, Manchester, N. H. Filed Apr. 26, 1895.

549,179. Printing-Telegraph System. Jonathan E. Woodbridge, Duluth, Minn. Filed Jan 29, 1895.

549,186. Eletrolytic Apparatus. Thomas Craney, Bay City. Filed Mar. 16, 1893.

549,189. System of Electrical Distribution. William M. Fairfax, Brooklyn, N. Y. Filed Feb. 7, 1893.

549,195. Electric Meter. Ralph O. Hood, Danvers, Mass. Filed Mar. 9, 1895.

549,201. Incandescent-Lamp Reflector. Charles J. Klein, New York, N. Y. Filed Apr. 18, 1895.

549,209. Electromagnetic Switch. Charles L. Penny, Newark, Del. Filed Mar 12, 1895.

549,234. Armature for Dynamo-Electric Machines or Motors. Ward Decker, Owego, N. Y. Filed Nov. 17, 1892.

549,237. Electric Switch. Gerald W. Hart, Hartford, Conn., assignor to the Hart & Hegeman Manufacturing Company, same place. Filed Mar. 19, 1895.

549,240. Electrical Annunciator. Robert L. Hunter, Minneapolis, Minn. Filed Dec. 11, 1893.

549,241. Electrical Annunciator. Robert L. Hunter, Minneapolis, Minn. Filed Feb. 3, 1894.

549,256. Fender Attachment for Trolley-Cars. Henry F. Risch, Brooklyn, N. Y. Filed Aug. 4, 1894.

549,268. Arc Cut-Out. Caryl D. Haskins, Newton, Mass., assignor to the General Electric Company, of New York. Filed Mar 6, 1895.

549,304. Telephone. Samuel Alexander, Hartford, Conn. Filed Sept. 24, 1895.

549,316. Safety Attachment for Street-Cars. Albert E. Hughes, Darien, Conn. Filed Feb. 21, 1895.

549,409. Electric-Arc Lamp. Charles F. Vogelius, Bloomfield, N. J., assignor to Joshua F. Bailey, New York, N. Y. Filed Jan. 17, 1895.

549,415. Car-Fender. Alpheus E. Williams, Orange, N. J. Filed June 17, 1895.

549,443. Electric Supporting-Insulator. Joseph Collins, Washington, D. C. Filed Sept. 23, 1895.

549,464. Electrical Dental Engine. Frank C. Priestly, Denver, Col. Filed Feb. 12, 1895.

549,470. Electrical Resistance. Henry R. Werline, Lancaster, Pa., assignor of three-fourths to Frank S. Barr, same place, and Edwin L. Reinhold and Henry Burd Cassel, Marietta, Pa. Filed Dec. 23, 1895.

549,477. Local Transmitter Circuit for Telephones. William W. Dean, St. Louis, Mo., assignor to the Bell Telephone Company of Missouri, same place. Filed Mar. 29, 1895.

ELECTRICAL AGE

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CONTENTS.

ONE CAUSE FOR DECREASE IN FIRE LOSSES.

The fire loss in the United States and Canada for the nine months of 1895, ending September 30, were $25,500,000 less than that for the same period of 1893, and $1,325,000 less than the losses during 1894. Electrical installations have increased in probably a greater ratio than the decrease of losses. Fire underwriters should bear this important fact in mind.

ELECTRIC POWER ON THE BRIDGE.

An important and significant step was taken by the Brooklyn Bridge trustees at their meeting on November 18. They granted permission to three of the largest electrical manufacturing companies to furnish a car equipment and make a test of the same for switching purposes. There is no doubt that such application of electric power will prove highly satisfactory. The installation of an electric system on the Bridge presents no difficulties; indeed the conditions are decidedly favorable, and after having proved the superiority of electric locomotives for switching purposes, it will be but a step further to apply the same power for the complete operation of the road.

MISMANAGEMENT OF THE BROOKLYN BRIDGE.

As an example of perfect mismanagement the Brooklyn Bridge stands unparalleled. The railway facilities on that structure are, in these days, totally inadequate. Not only that, the methods of operating the railway system are crude and dangerous. Every extraordinary condition finds the officials totally unprepared for emergencies, and it seems sometimes as if they deluded themselves with the idea that things on the Brooklyn Bridge cannot help running smoothly—without a hitch. It never fails that when there is a heavy rain-storm, or a fog, or any other extraordinary condition arises, the additional tax put upon the railway facilities causes some mishap which results in suspension of operations—either the cable breaks, or an engine or car is derailed. The long-suffering public are then compelled to "shank" it over if they are at all anxious to get home or to business. This sort of thing has happened so often that it is noticeable even to the bootblacks around the Bridge entrances. How the Brooklyn people submit to such treatment, and why they do not mob the Bridge trustees and drop them into the river is a mystery. The railroad is evidently run largely on the "luck" principle. There is a system of so-called signals used in the handling of trains, but it is entirely inadequate. After all his railroad experience man has reached the point where he can guard against almost every contingency in railroad practice, but the Bridge trustees do not seem to exercise any foresight or forethought—if they have any at all—in the management of the Bridge road. They trust a good deal to "luck" and personal judgment. As a result of this policy a collison of trains occurred on the Bridge on Tuesday morning last, in a dense fog, which resulted in the killing of two persons and the injury of several others. If a proper system of signals had been employed the accident would not have occurred, Fog, of course, is an added element of danger, but extraordinary provisions should be made for extraordinary occasions. No apparent efforts were made to guard against a rear-end collision, should, for some reason, the leading trains become stalled. This is just what happened; the rear train approached the Brooklyn station, in the dense fog, as if it were an absolute certainty that the way was clear. It happened not to be this time. The collision, of course, was not due to the system of operating; it was caused by the lack of proper precautionary and danger signals. For the failure to provide such signals, the Bridge trustees are, of course, responsible.

EXISTING COMMERCIAL APPLICATIONS OF ELECTRICAL POWER FROM NIAGARA FALLS.*

BY W. L. R. EMMET.

(*Continued from page* 277.)

A number of different methods of supplying this power were proposed and discussed, and the contract for building the apparatus was finally awarded to the General Electric Company, the fitness of the design proposed being, I believe, the principal ground for awarding the contract.

The chief merits of this apparatus are, first, it works without change of connection or opening of the circuit. Second, it is practically non-inductive at all stages of the process, the apparatus being so designed that the magnetizing currents are small, and self-induction is in no way depended upon for the control of the current. Third, the process is continuous, the voltage varying gradually, not in steps. Fourth, the apparatus is controlled automatically.

The apparatus consists in a transformer and a regulator. The former has a fixed ratio of transformation, being built for an E.M.F. of 2200 in the primary, and 185 in the secondary. The regulation is virtually a transformer in which the mutual induction of primary and secondary is variable. Its design is somewhat similar to that of an induction motor, there being two concentric parts built of laminations with distributed windings in slots of each. The outer member is fixed, while the inner is movable through an arc of 60°. This angle corresponds to the space between two poles, the windings being so grouped as to form six poles.

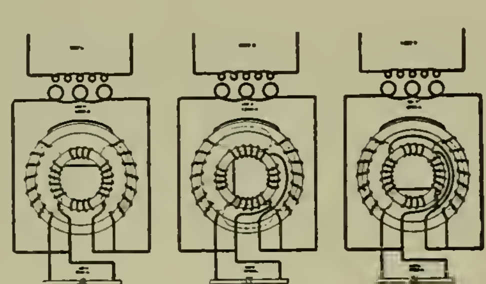


FIG. 5.

Feeder Regulator. Carb rundum Co.
Secondary 85v., 7,500a. Secondary 65v., 3,000a.
Primary 185v., 3,000a. Primary 185v., 1500a.

In addition to the regular windings, the movable member is fitted with closed turns of low resistance between the poles, so placed as to prevent magnetic short-circuiting when the regulator is in or near mid-position. Thus the regulator is a transformer in which the inductive relation of the two coils is reversible, and in which the mutual induction is variable.

The connections of the transformer and regulator between the line and furnace are shown in Fig. 5. The regulator there appearing has, for the sake of simplicity, been shown with two poles only, and of Gramme construction, while six poles and cylindrical winding are in reality used.

The transformer and regulator will be connected together and to the furnace by heavy copper bars, suspended above them from the roof of the building. The winding on the stationary part of the regulator is placed in series with the transformer secondary, and that on the movable part is in shunt. The conductors at different points are proportioned to the currents which they carry. Eight bars, 4″ x ½″ of suitable lengths, give the desired arrangement.

At the beginning of the process the resistance of the furnace is at its maximum, the current from the transformer divides, part energizing the movable part of the regulator, the remainder passing through the stationary part of the regulator, the effective E.M.F. being thereby raised from 185 volts to 250 volts.

From this position the regulator is gradually turned as the resistance falls, the result being that the added E.M.F. and the amount of current withdrawn from the circuit by the shunt portion of the regulator both continuously diminish. When the regulator reaches mid-position, the two parts have no mutual induction, and the regulator is entirely neutral except that the magnetizing current and losses of its two parts are supplied at the expense of the transformer.

As the regulator passes from the mid-position, the resistance of furnace continuing to fall, the E.M.F. generated in the stationary part begins to oppose the E.M.F. of the transformer, and the current in the furnace rises, being now the same as the currents from the transformer and from the movable part of the regulator.

The regulator is so arranged that it can be turned either by hand or by a motor. In the carborundum furnace the variations of resistance are so irregular that a continuous angular motion of the regulator can not be used. If the variation of resistance was uniform throughout the process, the regulator could be slowly turned by a properly guarded constant speed motor and would be automatic.

The transformer and regulator are cooled by circulating oil. A pump and two tanks are used, one above the other. The upper tank contains a coil of pipe in which water circulates. It is so arranged that the moving oil must flow over this coil and give up its heat. The lower tank receives the oil from the apparatus, and prevents an overflow in case the pump stops.

In the transformer the oil is admitted at the bottom and flows upward through and around the coils, the coils being placed vertically and the laminations horizontally. After overflowing at the top of the coil space, it finds its way downward over the outer surface of the laminations. The regulator is so constructed that it revolves in a horizontal plane. The cooling oil flows upward through the air-gap between the two parts, and down over the outer surface of the stationary part, and inner surface of the movable part. The transformer is placed in a cylindrical tank, while the regulator is self-contained, the cast-iron supporting shell forming the outer casing.

The oil is lifted by a small induction motor geared to a pump. Since the process is not continuous, some means of opening the circuits must be provided so that the apparatus may be cut out when the process is complete. A pair of large snap switches is placed, one in each lead from the generating station. In parallel with one of these switches a specially designed water rheostat is placed. This rheostat consists of an iron tank lined by a section of vitrified pipe of large diameter.

This tank is about half filled with water, and a pointed electrode is so arranged that it can be raised or lowered from the water by a rope leading to a small winch. Before the switch is opened the electrode is lowered into the water, which provides a non-inductive circuit in parallel with the switch. After it is opened the electrode is raised, which increases the resistance till the circuit is broken at the surface of the water. The vitrified pipe prevents the possibility of arcing or contact between the electrode and the iron tank.

A switchboard will be installed on which the switches will be mounted, also the switches for controlling the pump motor. Current indicators will be mounted on this board which show the current in the primary leads, also the current passing to the furnaces. These indicators will be operated from small transformers which encircle the conductors. A voltmeter will also be installed which will show the E.M.F. at the furnace terminals.

This plant will for the present be operated by cables branching from those leading to the Pittsburgh Reduction Company's plant.

CURRENT MEASUREMENT.

There are three ways in use by means of which we can measure an electric current: 1. By electrolysis. 2. By its magnetic action *a.* upon a magnet; b, upon another conductor carrying a current. 3. By its heating properties.

THE RATING AND BEHAVIOR OF FUSE WIRES.*

W. M. STINE, H. E. GAYTES, AND C. E. FREEMAN.

The thermal cut-out is still one of the most unreliable of the many devices employed on electric circuits. Its use is universal, but beyond a few practical details the device is but little understood. The blocks in which they are

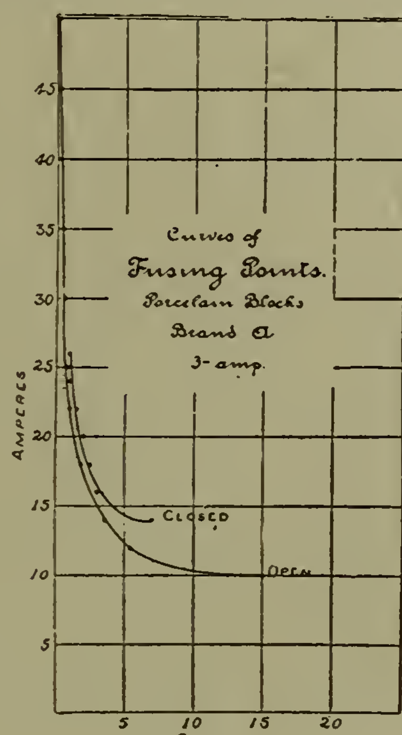


FIG. I.

used show some slow improvement, but most of this has been due to the vigilance of insurance boards, and they are still far from perfect. As a source of vexation and uncertainty, the fuse is probably unrivalled.

An analysis of the literature of the subject shows that the theory of the thermal cut-out has been thoroughly investigated. The elements entering its action have been carefully studied and incorporated into fairly satisfactory

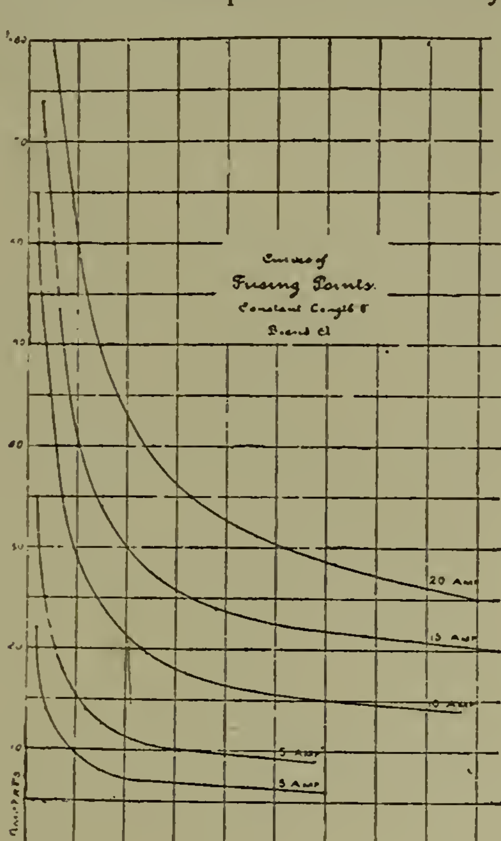


FIG. 2.

equations. Yet all tests and treatments have shown the thermal cut-out to be subject to such variations and modifying influences that but little of practical value can be deduced from analytical investigations.

These considerations led the writers to attempt further investigations. The fuse was dealt with as an auxiliary to electrical circuits, and its behavior under such conditions was carefully studied. The work in great part bears on points already treated of, but it was considered best to study the entire subject afresh, and endeavor to present a more or less complete discussion of the behavior of the ordinary alloys employed in practice. Naturally, the data obtained has been voluminous, in all some 1300 deter-

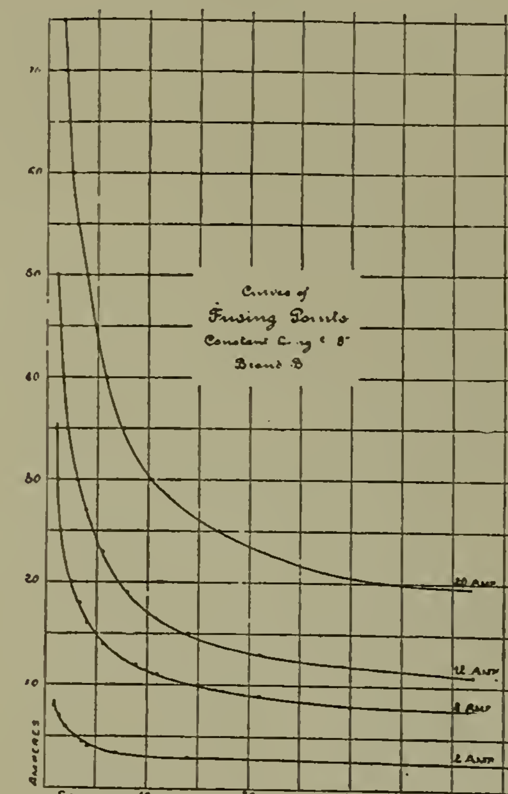


FIG. 3.

minations; but great care has been taken to thoroughly check all results.

The Experiments.—As our experiments were designed to exhibit the behavior and characteristics of the fuse used for protecting electrical circuits, it was considered best to adopt not more than two brands of wire for all the tests, rather than employ a large number of varieties. Other investigations have shown that the various makes of fuse wire closely resemble each other in behavior, and the conclusions obtained with one wire would be general for all. The first make of wire was purchased from supply houses, the second was furnished by the manufacturers.

First Series.—These tests were made under conditions

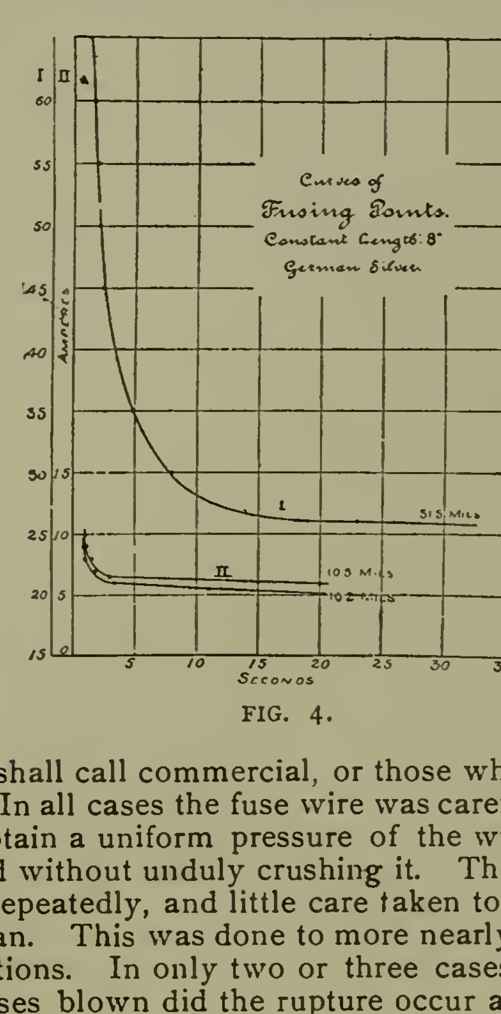


FIG. 4.

which we shall call commercial, or those which obtain in practice. In all cases the fuse wire was carefully inserted, so as to obtain a uniform pressure of the wire under the screw head without unduly crushing it. The same block was used repeatedly, and little care taken to keep the terminals clean. This was done to more nearly imitate practical conditions. In only two or three cases out of hundreds of fuses blown did the rupture occur at the contact.

* Abstract of a paper presented at the Meeting of the American Institute of Electrical Engineers, New York and Chicago, October 23, 1895.

Two classes of porcelain cut-outs were employed; one was the open porcelain base "Main Line" style, the other the closed porcelain "K. W." variety. In the latter, the 10-ampere size has a space of only ½ inch between its terminals, though the fuse is supended out of contact with the porcelain base. This style of block has recently been condemned by the underwriters, and very properly. With the terminals so close together, a fuse blowing under 20 amperes invariably establishes a vicious arc, and the terminals melt with such explosive violence as to frequently shatter the block. Though the open type of block has an added fire risk, the terminals are, as a rule, further apart. A pronounced fault in their construction is that the terminals are let in flush with the surface of the porcelain. Nearly all types of porcelain fuse-blocks merit severe criticism on several points. The terminals are too close together in small sizes, the fuse often resting on the top or base; and their mechanical construction is very poor. Too little attention seems to be given to the proper function of a fuse-block in its design.

The results plotted in Fig. 1 are significant. The upper curve was obtained from three-ampere fuses in the covered block. The curve is here more sharply marked than in the case of the same wire blown in an open block. This was found to be true for all sizes of wires tested in this manner, and indicates that a fuse is more sensitive in a covered than in an open block. In this case the shorter distance between the terminals raised the fusing point, and increased its inertia for higher currents.

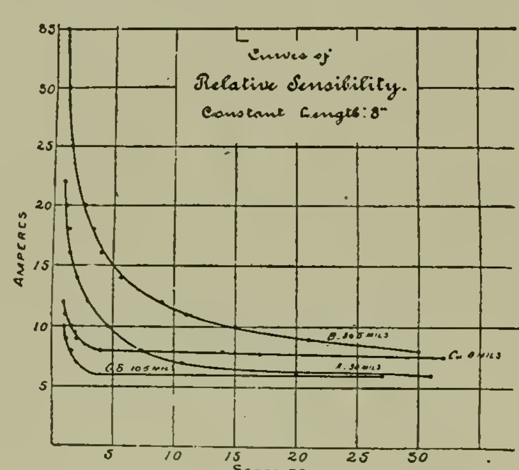


FIG. 5.

It was considered desirable to obtain data which should exhibit the action of the fuse with the cooling effect of the terminals eliminated. To accomplish this the fuses were blown in lengths of eight inches, with asbestos supports placed each inch of length, the block in all cases being horizontal. The supports practically prevented the breaking of the fuse from hydrostatic pressure.

The blowing of the fuse is not immediately an electrical act. The current fuses the metal, the cross-section is reduced at some point due to gravity, unequal expansion, or "sweating;" the heat in consequence intensifies at this point and a globule falls, breaking the circuit and establishing an arc, which soon burns out a length of the fuse. This accounts for the sluggish action of such thermal cut-outs. An ideal fuse would be one that would act at approximately a constant time interval for all currents in excess of its normal. It would, in this respect, closely resemble the action of an electro-magnetic cut-out. Its curve would be a straight line extending from its normal point and slightly approaching the vertical axis for all abnormal currents, being thus identical with the curve of the electro-magnetic cut-outs. In practice the curves of all thermal cut-outs must be more or less modified hyperbolas The ideal curve could only be attained were it possible to eliminate conduction and radiation losses. This is evidently the line to follow in designing a sensitive fusing block.

The curves in Figs. 2 and 3 clearly exhibit the relative sensitiveness of small and large fuse wires; the smaller diameters approach more nearly the ideal condition. This is of great practical interest in guarding against excessive currents of short duration, such as motors are subject to when operated from street railway and power circuits. In such cases a multiple fuse of four pieces of five-ampere wire would prove from two to three times as sensitive as one piece of 20-ampere size. Such multiple fuses have been found by the writer to effectually prevent the belt slipping off the pulley of small dynamos under short circuits. The sluggishness of large fuse wires may be due to the cooling of the outer layers which, with the oxide coating, prevent the fuse from breaking. It is evident that this effect would be less in small wires. For this reason a thin ribbon should prove more sensitive than a round wire.

These tests with long lengths of wire reveal some actions which may account for the lowering of the fusing point by use. In the A wires, with a current just below the fusing value, the wires were found to "sweat"; the oxide film broke in places and allowed the molten interior to ooze out. When the current was shut off the globules were drawn in, leaving the wire pitted. With the B fuses the metal was found to be remarkably plastic and free from the oxide film. These fuses sagged badly and twisted, showing a high coefficient of expansion. As a result they were drawn out and the cross-section reduced.

Fig. 5 gives the relative sensibility for the different fuse metals tested, and the copper curve is clearly the best. German silver acts well in these wires, but for the larger sizes (Fig. 4) it offers no advantages, and deteriorates more rapidly than any wire tested. It is now in general use on telephone and similar circuits. The wire is about four inches in length and inclosed in a fibre tube. A number of such fuses, obtained from the Chicago Telephone Company, were tested. They were rated for a carrying capacity of five amperes and fused in all cases within six amperes. A slight variation in fusing was no doubt due to the cooling effect of the tube in contact with the wire. Some such device as this, with copper for the fuse, would be most excellent for electric lighting and power circuits.

We believe sufficient data has been presented to show that it is poor practice to employ short lengths to economize in porcelain.

We may now summarize some of the practical conclusions deduced:

1. Covered fuses are more sensitive than open ones.

2. Fuse wire should be rated for its carrying capacity for the ordinary lengths employed.

2 (*a*). When fusing a circuit, the distance between the terminals should be considered.

3. On important circuits, fuses should be frequently renewed.

4. The inertia of a fuse for high currents must be considered when protecting special devices.

5. Fuses should be operated under normal conditions to insure certainty of results.

6. Fuses up to five amperes should be at least 1½ inches long, one-half inch to be added for each increment of five amperes capacity.

7. Round fuse wire should not be employed in excess of 30 amperes capacity. For higher currents flat ribbons exceeding four inches in length should be employed.

HOT STEAM RUINED THE BELTS.

On the morning of November 15 the main steam pipe in the engine room of the Elizabeth street station of the Brush Electric Light Co., New York, burst, causing considerable damage of a peculiar nature. Besides the damage to the plant, a large portion of the lower part of the city was left in darkness on Friday night as a result of the accident.

The dynamos are connected to the six big engines by belting of various widths and are located in a separate room. When the pipe burst the hot, dry steam had a disastrous effect upon the belts. They were burned and charred, as if they had passed through fire. and of course ruined. The company had some spare belts on hand and they were substituted for the damaged ones as soon as possible. One of the damaged belts was 44 inches wide. A new 44-inch belt had to be purchased to take the place of the old one.

The damage to the company's property amounted to $4,500.

RAILROAD TIES AND POLES.

BY N. W. L. BROWN.

(*Continued from page 278.*)

We know that our present scale of wages, the labor of tearing up and renewing track paved with ordinary Belgian blocks with a sand foundation and filling will cost about 36 cents per lineal foot of single track, and hence we can readily make a comparison for determining the most economical tie to use.

From the information before us we feel sure that we can safely assume twenty-four years as the life of a creosoted tie, and with this assumption we will determine the cost of keeping the different kinds of ties under sections of track for twenty-four years.

Assuming the ties to be spaced 2′ 6″ apart c. to c., creosoted ties will cost 24 cents per lineal foot of track; therefore 60 cents (36+24) will represent the cost of labor and ties per lineal foot in rebuilding. Principal and interest on 60 cents at six per cent. for 24 years, $1.46—which is the actual cost per lineal foot of keeping ties under this track for twenty-four years.

Cypress ties will cost 16 cents; 36 + 16 will represent the cost of labor and ties per lineal foot in rebuilding where they are used. With a life of twelve years, which is generally assumed as the maximum in railroad practice, two renewals would be required in twenty-four years, therefore for the first renewal,

Principal and interest 52c. at six per ct. for 24 years,	$1.27
and for the second renewal,	
Principal and interest 52c. at six per ct. for 12 years,	89
Total......	$2 16

Oak ties will cost 12c. per lineal foot, and 48c. (36+12) will represent the cost of labor and ties in rebuilding, where they are used.

With a life of eight years three renewals will be required in 24 years, therefore, for the first renewal,

Principal and interest 48c. at six per cent. 24 years, ..	$1 17
For second renewal,	
Principal and interest 48c. at six per cent. for 16 years,	94
For the third renewal,	
Principal and interest 48c. at six per ct. for eight years,	71
Total......	$2 82

Pine ties will cost 10½c. per lineal foot, and 46½c. (36+10½) will represent the cost of labor and ties in rebuilding, where these are used.

With a life of six years four renewals would be required in 24 years, therefore, for the first renewal,

Prin. and int. 40½c. at 6 per cent. for 24 yrs.....	$0.988
For the second renewal:	
Prin. and int. 40½c. at 6 per cent. for 18 yrs.....	0.842
For the third renewal:	
Prin. and int. 40½c. at 6 per cent. for 12 yrs.....	0.696
For the fourth renewal:	
Prin. and int. 40½c. at 6 per cent. for 6 yrs.....	0.551
	$3.077

From these comparisons we see that, with the lives assumed, cypress will cost 48 per cent. more than creosoted timber. Oak will cost 92 per cent. more than creosoted timber. Pine will cost 111 per cent. more than creosoted timber.

These comparisons assume that the service of the different ties during their lives is equally satisfactory, which is practically correct in the case of oak, pine and creosoted pine; but cypress, on account of its softness, gives inferior service.

These figures take no account of the disturbance to travel and to residents along the street while renewals are going on, nor do they consider that repairs are necessary long before complete renewal, and that these repairs would be much less where the track was going to pieces once than where it was going to pieces several times in a given time.

We have assumed in this comparison contract prices on creosoted ties delivered here by rail from a point many hundred miles distant, and while we believe that street-railway companies can creosote their own timber at much less cost generally than they can expect to have it done by contract

These creosoting establishments are generally extensive affairs, and while they may be kept busy for months at a time we think it is a fact that their interest on investment, salaries for expert superintendence, sales department, labor, etc., are much more regular items at least than their orders.

We feel that it would be economy for any street-railway company operating extensive mileage, and affected like ourselves with short-lived ties, to install a small creosoting plant on the power-house premises, which are generally large, and supply this plant with steam from the main boiler plant and with power for pumps, etc., by means of electric motors. In this way expert superintendence could be given by the chief engineer, the plant could be operated most economically, and when lying idle the interest on the cost would be about the only cost connected with it.

A porous wood is necessary for proper treatment, and while beech, on account of its great toughness, seems to give better results than almost anything, spruce and sap pine are standard articles for treatment. In many localities, especially in the South, this sap pine timber which is in little demand ordinarily, can be had at a very low price, and with a plant installed and operated in the manner outlined above, we feel sure that these ties could be purchased and treated at a total cost not exceeding 40 cents each.

We estimate that a plant consisting of a treating cylinder, 6′ in diameter and 36′ long, with a capacity of about 300 ties a day, should not cost more than $6,000 complete, with necessary cars, pumps, tanks, super-heating apparatus, etc., necessary for operating it. Not only would such a plant be of service for ties, but also for treating floor timbers for cars, trestle and bridge timbers, perhaps, and especially for treating cross arms and—

POLES FOR LINE CONSTRUCTION.

Red cedar poles have been almost universally used in our overhead construction, although iron poles set in concrete have been used in the heart of the city, and cypress poles have been used in a few cases when we could not secure cedar promptly.

The specifications by which most of our cedar poles were purchased required 28′ in length and a minimum top diameter of 6″, but these poles proved too small and in many cases too short, especially where guard wires are required. These red cedar poles for this market are generally obtained in East Tennessee, although the timber exists more or less bountifully in many sections of the South. It has been used almost exclusively by the Western Union Telegraph Company, and they estimate that their poles last on an average about fifteen years. The sap generally decays in five or six years, and in many cases they find that the heart decays in twelve years, while again in many cases it will last twenty years.

Cedar poles, especially when used according to the ordinary custom, have many defects in street-railway service.

1st. Their life is practically limited to the life of their sap, as when this decays the heart left is too small and weak for reliable service.

2nd. Larger poles are liable to be very defective, generally being hollow at the butt, and frequently containing rotten knots.

3rd. Cedar is very brittle and treacherous under tension.

4th. Large, short poles are excessively expensive, as they are equivalent on the market to long poles cut off.

We are now estimating that our cedar poles with large hearts will last twelve years. The cedar poles we have used appear to have cost us about $4.00 each erected.

Our iron poles, which have cost about $18 00 each erected, do not appear to be lasting as well as was hoped. They have too great a tendency to rust near the ground, and we doubt whether they can be safely depended upon for more than fifteen years.

We believe properly creosoted pine piles, 30' long and 8" at the top ordinarily, and 10" to 12" at the top where special demands are made upon them, should be equal in point of excellent service, and superior in point of long service to any poles on the market.

These poles, treated by contract to creosote, should not cost more than $5.00 each erected, and when treated in one's own plant this price could doubtless be reduced to $3.50.

Pine in its growth is one of the most perfect and symmetrical of all timbers, besides having a tensile strength about twice great as cedar. Creosoting is generally conceded to increase the strength, and all those properties would seem to indicate that the creosoted-pine pole should be strong enough and neat enough for city work, but it is the long life that makes this pole most eminently suited for street railway work.

Mr. W. H. Preece, the celebrated telegraph engineer, reported in 1884, as a result of thirty years of experience, that he had never seen one single properly treated telegraph pole which showed the least decay, and he referred to 318 poles, which after 35 years of service were torn down to make way for larger poles, every one of which showed after this service no signs of decay. Creosoted poles are universally used in English telegraph work. The District Superintendent of the Western Union Telegraph Co. here tells us that he was recently asked to examine a lot of creosoted poles, supplied to his company for experiment by the works at West Pascagoula, Mississippi, twelve to fifteen years ago, perhaps (as well as he remembers), and that he found every one in perfect condition. He dug down to the bottom of many and could find no sign of decay.

Creosoted poles installed near St. Augustine, Fla., 1888, have within the past few days been examined fully and are reported by the Superintendent there of the Western Union Telegraph Co. to show as yet no trace of decay.

Creosoted poles have a great advantage in being perfect insulators, over iron poles, which are grounded conductors, and liable to cause accidents to the lines and linemen.

If creosoted poles are superior to cedar in almost every respect, the question naturally arises, why are they not adopted by the Western Union Telegraph Co.? This question is easily answered.

Most of the poles of this company are along the railroads and insecurely protected against fire. A creosoted pole is very inflammable, and they are afraid this one great disadvantage in their work would more than offset its advantages.

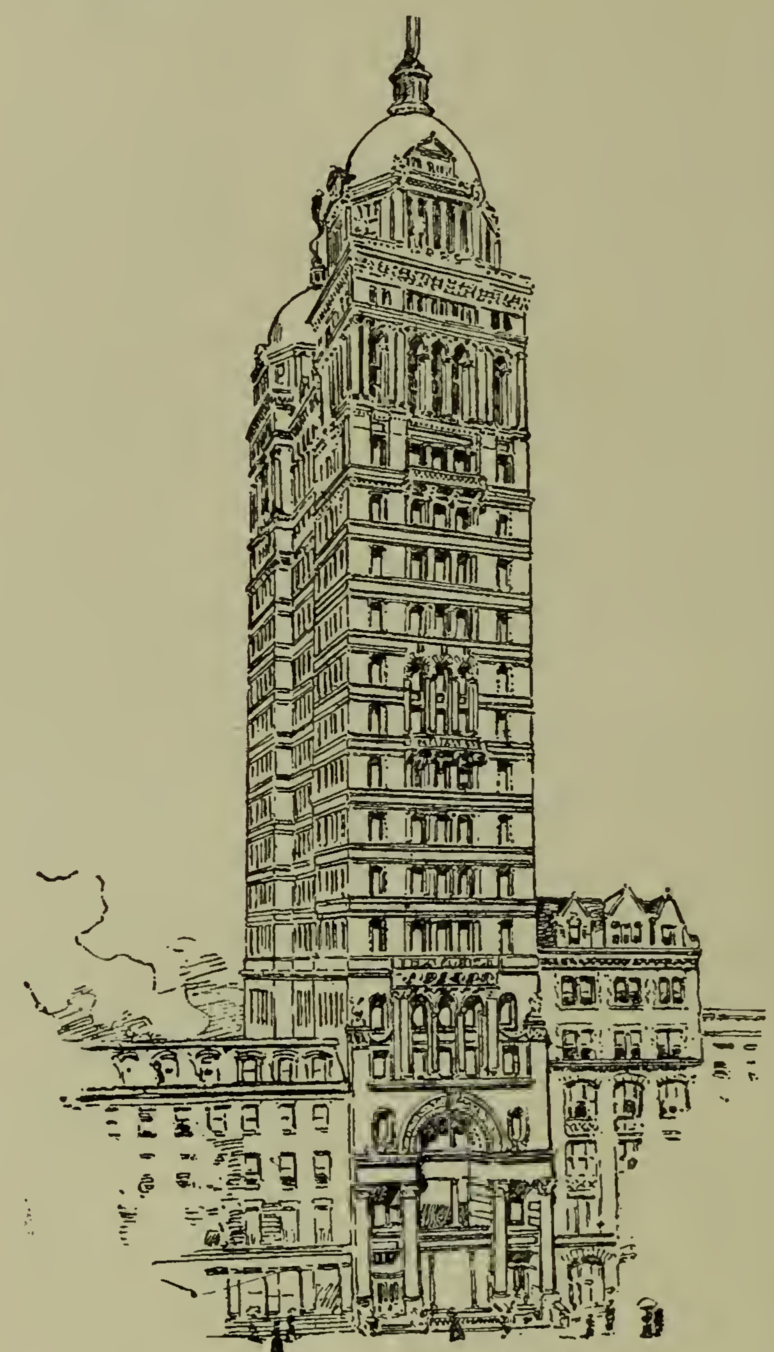
Much has recently been done toward developing to perfection the rational standards in street-railway engineering practice, but we feel that these standards in track and line construction would be, as a rule, improved by the use of creosoted timber.

THE STANDARD CELL.

Latimer Clark's cell, which has been adopted as the standard, is made as follows: pure mercury is covered with a saturated solution of zinc sulphate made into a paste with pure Hg_2SO_4 (mercurous sulphate) and $ZnSO_4$ (zinc sulphate). Pure zinc plunged into this paste forms the negative pole, while a platinum wire fused through the bottom of the cell, or carried down into the mercury in a glass tube from above, is the positive pole. The element is sealed with paraffin. This element when carefully prepared is said to be correct to $\frac{1}{1000}$, but only for currents not exceeding 0.0001 ampere. At a temperature of 15 deg. C. it gives 1.434 volts. According to Lord Rayleigh, at the temperature t it gives $1.437—0.001\ (t—15)$ volts.

THE COMMERCIAL CABLE CO.'S NEW BUILDING.

The accompanying illustration gives a general view of the proposed new building of the Commercial Cable Company, which will be erected on a site adjoining the New York Stock Exchange. The building will run through from Broad to New streets, and will be 21 stories in height. Above the 21st story will rise two towers, surmounted by domes representing the two hemispheres. The towers will be connected by a mansard roof, over 300 feet above the street level. On the domes will be shown in relief the old and new worlds, joined by the cables of the Commercial Cable Company.



COMMERCIAL CABLE COMPANY'S NEW BUILDING.

The general style of the building is the Italian renaissance, the elevations being worked out in light moulded and plain brick with terra-cotta ornaments of the same tones. Marble may be used for the columns of the lower stories.

The foundations will be built on caissons sunk to the solid rock. The beams, girders, columns, roof trusses, etc., will be of steel and wrought iron, and the beams will be filled in with fire-proof bricks. The floors throughout the building will be of concrete or mosaic.

The interior of the building will embrace every improvement and the finish will be the best. Six fast electric elevators will furnish adequate transit to the upper stories.

The ground cost the Commercial Cable Company more than a million of dollars a few months ago, and the building will cost $1,000,000, so that the total investment in land and structure will represent an outlay of at least $2,000,000.

Geo. E. Harding and Good, of the Postal building, are the architects of this magnificent, new structure.

THE THERMOPHONE.*

BY GEORGE C. WHIPPLE.

During the recent session of the Summer School of Civil Engineering of the Massachusetts Institute of Technology, held at Keeseville, N. Y., the writer had the pleasure of describing to the students the construction and operation of a new instrument for obtaining temperatures. This instrument, known as a thermophone †, is an electrical telethermometer of the resistance type. It is designed especially for obtaining the temperature of a distant or inaccessible place, but it embodies a principle which may often be used to advantage in scientific work for determining temperatures with greater accuracy than can be obtained with a mercurial thermometer.

The operation of the thermophone is based upon the principle that the resistance which a conductor offers to

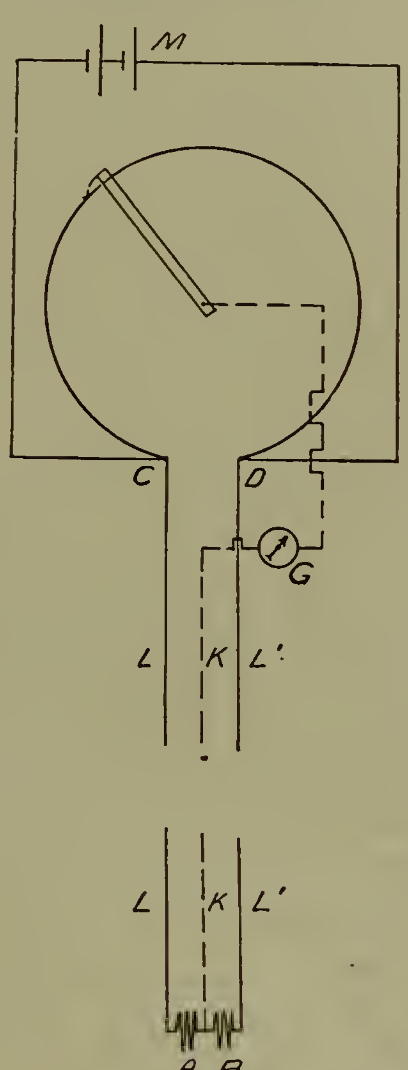


FIG. I.

the passage of an electrical current depends upon its temperature, and advantage is taken of the fact that different metals have different electrical temperature coefficients. Thus the resistance of a copper wire increases about one per cent. for each 5° Fahr., while in the case of German silver the increase is only about one-tenth as great. It is a curious fact that the coefficients of most pure metals are almost the same as that of copper, but that alloys have coefficients which are much lower.

The arrangement of the electrical parts of the thermophone is shown in Fig. 1. Students of electricity will recognize it as being a modification of a Wheatstone Bridge. Two coils of resistance wires, A, B, one of which is copper and the other German silver, are made to form two arms of the bridge. These two coils are joined together and placed at the point where the temperature reading is desired. They are usually drawn inside a long brass tube of small diameter, coiled into a helix and hermetically sealed, the space between the wires and the walls of the tube being filled with oil to prevent corrosion and to hasten the transmission of heat between the outside of the tube and the resistance wires. The sensitive coils are connected by the leading wires L and L' to the ends of a circular slide wire, C, D, and at these points connection is also made with the battery M. A third leading wire, K, extends from the junction of the two coils to a movable contact, Y, on the slide wire. In this circuit there is interposed either a galvanometer or a telephone in connection with a current interrupter, the latter being operated by an independent battery connection. This combination of telephone and current interrupter is used in all the portable forms of the instrument and has been found to be a very cheap and efficient substitute for a galvanometer. The presence of a current is indicated by a buzzing sound in the telephone; silence corresponds to the "zero deflection" of a galvanometer.

Bearing in mind the principle of the Wheatstone Bridge it will be seen that the galvanometer will indicate "zero deflection" when A : B = CY : DY. The coils A and B being made of metals having very different temperature coefficients will vary in resistance at different rates as their temperature changes, and consequently there will be a different value of the ratio of A to B for each degree of temperature. Thus it will be seen that with the bridge balanced there must be a different position of the contact Y for every degree of temperature, and a graduated scale may be constructed corresponding to the temperature of the sensitive coils. The slide wire is wound around the periphery of a mahogany disk, above which is another disk carrying a dial graduated in degrees of temperature. The movable contact which bears on the slide wire is attached to a radial arm placed directly under a hand on the dial, the two being moved together by turning an

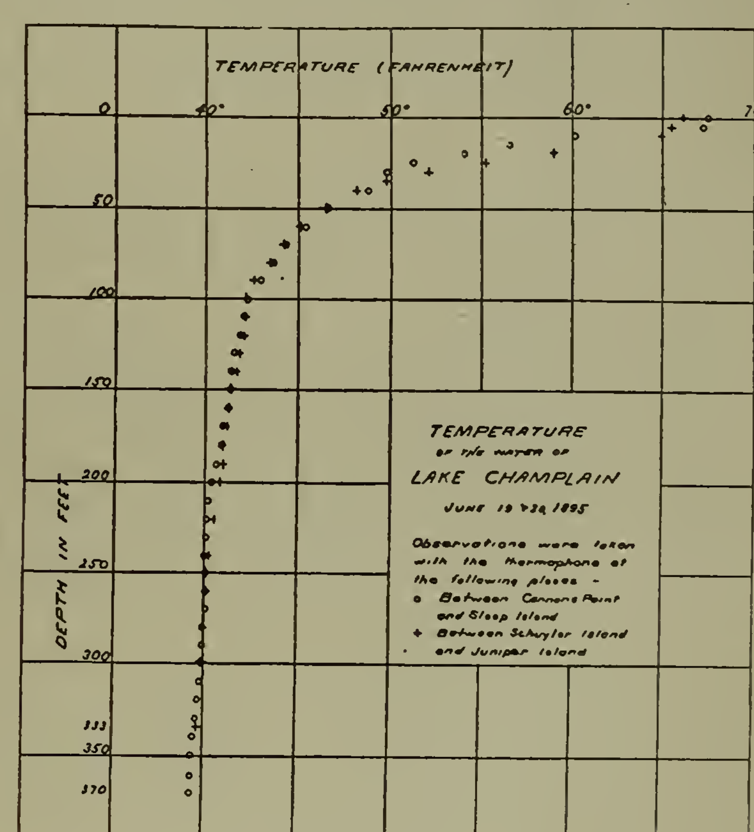


FIG. 2.

ebonite knob in the centre of the dial. This indicator is enclosed in a brass case attached to the box containing the battery, telephone, etc., the box being about seven inches square and ten inches high, and furnished on the outside with binding posts for the reception of the leading wires.

It is easily seen that the temperature of the slide wire has absolutely no effect upon the reading of the instrument, for being made of one piece of metal which has the same temperature throughout its length, it will rise or fall in resistance at the same rate on both sides of Y as its temperature changes, and consequently the ratio of CY to DY will not vary. The effect of temperature changes on the leading wires will not sensibly affect the readings because the two wires L and L' are on opposite sides of the bridge, and consequently balance each other. Compared with the resistances A and B these leading wires are of large size, and in order that they may have the same average temperature they are twisted together and covered with braided cotton.

The operation of taking a reading with the thermophone

* *Science.*

† Invented by Henry E. Warren and George C. Whipple.

is as follows: The helix containing the sensitive coils being placed at the point where the temperature is desired, and the leading wires being connected to the binding posts of the indicator box, the current is turned on and the telephone held to the ear. A buzzing sound in the telephone is found to increase or diminish as the hand is made to approach or recede from a certain section of the dial. By moving it back and forth a position may be found where the telephone is silent. When at this point the hand indicates the temperature of the distant coils. The instrument is extremely sensitive. An inexperienced observer may easily set it to one-tenth of a degree. With special instruments having a small range it is possible to make readings with much greater precision.

One of the uses to which the thermophone was put at the Summer School was that of ascertaining the temperature at various depths and at various places in Lake Champlain. A large number of observations were taken. The accompanying diagram, Fig. II, shows the results of two sets of observations taken where the depth was 333 and 396 feet respectively. It will be noticed that below a depth of 50 feet the readings at the two places agreed almost exactly; above that point they differed somewhat, but each curve preserved its regularity. It is interesting to observe how great a change of temperature there was in the first 50 feet below the surface, and how slight a change there was near the bottom. At a depth of 100 feet the water was but 3° warmer than at the bottom.

At the deepest place in the lake, which was found opposite Essex, N. Y., the temperature at 370 feet was 39.35° F., a point only slightly above the temperature at which water is densest. Unfortunately the thermophone wires were not long enough to reach to the bottom, which was 396 feet.

The fact that this temperature so near the point of maximum density was found during the summer season indicates that the water near the bottom is in a continual state of stagnation. It is probable that there is little circulation below a depth of 200 feet.

In passing it is interesting to note the growing interest that is being taken in the study of the temperature of lakes in connection with that of the micro-organisms in the water. The seasonal occurrence of many of these forms which cause trouble in water supplies has been shown to be directly connected with the vertical circulation of the water. Knowledge of the extent and character of these vertical currents can best be obtained by observing the temperature of the water at different depths.

One of the most interesting of the special uses of the thermophone principle is in connection with the accurate measurement of distances by means of a steel tape. Heretofore the greatest objection to the use of a steel tape for the measurement of a base line has been the alterations in its length, due to varying temperature and the impossibility of correctly ascertaining its temperature at the moment of use. Thermometer readings taken alongside the tape, or even with the bulb in contact with it, cannot give its exact temperature. Especially is this true when the work is done in the daytime and with the sun shining. For this reason the most accurate work has usually been done at night, when the temperature of the tape is substantially the same as that of the air. By the application of the thermophone principle the tape itself may be used as a thermometer and its exact temperature easily determined. This was experimentally demonstrated at the Summer School at Keeseville, where the apparatus was used for the first time.

The steel tape, 100 meters in length, was suspended a few feet above the ground between two iron poles, which bore an ingenious device for keeping the tape stretched at a uniform tension. At intermediate points, 10 meters apart, the tape was supported by insulated-wire hooks. Parallel to the tape, but insulated from it, a German silver wire was suspended in a similar manner, except that the tension was not regulated. At the rear end the tape and wire were electrically connected; at the forward end short flexible leads connected the tape and wire with the slide wire of the indicator. A third wire trailing along the ground connected the junction at the rear end with the sliding contact of the indicator, having in its circuit the telephone and interrupter. The arrangement was precisely the same as in the ordinary iustrument, the tape and German silver wire acting as the sensitive coils. The connections with the tape were made by adjustable clamps, which could be easily removed when it was time to carry the tape to a new position. The indicator box was conveniently placed near the forward end of tape, and readings were taken in the ordinary manner by holding the telephone to the ear and setting the hand on the dial to the point of silence. The dial bore two graduations, one showing the temperature of the tape, and the other the linear correction corresponding to the temperature. Thus it was possible, by a single reading taken at the instant when the measurement was to be made, to determine the amount necessary to be added to or subtracted from the length of the tape.

The experiments at Keeseville consisted of the measurement of a base line 900 meters in length and an accurate determination of the coefficient of expansion of the tape. The results showed conclusively that the error from temperature could be reduced to one part in 1,500,000, which was well within the precision of other portions of the work. The coefficient of expansion was determined by two sets of observations, the results being 0.00000613 and 0.00000615 respectively.

An interesting set of observations was made on the temperature of the tape at a time when clouds were passing over the sun. The rapid fluctuations were astonishing and indicated that the tape was much more sensitive to temperature changes than a mercurial thermometer. At times when a dark cloud would suddenly obscure the sun the temperature of the tape would drop ten or fifteen degrees in half a minute. A complete account of these experiments will be published in due time.

The thermophone has also its practical uses, which are as varied as the uses of a thermometer. For use in connection with the ventilation of buildings it possesses qualities which make it more valuable than the ordinary telethermometer. Besides being accurate and comparatively inexpensive it has this further advantage that any number of sensitive coils may be connected to one indicator. Thus in a large schoolhouse a sensitive coil may be located in each room and the leading wires carried to an indicator in the janitor's office, where, by using a switchboard, the janitor may read from one dial the temperature of any room in the building.

In buildings it is advisable to dispense with the telephone and current interrupter and use a galvanometer, so arranged that the temperature of the distant coil is indicated by the deflections of the needle. With such an arrangement it is only necessary to press a button in order to have the needle automatically indicate the temperature.

In conclusion, it should be remarked that the thermophone is admirably adapted for obtaining high temperature, *i.e.*, up to 1,500 or 2,000° Fahr., and will doubtless find an extensive use in boilers, chimney flues, etc. It is also the purpose of the inventors to make the instrument self-recording.

BURSTING FLY-WHEEL.

The large fly-wheel in the power house of the Albany Railway Company, Albany, N. Y., on November 12, burst into several pieces. Large holes were torn through the walls of the station, and one of the flying fragments crashed into a saloon on the opposite side of the street, killing there one man and injuring three others. Another piece of the wheel, weighing two tons, flew across the housetops for two blocks and badly damaged a dwelling. The entire electric railway system was paralyzed by the accident, which caused a loss to the company of about $50,000.

The Bluff City Telephone Co. has been incorporated at Trempealeau, Wis. The incorporatoɹs are: Dr. B. A. Corneille and Clarence S. Utter.

PRINCIPLES OF DYNAMO DESIGN.

BY

Newton Harrison, E.E.

(*Continued from Page* 257.)

The last tables correspond to a given induction in the air gap. Should this be at all increased or diminished the circumflux would change accordingly. It will be observed that in the formula for ampere-stream one of the multiplying factors is the induction in the air-gap. Therefore, should the density of field be increased, it is highly evident that with a constant length of gap and arc of embrace the capacity of the armature is likewise increased. A variety of opinions as to the strength of field in the gap have been produced by different writers on the subject. Some advocate 30,000 per square inch in the gap, yet it seems as though a close examination into actual working machines would be productive of the best information on the subject. It will be seen that the length of wire required per volt with the speed constant will be proportional to the density of field. Therefore, a saving of copper on the armature occurs if the gap be small and the magnetization heavy.

Carl Hering states that the fields of Weston machines used by the United States Electric Light Company had an intensity varying from 18,000 to 21,000 useful lines of force per square inch of pole-piece surface. In Edison machines the strength of field in the gap varies from 23,000 to 26,000 lines of force per square inch.

The material used in different field-frames has a great deal to do with the gap magnetization with a given number of ampere-turns. With steel or wrought iron composing the frame the least length of wire per volt can be obtained with a normal speed and limited amount of leakage. Some figures on this subject have been given by a well-known writer, showing inductions as follows:

CONSTANT POTENTIAL MACHINES.

Bipolar Drum.

Wrought iron field at 12,000 to 17,000.

Armature.	Gap.
10,000	4,000 per sq. cm.
15,000	7,500 " "

Bipolar Ring.

Wrought iron field at 12,000 to 17,000.

Armature.	Gap.
12,000	2,500 per sq. cm.
16,000	5,000 " "

Multipolar Ring.

Wrought iron field at 12,000 to 17,000.

Armature.	Gap.
10,000	3,000 per sq. cm.
15,000	5,000 " "

Arc Light Machines.

Wrought iron field at 17,000 to 20,000.

Armature.	Gap.
17,000	3,000 per sq. cm.
20,000	7,000 " "

It will be observed that the induction in the armature and air gap shows us this fact; that in ring armatures the induction per square centimeter is higher than in drums. The general length of wire per volt seems to be greater on a ring than on a drum armature, but this is not really true because of the fact that the inside or dead wire reduces the true length of wire per volt. It is now evident that the method of considering the length of wire per volt might better be used as a check than as a basis for calculation. Drum armatures are supposed to utilize one-third of their length for the head at each end, thus giving us in armatures having a core other than square a cross-section with different proportions of wire in the heads and consequently, with even the same gap densities, different lengths of wire per volt. The Eddy machine uses a drum armature of very great length in comparison with its diameter, while other makers use very short drum armatures. As many manufacturers use mild steel for their frames and work it at about the same average induction, the only variations that occur are due to, first, the different leakage and, secondly, the different areas of polar surface. Assuming the area of polar surface and the specific induction to be approximately alike, the length of wire per volt then depends upon the design of the armature. Hering figured out .025 to .030 of a volt per foot of active wire on the armatures of Weston incandescent light machines with an inductor velocity of one foot per second. Edison incandescent light machines give results of .033 to .037 volt per foot at the same speed. Arc light machines of the first-mentioned type gave .044 to .052 volts per foot at a similar inductor velocity.

It is a simple matter to start with the assumption that a definite voltage per foot of armature conductor with a given speed will require a certain length of active inductors. In drum armatures the formula for E. M. F. does not take this fact into consideration, yet by arriving at the dimensions of the core the length of each active inductor can be ascertained and the volts per foot quickly found. For instance, if it were required to produce an E. M. F. = 120 volts.

Number of conductors................	480
Revolutions per second...............	23
Flux...	1,100,000

The length of wire per volt would be found by considering the area of armature core required to carry 1,100,000 lines of force. By approximating its dimensions we obtain the entire length of wire and thus attain our object. At an induction of 50,000 lines of force per square inch, 22 square inches would be required for the armature core. Proportioning this so that it becomes five inches by five inches in dimensions, we have the length of each inductor five inches. As there are 480 inductors actively employed, the length of wire per volt would be

$$\frac{480 \times 5 \text{ inches}}{120 \text{ volts}} = 20 \text{ inches},$$

giving 20 inches per volt or .05 of a volt per foot at 30 feet per second inductor velocity.

Therefore it seems as though the requirements of practice called for at least 20 feet per volt with an inductor velocity of one foot per second. By increasing the inductor velocity the volts per foot rise accordingly, other things being equal. Limits to peripheral speed are outlined by practice and range anywhere from 1,000 to 5,000 feet per minute in modern armatures.

It is sometimes best in designing armatures of the drum type to limit the velocity to 3,000 feet per minute. This, after the cross-section has been calculated, at once determines the diameter and therefore the length of the armature core. The limits imposed upon an armature by the air-gap, density of field and length of pole-face must always be taken into consideration in connection with the nature of the work to be performed and the type of armature core. The different types of windings have considerable effect upon the proper action of the machine. The arc existing between pole-pieces contains a belt of windings which are practically inactive during the rotation of the armature. By consulting the table containing the data for air-gaps, polar arcs, etc., the arc of embrace may be assumed and the percentage of inactive turns obtained. Thus, if the arc of embrace be 120 degrees in a bipolar machine, the balance of the circle lying between the poles is 120 degrees or 60 degrees of true interpolar space. The ratio of 120 to 360 is as one is to three, 33⅓ per cent. of the armature turns being in the neutral space when the remaining 66⅔ per cent. are actively employed. Methods have been proposed and some tried having as their object the cutting out of these dead inductors when the armature is rotating, but such methods have become obsolete and their revival is not even expected.

(*To be Continued.*)

FIRE ALARMS.*

BY CAPT. BROPHY.

The city of Hartford, Conn., has been using the storage battery for several months. The power necessary for charging the same is obtained from the Hartford Electric Light Company and the amount required is 66 watts, or a total of 578,160 watts per year. The cost per annum for this power is $36.00 or .062 cents per kilowatt (a very low rate indeed). Estimating the output of a gravity cell at .04 watts the number of cells necessary would be 1,650. The cost per annum of this would be $1,650.00; at .08 watts the cost per annum would be $825.00; 08 watts per cell is the amount of energy required to operate the Gamewell automatic fire alarm telegraph. This would make the cost of producing 66 watts by means of the storage battery only about 4 per cent. of that of the same amount from the gravity.

But I find the number of gravity cells displaced was but 300; at .08 watts, their total energy would be 24 watts, about 36 per cent. of the energy supplied to the storage battery, showing that the efficiency of the storage battery is but 36 per cent. At $1 per year per cell the cost of gravity battery is $300, or $1 43 per K. W. (a kilowatt is 1,000 watts).

The cost of 578,160 watts, the amount required per annum, is $36.00, or but 12 per cent. of the gravity battery; but something must be added for depreciation, and I will call it 6 per cent.; this would make the annual cost of 578,160 watts, at .62 c. per k. w., $65.70; at 10 c. per k. w., $87.57; at .15 c. per k. w., $116.42; at .20 per k. w., $145,43; or 22 per cent., 19 per cent, 39 per cent. and 48 per cent. of the cost of producing the same amount of energy from the gravity battery.

The amount of energy delivered to the storage battery is 66 watts, and the amount required to operate the fire-alarm circuits is but 24 watts, or about 36 per cent. of the energy received—about 64 watts being expended in the battery or between the battery and dynamo.

In making these estimates I have taken the dynamo plant of the Boston fire-alarm system and the storage-battery plant of Hartford, Conn., as typical installations. As far as the experience of both has extended, I believe the figures are correct; the crucial test of time may necessitate a change therein.

From the data obtainable I am convinced that the cost of producing electric energy for fire-alarm purposes is much cheaper by the storage battery and very much cheaper by the dynamo, providing it is operated under the most favorable circumstances, than when produced by the gravity battery.

In installing a storage battery the watt or ampere capacity should be ample to provide against any interruption of the power service. The price paid for electric power as applied to motors, or for charging storage batteries, ranges from six to twenty cents per k. w.

When properly installed there is nothing equal to the motor generator for a central office fire-alarm system. With an automatic testing apparatus to test for "grounds" or other escapes, and to switch defective circuits on to a spare dynamo to remain thereon until the defect was removed, the dynamo system could be operated at its highest rate of efficiency, reducing the cost of power to the figures before given, or lower, depending on the rate charged per k. w. by the power company.

* Abstract of paper read before the Convention of Massachusetts Firemen, as reported in *The Fireman's Herald*.

THE PENN TELEPHONE.

One of the causes of inoperativeness in a telephone transmitter exists in the movable electrode which bears upon the diaphragm, and which is influenced by the vibrations of the same to vary the pulsations in the current over the circuit. In this improved transmitter the movable electrode is so arranged and combined with relation to the diaphragm and the fixed terminal electrodes that the point on lines of contact between the movable electrode and the terminal electrodes may be changed, and new surfaces presented, by simply tapping on the diaphragm with the finger, whereby the defect in the instrument is overcome and its normal working condition restored.

All springs, levers and equivalent adjusting devices, ordinarily employed to hold the movable electrode in yielding contact with the vibratory diaphragm are dispensed with in the Penn telephone.

The movable electrode is combined with inclined surfaces of fixed positive and negative terminal electrodes and with the diaphragm in such a manner as to rest or press against the diaphragm and remain in contact therewith and in electrical contact with the terminal electrodes, solely by the weight or gravity of the movable electrode itself. The pressure or force with which this movable electrode bears upon or against the diaphragm may be regulated — either increased or diminished — so as to vary the sensitiveness of the instrument, by changing the pitch or inclination of the surfaces of the fixed terminal electrodes, as may be required or desired.

The transmitter diaphragm does not constitute one of the terminals or electrodes of the working circuit, nor is it equipped or provided wlth an electrode or contact which is included in the circuit. The diaphragm is wholly independent of any positive or direct connections with the conductors of the circuit, and is removable at will from the instrument.

There are employed two terminal electrodes to which are electrically connected the conductors of the circuit, and these terminal electrodes are arranged out of contact with each other and on the base or back of the instrument. Upon these terminal fixed electrodes, rides or bears, the movable electrode, which is arranged to span the space between them and which is in electrical contact therewith, and also in contact with the diaphragm. The movable electrode thus serves to close the circuit between the terminal electrodes, upon which it has a rolling contact, and is actuated by the vibrations in the diaphragm to create the pulsations in the electric circuit.

SILEX AS AN INSULATOR.

Frederic J. Nash, in the *Fireman's Herald*, speaks very favorably of Silex as an insulating substance for electric wires. He proposes to use iron pipes as an outer envelope for the wires, and pack ground Silex between the wire and the inside of the iron tube. The Silex, he says, can be packed so firmly as to make it practically a solid core, and yet not a solid, for the particles of the flint or Silex will not adhere to each other by any chemical action or relation between them. It neither contains nor absorbs moisture, and will not melt nor burn. It is of higher insulating power than glass. Among the other advantages enumerated as possessed by Silex are, besides its high insulation, proof against decay; is infusible, is economical and is easily applied. The Silex core system of insulation has been patented and has been thoroughly tested. Silex, it is stated, will not melt at 12,000° F.

THE INFANT VISITS MASSACHUSETTS.

In a paper read before the recent convention of the Massachusetts State Firemen, at Pittsfield, these worthy public servants were informed that electricity is still in its infancy.

IMPORTANT TELEGRAPH DECISION.

The long-pending case of the United States against the Union Pacific Railway Company and the Western Union Telegraph Company was settled on November 18, by the unanimous decision of the United States Supreme Court, announced by Mr. Justice Harlan. The decision is one of the most important that has been made by the Supreme Court affecting the relations of the government and the Pacific railroads, declaring, as it does, that Congress has the right to add to, amend, or alter the acts of 1862–64 granting aid in bonds and land to the company for the construction of its line.

The Supreme Court, by its decision reversed the decree of the Court of Appeals and affirmed that of Judge Brewer at Circuit. Justice Brewer took no part in the consideration of the case before the Supreme Court. In his opinion Mr. Justice Harlan said, in reference to the object and scope of the Pacific Railroad acts, that the first eighteen sections of the acts of 1862–64 are wholly inconsistent "with the idea that the Union Pacific Railroad Company could have fulfilled its obligations to the government by simply constructing a railroad, without making any provision whatever for the construction or operation of a telegraph line, thereby leaving all communication by telegraph along its route to the absolute control of private corporations deriving no authority from the national government and whose operations would not ordinarily be subjected to national supervision."

As to the power of congress to alter or amend the acts of 1862–64, after discussing their provisions at length, Justice Harlan said: "We perceive no escape from the conclusion that it is entirely competent for congress to add to, alter, or amend those acts so as to require the Union Pacific Railroad Company (having the rights and exerting powers of its constituent companies) to maintain and operate by and through its own officers and employés telegraph lines for railroad and other purposes, and to exercise itself and alone all the telegraph franchises conferred upon it. It is enjoying the bounty of the government subject to the condition among others that it would perform those duties whenever so required by congress."

The opinion further holds that since the passage of the act of 1866 no telegraph company can, by contract with a railroad company operating one of the post-roads of the United States over which inter-state commerce is conducted, acquire an exclusive right to such railroads for telegraph purposes.

The cause was remanded to the Circuit Court, with instructions to make a supplemental decree enlarging the period in which the railroad and telegraph companies may make such arrangements, adjustments and changes as shall become necessary by reason of the annulling of the contracts between them to carry out the provisions of the final decree of that court.

ELECTRIC POWER ON THE BROOKLYN ELEVATED.

There is a rumor that the officials of the Brooklyn Elevated Railroad Co. are considering the advisability of adopting electric power in that company's road.

THE RUETE CONDUIT CO.

The Ruete Conduit Co., of Jersey City, N. J., has opened an office in Room 702, Havemeyer Building, New York. This company makes the Ruete insulated iron conduit, which has considerable merit. This conduit is ordinary iron pipe, of any diameter, treated with a special insulation. This conduit is guaranteed to be perfect in its insulating qualities, and has received the endorsement of the National Board of Fire Underwriters. The Ruete Conduit Company consists of a partnership, the members of which are A. T. Howard, E. T. Greenfield and W. T. Ruete. Mr. Fred. Noll is the general manager of the company.

ELECTRICITY ON THE BROOKLYN BRIDGE.

On November 18 the Brooklyn Bridge trustees gave permission to various electrical manufacturing companies to equip electric motor cars and test the same for switching purposes at the bridge terminals.

The General Electric Company will equip a car with 1200 G.E. motors, which will pull a 4-car bridge train. The Westinghouse Electric and Manufacturing Company will also supply an equipment, and the Walker Manufacturing Company, of Cleveland, has an order for one. These companies will make the tests for thirty days at their own expense. McGuire trucks will be placed under the General Electric Company's car. The Peckham Motor Truck and Wheel Company will be represented in this important test by seven large Peckham double motor trucks of new pattern.

New York Notes.

Electrical and Mechanical Engineering Co., 41 Cortlandt street, has been dissolved by Judge Lawrence, and Jonathan H. Vail appointed permanent receiver.

The Telegraphers' Mutual Benefit Association will hold its annual meeting in the Western Union building on November 20, and in the evening of the same day the Magnetic Club will hold its Fall dinner at Jaeger's, on 59th street. A large attendance at the dinner is probable.

P. Claus, No. 115 East 13th street, N. Y., has recently installed in the wood-working establishment of J. Scheina, 115–121 East 13th street, New York, a 300-light bi-polar Claus dynamo. He is now engaged in the building of a 1200-light dynamo for R. Hoe & Co., New York.

Jack Perry, who has been associated with Dr. W. P. and W. K. Freeman for the past fifteen years, has been in New York for several days. He is said to be on the hot trail of W. K. Freeman, and in possession of valuable information of which he will relieve himself for the benefit of one of the big electrical corporations.

The Edison Electric Illuminating Company of New York reports gross earnings for October of $148,219, a decrease of $336 as compared with the same month of last year, and net $62,716, a decrease of $5,909. For the ten months ending Oct. 31 the gross earnings were $1,469,376, an increase of $148,936 as compared with the corresponding period of last year, and net $708,433, an increase of $84,486.

The railroad committee recommended to the New York board of aldermen on Nov. 12 an ordinance by which all street-car companies shall heat every other car that runs three miles or more between Oct. 1 and Apr. 1 whenever the temperature is below 40° Fahrenheit. Each heated car shall have a sign on it to that effect, and a fine of $25 shall be imposed for every failure to carry out the provisions of the ordinance, which is to go into effect six weeks after the mayor has signed it. The report was laid over.

The report of the Metropolitan Street-Railway Company for the quarter ending Sept. 30 shows gross earnings $1,532,425, an increase of $165,093 as compared with the same period last year; operating expenses, $800,352, a decrease of $20,354, and net earnings, $732,073, an increase of $185,447. W. T. H.

Personal.—Mr. John Solomon is now connected with the Bryan-Marsh Company, 136 Liberty street, New York, manufacturers of high grade incandescent lamps. Mr. Solomon will direct his energies in securing orders for these lamps in the different cities.

W. J. Clark, late superintendent of construction of Francis Brothers & Jellett, Philadelphia, has taken the selling agency for the Imperial Arc Lamp of New York and the Phœnix Incandescent Lamp of Youngstown, Ohio.

Telephone Notes.

The Fraserville Electric Co., Fraserville, Que., is applying for incorporation, with a capital stock of $25,000 to operate telephones, and do electric lighting and supply electric motors for commercial purposes in Kamouraska and other counties in the Province of Quebec.

Oakland, Cal.—The Sunset Telephone & Telegraph Co. decided to lay a new cable between Oakland and San Francisco.

Albuquerque, N. Mex.—The Mutual Automatic Telephone Co. of Albuquerque. Incorporated; for the establishment of a telephone exchange. Capital. $25,000. Walter C. Hadley, Neil B. Field, Arthur G. Wells, Elias S Stover, Joseph E. Saint and others.

Traer, Ia.—The Union Telephone Co. have decided to extend their line from Traer to Dinsdale and Reinbeck.

Sistersville, W. Va.—A telephone line to connect Sistersville with the various oil-fields and Wheeling and Marietta is proposed. Messrs. McGhie & Moore, of East Liverpool, O., are promoting the scheme.

TELEPHONE PATENTS ISSUED NOVEMBER 12, 1895.

Railway Telephone System. Wm H. Clewley, Providence, R. I. (No. 549,491.)

Telephone Transmitter. Ignatius Lucas, Passaic, N. J. (No. 549,802.)

Telephone Transmitter. Ignatius Lucas, Passaic, N. J. (No. 549,803.)

Telephone. Alfred Stromberg and Androv Carlson, Chicago, Ill. (549,860.)

New Corporations.

Philadelphia, Pa.—A charter has been issued to the Philadelphia Electric Equipment Co. of Philadelphia. Capital, $50,000. Incorporators, Matthew Rettew, James R. Rettew, Edward T. Watts, A. F. Laidlow, all of Philadelphia, and John Maxwell of New York.

Philadelphia, Pa.—Application has been made for a charter for a new telephone company, to be called the Philadelphia Standard Telephone & Telegraph Co. Directors: Richard W. Clay, John Story Jenks, Nicholas Lennig, John H. Michener, Harry A. Berwind, W. Frederick Snyder and others.

St. Joseph, Mo —The Safety Arc Light Hanger and Improvement Co. has been incorporated with a capital stock of $25,000.

Buffalo, N. Y.—The Eclipse Electric Lamp Mfg. Co. of Buffalo. Capital, $100,000. Directors: Thomas F. Crean, of Brooklyn, H. H. Fulton of Elmira, W. C. Page, 325 Broadway, New York City; W. H. Crosby of Buffalo and W. M. Morrison of Montclair, N. J.

Springfield, N. J.—Premier Electric Light Co. has filed articles of incorporation. Capital, $50,000. Stockholders: Louis A. Jackson and Daniel Jackson of New York, Leon Abbett, of Hoboken.

St. Joseph, Mo.—The St. Joseph Light, Heat & Power Company. Incorporated. Capital. $3,500,000. Incorporators: Wm. M. Harriman, New York; Camille Weidenfold of Oyster Bay, L. I., N. Y.; George D. Patten of Plainfield, N. J.; Alfred Decks of South Orange, N. J.; R. A. Brown, Wm. T. and J. H. Van Brunt of St. Joseph.

New Albany, Ind.—The Highland Electric Railroad Co. of New Albany. Incorporated. Capital, $25,000. Directors: Henry Terstegge, John H. Shrader, Jacob Zinmeister, Charles Schwartzel and George W. Tuley, all of New Albany.

Catskill, N. Y.—Catskill, Cairo & Windham Street Railroad Company, incorporated to construct a street railroad about ten miles long in Greene county, from Long Dock, at Catskill Landing, on the Hudson river to and along Main street, Catskill village, to and along the Susquehanna turnpike in the village of Cairo. Capital, $100,000. Directors, Louis E. Robert, Michael A. Conway, Wm. C. Wood, Daniel H. Gilligan, John L. Heins and Jacob Faber, of Brooklyn. Daniel Sharp, of Catskill and S. Mattison, of Newark, N. J.

New York City.—The North End Street Railway Company, of New York City, incorporated, Capital, $5,000,000. Directors, Daniel H. Shea, Thomas J. Regan, Pierre Jay, Frank F. Ogston and Wm. Shailler, 621 Broadway, all of New York City; Charles S. Sisson of Mt. Vernon and Edward K. Lynch, W. D. Davies and Thomas B. Laughlin.

Contoocook, N. H.—The Contoocook Electric Light Company has filed articles of incorporation. Its object is to furnish lights to the towns of Hopkinton and Warner. Capital, $10,000. Hon. W. S. Davis, head solicitor of incorporators.

Conowingo, Md.—The Susquehanna Construction Company, incorporated for the purpose of constructing a plant at Conowingo, Md., that will supply electricity to Baltimore. Capital, $100,000. Incorporators, J. Wesley Kerr, Otto J. Fischer, John Henry Miller, George K. McGaw and Fridge Murdoch.

Key West, Fla.—Key West Electric Light & Power Company, incorporated. Capital, $25,000. Charles Curry, M. L. Kellings, M. W. Curry, Joseph Y. Porter are the projectors.

Lakeport, Cal.—The Clear Lake Electric Power Company, of Lakeport, incorporated to construct and operate irrigation works, electric power-producing works and to manufacture electricity. Capital, $2,000,000. Promoters are H. P. Clendenin, D. C. Rumsey, of Lakeport, J. K. Fraser of Kelseyville, C. E. Moore of San Francisco, and Richard Wylie of Napa.

Lexington, Mo.—The Lexington Electric Company, incorporated. Capital, $80,000. E. R. Kimball, E. G. Taylor, C. A. Burton, E. O. Marquis and D. M. Wolde.

Leechburg, Pa.—Leechburg Electric Light and Power Company has been chartered. Capital, $16,000. Directors, Dr. J. D. Orr, J. M. Anderson, C. A. Long, of Leechburg; W. W. Straub and E F. Austin, of Pittsburgh.

Portland, Ore.—Oregon Electric Construction Company, incorporated to construct and maintain a telephone and telegraph line between Portland, Astoria and branch lines thereto. Principal office, Portland. Capital, $20,000. Incorporators, George F. Housner, F. C. Miller and J. S. Urquhart.

Baltimore, Md.—The Susquehanna Construction Co. has been incorporated by J. W. Kerr, O. J. Fisher, J. H. Miller and others. Capital stock, $100,000.

Possible Contracts.

New York City.—The Third Avenue Railroad Company will build a one-story wood and iron power station corner of 136th street and Amsterdam avenue. Cost, $6,000. The engineer of the Third Avenue Railroad Company is the architect.

Burlington, Vt.—E. N. Porter has bought a lot on Pearl street of the J. N. Mathews estate and will erect a business block.

Glen Cove, L. I., N. Y.—Herman Ritter, of Glen Cove, has purchased a lot at South Glen Cove and has commenced the foundation for a large building.

Pittsburgh, Pa.—Architect W. S. Fraser has prepared plans for a six-story fire-proof building for Charles Lockhart, to be erected on Penn avenue near 9th street.

Brooklyn, N, Y.—The Brooklyn Board of Education has made arrangements to increase the school accommodations. Plans will be prepared immediately for the erection of nine new buildings and for additions to eleven old schools.

Terre Haute, Ind.—The laboratory building of the Rose Polytechnic Institute was destroyed by fire. Loss, $10,000. Insurance, $5,000.

Bath, Me.—Plans are being made for a new city hall at Bath. Cost, $40,000.

Sewickley, Pa.—Architect T. C. McKeo, Pittsburgh, is preparing plans for a large hotel to be erected at Sewickley. Four stories, brick and stone, to contain 100 rooms.

Charleroi, Pa.—W. W. Jamison, of Charleroi, will erect a new hotel building at that place. Plans are now being prepared.

Somerset, Pa.—Ground has been broken for the new hotel and sanitarium to be built at Somerset. Architect Joseph Stitberg, Pittsburgh.

Trenton, N. J.—Meeting of Common Council. P. E. Baker introduced a resolution for the appointment of a committee of three, to inquire into the cost of the electric lighting of the city and the necessity of the city establishing its own electric-light plant.

Fenton, Mich.—An electric railway from Fenton to Flint is promised to be in operation in July, 1896. John E. Nolan, of Saginaw, has a franchise on the streets of Flint, and the Fenton Common Council was instructed at a citizens' meeting to grant a franchise in Flint.

New York City.—The New York Steam Company has secured a site on south side of 59th street, east of Madison avenue, upon which it is proposed to erect a ten-story office and store building.

Shrewsbury, Mass.—The Shrewsbury Street Railway Company, of which F. S. Shaw is interested, has petitioned for franchise for its proposed electric road.

Sanborn, N. Y.—A company, of which Lewis T. Payne, of Pekin, is vice-president, is making arrangements to begin the construction of an electric road 10 miles long from Ely to Erie, Sanborn and Pekin.

White Fish Bay, Wis.—T. W. Williams and others are interested in the construction of an electric road to Mineral Spring Park.

New York City.—Architects Clinton & Russell, 32 Nassau street, have prepared plans for the twelve-story fireproof office building, soon to be erected on east side of William street, between John and Platt streets, by the Woodbridge Company, which was reported Nov. 9th.

Beatrice, Neb—The Beatrice Rapid Transit & Power Company and the Beatrice Light & Power Company consummated a consolidation, by the formation of a new company, to be known as the Beatrice Electric Company. Capital, $1,000,000. A resolution was adopted to at once extend the motor line. President, John A. Harbach; vice-president, John E. Smith; secretary, A. S. Maxwell; treasurer, Paul W. Harbach.

Cottondale, Ala.—The Tuscaloosa Manufacturing Company will put in an electric lighting plant.

Rat Portage, Ont.—W. Ross is again endeavoring to obtain an electric lighting franchise for Rat Portage, Ont. The council is considering the application.

Niagara Falls.—The Electric Light Company, Niagara town, has bought land on which to build an 80 by 100 brick power house to cost $10,000, and the machinery about $25,000.

Chester, Pa.—President Crosby M. Black, of the Prospect Street Railway, proposes to extend the new line from Moore Station to Rutledge and Morton, to connect with the Delaware County and Philadelphia electric railway. The extension will be about two and a half miles in length.

Hagerstown, Md.—Powell Evans, of Philadelphia, has obtained contract for lighting the city.

Reynoldsville, Pa.—A movement has been started at Reynoldsville to put in an electric light plant and build an electric railroad to Rathinel, three miles distant.

Elberon, N. J.—Plans for the erection of the new casino to be built at Elberon has been completed. The casino, which will be placed at the disposal of the guests at the Elberon Hotel and members of a social club, made up of Elberon cottagers, soon to be organized, to cost $15,000.

Brooklyn, N. Y.—J. B. McElfatrick, 1402 Broadway, New York City, has prepared plans and will build for the Bergen Beach Improvement Company, at Bergen Beach, a frame casino and pier, to cost about $40,000.

New York City,—The Woodbridge Company, of which the directors are Anson Phelps Stokes, 47 Cedar street; J. N. and J. D. Stokes, Jchn Harsen Rhoades and James W. McCulloch, filed articles of incorporation in the county clerk's office. Capital, $1,000,000, and the object is to acquire land fronting on William street, between John and Platt streets, on which it is intended to erect an office building twelve stories high. Work will be begun May 1, 1896.

Rochester, N. Y.—A business block is to be erected on the site of the old Ayers Hotel, on Mill street.

Philadelphia, Pa.—The New Haven & Derby Electric Railroad Company has a charter to build from New Haven to Derby, along the Derby turnpike.

New York City.—Adam Huppel will build a five-story brick warehouse. Architect, Franklin Baylies, 51 Bible House.

Flushing, L I., N. Y.—The trustees of the village have closed the contract with the Flushing Electric Light Company to light Main street. The officials of the electric light company will build at once an extension to their present plant.

Lonaconing, Md.—At meeting of the city council the electric light company was given exclusive right to light the city. Mayor Hamilton, Clerk Dixon.

Keene, N. H.—The contract for building an electric road at Keene has been signed by the Keene Electric Railroad Company.

SEALED PROPOSALS.

Sealed proposals will be received at the department of city works, Municipal Building, Brooklyn, N. Y., until 12 m., Nov. 25, for the installation of the electric light wiring in the Municipal Building. Amount of deposit required, $25. Amount of surety required, $250. Each proposal must be accompanied by a deposit in money or by a certified check in the same amount, payable to the order of the commissioner of city works. Proposals to be endorsed "To the Commisioner of City Works" (specifying work). Alfred T. White, commissioner of city works.

Sealed proposals will be received at the office of the Board of Administration, Cincinnati, O., until 12 m., Dec. 3, for electric lighting as follows: For one complete duplicate electric light plant, dynamos, engines, lamps, wiring, switches and belting, furnished and set in place ready for service at the Hunt street pumping-station. The capacity of each dynamo and engine to be 10 arc lights, or a corresponding illumination in incandescent lights. The plant to be furnished complete and ready for steam attachments, which will be made by the water department. Bidders will furnish complete specifications and state the make of dynamo and engine they propose to furnish. August Herrmann, president; A. P. Butterfield, clerk.

ELECTRICAL and STREET RAILWAY PATENTS

Issued November 12, 1895.

549,485. Electric Locomotive. Francis B. Badt, Chicago, Ill., assignor to the Siemens & Halske Electric Company of America, same place. Filed Aug. 1, 1895.

549,491. Railway Telephone System. William H. Clewley, Providence, R. I., assignor to William H. Nixon, same place. Filed Apr. 10, 1895.

549,500. Car-Fender. Levi Dederick, Albany, N. Y. Filed Oct. 11, 1894.

549,501. Electric Shunting Device. Augustus B. Depuy, Camden, N. J. Filed Mar. 19, 1895.

549,502. Dynamo-Brush. James Dickson and Robert G. Shapcott, London, England. Filed July 7, 1893. Renewed June 24, 1895. Patented in England Nov. 16, 1891, No. 19 854.

549,518. Car-Fender. James W. Madden, Brooklyn, N. Y. Filed Jan. 31, 1895.

549,522. Electric-Motor System and Traction Device. Thomas P. Milligan, South Orange, N. J. Filed Jan. 26, 1895.

549,542. Electric Elevator. Humphrey R. Smith, Chicago, Ill., assignor to the Winslow Brothers Elevator Company, same place. Filed Mar. 4, 1895.

549,556. Automatic Electric Cut-Off. Clinton E. Whitney, New York, N. Y. Filed Jan. 2, 1895.

549,577. Arc-Lamp Globe-Holder. Gilbert L. Moyer, Hartford, Conn., assignor to the Perkins Electric Switch Manufacturing Company, same place. Filed Mar. 19, 1895.

549,580. Conduit-Electric-Railway System. Byron E. Osborn, Albany, N. Y. Filed July 14, 1894.

549,597. Combined Rheostat and Reversing-Switch for Electric Motors. Jonathan P. B. Fiske, Alliance, Ohio. Filed Nov. 6, 1894.

549,598. Electric Controller. Jonathan P. B. Fiske, Alliance, Ohio. Filed Feb. 13, 1895.

549,608. Electric Controller. William H. Morgan, Alliance, Ohio. Filed Aug. 22, 1895.

549,621. Controller for Electric Motors. Merle J. Wightman and Oscar Urban, Scranton, Pa. Filed Feb. 6, 1895.

549,636. Electrical Steering-Gear. George S. Grimston and Alfred H. Dykes, London, England. Filed Apr. 9, 1895. Patented in England July 23, 1891, No. 12,525, and May 2, 1892, No, 8,268.

549,642. Friction Appliance for Electric Cars. Isaac W. Heysinger, Philadelphia, Pa., assignor of one-half to William G. Steele, same place. Filed May 18, 1895.

549,649. Storage-Battery. Morris Moskowitz, Newark, N. J., assignor to himself and Leon D. Adler, same place, Abraham S. Adler, Philadelphia, Pa., and Theodore W. Myers, New York, N. Y. Filed Apr. 20, 1895.

549,652. Underground Electric Propulsion. John E. Parker, New York, N. Y. Filed June 23, 1894.

549,655. Contact Device for Electric Railways. Constantin A. Philipsborn, Berlin, Germany, assignor, by mesne assignments, to the Siemens & Halske Electric Company of America, Chicago, Ill. Filed Apr. 20, 1893.

549,662. Street-Car Fender. Moses C. Swift, New Bedford, Mass. Filed Sept. 10, 1894.

549,709. Multiple Telegraphy. Thomas B. Dixon, Henderson, Ky. Filed Sept. 12, 1895.

549 715. Electric-Clock System. Adolf Franke, Berlin, Germany. Filed Sept. 19, 1893. Patented in Germany Mar. 7, 1893, No. 73,850; in Switzerland Aug. 12, 1893, No. 6,978; in England Aug. 14, 1893, No. 15,450; in Norway Aug. 17, 1893, No. 3,362; in Belgium Aug. 19, 1893, No. 106,030, in France Aug. 21, 1893, No. 232,-285, and in Italy Sept. 30, 1893, XXVIII, 34,703, LXVIII, 123.

549,724. Bracket for Incandescent Electric Lights. Wilber R. Hitchcock, Cornwall, Canada. Filed Mar. 27, 1895.

549,794. Lightning and Heavy Current Arrester and Alarm. Miller R. Hutchison, Mobile, Ala. Filed May 25, 1895.

549,802. Telephone-Transmitter. Ignatius Lucas, Passaic, N. J, Filed May 15, 1895.

549,803. Telephone-Transmitter. Ignatius Lucas, Passaic, N. J. Filed May 31, 1895.

549,810. Electric Switch. William T. M. Mottram, Dallas, Tex. Filed July 9, 1889.

549,860. Telephone. Alfred Stromberg and Androv Carlson, Chicago, Ill. Filed Sept. 21, 1893.

549,874. Electric Speed-Regulator. Carl W. Larson, Schenectady, N. Y., assignor of one-half to Walter N. Sheaff, Lynn, and Amond U. Jaasted, Boston, Mass. Filed Apr. 8, 1895.

549,876. Electric Motor. Robert Lundell, Brooklyn, assignor, by direct and mesne assignments, to the Electric Experimental and Developing Company, New York, N. Y. Filed Mar. 2, 1893.

549,886. Electric Meter. Ralph O. Hood, Danvers, Mass. Filed June 8, 1895.

ELECTRICAL AGE

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NEW YORK, NOVEMBER 30, 1895.

CONTENTS.

DAMAGE TO TELEGRAPH LINES BY SLEET.

On Monday night last a sleet storm between Buffalo and Chicago did considerable damage to telegraph lines. Telegraphic communication between Chicago and other large cities was seriously impaired and the service greatly crippled. The accumulation of damp snow and sleet upon the wires weighed so heavily upon the lines that they gave way under the extraordinary strain. These incidents are of so frequent occurrence in this country during the winter season that the question naturally suggests itself, "cannot some method of construction be adopted that will be proof against the damaging effects of these storms?"

AS TO TOPICAL DISCUSSIONS.

Secretary Pope, of the American Institute of Electrical Engineers, reports that the Institute's first experience in the line of "Topical Discussions" was attended with gratifying results in New York. Several timely communications on the topic, "Storage-Battery Applications," were presented at the last meeting. One of these by Nelson W. Perry is given on another page in this issue; the others will follow in later issues.

THE MEXICAN EXHIBITION.

The proposed international industrial exposition which will be held in the City of Mexico next year should present an attractive opportunity to electrical manufacturers in this country to make a liberal display of their apparatus and goods. There is a large and expanding field for electrical enterprise in the Southern republics, and by nature the United States is entitled to the lion's share of this prospective business. It cannot be had without effort, however, but the proposed exposition certainly presents an excellent opportunity to pave the way for it.

THE DAWN OF THE MILLENIUM.

One of our esteemed contemporaries has appointed itself a committee of one (no others admitted) to undertake the task of purifying trade journalism. We suppose it will begin the good work at home. His Satanic majesty is a pretty shrewd old gentleman, and it is not at all likely that he will permit a modern Pharisee to thwart his plans. The old boy is constantly asserting himself in one form or another, and picture to yourself if you can, gentle reader, the sublime spectacle of the advertising solicitor of our contemporary remarking, "get thee behind me Satan," when a prospective customer asks him what his circulation is.

STORAGE BATTERIES vs. GAS-ENGINES.

The communication of Nelson W. Perry, presented before the last meeting of the American Institute of Electrical Engineers, states in plain terms the author's opinion regarding the use of storage batteries for the purpose of relieving electrical systems of the strain due to sudden and violent fluctuations of load. Mr. Perry prefers the gas-engine to accomplish the desired results, where the question of economy is the dominant one. Even where it is necessary to use gas from the street mains, he maintains, it would be more economical to use a gas-engine to take the peak off the load than to install a storage battery plant for the same purpose. The gas-engine industry in this country, according to Mr. Perry, is managed in a very incompetent and unintelligent manner. He claims that American manufacturers do not really know what their own engines are capable of doing, and so unsatisfactory is the condition of things here, with respect to these engines, that "recent large orders for gas-engines have gone abroad, where the business is conducted on business principles." This is a serious charge to make, and if there is the slightest semblance of truth in it American gas-engine interests should be alive to the situation. For the benefit of those who are interested in this important subject we print Mr. Perry's communication on another page.

ELECTRIC CIGAR LIGHTER.

Many electric cigar lighters have been invented and placed upon the market, but it is doubtful if any simpler and more effective device of this class can be found anywhere than the one illustrated herewith.

The universal lighter is the only lighter on the market that fills all the requirements of a light-giving device It is the cleanest, handiest, quickest and simplest device for obtaining a light that could be devised, as you obtain a light by simply taking out the torch with one movement of the hand and extinguish it by replacing it in the sheath, which fits so closely as to wholly prevent evaporation. The torch is made of spun brass in the shape of a handsome ornament, with a silver-plated top; it is packed with asbestos wicking, which will not burn, but when saturated with about a teaspoonful of gasoline or naphtha will give a clear, bright light of about two-candle power, that will burn for three consecutive hours. It will last for ordinary use for a week or ten days in a store or house. The gasoline is put in the torch by unscrewing the top. This is the only attention the lighter requires—the filling of the torches once a week. The torch is ignited by an electric spark made by the breaking of an electric current, which is generated by two dry batteries and a spark coil. The circuit can only be closed by taking the torch out of the sheath, when it raises two wire springs and automatically closes the circuit, which opens again as soon as the torch has been removed. There is no spark made when the torch is replaced. The boxes are made of hard woods and are very highly polished with silver-plated trimmings.

FIG. 1.

FIG. 2.

The universal lighters are made in various designs and are very handsomely finished.

The style shown in Fig. 1 is designed as a wall lighter, for the use of clubs, hotels and private dwellings, where a lighter is needed in every room. This lighter does away with burnt matches being thrown on carpet or floor, and also keeps the woodwork, tables, chairs, etc., from being scratched up. It is placed in a convenient place in each room, and the batteries are placed in the cellar or some out-of-the-way place, all the lighters being connected on the one circuit, using the one set of batteries and spark-coil.

Fig. 2 shows a lighter made in the shape of an upright piano, the back part containing the dry batteries and spark-coil. This is the standard design, and is ornamental as well as useful.

The Universal lighters are made by The Universal Lighter Company, 621 Broadway, New York. The company is getting up a handsome design of its lighter. The lighter will have a glass front for advertising purposes.

A large number of Universal lighters are in daily use, and the demand for them is constantly increasing.

ELECTRIC POWER IN COAL MINES.*

BY L. B. ATKINSON.

Is the present position of power distribution by electricity such that we may use it with confidence for the whole of the power required at a colliery? The author's answer to this is yes.

The largest engine at a colliery is the winding engine, and suppose this to require to be capable of developing power at full speed of 1,000 H. P., which is an outside figure. This could be well replaced by two motors of 500 H. P., one on each end of the shaft of the drum, without gearing. There are numerous cases of dynamos and motors of this power working with ease and satisfaction and giving no difficulty whatever, and operated by ordinary mechanics with no more trouble than an ordinary steam-engine. Motors of smaller size are in use all over the world with universal satisfaction.

Are the claims made for efficiency of electric distribution of power realized? On this point the author has examined, carefully, tests made by himself and by others on electric power plants, and has arrived at this conclusion—while the efficiency of distributing electric power and its utilization in the motors does come up to that claim, the efficiency of the production of electricity is not, as a rule, as high as is claimed, or as high as may be realized, and the reason is that sufficient account is not taken of the fact that the average load is considerably less than the maximum requirement. In one known case, where the efficiency of electric generation, that is, the proportion between the electric power delivered to the cables and the indicated horse-power of the engine is as high as 86 per cent. at full load, it falls to 74 per cent. at half load, and

* *Cassier's Magazine* for December.

to about 58 per cent. at one-quarter load. The reason for this is to be found in the power the engine takes to drive itself. The engine is generally arranged to work with an economical cut-off at the full load or maximum power, and consequently is larger than necessary for all smaller

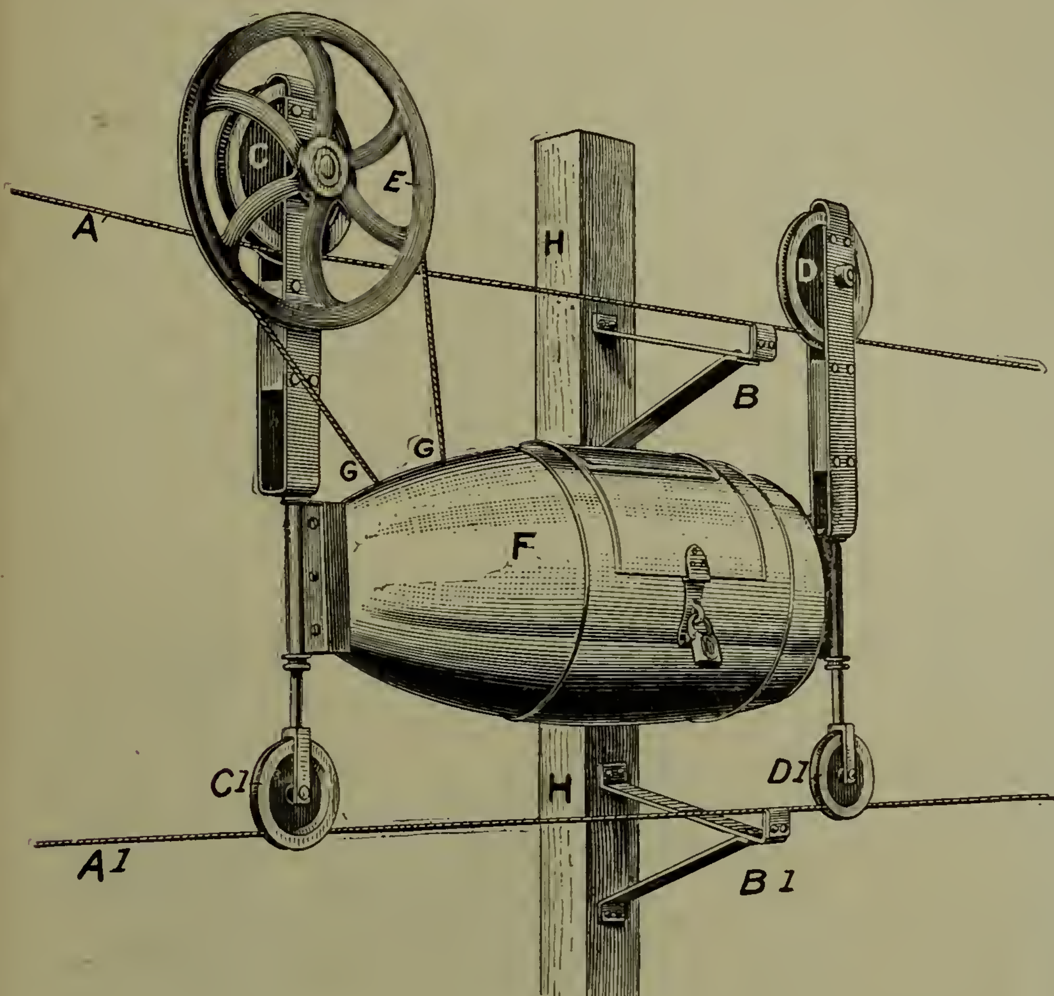

FIG. I.—ELECTRIC TRANSPORTATION.

loads. It should be arranged to work with an economical cut-off at the average power. The moral is to use engines with automatic expansion valves, permitting the engine to work with a cut-off as late as half or five-eighths of the total cylinder volume when developing the maximum power, and working with a more economical grade of expansion at the average load

WEST END'S REPORT.

The West End Street-Railway Company, of Boston, reports for the year ending September 30, gross earnings, $7,746,170 ; an increase of $922,291 over last year ; operating expenses, $5,633,163, an increase of $826,680; net earnings, $2,113,007 ; increase, $96,211. The company paid on common stock 6½ per cent. in 1895 and 7½ in 1894. From the above surplus there has been charged off $222,823, leaving $40,696 carried to surplus account. Included in expenses this year is $240,000 for injuries and damages. Passengers carried, 155,231,506 ; passenger mileage, 22,180,125 miles; average receipts per passenger, 4,912 cents. Electric cars furnished 95.13 per cent. of the mileage, and horse cars 4 87 per cent. Reconstruction of tracks, $115,891, charged to operating expenses, and total maintenance of tracks, 692,051, against $536,177 the previous year.

—Under no circumstances should series lamps be attached to gas fixtures There is danger of grounding and fire.

ELECTRIC TRANSPORTATION OF EXPRESS AND MAIL MATTER.

Hardly a day passes but what some one does not find a new application for electricity in one or another of its various forms. The electric-transmission field is one that is at the present time probably engrossing the attention of inventors more than any other, and one of the latest applications of electric power in this direction is the new system for mail and package delivery, which we describe and illustrate herewith. It does not present any radical departure from that for which the electric motor is now used, but it does open a new field for the commercial utility of the motor.

One-tenth of the capital required for the building of surface passenger transportation lines will build and equip an overhead line on this new system for the transportation of mail and express matter, receiving for each package carried the same remuneration as a surface electric railway does for each passenger.

The proposed plan of construction is clearly shown in the accompanying illustrations. Poles are set 50 feet apart along the proposed route, and one or two sets of bracket arms are attached to the poles. The lower bracket is placed 21 feet or more from the ground, so that the lower cable shall in no way interfere with the public traffic, and the upper bracket is placed at a suitable distance above that. Cables are then strung from bracket to bracket, and the cars run between these. Due preparation has been made for switching cars from one line to the other, and the mechanical workings of the same has been thoroughly tested. A, A^1 represents the cables, A being the positive and A^1 the negative, secured to brackets B and B^1, which are fastened to pole H H. C, C^1, D, D^1 represent grooved wheels running upon cables A, A^1. The current passes from wheels C, C^1, through frame to motor situated in car, F,

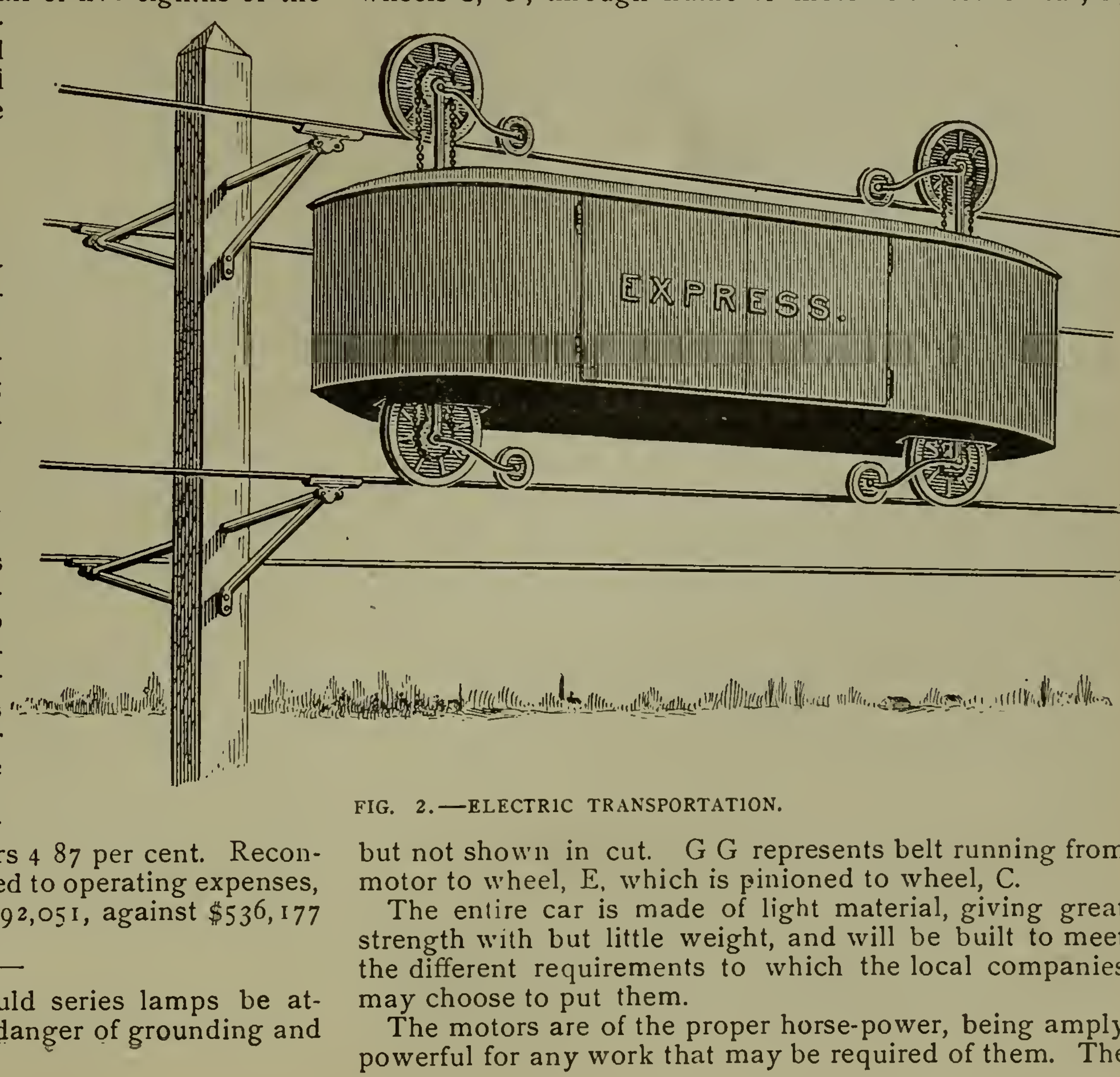

FIG. 2.—ELECTRIC TRANSPORTATION.

but not shown in cut. G G represents belt running from motor to wheel, E, which is pinioned to wheel, C.

The entire car is made of light material, giving great strength with but little weight, and will be built to meet the different requirements to which the local companies may choose to put them.

The motors are of the proper horse-power, being amply powerful for any work that may be required of them. The plan of operation is simple. The upper and lower cables are connected with the source of electricity, the upper acting as the positive and the lower as the negative, and from these the current passes to the motor situated in the car.

To avoid the cost, delay and expert help necessary to splice and tighten cables, there has been patented a simple device by which splicing is avoided, and the cables may be united at any points by self-acting cable-tighteners.

For a general example of the working of the system let A, B, C, D, E and F represent the several stations on the line of the proposed road, A and F being the terminal points and centres of trade dealing with the people living at the stations B, C, D and E Suppose the car to be loaded at A with packages for B, D and F, E, and C on this trip having none. The man in charge at A, when the car is loaded, turns on the current and starts it off, at the same time pressing a button which rings up the agent at B, letting him know that the car is on the way and has some packages for his station. The agent at B then turns on a switch which cuts off the current from a section directly in front of his station, thus bringing the car to a stop when it reaches this point. After B has removed the packages intended for him he notices that the next stop is to be made at D, and starts the car on again, at the same time ringing up the man at D. In this way, C having no packages is not disturbed, nor is any time lost by the car stopping uselessly. The men at D and E follow the same plan, and thus it goes on to F.

In many suburban districts families buy their supplies at the nearest trade centre, which is often five miles away. This causes a considerable loss of time in delivery, and consequently great inconvenience to the customer, to say nothing of the expense incurred by merchants in delivery. Let us suppose a customer at C buys supplies at A, which is some distance away. He mails a postal card or telephones to his butcher, grocer or druggist at A, asking him to send him such articles ; he fills the order, and on his delivery route leaves it at our station, to be delivered to the customer at C. It is sent down by the next car that leaves, and the agent at C holds or delivers it, as may be agreed. The customer or dealer, as it may be decided, pays five or ten cents. The probabilities are that the dealer will pay the charges, for it will certainly be a convenience to him, as it will save his wagon a trip of considerable distance there and back, and will be a convenience to the customer on account of quicker delivery.

The Electric Express and Transportation Co., Postal Telegraph Building, New York, which owns this system, gives the following general example, which will serve to show the business that may be done by an ordinary line, erected between a centre of trade and several small hamlets, in relation to cost of construction, maintenance and operation.

Let the following diagram represent such a line erected between the places, A, B, C, D, E, F. A is supposed to represent the business centre :

Towns,	A	B	C	D	E	F
Families,	1000	100	150	50	200	300

First, let us consider the cost of operating the line. At station A would be needed a man who was capable, to keep a general outlook over the entire line and see that the other station agents were attending properly to their business. He would also have to collect each night the moneys from the other agents and keep account of the general business. Such a man could be had for $4 a day. At B, C, D and E could be employed as agents boys of seventeen or eighteen years, as they would be amply capable of attending to the local business. They would probably receive for this $1 per day; or else local storekeepers might attend to it. At F a man would be needed who would be capable of tending to the switching of the cars back on the return line, and tend to the business at F. He would be paid $2 a day. Taking these figures, it would give for the day's expenses for labor the following :

Man at Station A	$4 00
Boys at Stations B, C, D, E	4 00
Man at Station F	2 00
Man attending cars and keeping line in order	1 50
Total cost per day for labor	$11 50

Let us now consider the year's expenses, allowing that the line is five miles long, and consequently cost to build and equip about $12,500. We will calculate that we will run every day in the year except Sundays—313 working days.

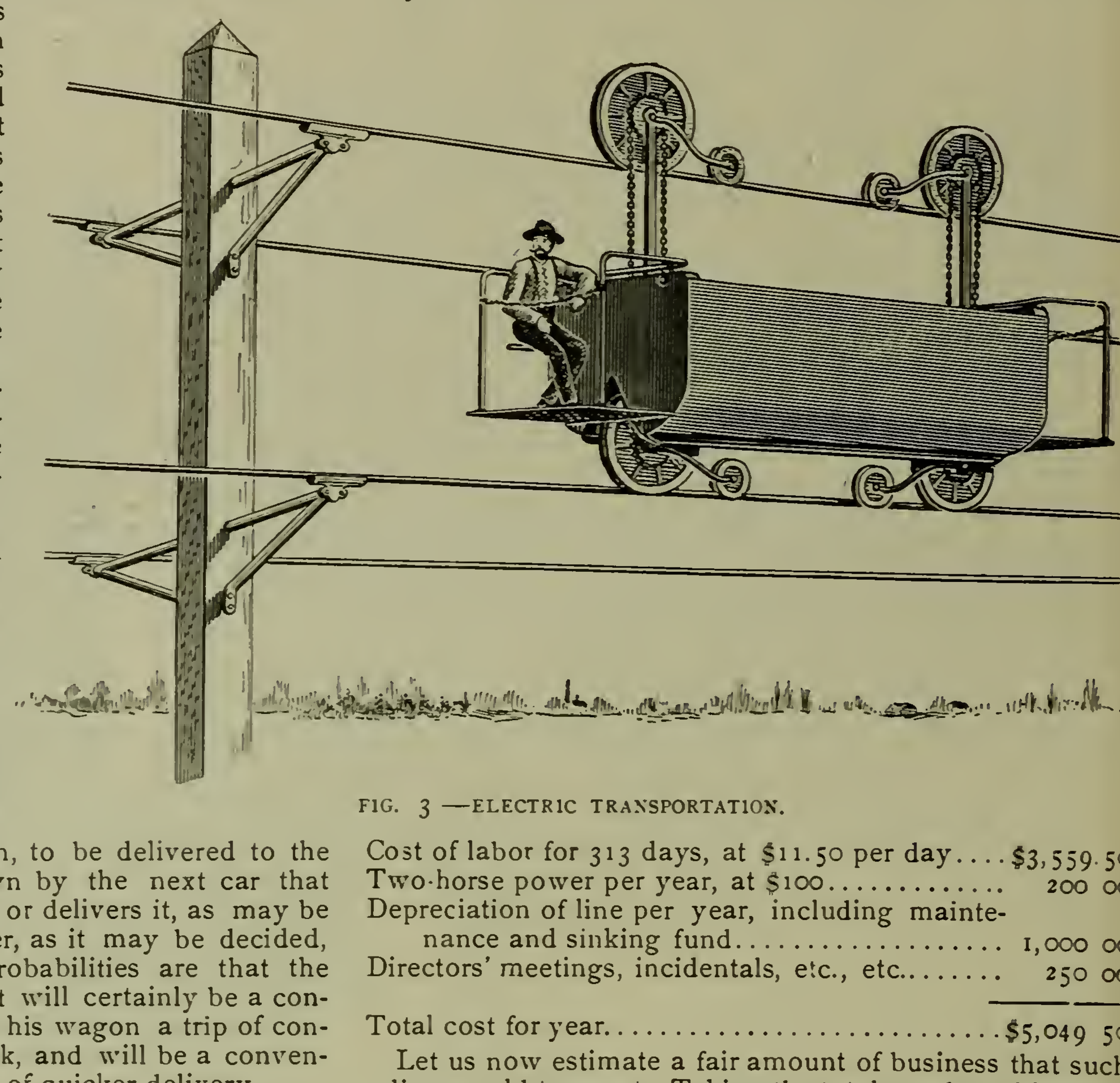

FIG. 3 —ELECTRIC TRANSPORTATION.

Cost of labor for 313 days, at $11.50 per day	$3,559 50
Two-horse power per year, at $100	200 00
Depreciation of line per year, including maintenance and sinking fund	1,000 00
Directors' meetings, incidentals, etc., etc	250 00
Total cost for year	$5,049 50

Let us now estimate a fair amount of business that such a line would transact. Taking the total number of families at B, C, D and E, we find it amounts to 500. Now, taking an average of the number of packages that each family would have sent to it a day as one, and allowing that one-tenth of the families at these places have packages that they desire to send to A or F, we see that we have for that business a total of 550 packages a day. Now A and F being trade centres would naturally have a large amount of business between them, and it is believed that taking one-tenth of the total number of families in each place as an average of the total amount of business a day, would be but a conservative estimate. These figures would then give us the following as the year's business :

680 packages a day, at 5 cents	$34 00
$34 per day for 313 days	10,642 00
Year's return for the business	10,642 00
Year's expenses	5,049 50
Profit	$5,592 50
Dividend of 10 per cent. on investment of $12,500,	1,250 00
Surplus	$4,342 50

ONE HUNDRED AND FIFTY-HOUR ARC LAMPS.

BY NEWTON HARRISON.

It is years since Sir Humphry Davy first demonstrated the possibilities of arc lighting. The steady stream of incandescent particles passing from carbon to carbon gave forth so brilliant a light that its adoption, as the most magnificent means of illumination known, followed as a mere matter of course. It was the means of promoting a host of inventions. A system of arc lighting, that held undisputed sway until a few years ago, predominated—the series arc lamp, brought to a practical basis by Brush, Thomson and others, being the foundation of large engineering ventures of this kind. Towns, cities, roads of great length, and a thousand other fields of a subsidiary nature, gave it a hearty welcome. But the scope of the work was not narrowed by these rapid developments; on the contrary, it widened and opened up new and important branches of arc lighting that would otherwise have received but passing notice from the increasing host of inventors.

Arc lamps are limited in life by the length of their carbons. Although the double carbon holder has been used for the purpose of switching in a relay of carbons when the first pair have been consumed, still this does not entirely remove the necessity for frequent trimming. That is, in certain cases, the cause of great annoyance. It is therefore evident, that the lamp which has but very little attention to receive in this respect is one which will appeal to the consumer in the strongest manner. Arc lighting, from the mere illumination of a street corner to the lighting of halls with lofty ceilings, or for photographic purposes, would gain immensely by any innovation that brought it nearer to the solution of this problem—the longer life of arc lamps; the lesser necessity for continual carbon renewals. It may be understood that the two classes of arc lighting that an age like this has called into play may be technically known as series, or high tension, and incandescent. or low pressure arc lighting; the first being the oldest; the second the latest of the prevailing systems.

As a general rule all arc lamps require 50 volts in order that a reliable action may be sustained most efficiently. The control of the carbon, by either clutch or clock-work mechanism, does not show a marked deviation in either case.

In the use of a resistance, the low tension arc lighting shows a difference that practice always requires in order that the safety of the system may be more assured and the lamp fulfil its function properly. These lamps by their general adoption have led to a most important development in the lamp itself, such that its life is not limited to only ten or twenty hours, but can be extended to 100, or even 150 hours of continuous action.

Closed Globe Arc Lamps. The incandescent lamp, in its present state of temporary perfection, contains within itself the live suggestion, by means of which the secret of long-life arc lighting could by prediction alone have been realized. Carbons burning in a medium like air are affected in two ways. First, an electrolytic effect takes place, and the transference of carbon becomes a spontaneous action. Secondly, the oxygen of the air consumes the incandescent particles in part and wastes away the carbon very rapidly. This difficulty can be greatly mitigated by the use of a closed globe in which the carbons form their arc. The air, with its $\frac{1}{5}$ of oxygen, can have but a very limited effect upon the carbons. Ozone is produced in very perceptible quantities at first, and then even this form of oxygen disappears, leaving behind the products of combustion and nitrogen—both entirely inactive henceforth. By providing a valve for the outlet of heated gases, the idea becomes one of practical significance, because the carbons will last eight or ten times as long; at least, the only tendency toward reduction in length being caused by the electrolytic action that inevitably ensues.

The conditions under which the carbons consume are now so very different from those hitherto observed that, as a mere matter of speculation, something of a peculiar nature might be looked forward to. There are several curious observations that may be made concerning the lamp, one of which is of considerable interest to the specialist, as evinced by the following data :

Candle-power, 1500. Carbons, 5-8 inch diameter.		Candle-power, 2000. Carbons, 3 16 inch diameter.	
Volts	75	Volts	50
Amperes	5	Amperes	6

The pressure required in lamps of this type varies from 70 to 85 volts. In the old form of lamp two could be used in series on a 110-volt circuit. It is evidently impossible to burn more than one of the closed globe type on a similar circuit. When the watts consumed in either case are alike it is necessary to refer to the light obtained, the saving in carbon and the value of an added convenience in order to draw a comparison that includes all advantages.

The fact that is full of interest is one explaining the higher pressure required is this peculiar type of lamp. When two ½-inch carbons are brought a short distance apart in a sealed globe, after the arc has been started, the crater that forms is of very sudden curvature; its concavity is such as to cause a continual movement of the arc in its effort to seek a point of lowest resistance. A flickering naturally results, readjustment is continually necessary, and the light thrown out is small because of the nearness of the surfaces to the carbon. By separating the carbons to a greater distance the crater almost disappears. The concavity becomes almost invisible, and the arc does not quiver but passes along between the two surfaces, wearing them away so uniformly as to make them present the appearance of flat faces. With the increased distance apart an increased pressure is required, and a greater amount of light can escape in proportion to the current than before. An open-air globe gives more light with ½ inch carbons than a closed globe, if both consume the same power. Yet small carbons will give more light in a closed globe for the same power than they would in an open globe. This is dependent, of course, upon the well-known fact that the radiation of the air is greatly and eventually almost wholly removed in the closed globe; the same or, at least, similar conditions existing in the incandescent lamp.

About 1882 Bidsley took out patents in relation to this form of lamp, and was followed by Baxter in 1883. The globe has not been so much the subject of discussion as the outlet or valve. The Howard globe, such as is now used, a small, cylindrical globe enclosing the carbon extremities, invites the claim that the gases within become luminous. The patent on the orifice or valve seems to be controlled by M. S. O'Kun.

In some of the early forms of this lamp the mechanism was exposed to the gases within ; the sequel to this was the gradual corrosion of the parts, ozone attacking them very violently and ultimately destroying them.

The life of a lamp having ½-inch carbons, within voltage of 75 to 80, is about 120 hours, steady run. The manner in which this form of lighting covers some of the ground formerly occupied by incandescent lamps is very apparent in many cases. It would be possible by the use of double carbon-holders and an automatic switch to have a steady light for 300 hours without renewed carbons. The sparks that fly from the lamps invite no danger and the wind cannot blow it out. By the use of small carbons the voltage can be decreased, and there is every possibility of this lamp being adopted in all parts of the civilized world.

WILL CHANGE FORM.

With its issue for January, 1896, *Modern Progress* (Erie, Pa.), will change to magazine form, and increase to at least 128 pages. It will give special attention to electrical applications, iron and steel manufacture, and coal and coke production.

AN EXPLANATION.

Touching the editorial article under the above title, which appeared in our issue of November 16, we have received a note from Mr. Cazin in which that gentleman says: "I would have fared much better at your hands had you printed all that Mr. Hasson, the self-confessed attorney for the Pelton Water-Wheel Company, had to say, because your readers then would know precisely that all of his accusations culminated in the statement that my criticisms grew out of selfish motives, as I claimed to be the inventor of a wheel superior to the Pelton, and made a demand on the Pelton Company that they purchase my patents. As the matter stands, your readers are at liberty to please their own imagination as to what I might have perpetrated in my rebellion against the sacred interests of the Pelton Company."

The *Pacific Electrician* not believing, as we do, that a technical journal degrades itself in allowing the use of its columns for personal attacks and vituperation, has printed Mr. Hasson's article in full.

We owe some protection to our contributors, and we consider the subject of hydraulic apparatus used as the means of electric power transmission of sufficient interest to our readers to justify the publication of Mr. Cazin's reply to the editor of the *Pacific Electrician*. It is as follows:

"To the Editor of the *Pacific Electrician*.

Sir:—Page 81 of your issue of September has been given over to W. F. C. Hasson, as the confessed agent of the Pelton Water-Wheel Co., evidently in consideration of their advertising patronage, and has been used by him for geting into print personal vituperation and misstatements, all of which are directed against the undersigned. The action is peculiar in so far as none of my work, which has aroused their wrath, had ever been published in your magazine. As a matter of fair play and of square dealing, so highly estimated in the literary profession, you will presumably also grant space for the refutation of these personal attacks and misstatements. I do not, however, intend to answer in kind, as such methods of argument are too foreign to my nature.

The facts in the case under discussion, as shown by the records, are as follows:

The Pelton Water-Wheel Co., manufacturing a percussion water-wheel of merit, has for many years past distributed all over the civilized world testimonials of two professors, one at the U. S. Naval Academy of Annapolis, Md., and the other at the Michigan University, of Ann Arbor, Mich., in which testimonials to the practical efficiency of these wheels is certified to be as high as 85 per cent. and over, of the highest possible theoretical effect that could be produced by the water striking the wheel.

Men versed in scientific hydraulics have for years denied the possibility of so high a practical effect, but they were on the one hand unwilling to impûte fraud to these professors (their testimonials bearing the evidence of good faith on their faces), and on the other hand unable to show precisely where the error had been committed. In consequence, therefore, the real practical efficiency of the Pelton wheel was, and is at present to some extent, looked upon as a matter of mystery.

If the undersigned has bestowed special attention upon this and kindred questions, the impulse has been given by the Pelton Water-Wheel Company itself and in behalf of its own interest.

In a series of articles written by me for *Electric Power* and published in its issues of October, 1891, to January, 1892, on "How can Mining and Metallurgical Industry be Benefited by Electric Contrivances?" I had occasion to refer to the special fitness of the Pelton wheel to the utilization of power from remote mountain streams. This reference procured for me the honor, when Pelton, the inventor, was accused in 1892 of plagiarism, of a communication on the part of the president of the Pelton Water-Wheel Company, in which amongst many other things the following occurs, namely:

"(Nov. 29, 1892.) If you have time, we should like you to go over the matter and make such answer as you think advisable under the circumstances. You doubtless know enough of the operation of our wheel to be able to make comparison." * * "We have never adveitised in *Power* and have no particular claim upon them, but they should in all fairness give place, having published the letter of the party—Smith."

"Have the kindness to acknowledge the receipt of this, and advise as to whether you can make it in your way to give the matter early attention."

In *Engineering News*, December, 1892, I made the desired comments or answer on the direct accusation of plagiarism, saying among other things:

"The curious part of the history of a correct principle of general theoretical mechanics and hydraulics, *which can be claimed by no one as his invention*, is found in this, that Mr. Atkins, in an attempt to make practical use of it, was misled, by his own faulty perception of the principle involved, into making an erroneous or faulty application thereof, and that Pelton was the first to make real, practical, well-directed use of the known theory.

"Mr. S. cannot possibly be in earnest, if he would claim that any mechanical contrivance can ever realize the full theoretical value of the jet. All that may be claimed is, that a more or less high percentage of the theoretical free energy contained in gravitating water will be realized with more or less perfect mechanism, applied to the purpose."

Under December 27, 1892, the president of the Pelton Water-Wheel Company wrote:

"The notes regarding the Jearum Atkins business were received some days previous. These, I should think, are about the thing."

It is evident that my writings then were not considered as "so full of error as to render them unworthy of consideration," and that in the opinion of the same parties they only became so, when, perchance, they considered them as not fostering their specific interest. Though in this they may overlook the fact that in mechanical art, industry and business the true and genuine interest of the manufacturer calls for the *real facts and not for fancied assumptions*.

The more or less perfect mechanism applied to the purpose of obtaining power from water-jets ejected under head or pressure then received on my part some further and specific attention and study, which finally convinced me that the Pelton wheel, though on the threshold of the correct solution of the problem, was yet far from being the acme of perfection as a 'mechanism applied to the purpose." Even a new wheel adapted to the theoretical requirements of the case in as perfect a manner, as science and art could make it, would not, in a critical test, give 86.59 per cent. of efficiency, as was claimed for the Pelton wheel. And since the new wheel would not, neither would the Pelton wheel under these same critical tests yield the stated efficiencies. They dropped behind in effect, though not in any other degree which must evidently be attributed to differences in lines of construction.

The necessity then arose for a thorough investigation into the correctness of assumptions and arithmetical evolutions, on which those exaggerating testimonials were based. The result of this investigation was published in a series of articles on the "Loss of Efficiencies," in The Electrical Age of July 6, 13 and 20, 1895. This publication is the one to which the Pelton Water-Wheel Company, by its special agent Hasson, objects, and would destroy its effect by vituperation and calumny.

Although the articles concern, in the first place, the power transmission plant at Bodie, Cal., their salient and really important points relate to the testimonials above refeired to.

Referring to the Annapolis certificate, after refiguring on the facts and data given, they say:

"And the highest theoretical horse-power that can possibly be derived from the water that comes into contact with the wheel, and by which the efficiency of the wheel as such alone can be measured, is:

$$\frac{\text{water-weight ejected . head}}{76.04} = \frac{9{,}722 \ . \ 59.36}{76.04} = 7{,}589 \text{ h. p.}$$

Efficiency by

$$\frac{\text{H. P. developed under test}}{\text{Theoretical h. p. possible}} = \frac{7.756}{7.589} = 102.25\%$$

As this is an impossible result, and as there is absolutely no cause for doubting the accuracy of observations or statement of facts made in the report, the question solely and exclusively arising in the premises relates to the method, first, of drawing conclusions from the facts, as observed, and second, of making interpretation of what the brake-test indicates."

In relation to the Ann Arbor certificate, they say:

"The result claimed is equivalent to 95.29 per cent. of efficiency, which is almost as evidently an impossibility as the Annapolis efficiency of 102.24 per cent. In both cases the cause of error is in the false interpretation put on the indications obtained in testing with the Prony brake, resulting in overestimating efficiency, in about the same manner as the false assumption (as to active head) has resulted in overestimating theoretical effect."

These conclusions were evolved from the statement in either case as to quantity of water used in the test and in logical, incontrovertible, exclusively scientific reasoning and calculation. It makes no difference whether at Bodie one kind or another kind of nozzle was used, this being irrelevant to the main issue. But even as to this the facts are at variance with Mr. Hasson's statement. I quote from THE ELECTRICAL AGE of September 28 in regard to this point:

"What Mr. Hasson attempts to prove in his criticism is, not that there is any illogical reasoning or error in conclusions, but purely and simply that, while Mr. Leggett speaks of 1⅓" nozzles, he in fact used other nozzles, thus denying a stated fact, and at the same time admitting that 'there is one chance for misapprehension in Mr. Leggett's article.' Mr. Hasson claims, however, that 'any chance of misunderstanding is removed by the final paragraph of the article, which states'—What he the nquotes as a statement of Mr. Leggett does not appear in Mr. Leggett's paper at all, and although it does appear in the discussion of the paper, it has no reference whatever to the point under present consideration, but to the electric efficiency as between dynamo and motor. My articles deal exclusively with the 'vital question' of Mr. Leggett's paper, namely: 'What efficiency of transmission can be attained from the water-wheel axle to the motor—or more correctly, the dynamo—axle?'

"It is true that Mr. Leggett's paper was devoted to this question, but the paper does not in any way contribute to the final answer, and it is true, also, that Mr. Hasson failed to get an insight into the real meaning of this question, or of the symbols I made proper use of in its discussion. Therefore, there is absolutely nothing in Mr. Hasson's criticism that calls for any other expression than that of surprise that petty-fogging should be resorted to for the purpose of discrediting scientific discussion.

"It is, therefore, not as an antidote of so unfair criticism, but in deference to the judgment of the readers of THE ELECTRICAL AGE that the matter is further discussed.

"All of the observations made and facts stated by Mr. Leggett were directly connected with his other statement as to the nozzles employed. He never mentioned that 'nozzles of various sizes had been used,' as Mr. Hasson declares, because he is well aware that such an assertion would have exposed him to ridicule. Where there are four wheels on one shaft and eight nozzles applied, the only rational and practical way of shutting off surplus power is to cut off the water-supply from one nozzle after the other, until the remainder adapts the power to the requirement."

"Before writing my articles, in view of a possible doubt, I advised Mr. Leggett of my intention to write on the Bodie plant for publication, and inquired specifically as to this point. Then was the opportunity for correcting or supplementing the statements made in this paper; but in his answer he omitted or evaded the information demanded as to nozzles used, thereby admitting the facts as stated in his paper."

It then remains for me to speak of what Mr. Hasson has to say concerning a "deal" attempted by me on the Pelton Water-Wheel Company. He has already admitted that what he stated as my utterance in regard to my new wheel was in fact not so uttered by me at any time.

But his revocation does not by any means go far enough, because all the rest of his statement in regard to my correspondence with his client, the "Pelton Water-Wheel Company," is absolutely false, untrue and without foundation in fact. I have at no time made a demand "that the Pelton Water-Wheel Company purchase his [my] patents," but what I have done is that, in a spirit more friendly and trusting than they deserved, I suggested to them that to a manufacturer it is of greater advantage to secure what progress there is in the line of his goods than to let progress and competition be identified, and that in consequence they should ascertain by comparative tests, made under their own auspices, whether my claims in favor of the new wheel were well taken. As a guarantee of good faith on their part, and as a protection against their shelving the new patents for the purpose of keeping the market for the old wheel, I offered, for a running consideration, to bind my hands until they would have terminated their test-work.

The entire question between the Pelton Water-Wheel Company and myself focusses in this: Is an author who has written for years on the specific scientific questions of hydraulics * debarred from exercising the right, otherwise common to all mortals, of doing business with a water-wheel; or, in other words, has the Pelton Water-Wheel Company a monopoly in this line, making progress therein a criminal attempt on their vested rights? If this were so, I should have to stand the consequences; but until this is proven I shall cling to the opinion that all the fuss the Pelton Water-Wheel Company and its agent, Hasson, are making about my essay on "Losses of Efficiencies" has but one purpose and object, namely, to head off a dreaded competition.

Very respectfully,

F. M. F. CAZIN, Consulting Engineer."

THE BERLIN EXHIBITION OF 1896.

The executive of the forthcoming industrial exhibition in Berlin have come to an extraordinary decision, says the London *Electrical Engineer*. They have resolved that the exhibition buildings proper should only be opened while daylight lasted, this decision being based on grounds of economy. It was estimated that the electric lighting of the buildings would entail an extra expenditure of 400,000 marks ($100,000), and the majority of the committee were of the opinion that for this and other minor reasons the lighting should be dispensed with. On the other hand, it was argued that the increased number of visitors would counterbalance the expense. It must be remembered, moreover, that the restaurants and other buildings in the grounds of the exhibition are to remain open until midnight. The resolution is meeting with considerable opposition, and it is not improbable that it may yet be rescinded.

HIGHWAYS OF COMMERCE.—The Department of State, Washton, has just issued an elaborately gotten up volume of 763 pages on the "Highways of Commerce." It contains several maps and describes the ocean lines, railways, canals and other trade routes of foreign countries.

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* "Resistance to Ship's Motion, a natural law newly discovered," the Journal of the Franklin Institute, March to May, 1893; "Solids falling in a Medium, I, II," Transactions of the American Institute of Mining Engineers, etc.

This system can be used without danger to man or beast. It can be run on roads across country, without in any measure hindering ground traffic. It can be run at a rate of speed from twenty miles an hour upward, as necessity may demand. Packages and mail can be delivered quickly, without interruption from ground traffic—a matter of no small moment in large cities of this country.

DESK LIGHT.

The desk electric light illustrated herewith is designed especially for roll-top desks, and its use is approved by the New York Board of Fire Underwriters.

It takes up the space of one pigeon-hole, and the simple act of pulling the lamp out of its retreat turns on the current; pushing it back, so the desk may be closed, extinguishes the light. When the light is on the lamp projects nine inches over the desk, and a special reflector throws the light down upon the work and protects the eyes.

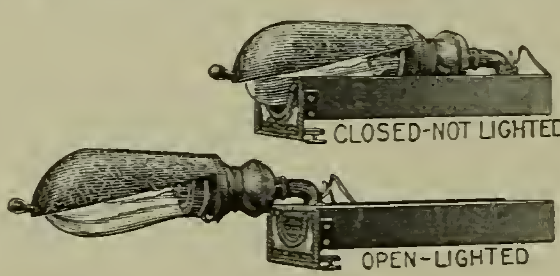

FIG. 1.

The device is handsomely finished in oxidized copper and can be attached in 15 minutes. It is made by The Desk Light Company, 707 Lancaster avenue, Wilmington, Del.

The Tucker Electrical Construction Company, 14–20 Whitehall street, New York, are the sole agents of this light for New York and New Jersey, and they state that this device is giving great satisfaction to those who have it in use.

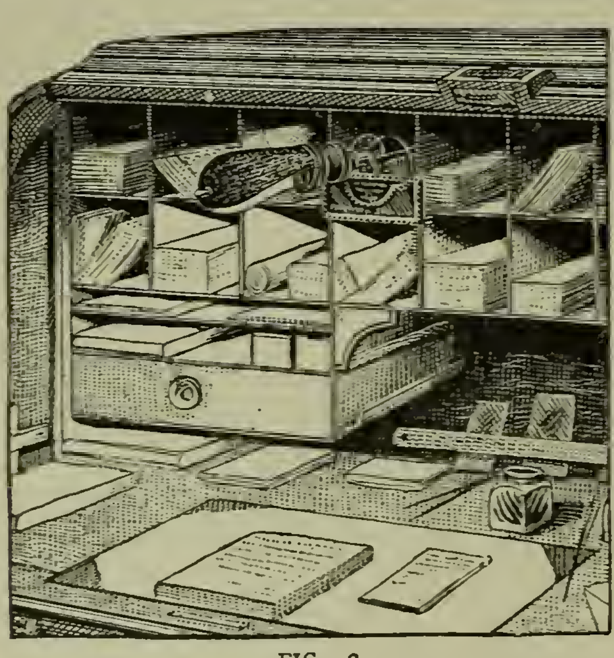

FIG. 2.

Figure 1 shows the positions of the lamp when in use and out of use, and Fig. 2 shows the device in operation on a desk.

THE STANDARD STORAGE BATTERY COMPANY.

The Standard Storage Battery Company, Room 29, No, 50 Exchange Place, New York, is equipping its new factory at Harrisburg, Pa., and will have batteries ready for delivery by December 1. The company is now prepared to fill orders of any size and at one-half the price of any other storage battery on the market. This battery was fully described in The Electrical Age of July 27 and November 2, 1895.

THE MEXICAN INTERNATIONAL EXPOSITION.

We have received a copy of the prospectus of the Mexican International Exposition of Industries and Fine Arts, which is to be held in the City of Mexico, beginning September 15, 1896.

The Exposition grounds are within 15 minutes' ride from the centre of the city, and comprise an area of 600 acres.

The general offices of the foreign department are at 45 Broadway, New York, where a copy of the prospectus can be obtained.

The New York Street-Railway Association.—We have received a copy of the report of the proceedings of the 13th annual meeting of the Street-Railway Association of the State of New York, which was held in Albany on September 17 last. This association was organized on December 20, 1883, and the officers during the present year are, President—G. Tracy Rogers, Binghamton; First Vice-President—William W. Cole, Elmira; Second Vice-President—John H. Moffit, Syracuse; Secretary and Treasurer—Benjamin Frick, Brooklyn, N. Y.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

At the regular monthly meeting of council held at the rooms of the Institute, 26 Cortlandt street, Nov. 20, the following associate members were elected:

Ball, Wm. D., consulting electrical engineer, Chicago, Ill.

Berg, Eskil, electrical engineer, General Electric Company, Schenectady, N. Y.

Brown, Chas. L., Chicago, Ill.

Burr, Clinton C., electrical engineer, Pittsburgh Reduction Company, Pittsburgh, Pa.

Burton, Paul G., constructing electrician, Western Electric Company, New York City.

Du Bois, Julian, chief electrician, Mohawk Division N. Y. C. & H. R. R. R., Albany, N. Y.

Friedlaender, Eugene, electrician, Carnegie Steel Company, Duquesne, Pa.

Gott, Clarence P., chief engineer and electrician, Grand Central Palace, New York.

Hopkins, Nevil Monroe, 1730 I street, Washington, D. C.

Hubbard, Albert S., electrician, Alexander-Chamberlain Electric Company, New York City.

Maccoun, Ellicott, assistant superintendent of the electrical department. The Carnegie Steel Company, Munhall, Pa.

Phisterer, Frederick William, 84 Heustis street, Ithaca, N. Y.

Rathenau, Erich, electrical engineer, Allg. Electricitats Gesellschaft, Berlin, Germany.

Warren, Alfred K., A. K. Warren & Company, 465 Greenwich street, New York.

Webb, Henry Storrs, instructor in electrical engineering, Lehigh University, South Bethlehem, Pa.

The following associate members were transferred as members:

Hartwell, Arthur, electrical engineer, Westinghouse Electric and Manufacturing Company, Pittsburgh, Pa.

Martin, Julius, master electrician, equipment department, New York Navy Yard.

Stearns, Joel W., jr., treasurer, Mountain Electric Company, Denver, Col.

Oudin, Maurice, electrical engineer, General Electric Company, Schenectady, N. Y.

Comstock, Louis K., electrical engineer, Monadnock Building, Chicago, Ill.

Brown, Edward D., district inspector, American Telephone and Telegraph Company, New York City.

La Roche, Fred A., vice-president and general manager, New York Electric Equipment Company, New York City.

O'Connell, J. J., telephone engineer, Chicago Telephone Company, Chicago, Ill.

Darlington, Frederick William, consulting electrical and mechanical engineer, Philadelphia, Pa.

Henshaw, Frederick Valdemar, electrical engineer, Providence, R. I.

At the meeting of the Institute at 12 West 31st street the evening was devoted to a consideration of the topic, "Storage-Battery Applications." Communications submitted by A. E. Childs and C. L. Edgar, of Boston ; F. B. Crocker and N. W. Perry, of New York, and Carl Hering, of Philadelphia, formed the basis of the discussion, which was participated in by H. Ward Leonard, E. T. Birdsall, J. B. Entz, J. Appleton, C. Blizard, Townsend Wolcott, J. W. Lieb, jr., and others. This was the first experience of the Institute in the line of topical discussions, and the result in New York was very gratifying.

The attendance of members and guests was 115, and President Duncan deemed it advisable to call for an adjournment at 11 o'clock. The subject was also discussed at Chicago and San Francisco the same evening.

THE STORAGE BATTERY OR THE GAS-ENGINE AS AN AUXILIARY.*

BY NELSON W. PERRY, E. M.

Whether it is economical or not to equip a central station with an auxiliary storage battery plant, is a question which must be decided separately for each particular installation. Generally speaking, the question will be decided by the character of the load line—a broad-topped curve being the most unfavorable, and a sharp peak the most favorable to storage battery economy. Again, a station having a very light day load may use the battery to good advantage, even though its night load may present a broad-topped aspect.

Aside from purely economic reasons convenience may be controlling, so that it is impossible to state, unless all the conditions are known, whether the storage battery is advisable or not.

The price of the battery is an important element, of course, but less so than popularly supposed, for the space which it occupies and the cost of maintenance may largely overbalance any gain in first cost over the cost of the extra boiler, engine and dynamo.

In regard to the cost of maintenance, manufacturers are willing to guarantee that it will not exceed 10 per cent. per annum, but it is well to understand just what this 10 per cent. means. It means, in the first place, that if you put in all the battery power that the manufacturer recommends, and take care of the battery exactly as he says, then the guarantee holds good. Under such conditions the manufacturer is undoubtedly safe, but if we install a plant under these conditions, we are pretty sure to find that the economy in first cost of the battery over engine and dynamo has entirely disappeared.

Then it is well to understand beforehand what the 10 per cent. means—10 per cent. of what? The public are given to believe that this means 10 per cent. of the *cost price* of the batteries, and the statement has been freely made that this is what it means.

Some time ago I had occasion to inform myself accurately on this subject, and to this end entered into quite a correspondence with the president of the leading storage battery company of this country. As regards the guarantee, he wrote me under date of June 18, 1894, as follows :

"We send you by today's mail our illustrated catalogue, and would especially call your attention to the question of maintenance as contained on page 11. We undertake, in these cases, to provide renewals when renewals are required at a specific price, with a guarantee that this will not be required sufficiently frequent (*sic*) to exceed an average 10 per cent. per annum. We have every reason to believe from our experience so far, that the actual cost of maintenance when the batteries are used at normal rates will not exceed five per cent."

Turning to page 11 to see what this meant I found the following :

"This company is prepared to undertake maintenance contracts according to a scheduled rate of charges, for periods up to ten years or longer, under which they will guarantee that the total amount paid for renewals during the term of the contract shall not exceed ten per cent. per annum on the *catalogue* price of the cells specified in the contract. . . . . . *In all cases of renewal by* contract the old material becomes the property of the company, *and must be returned to their works free of charge for carriage or packing.*"

[The italics are mine.]

Since the regular trade discount at that time was 20 per cent. of the catalogue price, and a further discount was offered which made the cost of the batteries comparable with that of an engine and dynamo, the guarantee assumed a very different aspect from that which it bore on its surface. When to this was added the cost of packing and carriage back to the factory, it ceased to be an attractive guarantee, and my calculations showed that in many cases where the storage battery might be recommended, if the guarantee was what it appeared to be, it would not be economical under the guarantee as it actually was.

This petty deception, together with the application of the battery to uses for which it is not adapted, has brought itinto an ill repute from which it will take a long time to recover, and for which the manufacturer has only himself to blame.

As before indicated, there are some situations in which either convenience or extremesteadiness of current may be controlling in deciding the question of the use or not of storage batteries. But where the question is one purely of economy, I would not myself recommend their use under any circumstances, simply because there is a still more economical method at hand. I refer to the gas-engine. Even if it were necessary to use illuminating gas from the street mains, it would be more economical (considering space and other factors,) to take the peak of the load with a gas-engine than to install a battery for this purpose. In this case there would be no stand-by losses and the engine would be ready at a moment's notice to be thrown into service.

It is a fact that has been amply demonstrated by others as well as myself, that a given number of lights can be produced with half the gas burned in a gas-engine that is required to produce them in ordinary burners. The mechanical efficiency of the gas-engine is not quite so high as that of large compound condensing steam-engines, rarely ever exceeding 83 to 85 per cent., while the latter may go to 90 per cent., but the total efficiency from fuel to the pulley of the gas-engine is about double that of the steam-engine—reaching 25 per cent. under favorable conditions, whereas, with the steam-engine it rarely equals 12 per cent. So that with the gas-engine operating at anywhere near its full load, there would be a gain in efficiency, instead of a loss of say 20 per cent. where the battery was used.

As indicating the performance of a gas-engine using illuminating gas at various loads, I quote the following figures obtained from a test of a 12 H. P. (actual) gas-engine.

Actual H. P. Developed.	Gas consumption (cu. ft.) each actual H.P.
12	15
11	15.3
10	15.5
9	16
8	16.5
7	17
6	18
5	19
4	21

*Topical communication presented to the Meeting of the American Institute of Electrical Engineers, New York and Chicago, November 20, 1895.

3 26
2 30
1 48

These figures are somewhat better than would be obtained in practice, but go to show that the gas-engine compares favorably at light loads with the steam-engine under similar conditions.

Thus far I have spoken only of illuminating gas; but the power may be much more cheaply generated by using a fuel gas.

The cost of producers or generators comes to about $11.00 per H.P. capacity—considerably less than the cheapest boiler, and an idea of the space required may be gained from a statement of Mr. J. Emerson Dawson, who, in estimating for a plant of 400 K. W. capacity, says that if the gas plant is all on one level it would occupy a ground space of 27 feet by 54 feet, but if necessary, all except the gas holder can be placed under or over the engine room. His estimate for such a plant is, including erection, foundations and ash-pit for generators, $5,500, or $10.38 per H. P.

These fuel gas generators can utilize advantageously the poorest grades of fuel, and produce from the better grades of anthracite about 160,000 cubic feet of gas of a calorific value equal to one quarter that of 16 C. P. illuminating gas, per ton of coal.

As to the stand-by losses of the gas producers, this has been very carefully determined in a number of cases. As an illustration I will cite a single case—by no means the best on record.

At Openshaw a generator which supplied gas for from 250 to 300 I. H. P. was shut down for 41 hours, and the fuel consumption during this time was but 3.9 pounds per hour or about one per cent. When we compare this with the stand-by losses of the steam boiler, which is estimated by Professor Kennedy at ten per cent. of the total consumption in all the boilers, we see how insignificant it is.

A situation usually considered peculiarly adapted to the storage battery is in subordinate or outlying stations where they are charged during the daytime from the central station and act as centres of supply during the night-time.

But gas can much more economically be distributed to these stations than can the electric current, for Mr. Denny Lane[1] has shown that with ordinary 16 C. P. gas, 3,000 H. P. can be sent a mile for an expenditure of one H. P., or one-thirtieth of one per cent. of the power conveyed.

My own calculations show that a six-inch pipe will deliver 6,000 cubic feet of gas per hour, at a distance of 10,500 feet under four inches of water pressure. If this be 16 C. P. gas, allowing 25 cubic feet per H. P. hour, this quantity represents 240 H. P.

Cast-iron pipe six inches in diameter, having a thickness of ½-inch, weighs 31.9 lbs. per foot. The total weight ot this two miles (nearly) of pipe will therefore be 334,950 lbs. This would be equivalent in conductivity to about 41,869 lbs. of copper. But four miles of copper weighing 41,869 lbs. would be equivalent to about four No. 000 B. & S. wires, which would have a resistance for the four miles of 0 325 ohms. If the charging current were transmitted at 220 volts, there would be required a current of 848 amperes; but a wire having a resistance of .325 ohms will only deliver under a pressure of 220 volts $220 \div .325 = 677$ amperes, there would, therefore, be required five No. 000 B. & S. wires to deliver this energy, and the weight of this would be 53,540 lbs.

If the distribution took place at 1,000 volts, the amperes required would be approximately 180. To deliver this at the same distance with a loss of 10 per cent. would require 6,264 lbs. copper, and to deliver it at one per cent. loss would require 62,642 lbs., which would cost far more than the pipe and still give less efficient transmission.

I think it would be very easy to prove that the gas-engine with fuel gas, would prove a much more economical auxiliary to the central station for taking the peak of the load and the loads amounting to fractions of a unit, than the storage battery, and when we consider the efficiency of transmission of energy in the form of gas, which will permit of the location of the gas generators where land is cheap and fuel easily procured, it seems to me that the plan must commend itself to electrical engineers.

Unfortunately the gas-engine business in this country seems to be in the hands of parties totally incompetent to handle it properly, as everyone knows who has ever had occasion to seek information from them.

It is probably not too much to say that every attempt thus far made in this conntry to adapt the gas-engine to electric lighting has proved a failure. Our own manufacturers either do not know what their engines are capable of doing, or else they are afraid to make public what they will do. I believe there is not a single manufacturer who has a printed price list, and my own experience and that of others whom I know has been, that it is impossible to get prices quoted until the manufacturer or his agent has been thoroughly satisfied of the exact purpose for which the quotations are desired. Information of any kind is almost impossible to get; and guarantees of performance, when given, are worthless. To such an extent is this true that nearly all, if not all, the recent large orders for gas-engines have gone abroad, where the business is conducted on business principles.

In England, Germany and France the gas-engine has come into extensive use in isolated lighting, and already has been adopted with satisfactory results in several central stations of considerable size.

When the business is properly handled in this country we may expect to see the gas-engine make its way rapidly in the lighting industry here also, for it has merits which need only be known to be appreciated.

1. *Electrician*, Oct. 9, 1891.

NEW BOOKS.

"Electrical Law of the State of New York," is the title of a book just published by Banks & Brothers, Albany, N. Y. The book is written by Wendell V. R. Barnard, and gives the substance of the state laws applicable to electrical industries of all kinds. Chapter I gives the general telegraph law, under which telegraph and telephone companies are organized.

The organization of electric light companies comes under the general gas law, to which Chapter II is devoted, and the general railway law, which includes street railways, is given in Chapter III.

The remaining thirteen chapters are devoted to the subjects named below:

IV—The General Industrial Law; Gas and Electricity, a manufacture. V—Eminent Domain; Poles and Wires for Telegraph, Telephone, Electric Light and Electric Power. VI—Highway Easements. VII—Wires Running Across Navigable Streams. VIII—Wires Running Along a Railroad. IX—Electrical Fixtures on Rural and Suburban Ways. X—Electrical Fixtures in City Streets, including Underground Wires. XI—Electrical Fixtures as Real Estate. XII—The Law of Telegraphic and Telephonic Messages. XIII—The Status of Telegraphic and Telephonic Communications. XIV—The Measure of Damages. XV—Higher Law. XVI—Miscellaneous Matter.

The work contains a long list of cited cases and altogether it forms a valuable compilation upon this important subject.

Poor's Directory of Railway Officials and Manual of American Street Railways.—Tenth Annual Issue; edition of November, 1895. Royal octavo, cloth, pp. 74 and 616. H. V. and H. W. Poor, 44 Broad street, New York. Price, $3 per copy.

Many new features have been introduced into this edition of the work that should largely increase its value to investors and bankers, as well as to railroad officials and manufacturers of railroad supplies.

The information presented in reference to street railroads—electric, cable and horse—is one of the most important departments of the directory and shows, in addition to a complete list of the officials of each company in the United States and Canada, statistics of mileage, equipment, gauge, weight and kind of rail, capitalization, etc , etc.

The statistics of the street railroads of the country are this year presented in tabular form, which possesses the double advantage of enabling subscribers to arrive at the most important facts pertaining to each almost instantaneously, and of permitting of a comparison of one road with another without inconvenience. In this form this information is especially valuable for ready reference, particularly in view of the great changes that are now taking place in this class of enterprises. In no department of our vast transportation system are changes being made at this time so rapidly and with such possibly far-reaching effects on the properties concerned as in the department of city and suburban transportation ; and until these consolidations, leases, and changes of motive power shall have been consummated, no comprehensive statement of the new combinations can be presented.

The publishers have collated all the most important data respecting these lines in tabular form, and present in the introduction a summary of the mileage, capitalization. etc.

The total length of the street-railway lines in the United States equals 13,176.38 miles, an increase of 3,514.32 miles over those in operation in 1891. Of this total, 13,176.38 miles, 409.40 miles are operated with steam dummies, 10,238.13 by electric power, 578.54 by cable and 1,950.31 by animal traction.

It is impossible, owing to the meagre information furnished by many companies, to supplement this statement of mileage with complete or satisfactory statistics of the equipment, capitalization or operations of the street railroads of the country. Such returns as have been received have, however, been totalized with the result of showing an equipment of 30,857 passenger cars, 12,563 motor cars, 2,607 dummies and 45,353 horses.

The rapid substitutions of electric traction for animal power may be judged by the fact that since 1891 the number of horses employed in the street-railway service has declined nearly 145,000, or about 71 per cent.

Of the 13,176.38 miles of street railways in operation, companies operating 378.88 miles failed to supply complete statistics of capitalization either as to stock, bonds, or both. The capitalization of the remaining 12,797.50 miles is therefore shown to be $520,745,823 stock and $367,694,477 bonds, an average of $40,691 per mile of stock and $28,333 per mile of bonds, equal in the aggregate to $69,024 per mile of stock and bonds as against $56,611 per mile for steam railroads.

Of the total railroad mileage in the United States, aggregating on the 1st of October, 1895. 180,815 miles, no less than 38,613 miles are operated under receivership. A full list of these roads with their capitalization is given in the introduction to the directory,and is one of the most important tables in the book.

THE HATCH STORAGE BATTERY.

This battery has been tried on practical work on a large scale during several years, and its superiority has been fully demonstrated. It has also been tested by the most eminent storage battery experts in this country and Europe and pronounced a distinct step in advance in the art of storage-battery manufacture.

Unglazed earthenware is used as the support for the active agent of the element, and this does the work perfectly, besides adding little weight.

These pottery diaphragms have receptacles on their faces into which the active material is filled, while on their reverse sides they are grooved, so as to admit of a free circulation of the electrolyte of the cell.

These diaphragms, loaded with active material, are then placed back to back, with the grooves crossed. and thus prepared are assembled as an element, to which the electrodes are applied.

It will be seen that the electrodes are thus used only for their legitimate function, as conductors, to convey the current to and from the active material, and in nowise as a support, and therefore the necessary weight by thickness of lead is materially reduced.

The two outer conducting sheets or electrodes are supported in position by rigid backs of glass or other suitable material, and the element thus assembled is firmly bound together with flexible rubber bands, made expressly for the purpose of pure gum rubber, thus providing an elastic element to allow for the expansion and contraction of the active material during charge and discharge.

The Hatch Storage Battery, which has already become widely known to the scientific and commercial world, is claimed to be the first, and thus far the only practical storage battery, from a commercial standpoint, which can be used for the propulsion of street cars and general motor work, inasmuch as the widely varying and, at times, extremely heavy draughts of current do not affect the duration or life of the element. This has been proved by actual use with a car, built purposely of great weight (something over sixteen tons), which was run continuously for months.

Moreover, the Hatch Storage Battery is equally as good for lighting purposes as any of the old style accumulators, while in supplying varying draughts to a varying number of lamps it cannot disintegrate or get out of order. This makes it particularly adapted for use in train lighting.

In the Hatch Storage Battery all difficulties which have heretofore beset what is commonly known as the "Grid" type of element are overcome, and, in a most simple manner, while providing a battery which is cheap, light and durable, and at the same time the electrical efficiency is equal, if not superior, to the best known "Grid" batteries.

The Hatch Storage Battery Company, 421 Chestnut street, Philadelphia, Pa., is preparing to fit up a factory for manufacturing the Hatch Battery on a large scale, and to supply it in quantities for all kinds of work.

In connection with the above it now looks as if there would be a legal war between the Hatch interests and those of the Electric Storage Battery Company, judging from the following letter :

Philadelphia, November 20, 1895.

Mr. W. W. Gibbs, President,
The Electric Storage Battery Co.

Dear Sir:—Your letter of November 19, 1895, addressed to me as President of The Hatch Storage. Battery Company, has been received and contents noted. In reply thereto I beg leave to say that I and my associates caused to be made a thorough examination, both as to the merits and title of the Hatch battery, before we became identified with the enterprise. We were advised by experts of the highest competency that this battery is a complete departure from the type of storage batteries such as are manufactured by your company,and is a distinct step in advance in the art. They also advise us that they are equally as efficient and are lighter and cheaper to construct than other batteries and, therefore, meet public requirement in this line of electrical work. You speak of being informed by your electrical experts and counsel that our battery "infringes on important patents owned by your company," and we are likewise informed by our experts and counsel that our patents cover a distinct field, and do not in any way infringe on any patents owned or controlled by your ompany. We are fully prepared to meet that issue in any orm or manner in which your company may desire to make it.

Very truly yours,

(Signed) Jacob E. Ridgway, President.

ENLARGEMENT OF THE WESTERN ELECTRIC COMPANY'S WORKS AT CHICAGO.

The eight-story building now in course of construction for the Western Electric Company of Chicago at West Congress and Jefferson streets, in the rear of the present factory will, when completed, make their works there cover 104,000 square feet of space, and this with their branch factories in New York, Antwerp, Berlin and Paris will make a total of sixteen acres occupied by them. Six stories of the building are now up, and it is expected that the other two will be completed and the building under roof by December.

One of the most interesting features of the new building is that it is constructed to accommodate a travelling crane with a span of twenty-five feet, a space reaching the entire length of the building and taking up the basement and first story being set aside for this purpose. The crane will be used in handling heavy castings, like those which enter into the construction of the new types of dynamos and motors. Electrical power will be substituted almost entirely for other methods, when the new arrangements are completed.

Among the leading products of the works are telephones and telephone appliances, underground electric cables, insulated wires, arc light machines, motors, police and fire-alarm boxes and telegraph instruments. In the marine line they manufacture Lieutenant Fiske's range-finder and other specialties. In manufacturing cables they keep five presses going, and consume 300 tons of pig lead per month. At Chicago employment is given to 1,500 men, making a total, including those at the branches named, of 3,000 employés.

Possible Contracts.

New York City.—Marcellus Hartley, president of the Remington Arms Co., 232 Madison avenue, will build a bicycling academy at West 59th street to cost $15,000. Architect Richard Berger, 309 Broadway.

Brooklyn, N. Y.—A new bicycle academy will shortly be erected on the site formerly occupied by Gormully & Jeffrey, opposite the Willinck entrance to the park.

Beverly, Mass.—The Beverly & Danvers Railroad is to be equipped with the overhead system of electricity.

Toronto, Can.—Application will be made at the next session of the Parliament of Canada for an act to incorporate the Canadian Electric Railway and Power Co. with power to build, operate and maintain an electric railway from the City of Montreal, in the Province of Quebec, to the City of Windsor, in the County of Essex, via Rockville, Kingston, Bellville, Toronto and London, with power to build a branch line from Toronto or other point on the main line to Suspension Bridge, etc. Edmund Bristol, Howland, Arnoldi & Bristol, Toronto, solicitor for applicants.

Middletown, Conn.—The Worcester Cycle Co. will engage in the manufacture of electrical supplies, and already have a large number of workmen employed.

Cape Vincent, N. Y.—The New York Central, Grand Central Depot, New York City, will erect a new and modern station at Cape Vincent.

York, Pa.—Plans of Architect J. A. Dempwolf for the new passenger depot, to be erected corner of George and Washington streets by the Western Maryland R. R. Co., have been approved.

Newark, N. J.—McManus Bros., the furniture house on Market street, have purchased the saloon property at 83 Market street and will erect on the site a modern business building, at a cost of $25,000.

New York City.—Adam Huppel will build a five-story brick warehouse at First avenue and 91st street, to cost $30,000.

Burlington, Vt.—S. B. Saxe has purchased a lot on Pearl street, upon which he proposes to erect a block containing a store and three tenements.

New York.—Plans for the million dollar office building, which the Commercial Cable Co. intends to erect in Broad and New streets adjoining the New York Stock Exchange, have been completed by George Edward Harding & Gooch, 253 Broadway.

Baltimore, Md.—Baltimore Athletic Club has decided to build a handsome club-house, which with equipments will cost $60,000.

Richmond, Va.—The Richmond Traction Co. negotiated a mortgage of $500,000 in Baltimore, Md., to complete its rapid transit system.

Unionville, Pa.—The citizens of Unionville are making efforts to secure an electric railway from Unionville to West Chester.

Philadelphia, Pa.—Plans are under consideration by Murrell Dobbins for the erection of a theatre at corner Eighth and Vine streets.

Ilion, N. Y.—Heacock & Walker will erect a new opera house block on Main street, three-stories, brick with stone trimmings.

Buffalo, N. Y.—Plans are in existence for a large modern building, which the Austin estate may build on Main and Seneca streets. Architects, M. E. Beebe & Son. Cost, $1,000,000. Equipped with system of elevators, etc.

Richmond, Ind.—It has been announced that an electric line is to be constructed from Dayton, O., to Richmond. John K. McIntyre, of Dayton, O., together with some of the stockholders of the Barney-Smith Car Works, have organized a company that will put the line through.

Akron, O.—The old Akron and Cleveland Electric Railway Co., which two years ago secured franchises from Akron to Cleveland, via Richfield, has joined hands with the Akron and Cuyahoga Falls Rapid Transit Co. and work on the line will be begun at once. C. F. Dunbar, F. M. Chandler, and F. M. Wilcox of Cleveland, are interested.

Chatham, Ont.—The Chatham Gas and Electric Co. propose putting in new machines and engines, and remodelling their plant, in the spring.

Toronto, Ont.—The Toronto Electric Light Company is about to erect a new arc lighting station to cost about $20,000. The building will be constructed of brick and iron.

Brantford, Ont.—The Brantford Electric Light and Power Co. are offering for sale the Brantford canal level and electric lighting and power plant, consisting of land, dams, buildings, engines and boilers, arc dynamos, generators, etc., together with the company's franchises. Tenders close on the 26th inst., and are to be addressed to John McGeary, secretary treasurer, or Wilson & Watts, solicitors.

Millbury, Mass.—Indications point to another street railway from Millbury, to be known as the Millbury, Sutton and Douglas Electric Railway. James W. Stockwell, president; Thos. E. Meek, agent of the Douglas Axle Co., vice-president. Capital stock, $200,000.

Boston, Mass.—Milford, Holliston and Framingham Electric Road have secured land on the New York and New England Railroad, bordering Charles River, and will at once erect a fire-proof power house capable of furnishing 500 horse-power.

Charlestown, N. H.—It is rumored that the construction of an electric road from Springfield, Charlestown is contemplated. Cost, $100,000.

Oswego, N. Y.—The Street Railway Co. will present a petition to the Common Council, asking for a franchise to extend their lines on West 5th and Erie Streets to West Hawley.

New York City.—Central Real Estate Association, 309 Broadway, have filed plans for a thirteen-story factory building at south-west corner of 19th Street and Fourth avenue, to cost $500,000.

New York City.—James S. Barclay, 41 Liberty Street, will erect a seven-story brick store and lofts of various dimensions, at 47 Ann Street, to cost $50,000. Architects, J. Bockell & Son.

Philadelphia, Pa.—Steele & Co. are engaged on the plans of a large factory to be erected uptown, to cost in the neighborhood of $30,000.

New Corporations.

Ellsworth, Wis.—Pierce County Telephone Company, incorporated. Capital, $3,000. Incorporators, A. Combacker, E. R. Condit, J. M. Johnson, T. E. Nelson and A. E. Michael.

Oconto, Wis.—Oconto Telephone Company, incorporated. Capital, $7,500. Incorporators, A. H. Luckenbach, C. W. Stoelting and D. G. Classon.

Janesville, Wis.—The Western Telephone Construction Company, incorporated. Capital, $5,000. Incorporators, W. F. Palmer, George S. Parker and T. A. Pipelow. The company will enter into the telephone field both as manufacturers of telephones and the building and equipping of lines. The factory will be located in Janesville.

Albany, N. Y.—The Albany, Helderberg & Schoharie Railway Company, incorporated to build a railroad from Albany to Scoharie, a distance of 30 miles, to be operated by electricity, locomotive steam-power or compressed-air power. Capital, $300,000. Directors, Jonas H. Brooks, B. M. Secor, John W. Van Valkenburgh and Robert J. McCauley, of Albany, and others. Principal office, Albany, N. Y.

Buffalo, N. Y.—The Automatic Telephone Service Company has been incorporated by Oliver Watson, Edward Mitchell, Henry Koons and others, to provide for the use of the Strowger automatic telephone. Capital stock, $300,000.

Boone, Iowa.—Benning Current Motor Company has been incorporated with A. B. Stedman, president; A. L. Bradley, vice-president; A. B. Millerd, secretary; E. A. Turner, treasurer; to generate electricity. Capital stock, $50,000.

Wakefield, Mass.—The Peabody, Lynnfield & Wakefield Electric Street-Railway Company has been organized by B. W. Russell and Thomas H. Johnson, of Salem, Mass.; J. M. Danforth, of Lynnfield, and E. P. Shaw, of Newburyport; to build a line about 10 miles long. Capital stock, $50,000.

Shelton, Conn.—The Shelton Street Railway Co. has been organized. Capital, $22,000. Directors, Thomas L. Watson and Allen W. Paige, of Bridgeport; W. J. Miller and D. S. Brinsmade, of Chelton, and W. S. Downs, of Derby.

Washington, D. C.—The Home Telephone Co. has been incorporated, with J. B. Hubbell, president; James Russell, treasurer, and W. J. Atkinson, secretary and general manager. Capital stock, $25,000.

Allegan, Mich.—Metropolitan Electric and Power Co. has been incorporated by C. G. S. Thomas, Arthur S. Pinkham, Paul C., John S. Ranney, and Frank E. Remon. Capital stock, $200,000.

Los Angeles, Cal.—Pacific Coast Telephone and Electric Motor Co. has been incorporated by T. M. Gibson, Wm. C. Harrison, John C. MacCabe, L. Weatherbolt, H. J. Lloyd. Capital stock, $100,000.

Atlantic, N. J.—Atlantic City Light, Heat and Power Co. has been incorporated by James R. Merritt, William E. Findley, John M. Kelly. Capital stock, $250,000.

Newark, N. J.—New Jersey Incandescent Light Co. has been incorporated by Barnett Shatz, Wm. M. Keane, J. Albert McGown. Capital stock, $100,000.

Key West, Fla.—Key West Electric Light and Power Co. has been incorporated by Charles Curry, M. L. Kellings, M. W. Durry and Joseph Y. Porter. Capital stock, $25,000.

Portland, Ore.—Oregon Electrical Construction Co. has been incorporated by J. S. Urquhart, George F. Housner and F. C. Miller, to construct telegraph and telephone lines between Portland and Astoria. Capital stock, $20,000.

Elmira, N. Y.—The Chemung Gas and Electric Light Co. has been incorporated by C. G. Thomas, Arthur S. Pinkham, Paul C. Safford, Frank McKelvey, John Doyle, George T. Carhart, and Albert E. Ettinger. Capital stock, $200,000.

New York, N. Y.—Johnson-Lundell Electric Co. has been incorporated by Frederick H. Benedict, Edward H. Johnson, Robert Lundell, Frank S. Hastings, and others, to manufacture and deal in all kinds of electrical machinery. Capital stock, $500,000.

Los Angeles, Cal.—Herman D. Laguna has filed to presentation to the council his acceptance of the telephone franchise which was let to him by the council.

Richmond, Va.—The Mason Telephone Company's plant has been sold to the Mason-Maxwell Telephone Co. The new concern was organized in Charleston, W. Va., capitalized at $100,000. Walter Somers Risely, of Camden, N. J., is president, and Lewis Ashman, of Baltimore, is secretary and treasurer. The plant will be enlarged and run to its full capacity.

Buffalo, N. Y.—Eclipse Electric Lamp Co. has been incorporated by Thomas F. Cream, H. F. Fulton, W. G. Page and others. Capital stock, $100,000.

Weldon, N. J.—Electric Iron and Steel Co. has been incorporated by Jonathan F. Whipple, George Merrill, Byron C. Davis. Capital stock, $1,000,000.

Leechburg, Pa.—Leechburgh Electric Light and Power Co. has been incorporated by J. D. Orr, J. M. Anderson and others. Capital stock, $16,000.

Telephone Notes.

Ithaca, Mich.—A meeting of the Gratiot Telephone Company was recently held, and it was decided to authorize the board of directors to secure the requisite funds and extend the line to Alma and St. Louis.

Hartford, Conn.—The Hartford Street-Railway Company is about to construct a telephone line on its suburban roads, to enable the conductors to communicate with the car dispatchers in case of accident or delay.

Wharton, Tex.—It is probable that telephone connections will shortly be established between Wharton & Eagle Lake.

Monson, Conn.—The Selectmen have granted a franchise to the New England Telephone and Telegraph Co., to erect and maintain poles and wires on certain streets of the city.

Wilmington, Del.—Wilmington's new telephone company has commenced soliciting subscribers for the new system. The company has a capital of $250,000.

TELEPHONE PATENTS ISSUED NOVEMBER 19. 1895.

Toll-Collecting Telephone Apparatus. Geo. K. Thompson, Malden, Mass. (No. 550,204.)

Correction.—In our issue of November 23 were referred to some recent installations of Claus dynamos, as being the work of P. Claus. The work was done by the Claus Electrical Works, at 115 East 13th Street.

The Ansonia Brass and Copper Co., 19 and 21 Clift Street, New York, has just issued a pamphlet on Tobin Bronze. It gives some valuable and interesting facts concerning this metal, and the testimonials given show that it meets every claim and test.

Trade Notes.

The Chesley Electric Company, 601–605 Newark street, Hoboken, N. J., has been very busy on repair work and has recently added some heavy machine tools to its equipment. It has also opened an office in the Havemeyer Building, New York City, in charge of Mr. W. J. Johnson, formerly manager of the M. & M. Electric Company. This company reports a number of sales of second-hand machines, of which it makes a specialty.

The Bishop Gutta-Percha Company, 420–426 East 25th street, New York, has just issued a new catalogue and price list of its celebrated insulated wires and cables. The company manufactures highly insulated electric wires, flexible cords, aerial, subaqueous and subterranean cables insulated with gutta-percha, india-rubber, Balata and their compounds. At the back of the catalogue several valuable wire tables are given.

The Peckham Motor, Truck and Wheel Company, Havemeyer Building, New York, has shipped to California seven large Peckham's double electric motor trucks of a new pattern. These trucks are to be placed under electric locomotives.

ELECTRICAL and STREET RAILWAY PATENTS

Issued November 19, 1895.

549,899. Plate for Storage-Batteries and Process of Making It. Francis J. Clamer, Philadelphia, Pa. Filed Dec. 20, 1893.

549,906. Automatic Electric Fire-Alarm. Harry A. Edgecomb, Mechanic Falls, Me. Filed Jan. 5, 1894.

549,919 Electrical Indicator. John W. Howell, Newark, N. J., assignor to the Edison General Electric Company, New York, N. Y. Filed Jan. 2, 1892.

549,920. Underground Trolley System. Charlie E. Hubbs, Streator, Ill. Filed May 23, 1895.

549,995. Underground Conduit. James F. Cummings, Detroit, Mich., assignor to the Cummings & Engelman Conduit Company, same place. Filed Mar. 4, 1895.

550,008. Self-Propelling Vehicle, Boat, Etc. George A. Washburn, Cleveland, O. Filed Mar. 6, 1895.

550,018. Electrical Steering-Gear. Frank L. Dyer and Leonard H. Dyer, Washington, D. C. Filed Oct. 4, 1894.

550,039. Galvanic Battery. Edward S. Boynton, Brooklyn, N. Y. Filed Feb. 21, 1895.

550,042. Electric Fan. Philip Diehl, Elizabeth, N. J. Filed May 11, 1891.

550,044. Rheostat for Use in Electric-Motor Circuits. Rudolf Eickemeyer, Yonkers, N. Y.; Rudolf Eickemeyer, Jr., executor of said Rudolf Eickemeyer, deceased. Filed Jan. 14, 1893.

550,057. Closed-Conduit Electric-Railway. Herluf A. F. Petersen, Milwaukee, Wis. Filed Oct. 29, 1894.

550,059. Trolley. Francis J. Pribyl, Hazelton, Pa. Filed Mar. 9, 1895.

550,069. Car-Guard. Timothy A. Devane, Troy, N. Y. Filed Oct. 6, 1894.

550,096. Fuse-Box or Cut-Out. Augustus C. Carey, Lake Pleasant, Mass. Filed Apr. 13, 1895.

550,097. Insulated Pipe-Coupling. Edmund E. Clift, Philadelphia, Pa., assignor to John F. Pole, same place. Filed Sept. 20, 1894.

550,102. Underground Trolley System. Cornelius J. Hamilton, Philadelphia, Pa, assignor of one-half to James Lilley, same place. Filed Apr. 26, 1895.

550,121. Speaking-Tube Apparatus. Charles A. Bartliff, Memphis, Tenn. Filed Mar. 15, 1895.

550,132. Electric Appliance for Railways. Herluf A. F. Petersen, Milwaukee, Wis. Filed Mar. 19, 1894.

550,167. Electric Battery. Thomas Froggatt, London, England. Filed May 1, 1895. Patented in England, Oct. 23, 1892, No. 19,393, and in France, Jan. 18, 1894, No. 233,667.

550,192. Electric Protective Appliance. Alfred H. McCulloch, Boston, Mass., assignor to the American Bell Telephone Company, same place. Filed Jan. 24, 1895.

550,204. Toll-Collecting Telephone Apparatus. Geo. K. Thompson, Malden, assignor to the American Bell Telephone Company, Boston, Mass. Filed Aug. 24, 1895.

550,205. Electric Time-Signaling Apparatus. James T. A. Todd, Fort Worth, Tex. Filed Feb. 1, 1895.

550,215. Electric-Arc Lamp. Edouard Cannevel, Paris, France. Filed Apr. 20, 1893. Renewed July 22, 1895. Patented in Belgium, Sept. 26, 1892, No. 101,508; in England, Feb. 28, 1893, No. 4,390; in France, Mar. 25, 1893, No. 228,891; in Italy, Apr. 13, 1893, LXVI, 189; in Portugal, May 17, 1893, No. 1,792, and in Spain June 21, 1893, No. 14,436.

550,220. Electric Car or Locomotive. Rudolf Eickemeyer, Yonkers, N. Y.; Rudolf Eickemeyer, Jr., executor of said Rudolf Eickemeyer, deceased. Filed Apr. 8, 1891.

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NEW YORK, DECEMBER 7, 1895.

CONTENTS.

ELECTRICAL EXPOSITION IN NEW YORK.

A company has been organized in this city under the title of "The National Electrical Exposition Company," for the purpose of holding here an electrical exhibition in May next, in connection with the convention of the National Electric Light Association, which will be held at the same time and in the same place. The organizers of the new company are men well known in the electrical trades, and their connection with the enterprise gives it a backing and standing that can hardly fail of success, They are, moreover, familiar with what is essential to make a success of such an undertaking, and, judging from their plans, there is no doubt that the show will surpass anything of its kind ever held, excepting, of course, the World's Fair Electrical Exhibition. The hall in which the exhibition will be held is a very large one, and was built expressly for just such purposes. This exhibition ought to give a boom to the electrical business in this vicinity by stimulating a popular interest in electricity and its various applications. It is safe to say that there are thousands of people in New York city who do not know the difference between a battery and a dynamo. Such knowledge is, as far as the general public is concerned, a matter of education by observation, and the more these people see of such things the more familiar they will be with them. Naturally, the greater the popular interest the greater the business. The plans of the company, the names of its organizers, officers, and other details concerning it, are given a little more fully elsewhere in this issue.

THE STORAGE BATTERY.

The Storage Battery passed through the fire of criticism at the hands of the American Institute of Electrical Engineers at the November meeting, and the net results seem to be rather favorable to it. This apparatus, about which there exist in many quarters some exaggerated notions as to its capabilities and possibilities, is entitled to a fair and impartial consideration by a scientific body of high standing, and we think it has, in this case, received such. All the authors of papers on the subject, of course, did not agree on every point, but none of them had anything very unfavorable to say regarding the battery. All recognize that it has limitations in practical work, and the expression of the views of so many authors of high standing will no doubt ultimately redound to the good of the battery. In our last issue we gave the paper of Mr. Nelson W. Perry on the subject; this week we print Mr. Arthur E. Child's contribution, and in subsequent issues we shall tell our readers what other eminent gentlemen have to say on this interesting topic.

TROLLEY CARS IN CHICAGO.

A Chicago despatch says that J. P. Barrett, city electrician, has begun a movement looking to the enforcement of a law compelling traction companies in that city to use a conduit system. This appears to be the result of the publication of the statement that in 18 months 42 persons have been killed and 336 injured by trolley cars in that city.

THE FIRE HAZARD.

The National Board of Fire Underwriters is doing commendable work in issuing educational papers for the benefit of fire brigades. Its paper on the electrical hazard (which appears on another page in this issue) is right to the point, and will be of great service for the purpose for which it is intended.

ROYALTY TO MEET ELECTRICAL ENGINEERS.

The Duke of Cambridge will attend the annual dinner of the Institution of Electrical Engineers, London, on December 13.

PRINCIPLES OF DYNAMO DESIGN.

BY

Newton Harrison E.E.

(*Continued from page 292.*)

The peripheral speeds of both drum and ring armatures are generally confined within the following limits :

PERIPHERAL SPEEDS.

(FEET PER MINUTE.)

Size of Armature, Diameter.	500 Revs.	1000 Revs.	1500 Revs.	2,000 Revs.
48 inches,	6283.2	12566.4	18849 6	25132.8
36 "	4712.4	9424.8	14137.2	18849.6
24 "	3141.6	6283.2	9424.8	12566.4
12 "	1570.8	3141.6	4712.4	6283.2
6 "	785.4	1570.8	2356.2	3141 6
10 "	1309.0	2618.0	3927.0	5236.0
15 "	1963.5	3927.0	5895.5	7854.0
20 "	2618.0	5236.0	7854.0	10472.0
25 "	3289.2	6578.4	9867 6	13156.8
30 "	3927.0	7854.0	11781.0	15708.0
40 "	5236 0	10472.0	15708.0	20944 c
50 "	6578.4	13156.8	19735.2	26313.6
60 "	7854.0	15708.0	23562.0	31416 0

In a test made upon an Edison dynamo the data derived was as follows :

Speed	1400
E. M. F.	125 Volts
Length Armature	15 Inches
Diameter	9 "
No. of Inductors	67

Active length of wire per volt = 8.04 inches.
Peripheral speed = 3282 ft. minute.

At an inductor velocity of 1 foot per second,
Volts per foot = .0271.

It must always be understood that the density of field and number of inductors will change these accepted speeds sometimes within very wide limits. An armature of very large diameter, such as those used for heavy generators, can safely approach a very high rate of speed without any great danger. The usual speeds for all types lie within the above limits. According to Esson 6,000 feet per minute can

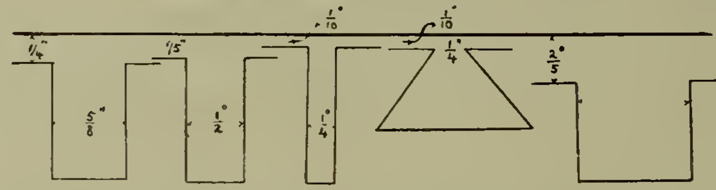
STYLE OF TEETH.

Rect. Trapez. Square. Circle.

be reached by large armatures without danger. The huge Ferranti armatures, 15 feet in diameter, have a peripheral speed of 5,400 feet a minute. Alternators are in some respects radically different from continuous-current machines, yet their speed of rotation is, although at times very high, usually within a very definite circle of average velocities. Those in which the field magnets revolve, such as the generators at the Niagara Construction Company's plant, have a high speed of rotation. There are some alternators going at the rate of 7,000 feet per minute at the present day. When more than the normal speed is exceeded (and this alone can only be determined by a careful consideration of the conditions of working), there is a tendency among the inductors to loosen. Should an overload be suddenly thrown on the machine, this radial swelling is greatly increased and sometimes ends in the total destruction of the armature. The force at times acting to strip the armatures is often enormous. In railroad work this fact has been duly recognized, and armatures having the means of holding the conductors in place securely are now generally employed.

The usual practice at present is to utilize grooves, teeth, or slots, as they are generally called. The first Paccinotti model did not differ very materially from the present design of toothed armatures. These teeth are advantageous in two respects ; they are mechanically beneficial to the conductor and also reduce the magneto-motive force otherwise required. It has been the practice to use several varieties of teeth. The Wenstrom Company manufacture an armature having inductors threaded through circular holes around the periphery. The holes are very close to the edge of the plate and are by this means protected in the best possible manner from external injury.

RATIO OF SLOT WIDTH TO GAP.



The Crocker-Wheeler and other concerns use the trapezoidal form of tooth, the edges of the slot closely approaching each other. This form of slot has almost all the advantages of the Wenstrom method, without its mechanical difficulties. In fact, when the object of the designer is the production of an efficient machine, it is absolutely necessary to pay the greatest attention to the purely mechanical features in order that their perfection shall assist in the development of the perfected type.

The other forms of teeth, or slots, may be looked upon as the most usual. The square groove will contain the greatest amount of wire and possess the largest surface for radiation ; but its defect is sadly evident to those whose experience has led them to use it. The reasons will be shortly treated in the subsequent portion of this article. When the design of the armature leads us to adopt the rectangular slot, the satisfaction resulting becomes very enduring. The position of the inductors, the large and permeable teeth of the armature, and the saving of copper on the field lead to the most favorable of conclusions concerning it. In reviewing these several varieties of slotted armatures, the fact becomes very noticeable that those armatures in which the inductors are almost covered with iron are the most popular forms with all prominent builders. This is due to a set of conditions to which all toothed armatures are subjected, and which, if not recognized as part and parcel of the armature design, will entirely prevent its successful operation. When a toothed armature is revolved in a magnetic field the lines of force assemble around the teeth and destroy the unfoımity of the field.

The teeth quickly pass in front of the pole-pieces and cause the lines of force to practically oscillate to a slight degree, due to this continual concentration and subsequent sudden change.

The pole-pieces, as a consequence, suffer to such an extent that they heat sometimes to an alarming degree. The quivering of the field sets up eddy currents in the polar faces. These, forming closed circuits amongst themselves, cause the aforesaid heating. Should the gauge of the armature plates be too heavy the magnetic changes will likewise set up these minute currents and hot teeth will result. The same phenomenon will occur in the conductors of a smooth core armature should the winding be of very heavy gauge. It is therefore necessary that the adjustment of the teeth or slots be so made that the distribution of lines of force on the pole face is not materially disturbed and the teeth themselves remain unaffected. By tests made on several occasions it has been found that the size of the air gap and width of slot must bear a definite relation to each other to obviate the above effects. Generally speaking the ratio between the air-gap length and slot width varies from 1 : 2½ to 1 : 4. The slot being at least $2\frac{1}{2}$ times as wide as the air gap is long, on one side only.

From previous considerations it has been seen that the air gap is also regulated by the circumflux on the armature. It is very likely that the two imposed conditions will lead to the adoption of an air gap eminently suited in all respects to the smoothness and sparklessness so desirable. It will be observed that in the cases of slotted and drilled armature cores, the great object to be attained was the uniformity of the core surface from a magnetic standpoint. The circular slot, if it may be so termed, of the Wenstrom armature, the trapezoidal groove of the Crocker and Wheeler armature and the narrow and deep slot employed by the makers of raiload motors, plater builders, etc., looked forward to the same result in each case The Wenstrom process undoubtedly caused leakage in the thin casing of metal left from pole to pole.

The induction in the tooth, if very high, will crowd the lines of force, lower the permeability of the metal it consists of and thus act as though the air gap had been enlarged. From this standpoint armatures with heavily saturated teeth, and therefore practically a large air gap, at no load, have the magnetization lowered by armature reaction, etc., and thus decrease the *air gap* with a load at the very time when it would be best to increase it. The hysteresis in the teeth may heat them at a heavy induction to a perceptible degree, but the worst to be feared is the Foucalt current effect.

It is generally understood that the density of field in the air gap does not rise to very high limits. An intense field in air costs greatly for copper, and the curvature of the pole-piece at any rate would lower its density. Leakage in general is greatly influenced by the value of the air gap and incidentally by the saturation in the teeth. A drum armature, as a rule, unless it be abnormally small in diameter, usually runs at a very low induction in the core. The great problem, both mechanical and electrical, is the adjustment of the inductors to an armature surface of sufficient size to take them without crowding, and of sufficient cross-section in core to carry the field. The first is only solved by making the peripheral surface sufficiently large; this naturally forces the designer to the use of low inductions in the core. The deep slot with its conductors laying above each other must therefore be at least equal in depth to that portion of the outer armature surface otherwise required. An armature which, as a smooth core and a given number of lines of force, would require a certain surface for conductors, can have that provision made in the slots, so that the capacity of the slots for conductors considered as surfaces would, when added together, give the same area. In the magnetic considerations the body of the armature core begins at the base of the teeth. Were it desirable for any reason to have the armature core at a high induction, the use of deep slots would allow of such sult without any difficulty.

(*To be continued.*)

TWO OF LINCOLN'S KIND ACTS.

Among the wounded Bull-Run prisoners returning from Richmond after many weary months in Libby was a lad named Will Upham, of the Second Wisconsin Infantry. This boy found his way into the presence of Lincoln, who sympathetically drew from him the story of his adventures in battle and in prison, and sent him away with an appointment to West Point, from which academy Upham was subsequently graduated with honors. Recently this protégé of Lincoln was chosen Governor of Wisconsin. One day Lincoln was found counting over and dividing into parcels a small sum in greenbacks for a negro messenger in the Treasury Department who was in hospital with the smallpox, unable to sign the roll and draw his pay. The President of the United States cheerfully undertook to cut the Gordian knot of red tape, procure the poor man's wages, and make the desired disposition thereof. ["Appeals to Lincoln's Clemency," by Leslie J. Perry, in the December *Century*.

THE STORAGE BATTERY FOR CENTRAL STATIONS.*

BY ARTHUR E. CHILDS.

The object of this paper is to bring before the Institute the main facts and considerations concerning the application of accumulators in electric generating stations both for light and power. The fact that storage batteries have reached a point of high efficiency and low cost of maintenance, has stirred up engineers in this country to consider the application of storage batteries to their own plants, and thus the accumulator has assumed great importance at the present time, especially as power and light stations are so far developed that further increase in generating capacity means large additional expenditure, and in a great many cases the rebuilding of the entire plant.

Realizing, therefore, that storage batteries are eminently practical as auxiliaries, and that their utility and value are acknowledged throughout Europe, it is not surprising that engineers and managers in this country are inquiring about them with the end in view of securing the full measure of their advantages and benefits. In England and on the Continent, storage batteries have been used in central stations for more than five years, and the success of their application has brought about a great change of feeling regarding them; and the respect with which they are now regarded is an ample indication of the value they have been to managers in the operation of their stations.

It is an acknowledged fact that the great variations and fluctuations of the load on power circuits, especially those power circuits supplying trolley lines, are among the greatest difficulties which engineers have to contend against, and any appliances which will aid them to arrive at a satisfactory running of their station is looked upon with favor by them. It is only in the ranks of those short-sighted engineers, where ignorance and prejudice are the rule rather than the exception, that there are found men who will refuse to consider the storage battery as an auxiliary.

In this paper the term "variation" is used to designate the change of current induced by the adding of lights on to a lighting station, or the cars or motors on to a power station. The term "fluctuation" is used to indicate those rapid and necessary changes of current taking place on the outside line, due to stoppiag or starting of cars or throwing on or off of stationary motors. Although they may be thus differentiated, they bear a certain relation to each other, and in applying a storage battery a study of the conditions will quickly indicate the type of battery which will be more favorable in each case. By the "type" of battery is meant the slow discharge battery for a long period of service, or the rapid discharge battery for a few hours, or even less time of discharge.

In the lighting station, if we bear in mind the usual form of curve, it will be remembered that the instantaneous changes of current are minute and almost imperceptible compared with the steady increase or diminution of the total current of the station. Comparing the lighting curve with the usual form of power station curve, it will be noticed that the instantaneous changes of current are enormous compared with that in the lighting station curve. There is a similarity in the two curves in the fact that at certain hours of the day more cars are operated than at other hours, thus producing a general rise in the level of the power curve corresponding to throwing on of a number of lights in the lighting curve.

It is not the purpose of this paper to discuss the characteristics of the two curves, but to consider in a general way the application of storage batteries to the wiping out of the fluctuations and variations as they come upon the dynamos and engines. The introduction of a storage battery into a central station acts in a certain sense as a buffer between the external load and the dynamos, taking the shock of the variations without throwing the same on

* Topical communication presented at the meeting of the American Institute of Electrical Engineers, New York and Chicago, November 20, 1895.

the engines. In this regard they have the effect of reducing the average percentage variation in load on the dynamo from a large amount to a very small one, making the operation of the machines more efficient. In fact, a storage battery acts as a regulator in this instance, maintaining as it does a constant voltage at the switchboard. This introduces the question of the efficiency of engines with varying loads; and, leaving out of account the reports by engine builders, who are naturally interested parties, it is a fact that not many extended and careful investigations of efficiency under varying loads have been carried out. Prof. W. C. Unwin, of the Central Institution at South Kensington, has shown, however, that a decrease of mechanical efficiency has a serious effect on the economy of working with a variable load, and with a load varying from 100 per cent. to 25 per cent. the efficiency decreases from 85 per cent to 40 per cent.

As applied to power stations, and especially where water-power is used, storage batteries are almost indispensable. The writer knows of several plants where the successful maintenance of a constant voltage on the machines is dependent upon the fact that an attendant sits by the governors of the wheels and regulates them by hand, as the inertia of the water, even when the best water-wheel governor that has ever been produced is employed, is too great to allow the turbines to pick up or throw off the load with anything like the quickness with which it is thrown on or off by the outside circuit. The stations in mind are not small stations, as might be supposed at first thought, but are stations where several thousand horse-power and over are generated at certain hours of the day; and it is surprising that engineers of intelligence, who are usually quick to perceive the advantages of new applications, are still allowing their prejudices to prevent them from investigating the merits and value of accumulators as regulating governors in their stations.

In the application of storage batteries to the power station of a trolley system, it is not unusual to find the variation in load as much as 50 per cent. below the average horse-power, and even as great as 200 per cent. above the mean load. These enormous fluctuations take place in the course of a few minutes, and are an expense to the railroad companies in at least three ways. In the first instance, they require thc use of a dynamo capacity very much in excess of that required where the station is operated at a constant load. In the second instance, these fluctuations reduce the life of the machinery of the station, producing a very large depreciation account. In the third instance, the efficiency of the generating plant is very much reduced, as pointed out in a previous paragraph. It has been figured out in a number of instances that could the steam be utilized in a proper manner in the engines driving the dynamos, that at least 40 per cent. more work could be obtained from it.

When considering the application of storage batteries to illuminating plants, it is found that their value is equally as great as in the case of power stations, as the charging of the battery can be done while the plant is operating at light loads, thus making use of the power of their machines to great advantage. At the period of heavy load the battery is able to take care of the peak of the load, and also to operate the lights during that period of the 24 hours when few lights are being supplied from the station.

The value of an accumulator plant attached to an illuminating station has been thoroughly demonstrated by the New York Edison Illuminating Company, and the Edison Illuminating Company of Boston, and recently in the plant of the Lawrence Gas Company, Lawrence, Mass. In the latter case the battery is used in connection with their Edison three-wire system, and is used in the regular way of carrying the peak of the load during the busy hours of lighting. A secondary use of this particular battery is that at noon, when the large mills on the Merrimac at Lawrence shut down, they back up the water into the river above and entirely cut off the supply to the wheels of the gas company (for some 25 or 30 minutes) which are thus unable to operate the machines furnishing light and power until the overflow of the water which is dammed back comes down and allows the station to be operated. This short period of absence of water is taken care of by the storage-battery plant.

The storage battery can also be used as a valuable adjunct to both power and lighting stations at points in their systems where it is difficult to maintain the voltage at periods of heavy load. In these cases the feeders are usually not sufficient to carry the whole current direct from the station. But during the periods of small load the feeders can be utilized up to their maximum allowable drop in potential to charge battery sub-stations placed at these weak points. When the load at such points becomes greater than the capacity of the feeder, the battery comes into play and carries the load in connection with the station supply at that point, thus maintaining the voltage and doing satisfactory and valuable service. There must be hundreds of street railroads in this country that have just such weak points, and it will only be in accordance with the established progressive character of American street railway and lighting engineers to investigate the value to them of a storage battery, as soon as it has been brought thoroughly to their notice. This cannot but result in a widely extended use of the storage batteries for this purpose; and the expectations of those interested in storage batteries would not be exceeded if half the street railroads and direct current lighting plants in this country and Canada should adopt within the next few years storage batteries either at their central stations or at sub-stations, the more especially as they can now obtain storage batteries which are thoroughly reliable, and which can be installed under a guarantee.

The extent to which storage batteries have been used in England and on the Continent is very great; and it will surprise many engineers in this country to know that there are more than 20 lighting stations and several thousand isolated plants in Great Britain alone, using storage batteries. Further than this, there are in Germany 5,000 isolated plants and 15 railway power plants using storage batteries. In fact, 80 per cent. of all the central stations in Germany and Austria are equipped with storage batteries. In addition to the above, there are many stations in France, Italy, Holland, Belgium, Sweden, Norway, Denmark and Spain, and two or three in Switzerland.

A survey of the progress which storage batteries have made in European countries indicates no very great change in the principles of construction, but the results seem to be rather due to a thorough analysis and appreciation of the requirements of each case. This has resulted in a proper use of batteries and a correct recognition of the limitations of their usefulness. This fact alone has contributed largely to their successful application. The great difficulty in this country has been that engineers have not recognized a proper limit to the usefulness of a battery, but have, in many cases, far exceeded their specified limitations, and in this way have injured the batteries and cast discredit on them. It would be just as reasonable to overwork an engine until injured or worn out, and then declare that all engines were useless and expensive mechanical contrivances.

One point which has contributed largely towards the success of storage batteries in Europe, is the fact that engineers have endeavored to obtain long life and high efficieny even at the expense of increased first cost, and instead of attempting to obtain a large output per pound of element, they have limited themselves to a reasonable number of ampere-hours per pound. The result of this has been that the batteries in use in Europe have shown great endurance and solidity. The experience, however, which has been obtained with many American batteries has not been so promising as on the continent, owing to the lack of proper appreciation of them. It would be greatly to the advantage of American engineers if they would follow the lines laid down by their European confreres; and if, instead of waiting for some marvellous development in the manufacture of storage batteries, they should make use of the existing high class and efficient batteries which are now offered to the public, and by using them in a reasonable manner they would obtain valuable and even remarkable results.

Great progress has recently been made in manufacturing large batteries which have a capacity large enough to take care of the needs of central lighting and power stations, and engineers need no longer complain that they are unable to get the large cells which they require. In fact, manufacturers can produce cells having almost any given capacity.

Considering the efficiency of a storage battery, the factors which tend to reduce it are due to a loss in voltage and in the quantity of current. These losses, however, are not so serious as they have been in the past, and manufacturers are at present able to guarantee a very high efficiency. In cells which were submitied to Prof. H. L. Callender, an ampere efficiency of 96.1 per cent. was recorded, the watt efficiency being 84 per cent. In certain instances, however, known to the writer, these efficiencies have been slightly exceeded, and complaints from central station managers that they cannot obtain efficient cells are now groundless, as with the efficiencies named an eminently satisfactory service can be obtained. It must be borne in mind that a loss of 16 per cent., or even 20 per cent., in the efficiency of the battery does not mean the loss of the same percentage in the output of the station, as the battery usually supplies approximately, or even less, of the whole output in watt-hours, and it is, therefore, from that fraction of the whole output that the loss in the battery must be deducted.

In the matter of cost of maintenance of a storage battery outfit, it is now usual for the manufacturer to guarantee a fixed annual percentage. This percentage varies from ten per cent. in small plants to a smaller percentage in large plants, depending, of course, on the conditions of operaation and the use to be made of the battery, a study of which will soon determine what percentage can be guaranteed. In first class plants, well installed and operated by careful engineers, the cost of maintenance can be reduced to the vicinity of 3.5 or 4 per cent. It is customary for the manufacturers to enter into a contract, in the case of large plants, guaranteeing that the cost of maintenance shall not exceed a certain percentage per annum for the period of contract. This can be carried out in two ways. Either the lighting or railroad company can pay the manufacturer the percentage specified, every year, and the manufacturer will inspect and keep the battery in first-class condition; or the company employing the batteries can inspect and order renewals themselves, in which case should the cost of maintenance exceed the percentage guaranteed, the manufacturer will not charge more than the specified amount. This is an exception rather than the rule, however, as the cost of maintenance is usually somewhat lower than that specified by the manufacturers, so that the company owning the battery is the gainer by the difference in percentage. By a thorough attention to details, both large and small, the percentage can be kept down to a very low figure; and it is to be regretted that the practice of engineers which prevails in Europe, of treating the battery with care and consideration, does not seem to exist among the engineers of this country, to the detriment of their own lighting or railroad plants, which would otherwise be able to utilize batteries in an efficient manner.

It must not be assumed from the above that storage batteries require an inordinate amount of care and trouble. On the contrary, they do not require either expense or great care. All that is demanded is regular and systematic attention on the part of those having them in charge. When such care is exercised, it is found that batteries perform a very valuable service, and largely reduce the operating expenses of the station—in many cases as much as 30 to 35 per cent. This reduction in operating expenses is, of course, due to the saving in cost of coal consumed, a saving which could not otherwise be obtained. Where water-power is employed, a storage battery enables the water-wheels to be operated for 24 hours, storing current while the station output is reduced to a minimum, and aiding the station during the busy hours of the day. In many cases this practically doubles the output of the station without increasing the cost of installation to a corresponding amount. In fact, in many cases where water-power is used it would be impossible to double the power of a station, as there would not be enough water at hand to give double the power. This is especially true in those sections of the country where the power of small streams has been utilized and where the flow of water is continuous but not very great. In addition to a storage battery acting as a receiver for storing the current while the station is not giving a large output, it also maintains during the operation of the station a perfectly uniform voltage, which would not be obtained with the varying load direct upon the water-wheels, on account of the difficulty in governing previously mentioned.

When an entirely new power plant is to be built, there is no doubt that, by adopting the storage battery in the first instance, the initial cost of installation will be less than for the plant not using storage batteries, and the cost of operation of the station will certainly be very much reduced when the station uses storage batteries. In the case of existing plants which have to be extended, it has been proved that a kilowatt-hour capacity can be added more cheaply to the station by the addition of storage batteries than by the addition of generating machinery; while, of course, the cost of operation is much reduced.

Referring to the primary cost of storage batteries, the cost per kilowatt hour output is relatively greater for small cells than for large ones, since the cost of manufacture is reduced per kilowatt-hour in the larger sizes, whereas the jars and tanks which are used to hold elements do not decrease very much with the decrease in size of the elements. The cost of shipment and erection are, of course, slightly less per kilowatt-hour with the larger sizes than with the smaller ones, and on the whole the cost per kilowatt-hour with the larger cells is less than with the smaller sizes. It is stated by the Electric Storage Battery Company that they are now installing large plants of the Tudor type at a cost per kilowatt-hour of about $37 to $40, which cost, it is understood, can be reduced in the larger stations. The question of cost, however, is one which must be studied out in each case where it is proposed to install storage batteries, and a consideration of the cost of installation of storage batteries with their attendant reduction in operating expenses will very soon bring to the mind of purchasers that it is cheaper to invest in accumulators than to invest in additional boilers, engines and dynamos.

As previously stated, it has been the object of this paper to bring before the institute the general facts and considerations relating to the Installation of storage batteries as auxiliaries to power and lighting plants. Lengthy description of plants already installed have been avoided, and those interested are referred to the published descriptions which are constantly appearing in the technical journals.

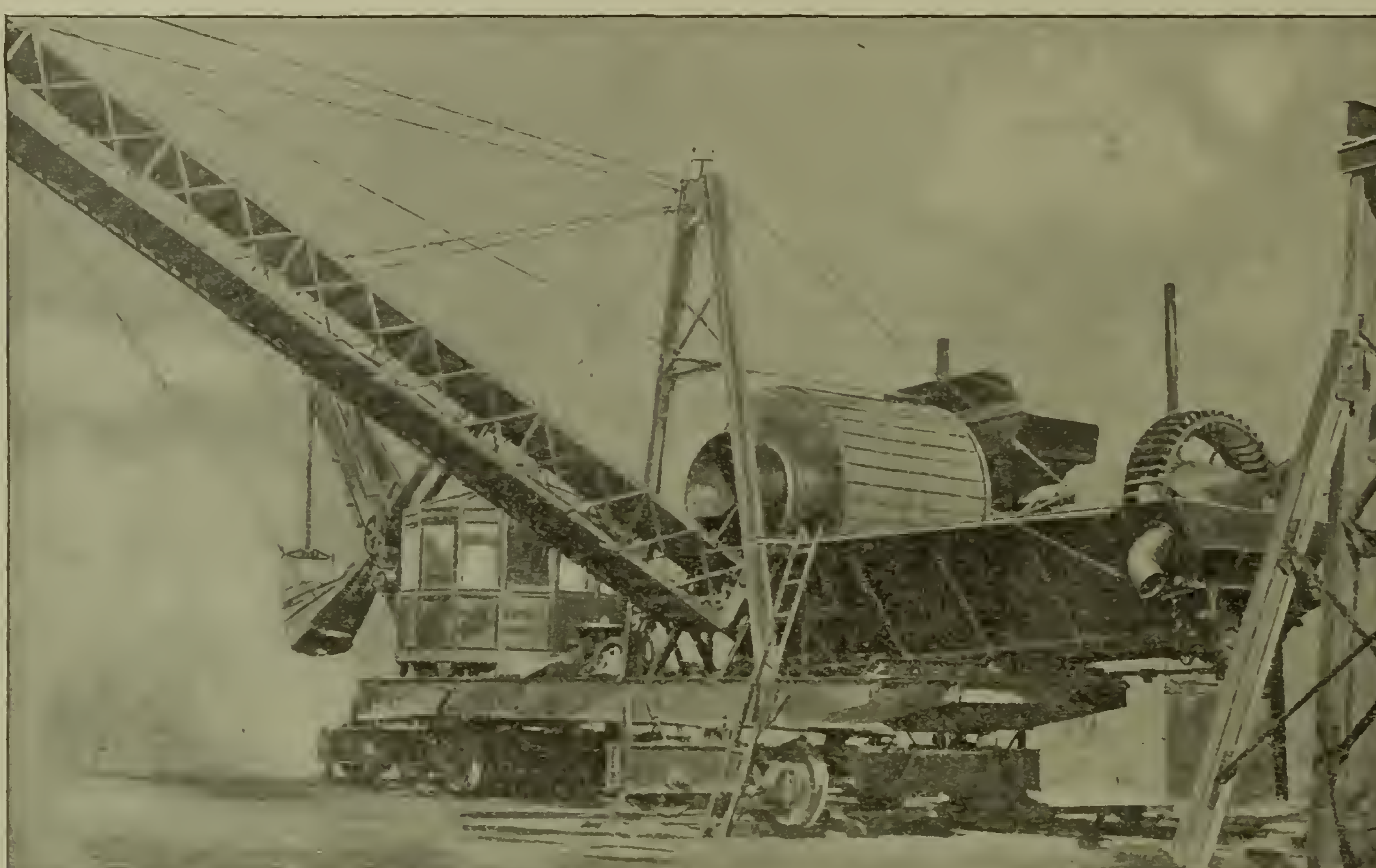
ELECTRIC RAILROAD CONSOLIDATION IN BROOKLYN.

It was reported in Wall street last week that the terms for the lease of the Brooklyn Traction Company by the Nassau Electric Company had been agreed upon and that the necessary papers would shortly be signed. It was said that the Brooklyn Traction Company would be reorganized and that $4,500,000 of new common stock would be issued in exchange for the $6,000,000 of common and $3,000,000 of preferred now outstanding, the preferred to be exchanged into new common at par and the present common at the rate of four for one. It is said that an alternative proposition will bo made to the common stockholders to pay 7½ per cent. assessment and receive therefor at par the five per cent. bonds of the Brooklyn, Bath Beach and West End Railroad now in the treasury of the Atlantic Avenue Railroad, or to pay two per cent. assessment for which nothing will be given. The new stock given in exchange for the preferred stock is to receive three per cent. for the first year and four per cent. thereafter, and that given for the common two per cent. for the first year and four per cent. thereafter.

AMALGAMATOR OPERATED BY ELECTRIC MOTORS.

A somewhat unique application of electricity, and one of interest to the mining industry, has recently been made in the adaptation of electric motors to the operation of a Bennett amalgamator. The amalgamator consists essentially of the following parts: A truck and frame for supporting the larger part of the machine—arranged to be run forward on a track as the work progresses; a turn-table supporting a boom and dipper; the boom and dipper for excavating the dirt and a revolving cylinder or screen with a hopper. Into this the earth is thrown from the revolving screen, the finer material passing through into the amalgamator, the coarse material being discharged at the end of the drum into the tailings carrier.

The amalgamator is a large trough in which the fine material, after passing through the screen, is amalgamated. In the bottom of the amalgamator is an agitator, moving backwards and forwards to keep the material well stirred up, and a wheel for raising and discharging the fine tailings after the removal of the gold.



BENNETT AMALGAMATOR OPERATED BY ELECTRIC MOTORS.

The four motors used in operating this machine have been supplied by the General Electric Company, and are so constructed as to be thoroughly protected from water or dust. One of these motors is mounted on the frame of the machine, between the turn-table carrying the cab and the revolving screen. It is geared to a shaft connected by a sprocket chain to the revolving cylinder, the tailings carrier, the agitator in the amalgamator and the wheel for discharging the tailings at the outer end of the amalgamator. A clutch is provided to throw it into gear with the trucks for moving the entire machine backwards and forwards.

The second motor is placed in the cab and operates the dipper by means of a fine wire rope, passing around the drum to which the motor is geared.

The third motor is mounted on the dipper boom and is geared to a drum placed just above it. Fine wire ropes pass around this drum and are attached to both ends of the dipper handle. The dipper may thus be thrust out or in, according to the requirements of the work.

The fourth motor occupies a place in the cab and drives by means of a beveled gear and large sprocket chain the turn-table. This motor is also used to swing the dipper boom around from the front of the amalgamator to a position which allows of the dirt being thrown into the hopper of the revolving screen. The motor operating the cylinder, the tailings carrier and the agitator in the amalgamator, runs continuously when the machine is in operation and is provided with a simple starting rheostat only. The other three motors are controlled by reverse rheostats in the cab and are handled by one man.

THE RECOIL OF GUNS.

We have received, with the author's compliments, a copy of a pamphlet entitled, "Note on a Photographic Method of Determining the Complete Motion of a Gun During Recoil," by Dr. Albert Cushing Crehore, assistant Professor of Physics, Dartmouth College, and Dr. George Owen Squier, First Lieutenant Third Artillery U. S. A. The results of the tests are illustrated by several half-tone cuts, and are extremely interesting.

THE MASON-MAXWELL TELEPHONE MFG. COMPANY.

This company has succeeded the Mason Telephone Co., of Richmond, Va., and will greatly increase its facilities for prompt and satisfactory service. The new company will absolutely guarantee all its goods, and with its increased facilities it will be enabled to give better instruments at less cost. All the directors ot the old company hold similar positions in the new.

Electric Traction in Belgium.—It has just been decided by the Société National des Chimins dé Fer Vicinaux to adopt electric traction on its railways in the Centre and Charleroi districts of Belgium.

Electric Traction in Japan.—A project has been prepared, and is at present receiving consideration, for the construction of an electric tramway between the towns of Uraga and Tokosuka, Japan.

INSULATION OF OVERHEAD AND UNDERGROUND CIRCUITS HAVING A DIFFERENCE OF POTENTIAL OF 2,000 VOLTS AND OVER.*

BY CAPT. WM. BROPHY.

My earliest recollection of arc light dynamos dates back to those of one light capacity, with a difference of potential of from 30 to 50 volts. No attempt was made at that time to run two or more lamps in series. After the lamp was improved so as to make it possible to operate several of them in series the capacity of the dynamos was gradually increased from 1 to 5, 10, 15, 25, 30, 50, 60 and 65 2,000-candle-power lamps at 50 volts and 10 amperes or 500 watts, increasing the difference of potential at the brushes or switchboard from 50 volts to 3,250, this being exclusive of the energy required to overcome the resistance of the wire, connections, etc.

For some years no attempt was made to increase the capacity of arc-light dynamos beyond 65 lights. Quite recently, however, 125-light dynamos have been constructed and put in operation. This means a difference of potential of 6,250 volts, independent of the resistance of the rest of the circuit

I have thus far dealt with constant-current dynamos and circuits wherein the difference of potential varies with the number of lamps in the circuit. But, as you all know, we have to deal with the primary circuits from alternating dynamos as well, in which is maintained a difference of potential throughout their entire length of from 1,000 to 2,000 volts. While the voltage in this class of circuits does not increase with the increase of the capacity of the dynamos from 650 to 8,000 and 10,000 lights, yet this increased energy is sufficient to afford ample food for thought to those on whom devolves the duty of so insulating such circuits as to reduce the loss of energy to a minimum and prevent accidents to persons and loss by fire.

The same insulating supports, and practically the same insulating covering of the wires, that were used for overhead circuits of five arc lights are used on circuits of 125 lights at the present day. The same style of glass insulator that is used for telegraph circuits is used today for arc-light circuits with a difference of potential at the dynamo of between 6,000 and 7,000 volts, and for constant potential circuits with a difference of potential of 2,000 volts throughout their entire length.

The insulating covering of the wires differs in name only from that first used on the small five and ten-light circuits. That the insulation of high potential circuits has not kept pace with the increased amount of electrical energy maintained therein no one can deny, and it is self-evident that perfect insulation will result in increased profits to electric light and power companies and increased immunity from loss and personal injury to the public.

How can this most desirable end be best attained? This is the problem to be met and solved. The manufacturers of lead-covered insulated wires and cables have succeeded in producing an insulation that meets the exacting requirements of the Boston Wire Department, viz., 20 megohms per mile per 100 volts. There is not an underground wire or cable used on high potential circuits in Boston the insulation of which does not exceed this, but the question of how long this high grade of insulation can be maintained is yet to be determined. The almost perfect insulation of underground wires and cables has already been accomplished, and the question now to be met and answered is, can the same grade of insulation be secured for overhead circuits?

My answer is yes, if the same grade of insulation is used, and no, if the present grade of insulation and construction is continued. If the same grade of wires used in the underground circuits is used, however, I would not advise any one to adopt this plan, as the proper place for such conductors is underground; and while the cost when compared with that of overhead construction is very great, the amount of energy saved that is now lost would, I believe, pay a handsome dividend on the money invested, to say nothing of the immunity from loss and injury of the community, and the absence of vexatious damage suits.

I believe that all the high potential circuits should be placed underground, and I believe it can be done with ultimate profit to their owners.

But we have, and I fear will continue to have for some years to come, overhead circuits, and I come now to the question of how to construct and insulate them.

I hold that all high-potential circuits should be supported on wooden poles and cross-arms, and the wires of all low-potential circuits excluded from such poles; and I do not believe it best to place such wires on fixtures placed on roofs or other portions of buildings, but if they are so placed they should be beyond the reach of persons standing or working on the roofs.

I believe the so-called insulating covering in use at the present time for high-potential overhead circuits to be worse than a delusion and a snare. I believe it would be better to hang out the danger signal at once, by using bare copper wire, than to continue the use of this flimsy fraud that affords no protection to human life or property, but lures innocent people on to injury and death. Knowing the worthlessness of the material, it becomes necessary to use the best form of insulating supports. The present style of glass insulators is not what is required. Many of these insulators are only so in name. The very best grade of glass or porcelain should be used, and the double or single petticoat pattern, the form best suited to the purpose being that which will offer the greatest amount of dry surface between the wire and the supporting pin. These insulators should be supported on wooden pins.

Iron poles on any part of high-potential circuits should not be tolerated in any civilized community. They are a relic of barbarism that should be relegated to the scrap heap, and any attempt to patch them up only serves as a thin disguise to the danger that lurks within them. Twenty-five to forty feet of wood between the iron and the ground means that much insulation, while one hundred feet of iron only means what the glass insulator, wooden pin and cross-arm afford. The waste of energy due to the iron poles on the long circuits on which are placed 125 iron lamp poles is simply enormous—so great that in rainy weather such circuits have to be cut in halves in order to send sufficient current through the lamps.

Where such circuits are placed on the modern iron and steel structures they become a source of danger to persons who have occasion to handle these or other wires on the same or other fixtures.

Such circuits should not be run between the branches or through the foliage of trees, but when it cannot be avoided the highest class of insulated wire should be used, and this encased in lead or iron. Any attempt at protecting this insulation from abrasion by covering it with tape or cotton braid is useless

All that I have said up to this time applies with equal force to direct and alternating current circuits; but there are certain features of the latter that require separate treatment.

As you know, a difference of potential of one, two or more thousand volts exists throughout the entire length of the primary circuit and between it and the earth, so that the danger from derived circuits to ground or from one side to the other is the same at a point one or more miles distant from the dynamo as it is at the brushes. Again, it is necessary for electrical and other reasons to run the wires in parallel and close together, in order that no other wires can be placed between them and for convenience in making connections to the different transformers. Workmen and others can hardly pass between them without coming in contact with both of them, and for this reason I consider them far more dangerous than high-potential series arc light circuits. As before stated, the covering of these wires affords little or no protection to those persons

* Abstract of paper read before members of the Electric Potential, Boston, November 25, 1895.

in dry weather and none whatever during or immediately after rain storms.

If these circuits are to remain above ground they should be separated so that both cannot be reached at the same time by any person; but this would involve the changing of nearly every existing circuit and a considerable increase in the cost of constructing new ones. Rather than adopt this plan, a high grade of lead-covered insulated wire should be used, and when that is done the proper place for them is underground.

The transformers should be placed beyond the reach of everyone, and the primary wires that lead to them. The best way to do this is by placing the former in a stout wooden box, kept securely closed and well ventilated, and using high grade lead-covered insulated conductors.

I believe the time is coming when all these circuits will be placed underground, and the transformers also. Instead of placing the latter on the outer walls and roofs of buildings and in some portions of their interior, they will be placed in suitable vaults beneath the streets and sidewalks; and each one will be of sufficient size to supply a large number of lamps or motors.

The danger to life from high-potential circuits comes from two causes—establishing a derived circuit from any one point thereof through the person to the ground and from the ground to some other point of the circuit, or by closing the circuit through the body.

The danger from fire is mainly due to imperfect insulation.

The placing of the wires of alternating circuits underground removes one source of danger but adds another not heretofore considered. On such circuits a second ground is not necessary to injure or kill a person who accidentally connects any portion of one of these circuits to the ground through himself. A person standing on or touching with one hand an iron pole, and with the other a bare or poor insulated wire, or the iron case of a transformer that is in contact with the primary coil contained therein, will, owing to the failure of the insulation, surely receive a severe or fatal shock, although the circuit be perfectly free from "grounds." The reason for this is that the copper conductor is one and the ground the other, plate of a condsnser; and these plates readily discharge through any path of low resistance that is offered from one to the other. This, unlike the Leyden jar, is continually charged, owing to the alternations of the current; and the energy thus produced passes through the body of the unfortunate person who forms the connection from wire to earth, and vice versa.

To this cause may be laid the loss of one life at least; and in this case the circuit on which the accident occurred was clear of "grounds," with the exception of the one established by the unfortunate victim through the medium of an iron pole on which one of his hands rested, while the other grasped one of the primary wires leading to the idle transformer.

Tests of the circuit just previous to the accident proved it to be clear of any perceptible leakage to ground. This fact having been established, the question of how this man lost his life had to be answered. This answer was rendered after the following test had been made; a known resistance was inserted in a wire, one end of which was connected to ground, while the other was connected to one side of the circuit. The electromotive force was measured by means of a Weston voltmeter, and it was found that a sufficient amount of energy passed over the wire and through this resistance to instantly kill.

From this you can see the necessity for the best possible insulation of the wires of these circuits and the greatest care in placing transformers, in order to prevent a recurrence of similar fatalities.

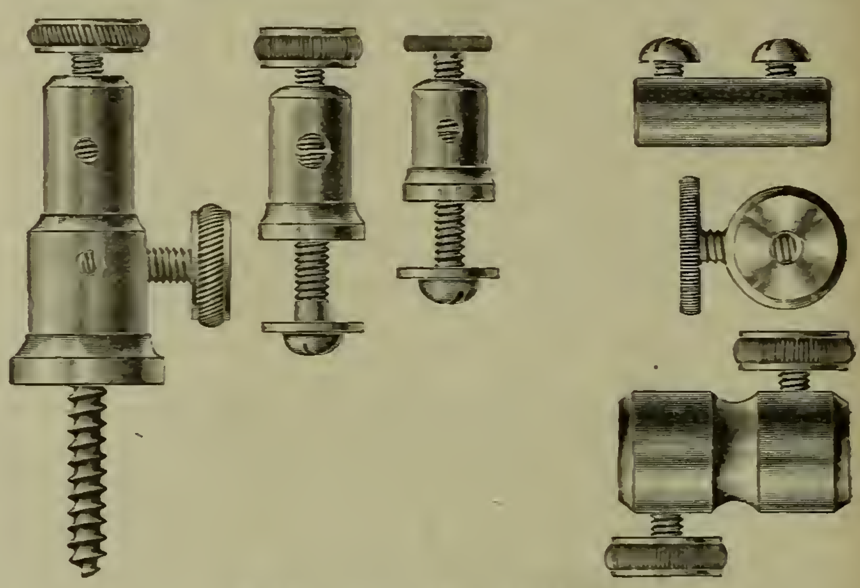
Having occupied much more of your time than I should have done, I will close this address by expressing the hope and wish that this club—a semi-scientific organization—will never hesitate to warn the public of any real dangers that may exist in connection with the transmission of electrical energy. I consider it a crime to lull the public into a sense of false security. It is equally one to needlessly alarm it.

THE INTERNATIONAL ELECTRIC COMPANY.

The International Electric Co., 76 Beekman street, New York, is building up an excellent trade in its line.

This company manufactures electrical instruments of all kinds, and its Ruhmkorff induction coils are of standard construction and excellent in finish.

The accompanying illustrations show a few of the differ-



BINDING POSTS AND CONNECTORS.

ent styles of binding posts made by this company. They are well made, and the company has ample facilities for turning them out in large quantities.

Besides the manufacture of the above-named articles, the company perfects inventions, and constructs small machinery. Fine and complicated work is made a specialty.

TELEGRAPHS OF THE WORLD.

A reliable authority gives the following figures regarding the telegraphs of the world for 1895–96. Total length of lines in the world, 904,701 miles; total miles of wire, 2,682,583. Total miles of line in the United States at the close of 1894, 190,303; total miles of wire, 790,792.

PERSONAL.

Mr. Francis R. Upton, general manager of the lamp department of the General Electric Company, has severed his connection with that company and has accepted a responsible position in the office of the general manager of the National Tube Works, of McKeesport, Pa.

AUTOMATIC MERCURIAL AIR-PUMP.

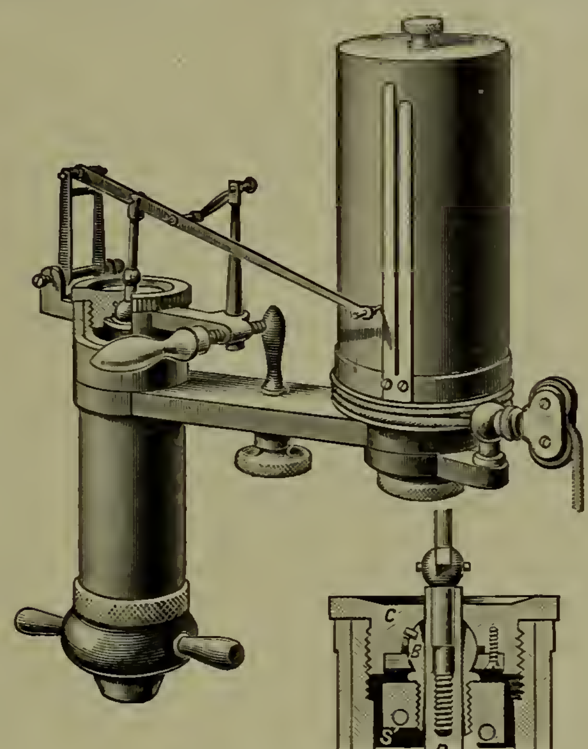
A mercury air-pump is described by Herr F. Neesen in *Wiedemann's Annalen.* It is worked by an auxiliary water-pump, the mercury being raised and lowered in the reservoir by the automatic motion of two valves, which allow the mercury in the cistern to be exposed to the atmospheric pressure or freed from it by the action of the auxiliary pump. The peculiarity of the automatic valve motion is that the valves are moved by a system of floats, of which one part varies its weight by admission and recess of mercury, so that there is the necessary difference of level in the cistern between the phases of valve opening and closing, corresponding to whether the mercury is rising or falling. The adjustment for preventing too rapid rise of mercury as the pressure falls below 1mm. is made by withdrawing a little mercury from the cistern into a side vessel. The author describes an arrangement with a tap instead of valves, the difference of phase in action being effected by an automatic variation of the leverage acting on the tap.

IMPROVED STEAM-ENGINE INDICATOR.

The Robertson-Thompson steam-engine indicator, as shown in the accompanying illustration, and made by Hine & Robertson, New York, possesses some very important and valuable improvements over the ordinary indicator.

As is well known, friction between the moving parts of the indicator is the main detrimental element to be avoided. To accomplish this desirable result the least possible motion must be permitted in any of the joints, and to this should be added the best possible design and workmanship.

In the final adjustment of the spring it is customary to provide some form of a "universal" or ball and socket



IMPROVED INDICATOR.

joint for its attachment to the piston. Owing to the fact that this, as well as every other part subject to movement, must be constructed as light as possible, this ball joint has been made much smaller than considerations of lubrication and freedom from wear under the excessive pressure would indicate.

To overcome this difficulty the arrangement shown has been devised. Briefly speaking, it consists in transferring the ball and socket joint from the piston to the cylinder head, where it has no movement, so that it can be made with a wearing surface probably fifty times greater than has been usual. As it requires no attention in changing springs, there are no adjusting screws which, sooner or later, will work loose while in operation and vitiate the diagram. The device can be applied to any standard indicator at present on the market.

ELECTRICAL INSTRUCTION FOR FIREMEN.

The National Board of Fire Underwriters has prepared a series of educational papers upon fire brigades. Here is what it says about the electrical hazard and how to guard against it:

1. Have your wiring done by responsible parties and make contract subject to the underwriters' rules. Cheap work and dangerous work usually go hand in hand.
2. Switch bases and cut-out blocks should be non-combustible (porcelain or glass).
3. Incandescent lamps get hot; therefore all inflammable material should be kept away from them. Many fires have been caused by inflammable goods being placed in contact with incandescent lamp globes and sockets.
4. The use of flexible cord should be restricted to straight pendant drops, and should not be used in show windows.
5. Wires should be supported on glass or porcelain, and never on wooded cleats; or else run in approved conduits.
6. Wires should not approach each other nearer than eight inches in arc and two and one-half inches in incandescent lighting.
7. Wires should not come into contact with metal pipes.
8. Metal staples to fasten wires should not be used.
9. Wires should not come into contact with other substances than their designed insulating supports.
10. All joints and splices should be thoroughly soldered and carefully wrapped with tape.
11. Wires should always be protected with tubes of glass or porcelain where passing through walls, partitions, timbers, etc. Soft rubber tube is especially dangerous.
12. All combination fixtures, such as gas fixtures and electric lamps attached, should have approved insulating joints. The use of soft rubber or any material in such joints that will shrink or crack by variation of temperature is dangerous.
13. Electric gas lighting and electric lights on the same fixture always increase the hazard of fire and should accordingly be avoided.
14. An electric arc light gives off sparks and embers. All arc lamps in vicinity of inflammable material should have wire nets surrounding the globe, and such spark arresters reaching from globe to body of lamp as will prevent the escape of sparks, melted copper and particles of carbon.
15. Arc light wires should never be concealed.
16. Current from street railway wires should never be used for lighting or power in any building, as it is extremely dangerous.
17. When possible the current should be shut off by a switch where the wires enter the building when the lights or power are not in use.
18. Remember that "resistance boxes," "regulators," "controllers," "rheostats," "reducers" and all such things are sources of heat and should be treated like stoves. Any resistance introduced in an electric circuit transforms electric energy into heat. Electric heaters are constructed on this principle. Do not use wooden cases for these stoves nor mount them on woodwork.

THE NATIONAL ELECTRICAL EXPOSITION COMPANY.

The National Electrical Exposition Company has been incorporated for the purpose of holding an electrical exhibition in May, next, under the auspices of and in connection with the nineteenth convention of the National Electric Light Association.

The officers of this company are Harrison J. Smith (superintendent of the Edison Illuminating Company of New York), president; Wm. F. Weiss (vice-president of the New York Steam Company), vice-president; George F. Porter, secretary and treasurer.

The executive committee, which is the governing power of the company, is composed of H. J. Smith, C. O. Baker, Jr., R. B. Corey, H. L. Lufkin, E. F. Peck.

The board of directors consists of H. J. Smith, C. O. Baker, Jr., John A. Seely, R. B. Corey, W. A. Stadelman, H. H. Harrison, H. L. Lufkin, W. F. Weiss, J. W. Godfrey and E. F. Peck.

The stock has all been subscribed for and ten per cent. of its capital paid into the hands of the treasurer.

The New York Industrial Building has been secured for the exhibition hall. This building occupies the block bounded by 43d and 44th streets, Lexington avenue and Depew place. The building was constructed expressly for trade exhibitions. It has seven stories with roof garden, is lighted from a plant of 5,000 incandescent lights and has spare steam plant of 300 H.P. The lighting companies of New York can also supply direct or alternating current to any amount desired, and two gas companies can furnish gas through two 4-inch mains. The company is now prepared to receive applications for space.

All communications should be addressed to the executive office of the company, 136 Liberty street, New York.

MONTREAL NOTES.

There was a meeting of the gentlemen interested in taking over the charters and stock of the Citizens' Light and Power Company. A board of directors and officers was elected. The valuable charters of these two companies are now in new hands and will be pushed with all possible haste. The capital of the new companies will be placed at $1,000,000, and will probably be increased at no distant date to $2,000,000.

The gentlemen at the head of the electric companies are those who are interested to a great extent in the Lachine Rapids Hydraulic Land Company, and it is understood that those having stock in the latter will be privileged to purchase a like number of shares in the electric companies. The title of both the electric companies will remain unchanged, each company being to a great extent a distinct organization.

As regards the refusal of the city surveyor to locate the poles of the Citizens' Company, that company has a notarial agreement with the city by which it is stated that the city surveyor should locate poles in the various streets. This, however, he refuses to do at the advice of the city attorney. The poles, when laid, will run from St Luke street to Guy, to Sherbrooke, and to Simpson streets, up Simpson to Pine avenue, to Park avenue, and up Park avenue to St. Louis de Mile End.

The franchises that the two light and power companies own are the supplying of power of all kinds to St Henri and St. Cunegonde, the street, lighting of Westmount and St. Louis de Mile End, and the lighting of the Montreal Harbor.

ELECTRIC CANAL BOATS.

It is reported that the Erie Canal Traction Co. has entered into a contract with the Erie Construction Co. to install an electric system for the propulsion of canal boats on the Erie Canal. The sum of $6,500,000, it is reported, will be expended in equipping the canal with the system.

ROOT BOILERS.

Arthur Loretz, Jr., No. 28 Cliff street, New York City, representing the "Root" Water-Tube Safety Boiler, has been awarded the contract for three boilers of 175 H. P. each for Lord's Court Building, Exchange Place and William street; for two boilers from Skilton & Son, 31 Broadway, New York, for the San Antonio Electric Light Co., Cuba, W. I., and the new boiler plant for the Atha & Hughes Works, Newark, N. J. The Abendroth & Root Mfg. Co. are erecting two boilers for the Oneida Community Co., Limited, Kenwood, N. Y., and 3,000 H. P. in St. Louis, Mo., for the Liggett & Meyer Co.

Possible Contracts.

New York City.—Henry Webendorfer, 194 Church street, will erect four 2-story brick stores and warehouses at 274–280 103d street, to cost $20,000. Architects, Clinton & Russell, 32 Nassau street.

Philadelphia, Pa.—Plans are being prepared by Charles P. Nesbitt for a four-story addition to the warehouse at 125 Market street.

Watkins, N. Y.—It is intended to extend the Watkins and Montour Falls Electric Railway through to Horseheads.

Carrollton, Ill.—The City Council of Carrollton has decided to advertise for bids to put in an electric light plant at that place.

Red Cloud, Neb.—Red Cloud is at work on the project to rebuild the flouring mills recently burned and operate them with electricity.

Xenia, O.—Rapid Transit Co. has contracted with the George H. Mellen Co., of New York, to build an electric road between Xenia and Springfield, a distance of 25 miles. Work to be commenced Feburary 1.

Columbia, Ind.—A franchise has been granted to the Fort Wayne, Columbia and City Electric Railway, and work on the road will be begun soon. President Everett has stated that the road will be completed within six months. The Huntington, Columbia City and Ligonier Electric Road, which will be built by Indianapolis capital, has also been granted a franchise and its construction will be commenced soon.

Philadelphia, Pa.—Delaney & Co., glue manufacturers, whose plant was burned at Hancock and Jefferson streets, have secured a site at Bermuda and Tucker streets, near the new Delaware River bridge, and will soon commence the erection of large buildings.

Architect Jacob Herold has just finished plans for a four-story structure, a two-story engine house and a one-story boiler house, all to be erected at Reger & Gretz's brewery, 4th and Oxford streets. The contract will shortly be let. Cost of additions, $100,000.

Allegheny, Pa.—Allegheny Select Council, at its meeting November 21, passed a general ordinance requiring all new corporations entering the city to put their wires underground within the limits of North avenue, Allegheny, Cedar avenue and the Allegheny River. The Allegheny Power Co. was granted rights to put down electric wires under this ordinance.

Lewiston, Mont.—Efforts are being made to establish a telephone exchange in Lewiston. The Bank of Fergus County, The Power Mercantile Co. and Charles Lehman are behind the enterprise.

New Richmond, Wis.—C. W. Richards has applied to the city council for a franchise to establish a telephone exchange.

Medina, N. Y.—The project of a new telephone exchange is being quietly put under way by prominent men.

New York City.—Cass Realty Company has announced the completion of the plans of Architects Renwick, Aspinwall & Renwick, 367 5th avenue, for a fourteen-story office building to be erected at 43 and 45 West 32nd street, recently purchased by the company. The projected structure will be fire-proof and contain the latest improvements. Estimated cost, $400,000. Another large building is to be erected by Ludwig Baumann at 260–266 West 37th street, eight stories, 75x100 feet, to cost $175,000.

Binghamton, N. Y.—The erection of a city hall is in contemplation. Wm. J. Morgan, deputy and acting comptroller.

Rochester, N. Y.—Office of J. Foster Warner, architect, 1036 Granite Building. Proposals will be received at said office until 12 m., Dec. 17th, for gas and electric fixtures for the new Monroe County Court House, in accordance with the printed instructions of the architect, which together with the plans of the building may be seen at his office. Designs must accompany all proposals, which must be not less than $18,000 for the work complete and accompanied by a certified check for $1,000, and all enclosed and securely sealed and marked, "Proposals for gas and electric fixtures in Monroe County Court House," and addressed to Lyman M. Otis, chairman building committee. The right is reserved.

Meadville, Pa.—It is said that the Meadville Street Railway will be extended to Cambridge and Edinboro.

Niagara Falls, N. Y.—An effort is being made to form a company to build a single rail electric road from Fort Erie to Port Albino, via Crystal Beach.

Fremont, O.—The Fremont Street Railway has been sold at receiver's sale. The road is a mile and a half long. The purchaser is Dr. Frank Creager, of Fremont. Eastern capitalists will take hold of the road and extend the line.

Larchmont, N. Y.—A three-story frame hotel will be erected. Messrs. Morse, owners. Architects Palliser, Palliser & Company, 24 East 42nd street, New York City. Chatsworth Inn, S. H. Wetmore, lessee, will entirely be remodeled and an addition built, to contain 52 bed-rooms. Also a new building to be used as servants quarters, to cost $20,000.

Bay Ridge, L. I., N. Y.—Plans have been completed for the Bay Ridge Free Library and Reading Room. Estimated cost of the building, $10,000. Site for the proposed structure is at 74th street and 2nd avenue, on site donated by E. W. Bliss. Architect, John G. Petit; president, Mrs. Neil Poulson; vice-president, Mrs. E. W. Bliss.

Nashville, Tenn.—Nashville Street Railway Company has been granted permission to extend line on West Line street.

Burlington, Vt.—An electric line to Hinesburgh has been proposed.

Harrisburg, Pa.—Arrangements are now being made by the recent purchasers of Penn's Cave, in Center County, to build an electric road to connect the Cave grounds with Lewisburg and Tyrone Railroad at Center Hall, also for the illumination of the cave with electricity.

Orange, N. J.,—At meeting of the Orange Common Council, an ordinance was passed granting the Suburban Traction Company the right to an extension of its line from the present terminus in Scotland street and Tremont avenue, etc., to the West Orange line.

Decatur, Ill.—John H. Culver, of Decatur, has been granted a franchise by the City Council for putting in an electric light plant to cost $10,000. The franchise is for 20 years and the contract for the city will be for 10 years.

Philadelphia, Pa.—The S. S. White Dental Mfg. Co. will erect a factory on 12th street, on site of the old Philopatrian Literary Institute.

Niagara Falls, Ont.—The Local Electric Light Company have decided to construct a dam here by means of which it will be possible to dry the basin above the lock and thus remove the guard and lock gates at any time necessary.

Levis, Que.—The Board of Trade have under consideration the question of the proposed new system of electric lighting, to cost $65 to $70 per arc light.

Telephone Notes.

Ellsworth, Kan.—The Ellsworth and Kanopolis Telephone Company has been chartered. Directors, John S. Judson and C. E. Jennings of Kanopolis; G. A. Collett, G. L. Levitt and C. W. Flanders of Ellsworth.

Stonington, Conn.—An agent of the Nixon Telephone Company of Providence, R. I., has been in Stonington with a view of establishing a local telephone system.

The Automatic Telephone Construction Company has been incorporated in New York by Henry M. Whitney and others. Capital stock, $100,000.

A second telephone line will be erected next Spring between Berlin and Vienna. The Austrian government has voted a credit of 300,000 florins towards the cost of the new line.

Middletown, N. Y.—G. Christian, President of the Sullivan County Telephone Co., has arranged to extend his line from Liberty to Livingston Manor and Rockland, where it will connect with the Beaverkill Co.'s line to Lewbeach.

Berkeley Springs, W. Va.—A telephone company is being organized at this place and it is proposed to connect with Hancock, Sir John's Run and Gt. Cacapon.

TELEPHONE PATENTS ISSUED NOVEMBER 26, 1895.

Apparatus for Hanging and Cleaning Telegraph or Telephone Wires. Alphono Custodis, Dusseldorf, Germany. (No. 550,255.)

Telephone-Circuit Signal. Mark A. Edson, Chicago, Ill. (No. 550,260.)

New Corporations.

Phœnix, N. Y.—A new electric light company, with a capital of $15,000, has been formed in Phœnix. Incorporators: Robert L. S. Sloan, Orin F. Gaylord, Elisha B. Powell, of Oswego, and S. Dana Greene and Edward S. Taft of Phœnix.

New York, N. Y.—National Electrical Exposition Co. has been incoporated by Harrison J. Smith, Marcus Waltham, Ed. F. Peck, Robt. B. Corey and others, to hold exhibitions of all productions of electric and kindred industries, and to sell goods of all kinds. Capital stock, $30,000.

St. Louis, Mo.—The Skein Electric Switch and Signal Company has been incorporated by A. T. Gast, C. F. Joy, C. H. Witthoff and Herman Lanerwein. Capital stock, $5,000.

New Orleans, La.—The New Orleans Edison Co. has been incorporated by Jos. P. Ord, Robt. T. Paine, Ronald T. McDonald and others. Capital stock, $3,000,000.

Pittsburgh, Pa.—A charter has been granted to the Pittsburgh & Monongahela Traction Co. Capital, $12,000. Length of road, two miles.

Harrisburg, Pa.—A charter has been granted to the Chester and State Line Railroad Company to build a line 4½-miles long from Chester, at the intersection of Chester Creek and the Delaware River to the intersection of the Delaware River with the State line. Capital, $50,000. Pres. John Edwin Thomson of St. Louis, Mo.; Wm. Simpson, Jr., and Wm. Percy Simpson, Jr., of Overbrook, and Wm. H. Badger, Jr., of Wayne, and others are the directors.

Sioux City, Ia.—The Central Traction Company of Sioux City, incorporated. Capital, $500,000. Incorporators, Howard S. Baker, S. H. Swan and George P. Morris.

Los Angeles, Cal.—The Pacific Coast Telephone and Electric Motor Co. filed articles of incorporation. Capital, $100,000. Directors: T. M. Gibson, Wm. T. Harrison, John C. Maccabe, S. Weatherholt and H. J. Lloyd, all of Los Angeles.

Rossland, B. C.—Rossland Electric Light and Power Company. Incorporated. Capital, $20,000. T. W. Stack and Angus J. McDonald are among the promoters.

Trade Notes.

The J. H. McEwen Mfg. Co., 26 Cortlandt street, New York, has just issued a neat catalogue of its Thompson-Ryan direct-current multipolar electric generator.

ELECTRICAL and STREET RAILWAY PATENTS

Issued November 26, 1895.

550,252. Commutator-Brush. Nellis M. Cross, North East, Pa., assignor of one-half to Charles A. Ensign, same place. Filed Oct. 29, 1894.

550,255. Apparatus for Hanging and Cleaning Telegraph or Telephone Wires. Alphons Custodis, Dusseldorf, Germany. Filed May 15, 1895.

550,260. Telephone-Circuit Signal. Mark A Edson, Chicago, Ill., assignor to the American Bell Telephone Company, Boston, Mass. Filed May 20, 1895.

550,283. Electric Mining-Machine. Edmund C. Morgan, Chicago, Ill. Filed Dec. 12, 1894.

550,298. Electrically-Controlled Clutch Mechanism. John E. Stannard, Springfield, Mass. Filed Apr. 5, 1895.

550,319. Electric Tramway With Underground Distribution of Current. Alfredo Diatto, Turin, Italy. Filed Sept. 18, 1894.

550,329. Electrical Pumping Apparatus. Gustaf Rennerfelt, Arvika, Sweden. Filed July 16, 1894.

550,330. Electric Pumping Apparatus. Thurs G. Rennerfelt, New York, N. Y. Filed July 3, 1895.

550,344. Electro-Locomotive. Jean J. Heilmann, Paris, France. Filed Feb. 13, 1895. Serial No. 538,188. (No model.)

550,354. Self-Exciting Constant-Current Alternator. Albert Schmid, Allegheny, and Benjamin G. Lamme, Pittsburgh, Pa. Filed Aug. 24, 1891.

550,355. System of Electrical Distribution. Oliver B. Shallenberger, Rochester, assignor, by mesne assignments, to the Westinghouse Electric and Manufacturing Company, Pittsburgh, Pa. Filed Oct. 12, 1886.

550,360. Non-Welding Contact. Alexander J. Wurts, Pittsburgh, Pa., assignor to the Westinghouse Electric and Manufacturing Company, same place. Filed Apr. 11, 1895.

550,365. Electric Arc-Lamp. Frank Emery, New York, N. Y., assignor to the Standard Thermometer Company, Peabody, Mass. Filed Apr. 22, 1895.

550,393. Electric-Car Truck. Louis J. Hirt, Somerville, Mass. Filed Mar. 5, 1894.

550,403. Electro-Depositing Apparatus. Henry L. Bridgman, Blue Island. Ill. Filed Dec. 22, 1894.

550,407. Commutator. John Dick, Wilkinsburg, Pa. Filed Aug. 21, 1895.

550,411. Electric Switch. Thomas Harper, New Brunswick, N. J. Filed Aug. 29, 1894.

550,421. Life-Guard for Street-Cars. Richard Pollard, Syracuse, N. Y. Filed Mar. 18, 1895.

550,432. Electric-Lighting Gas-Burner. John M. Anck, Philadelphia, Pa. Filed Mar. 29, 1895.

550,437. Electric Railway. David Brooks, jr., Philadelphia, Pa. Filed Feb. 28, 1894.

550,448. Car-Fender. George W. Greer, Gap, Pa., assignor of three-fourths to Christian L. Kauffman, same place. Filed Apr. 8, 1895.

550,458. Trolley. Eugene L. Richter, Philadelphia, Pa. Filed Mar. 27, 1895.

550,462. Register for Fire-Alarm Systems. Nathan H. Suren, New York, N. Y. Filed Jan. 29, 1895.

550,464. Dynamo-Electric Machine. Elihu Thomson and Merle J. Wightman, Lynn, Mass., assignors to the Thomson-Houston Electric Company, of Connecticut. Filed Dec. 2, 1889.

550,465. Electric Railway. George Westinghouse, Jr., Pittsburgh, Pa. Filed June 13, 1890.

550,467. Electric and Fluid Locomotor. George Westinghouse, Jr., Pittsburgh, Pa. Filed Feb. 5, 1892.

550,468. Ventilating Means for Electrical Apparatus. George Westinghouse, Jr., Pittsburgh, Pa. Filed May 2, 1895.

550,480. Plate for Secondary Voltaic Batteries. William A. B. Buckland, London, England. Filed July 15, 1895. Patented in England, Mar. 25, 1895, No. 6,163; in France, Mar. 28, 1895, No. 245,999; in Belgium, Mar. 30, 1895, No. 114,832; in Italy, May 7, 1895, LXXV, 464; in Spain, June 25, 1895, No. 17,244, and in Canada Aug. 14, 1895, No. 49,674.

550,481. Controlling Apparatus for Electromotors. Jean B. G. A. Canet and André Hillairet, Paris, France. Filed Aug. 28, 1894. Patented in France, Nov. 28, 1893, No. 234,373, and in England, July 30, 1894, No. 14,602.

550,484. Electric Regulator. George W. Colles, Jr., Hoboken, N. J. Filed Feb. 4, 1895.

550,510. Telegraphy. Isidor Kitsee, Philadelphia, Pa. Filed May 25, 1895.

550,511. Telegraphy. Isidor Kitsee, Philadelphia, Pa. Filed Sept. 7, 1895.

550,533. Well for Batteries. Jens G. Schreuder, Edgewood, assignor to the Union Switch and Signal Company, Swissvale, Pa. Filed Dec. 2, 1893.

550,534. Battery-Well. Jens D. Schreuder, Edgewood, and Simon H. Stupakoff, Pittsburgh, assignors to the Union Switch and Signal Company, Swissvale, Pa. Filed Oct. 25, 1894.

550,535. Railway-Signal. Jens G. Schreuder, Edgewood, assignor to the Union Switch and Signal Company, Swissvale, Pa. Filed Apr. 20, 1895

550,566. Track Instrument for Electrically-Controlled Railroad Signals. Charl-s H. Sherwood, Utica, assignor of one half to Henry C. Lyman, Sherburne, N. Y. Filed Dec. 10, 1894.

ELECTRICAL AGE

VOL. XVI., No. 24. NEW YORK, DECEMBER 14, 1895. WHOLE No. 448

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CONTENTS.

THE GOVERNMENT BERLINER SUIT.

In his annual report the United States Attorney-General asks Congress to direct him what to do in the Bell Telephone litigation. The expense of this case, he says, is very heavy. It will take six months to prepare rebuttal testimony. He favors continuing the case to a final decision, provided the expenses can be met, and says: "If the people have been deprived of their natural rights by the improper issue of a patent, as the Government avers, it would not be a proper course on its part to discontinue litigation which has probably been purposely protracted until the patents have expired, but such litigation should be persisted in to establish finally, for the sake of future action on its part, its rights to sue to annul patents."

ELECTRICITY ON THE FARM.

Threshing grain by electric transmission of power is at present being carried on with very satisfactory results at Mjölby, in Sweden. The electricity is conveyed a considerable distance from the main cable to a motor in the immediate vicinity of the thresher.

A CABLE UP THE AMAZON.

Brazilian advices say that the steamer Faraday will shortly leave England with the cable which is to be laid in the Amazon River from Pará to Manáos. This enterprise is being carried out by an English company under contract with the Brazilian Government. The line will be 1,400 miles long, and will have sixteen intermediate stations. All previous attempts at establishing telegraphic communication in these districts have been unsuccessful, owing to the dense and rapid growth of the forest along the banks of the river. The Faraday, a steamer of 5,000 tons, can easily ascend from the mouth of the river to Manáos.

DECISION IN THE UNDER-RUNNING TROLLEY CASE.

The General Electric Company has, since the Spring of 1893, been contesting with the Westinghouse Company the question as to whether or not Vandepoele's invention of the under-running trolley was secured by a good and valid patent or not. The suit was nominally Thomson-Houston Electric Company vs. the Winchester Avenue Street-Railway Company, of New Haven, Conn. Two patents were involved in the contest, one having claims to a grooved wheel under-running a conductor located overhead, the wheel supported at the end of a long arm having universal movement, that is, either vertically or laterally, and being upwardly spring-pressed. This brief statement of the claims in controversy is an accurate summary of the subject matter of numerous claims; there are sixteen in the patent. The other patent issued on the same day, April 11, 1893, has narrower and less important claims, the subject matter being a vertical support for the universally movable arm located on a turn-table device, so that the direction of motion of the car being reversed, the arm can be caused to incline rearwardly or trail.

Judge Townsend has rendered a very fair and lucid decision sustaining the claims of the first-named patent, and reviewing the state of the art as presented with great elaboration by the defendant. The prior patents of Edison, J. G. Smith, D. G. Fitzgerald, W. D. Wesson and others, and the alleged prior inventions of Daft and of Sprague, are found to be either too late in point of time, or lacking in description or suggestion. The court finds the subject matter of the second patent involved, wanting in novelty and patent invention, by reason of the use and description of substantially the same mechanism and apparatus in other arts, such as in a revolving chair, for instance, patented to Wright in 1879.

The result of this litigation locates the monopoly of the overhead conductor, combined with an under-running grooved wheel, at the end of a long arm having universal movement and upwardly spring-pressed, in the possession of the assignees of Vandepoele, and tends to clear up the situation as regards patentable subject matter in the art of electric locomotion.

ELECTRIC PROJECTION AND PHOTO-ENGRAVING LAMPS.

One of the most valuable uses for the electric arc light is its application in lantern projection, photo-engraving, and for other purposes where a strong, concentrated light is desired.

Prior to this particular application of the light the results in lantern projection were comparably far inferior, and photo-engraving at all times was practically impossible.

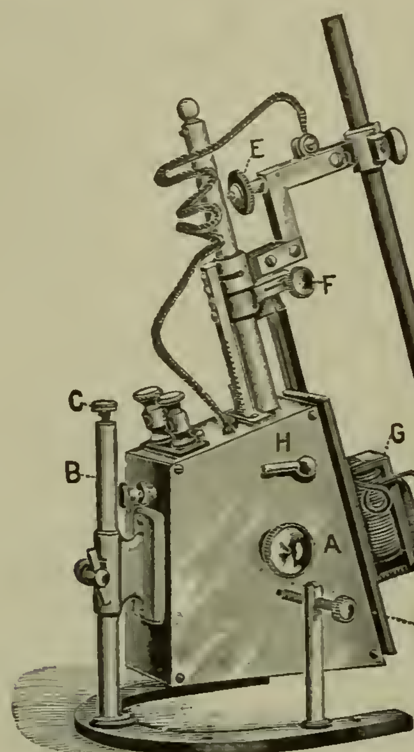


FIG. 1.

In projection work the amount of detail brought out on the screen by the electric light was unattainable with the calcium and other artificial lights, and the ease with which the electric light can be applied and controlled at once brought it into popular favor. In photo-engraving work the use of the electric light means a great deal; the work can be carried on as well at night and on cloudy days as on clear days. Taking it altogether the electric light has accomplished an industrial revolution of such magnitude that few people have any idea of its extent and importance.

The manufacture of the proper apparatus for this class of work requires a practical knowledge of the principles of electricity and its application; first-class material and mechanical workmanship. Perhaps no house has had greater success in this line of work than that of J. B. Colt & Company, 115 and 117 Nassau street, New York, a few of whose articles of manufacture and brief descriptions of the same we give herewith.

The improved automatic electric lamp (Fig. 1) is the most compact on the market. The regulating mechanism is contained in the metal case, which is 2" thick, 3¼" wide and 4½" high. The light is very steady and self-centring. In operation the feeding of the carbons is not dependent upon gravity; the carbons therefore can be placed at any desired angle. The lamp is perfectly insulated and may be handled without fear of shock. It is adapted to any continuous current circuit, either arc or incandescent.

The firm also makes a lamp of the same general style and construction for alternating-current circuits.

These lamps may be used with storage batteries, and in connection with the firm's adjustable rheostat the current may be varied at will, according to the amount of illumination required. Both carbons are automatically fed, and are inclined at an angle of 30 degrees in order to secure the best illumination.

The lamp is noiseless in operation and is meeting with a large demand for theatre lighting, as it is more intense and less expensive than the calcium light.

Fig. 2 shows the adaptation of the lamp to the "Morton" or "College" lantern, where the body of the instrument is mounted on tall, upright posts.

In Fig. 3 is shown the "Criterion" electric lantern, model B. This apparatus weighs only 15 pounds and can be readily connected to the main circuit by m ans of flexible cord.

The universal hand-feed electric arc lamp (Fig. 4) may be used on either direct or alternating currents. The arm supporting the lower carbon-holder is moved up or down by one screw-rod, which is also operated by the same fibre knob, means being provided for proper feeding according to whether direct or alternating current is used. In this way the different rates of carbon consumption are compensated.

Fig. 5 is an illustration of Colt & Co.'s Open Reflector Stage Lamp. It is constructed so that it may be inclined at any angle and elevated to any height. This lamp is provided with a fixed rheostat for the purpose of regulating the light.

An electric balcony or front light is shown in Fig. 6. This is said to be the most perfect "front" light ever produced. By simply sliding the lamp backward or forward on its bracket the light is made to cover any desired space on the stage. It is easily operated, is steady and gives a soft, beautiful light.

The electric lens box (Fig. 7) can be used on any volume of current. The lens may be focussed to cover a large or small field, and may be turned or inclined at any angle.

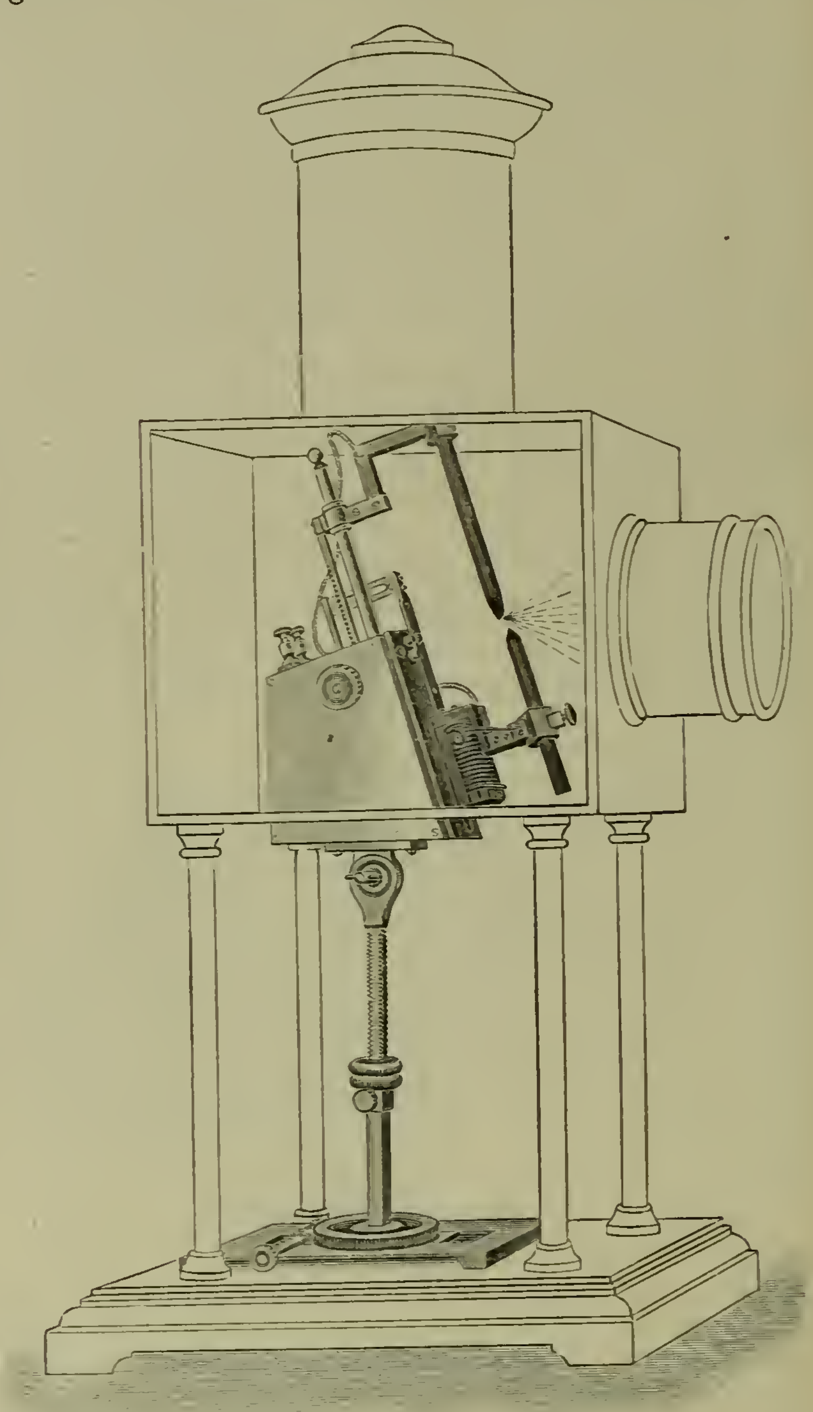


FIG. 2.

Fig. 8 illustrates Colt & Co.'s improved automatic electric lamp for photo-engraving, etc This lamp is provided with a fixed rheostat and a reflector, for the purpose of throwing every ray of light upon the subject. These lamps are used by many of the largest engraving companies and giving the best of satisfaction.

The members of the firm are J. B. Colt and Charles Goodyear, Jr., the latter being the grandson of Charles Goodyear, of India rubber fame.

Many of the inventions and improvements in the firms electric apparatus are the products of Mr. Goodyear's genius.

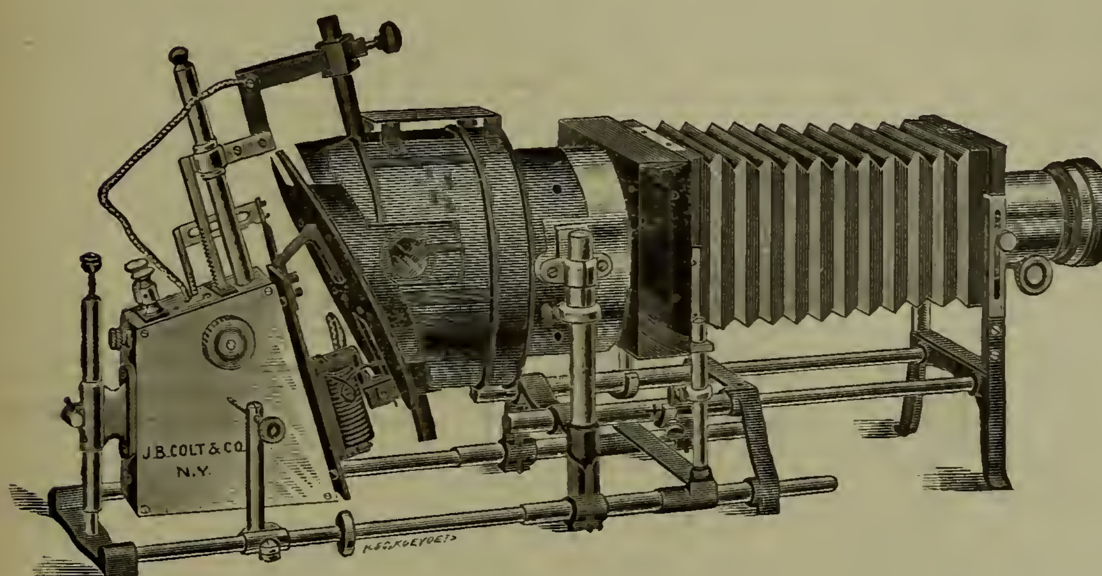


FIG. 3.

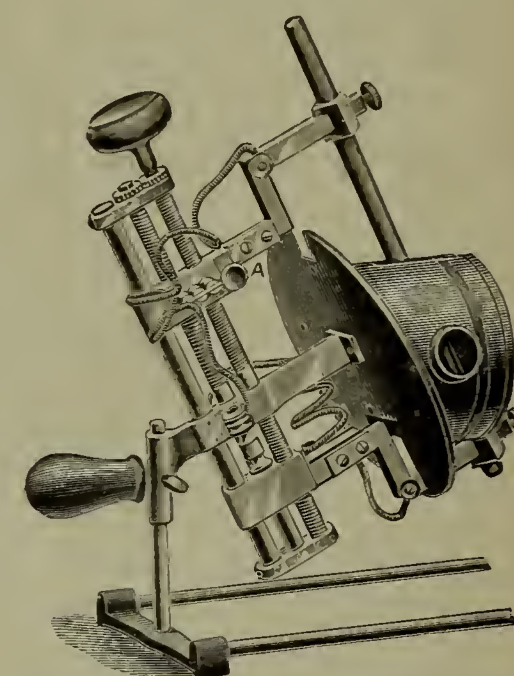


FIG. 4.

FIG. 5.

FIG. 6.

FIG. 7.

FIG. 8.

PARKER'S ELECTRIC RAILWAY.

The accompanying illustrations give longitudinal and cross-sectional views of an underground conduit system for electric railways, invented by Mr. J. E. Parker, No. 1 Broad street, New York City.

The iron conduit *A* is about 18 inches deep by 15 wide, with a flange on the underside 3″ wide or thereabouts. This conduit is set on a level bottom in the centre of the track and spiked to the cross ties, the top being flush with projecting from the bottom of the car, wide enough to ride easily in the road slot, and connected together by a flat frame of metal (*G*) having a slot in the centre, in which is placed a wheel (*I*), which also runs in the roadway slot. The trolley-guard performs three functions, viz: It clears away all obstacles from the slot; protects the trolley-shaft from injury, and presses against the sides of the slot, forming an earth connection for the return of the current.

The trolley-shaft, *h*, is made of vulcanite or some other suitable non-conductor. Its peculiar formation at the end

Fig. 1.

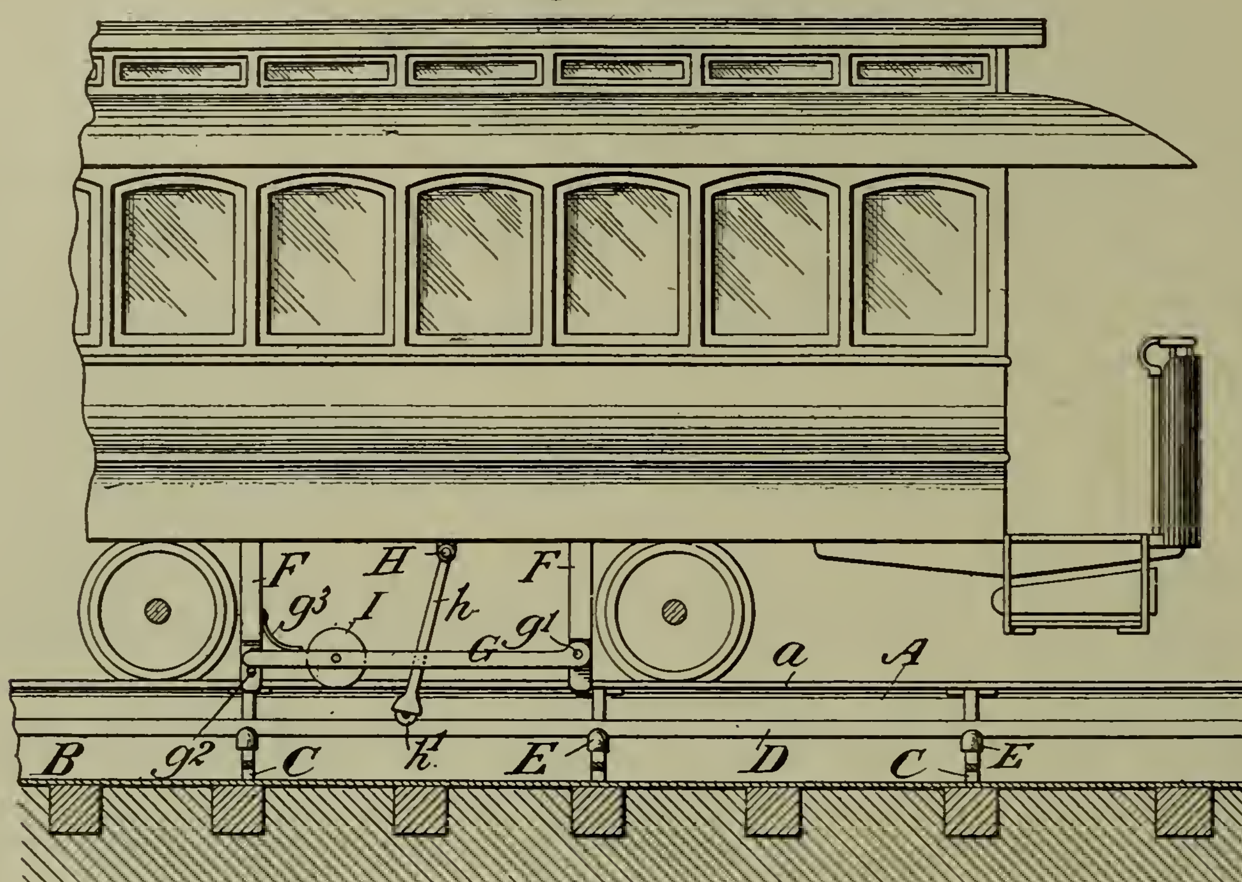
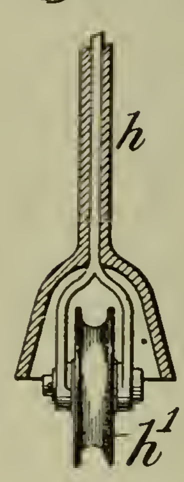


Fig. 2.

Fig. 1a.



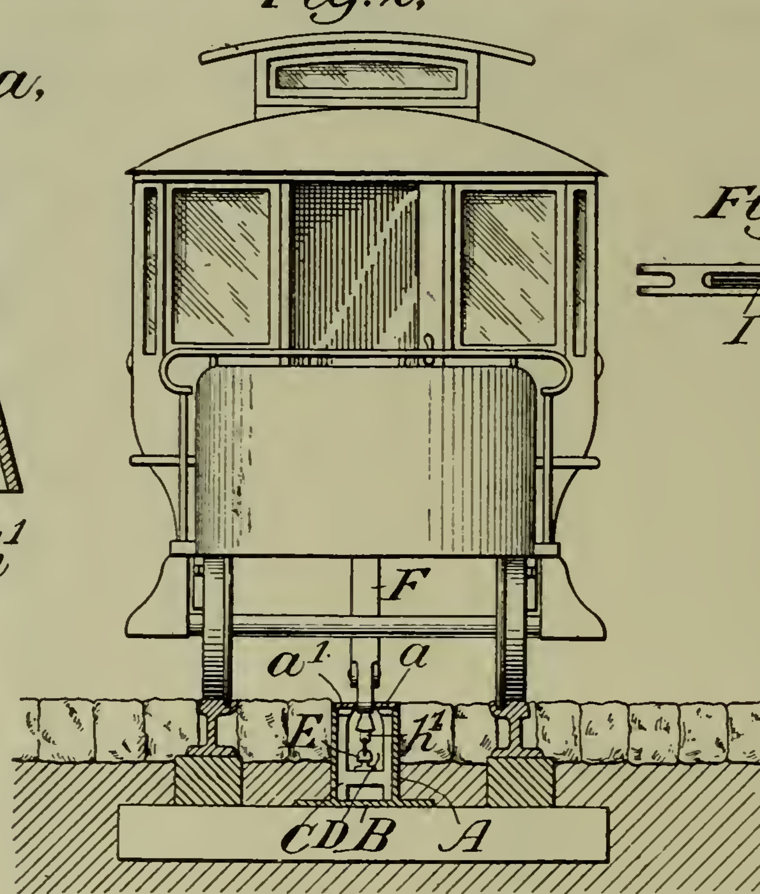
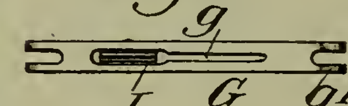


Fig. 3.



PARKER'S ELECTRIC RAILWAY.

the roadway. The sections may be made in 10-foot lengths and joined together by fish plates, and at proper intervals a connection made with the sewer.

The conductor is supported on a glass or porcelain insulator, *E*. This insulator is bell or umbrella-shaped underneath, and has a channel across the top for the reception of the conductor.

The trolley guard, *F*, *G*, *I*, consists of two bars of metal insulates it. A simple mechanical device is provided which enables the motorman to reverse the position of the trolley, so that the car may run in an opposite direction.

The construction of the trolley is shown in Fig. 1, *a*; the flanged wheel, *h*, rides on the top of the conductor.

It will be readily seen that in consequence of the direct contact of the trench all along its length and of the whole of the metal-work with the earth, that not only is the contact for the return or earth-current made with the greatest certainty, but any possible derangement of the conductor would be quite harmless both to person and property.

Another advantage of this system is, that all other lines can be crossed by it and the cost of the system would be less than one-half that of any other system at present before the public.

The conduit can be readily cleaned by taking off the cover—one or two men continually employed can keep the whole line cleaned. An advantage of this system is that by attaching a connection with the underpart of the conductor, by means of a clamp, part of the current can be diverted and the company operating the system will be in a position to supply electricity for electric lighting and power. The street lamps may be lighted or private persons supplied with light or power from the same conductor. Another advantage is that any number of car companies can use the same conduit, thus obviating the necessity of more than one track in each street, and each company sharing the expense of building and maintaining the same.

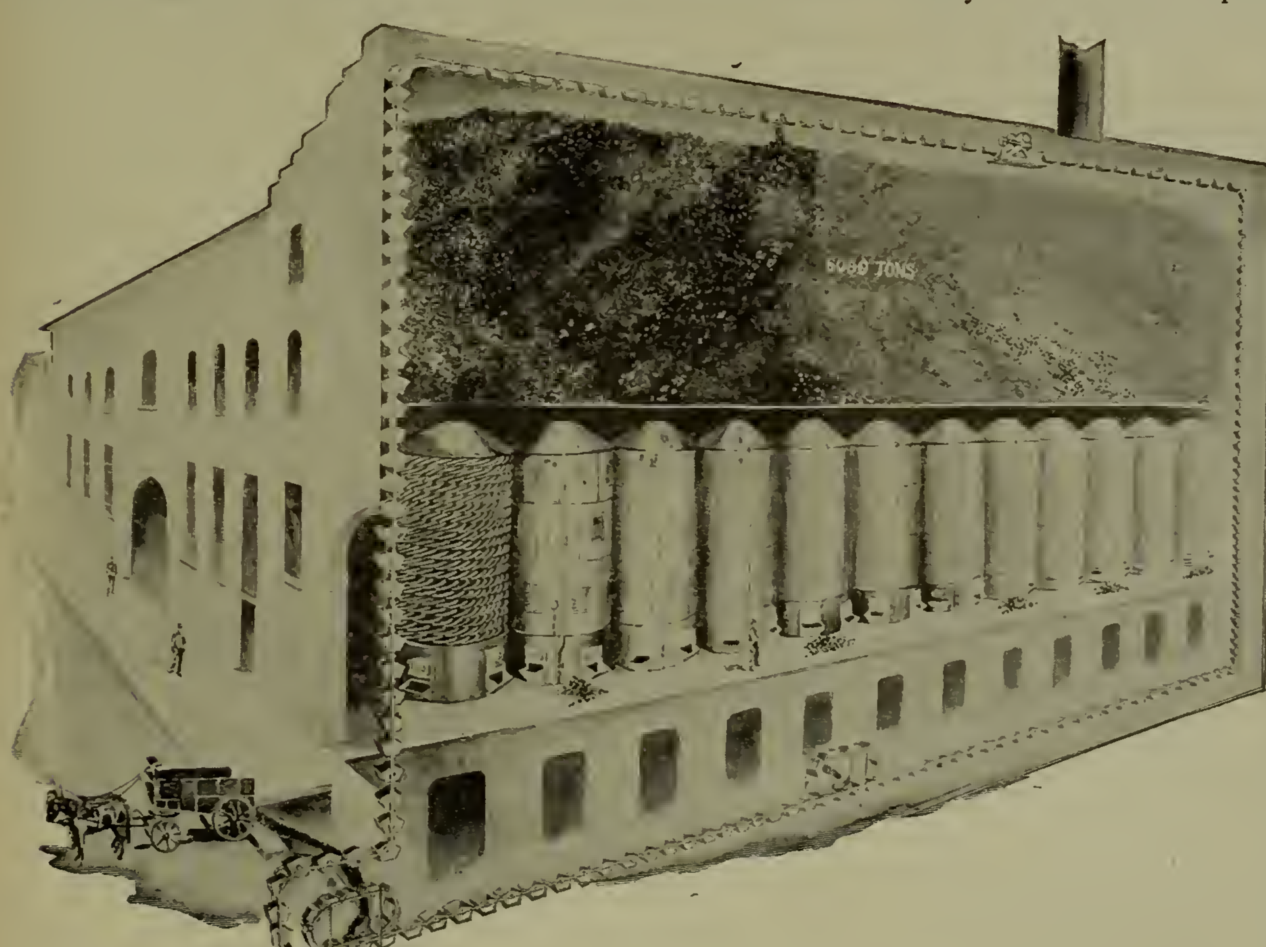
Mr. Parker has patented his invention in the United States and Great Britain.

LARGE COAL STORAGE AND BOILER PLANT.

The new plant near the foot of East 28th street, New York, of the United Electric Light and Power Company, when completed, will have a capacity of 20,000 H. P. One-half of the station is built on a lot of 98½ feet wide by 161 feet long, and combines with the great horse-power the large coal-storage capacity of 3,000 tons.

As the station is not situated on the water front the handling of coal and ashes presented quite a problem, which was solved by the employment of a conveyor system installed by the C. W. Hunt Co. of New York. The coal is received in wagons, as shown in the accompanying illustration, and dumped into the hopper under the sidewalk, and carried by the conveyor to the top of the cold-storage building over the boilers. This storage bin is so constructed that all the coal will run to the boilers.

On its return, the conveyor runs under the boilers, and the ashes are drawn into the same conveyor that handles the coal and carried to an ash tank, from which they are removed.



BOILER AND COAL STORAGE PLANT, UNITED ELECTRIC LIGHT AND POWER CO., NEW YORK.

The boiler plant, as shown in the illustration, consists of 12 "Climax" boilers, which are manufactured by the Clonbrock Steam Boiler Works, Brooklyn. The "Climax" boiler gives the greatest power in the smallest space, and was naturally looked upon with much favor in the equipment of this station, where the available space had to be utilized to the best advantage.

ELECTRIC WELDING.

The heating of a wire by an electric current gives rise to a series of phenomena, one of which it is our object to dwell upon in this article. A physical change which becomes most apparent is the pliable condition of the wire. The heavier the current the greater the temperature, until a point is reached at which the particles are completely volatilized. This chemical change by which the metal is oxidized is to be avoided, when the object in view is the coalescence or welding of two pieces of metal. A wire that becomes heated by electrical energy offers a picture of a series of complex effects.

The internal heat, the encircling lines of force and the gradual tendency towards a complete collapse, due to the heat and oxygen, illustrate the action of three distinct forces.

It would be a difficult matter to even try to see clearly into the causes by which a wire or metal, or any other material, is heated by an electric current. It seems as if some rapid, but exceedingly irregular movement took place amongst the particles, each individually exciting the other to a state of higher temperature. Matter in itself is regarded by many as simply a collection of centers of force. The effects produced either physically or chemically are due to the presence of a disturbing factor, such that their previous relationships are changed and may be totally annihilated. Should a bar of copper be exposed to the influence of a powerful current, the positive end will become heated to a greater degree and become negative. If the current is sufficiently strong to heat the bar to redness, this cherry color will be seen to spread almost imperceptibly from the positive to the negative extremity. It is marvelous to realize that such is the case, for upon this fact may possibly be built some theory of substantial value, explaining more of the inner nature of an electric current.

When two metals are placed loosely in contact, an intense heat will be developed at the point of junction upon the passage of a current of sufficient strength. These two pieces of metal can be welded to each other very firmly if certain conditions be observed during the process. Each surface in contact must be at a high temperature and the proper pressure must be applied to force them into intimate contact. A coherent and uniform mass will then join both securely and permanently.

It is well known that an exceedingly high temperature will cause certain internal changes which may completely destroy the most valued properties of the metal.

For instance, when two steel rods are to be welded together the terrific heat will by some means drive out the carbon and spoil the steel. To avoid this the welding must be timed to a certain interval at which the current must be shut off, or the conditions described will result. Steel may be renovated, should such an occurrence arise, by applying some carbon-giving material to the steel so that it can reabsorb its proper amount and thus return to its original condition. Welding may be carried on by both continuous and alternating currents. It is the practice today to use alternating currents for such purposes. The greater heating of one pole than the other, or the positive than the negative piece of metal, when using direct current, causes a difference of temperature that prevents a successful weld from taking place, while with an alternating current the temperature is equally divided between each pole, so that by the application of the proper pressure a firm, enduring weld is made. Care must be taken that the outer edges only do not weld, and that the centre is not left as before, but uniformly welded with the rest.

When all these conditions are observed a successful weld can be expected, provided that the oxidation of the surfaces is avoided. Joints between copper and brass, brass and steel, can be successfully made by a skilful operator.

THE METROPOLITAN TRACTION COMPANY.

The Railway Committee of the New York Assembly last week held an inquiry into the New York city street traction companies, and brought out some interesting facts concerning the same.

Mr. Herbert H. Vreeland, president and manager of the Metropolitan Street Railway Company, stated that the company was formed on May 28, 1894, by the consolidation of a number of smaller companies, whose tracks aggregated nearly 140 miles in length. About thirty-three miles are operated by cable or electricity. The electric equipment of the road is of the underground bar conductor style, and it is the only one of the kind in the country. It is more expensive to build than an overhead system, and is largely experimental. If the line works successfully this winter the system will be extended to all the lines of the company not equipped with cables.

The company now has 300 cable cars in constant service, and 650 horse cars, employing in all nearly 2,800 men. On the Broadway-cable line the men work 9¼ hours a day. An hour is allowed for lunch. Six round trips constitute a day's work for a gripman, for which $2.40 is paid. If a man works extra he is paid for it, and the men usually earn about $17 50 a week. The entire service is governed by civil-service rules, and a system of promotion and increase in pay has had good effects on the men. Applicants for situations are examined carefully as to their sobriety and integrity. Of the 500 gripmen employed only eight left the company during the months between May and October. Six of these were discharged for drinking, which the company will not allow, and two resigned.

Mr. Vreeland said that he considered vestibuled cars as utterly impractical in a crowded city like New York, for in winter the glass in the windows would become coated with frost and prevent the gripman from seeing plainly.

Last year the company carried 140,000,000 passengers, and 30,000,000 more on transfers.

The Metropolitan Street Railway Company has a capital of $16,500,000, and a bonded debt of $9,400,000. It paid $439,993.07 in taxes last year. Last year its gross receipts were about $6,000,000. A dividend of three per cent. on the stock was paid, and the interest at five, six and seven per cent. on its bonds. The company leases the following lines: Broadway and Seventh Avenue, $835,000 a year; Twenty-third Street line, $193,000; Forty-second and Grand Street Ferry line, $148,800; Central Park, North and East River, $228,000; Sixth Avenue $145,000; Ninth Avenue, $50,500. The company's real estate is valued at $3,500,000.

The Cyanide Process.—We have received from the author a copy of a pamphlet on "The Cyanide Process and the Cyanide Patents—a Guide to Relief from Royalty," by George G. Turri, F. M. I. P. A., Melbourne, Australia.

THE GOLD MEDAL MOTOCYCLE.

A gold medal has been awarded to the Morris & Salom Electric Carriage, which was one of the contesting vehicles in the recent motocycle race in Chicago.

This carriage was equipped and propelled with and by a Lundell motor outfit, and the result of the contest speaks praises for the Interior Conduit and Insulation Company's apparatus.

Among the factors of the race were safety, ease of control, absence of noise, vibration and heat, and general excellence of design and workmanship, and the award of the coveted medal to this carriage gives recognition to all these qualities in the Lundell machine.

The Interior Conduit and Insulation Co., which manufactures the Lundell motor, is to be congratulated on their good fortune in receiving this high testimonial of their apparatus. Messrs. Morris & Salom, of Philadelphia, are the manufacturers of the vehicle.

GEORGE GOULD FAVORS ELECTRICITY.

Mr. George J. Gould was examined last Thursday by the Assembly Railway Committee on the affairs of the Manhattan Elevated Railway Company, and he gave expression to some opinions that the public rarely hears from one so high in authority.

Regarding the proposed underground railway for New York city he said that in his opinion the construction of an underground road is perfectly practicable, as any engineering project is if there is sufficient money behind it—even the Panama Canal. He thought, however, that such a road would never be popular and would never pay.

"It is practical engineering, but not practical financiering," said Mr. Gould. "It is not popular in London."

Touching on the elevated system in New York, Mr. Gould said, among other things, "I think that an elevated railroad, equipped with electric appliances, is the best form of rapid transit. Electricity has reached a point where it is practical. It is much cleaner and less noisy than steam, and it seems to me that it is far superior to any other power. We have been, and are, watching the subject very closely, and my plan has been to try some experiments. I want to do the best I can to accommodate the public, and I don't want to have an accident that will break down the line and force 500,000 people to walk or rely on some other form of transportation. There is a system in Chicago that works successfully, but I think that a better one can be devised. There 16,000 people are carried daily; we carry half a million."

Referring to the complaints of poorly lighted cars on the elevated road, he said the company is now using oil. "A year ago," he continued, "I was on the point of adopting a gas system for cars and stations, but now I think that electricity is the best light. It is cooler than gas. I have examined storage battery systems, but none of them is practical. We intend to change the lighting system, and want to take the light from the same source from which we derive our motive power."

Mr. Gould expressed himself on the question of municipal ownership of street transportation companies as follows:

"I do not believe in municipal ownership. I do not think it is a proper thing for the Government to take up. It should be left to private capital. A Government railroad is never run as carefully financially, or from a public standpoint, as one controlled by a private corporation. It doesn't pay in Europe, where it has been tried. The taxpayers pay. It is the same with the telegraph and the telephone. The postal telegraph in England has a deficit every year. Government ownership is a leaning toward socialism. Private capital should be left to develop these enterprises and should take the risks. We tried Government ownership, in a way, with the Pacific Railroad, and it resulted disastrously for the Government and the railroad too."

The Manhattan Elevated Railway Company employs 6,000 men, and runs 3,000 trains a day.

OBITUARY.

THOMAS MCCOUBRAY.

Mr. Thomas McCoubray, who was well known in electrical circles, died on December 5. He was born in the District of Columbia, on May 20, 1847, and was descended from Scotch-Irish stock on both sides. He was raised in Baltimore, and graduated from the Baltimore City College.

Mr. McCoubray was a member of the F. & A. M. He was five times elected Master of St. John's Lodge, and twice elected High Priest of St. John's Chapter. He was Eminent Commander of Baltimore Commandery No. 2, K. T., and served as Grand Inspector (or D. D. G. M.) for one term.

Mr. McCoubray was one of the organizers and the first Grand Potentate of Boumi Temple, A. A. O. U. M. S., and was a 33° mason of the A. A. Scottish Rite, having held offices in each of the bodies. He was Secretary of the Board of Relief at the time of his death.

Mr. McCoubray at one time was secretary of the National Electric Light Association, and during his career held several positions of trust in the commercial side of electrical interests. Of late he gave his attention to the invention and development of the Auto-Telephone System, which has proven a success.

THE BROOKLYN HEIGHTS R. R. CO. FORECLOSURE SALE.

The foreclosure sale of the stock of the Brooklyn Heights Railroad Company, the Long Island Traction Company, the right, title, and interest of the Brooklyn Heights Company in the 999 years' lease of the Brooklyn City Railroad Company, and the stock of the Brooklyn, Queens County and Suburban Railroad, which was ordered to take place at the Real Estate Exchange in New York, on December 5, has been postponed. The plaintiff in the foreclosure proceedings, which were brought in Virginia, because the Long Island Traction Company was incorporated in that state, was the New York Guaranty and Indemnity Company, which holds collateral trust notes of the Long Island Traction Company for $2,000,000. These notes were taken up by the Indemnity Company and bear interest at six per cent. The interest was due in August last, and there was a default in the payment. The property covered in the proposed sale includes some of the most valuable surface railroads in the city of Brooklyn.

An order adjourning the sale was issued by Judge Nathan Goff of the United States Circuit Court for the Eastern District of Virginia, on an application by Lawyers James C. Church and Almet F. Jenks, of Brooklyn, on behalf of Mrs. Emma J. O'Connor, a stockholder of the Brooklyn Heights Railroad Company. Mrs. O'Connor alleges that there has been mismanagement and a reckless waste of money in the conduct of the roads concerned, and she also asserts that the issuance of the notes was irregular. Mrs. O'Connor has applied for a rehearing of the decree of sale, and the case will be argued in the Virginia court on December 12.

NEW YORK'S RAPID TRANSIT FACILITIES.

In respect to its traction systems, says the *American Engineer and Railroad Journal*, New York is singularly behind other large cities in adopting the latest improvements; but this seems to be the result of conditions that strangely justify her course. Thus, the elevated system of New York City was brought to completion long before the perfection of the electric-car motor. When the electric car first came on the scene the elevated in New York had been long completed on all the avenues on which it now runs, and steam became the motive power by mere accident of time.

—Vaseline is the best lubricator for commutators. A very small quantity should be applied.

COPPER REFINING BY ELECTRICITY.*

BY H. C. GARNEAU.

The problem of the cheap and rapid refining of copper has been solved by that almost universal agent, electricity. The fact that copper can be purified by deposition by means of a galvanic current has long been known, but its practical application to commercial uses is something we owe to these latter days. Its commercial application has shown that it is the cheapest and best method by which to recover and save those valuable impurities in copper, if we may call them impurities, gold and silver.

The ores of Michigan, Calumet and Hecla contain a comparatively small amount of gold and silver, whereas in those of Montana, as the Anaconda ores, these precious metals cut quite a figure. As the Anaconda ores come nearer the ideal than any other native ores for electrical refining, we will take them as the example in the description following.

All the preliminary smelting is done at the mines, and consequently the copper as received at the refining works is in a comparatively pure state. It is received in plate bars, having dimensions in feet of about $1.5 \times 1 \times .5$. These plates, weighing about one hundred and twenty-five pounds, are placed in furnaces, where they are heated to a bright redness. When they have reached the desired temperature they are rolled in return rollers (generally of five sizes) until the plates are about twenty-three feet long, one inch thick and one foot wide. As this strip of metal goes out of the last roll it is passed through a trough of cold water to cool it quickly, and thus prevent the formation of any oxide as an impurity and a loss. These strips are then cut into small plates about a foot and one-half long and one foot wide; the rough edges are also cut off, and when sufficient scrap accumulates it is re-heated and re-rolled.

Two of these small plates are put in suitable grooved, wooden racks, which may be used over again two or three times.

These racks, when filled, are brought to the electrical depositing room. This is a large room containing vats in series, each vat having a capacity of fifteen to twenty plate racks. There are generally twenty vats to a series, but the number varies. These vats are filled with a solution of medium strength of blue vitriol, sulphate of copper, which acts as a carrier for the copper in process of deposition. The copper sulphate solution is constantly kept moving and renewed by hydraulic pumps at the end of each series of vats and by means of a system of pipes and gutters.

The racks are now placed in these vats and electric wires attached. The current from the adjoining dynamo-room is turned on and the copper begins to deposit from the positive to the negative side, or *vice-versa*, according to the direction of the current. This deposition is allowed to go on, unwatched, for a period of fourteen days, at the end of which time the copper plates have completely re-deposited themselves and the copper is *almost* pure. While the deposition is going on the impurities, as gold, silver, sulphur, dirt and a little copper, etc., fall to the bottom of the vats and form a very important bye-product or residue, which is called "slime," of which we will speak later at greater length.

The copper sulphate solution is now drawn off from the vats, and the plates are washed with a strong shower of water to wash off any slime that may have adhered to them. The plates are then removed from the racks and are brought to the furnace-room. Here the copper is melted and any remaining impurities removed by obtaining the right temperature and pitch (*i. e.*, the right amount of oxygen), the arrival at which point the experienced eye of the operator notes.

The copper is then cast into ingots and bars, which, when sufficiently cool to form a homogenous solid, are dumped into troughs of cold water to cool them quickly, and thus prevent the formation of any oxide.

The ingots weigh from fourteen to sixteen pounds and

* From *The Yale Scientific Monthly.*

are used for making brass, bronze and other commercial articles. The bars weigh much more than the ingots, generally about one hundred and thirty-five pounds, and are used in wire mills for making trolley and other varieties of copper wire.

Treatment of the Slime. In copper containing gold and silver the treatment of the slime is one of the most, if not the most important part of the refining, for out of it we recover the precious metals, gold and silver. In fact, it is said that the recovery of the gold and silver pays for the running of a refinery and the copper represents the profit.

The slime is treated as follows: It is first scraped from the bottom of the vats and put into "slime barrels," in which it is taken to the "slime house." This is a building, generally of three or four stories, where the slime starts from the top floor and, being purified in its descent, appears at the bottom as bars of silver and gold.

The "slime" is first made of a thin, mud-like consistency. It is then run into a swiftly revolving centrifugal, which has inside a forty-mesh sieve. This sieve allows all the gold and silver, some dirt and a little finely divided copper, to pass through, while it retains the wooden chips (from the racks and vats), most of the dirt and copper (as small slivers and scales). That which is retained is rejected, while that which passes through is run into a vat, where it is boiled by steam with a five per cent. solution of oil of vitrol; it is treated thus until all the copper is dissolved as copper sulphate, the solution of the vitriol being too weak to dissolve any silver as silver sulphate. This, with the gold, settles to the bottom in its elementary state. The mass is then filtered on coarse cloth or canvas filters, and then washed two or three times to free of copper sulphate and dirt. The residual silver and gold are cast into bars, which, however, contain copper and other impurities. These bars are then dissolved in sulphuric acid, the silver going into solution as silver sulphate; the gold unacted upon by acid falls to the bottom of the vat in a finely divided state. It is then gathered up, filtered and washed free of silver sulphate, etc.; it is then dried on pans, and when sufficient has accumulated is cast into bars.

The silver is recovered by putting into the solution bars of copper. The copper being more electro-positive than the silver, supplants it in the solution of the sulphate, and the free silver deposits on the copper bars. This reaction is allowed to go on until all the silver is deposited or until the solution gives no white precipitate (silver chloride) with a drop of hydrochloric acid. The free silver is then filtered and washed free of copper sulphate. It is finally dried on pans and cast into convenient bars. Thus the silver and gold are recovered.

HYDRAULIC GEARING.

Mr. Harry E. Dey, of the Dey-Griswold Co., this city, will deliver a lecture before the Brooklyn Electrical Society, on December 17, on the subject of "Hydraulic Gearing Applied to Electric Motors"

THEATRE CARS FOR BROOKLYN.

A number of theatre trolley cars are being built in Philadelphia and in Dayton, O., for the Brooklyn Heights Company, and three of them are expected in a few days. They rest on two trucks, are of the drawing-room pattern, with movable chairs upholstered in plush, and lighted and heated by electricity.

PAPER FLY-WHEELS.

The use of paper in the construction of large fly-wheels is regarded with favor. The tensile strength of paper is enormous, and it is quite possible that some large wheels will have paper rims.

"SAFETY" WIRES AND CABLES IN BOSTON.

The Safety Insulated Wire and Cable Company, New York, has made a record in Boston that is very gratifying to the management. In 1894 this company furnished the Boston Electric Light Company forty miles of lead-covered underground cable, and in 1895 one hundred miles—all guaranteed for a pressure of 10,000 volts.

The Safety company also furnished underground cables for lighting the Back Bay Fens, Boston Common and Franklin Park, and is now furnishing underground cable in Boston for the Western Union Telegraph Company, the Police Department, Holmes' Electric Protective Company, of Boston; Boston Electric Protective Association, Boston Automatic Fire-Alarm Company, the United Telegraph Company, the Boston Auxiliary Fire-Alarm Company, and the underground cables for the town of Brookline.

The Safety Insulated Wire and Cable Company manufactures seamless insulated wires and cables for all purposes, and "Requa White Core" and "Safety" wires are

·TRADE·MARK·

in every particular of the highest quality. All the company's wires and cables are made with a view to perfect safety.

Requa White Core wire, which bears the company's trade-mark, was used largely in the Boston installations. The illustration of Ajax with a coil of wire around the globe symbolizes strength and conductivity, with special reference to the Safety company's wires.

ELECTRICAL WORKERS ON STRIKE.

The Electrical Wiremen's Union, on December 6, ordered strikes in several shops in New York city in accordance with a resolution passed at its last meeting not to allow its members to work with non-union men Fifty-eight members of the union are now out, including thirty-eight who were employed by the Western Electric Company. There are some of those on strike who, it is alleged, struck in sympathy with the striking housesmiths.

Aluminum.—This metal is very ductile and can be rolled into sheets .0005 of an inch in thickness, and, if it is desired, thinner than this. It is hammered into leaf in exactly the same manner that gold leaf is hammered, and is used extensively for decorating purposes. From the leaf the metal is ground into powder, which has its uses, not only for decorating purposes in the form of an aluminum bronze paint, but is used in flash-light photographing, and also very extensively in pyrotechnical displays, burning with a very brilliant light.

BALL OF ZIMDARS & HUNT'S EMPLOYÉS.

On the night of December 16 the associated employés of the electrical firm of Zimdars & Hunt, New York, will hold their second grand annual ball at the Central Opera House, 67th street.

In the way of decorating the interior of the hall, every available nook and corner has been utilized in some tasty manner, and everything is being done in that line to make the ball one of the most attractive of the holiday season.

For the past six months or more the members have been acting in unison in the interests of the affair, each lending his individual aid where and when needed most. The good wishes of all are with them.

Of course the crowning feature of the occasion will be the electrical decorations. Already there are in course of construction many electrical designs, banners, mottoes, etc., which, when completed and installed, promise to make a beautiful display, being something never before attempted upon an occasion of this kind. All are most cordially invited to attend.

CAR-LIGHTING BY ELECTRICITY.

A party of New Yorkers, including Postmaster C. W. Dayton ex-Controller Theo. W. Myers, ex-Corporation Counsel Wm. H. Clark and ex-Sheriff Sexton, went to the Atlanta Exposition a few days ago on a special car equipped with the Moskowitz electric system of car-lighting. The car was specially built for exhibition purposes and cost $20,000.

The electric system consists in brief of a small dynamo built on the truck, the armature forming a sleeve on the axle of the car. When the car attains a speed of 10 miles an hour the dynamo generates current of the proper potential. About one half of the current is consumed by the lights; the other portion being used for charging storage batteries, which light the car when the dynamo is not in operation by reason of stoppage of the train. In a seven hours' run it is stated that enough energy is stored in the cells to light the lamps 12 hours. The current can be perfectly regulated.

This special car is lighted by 34 lamps, 17 of them of 16 candle-power, and the other 17 of 8 candle-power.

LONG ISLAND CITY STREET RAILROADS.

Details of a deal by which a syndicate of Philadelphia capitalists has secured control of the trolley railway system of Long Island City have been made public.

The five roads acquired are those of the Steinway Railway Company of Long Island City, the Newtown Railway Company, the Pike Avenue and Sanford's Point Railway Company, the Long Island and Newtown Railway Company, and the Flushing and College Point Railway Company. In addition to the railways, the syndicate has acquired the Long Island City Illuminating and Power Company.

The system comprises nearly sixty miles of trolley lines, nearly all double-tracked, including all the lines in Long Island City, its suburbs and two or three neighboring summer resorts.

The organization of a consolidated company to operate the trolley lines, under the name of the New York and Queens County Railroad Company, has been conducted entirely in Philadelphia.

The capital stock will be $2,500,000 in 25,000 shares of $100 par, and in addition, an issue of $2,500,000 five per cent. 50-year gold bonds will be made. Of these issues the company will retain $500,000 in stock and $500,000 in bonds in its treasury.

The bond issue, it is said, will be sufficient to cancel all the floating indebtedness of the five companies and provide for new equipment and extensions.

Nearly the entire amount of bonds has been subscribed in Philadelphia.

CANADIAN NOTES.

Mr. Chas. Desmarteau, Liquidator for the St. Jean Baptiste Electric Light Company, 1598 Notre-Dame street, Montreal, will sell by public auction on the 19th of December, at his office, the following lots, consisting of:—

Lot 1. All engines, boilers, dynamos, tank (45,000 gallons), machinery, belting shafts and general plant used for manufacturing and generating electricity, as well as the wires and posts, transmitters, meters, lamps, etc., used for distributing and furnishing electric light to the citizens of Montreal and suburbs, the material and stock used for repairing the lines of the company, the whole amounting in value to $343.371; the franchises, rights and privileges acquired by this company to plant poles in the streets of the city of Montreal.

Lot 2. The office furniture and fixtures, amounting to $196.

Lot 3. The book debts, amounting, as per list, to $3,456.

The purchasers of movable assets shall have to make a cash deposit of ten per cent. at the time of adjudication.

TRADE WITH BRAZIL.

The December number of *International Trade* is just out. It is devoted mainly to the Brazilian trade, and includes a paragraph on the rubber industry of Brazil. *International Trade* is published by Henry Glassford, 66 Broad street, New York.

"SAFETY" BALL.

It would be impossible to get up a more decorous ball than that of the employés of the Safety Insulated Wire and Cable Co. in the Murray Hill Lyceum, New York, on November 26. The assemblage was not only select but large, just enough to comfortably fill the hall. No effort was spared to make this, the second annual ball, a success.

The arrangements worked smoothly and a noticeable thing was the lack of the clouds of tobacco smoke so common to the general run of balls and dances, a fact which the ladies appeared to enjoy. Herbert E. Whitcomb managed the floor with the assistance of Richard Dwyer.

A large number of friends were prevented by the rain from attending, among them being Mr. L. F. Requa, general manager and treasurer of the Safety Insulated Wire and Cable Co., and family; Mr. H. F. Stevens, of the N. Y. & N. J. Tel. Co., and party; Mr. H. T. Richards and party, and others. Among the occupants of boxes were Mr. and Mrs. Wm. H. Dykeman, Mr. and Mrs. Narciso J. de Luna, Mr. and Mrs. Avery P. Eckert, Mr. and Mrs. Charles Conner, Mr. and Mrs. James Conner, Mr. and Mrs. Geo. W. Nelson, Mr. and Mrs. Jacob Kuder, Mr. and Mrs. Thos. J. Adams, and Messrs. P. A. Galvin and Robert E. Lee.

About two hundred couples attended during the evening and it was five o'clock before the last weary dancer had left, and the second grand annual ball of the employés of the Safety Insulated Wire and Cable Co. was a thing of the past.

Telephone Notes.

Griffin, Ga.—A new telephone company is being organized by the business men of Griffin.

St. Joseph, Mo.—The Missouri and Kansas Telephone

Co. have received permission to build their new exchange on 7th street, between Felix and Edmund streets, to cost $35,000.

Wausau, Wis.—The Wausau Telephone Co. and the Merrill Telephone Co. will about complete its arrangements to build a toll line between Wausau and Merrill, and it is expected that the work will be done in the spring. Cost, $1,000.

Hoquiam, Wash.—J. G. McMillian has been trying to form a telephone company to run from Hoquiam to Montosano, through Aberdeen and Cosmopolis.

Centreville, S. D.—The Iowa and Dakota Telephone Co., incorporated. Capital, $25,000. Incorporators: J. E. Tomlinson, W. A. Houts and W. A. Cottrell.

Salamanca, N. Y.—Salamanca is agitating the question of putting in a local telephone system, and a committee has been appointed to ascertain the cost, etc.

Holmen, Wis.—M. J. Vought has been in town looking over the proposed telephone line from La Crosse to Holmen.

Dodgeville, Wis.—The Southwestern Telephone and Construction Co. has been organized at Dodgeville. Capital stock, $2,000. President, Henry Halverson; Vice-President, Dr. Charles Schmidt; Secretary and General Manager, G. E. McAfee; Treasurer, John M. Reese.

Centerburg, O.—At a called meeting of the Council, the ordinance granting the franchise of the Mt. Vernon Telephone Co. was passed.

Maple Rapids, Mich.—The Crowley Telephone Co., of Maple Rapids, incorporated. Capital, $2,200. Incorporators' names not given.

Stephenson, Mich.—A company for the establishment of a telephone line, connecting Menominee with the villages of Wallace, Ingalls, Stephenson, Daggett, Talbot, Bagley, Caney and Nadeau, Menominee County, a distance of 36 miles, is being organized. Dr. Sawbridge, of Stephenson, is the chief promoter of the enterprise.

Centerville, S. D.—The Iowa and Dakota Telephone Co., headquarters at Centerville, incorporated. Capital, $25,000. Incorporators: J. E. Tomlinson, of Centerville; A. Hotz, of Parker, and W. H. Tottell, of Lemars, Ia.

Philadelphia, Pa.—Bell Telephone Co. have made application for permission to lay underground conduits on the streets of the city.

Bloomington, Ill.—Mutual Telephone Co., with a capital of $1,500, has been organized. Incorporators: E. D. Jacob and B. F. Funk.

Aberdeen, Wash.—The People's Telephone Co. is making arrangements to build a line at this point.

Kane, Pa.—W. A. Putney, representing the American Electric Telephone Co., of Kokomo, Ind., has been in Kane, interviewing the citizens on the telephone question. He proposes to equip and place in working order a local exchange.

TELEPHONE PATENTS ISSUED DECEMBER 3, 1895.

Permutation-Selector. Almon B. Strowger, Chicago. (No. 550,658).

Automatic Telephone Exchange System. James G. Smith, New York. (No. 550,728).

Automatic Exchange System. James G. Smith, New York, N. Y. (No. 550,729).

Signaling Apparatus for Telephone Switchboards. Charles E. Scribner, Chicago, Ill. (No. 550,765).

Possible Contracts.

New York City.—P. Skelly, 51 West 16th street, will erect a seven-story brick stable and storage warehouse corner First avenue and 37th street, to cost $80,000. Architect, Louis Oberlein.

Springfield, O.—Trustees of the Ohio Odd Fellows' Home have decided in favor of the erection of a $50,000 administration building, instead of a series of cottages.

Archibald, Pa.—The Father Matthew Society intends to make improvements to the hall on south Main street; the entire building will be lighted by electricity.

Windsor, Ont., Can.—W. W. Herider, of Indianapolis, Ind., will erect a brick and stone hotel and sanitarium at Windsor, to cost $50,000.

New London, Conn.—A $40,000 power-house will be erected by the New London Street Railway. Mayor Johnson.

Norwich, Conn.—A new building will be erected on Washington street. It will be erected and jointly occupied by the City National Bank and the South Norwalk Savings Bank. Work will be begun early next spring.

Terre Haute, Ind.—The Y. M. C. A. are arranging to build a $50,000 association building.

New Orleans, La.—On March 3, 1896, a 50-years' franchise for street-railway purposes, over the streets of the city, will be sold. Address Charles R. Kennedy, comptroller.

Newton, Mass.—Dr. F. E. Parker has sold his property, corner Newtonville avenue and Walnut street, to the Masonic Order. It is proposed to build a Masonic temple on the site.

Detroit, Mich.—G. I. Chiera, 18 Gratiot avenue, will erect a six-story hotel and bath-house of brick, stone and pressed brick. Cost, $100,000. Lighted by electricity and equipped with passenger elevators, etc. Architect, A. C Varney, 50 Campau Building.

Pontiac, Mich.—At meeting of the stockholders of the Pontiac and Silver Lake Railway, the question of issuing $40,000 in bonds was decided. The contract for building the car-house on Sanderson avenue has been let to August Schneider. Work will be begun at once.

St. Joseph, Mo.—The Missouri and Kansas Telephone Company will build a new exchange on 7th street, between Felix and Edmund streets. Cost of proposed structure is estimated at $35,000.

Binghamton, N. Y.—Binghamton Odd Fellows are soon to build a handsome new home. A $20,000 three-story building of brick, stone and iron is to be built on the site adjoining the Stone Opera House.

Canarsie, L. I., N. Y.—Improvements under way at Canarsie, including a two-story frame hotel, with bulkhead and sea-wall, to cost about $60,000, for the New York & Rockaway Beach Railway Company.

New York City.—The Metropolitan Telephone Company, 18 Cortlandt street, has purchased the building and lot at 17 Dey street. The site will be utilized for the erection of a ten-story building, to be connected with the corporation's building in Cortlandt street.

New Haven, Conn.—New Haven Savings Bank has had plans prepared by Brown & Von Beren for a new banking building to be erected corner Orange and Court streets. The structure will be fire-proof, costing from $75,000 to $100,000.

New Katonah (Katonah), N. Y.—Surveys are being made by the New York Central Railroad, preparatory to erecting a handsome passenger and freight depot at New Katonah.

Crebasse, Mont.—The Parkville Mining Company will make extensive improvements to their property. A five-mile flume will be constructed and a one-hundred stamp mill with a complete electric plant will be placed in operation.

Richmond, Va.—Plans have been prepared for the new Chesapeake & Ohio Railway passenger depot to be built at Richmond. The depot and other improvements will involve an expenditure of about $2,000,000, and the structure will be located on the north side of Main street.

ALBANY, N. Y.—A company to build and operate an electric railroad between Albany and Schoharie has been incorporated. Capital, $300,000.

CONTOCOOK, N. H.—The Contocook Electric Light Company has been incorporated with a capital stock of $10,-000.

NIAGARA FALLS, N. Y.—It is announced that the Niagara Falls Power Company is inviting proposals for the extension of its present wheel pit, to the full length necessary to contain seven turbines, in addition to those now installed. The next installation in this extended pit will probably be not less than 5,000 H. P. turbines and dynamos attached.

BROOKLYN, N. Y.—Rambler Bicycle Company will erect a two-story bicycle academy on west side of Flatbush avenue, north of 8th avenue, to cost $40,000.

PHILADELPHIA, PA.—Architect Seymour Davis is preparing plans for a large bicycle factory to be built at Clifton, Delaware county. It will be furnished with steam-power and heat, electric wiring and conveniences.

PHILADELPHIA, PA.—The Griswold Worsted Company will erect a large warehouse on Mill street. Darby.

Architect Seymour Davis is preparing plans for a brick bicycle factory to be built at Clifton, Delaware county, to be two stories, and furnished with steam-power and heat, electric wiring, etc.

KNOXVILLE, TENN.—An ordinance has been passed granting a franchise to the Citizens' Railway Company to extend its line in four directions.

NEW HAVEN, CONN.—O. A. Dorman, 696 Chapel street, will erect a building for the accommodation of his business. Cost from $25,000 to $30,000.

BROOKLYN, N. Y.—The Royal Arcanum Building, for the benefit of the members of the order in Brooklyn, will be erected on Tompkins avenue, between Jefferson avenue and Hancock street. The structure will be five stories high. Cost, $75,000. Charles A. Turner, Chairman of the Board.

BROOKLYN, N. Y.—C. B. Templeman & Co. will erect a three-story brick building on Fourth avenue to contain storage and lodge rooms. Cost, $75,000.

PLATTSBURGH, N. Y.—T. F. Conroy of Plattsburgh has purchased Ausable Chasm, including hotel and about 500 acres. It is expected that a trolley system will be built from Plattsburgh to the Chasm.

PHILADELPHIA, PA.—The engineers of the Pennsylvania Railroad Co. are preparing plans for extensive improvements at Germantown Junction, where the company intends to replace the present station with a handsome new structure.

New Corporations.

Philadelphia Standard Telephone and Telegraph Co., incorporated for the purpose of operating, building telephones and telegraph lines through the county of Philadelphia. Capital, $10,000. Incorporators: Richard W. Clay, John F Jencks, Nicholas Lenning, John H. Michener and others, all of Philadelphia.

DENVER, COLO.—The Salida Electric Co., incorporated to operate in Chaffee County; main headquarters will be in Denver. Capital, $50,000. Incorporators: Thomas B. Stearns, John W. O'Connor, Wm. F. Bagate, John D. Parrish and Joel W. Stearns.

BRONSON, MICH.—The Bronson Electric Co., incorporated for the purpose of manufacturing electricity. Capital, $10,000. Incorporators: H. P. Mowry, J. S. Shenemon and J. F. Werner, all of Bronson, and F. C. Rhoubottom and Wm. H. Bond, of Union City.

FORT WORTH TEX.—Fort Worth Stockyards Belt Railway Co., incorporated. Capital, $100,000. The purpose of said organization is to construct and operate a railway around the city of Fort Worth. Incorporators: C. W. Simpson, of Chicago, Ill.; H. W. Simpson and L. V. Niles, of Boston, Mass.; Walter Ross, W. E. Skinner, C. H. Silliman, Page Harris and others, of Fort Worth.

POTTSTOWN, PA.—A charter was granted at Harrisburg, November 27, to the Pottstown and West Chester Electric Railway Co. Capital, $500,000. President, John P. Robinson, of Philadelphia; Directors: Arthur C. Ash, of Trappe; A. C. Clay, of Pottstown; Henry H. Robison, of Collegeville: Forrest D. Ash, of Spring City, and Joseph F. Ash, of Trappe. Length of road will be 22½ miles and will be run from South Pottstown to West Chester.

SACRAMENTO, CAL.—Sacramento Electric Power and Light Co., incorporated to conduct a street railroad in Sacramento and also a general electric lighting business. Capital, $1,500,000. Directors: Albert Gallatin, Andrew J. Ralston, Horatio P. Livermore, Charles P. Livermore and Joshua Barker, of Oakland.

NEW YORK CITY.—The Bergmann Electric Co., incorporated to manufacture appliances to produce electricity, gas, steam or heat. Capital, $500,000. Directors: Sigmund Bergmann, 578 First avenue; Harry E. Bailey, Edwin Lavens, Philip H. Klein, Jr., and Frederick La Roche, of New York City.

Automatic Telephone Construction Co., of New York City, incorporated. Capital, $100,000. Directors: Henry H. Whitney, Silas B. Dutcher, James F. Pierce, of Brooklyn; George M. Hard, 192 Broadway, August Thalmann, R. T. Wilson, Jr., and Wm. D. Chase, of New York City; John G. Doorance, of Nyack, and James W. Hinckley, of Poughkeepsie.

NEW YORK CITY.—The Niagara Electric Chemical Co., incorporated to manufacture chemicals and chemical products in New York City. Capital, $100,000. Directors: Hamilton Y. Castner, of London, Eng.; Jacob Hasslacher, 73 Pine street, New York City; Franz Roesseler, of Perth Amboy, N. J., and Wm. A. Haman, of Mt. Vernon.

BLOOMINGTON, ILL.—The Mutual Telephone Co. has been incorporated by Doane N. Funk, E. D. Funk, Jacob Funk and B. F. Funk, to operate telephones. Capital stock, $1,500.

CHICAGO, ILL.—Meyer Storage Battery Co. has been incorporated by Fritz Meyer, E. W. Adkinson, David M. Ball. Capital stock, $50,000.

PORTLAND, ME.—National Electric Carbon & Mfg. Co., organized for the purpose of manufacturing carbon machines and carbons. Capital, $500,000. President, Wm. A. Holmes; treasurer, Charles F. Clark, both of Boston, Mass.

KALAMAZOO, MICH.—Kalamazoo Telephone Co., incorporated. Capital, $30,000. Directors: C. H. McGurin, W. A. Doyle, H. F. Hodgman and others.

FINANCIAL.

The Scranton Traction reports gross earnings for November of $26,709, an increase of $4,720 as compared with the same month of last year, and net $12,945, an increase of $3,368. For the five months ending November 30 the gross earnings were $139,374, an increase of $24,122 as compared with the corresponding period of last year, and net $72,435, an increase of $24,108.

The Partridge Carbon Co., Sandusky, Ohio, is receiving many orders for its celebrated self-lubricating motor brushes, and its facilities for production are utilized to their utmost. A good article is always staple.

New York Notes.

The Commercial Cable Company has declared a quarterly dividend of 1¾ per cent., payable January 2.

H. W. Jones, of the Electrical Supply and Manufacturing Co., Cleveland, Ohio, was in town last week, stopping at the St. Denis. W. T. H.

ELECTRICAL and STREET RAILWAY PATENTS

Issued December 3, 1895.

550,574. Electric-Arc Lamp. Thomas E. Adams, Cleveland, Ohio. Filed Mar. 14, 1895.

550,577. Electric Switch. Christoph Bach, Jr., Milwaukee, Wis. Filed Apr. 12, 1895.

550,600. Electric-Arc Lamp. Stefan Doubrava and Josef Donát, Brünn, Austria-Hungary. Filed Feb. 2, 1895.

550,615. Car-Fender. Harry M. Hill, St. Louis, Mo. Filed Apr. 2, 1895.

550,616. Cable-Railway Mechanism. Louis J. Hirt, Brookline, Mass. Filed Dec 13, 1894.

550,638. Electrical Protective Appliance. Alfred H. McCulloch, Boston, Mass., assignor to the New England Telephone and Telegraph Company, of New York. Filed Sept. 14, 1895.

550,658. Permutation-Selector. Almon B. Strowger, Chicago, Ill. Filed June 14, 1894.

550,663. Dynamo-Electric Machine for Plating. William M. Thomas, Chicago, Ill. Filed Mar. 25, 1893.

550,666. Dynamo-Electric Machine. Henry P. White, Kalamazoo, Mich., assignor of three-fourths to Charles D. Fuller, same place. Filed Jan 29, 1895.

550,670. Signal-Circuit. John V. Young, Boston, Mass., assignor to the Union Switch and Signal Company, Swissvale, Pa. Filed July 8, 1893.

550,673. Cross-Over Insulator. Frank G. Beron, Waterbury, Conn , assignor of one-half to James F. Gaffney, same place. Filed Feb. 18, 1895. Renewed Oct. 4, 1895.

550,682. Voltmeter. Frank Holden, Schenectady, N. Y., assignor to the General Electric Company, of New York. Filed Aug. 31, 1895.

550,683. Trolley-Wire Crossing. John C. Kinney, San Antonio, Tex. Filed Apr. 17, 1895.

550,684. Fender for Street-Cars. Duncan S. Macorquodale, Toronto, Canada. Filed Mar. 8, 1895. Patented in Canada July 26, 1894, No. 46,650.

550,686. Electric Cigar-Lighter. James F. McLaughlin, Philadelphia, Pa. Filed Apr. 24, 1893.

550,688. Electrotherapeutic Apparatus. Charles Palmleaf, Seattle, Wash. Filed Apr. 1, 1895.

550,692. Armature. Henry G. Reist, Schenectady, N.Y., assignor to the General Electric Company, of New York. Filed Aug. 31, 1895.

550,703. Commutator. Henry P. White, Kalamazoo, Mich., assignor of three-fourths to Charles D. Fuller, same place. Filed Jan. 29, 1895.

550,728. Automatic Telephone-Exchange System. James G. Smith, New York, N. Y. Filed Feb. 18, 1893.

550,729. Automatic Exchange System. James G. Smith, New York, N. Y. Filed Feb. 20, 1893.

550,733. Electric Safety Device. Elihu Thomson, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed May 19, 1887.

550,765. Signaling Apparatus for Telephone-Switchboards. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Apr. 16, 1895.

550,782. Method of Distributing Electricity to Electric-Lighting Systems. Charles M. Davis, Chicago, Ill. Filed Apr. 14, 1892.

550,812. Holder for Electro-plating. Elbert R. Allen, Wallingford, Conn., assignor to Simpson, Hall, Miller & Co., same place. Filed Sept. 30, 1895.

550,822. Self Winding Electric Clock. Charles M. Crook, Chicago, Ill. Filed Mar. 25, 1895.

550,823. Electric Meter. Thomas Duncan, Fort Wayne, Ind. Filed May 22, 1895.

550,841. Electrical Measuring-Instrument. Herschel C. Parker, Brooklyn, N. Y. Filed May 9, 1895.

550,860. Electric Car-Lighting Apparatus. William Biddle, Brooklyn, N. Y. Filed Jan. 7, 1895.

550,866. Electric Furnace. Frédéric Chaplet, Laval, France. Filed May 29, 1894. Patented in France Aug. 1, 1893, No. 231,902.

550,868. Automatic Electric Switch for Railways. Robert V. Cheatham, Louisville, Ky. Filed Mar. 7, 1895.

550,869. Car-Fender. Theodore Cocheu, Brooklyn, N.Y. Filed Mar. 30, 1895.

550,928. Car-Fender. Albert C. Woodworth, Providence, R. I. Filed Dec. 6, 1894.

ELECTRICAL AGE

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T. R. TALTAVALL, Secretary and Editor.
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THE ELECTRICAL AGE PUBLISHING COMPANY,
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NEW YORK, DECEMBER 21, 1895.

CONTENTS.

A MERRY CHRISTMAS.

As the next issue of The Electrical Age will not appear until after Christmas-day we take this opportunity to wish our many friends a Merry Christmas. We trust that "Santa Claus" will deal liberally with them, and that they will meet the new year with smiles and full of hope and determination to win the game next year. Merry Christmas to all!

FIRE UNDERWRITERS MEET.

The National Board of Fire Underwriters held a meeting in this city on December 10 for the purpose of revising the rules for the installation of electric wires. The particulars of the meeting have not yet been made public, but it is said that it was in part of a lively character.

"BEFORE AND AFTER" MUNICIPAL CONTROL.

An exchange gives the following table, which purports to show the cost of electric lighting in the places named before and after municipal ownership, "the 'after' service being the same as, or better, than the service it replaced." The figures rest upon, it is said, official reports and returns of municipal officers.

	Before.	After.
Bangor, Maine	$150	$48
Lewiston, Maine	182	55
Peabody, Mass.	185	62
Bay City, Mich	110	58
Huntington, Ind	146	50
Goshen, Ind	156	77
Bloomington, Ill	111	51
Chicago, Ill	250	96
Elgin, Ill	266	43
Aurora, Ill	326	70
Fairfield, Ia	387	70
Marshalltown, Iowa	125	27
Jacksonville, Fla	24	5

It is evident that the reports of which these figures are the residue, received a very severe "boiling down." The "lopping off" process might have been continued until nothing remained.

STRIKE OF TRACTION EMPLOYÉS IN PHILADELPHIA.

On the morning of December 17 the employés of the Union Traction Company, Philadelphia, went on strike, and during the first day there was considerable disorder in various parts of the city. Philadelphia despatches state that much railroad property was destroyed by mobs in different sections of the city. The strikers themselves, however, are not charged with these lawless acts. A strike of this kind in any city always gives an opportunity to evil-doers and criminally-disposed persons to do all the damage they can to the property of persons and corporations, and very frequently the strikers get the blame for the violence thus committed. As a rule the employés themselves abstain from such acts of violence; but they are compelled very often to shoulder the responsibility just the same.

In the experience of other cities in the past, under like circumstances, the railroad companies have been charged with placing the blame upon the strikers for the destruction of their property, in order to induce the authorities to take strong measures to break the strike; but it is a well-known fact that the damage is most always done by lawless persons and unorganized mobs of loafers and not so much by the strikers as is usually represented. Therefore, let the strikers have all the credit that is due them. It is said that in the present case they have good grounds for striking. They are compelled to work, it is said, 13 hours per day for 12 hours' pay, with no time allowed for lunch. Efforts were made to bring about an understanding between the contending forces in order to avoid the trouble, but without any satisfactory result, and the strike was the outcome. The Traction Company employs 8,000 persons, 6,000 of whom are on strike. At this writing the strike is still in progress, and there is talk of calling out the troops to quell the rioting and protect property, as the police of Philadelphia seem to be unable to master the situation.

THE GOLD MEDAL MOTOCYCLE.

In our last issue we referred to the award of the gold medal by the judges in the Chicago *Times-Herald* Motocycle contest to the entry of Morris & Salom, of Philadelphia. A few details of this interesting vehicle will be acceptable to our readers.

This carriage presents a handsome appearance, and at first sight one is not sure that it is not some new style of surrey. No machinery is in sight with the exception of the steering lever, and it is exempt, therefore, from the criticism generally passed on motor vehicles, that they look more like a piece of machinery than a pleasure carriage.

The carriage seats two, but is arranged to have another seat on the back. The body was built for Morris & Salom by Chas. S. Caffrey Co., of Camden, N. J.

There are two Lundell motors of nominal one and one-half horse-power capacity, each attached to the front axle with pinions on the armature shafts gearing directly into the driving gears attached to the front wheel.

The steering is accomplished by turning the hind wheels parallel with each other from a point about three inches

"ELECTROBAT" GOLD MEDAL MOTOCYCLE.

inside of the plane of the wheel and connected by a rod to a vertical lever of a convenient height to be operated from the seat of the carriage. Although at first sight it might be supposed that steering from the rear would be more difficult than steering from the front, yet as a matter of fact this has been found not to be the case, as this carriage can be moved with the slightest effort on the part of the driver and with great certainty in any direction desired, and can be turned completely around in a circle of twenty feet in diameter.

The wheels are of wood and of the usual construction, except that they are fitted with pneumatic tires and ball bearings. The driving or front wheels are forty inches in diameter, and the rear or steering wheels twenty-eight inches in diameter.

The batteries are furnished by the Electric Storage-Battery Company, of Philadelphia, and consist of four sets of twelve cells each having a normal capacity of fifty ampere hours per cell. They are grouped in boxes and so arranged that they can be readily and quickly pushed into place inside the body of the carriage, all the connections being made automatically.

The controller is a small instrument standing in a convenient position vertically in front of the seat, and is operated by means of a small hand-wheel on top. There are four speeds ahead and one backward, which are obtained by various groupings of the batteries and motors in series and parallel.

The carriage has a maximum speed of twenty miles an hour on good roads, having shown over twenty-one miles per hour on the testing machine. The capacity of the battery is sufficient to give twenty-five to thirty miles on a charge. The weight complete with the batteries is 1,650 pounds.

The introduction of electrically-propelled vehicles will open up an entirely new and immense field for the use of storage batteries, and as the Electric Storage-Battery Company of Philadelphia control all the basic patents for the manufacture and use of storage batteries, the new industry about to be formed will greatly increase the volume and magnitude of their business.

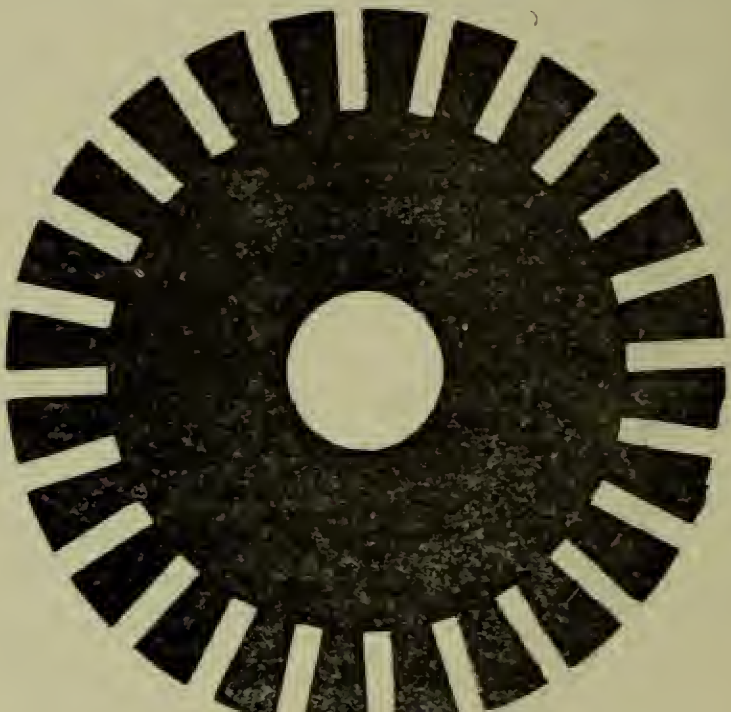
PRINCIPLES OF DYNAMO DESIGN.

BY NEWTON HARRISON, E. E.

(*Continued from page 313.*)

The deep rectangular teeth seem to be of a popular nature, if judgment may be formed from a great variety of cases. The slightly trapezoidal form is also in use, and the reasons which govern the choice of each are almost identical. In the sketch is given the proportion of teeth to circumference, and in fact the entire armature plate as used in a running machine. Should the slots be made too deep in a toothed armature, it is highly evident that the growth of heat will be too great for the radiating area allowed and the result will be a constant aggregation, possibly ending in the scarifying or scorching of the insulation.

The allowance made on any armature should not be too great, either for unused surface or exposed area. It has been usual in many cases to combine the several points of design in such a way that the limits of overload are practically confined by the armature surface allowed



PROPORTION OF TEETH TO CIRCUMFERENCE.

for the dissipation of heat. A dangerous rise in temperature will take place if the teeth generate heat. This may occur if the plates are too thick, even though the ratio of distances between slot and gap be properly observed.

A phenomenon aptly described by one dynamo builder as the "roaring" of the teeth takes place if the uniformity of the field be destroyed. The rapid oscillation, even though temporary, must be intense while it lasts, and it seems as though this were of as much importance in design as attention to any other details. One type of dynamo afflicted with the trouble mentioned became rid of it partially by slightly twisting the teeth. Arranging the grooves so that they had a definite screw twist or helical turn, allowed them to enter the field gradually and to leave it just as satisfactorily. The Crocker and Wheeler Co., to obtain the same result, use pole faces that are elliptically shaped with respect to the armature; but this it seems would invite the use of slightly more copper on the field, although the neutral space is increased a trifle and better commutation effected. The data obtained from a line of multipolar machines with toothed armatures gives the following relations:

Diam. Ins.	No. Slots.	Air Gap. Ins.	Volts.	Amp.	Speed.	Depth of Slot. Inch.	Width of Slot. Inch.
13	124	$\frac{5}{32}$	110	125	850	.593	.145
14½	110	$\frac{1}{8}$	110	175	700	.812	.160
14½	102	$\frac{5}{32}$	110	175	500	.710	.160

By examining this material with a view to establishing a parallel between practice and its required proportions as given, it will be seen that the ratios are as follows:

Width of Slot.	Air Gap.	Ratio.	Approx.
.145	$\frac{5}{32}$ = .156	29 : 31	1 : 1
.160	$\frac{1}{8}$ = .125	32 : 25	1 : .83
.160	$\frac{5}{32}$ = .156	32 : 31	1 : 1

The above may be taken as the results of such practice as the builders of heavy machinery are apt to follow; although the ratio between slot and gap was given in the ratio of 2½ : 1, these figures represented the extreme limits. The changes to be made would bring the figures of the ratio from 2½ : 1 to 2 : 1, 1½ : 1 and eventually as in the above, 1 : 1. It is essential to observe that such ratios will range from the maximum to the minimum limits according to the field strength. With a weak field the abruptness of the change would not be as severe as with a stronger and, in a sense, a more rigid field. The hum observable in machines of early design using toothed armatures is hardly perceptible in heavy General Electric and other finished types of multipolar dynamos. The depth of the slot is determined by the amonnt of wire it is supposed to receive.

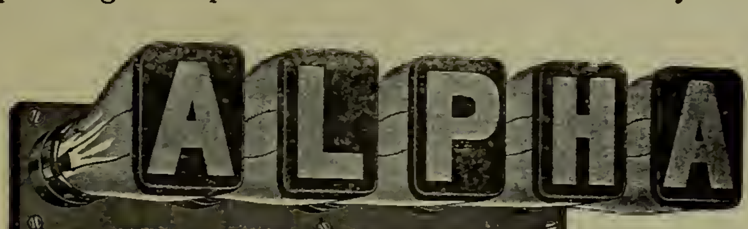
Either a wire of solid conductor, stranded conductor, or a wire cable composed of two or more separate conductors is generally employed. The simplest practice would call for the single conductor wound repeatedly around to secure the E.M.F. desired; but there are certain limitations to this, due to the fact that a solid conductor may, due to its diameter, generate eddy currents and it may resist the efforts made to mould it around the armature core. Therefore the stranded conductor or, what is practically the same thing, the cable composed of the same cross-section of copper subdivided is employed.

(To be Continued.)

THE ALPHA SIGN LAMP.

The accompanying illustration tells its own story. It represents a new idea in utilizing the incandescent lamp for advertising purposes.

The Alpha sign lamps are furnished in alphabets, each lamp being a separate letter. The letters may be ar-



THE ALPHA SIGN LAMP.

ranged and transposed by simply detaching and attaching the lamps as desired. The letters form part of the glass bulb, and are, therefore, undetachable.

This new lamp makes a low-priced sign, economical to maintain, changeable as often as desired with greatest ease and is attractive, and no doubt it will meet with a large sale.

The Dickinson Electric Supply Co., 150 Nassau street, New York city, are the dealers in the Alpha lamp.

The low price of such a sign is obvious and one of the strongest points in its favor.

THE BEERS THERMOSTATIC REGULATOR.

A brief description of this regulator, which is growing in popular favor, will no doubt be appreciated by our readers.

When cold weather arrives there is a certain amount of comfort to be derived in reading of apparatus designed to

FIG. 1.

heat our homes and places of business and maintain the heat at a comfortable point.

The principal object of all inventions of this kind is of course, to give uniform heat with the lowest consumption of fuel. Everyone knows that a great deal of fuel is need-

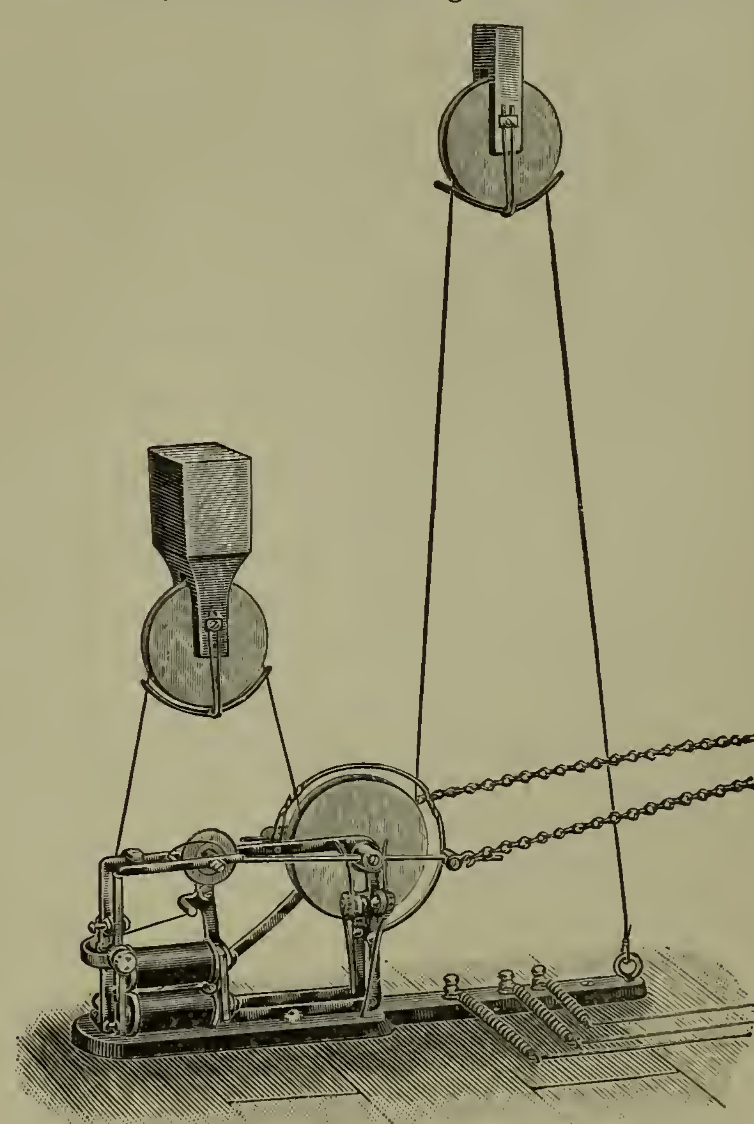


FIG. 2.

lessly wasted in heating apparatus, and if they could be made to understand the equivalent of this waste in dollars and cents, their eyes would likely stick out of their sockets like the traditional kettle-feet.

In many cases, the adoption of an automatic regulator would effect a saving of fuel consumption that would go a long way in one season alone towards paying for the apparatus.

The Beers Thermostatic Regulator is designed for the regulation of the temperature of dwellings that are heated by furnaces, steam or hot-water heaters. It is a simple electrical appliance that perfectly controls the drafts of the furnace or heater.

There are two parts to the system, the thermostat and the regulator. The thermostat (Fig. 1), which is about four inches in diameter, is placed in the living room and is connected electrically with the regulator (Fig. 2); which is placed in the cellar.

To operate the apparatus the thermostat is set at the degree of temperature desired and, as soon as the temperature reaches that point, the regulator closes the dampers and thus shuts off the draft. When the temperature falls below the given point the regulator opens the dampers, which allows the fires to burn up and thus increase the heat.

The power to operate the dampers is furnished by a weight.

By the use of this regulating apparatus the least amount of fuel is burned, giving an even temperature, and the saving in fuel increases the durability of the heating apparatus.

The steam-pressure of a boiler can as well be regulated by this system.

This thermostatic regulator is made by Beers Brothers' Electrical Supply Company, 433 State street, Rochester, N. Y.

The apparatus is giving the best of satisfaction wherever it has been installed.

ELECTRICITY IN ORGAN-PLAYING.

A meeting of the New York Electrical Society was held at the "Marble Church," 29th street and Fifth avenue, on Thursday night, December 12, when Mr. George G. Wacker, the well-known organ builder delivered a lecture accompanied by instrumental illustrations on the subject of "Electricity in Organ-Playing." The lecture touched on the following points :

(1) a. The electric action—historical sketch.
b. Different constructions of electro-magnets.
c. An organ action ; its functions.
d. The pneumatic lever ; a relay.
e. Electric action up to date.

(2) Antiphonal effects possible. Illustrated by appropriate selections.

(3) Flexibility and promptness. Illustrated by appropriate selections. "Largo," "Andante," "Allegro," "Capriccio."

Mr. Wacker was assisted by Mr. R. T. Percy, the organist of the church, who, by the kind permission of the rector, the Rev. Dr. Burrel, played the illustrative selections, and also one or two pieces, including the overture from "William Tell," thus demonstrating the perfection attained through the aid of electricity in performing on separate and distinct instruments from one key-board.

Mendelssohn's organ sonata was rendered before the opening of the meeting, and after Mr. Wacker's lecture special illustrations of the possibilities of the electric organ were given with highly artistic and musical effect. A melody was played on one organ and the accompaniment on another. The choral effects produced were exquisite and stirred the souls of the good-sized audience present, which included many ladies.

The illustrations of the flexibility and promptness of the organ were :

a. Capriccio, by Lemaigre.
b. Death of Asa, by Grieg.
c. Theme and Variations on American Air.

These were rendered with wonderfully artistic effect.

After the close of the meeting, overture "William Tell" was given.

IMPROVEMENTS IN INCANDESCENT LAMPS.

A new incandescent lamp, which has some novel constructional features, is being introduced by the Dickinson Electric Supply Company, No. 150 Nassau street, New York City.

Green's patent railway lamp (Fig. 1) has a non-vibrating filament, and is guaranteed to outlast three lamps of any other type now in use. It gives the best of satisfaction in use on electric railways, on steamboats or in factories, and all other buildings and places where there is any vibration. By means of the peculiar method of anchoring the filament has no vibration whatever, and cannot droop or come in contact with the glass in whatever position the lamp may be placed.

Fig 2. shows an illustration of Green's Patent Capless Lamp with detachable cap. This lamp is made entirely

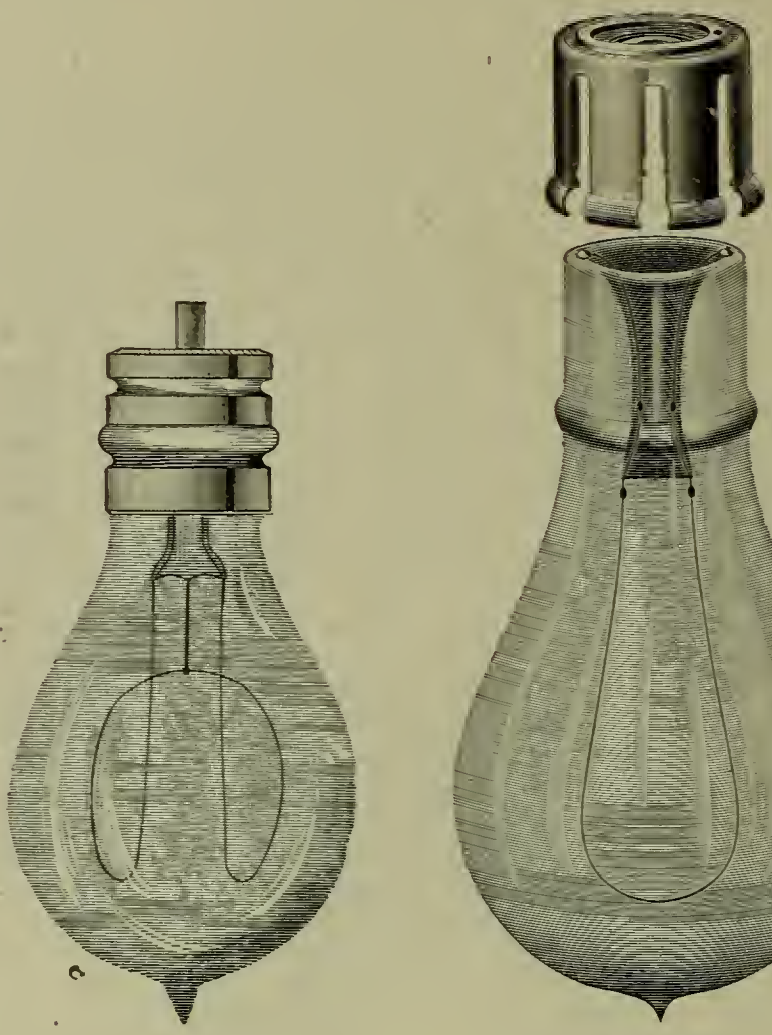


FIG. 1. FIG. 2.

of glass, in the ordinary manner, up to the point of capping.

The saving of the cap and the labor of manufacturing enables the company to sell these lamps for less money than the cost of any other first-class lamp on the market.

A sufficient number of detachable caps fitting any socket is supplied with every first order for lamps of this make, no caps being required for subsequent orders. These lamps are made for all voltages, candle-powers and bases.

The Ætna Electric Company, Hartford, Conn., are the manufacturers of these lamps and their appurtenances, and control the patents on apparatus and automatic machinery for the manufacture of the same.

Mr. Henry Green, the inventor of the lamps above described, and of other valuable electrical appliances, has charge of the construction department of the Ætna Electric Company, and Mr. C. F. Reinmann, for five years chief filament-maker of the Sawyer-Mann Company, has charge of the filament department.

The services and experience of these two gentlemen, together with the fact that only the highest grade of labor and materials are used in the manufacture of these lamps, are an excellent guarantee for the quality of the products.

PAST AND PRESENT OBSTACLES IN THE STORAGE BATTERY DEVELOPMENT.*

BY CARL HERING.

The great and numerous advantages of a satisfactory electric storage battery have been described so often and are so well recognized and admitted by the unbiassed that it seems unnecessary to again enumerate and discuss them here. The question which the engineer and constructor should discuss at present is not "Is a battery desirable?" but rather "Why is it that storage batteries seem to have been unsatisfactory?" and the question which concerns the capitalist is "Does it pay in dollars and cents to use the storage battery even if it is kept in a satisfactory condition by the makers?"

The latter question can be disposed of here in a few words. If the makers guarantee to keep the battery in a satisfactory condition for a certain rate per annum, or if they rent them, then it becomes a mere matter of calculation to find whether it pays or not; but this calculation must be made for each specific case, as the cost of the batteries and their maintenance seem at present to be such that an estimate for a general case can hardly be considered conclusive, the margin being in many cases too small. In some specific cases it will be found to be decidedly cheaper; in some it will be doubtful, and in some, decidedly too expensive. Limiting ourselves to this country and judging in a general way from the number of storage-battery installations, it would seem that the price at present (including of course the cost of maintenance) is such that in, perhaps, the majority of cases the margin of profit to the user is so small or so doubtful that it does not balance the supposed risk. The commendable practice of renting relieves the purchaser of this risk, which then leaves the question a mere matter of cost. A material reduction in the first cost and cost of maintenance would therefore at once turn the tables in many cases so decidedly in favor of the storage battery that there would be little doubt left as to the economy, and it would render the practice of renting unnecessary in most cases. Cheapness, therefore, is one of the most important points which affect the outlook of the storage battery.

To return to the first question, "why is it that strange batteries seem to have been unsatisfactory," we must limit ourselves to this country, as probably thousands of tons are and have been in successful use abroad. In Germany, for instance, almost every one of the large continuous current central stations is equipped with a battery plant; in England they are used very largely for private plants, as also for central stations; an English firm recently claimed to have sold a total of "six miles" of accumulators placed in one continuous row, and a French firm is stated to make several tons a day.

The chief reason why so few storage battery plants exist in this country seems to have been that the accumulator companies have for years been so busy fighting each other's patents, and have spent so much money in this litigation, that they have had neither time nor money left to manufacture and install their batteries. But all this litigation has now come to an end, thanks to an enterprising company which has bought up all the little life that is left of these historic "pasted-plate" patents. This, together with the fact that it is now conceded by many authorities that for many if not most purposes the unpatented Planté type of cell is the better, removes the chief obstacle in the storage battery development in this country. The fact that the companies have been too busy with litigation to attend to legitimate business has shaken the confidence of the public, who naturally ask, "where are your batteries in use;" the only and unsatisfactory answer to which is "abroad." Much "missionary work" must first be done before public confidence will be restored, and let us hope that the recently started "rental" companies will soon accomplish this. It is up-hill work, but prospects at present seem bright and encouraging.

As the patent question has now been settled and as cells of the Planté type have now been developed into practical forms, the storage-battery outlook at present lies largely in the hands of the constructing engineer, and we should therefore look at the question from this standpoint.

The storage battery has for years had the reputation of being like a delicate, sickly baby, continually threatened with half a dozen diseases, and requiring the constant attendance of a trained nurse, besides the fatherly care and large purse of its manufacturer. To the user the five chief diseases of the accumulators appear to be: buckling, short circuiting, sulphating, disintegration and dropping out of the peroxide. Many inventors have thought that most of these may be made uninjurious by a process of opposing or resisting their disastrous effects, as distinguished from preventing their occurrence, although the term "preventing" has incorrectly been used to describe it. Buckling has been opposed by main strength and sometimes awkwardness, short circuiting by porous insulating sheets between the plates, falling out, by enclosing or locking the peroxide so that it cannot drop out, etc. Whether and how far such heroic methods have been successful can be determined only by tests, but it seems to the writer that many of the methods are like curing corns by cutting oft off one's feet; the cures may be effective, but can hardly be called satisfactory. To attempt to prevent the almost irresistible force of expansion of the peroxide from exercising itself by confining the material in an elestic lead frame is a formidable and, it seems, an almost hopeless task; the inevitable result is that one or the other must give way; if it is the peroxide, it will ultimately be crumbled by the pressure; if it is the lead, there will probably be b uckling or at least a separating of the contact surfaces at the subsequent contraction of the peroxide, and this inevitably results in the formation of that very objectionable layer of white sulphate which practically insulates the active material from its conductor, the consequences of which are sure to be fatal. The development of the storage battery has been greatly retarded by the fact that it was in the hands of mechanical engineers instead of chemists.

The careful constructor should attack the problem in a different way; he should go back to the beginning to find out the prime causes, and then prevent, if possible, these causes from arising, rather than to attempt to oppose their effect by sheer force and awkwardness. These causes seem now to be understood, and the question therefore is how to prevent them. One way is to supply with each battery a printed and neatly framed long list of "don'ts" or limitations in the form of rules telling you what you must not do, with a foot note attached, saying, that the company's guarantee ceases if these rules are violated. This may be satisfactory to the company, but certainly not to the user. A more satisfactory way would be to construct the plates, if possible, so that these prime causes of trouble cannot arise, no matter what mistakes the attendant may make or what emergencies the battery may be called upon to meet—within reasonable limits, of course. To discuss all these prime causes in detail would require writing a treatise on the subject, but they may be summarized briefly and their prevention will then suggest itself.

The chief evil effects are apparently caused by too rapid charging and discharging. With many of the favorite methods of avoiding the effects of high rates, the capacity and efficiency at such rates both become so low that the user will be discouraged from discharging so fast, and the current will fall so rapidly that it will have little chance to do much mischief. Such methods are applicable only when rapid rates are never desired; but those cases are the exception, rapid rates, or at least a provision for them, being generally very desirable and often essential, as in traction work for instance; such methods have therefore solved this problem only for a limited field. What should be done is to try to construct the plates so that they are adapted to high rates without a great loss of efficiency or capacity. It will be found that in the majority of cases in

* Communication presented at the meeting of the American Institute of Electrical Engineers, New York and Cnicago, November 20, 1895, on the topic, "Storage Battery Applications."

which the storage battery would be of especial value, it is a question of *rate* rather than *capacity*, that is, a great horse-power for a short time is more often required than a large quantity of energy delivered at a slow rate: it seems from a number of cases, about which the writer has recently been consulted, that any capacity above that which is obtained at a one, two or three-hour discharge is generally of comparatively little value.

To study the effects of rapid discharges it must be remembered that the acid is as important as the lead oxides; when its density falls too low there will be a lowering of the E. M. F.; acid is withdrawn from the solution during discharge, hence the diluted acid in the fine pores of the active material must get out and denser acid must get in; but the only force which does this is the difference between their specific gravities, and as this is very small, the force will be small and therefore the circulation will be slow, which in turn reduces the E. M. F. The chemical action will therefore be confined chiefly to the external surface, which is freely exposed to the acid, and the action then becomes so great per unit of surface, that white sulphating, or better, complete sulphating, takes place. If a rapid discharge is not to injure the plates nor lower the voltage by reason of the acid in the pores becoming too dilute, the circulation must be rapid; great porosity accomplishes this partly, but is attended by frailty and poor conductivity of the peroxide, which again results in a fall of the voltage. The ideal method would, therefore, seem to be a vertical lead plate to act as a good conductor with an extremely large surface and a very thin layer of peroxide on it, freely exposed to a large quantity of acid, which is capable of circulating rapidly. That such a plate may be made to have a greater capacity per pound of plate for rapid discharges and perhaps an equal one for slow discharges, as compared with the best thick, porous plates, has been shown by experiment. The great capacity is doubtless due to the fact that the active material is more completely utilized, as it is all close to the conductor and freely exposed to the acid.

(*To be continued.*)

LIGHT WITHOUT HEAT.

BY NEWTON HARRISON.

The theories advanced by Clerk Maxwell, regarding the nature of light, have been received with a certain amount of confidence by scientists of repute. The experiments of Hertz and the ideas developed in a practical way by Nikola Tesla all tend towards the same general conclusion. There is but one created or species of insect which employ a natural means of producing this remarkable light. The processes of nature by which an object becomes luminescent and gives forth a cold phosphoric light are practically unknown. But this fact we realize, that the light with all its coldness and purity is capable of being reproduced by electric means.

The great question lies before us yet in a sense unanswered—What device can be employed to make a bright phosphorescence glow from an empty tube? If we inquire into the nature of an electric wave; if we could consider the prodigious velocity with which electricity moves, we will be inclined to believe more than ever in the possibility of having its functions exercised on matters less gross than carbon. A single impulse of electricity throws out a circle of force moving at the rate of 186,000 miles a second. Increase the impulses per second and the waves diminish in length. They at least are so affected that instead of one we have many waves per second, each separated by their proportional part of 186,000 miles. When one of these waves becomes so short as to be about $\frac{1}{10000}$ of inches in length and it be vibrated by an unceasing undulation, back and forth, then a light will gleam from it such as nature has taught the glow-worm to produce. The effect on the world at large, the saving of coal and the vastness of new enterprises which would have as their object the production of heatless light are almost too great to contemplate. A pound of coal may at present be burned in such a variety of ways, and yet with such wastefulness, that seems hard to realize. Our present machinery is, in spite of its nicety, rough and unfinished in comparison with that which later ages shall produce. The dawn of new civilization is approaching, bringing with it a new era of invention; the steam engine will disappear; the locomotive will have become a thing of the past, and by ways and means that at present few can predict, men will communicate and call upon natural forces to do work for them.

NEW BOOKS.

Receipts for Electricians, by E. Hospitalier, Paris, France. One vol., 18mo. Illustrated.

These receipts have been collected and arranged by Mr. Hospitalier and are of the most practical kind for electricians. In 1883 Mr. Hospitalier published a similar work, but the rapid advances in electrical science and the arts since that time have rendered necessary a revision of the work to bring it up to date. It contains receipts relating to glues, cements, polishes, varnishes, tools, leather belts, batteries, etc. Electro-chemistry is treated of liberally, and electroplating receives special attention. Electric conduits, electric fittings, dynamos and accumulators are also dealt with in a manner commensurate with their importance.

The book concludes with official electrical rules and regulations of interest to electricians.

The work is published in French, and the price is four francs. G. Masson is the publisher.

INTERESTING ELECTRICAL NEWS FROM WASHINGTON.

(*From our Special Correspondent.*)

Among the many bills that have already been introduced in Senate and House is one introduced by Senator Call, asking that the sum of $500,000 be appropriated for the purpose of making new and improved conduits in Washington and the District of Columbia; also for better and cheaper lights and electric appliances.

One introduced by Senator Mitchell, of Oregon, asks for an appropriation not to exceed $50,000, to be used for the purpose of constructing a military and commercial telegraphic line along the coast between Yaquina, on Yaquina Bay, and Port Oxford, to connect with Newport, on Yaquina Bay; Alsea Bay, Florence, on Sinslaw Bay; Gardiner, on the Umpqua River; Empire City and Mansfield, on Coos Bay, in the state of Oregon.

Perhaps one of the most important bills that has been introduced up to the present time is one by Senator Kyle, asking that a government telegraphic system shall be established within the United States. It names the secretary of state, secretary of war and the postmaster-general as a board who shall cause to be located and arranged four trunk lines, which will connect the northeastern, northwestern, western, southwestern and the southern parts of the United States with Washington, and that telegraph offices shall be erected and maintained where necessary along the lines.

It further provides that the government telegraph shall be carried on and operated as a part of the postal system of this country, and that the rates shall be established by the above-named board; and to be constructed and kept in repair under the direction of the secretary of war and through a corps of engineers, and shall be under the same general provisions of law as other public works of the United States. The sum to be appropriated for this work is $5,000,000. The working and operating of these lines would be under the charge and direction of the postmaster general. This act will not prohibit individuals or corporations from carrying on the business of operating telegraph lines.

A bill has been introduced to amend the charter of the "Capital Traction Company of the District of Columbia," authorizing them to lay down single or double track, with the necessary switches and turnouts, along several thoroughfares of the city.

A bill has been introduced by Senator Gorman, asking that the commissioners of the District of Columbia be authorized to permit the Standard Telephone Company of Washington and Baltimore to operate a telephone and telegraph plant and exchange in the District of Columbia; and the bill provides that the rates shall not, at any time, be more than $36 per annum for residences, nor more than $48 for business houses, and that the various departments shall not be charged more than the rate of $18 per telephone per year. A. F. T.

WIRE FLY-WHEEL.

The Mannesmann Tube Company, in Germany, has lately installed at its works a fly-wheel in the construction of which wire bears an important part.

The wheel is described as a cast-iron hub or boss, to which are attached two steel-plate disks or cheeks, about 20 feet in diameter. The peripheral space between the disks is filled in with some seventy tons of No. 5 steel wire, completely wound around the hub, the tensile resistance thus obtained being found to be far superior to that of any casting.

This huge fly-wheel is driven at a speed of about 240 revolutions per minute, or a peripheral velocity of 2.8 miles per minute, or approximately 250 feet per second, which is said to be nearly three times the average speed of any express train in the world. For such a constructed fly-wheel the length of wire is estimated at about 250 miles.

ELECTRICITY IN POWDER MILLS.

In November, 1894, the Ætna Powder Company, of Ætna, Ind., decided to install two small slow-speed generators for operating incandescent lamps on the Edison three-wire system. As these could not be delivered immediately, two second-hand machines were installed temporarily, and before the first two new ones ordered could be delivered the order was changed to two larger moderate-speed generators, with the privilege of changing them for two still larger ones. In June, 1895, the last two were ordered, together with two motors, one of one horse-power, the other of five horse-power. On August 2 the Ætna company ordered another motor of five horse-power, and on August 14 still another of the same capacity. The company having enlarged its plant during the summer found its electrical installation insufficient, and on October 12 ordered two 45-kilowatt moderate-speed generators, and two moderate-speed motors, one of 20 horse-power, the other of 30 horse-power. Thus within one year electricity had given the powder company such satisfaction that it now has 66 horse-power in motors and 93 incandescent lamps taking current from the two 45-kilowatt generators. The one horse-power and the five horse-power motors are used to drive small mixing machines in the manufacture of dynamite. The 30 horse-power motor operates a large machine used for pulverizing nitrate of soda and the 20 horse-power runs a number of machines such as the dry pan and mixing machines. The powder company found that the first 5-horse-power motor, which they substituted for a steam-engine, readily performed a duty with which the engine found difficulty in doing.

The recent gradual increase in the use of electric power in powder mills is especially noteworthy. During the past year the General Electric Company has equipped several with electric motors, and present indications point to the speedy complete elimination of the steam-engine from the operation of machinery in and about powder manufacturing establishments.

—At a cent a mile it would cost $930,000 to make a trip to the sun, and at a speed of 40 miles an hour it would take 265 years to get there.

THE PRIMARY BATTERY QUESTION.

Editor Electrical Age:—In your issue of November 2 last I noticed an article upon "Incandescent Light at Home" in which the writer shows that with a lamp now obtainable which, being of very low voltage, can be glowed to full candle-power and only consume one watt per candle, so that with four cells of primary battery an 8-c. p. lamp can be lighted for full *eight hours.* This to many will seem encouraging, but we think the degree of encouragement is far short of what has been secured. A test recently made by the superintendent of one of the prominent electric supply houses of this city shows the following result: three cells, common size, 6 x 8, were set up with charge costing as follows

Sulphuric acid..............5 cents
Mixed salts.................7 " =12 cents.

Six-volt 6-c. p. lamp glowed full *60 hours.* The cells were not exhausted, but ran an eight-inch fan at high speed for 12 hours with no additional charge of any kind. Four cells with 8-volt and 8-c. p. lamp show equal results. Freedom from waste on open circuit is equal to the best form of Fuller battery. W. H. O., New York.

NEW POSTAL CARS IN BROOKLYN.

On the afternoon of December 16 the Brooklyn Heights Railroad Company gave an excursion to several invited guests in the five new postal cars which have been built by the company for the use of the post-office authorities in Brooklyn. Among the party were Postmaster Sullivan and several other gentlemen prominent in postal and city affairs in Brooklyn. Mr. T. S. Williams, secretary and treasurer of the company, took charge of the party. A trip was made around the city to Flatbush, where a lunch was served. The party then returned to the city.

The new cars went into regular service on December 18. They were built by the J. G. Brill Co. of Philadelphia. They are 24 ft. 6 in. long inside, and 35 ft. over all. The mail compartment is 12 ft. inside measurement by 7 ft. 4 in. wide and is fitted up with the standard steam railway post-office fittings.

These cars will be run as a sub post-office, and stamps may be purchased from the postal clerks in any quantities.

The passenger compartment is also 12 ft. in length, finished in cherry and reversible Hale & Kilburn seats upholstered in spring rattan, and seat comfortably twenty passengers. Electric call-bells are opposite each seat for signaling the conductor. The platforms are 4 ft. 6 inches long with rounded dash open on one side and a large single door near the step, instead of in the centre of the car as customary. The cars are lighted by eight lights in the passenger and ten lights in the postal end, and also furnished with platform lights and electric headlights. The passenger end of the car is equipped with the Consolidated Company's electric heaters and the postal end with the Central Company's heaters. The cars are mounted on two Brill's maximum traction trucks, eight wheels under each car, making a very comfortable, easy riding car.

These cars will be used as ladies cars, and will be run upon a regular time-table between stated parts of rhe city. They are said to be the handsomest postal cars run outside of the regular steam U. S. railway post-office routes.

RUBBER PRODUCTION OF BRAZIL.

The production of rubber in the Amazon Valley during the year ending June 30, 1895, was nearly 20,000 tons, or, in actual figures, 43,612,800 pounds. The crop was about 1⅓ per cent. less than the crop of the previous year. Of this crop 56½ per cent. was shipped to the United States and 43½ per cent. to Europe.

During the past thirteen years the rubber crop of the Amazon has doubled in quantity. The greatest crop year was that ending June 30, 1894, and it will thus be seen that the crop of this year is but slightly below the greatest ever gathered. The above figures refer to the Amazon rubber, commonly called Pará. A small quantity is also shipped from Bahia and Pernambuco—about 300 tons annually—but it is of a lower grade. From Ceará about 50 tons of a still poorer quality are shipped Of this poor rubber the larger part goes to the continent, although nearly one-half is taken by the United S ates. The average price for the year of seventy cents for fine grade Pará and fifty cents for coarse, equals the total of $28,000,000, which represents the gold value of this wild product of the Brazilian forests.—*International Trade*, December, 1895.

THE PHILADELPHIA EDISON COMPANY VS. ABENDROTH & ROOT MFG. CO.

On the nineteenth of November last, a suit was begun by the Philadelphia Edison Electric Light Company, of Philadelphia, against the Abendroth & Root Mfg. Co., of New York City, to recover $34,000. A countersuit was put in by the Abendroth & Root Mfg. Co., against the Philadelphia Edison Electric Light Co., for $6,830 99. This suit was tried in the United States Court in Brooklyn, before Judge Wheeler and a jury, and a verdict has now been rendered in favor of the Abendroth & Root Mfg. Co. for the amount of the countersuit.

The Abendroth & Root Mfg. Co. are the manufacturers of the well-known Root Water-Tube Boiler, and between the years 1889 and 1891 they furnished the Philadelphia Edison Electric Light Co. with about 3,500 horse-power of boilers, these boilers being supplied on four different contracts, each of which followed the other at short intervals.

Soon after these boilers were erected and in operation in the Philadelphia Edison plant a series of troubles followed, which finally culminated in a fatal accident. This brought the matter into the Coroner's Court in Philadelphia, where, after a careful investigation by a jury of experts, a verdict was rendered acquitting the Abendroth & Root Mfg. Co., and holding the Philadelphia Edison Electric Light Co. responsible.

The troubles above-mentioned were due, as claimed by the Philadelphia Edison Electric Light Co., to bad workmanship, bad material and faulty design, and also due to the contractors failing to comply with all the articles agreed upon in their contract; and on these grounds they brought the suit just closed, in which they sought to recover $34,000, which they claimed they had spent in remedying the so called defects.

The Abendroth & Root Mfg. Co. claimed that the plaintiffs had not paid them all that was due on their orders for boilers, and also for additional material furnished to them, and on these grounds they brought the countersuit mentioned above.

The Abendroth & Root Mfg. Co. succeeded in the first place in establishing the fact that they had lived up to every article of their agreement, and had even done more than they agreed to do.

In the second place they succeeded in establishing the fact that they had used the best material obtainable in the market.

In the third place, to answer the allegation of bad workmanship, the Abendroth & Root Mfg. Co. showed by means of photographs the tools which they now use in the manufacture of their boilers, and they proved that these same tools had been used in manufacturing all of the boilers supplied to the Philadelphia Edison Co. They also showed that the Edison Co. employed unskilled labor.

In the fourth place, the Abendroth & Root Mfg. Co. succeeded in proving that the accidents were due entirely to the unreasonable handling of the boilers by the Edison Co., with the object of forcing these boilers far beyond their rated capacity, sometimes exceeding this rating by as much as 100 per cent. and over.

One of the very important matters brought to light in this case, and acknowledged by the Edison Co., was the use of extremely bad feed-water.

Another very important point established by the evidence was that an excessive forced draft was used in order to drive the boilers to the unreasonable extent to which they were used, and evidence showed that this draft was sufficient at times to support a column of water from three to four inches in height.

THE NATIONAL ELECTRICAL EXPOSITION COMPANY.

This company, under whose auspices is to be held an exhibition of electrical apparatus and appliances in New York City during May, next, has just issued its rules and regulations regarding exhibit space. This exposition will be held at the New York Industrial Building, 43d and 44th streets, Lexington avenue and Depew place, in connection with the 19th convention of the National Electric Light Association, and is endorsed by the American Street-Railway Association.

The exhibition will open on May 4th and close on May 31st.

The rules and regulations are as follows :

1. Applications for space must be made to the National Electrical Exposition Company, accompanied with remittance for 25 per cent. of space applied for, and accepted draft (on form provided) for the balance, payable April 15, 1896.

2. Applications will be received for space (including general aisles, elevators, entrances, stairways and toilet rooms). Said space will be allotted by the executive committee in a way to conform with an artistic and judicious arrangement of the exposition as decided by the management and their engineer.

3. Applications must in all cases mention the nature of the exhibit, and the executive committee reserve the right to reject any application, returning check and draft.

4. Charges for floor space of 100 square feet or over will be at the rate of $1.00 per square foot.

5. Signs, banners, etc., containing advertisements thereon will not be allowed except upon booths of exhibitors to whom they belong, and no exhibitor will be permitted to display such advertising signs or decorations beyond the line of his exhibit. No advertising signs or banners will be allowed unless approved of by the management.

6. Notification in writing must be given the management by exhibitors at least ten days before the date fixed for opening of exposition of such connections as are desired in exhibitor's booth in the nature of water, gas, electric light, power or sewerage, stating about the quantity of water to be used, number of feet of gas and number of lights or amount of power, as the case may be. All such connections to be made at the expense of exhibitors, who can contract for same direct or by special arrangement with the management. Current for special lighting or power will be furnished by city central stations, whose connections are in the building, at regulation prices.

7. The Exposition Company will furnish general illumination. Any exhibitor so arranging his exhibit as to shut off the light from his exhibit, must arrange at his own expense for interior lighting.

8. No goods will be received after the exposition has been opened, excepting such exhibits as may be unavoidably detained, which will be admitted before 9 A. M.

9. Advertising cards or samples for distribution will not be permitted except from exhibitors' booths to whom they belong, and no advertising cards or samples will be allowed except such as relate to the goods there exhibited. The management reserves the right to prohibit the distribution or display of any advertising matter that may be deemed objectionable.

10. All spaces not taken possession of and ready for exhibition by 9 A. M. of the opening day may be declared forfeited at the discretion of the management.

11. Arrangement of or changes in exhibits will not be permitted during exposition hours.

12. No exhibitor will be allowed to remove his exhibit until the exposition is over.

13. No cooking of any nature will be permitted unless by permission of the management in writing.

14. No oil stoves or any inflammable material whatever will be allowed in booths. Any wiring or construction work in connection with exhibits must be done in strict accordance with the rules and regulations of the Public Departments of the City of New York, and notice of same must be given to the management prior to starting same.

15. No nails, tacks or screws shall be placed or driven into the floor or walls, and all decorations or signs must be put up without defacing the building.

16. No signs or advertising matter of any description will be allowed displayed or distributed if same reflects injuriously on the goods of another exhibitor.

17. All differences arising between exhibitors in regard to space, advertising or articles to be exhibited shall be referred to the management, whose decision shall be final.

18. At least twenty days before the opening of the exposition every exhibitor shall submit to the management a diagram or description in writing of proposed exhibit, showing in detail, as far as practicable, the height and general arrangement of same.

19. Every exhibitor or each member of firm exhibiting and all *bona fide* attendants at booths will be allowed a single ticket of admission each during the period of the exposition, the management reserving the right to recall any such ticket issued if person to whom it is issued becomes objectionable in such a manner as to bring discredit upon the exposition. Exhibitors' and attendants' tickets are not transferable, and will be forfeited if transferred.

20. The management reserves the right to refuse admission to any exhibitor or employé for disorderly or improper conduct or any infringement of these rules, and to remove exhibit of such exhibitor.

21. Exhibitors must cart, receive, unpack and place their own goods at their sole risk and expense; also repack and remove same at close of exposition. Special arrangements can be made with the management by those exhibitors who will not be personally represented for the reception, care and placing of goods, packing and attending to shipping of same at the close of exposition. Fire insurance must be effected by exhibitors on their goods, or, on application to the management, rates will be furnished.

22. Height of platforms of booths shall not exceed ten inches, unless by special arrangement. Exhibits shall be so arrangedas not to exclude light from adjoining exhibits.

23. The exposition building will be open for the reception of goods commencing April 27th, between the hours of 7 A. M. and 5 P. M. Goods should be consigned to exhibitors to whom they belong, care of Grand Central Palace, New York. All goods will be received at Forty-third street entrance. All exhibits must be received and in place by Saturday, May 2d.

24. No space or part of same shall be sublet without permission of the management in writing, nor will any exhibitor be allowed to use his space for any other purpose than that contracted for.

Should it be impossible from any unavoidable cause, such as fire, water or the elements, to hold the exposition, no applicant for space shall have any claim whatever against the association, save and except for the return of such payment as may have been made for space.

The management reserves the right to alter the above rules or to add thereto and make such changes as will, in their opinion, contribute to the success of the exposition, and to make such changes in the arrangement of spaces and aisles as they may deem proper.

All goods must be removed within one week after the close of exposition, or they will be stored at risk and expense of exhibitors.

All exhibits, cases or packages shall be at the risk of exhibitors, the management taking every precaution to protect same by having a thoroughly disciplined force of watchmen and detectives in attendance night and day during the continuance of the exposition.

THE AMERICAN STREET-RAILWAY ASSOCIATION.

At a meeting of the Executive Committee of the American Street Railway Association held in St. Louis, December 9, the Southern Hotel was selected as the headquarters of the association during the convention.

The meetings will be held in the Olympic Theatre, across the street from the hotel. The exhibition hall has not been selected as yet, but will be in the near future.

Mr. T. C. Penington, secretary and treasurer of the association, informs us that the local committee at St. Louis is straining every nerve to make next year's convention the pleasantest ever held by the association.

Mr. Lewis, manager of the Southern Hotel, will reserve accommodations for all who apply. The hotel is large, but as there is every indication of a large attendance at the convention those intending to be present should secure accommodations as early as possible.

An interesting programme is being prepared.

New York Notes.

The Safety Insulated Wire and Cable Company, 225–235 W. 28th street, New York, is filling a large order for lead-encased and armored cables for a big brewery in Milwaukee, Wis. Among the lead-encased cables are six of three conductors each, the conductors varying in size from No. 10 to 0. The armored submarine cables are to be laid under the Milwaukee River to connect separate parts of the brewery. There are four of them, with conductors varying from No. 10 to 00. The brewery and bottling establishment cover several acres of ground.

The Wilson-Bates Electric Company, engineers and contractors for telephone systems, gas-lighting plants, bells, supplies, etc., recently opened their office at 136 Liberty street.

The Boynton Multi-Volt Battery Company, Brooklyn, N. Y., will move to the southeast corner of Greenwich and Cortlandt streets, New York.

O. Moran, manufacturer of the "Acme" Telephone, has moved to 91 Liberty street.

The executive committee of the Western Union Telegraph Company has recommended the declaration of the regular quarterly dividend of 1¼ per cent.

Telephone Notes.

Gettysburg, Pa.—R. H. Hazlitt, general manager of the Western Maryland Telephone Company, of Westminster, Md., is in Gettysburg interviewing the business people of that place, and endeavoring to establish a telephone company.

Cheboygan, Mich.—Wm. Blake, the projector on the cheap-rate telephone company in Cheboygan, has announced that he will start the construction of a new line between Cheboygan and Petosky, as soon as the weather will permit in the spring.

Rochester, Ind.—At a regular session of the council in Rochester, recently held, a franchise was granted to the Rochester Telephone Company, composed of L. M. Brackett, Joseph A. Myers, George W. Holman, R. C. Stephenson and H. A. Barnhart.

Lyons, N. Y.—The Wayne Telegraph and Telephone Company has been granted a franchise to erect poles, string wires for an electric telephone and telegraph service in the village of Lyons.

Youngstown, O.—Youngstown, Ohio, council has granted to the new telephone company a franchise.

Calais, N. B.—A long-distance telephone line is to be constructed next spring between Calais and other places in New Brunswick connecting with Boston.

Tuscola, Ill.—Douglas County Telephone Co. Incorporated. Capital, $25,000. Incorporators : John T. Todd, Joseph W. Hamilton and Geo. W. Grimes.

Indianapolis, Ind. — R. O. Hawkins, attorney for the Central Union Telephone Co., held an interview with the Board of Public Works December 6, to arrange a meeting between the officers and the board, to consider the question of putting wires underground.

Youngstown, O.—Council has granted a franchise to Morgan T. James to erect and operate a telephone exchange and use the streets of the city.

TELEPHONE PATENTS ISSUED DECEMBER 10, 1895.

Multiple Switchboard System. Theodore Spencer, Cambridge, and Thomas C. Wales, jr., Boston, Mass. (No. 551,056.)

Telephone Circuit. John S. Stone, Boston, Mass. (No. 551,060.)

Telephone Transmitter. John Goodman and Henry M. Goodman, Louisville, Ky. (No. 551, 275.)

Telephone Receiver. Alfred C. Brown, London, Eng. (No. 551,347.)

Possible Contracts.

New York City.—New York Realty Company, 54 William street, will erect a fifteeen-story brick office building at 57 and 59 William street, to cost $500,000. Architect R. S. Townsend, 1298 Broadway.

Asbury Park, N. J.—Miss M. E. Null, of the Gladstone, has purchased the Miles at Bergh street and 2nd avenue, and it is understood that a large hotel will be erected on the site.

Lakewood, N. Y.—Lakewood Hotel and Land Company, of Lakewood, incorporated. Capital, $150,000. Directors, Harry L. Moore, James S. Rilling, John C. Brady, of Erie, Pa.; C. Griffith Trusseli, of Lakewood, and James N. Marvin, of Jamestown.

New York City.—David H. King, jr., 4 West 43d street, will build an eight-story brick hotel at 514 5th avenue, to cost $150,000. Architects Howard & Cauldwell, 32 Pine street.

Nyack, N. Y.—The Nyack Hospital Association purchased ground on which to erect a hospital, on the property known as the Templeton plot, between Midland and Highland avenues.

Atlanta, Ind. — Capital stock has been subscribed for the organization of an electric-light plant at Atlanta. The capacity of the plant will be 50 lights; 30 of these will be used for street purposes.

Albany, N. Y.—Albany Insurance Company has purchased the Gladding property on State street, on which it will erect a building. Building committee is composed of John E. McElroy, Charles L. Pruyn, Ledyard Cogswell, Theodore Townsend and J. Townsend Lansing.

Salem, O.—The stockholders of the Salem Power & Light Company and the Salem Electric Railway Company will hold a joint meeting, for the purpose of consolidating both concerns. Should the consolidation be consummated, considerable improvements will be made.

Columbia, Pa.—Ashley-Bailey Company, proprietors of the silk mills, contemplate the erection of a four-story brick building, for the use of the manufacture of ribbons.

London, O.—The Council of London held a meeting and adopted plans and specifications prepared by the engineer for the proposed new electic light plant of said city. Cost not to exceed $15,000.

Philadelphia, Pa.—George W. Ruch will erect a factory building on Warnock street. Estimated cost, $10,000.

New York City.—Francis A. Clark, 1,879 Second avenue, will build a six-story factory on 95th street. Architect, Edward Wenz, 1,491 Third avenue, to cost $50,000.

Columbus, O.—Sealed proposals will be received at the office of the Director of Public Improvements, until January 4, for lighting by electricity the streets, avenues, etc., of the city, in accordance with plans and specifications on file in the office of said board, for a term of ten years from the date of the contract, that all shall be awarded under said specifications. Jared P. Bliss, Director.

Denison, Pa.—Major C. E. Mitchener, of New Philadelphia, has been granted a franchise for the proposed street railroad between New Philadelphia and Urichsville.

Greencastle, Pa.—A new electric car line is projected at Greencastle by Hugh Keogh, contractor of Lancaster, Samuel A. Miller and Edward Saxman, of Latrobe, and some Pittsburgh capitalists.

New Corporations.

Zanesville, O.—The Ohio Drake Telephone Co. of Zanesville ; incorporated. Capital, $10,000. Incorporators' names not given.

McKee's Rocks, Pa.—McKee's Rocks Electric Light Co. of Allegheny County has been chartered. Capital, $20,000. Incorporators' names not given.

Farmington, Ia.—The Farmington Telephone Co. ; incorporated. Capital, $1,000. C. P. Paisley, W. F. Thero, G. H. Noff. Mrs. E. H. Rockwell. The object is to establish and operate a telephone exchange.

Elizabeth, N. J.—Mutual Investment Co. has been organized in Elizabeth. Its purpose is the placing of electric light plants, railways, etc., in Mexico and Central America. John W. Rehill, Wm. F. Stryker and James P. Powers are the promoters.

New York City.—The Pacific Cable Co. ; incorporated. Capital, $100,000. To run its own or leased wires from New York to California, etc. Capital, $100,000. Directors : Edmund L. Bayliss, H. L Leroy, C. D. Wetmore, G. A. Mills, Montclair, N. J. ; J. M. Robertson and W. N. T. Hughes, 55 Pine street, New York city, and F. L. Allen of Pelham Manor.

Brooklyn, N. Y.—The Brooklyn Bridge, Prospect Park & Eastern Railway Co. of Brooklyn, incorporated to run a street-surface electric road about 45 miles in length in the city of Brooklyn. Capital, $500,000. Directors : A. M. Brady of Albany, J. R. Pettit, Fred S. Flower, Edward Brown, G. M. Curtis, jr., 32 Nassau street, all of New York city, and others.

Port Jervis, N. Y.—Port Jervis Electric Street-Railway Co. ; incorporated to operate a road in Port Jervis, seven miles in length. Capital, $70,000. Lafe Pence and George N. McGichon of New York, S. D. Lake, Gus Elston, J. E. Wichham, J. S. Marsh and others of Port Jeervis.

Syracuse, N. Y. — Syracuse Gas Co. ; incorporated to manufacture both gas and electricity for light, heat and power in Syracuse, and the cities and towns within the State. Capital, $2,500,000. Directors : Robert C. Pruyn, of Albany ; Stephen Peabody, Emerson McMillan, Henry Seligman and A. C. Humphreys, 66 Broadway, New York city ; Wm. B. Elkins, jr. of Philadelphia, Pa ; Hamilton S. White of Syracuse, and others.

Ramona, Cal.—The San Diego & Back County Telephone Co.; incorporated. Capital, $2,500. Waldo S. Waterman of San Diego, J. E. Gedvey of Masa Grande, J. A. Berlagne and George A. Telford of Romana, and others.

Topeka, Kan.—A company has been organized at Topeka to build a telephone line from Salina to Kansas City. Capital, $100,000. President, A. K. Rogers; Vice-President, Simon Greenspan of Topeka; Secretary, C. W. Glick of Atchison.

Parry Sound, Ont.—Parry Sound Electric Light Co. Incorporated. Capital, $20,000.

Vancouver, B. C.—Western Light, Heat & Power Co. Charter applied for. Capital, $150,000. Object, general electrical business. Promoters: C. D. Crandell, J. E. W. McFaren, Geo. M. Cowan and Wm. T. Steward.

Boston, Mass.—National Electric Carbon & Manufacturing Co. has been incorporated, with William A. Holmes, president, Boston; Charles F. Clark, treasurer. Capital stock, $500,000.

Bronson, Mich.—Bronson Electric Co. has been incorporated by H. P. Mowry, J. S. Shonemen, J. F. Werner, Bronson; F. C. Rheubottom, Wm. H. Bond of Union City. Capital stock, $10,000.

Corry, Pa.—A charter has been issued to the Corry Street Railway Co. Capital, $25,000. Directors: J. P. Jefferson, G. L. Sill, R. F. Van Doorn, Charles B. Ayers, S. J. Franklin of Warren; president, Manly Crosby.

Elizabeth, Pa.—A charter has been granted to the Pittsburgh & Monongahela Traction Co. Capital, $12,000. M. D. Bulger, of Brownsville, president. The line will begin at West Elizabeth and run through the streets of Elizabeth and West Elizabeth.

Pittston, Pa.—A charter has been granted to the Pittston People's Electric Co. Capital. $50,000. President, Joseph H. Glennon of West Pittston.

THIS IS NEWS.

A one-half horse-power alternating-current motor has just been received by N. M. Garland, 112 Liberty street, New York. This is the second machine made by the Emerson Electric Co., for which Mr. Garland is agent. This motor will start instantly with a heavier load than it is intended to carry permanently. It starts as a series motor and, after attaining full speed and getting into synchronism, it runs as an induction motor and will carry a full half horse-power.

ELECTRIC LIGHTING AWARDS IN NEW YORK.

The gas commission has awarded contracts for lighting the streets of New York City during 1896. The electric lighting contracts awarded are as follows: Brush Illuminating Company, 720 lamps at 40 cents a night and 92 at 45 cents; Madison Square Electric Company, 312 lamps at 40 cents and 10 at 50; Mount Morris Electric Light Company, 361 lamps at 40 cents; Harlem Electric Light Company, 212 lamps at 40 cents and 19 at 50; Manhattan Electric Light Company, 241 lamps at 40 cents; Edison Electric Light Company, 165 lamps at 50 cents.

Steps were taken with the object of having subways constructed on the east side of the city, in order to extend the electric light in that section.

JERSEY CITY LIGHTING CONTRACTS.

The Jersey City Board of Street and Water Commissioners has awarded the contracts for lighting the city for the fiscal year which began December 1. The entire cost for the year will be $104,000. The People's Electric Light and Power Company of Newark will furnish 340 arc lights at $90 each per annum; the Hudson County Electric Light Company 360 arc lights at $110 each; the New York and New Jersey Globe Gas-Light Company 1,000 oil lamps at $20.96 each, and the United Gas Improvement Company 550 gas lamps at $19.50 each.

FINANCIAL.

The Bridgeport Traction reports gross earnings for November of $24,427, an increase of $6,729 as compared with the same month of last year, and net $10,095, an increase of $1,775.

The Edison Electric Illuminating Company of New York reports gross earnings for November of $179,599, an increase of 6,755 as compared with the same month of last year, and net 90,755, a decrease of 1,739. For the eleven months ending November 30 the gross earnings were $1,658,976, an increase of $165,691 as compared with the corresponding period of last year, and net $779,189, an increase of $82,746.

The Edison Electric Illuminating Company of Brooklyn reports gross earnings for November of $77,728, an increase of $27,709 as compared with the same month of last year, and net $38,143, an increase of $10,933. For the eleven months ending November 30 the gross earnings were $541,398, an increase of $167,668 as compared with the corresponding period of last year, and net $197,411, an increase of $35,111.

CALENDARS.

The Knowles Steam-Pump Works, 183 Devonshire street, is one of the first concerns in their line to issue a Calendar for 1896. It is to hang on the wall, and in the centre of the sheet is a beautifully colored portrait of Diana.

A FINE BALL.

The employés of Zimdars & Hunt held their second grand annual ball at the Central Opera House, New York, on the night of December 16, and it was an immense success. A large number of prominent electrical people were present, and a very enjoyable time was had. The electrical display on the stage and about the hall was magnificent. The columns were festooned with colored incandescent lamps, and disposed about the hall and stage were the American flag, shields and other devices worked in colored lamps. Several hundred couples were present. We will give fuller details of the ball in our next issue.

Trade Notes.

The American Signal and Power Company, Lumber Exchange, Minneapolis, Minn., is doing a good trade in the manufacture of automatic electrical annunciators, electric bells, non-infringing telephones and small electric motors.

ELECTRICAL and STREET RAILWAY PATENTS

Issued December 10, 1895.

550,956. Carbon-Holder for Arc Lamps. Hugh J. Farley, Philadelphia, Pa. Filed Dec. 15, 1894. Renewed Oct. 7, 1895.

550,959. Electric Clock. Benjamin Franklin, Chicago, Ill., assignor of three fourths to David H. Fletcher, George H. Merriell, and Calvin R. Beach, same place;

Mary A. Franklin, administratrix of said Benjamin Franklin, deceased. Filed Apr. 1, 1893.

550,965. Electrical Conduit Railway. John D. Griffen, New York, N. Y. Filed Dec. 5, 1892.

550,982. Harmonic Selective Signal for Party Telephone-Lines. James A. Lighthipe, San Francisco, Cal. Filed June 24, 1895.

551,020. Electromagnet. Samuel T. Wellman, Upland, Pa., assignor of one-half to Charles H. Wellman, same place. Filed April 18, 1894.

551,021 Electric Rail-Bond. William H. Wiggin, Worcester, Mass. Filed May 22, 1895.

551,029. Electric-Arc Lamp. William J. Davy, London, England. Filed Apr. 19, 1895.

551,032. Cleat for Electric Wiring. James K. Hemphill, Akron, Ohio. Filed Sept. 26, 1895.

551,033. Commutator-Brush. Robert Hirsch and Herman Meminger, Milwaukee, Wis. Filed Jan. 28, 1893.

551,046. Electric-Arc Lamp. Frederick N. Pike, New York, N. Y.. assignor to himself and Edward N. Dickerson, same place. Filed June 27, 1894.

551,053. Electric Controller. Sidney H. Short, Cleveland, Ohio. Filed Aug. 26, 1895.

551,054. Electric Controller. Sidney H. Short, Cleveland, Ohio. Filed August 27, 1895.

551,056. Multiple-Switchboard System. Theodore Spencer, Cambridge, and Thomas C. Wales, Jr., Boston, assignor to the American Bell Telephone Company, Boston, Mass. Filed Mar. 18, 1895.

551,060. Telephone-Circuit. John S. Stone, Boston, Mass., assignor to the American Bell Telephone Company, same place. Filed July 6, 1895.

551,090. Signaling Apparatus. Bernice J. Noyes, Boston, Mass., assignor to George W. Gregory. same place. Filed Sept. 11, 1889.

551,145. Switch for Underground Electric Railways. Alfred Rosenholz, San Francisco, Cal., assignor of one-half to Samuel J. Clarke and Harvey S. Brown, same place. Filed Apr. 12, 1895.

551,168. Trolley. David Lippy, Ira E. Finfrock, George A. Rinehart, and David R. Francis, Mansfield, Ohio. Filed Sept. 24, 1895.

551,169. Trolley. David Lippy, Ira E. Finfrock, George A. Rinehart, and David R. Francis, Mansfield, Ohio. Filed Sept. 24, 1895.

551,170. Switch for Electric Plants. Austin H. Lucas, Pittsburgh, Pa. Filed Jan. 4, 1895.

551,192. Telegraph-Relay. Archibald D. McDonald, Melbourne, Victoria. Filed Nov. 2, 1894.

551,197. Car-Fender. Frank B. Scaife, Philadelphia, Pa. Filed Sept. 4, 1895.

551,203. Electric Switch. John E. Criggal, Springfield, Mass. Filed Jan 15, 1895.

551,210. Automatic Brake and Safety-Fender. John Kurtz and John G. Kurtz, Moore, Pa. Filed Mar. 21, 1895.

551,217. Car-Fender. Patrick Long, Philadelphia, Pa. Filed July 18, 1895.

551,230. Composition of Matter for Insulating Purposes. Rufus N. Pratt, Hartford, Conn., assignor to the Johns-Pratt Company, same place. Filed Oct. 31, 1889.

551,231. Car-Fender. William Purling, Philadelphia, Pa., assignor of one-half to Aaron E. Kemper, same place. Filed Aug. 31, 1895.

551,241. Car-Fender. Henry T. Vaders and Harper F Smith, Philadelphia, Pa.; said Vaders assignor of two-thirds to said Smith. Filed Aug. 2, 1895.

551,244. Electric-Arc Lamp. William P. Wiemann, Washington, Pa., assignor of one-third to H. P. Chambers, same place. Filed Apr. 17, 1895.

551,263. Anti-sparkle Commutator Compound. John R. Davis, New Iberia, La., assignor of one-half to Margaret M. Davis, same place. Filed May 30, 1895.

551,275. Telephone-Transmitter. John Goodman and Henry M. Goodman, Louisville, Ky. Filed June 14, 1895.

551,284. Electric Sunshine-Annunciator. Leonard Hunt and Frederick W. Duenckel, St. Louis, Mo. Filed May 20, 1895.

551,326. Reversible Car-Seat. William N. Norcross, Philadelphia, Pa. Filed Oct. 4, 1894.

551,328. Car-Fender. Samuel B. Willis, New York, N.Y., assignor to Michael C. Murphy, same place. Filed Apr. 15, 1895.

551,334. Electric Railway. Robert Lundell, Brooklyn, assignor to the Johnson Subtrolley Company, New York, N. Y. Filed June 9, 1894. Patented in England July 17, 1894, No. 13,765; in France July 17, 1894, No. 240,115; in Italy Aug. 20, 1894, No. 271; in Spain Aug. 28, 1894, No. 16,075; in Austria Feb. 15, 1895, No. 525, and in Germany July 26, 1895, No. 84,206.

551,337. Electrode for Arc Lamps. Thomas G. Portis, St. Louis, Mo. Filed May 14, 1895.

551,347. Telephone-Receiver. Alfred C. Brown, London, England. Filed July 11, 1865.

ELECTRICAL AGE

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NEW YORK, DECEMBER 28, 1895.

CONTENTS.

A HAPPY NEW YEAR.

THE ELECTRICAL AGE wishes all of its readers and friends a happy new year. It hopes the entire year will be one of prosperity and happiness. This is a great deal to hope for, but that does not deter us from expressing the wish. You may be one of fortune's elect in 1896. May it be so!

BROOKLYN'S LARGEST TAXPAYER.

The Brooklyn Heights Railroad Company, a few days ago, paid to the city of Brooklyn $207,528.11 in taxes on its real estate and tracks. This payment, together with the taxes to be paid on the real property of the Brooklyn, Queens County and Suburban Railroad Company, makes the Long Island Traction Company, which controls all these properties, the largest taxpayer in the city of Brooklyn.

TELEGRAPH CABLE TO CUBA.

A bill has been introduced in the United States Senate providing for the laying of a submarine telegraph cable between the United States and Cuba by a private corporation.

The company is organized under the laws of New York, and asks for authority to lay its cable through the waters controlled by the United States and make a landing on the coast. It agrees to complete the work within two years, and asks, as an indirect subsidy from the government, a contract to carry any and all government messages at the rate of $25 per nautical mile per annum, without additional charges of any character.

END OF THE PHILADELPHIA STRIKE.

The motormen and conductors of the Union Traction Company, Philadelphia, who struck on December 17, on the night of December 23 accepted the company's proposition and returned to work. The men struck for a working day of ten hours, $2 per day, and the recognition of the Amalgamated Association of Street-Railway Employés. The company would not recognize the organization as a medium of conducting negotiations between itself and its employés, though it had no objection to the employés belonging to the association. A committee of the employés conducted the negotiations with the company. The result is viewed in two opposite aspects; one that it is a substantial victory for the men; the other that it is the company's victory. The strike cost the Philadelphia business houses $2,500,000 in lost Christmas trade, and the president of the traction company is blamed for this loss in not according the men an earlier privilege of presenting their case.

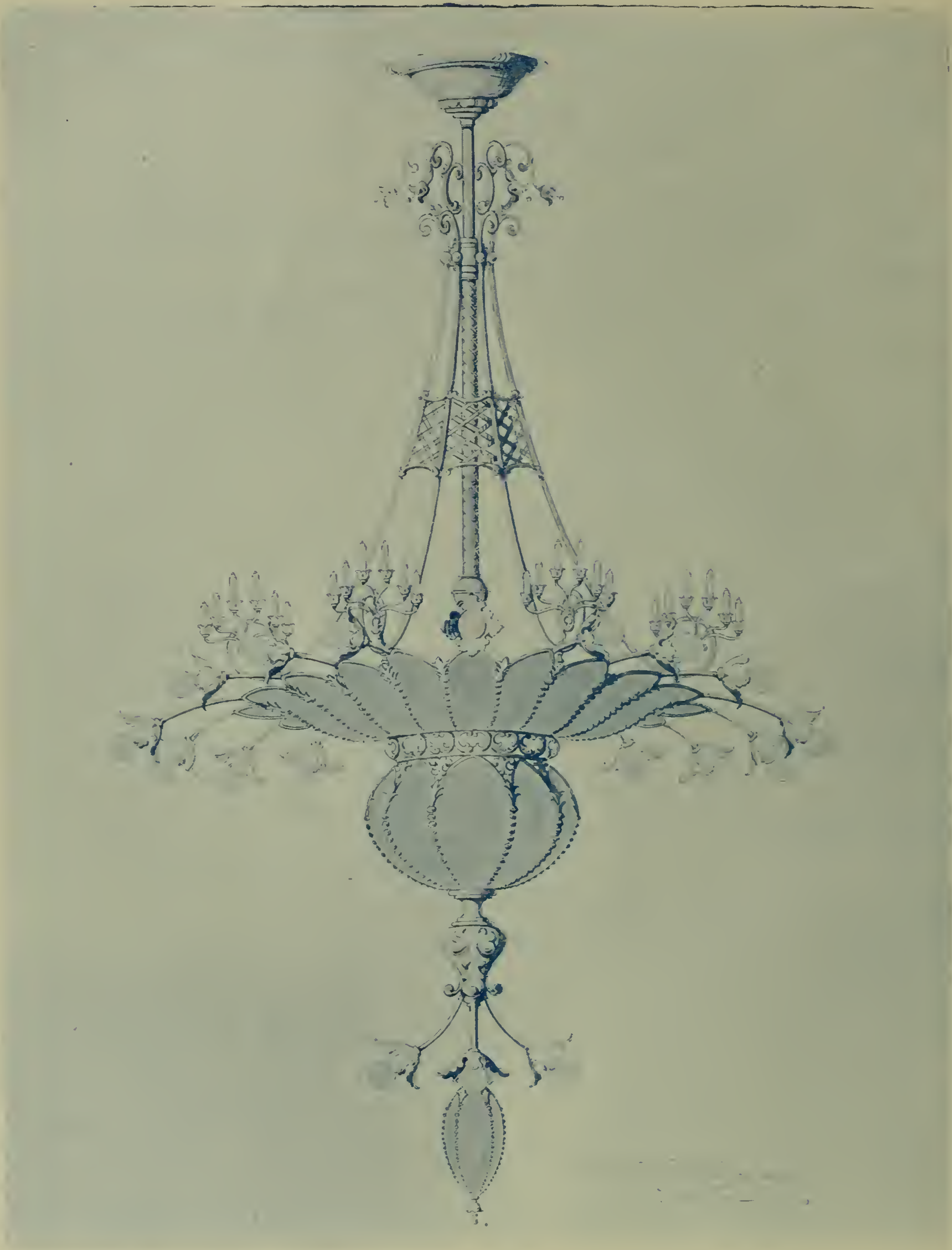
HAD ENOUGH OF MUNICIPAL CONTROL.

Municipal control of electric light plants is a very attractive subject when considered prior to experience, but after experience has been had the idea loses many of its charms. In almost every issue we have occasion to refer to nibbling and biting of the alluring bait on the part of some place or another, where the municipal control idea prevails, and all looks lovely. After a season's experience the taxpayers begin to kick at the cost of their light and then the music begins. Brainerd, Minnesota, has had some experience in controlling its own electric light plant, and now the city council recommends that the question of the sale of the city plant be submitted to a vote of the electors of the city. The council approves of the proposition. The recommendations state that "the ownership of the plant by the city has not proven profitable to the city, and without criticising anybody, we must say the service has been poor and not entirely satisfactory," and, further, "we may be reasonably certain that we shall get better service if the plant is sold." In this connection it is interesting to note that Brainerd has a fine water-power, and it has cost the city practically nothing for power to run the dynamo.

AN ELEGANT ELECTRIC-LIGHT CHANDELIER.

The adaptation and distribution of electricity for decorative and lighting effect is finely exemplified in the fixture illustrated herewith. It is one of the creations of the W. C. Vosburgh Mfg. Co., Limited, the well-known fixture manufacturers of Brooklyn, N. Y., and Chicago, Ill. This fixture is one after the design of which four have been made and furnished for the new Montauk Theatre in Brooklyn. In fact, all of the lighting fixtures in this playhouse, which is one of the most thoroughly equipped and handsomely appointed in the country, have been supplied by the W. C. Vosburgh Mfg. Co., Limited.

As will be seen, this fixture is intended for use either with gas or electricity, or both, but the electric part of lighting fixtures is the predominating feature nowadays. This in time will tend to supplant gas, as it is the experience of the W. C. Vosburgh Mfg. Co., Limited, as with other manufacturers, that their orders for electric fixtures almost treble those for use with gas alone, although their trade in the latter is large. They have been doing an ever-increasing business in the electrical line, and were it not



ARTISTIC ELECTRIC LIGHT FIXTURE.

fixture is made up in what is known as the rococo style, the principal feature of which is that all lines seem to be drawn at variance while the ensemble is brought into a tasteful and pleasing design. The central part of this fixture is made up with art-glass effect through which electric lights are made to reflect, giving a highly artistic as well as pleasing and satisfactory effect to the eye.

for the fact that the depression in business during the past few years has heightened competition to a very great extent, necessitating lowness of prices, they would have every cause for congratulation. As it is, however, their capacity for manufacturing has been and is taxed to the extreme, and they are doing a highly satisfactory businesss as to volume of orders received. They are looking forward to a general business revival, when they trust people will feel more liberally disposed and willing to pay prices for goods adequate to their value. They are prepared to meet any and all legitimate competition, nevertheless, and willing at any time to give estimates on special or regular work. As an evidence of their success in competition is the fact that during the past year they have taken the orders for fixtures required for twenty-eight churches, besides many other large buildings, and they have received nothing but flattering praise for the satisfactory manner in which they have executed every contract. They invite the inspection of the trade and the public generally to their goods, and are ever ready to welcome all interested parties to their show-rooms, where they have a large and finely assorted stock of goods on exhibition from the very cheapest to the most expensive.

MEDICAL BATTERIES.

Some of the various styles of medical coils handled by Stanley & Patterson, 32 & 34 Frankfort street, New York, are described and illustrated below.

Fig. 1 shows the "Eclipse" Graduated Medical Coil. It is very compact, but complete and powerful. It is supplied with a scale with units graduated from 1 to 100. By means of this scale the relative strength of the current can be readily ascertained, enabling a person to take the same strength of current each time. The "Eclipse" is a hand-

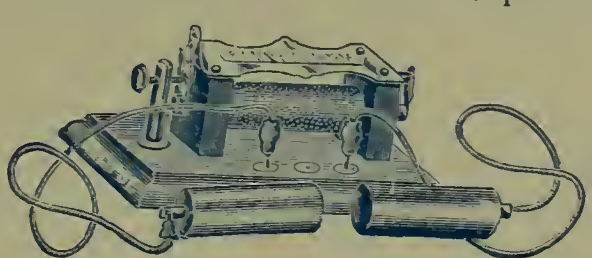


FIG. 1.

somely finished instrument, and one of the best obtainable for the money.

"The Standard" Double-decked Medical Battery is shown in Fig. 2. The battery used is of the best dry form, and the strength of the various currents from that so mild as to be scarcely perceptible, to the most powerful that can be

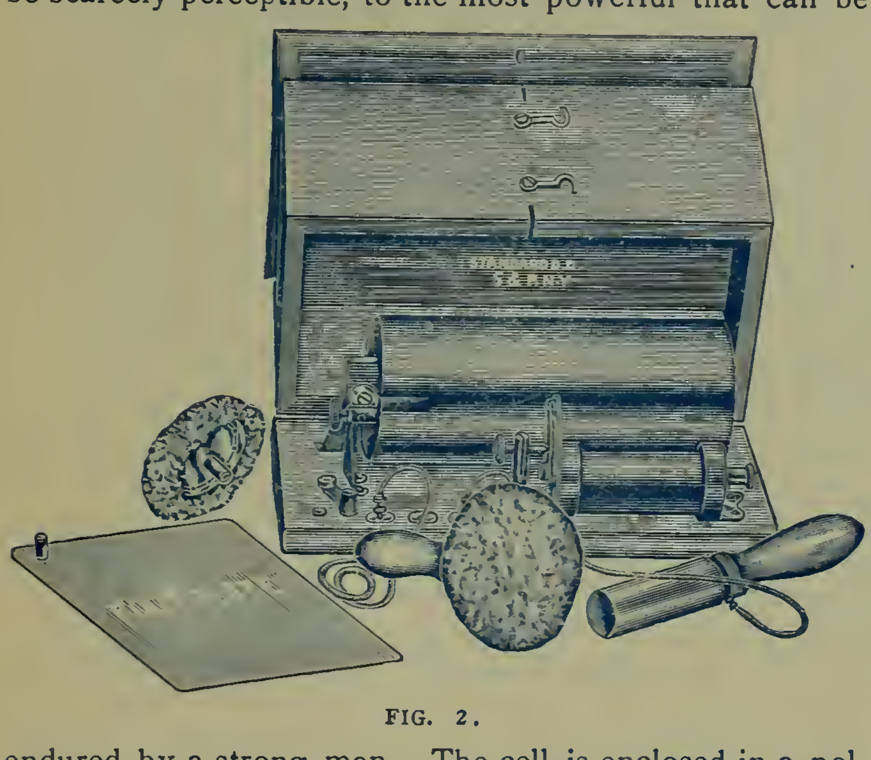


FIG. 2.

endured by a strong man. The cell is enclosed in a polished nickel tube, and furnishes three currents—Primary, Secondary, and Primary and Secondary combined, any one of which may be varied at will by the movement of the small inner tube. This apparatus is compact and portable, and this feature makes the battery one of great convenience for physicians to carry about. The cabinet is furnished either in mahogany or antique oak, finished in the best manner.

Fig. 3 shows "The Standard" Single-deck Medical Battery, which is of the same general design and appearance as the doube-deck machine just described, with the exception that no separate compartment is provided for the electrodes which go with the instrument.

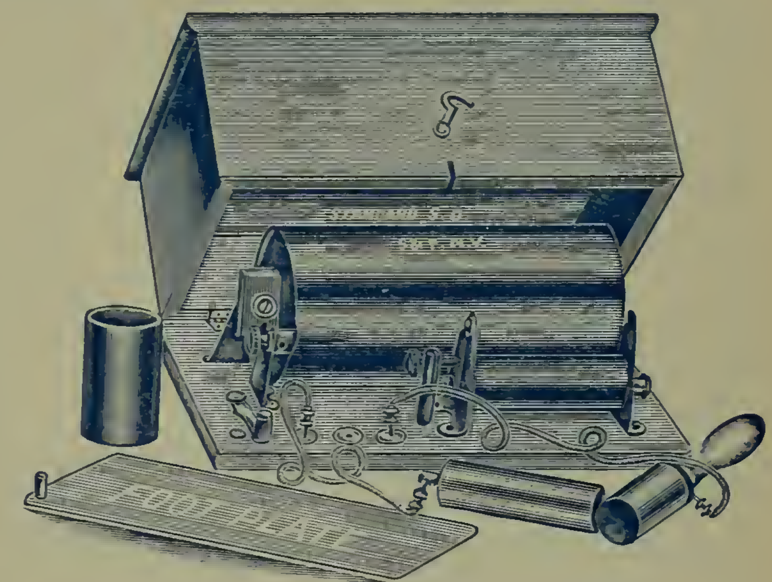


FIG. 3.

"The Diamond" Medical Battery (Fig. 4) has all the advantges of the Standard Double-deck instrument in the way of portability and freedom from acids and liquids of every description, and while smaller than the Standard it is capable of giving an equally powerful current. The battery cell is located directly under the coil and can be readily removed when exhausted. An automatic device is provided, which promptly shuts off the current when

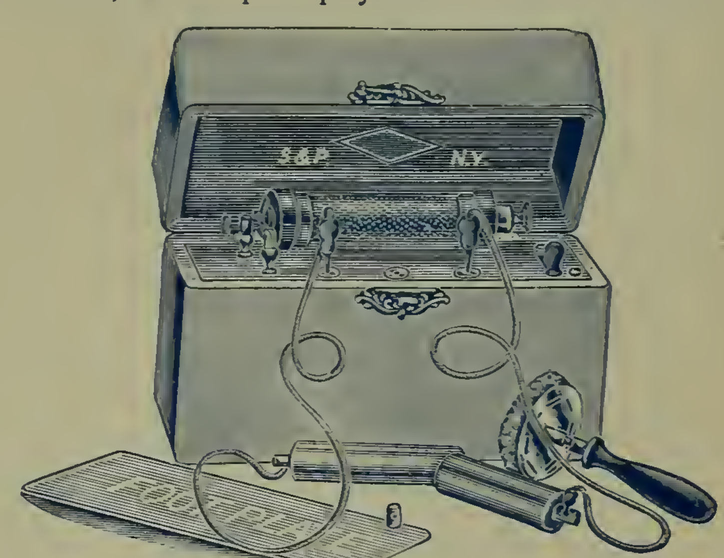


FIG. 4.

the case is closed, thus saving the battery should the operator neglect to turn the switch. The cabinet is of highly polished mahogany, with locked corners, and all trimmings are of nickel.

REPORTED SALE OF THE MONTMORENCY PLANT.

The Montmorency Light and Power Co., Quebec, has sold its business and franchises to the Electric Street Railway Company, of that city. The stockholders of the first-named concern, on December 11, voted to accept the proposition for the sale of their interests. It is stated that the new company will be capitalized at $2,500,000, and that New York and Baltimore capital will enter largely into the scheme.

The Montmorency Light and Power Co. operated the water-power plant at Montmorency Falls, 23 miles below Quebec, and supplied the city with all of the current necessary for street and private lighting and power purposes. This plant was fully discribed in THE ELECTRICAL AGE of August 10, 1895.

THE OKONITE COMPANY, LTD.

Okonite has been a record-breaker during 1895. Notwithstanding the general dullness of trade the Okonite Company, Ltd., New York, has done well, and Okonite wires and cables are household words in the trade. The mere mention of the name is "catching," and it seems as if there were some subtle influence in the word "Okonite," judging from the triumph it has scored.

TESTING ROOM AND LABORATORY, OKONITE CO.'S FACTORY.

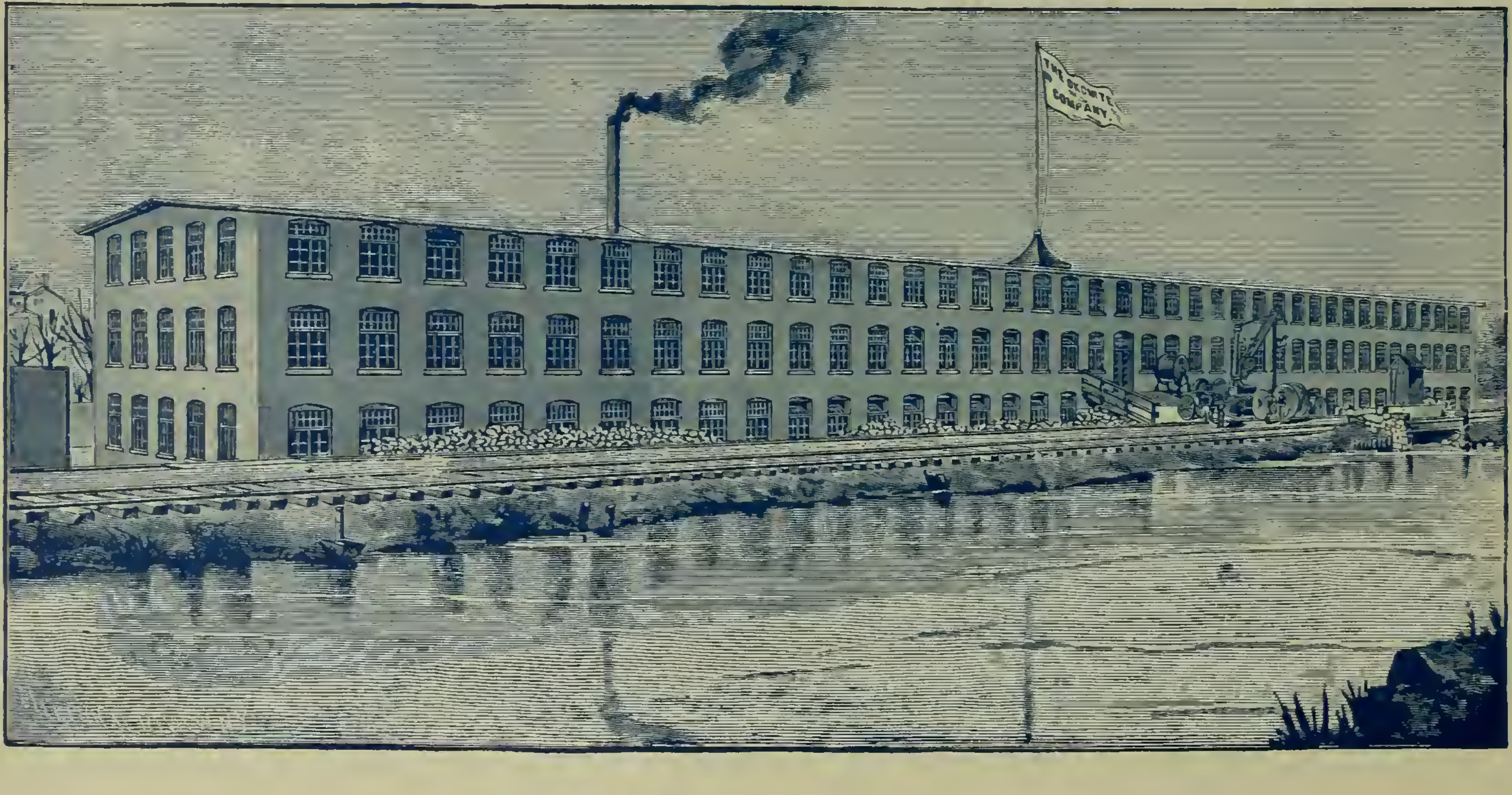
The Okonite Co., L'td, received the World's Fair award for rubber-insulated wires for electric lighting. It also received the award for lead-covered cable for underground electric-light service.

The excellence of Okonite goods is constantly maintained, and its merits are well-known and established in the trade.

The word "Okonite" refers to the insulating compound used by the company. This composition has superior insulation, durability, toughness and resistance to the decomposing influence of the elements. The Okonite is vulcanized after being put in position upon the wire, and by an ingenious method of manipulation it takes a firm and even finish. Wires and cables of all sizes may be insulated with any thickness of Okonite, according to requirements. The company's factory is located in Passaic, N. J. It is a very large building, and is complete in its equipment for the business for which it is used. The wires and cables are very carefully and accurately tested for conductivity and insulation, and they must come up to the company's high standards before they are permitted to be put upon the market.

A view of the testing room is given herewith. The instruments used in this delicate work are the finest made, in order to attain the most accurate results, and it is through this care of details that has given Okonite wires and cables the reputation which they bear.

The tenacity and toughness of Okonite, rendering it non-liable to destruction by reason of abrasion or rubbing, and the fact that it is not susceptible to extreme ranges of temperature, have made this insulating substance highly popular among users of electrical supplies, and the company has the highest endorsements of its value from many of the largest users of insulated wire, here and abroad. Okonite wire has been subjected alternately to a temperature of 20° below and 350° above zero, the result showing no apparent change in the quality of the insulation. Okonite or "Manson" tape is another product of the Okonite Company, that is indispensable to every wireman and electrician. It gives a wire joint as safe insulation as Okonite itself, and is in universal use in the electrical trade. A general view of the Okonite Company's offices at 13 Park Row, New York City, is given in one of the accompanying illustrations.



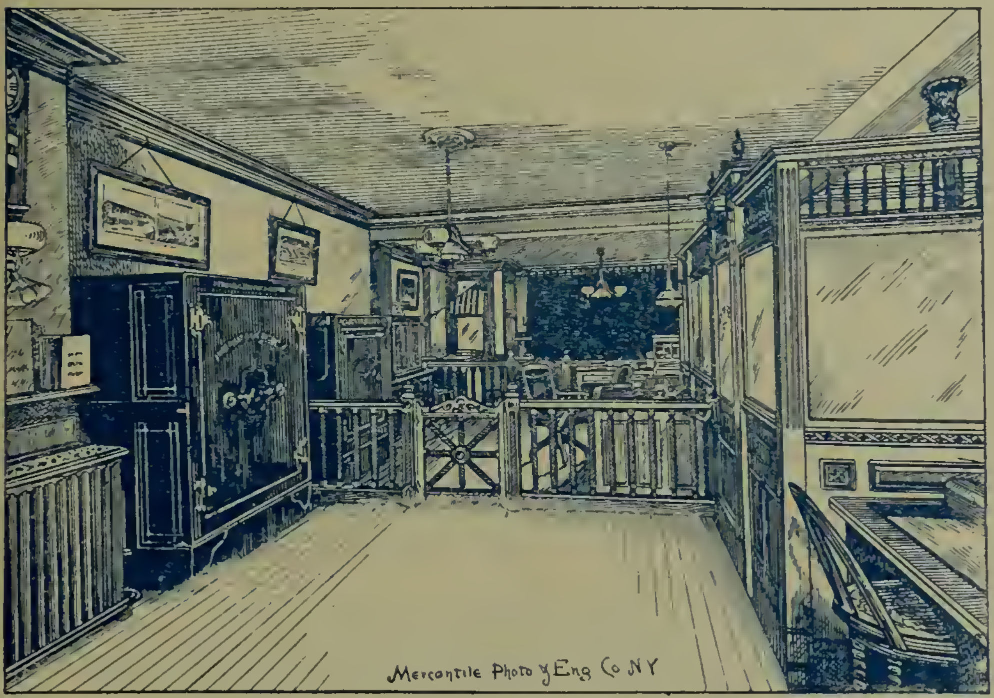
OKONITE COMPANY'S FACTORY, PASSAIC, N. J.

Personal.—Mr. James Partridge, manager of the Partridge Carbon Co., Sandusky, O., was in town last week and paid his respects to The Electrical Age. He reports a very good business in his line.

UNDERWRITERS' NATIONAL ELECTRIC ASSOCIATION.

The meeting of the Electrical Committee of the Underwriters' National Electric Association, which was held in New York City on December 10, 11 and 12, was largely attended. It was opened with a short address by Chairman F. E. Cabot, of Boston, after which the following resolutions were adopted :

Resolved: That any increase of voltage on interior incandescent lighting circuits would result in a corresponding increase of danger to life and property, and that owing to



CORRIDOR OKONITE CO.'S OFFICES, NEW YORK.

the tendency toward the introduction of high voltages it be urged that extreme care be taken by inspectors and others in charge of such installations, without which we believe serious hazards may be incurred ;

Resolved: That the members of this committee and other electrical inspectors, here present, pledge ourselves to exert our influence to further the enforcement of the rules and requirements of the National Board of Fire Underwriters and to co-operate with the electrical bureau of said board in furnishing that bureau with facts which come under our observation regarding devices and materials which may not be constructed in accordance with these rules and the introduction of which would create a hazard to property ;

Resolved: That we further agree that all bureau reports received setting forth such facts shall receive careful consideration and the findings of the report be followed out as far as possible in our respective territories, to the end that co-operative work along these lines may be established and uniformity of action in all essential matters secured ;

Resolved: That the introduction of trolley wires in municipal districts is inimical to the safety of the property of the inhabitants of such districts, and that because of this fact all possible precautions should be taken by the managers of trolley roads throughout the country to insure cutting the current off of the wires in case of fire in abutting property ; also that trolley wires should be effectually protected against the possibility of contact between them and other conductors ; also that trolley systems should be so arranged that practically no difference of potential due to the effects of trolley roads should exist between subterranean pipes.

A committee was appointed to consider and report upon the question of how to best guard against the hazard due to the possibility of the breaking down of the insulation between the primary and secondary coils of transformers.

A committee was also appointed to consider the subject of protectors, to obviate the hazard due to the liability of telegraph, telephone and other signal wires becoming crossed with electric-light and power wires.

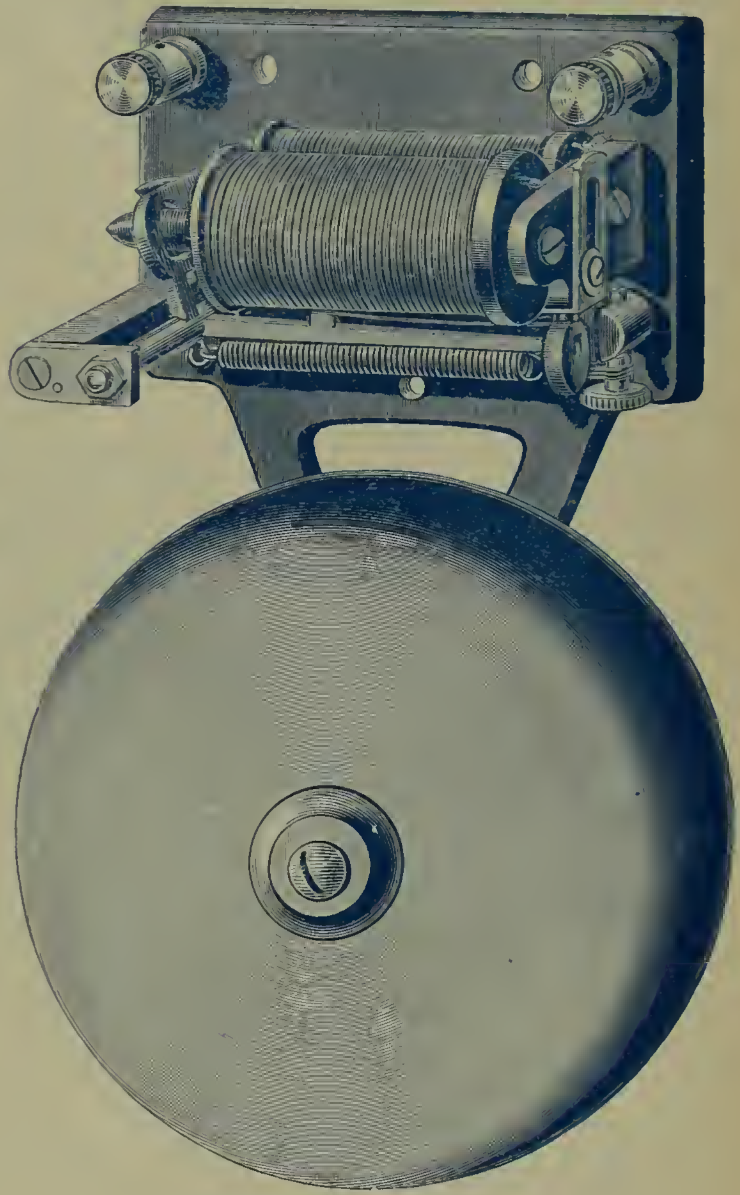
The preparation of rules for marine wiring was turned over to Mr. Ralph Sweetland.

The wiring rules were changed in several minor respects in order to better harmonize with the progress of the electrical industry. There were no radical changes made.

Questions relating to more efficient automatic safety cutouts ; to the damage to storage-batteries by water in case of fire, and standard iron or steel-armored conduits were referred to appropriate committees.

THE "VIGILANT" BELL.

This bell has a single stroke and is intended for railroad stations, factories, fire-alarms, etc. It can be used as a



"VIGILANT" BELL.

vibrating bell as well as a stroke bell, if desired, and when these bells are rung in series they are arranged to cut out their magnets at every vibration but to close the line circuit. By this means any number of bells can be rung at once.

The hammer gives powerful blows and instantly leaves the gong after striking it. The signals are, therefore, perfectly distinct, no matter how rapidly they are given.

This bell is made by Edwards & Co., manufacturing electricians, 144th street and Fourth avenue, New York.

WASHINGTON NOTES.

(*From our Special Correspondent.*)

Information comes to Washington to the effect that the Swiss National Exposition will be held at Geneva, beginning May 1 and terminating October 15, 1896. Liberal appropriations have been made and the directors of the national enterprise have erected fine buidings and prepared spacious and ornamental grounds, now rapidly approaching a state of completion.

In the electrical department there are to be some unique and surprising features. The electrical exhibit will probably form the most important collection of ingenious electrical appliances ever seen in Europe. There will be a travelling footpath, operated by electricity, which will traverse the entire length of the great machinery hall. A prominent feature will be horseless cabs driven by electricity. The exhibition promises to represent all that is best in science, industry, machinery and electricity of Switzerland.

A. F. T.

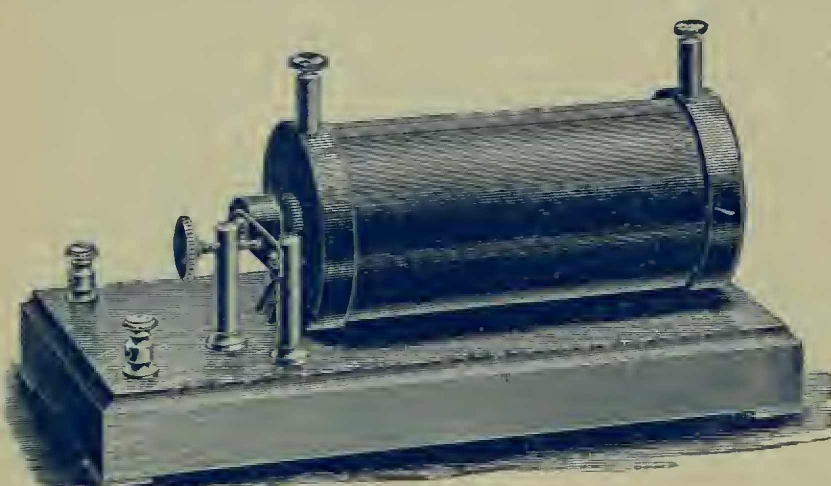
THE INTERNATIONAL ELECTRIC COMPANY.

This company has had a successful year and begins the new year with splendid prospects. The work turned out from this establishment is of the best character.

Mr. Tropp, the company's electrician, is an expert on fine electrical work, and anything produced by this company can always be depended upon as first-class.

The company makes a very fine line of Ruhmkorff induction coils—from the small to the largest sizes. Some of its instruments of this class are in regular use in many of the most prominent colleges.

The telephone and spark coils made by this company are reliable and of the best make, and in the matter of fine



RUHMKORFF COIL.

wire-winding for all electrical purposes nothing better can be done elsewhere.

The company manufactures a long line of goods, including binding-posts of all kinds, electric cigar-lighters, etc., and does a large business in general experimental work. Mr. G. Huerstel is the manager of the company.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

At the monthly meeting of Council, December 18, the following associate members were elected :

Bancroft, Chas. F., Lowell and Suburban Street Railway ; residence, Lowell, Mass.

Herdman, Frank E., Crane Elevator Co., Winnetka, Ill.

Lamb, Richard, The Trenton Iron Co., No. 1 Broadway, N. Y.

Le Pontois, Leon, The Westinghouse Elec. and Mfg. Co., Pittsburgh, Pa.

Ludlam, Harry W., Western Electric Co., N. Y. City.

McMeen, Samuel G., Central Union Telephone Co., Chicago.

Scidmore, Frank L., Western Electric Co., New York City.

Stone, Joseph P., General Electric Co., Schenectady, N. Y.

Storer, Norman W., Westinghouse Elec. and Mfg. Co., Pittsburgh, Pa.

Thordarsson, Chester H., Chicago Edison Co., Chicago, Ill.

Wybro, Harrison C., Wybro & Lawrence, Los Angeles, Cal.

The following associate members were transferred to full membership, their applications having been approved by the Board of Examiners :

Stephens, George, Canadian General Electric Co., Peterboro, Ont.

White-Fraser, George, electrical engineer, Toronto, Ont.

Dow, Alex., Public Lighting Commision, Detroit, Mich.

Neiler, Samuel G., Pierce and Richardson, Chicago, Ill.

Perot, L. Knowles, Schuylkill Valley Illuminating Co., Phœnixville, Pa.

Blood, John Balch, General Electric Co., Schenectady, N. Y.

Sheble, Franklin, Philadelphia, Pa.

Freedman, Wm. H., Columbia College, New York City.

Riker, Andrew L., The Riker Electric Motor Co., Brooklyn, N. Y.

McCrossan, John A., Citizens' Telephone and Electric Co., Rat Portage, Ont.

The following committee was appointed by President Duncan to consider the question of incorporation of the Institute, and any revision of the Constitution that might be necessary to comply therewith : W. B. Vansize, Esq., chairman ; Prof. H. S. Carhart, Mr. W. F. C Hasson, Mr. A. S. Hibbard, Dr. Cary T. Hutchinson, Mr. T. C. Martin, Mr. Townsend Wolcott.

SAFETY WIRES AND CABLES.

The record of the Safety Insulated Wire and Cable Co., New York, for the year 1895, is one that the company may well be proud of.

The company's wires and cables have been laid down in most of the large cities, and the reputation for serviceability these goods possess grows apace.

In Newark, N. J., thousands of feet of Safety cables have been installed for the fire and police departments, and in New York City all of the electric-light companies have been liberal in their preference for Safety cables. The fire and police departments, and the telegraph and telephone companies have also used hundreds of miles of these cables. Over 500 miles of rubber-covered and lead-encased Safety cables are in practical use in New York City subways, and 15,000 miles have been put down in other large cities throughout the country.

The People's Traction Company, of Philadelphia, has installed eighty miles of rubber and lead-encased cables of 1,000,000 c. m. The West Chicago Street Railway Company is using sixty miles, and the Chicago City Railway Company ten miles of the same class and size as that used in Philadelphia by the Traction Company.

During 1895 one hundred miles of lead-covered underground cables were laid down in Boston for the Boston Electric Light Company which, in addition to the forty miles put in during 1894, makes 140 miles in all in use by this one company.

The Safety Company also furnished underground cables for lighting Black Bay Fens, Boston Common and Franklin Park, and is now furnishing cables for the Western Union Telegraph Company, the police department, Holmes Electric Protective Company, Boston; the Boston Electric Protective Association, Boston Automatic Fire Alarm Company, the United Telegraph Company, the Boston Auxiliary Fire Alarm Company, and all the underground cables for the town of Brookline.

In the Boston installations Requa white-core wire was largely used.

Besides these installations may be mentioned those on the U. S. war ships. "Safety" navy marine wires and cables are used exclusively on the New York, Cincinnati, Texas, Raleigh, Bancroft, Marblehead, Miantonomoh, Columbia, Olympia, Oregon, Minneapolis, Indiana and Massachusetts.

Since the organization of the Safety Insulated Wire and Cable Co. its success has been phenomenal. But this is simply a practical demonstration of the axiom that "the best is the cheapest," when wires and cables are concerned.

PAST AND PRESENT OBSTACLES IN THE STORAGE BATTERY DEVELOPMENT.*

BY CARL HERING.

(*Concluded from Page* 340.)

The capacity of such a plate will evidently be affected only slightly by the rate and the loss of voltage, and therefore the watt efficiency will depend more on the conductivity of the lead than on the acid becoming too dilute in the immediate neighborhood of the active material. To obtain high rates accompanied by good efficiency and capacity, there is little doubt that the best way is to use large freely exposed surfaces rather than to try to resist the evil effects of high rates, mechanically.

In rapid charging the acid becomes too dense in the pores of a thick mass of active material if the circulation does not keep pace with the demand: this dense acid softens the peroxide and there is a tendency to form gases when the proper chemical action cannot keep pace with the current. Both the softening of the peroxide and the mechanical effects of the gases are injurious. What was said regarding porosity and the ideal plate applies, therefore, also to the charging.

The negative plates being soft and tough, are not so easily injured, but unless the acid can circulate very freely there will still be a lowering of the voltage like with the positive plates, and probably also a lowering of the ampere-hour capacity.

The contact between the peroxide and its conductor must be very good, for, if poor, then a white sulphate forms at the surface, which practically produces an insulating layer and disastrous effects are then inevitable. The ideal contact is obtained when the peroxide is formed on the lead electrolytically, as in the Planté processes.

The peroxide will insist on expanding during the discharge and on contracting during the charge. It would be much better to accept this as an inevitable fact than to try to keep the material from obeying the laws of nature by forcibly confining it within an inelastic frame, as many inventors have attempted to do; the results of such an attempt have already been described. To hold a large mass of active material firmly in contact with a lead conductor, when one expands and contracts while the other does not, or expands without afterwards contracting again —is a difficult matter. The best solution seems to be, to have the active material in the form of an extremely thin layer over a large surface and formed from the lead itself, as this increases its adhering properties. If such a layer can be made porous, and if the surface is made up of small facets, there will be little tendency to buckling or scaling.

The gradual washing away of the surface of the peroxide, and the slow peroxidation and consequent disintegration of the lead supports, seem to be absolutely unavoidable. Until some preventative is found, if it ever will be, it seems wisest to accept the inevitable and acknowledge that the positive plates are perishable. To use any other metals or carbon is out of the question; the addition of antimony to the lead seems to retard but does not prevent peroxidation. The favorite method of trying to avoid the effects of disintegration is to make the frames of the positive plates quite thick, thus prolonging their life. This, if not accompanied by other disadvantages, may be satisfactory for stationary plants in which the great additional weight is no hindrance, the only objection to it being the cost of the metal, which is no small factor in the total cost of the plate. But such a method is certainly not satisfactory for cheap or portable cells, and the gradual washing away of the peroxide remains the same whether the frame is heavy or light, provided that the surface exposed to the liquid is the same.

But there is another way of meeting those unavoidable effects of use, which has recently been applied and which seems to be a much more rational and effective solution of this vexed problem, at least when lightness and smaller first cost are desired. Instead of making the positive plates heavy and expensive, they may be made very light, cheap and easily replacable; their life may then be shorter, but the battery will be as good as new whenever these perishable parts have been renewed; their life is soon known to the user and he can then readily determine for himself how much he must allow for amortization. Anyone who has urged the use of accumulators will appreciate the great value of being able to satisfy the user as to the amortization factor. A purchaser will believe you if you admit that the life of the perishable parts will be comparatively short, but he will not believe you if you say it will be long, even if you tell the truth. But such a method, to be successful, requires that the old plates and sludge can be converted at a small cost into new plates; this it seems can now be done, and the writer believes that this alone will have a very important bearing on the outlook of the storage battery, at least for portable cells as are required for traction and many other purposes, or for both portable and stationary plants if the first cost is an important factor. Such a method becomes practicable only when the chief factor in the cost of the plate is the material, the cost of labor and forming being small.

For stationary purposes, in which the only objection to the weight is the first cost of the lead, good storage batteries have been used abroad with success for some time, provided the rates of charge and discharge are kept low. Assuming that the same storage batteries may be made in this country as well, the question which affects the outlook here is then only one of the cost. But neither abroad nor here does there seem to be a battery in the market in which the weight has been sufficiently reduced and the rate sufficiently increased for a really successful traction battery, the success of which has been demonstrated beyond dispute. It is here assumed that, to the public and to railway companies, traction batteries are not a demonstrated success until a traction company which has no affiliation with the accumulator makers finds it to its own advantage to use them in preference to other systems. That accumulator traction is the ideal system has been repeatedly acknowledged by good authorities, and that this field for batteries is very large, and perhaps larger than that for stationary work, is likely. The large first cost and cost of maintenance of the overhead construction for trolley roads, the large power station required, and the threatened damages done by electrolysis, would doubtless turn the tables in favor of the storage battery for many long roads on which traffic is not too dense, and possibly also for many suburban steam roads.

It seems to the writer that the only batteries which have a promising outlook for this very trying work are those which have a very large surface, very small depth of active material formed electrolytically, and a very free circulation of the acid. The lead frames should be made only thick enough for proper conduction; the batteries must be cheap in first cost, and the positive plates should be capable of being replaced comparatively frequently at small cost. They should be proportioned so that a discharge corresponds to one trip of the car—and only one. To claim as an advantage that a battery can run a car, say four trips, is mere deception, and to the intelligent engineer it is simply an admission that it can do no better. No one would think of carrying four relays of horses on a trailer of a horse car, and why should the equivalent be done with the storage battery, unless it is that the battery can do no better and that it cannot be discharged rapidly enough so that the capacity and weight may be reduced to that required to run only one trip. The ideal is certainly a single trip discharge. If the rate for a four-trip battery could be increased four times without materially affecting the capacity, its weight and capacity for a single trip discharge would evidently need be only one-fourth as great. The charging rate should also be equal in hours to the discharge rate, or else it will take a plant of more than two sets of batteries to a car.

These various ideals mentioned above would have only a theoretical and not a practical interest, were it not for the fact that recent tests have shown that a near approach to them has apparently been reached; it is somewhat premature at present to say more until the results of the tests have been confirmed by practice.

The above discussion may be briefly summarized as follows: cessation of litigation and the development of the Planté type of cells make the storage battery outlook in this country much brighter; the cost of a guaranteed storage battery seems in many cases to be too nearly equal to that of the direct generators to encourage their general adoption. A reduction in the cost would therefore open a large field, much larger than in proportion to the reduction; the renting of accumulators seems a commendable method for introducing them. Most of the diseases which storage batteries are subject to could be avoided or made much less disastrous by having large surfaces, small depths of active material and free circulation. The first cost would be reduced and the vexing question of the uncertain amortization settled by a light, short-lived, cheap positive plate and a cheap process of reconverting old into new positive plates. Storage batteries for slow discharges have been a success abroad; a very large additional field would be opened by a light, cheap, rapid-rate cell.

The objection to a plate with a thin layer of active material is, that it may not retain its charge as well as one with a thick layer or pellets; but in most cases in which rapid rates are desired or cannot be avoided, the small loss in standing is probably more than balanced by the fact that the plates are not injured by rapid rates. As a rule, long periods between charges go hand in hand with slow discharges and less objection to great weight, while short periods between charges, high rates of discharges and lightness usually go together.

In conclusion the writer desires to take this opportunity to make the following recommendations in the interests of engineers who may have to calculate accumulator plants.

That rates of charge and discharge be designated in *hours* and fractions, the current (or for power purposes, the watts,) during that time being considered to be kept constant. There can then be no mistake as to what is meant, as this represents the time in hours during which a cell will continue to give a practically constant current before the voltage falls below its limit.

That efficiencies and capacities be always accompanied by the corresponding rate in hours.

That in giving an efficiency it should always be stated whether it is for ampere-hours or watt-hours.

That for portable batteries intended for power purposes, the capacity be given in watt-hours instead of ampere-hours, and that the weight given be that of the complete cell ready for use, as distinguished from the weight of the plates alone.

A LARGE ISOLATED PLANT.

E. H. Forst, of the California Electric Construction Co., 1145 Market street, San Francisco, is in town and will remain here for a couple of weeks. He is installing the largest isolated plant in the West—that in the Parrot Estate Building, in San Francisco. The building will be lighted by 5,000 incandescent lamps and 500 arcs. Habirshaw wire will be used entirely, and will be run in brass-armored interior conduit. The switchboard will be of white marble and finely finished. The building will be equipped with 15 Sprague electric elevators.

The power plant will consist of three triple-expansion and one compound-condensing engines made by the Union Iron Works of San Francisco. Siemens & Halske dynamos will be used in the plant.

Mr. Forst is in the market here for 10,000 16-c. p. incandescent lamps and 550 incandescent arc lamps. His headquarters are at Room 52, No. 15 Cortlandt street.

MUNICIPAL OWNERSHIP.

The Board of Aldermen of Taunton, Mass., have adopted a resolution to the effect that it is expedient for the city to own a municipal lighting plant.

A committee has been appointed in Beatrice, Neb., to consider the question of the city operating its own electric light plant.

Steps are being taken in Benton Harbor, Mich., to secure an electric light plant, to be owned and operated by the city.

THE STATE OF BUSINESS.

A representative of The Electrical Age, in making his usual rounds during the past week, endeavored to ascertain the views of various individuals and representatives of companies and firms regarding the state of business and the outlook for future trade. There are a few modest gentlemen who wish to remain in the background, where the light of intelligence and publicity is not strong. We feel sorry for them. They will emerge from their seclusion bye-and-bye and seek the reward that comes from hustling.

From among the expressions of opinion from wide-awake persons and concerns we give the following:

Mr. H. C. Beck, president of the Vosburgh Mfg. Co., Ltd., Brooklyn and Chicago, expresses his opinion regarding the business outlook: "There will be no healthy trade until the country is represented in congress by a majority of that party having for its fixed policy the protection of American labor and manufactures by a tariff requisite for that purpose, and in so doing obtain at least enough funds (a surplus will do no harm) to meet all expenses of conducting the government, aside from a liberal revenue on wines, liquors, tobacco, etc. Revenue reform as illustrated during the term of the 53d Congress means nothing unless a farce, or worse. Revenue reform with incidental protection to large monopolies and foreign manufacturers is a crime to American labor and American capital. Speed the time when this country will have a congress and an administration that can and will provide not only sufficient revenue to pay all demands upon it, but a surplus. The business men of this great and glorious country would very much like a surplus. Where is the business man who has wakeful nights because of the fact that he is accumulating a surplus. There are many, on the contrary, who cannot sleep of nights because of a deficiency, which is not only a "theory" but an actual "condition." This is what has been confronting them for the past two years."

W. R. Ostrander & Co., manufacturers of electrical goods, speaking tubes, etc., 204 Fulton street, New York, begins the New Year with the belief that it will be a much livelier one than its immediate predecessor. The firm is carrying a larger stock of goods than ever, and during the past year has done a very satisfactory business. Their business is increasing and, in their eyes, the future looks bright.

Mr. Hunt, of the well-known firm of electrical contractors, Zindars & Hunt, 127 Fifth avenue, New York, looks into the future with great hope. Notwithstanding the general dulness of trade this house is doing well. It has plenty of contracts on hand—wiring buildings, installing electric plants on yachts, in buildings, etc., etc. Mr. Hunt thinks that the New Year will bring greater general prosperity.

NEW LIGHTING COMPANY IN BROOKLYN.

The old Liberty street electric-light station in Brooklyn, N. Y., is being overhauled by Charles Cooper, one of the original arc-light promoters in that city. Mr. Cooper has organized the Kings County Electric Light Company and has wires strung all ready for his expected contract for street-lighting.

The old plant will be put in first-class condition, although just at the present time it has not yet been decided what system will be installed. It is stated that the new company will make it warm for the present one, which has been running things pretty much its own way.

LECTURE POSTPONED.

The lecture on "Hydraulic Gearing Applied to Electric Motors," which was to have been given by Harry E. Dey before the Brooklyn Electrical Society, has been postponed until the evening of January 7, 1896.

THE SANDUSKY TELEPHONE CO.

The Sandusky (Ohio) Telephone Company has over 400 subscribers and is giving excellent service. The Harrison system is used. The company charges $30 a year per 'phone for commercial houses and $18 for residences. The service is said to be superior to that of the Bell Company and the popular sentiment is with the opposition. The Sandusky Company expects to increase the number of its subscribers to 600 by the first of the year.

Mr. James Partridge, manager of the Partridge Carbon Co., Sandusky, Ohio, is a director in the Sandusky Telephone Company.

DOES THIS MEAN WAR?

The United States government has ordered a fleet of 25 electric launches from the Universal Electric Launch Co., 45 York street, Brooklyn. N. Y.

IN FAVOR OF HATZEL & BUEHLER.

The suit of Hatzel & Buehler against the Hoffman House Co., on December 6, came up before Justice Cullen in the Supreme Court at White Plains, N. Y., and judgment was rendered in favor of the plaintiffs for the full amount, with interest and all costs. The amount involved, which was for wiring work, was $1,450, with interest from the first of January, last.

RED, WHITE AND BLUE.

Messrs. J. W. Godfrey, F. W. Harrington and J. B. Olson will entertain their friends on December 31, between 2 and 6 o'clock P. M., at the offices of the India Rubber and Gutta-Percha Insulating Co., Room 52, No. 15 Cortlandt street. Direct connection will be had with the ambulance corps by special Habirshaw wires.

THE PECK ELECTRICAL COMPANY.

Mr. E. F. Peck, vice-president of the National Electric Light Association, who for the last ten years has been the general superintendent of the Citizens' Electric Illuminating Company of Brooklyn, has formed a company to be known as The Peck Electrical Company, with an office at 15 Cortlandt street, New York.

The company proposes to manufacture and deal in electrical specialties and supplies, and also to engage in electrical engineering in all its branches. Mr. Peck's long and practical experience as superintendent of one of the largest and most successful electric lighting plants in the country, together with his recognized capacity as an electrical engineer, will undoubtedly command for the company a large share of public and private patronage.

THE OKONITE CO.'S ANNUAL MEETING.

The annual general meeting of The Okonite Company, Limited, was held at the office of the company, 13 Park Row, New York City, on Wednesday, December 18. A number of matters of interest to the company were discussed. The accounts were also presented and passed.

THE WALTER R. WOOD COMPANY.

Walter R. Wood & Company, mechanical engineers, 136 Liberty street, New York, have reorganized as the Walter R. Wood Company, Limited, with a capital of $50,000. Walter R. Wood, president and general manager; E. Fox Leonard, vice-president; Alexander Thompson, secretary and chief engineer; Crosby Leonard, treasurer.

They have closed a number of mechanical contracts lately, among them being one for the complete steam and power plant for the Sawyer Building, 179–183 Wooster street, New York. They are making a specialty of complete mechanical plants for buildings.

Telephone Notes.

Contract for construction of a telephone line from Shubuta, Miss., to Cocoa, Ala., has been let to C. W. Gallagher, of Meridian.

A telephone system will be established in Alexandria, Va., by the Home Telephone Co, of Baltimore, Md.

Proposals for equipment of a telephone line are wanted by the Home Telephone Co., Baltimore, Md. Address, W. J. Atkinson, general manager.

Marysville, Ky.—There is talk of building a telephone line from Flemingsburg to Moonfield, which will give Marysville connection with Carlisle, Sharpsburg, Mt. Sterling and other points.

Youngstown, O.—The new telephone company is taking steps towards the erection of a new telephone exchange in Youngstown.

Rockford, Ill.—The City Council passed an ordinance granting a franchise to the J. B. Whitehead Company to construct and operate a telephone exchange, to compete with the Bell system now in use.

Springfield, Ill.—J. L. Stryker and W. C. Carrard, citizens of Springfield, have been in Decatur to look over the plant of the Citizens Mutual Telephone Co.; a company of local capitalists has been organized in Springfield, for the purpose of putting in a similar plant.

Rock Rapids, Ia.—The Clark Automatic Switch Company, of Sioux City, has been granted a franchise to put in a telephone system at Rock Rapids.

Honesdale, Pa.—A charter has been issued to the Citizens' Telephone Co., of Honesdale. Capital, $5,100.

Wilmington, Del.—A director of the Delmarvia Telephone Co. has stated that the list of subscribers now number about 800, and that the construction of the line will be commenced within 60 days.

Parkersburg, W. Va.—Capt. S. F. Shaw is organizing a stock company to build a telephone line from Parkersburg to Waverly. An application for a charter has been made. Incorporators are John W. Dudley, George W. Carney, W. H. F. Kelly, H. H. Morse and others.

TELEPHONE PATENTS ISSUED DECEMBER 17, 1895.

Automatic Telephone-Exchange System. William F. Lounsbury, Owego, N. Y. (No. 551,391.)

Holder for Telephone Receivers. Fergus W. Martland, Fall River, Mass. (No. 551,551.)

Telephone Transmitter. Theodore Grissinger, Mechanicsburg, Pa. (No. 551,674.)

NEW TELEPHONE COMPANIES.

Albany, N. Y.—The Wayne Telephone and Telegraph Company, to connect Auburn, Geneva, Palmyra, Lyons, Clyde, Seneca Falls, Waterloo and numerous smaller places by telephone. Capital, $5,000. Directors: S. E. Bishop,

A. B. Bishop, George E. Brisbin, Derick Douglas, John H. Childs and Albert C. Lux, of Clyde, and E. W. Brown, of Palmyra.

Tuscola, Ill.—Douglas County Telephone Company; incorporated. Capital, $25,000. John T. Todd, Joseph W. Hamilton.

New Castle, Ind.—New Castle Telephone Company- incorporated. Capital, $4,500. Directors, E. B. Phillips, C. S. Hernly and E. N. Bundy.

Baltimore, Md.—The Southern State Telephone Company, of Baltimore; incorporated. Capital, $100,000. Augustus G. Davis, J. Austin Fink and Wm. H. Winkelmann, of Baltimore, and others.

Kalamazoo, Mich.—Kalamazoo Telephone Company has filed articles of association. Capital, $30,oco. Directors, C. H. McGurrin, Wm. A. Doyle, Charles A. Peck and others.

Zanesville, O—Drake Telephone Co.; incorporated. Capital, 10,000. Incorporators, Thomas Drake, of McConnellsville; O. F. McKinney, John R. Andrews, J. Hope Sutor and John S. Gillespie, of Zanesville.

Baltimore, Md.—The Southern States Telephone Co., Baltimore, Md., has been organized by Chas. E. Fink, president; A. G. Davis, vice-president, and R. B. Hazlett, secretary-treasurer; to construct telephone systems, etc. Capital stock, $100,000.

Tuscola, Ill.—Douglas County Telephone Co. has been incorporated by John T. Todd, Joseph W. Hamilton and George W. Grimes; to operate a telephone exchange. Capital stock, $25,000.

New Corporations.

Norfolk, Va.—The Norfolk Electric Light and Power Co. has been incorporated by Paul R. Boyd, B. N. Sperry, Geo. Russell and others. Capital stock, $15,000; with privilege of increase to $500,000.

Jersey City, N. J.—The Sprague Electric Railroad Co.; capital, $1,000,000; incorporators: Frank and Charles Sprague, of New York City, and Howard Gurney, of Jersey City. The company will build and equip electric railways.

Herington, Kan.—The Herington Electric Light and Power Co. has been chartered. Capital, $30,000. H. S. Towner, I. S. Brumdage, T. M. Bixby, T. G. Dayton and R. A. Wilson.

Washington, N. J.—The Mountain and Lake Improvement Co. has been incorporated with a capital of $35,000, and will erect a hotel by the time the summer season opens at Green's Lake. Incorporators: Ex-Surrogate Wm. O'Neill, of Belvidere; W. C. Folkner, Buttzville; George Givens, of Easton; Michael McCabe, of Oxford, and Ex-Sheriff Michael W. Weller, of Columbia.

Chrisman, Ill.—The Schance & Fair Electric Company; incorporated. Capital, $6,000. George W. Fair, John G. Schance.

South Bend, Ind.—South Bend Street Railway Company; incorporated. Capital, $300,000. Directors, J. Ben. Burdsell, F. C. Niopold, A. L. Brick, James M. Smith and others.

New Orleans, La.—New Orleans Edison Co. has been incorporated by J. P. Ord, R. T. Paine, R. T. McDonald, Wm. T. Hardie, Wm. B. Nicholls, to operate electrical plants and works, including electric railways. Capital stock, $3,000,000.

Reading, Pa.—A charter has been granted to the Union Traction Company, of Reading. Capital $400,000. Subscribers Robert Carson, P. F. Carson, of Philadelphia; Richmond L. Jones, of Reading, and others.

Parry Sound, Ont.—Parry Sound Electric Light Company has been incorporated by W. H. Pratt, Toronto; W. B. Armstrong, S. Armstrong, John Galna, Wm. Beatty, T. S. Walton. Capital stock, $200 oco.

Possible Contracts.

Waterbury, Conn.—It is proposed to form a joint stock company for the purpose of erecting a theatre to cost $125,000. John Moriarty is at the head of the project.

Gainesville, Fla.—Messrs Graham, Taylor & Company have asked for a franchise for the operating of an electric light and street-railway plant in Gainesville.

Pensacola, Fla.—Sterritt Tate and others are organizing a company to build a trolley line.

Savannah, Ga.—Savannah Masons have completed the deal for the site for their new temple at Bull and Charlton streets. The new home of the fraternity is to cost in the neighborhood of $75,000.

Peoria, Ill.—The Pabst Brewing Company is looking for a location to erect a building to cost $75,000, and to be used as a hotel.

Fort Wayne, Ind.—A Cleveland syndicate, headed by John J. Shepherd, has just closed a deal by which the entire street-car system of Fort Wayne comes into his hands. The capitalization of the consolidated company is $1,500,000 and a mortgage of $1,500,000 has been filed to cover the bonds of the company. It is stated that the Cleveland syndicate will spend $300,000 in improvements on the property, extensions and additional equipments being intended.

Boston, Mass.—Walter M. Lowney Chocolate Company will erect a four or five-story manufactory in the vicinity of Commercial and Hanover streets.

Morristown, N. J.—It is proposed to form a stock company with a capital of $50,000, for the purpose of purchasing grounds and enlarging club house for the Morris County Club. Thomas C. Bushnell, Charles Bradley, Robert S. Valentine and others are among the stockholders.

Passaic, N. J.—A movement is on foot in Passaic to erect a $30,000 opera house.

Fort Hamilton (Brooklyn), N. Y.—The Dyker Golf Club intends to erect a handsome club house at Fort Hamilton.

Johnstown, N. Y.—The Amsterdam Street-Railway Company will extend their line in Johnstown.

Kingston, N. Y.—A franchise has been granted to the Rondout and Eddyville Electric Railway Company.

Mt. Vernon, N. Y.—The Mt. Vernon Turn Verein will soon break ground on Stevens avenue for their new $25,000 turn hall.

New York City.—Francis A. Clark, 1879 2nd avenue, is interested in the erection of a seven-story fire-proof brick and stone apartment hotel to be erected corner 7th avenue and 120th street.

Wm. Vogel, 27 East 72nd street, will erect a five story brick warehouse at 1478 Third avenue to cost $30,000. Architect, Louis Korn, 621 Broadway.

Yonkers, N. Y.—The New York Central and Hudson River Railroad Company, Grand Central Depot, New York City, contemplate erecting a new depot at Yonkers.

Akron, O.—Akron Street-Railway and Illuminating Company has received its charter and the following officers have been elected. General Samuel Thomas, J. B. Clews and E. C. Gibson, of New York; J. A. Long, Aaron Wagener, Ira Miller and F. A. Seiberling, of Akron. The power-house of the old street railway will be abandoned and the power-house of the electric-light company will be used, capacity of which will be increased to 1,800 H. P.

PITTSBURGH, PA.—Architect F. J. Osterling is preparing plans for a large warehouse building for the Pennsylvania Door and Sash Company.

PROVIDENCE, R. I.—A committee of Philadelphia and Rhode Island capitalists has decided to build and operate an electric railroad from Providence to Taunton, Mass. The capital is placed at $3,000,000.

COLUMBIA, S. C.—The Columbia Water-Power Company intend at an early day to erect an extensive electrical power-house at the foot of the canal, generating from 6,000 to 8,000 horse-power and furnishing power for the operation of cotton mills.

MONTPELIER, VT.—The United States Clothespin Company of Montpelier contemplates some extensive changes and improvements. It expects to take a new lease of the building it occupies and to put in electric power, machinery. etc.

PARKERSBURG, W. VA.—Parkersburg Academy of Music, recently burned, will be replaced by a $100,00c auditorium.

PHILADELPHIA, PA.—A permit has been granted to Contractor John Duncan for the erection of a new addition to the building of the City Trust Safe Deposit and Surety Co., to cover the site of the old Inquirer Building, at 929 Chestnut street. The structure will be eight stories ; estimated cost of improvements, $110,000.

SYRACUSE, N. Y.—The work of erecting the new Central station train shed will be begun at an early day.

NEW YORK CITY.—Harry Chaffee has purchased property at 43–49 Bleecker street and will erect an eight-story fireproof business building on the site.

BRADFORD, PA.—An ordinance granting a franchise to the Bradford Electric Street Railway Company came up for final passage at meeting of council, December 16, and was adopted.

CHESTER, PA.—A number of gentlemen have been considering the advisability of using the water power of Ridley Creek to furnish an electric light plant for the upper end of the city.

NEW YORK CITY.—Alexander Brown, Jr., 245 West 45th street, will erect a six-story brick fruit exchange and office, corner of Jay and Staple streets, to cost $100,000. Architect, John De Hart, 1637 Fox street.

Commercial Cable Building Co., 253 Broadway, will erect a twenty-one-story brick office building on Broad street to cost $1,000,000. Architects, George Edward Harding and Cooch, 253 Broadway.

ELLWOOD CITY, PA.—The directors of the Ellwood City National Bank have purchased lots on Main street, and in the spring will begin the erection of a handsome stone bank building, which will cost about $10,000.

MONTREAL, QUE.—Canadian Pacific will build a station and hotel in Montreal, to cost $350,000.

BOSTON, MASS.—A new block is to be built in Newton on Washington street, by W. F. Bacon.

The City Council of Gainesville, Fla., has been petitioned for an electric light plant franchise by J. M. Graham, H. E. Taylor and F. W. Cole.

Alexandria, La., will double the capacity of its electric light plant, putting in dynamos, boilers, engines, etc. Address, Superintendent, City Electric Light Plant.

Bids are being invited for an $18,000 electric light plant, to be erected by the city of Unionville, Mo.

A company has been organized by Geo. W. Greathouse of Beeville, Tex., to erect an electric light plant.

A thirty-mile trolley line is to be built between Louisville and Fairfield, Ky. Address Rowland Cox, chief engineer, care of Willard Hotel, Louisville, Ky.

Bids are wanted for the equipment of an electric light plant by the Satilla Manufacturing Co., of Waycross, Ga.

ASHEVILLE, N. C.—An electric railway is to be built between Asheville and Biltmore.

NEW YORK CITY.—The Colonial Real Estate Association, 309 Broadway, will erect a ten-story brick store at 53–57 West 14th street, to cost $250,000. Architect, Richard Bergen, 309 Broadway.

August Belmont, 55 Wall street, will erect a store and office on 138th street, to cost $30,000. Architects, Hoppin & Koew, 160 5th avenue.

Donald Mackay, of Englewood, N. J., will erect an eight-story stone and brick office building, corner of Nassau and Pine streets, to cost $350,000. Architect, John R. Thomas, 160 Broadway.

Trade Notes.

The National Glass Co., manufacturers of glass insulators for telegraph, telephone, electric light wires and all electrical conductors, have opened their factory at No. 26 Lake street, Somerville, Mass., for the manufacture and sale of glass insulators, glass tubing for interior insulation, glass tiling, glass vault and sidewalk lights, glass conduit pipes for underground wires and glass globes for arc or incandescent lamps, all under the direct management and personal supervision of Mr. Chas. H. Jenkins, for twenty-eight years manager of the Suffolk Glass Works, at South Boston, Mass. Their improved insulators are manufactured by the latest and most improved patented appliances, made from selected material, with a perfect screw thread from top to bottom. The company is prepared to supply insulators of any description, size or color and has a large assortment now on hand to select from. The offices of the National Glass Co. are at 75 State street, Boston, and 40 Broadway, New York.

Stanley & Patterson, 32 Frankfort street, New York, have secured the sole agency in New York for the New York and Ohio Company's Packard Lamp. They carry in stock at all times a full line of these lamps.

Mr. Hugo Benedix, of the Boudreaux Dynamo Brush Co., is giving out to the trade a handsome Christmas souvenir. It consists of a brush on a crimson plush shield, with the initials of the company set in gold letters at the top. The device makes a very attractive ornament.

ELECTRICAL and STREET RAILWAY PATENTS

Issued December 17, 1895.

551,357. Incandescent Electric Lamp. Charles A. Beal, Abington, Mass. Filed Feb. 28, 1895.

551,361. Apparatus for Manufacturing White Lead by Electrolysis. Arthur B. Browne, Cambridge, and Edwin D. Chaplin, Natick, Mass., assignors to the American Lead Company, Kittery, Me. Filed July 2, 1894. Renewed May 18, 1895.

551,364. Magnetic Electric Lamp Holder. Martin H. Collom, Denver, Colo. Filed June 12, 1895.

551,371. Means for Operating and Regulating Speed of Electric Motors. Rudolf Eickemeyer, Yonkers, N. Y., Rudolf Eickemeyer, Jr., executor of said Rudolf Eickemeyer, deceased. Filed Dec. 31, 1892.

551,372. Electric Program-Clock. Frederick Frick, Waynesborough, Pa. Filed Apr. 29, 1895.

551,380. Street-Car Fender. William J. Hinphy, Montreal, Canada, assignor of one-half to Hubert Root Ives, same place. Filed Sept. 21, 1894.

551,388. Strong-Current Protector. Adriag L. Joynes, Paducah, Ky. Filed Jan. 9, 1895.

551,391. Automatic Telephone-Exchange System. William F. Lounsbury, Owego, N. Y. Filed Apr. 23, 1895.

551,394. Electric Light. David Misell, New York, N. Y. Filed Apr. 5, 1895.

551,398. Car Signal. Elihu Nelson, New York, N. Y. Filed Dec. 21, 1893.

551,427. Heat Regulator. William W. Wilcox, Westerly, R. I., assignor to Phineas M. Randall, Jr., Taunton, Mass. Filed Apr. 6, 1895.

551,436. Electric Meter. Thomas Duncan, Fort Wayne, Ind. Filed July 11, 1895.

551,451. Electric Lighter. Herbert E. Rider and John Hencken, New York, N. Y., assignor to Robert W. Inman, same place. Filed Nov. 10, 1894.

551,470. Controlling Electric Motors. David Mason, Schenectady, N. Y., assignor to the General Electric Company, of New York. Filed Apr. 22, 1892.

551,504. Cable Hanger. Sylvester S. Leonard, Chicago, Ill., assignor, by direct and mesne assignments, to the Hallet Iron Works, same place. Filed Aug. 8, 1895.

551,521. Car Fender. George H. Zane, Philadelphia, Pa. Filed May 31, 1895.

551,534. Closed-Conduit Electric-Railway System. Frederick C. Esmond, Brooklyn, N. Y., assignor to the Esmond Electric Traction Company, of West Virginia.

551,535. Closed-Conduit Railway System. Frederick C. Esmond, Brooklyn, N. Y., assignor to the Esmond Electric Traction Company, of West Virginia. Filed Apr. 12, 1895.

551,536. Closed-Conduit Electric-Railway System. Frederick C. Esmond, Brooklyn, N. Y., assignor to the Esmond Electric Traction Company, of West Virginia. Filed Apr. 26, 1895.

551,537. Closed-Conduit System for Electric Railways. Frederick C. Esmond, Brooklyn, N. Y., assignor to the Esmond Electric Traction Company, of West Virginia. Filed Sept. 11, 1895.

551,551. Holder for Telephone-Receivers. Fergus W. Martland, Fall River, Mass., assignor of one-half to George W. Hoar, same place. Filed June 10, 1895.

551,567. Electric Motor. Merle J. Wightman and Oscar C. G. Urban, Cleveland, Ohio. Filed May 16, 1893. Renewed May 15, 1895.

551,585. Car Fender. John Grant, Omaha, Nebr. Filed Sept 19, 1895.

551,586. Trolley-Wagon. George H. Hulett, Cleveland, Ohio. Filed Apr. 29, 1895.

551,587. Electric-Railway. Rudolph M. Hunter, Philadelphia, Pa., assignor to The Electric Car Company of America, same place. Filed Feb. 23, 1887.

551,621, Street-Railway Car. Willard R. Dodson, Jermyn, Pa. Filed Aug. 7, 1895.

551,633. Electric Motor Frank E Herdman, Winnetka, Ill. Filed Aug. 6, 1894.

551,634. Mechanism for Admission and Regulation of Currents to Motors. Frank E. Herdman, Winnetka, Ill. Filed Mar. 29, 1895.

551,635. Mechanism for Admission of Currents to Motors and Regulation of Currents in Same. Frank E. Herdman, Winnetka, Ill. Filed June 28, 1895.

551,648. Electrolytic Process of Obtaining Precious Metals. Louis Pelatan, Paris, France, and Fabrizio Clerici, Milan, Italy. Filed June 25, 1895.

551,664. Electric-Railway Motor Shield. Isaac F. Baker and William R. McLain, Lynn, Mass., assignors to the Thomson-Houston Electric Company, of Connecticut. Filed Nov. 25, 1889.

551,674. Telephone Transmitter. Theodore Grissinger, Mechanicsburg, Pa. Fiied Oct. 18, 1894.

551,682. Electric Lock. Philip Meyer and Julius A. Meyer, Newark, N. J., assignors of one-third to Emil Blumenhein, same place. Filed Feb. 23, 1895.

551,700. Combined Car Brake and Fender. Joseph C. Walier, Syracuse, N. Y. Filed Apr. 26, 1895.

551,702. Car Fender. John A. Wolfram, Philadelphia, Pa., assignor of one-half to Gottlieb J. Hutt, same place. Filed Aug. 2, 1895.

551,712. Dynamo Electric Machine. Alexander B Blackburn and William Buchanan, Wolverhampton, England. Filed Oct. 1, 1895.

551,734. Transmission of Electricity to Moving Cars. Thomas Nesom, Indianapolis, Ind., assignor, by direct and mesne assignments, of one-half to William D. Eckenrode and Edward S. De Tamble, same place. Filed Sept. 21, 1894.

551,743. System for Regulating Effective Tension of Electrical Circuits. Herman O. W. J. Breul, Berlin, Germany. Filed Nov. 17, 1893. Patented in Germany July 12, 1890, No. 59,169; in Belgium Dec. 8, 1890, No. 93,012; in France Dec. 11, 1890, No. 210,144; in Austria-Hungary Sept. 29, 1891, No. 45,991 and No. 78,757, and in Switzerland Sept. 30, 1891, No. 4,151.

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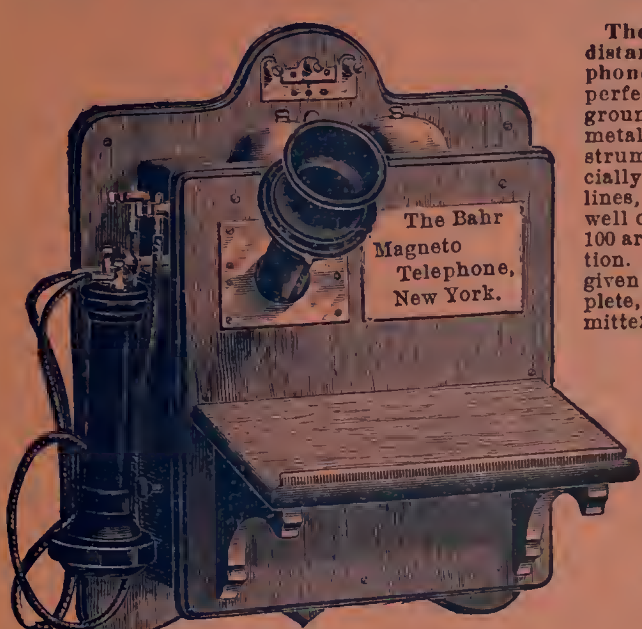

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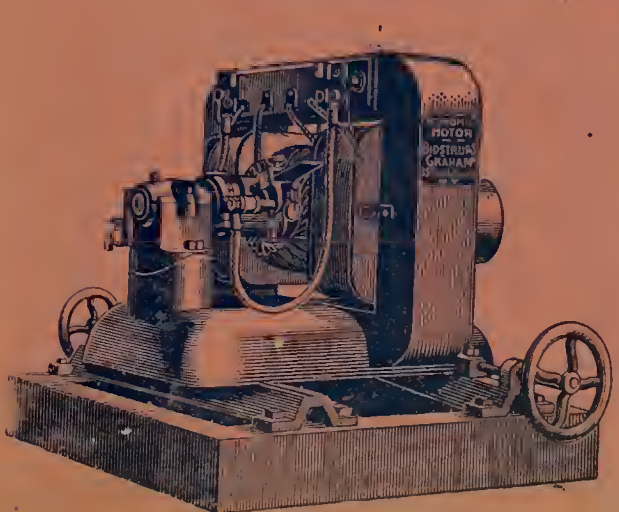

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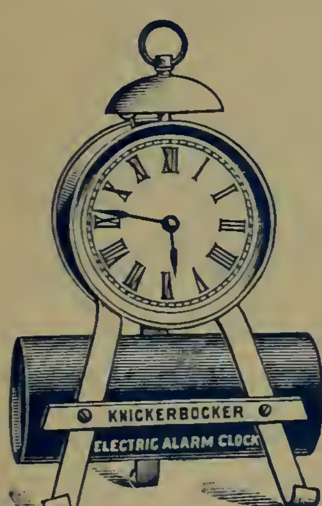

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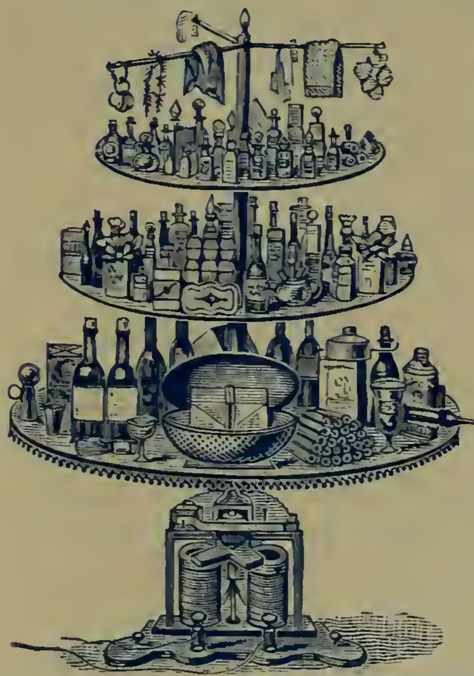

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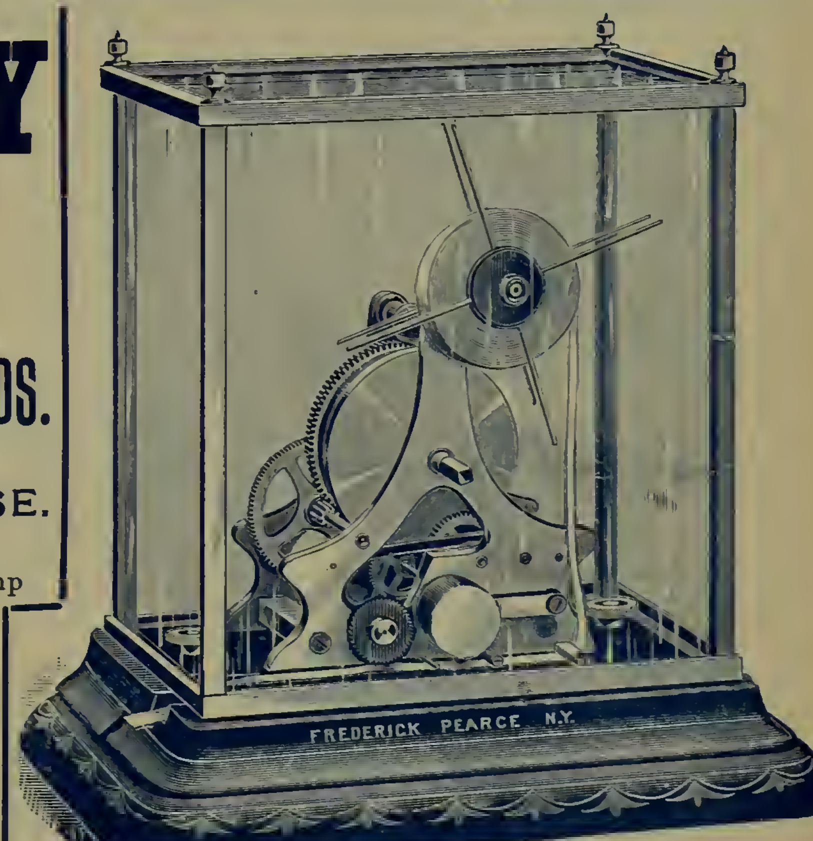

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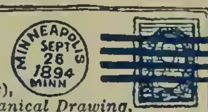

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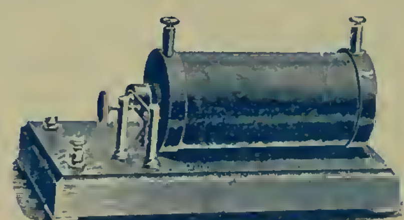

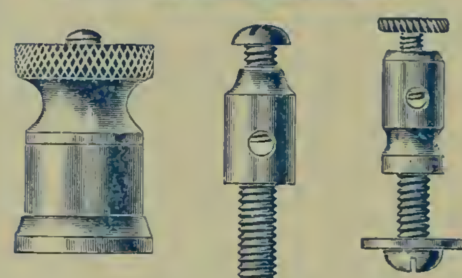

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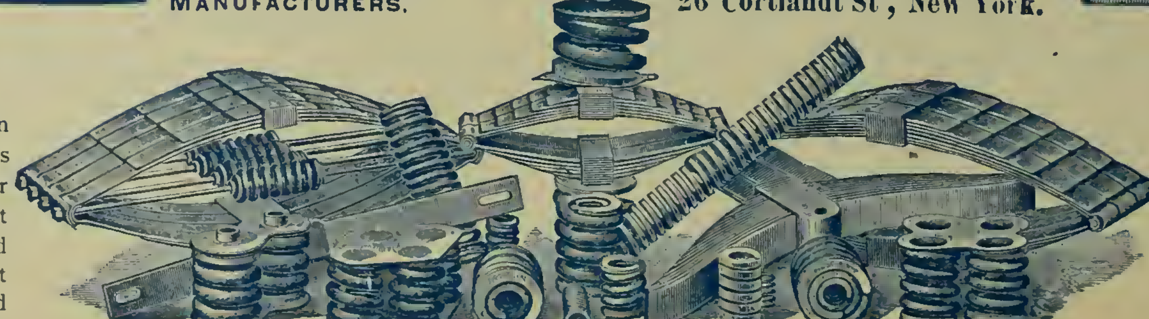

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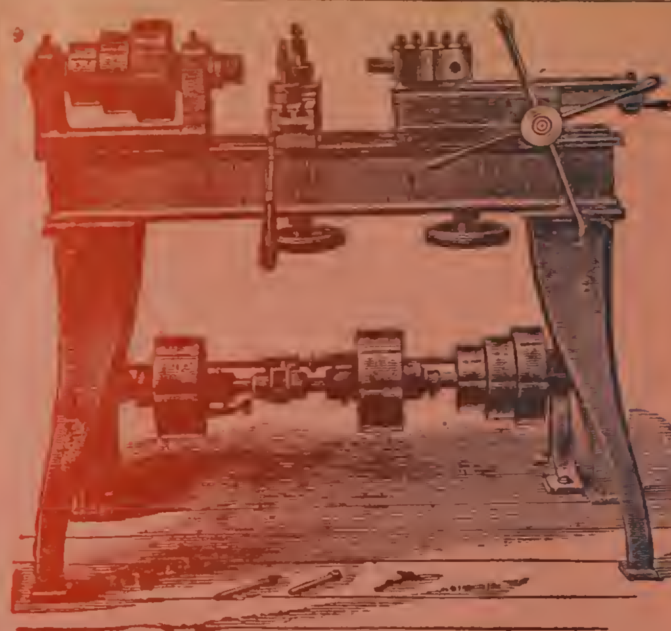

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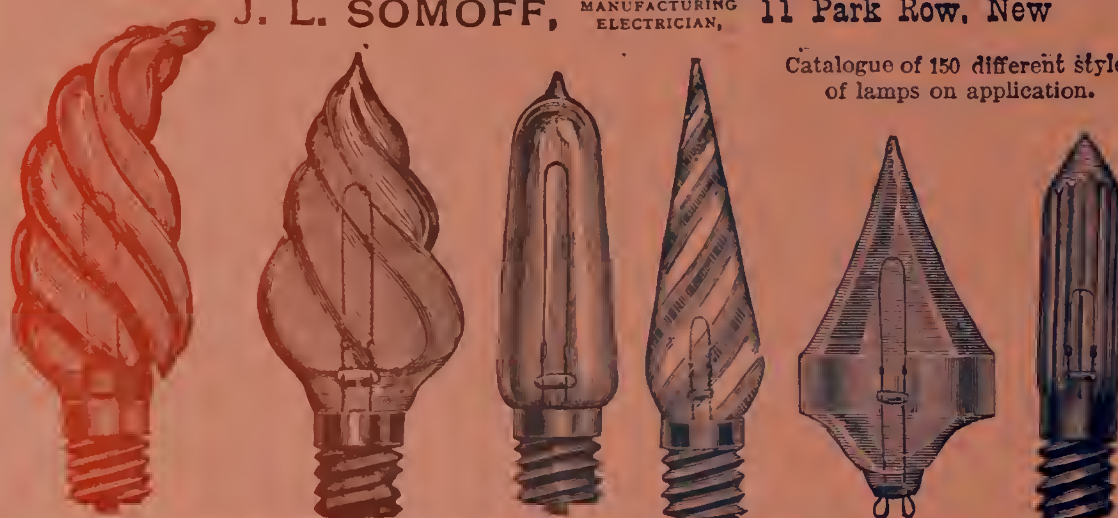

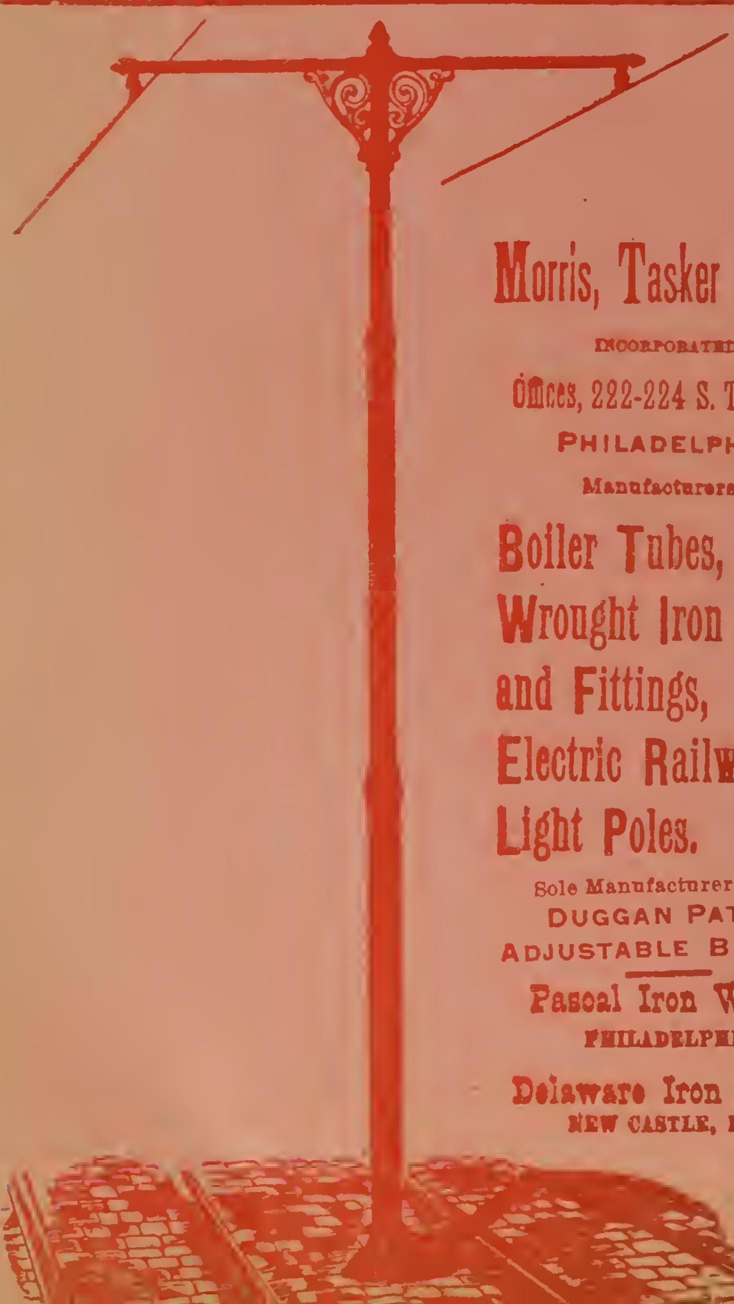

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