REVIEW OF THE TELEGRAPH AND TELEPHONE

JOURNAL OF ELECTRICAL, SCIENTIFIC AND MECHANICAL NEWS.

Vol. 2, No. 2. NEW YORK, MARCH 1, 1883. [$2.00 Per Annum. Single Copies, 10 Cents.

Entered at Post Office, New York, as Mail Matter of the Second Class

Life's Game.

Life's Evil Genius with the sunless wing
  And our white Guardian Angel sit and play
Their silent game of skill from day to day,
  Where thoughts are pawns, and deeds are queens and kings.
And every move on that strange chessboard brings
  Some change in us—in what we do or say;
Till with our life the winner sweeps away
  The last few pawns to which his rival clings.
We seem permitted, ever and anon,
  To catch a glimpse of that great fatal game
By which our soul shall be or lost or won.
  We watch one move, then turn away in shame;
But though we lack the courage to look on,
  The game goes on without us all the same.

ELECTRIC LIGHT

A New Secondary Battery.

Some experiments have recently been made with a form of secondary battery invented by Messrs. Liardet and Donnithorne, London, Eng., the main features of which, as stated by the inventors, are the intermixture of porous lead, deposited either by direct action by means of a galvanic current, or by the action of spelter, with oxides and salts of lead such as may be produced from galena or other lead ore, as the acting substance of the plates to accumulate the current. This mixture is placed on very thin plates of pure lead, which serve as conductors, and is kept in position by porous plates. Great stress is laid upon the purity of the lead and lead compounds, as by this means the inventors seek to avoid local action and to increase the intensity and durability of the battery. The experimental set of cells consist of 50 elements, each of which has an area of one-twelfth of a square foot, the weight of the set being 315 lbs. The cells, having been charged with a dynamo, are reported to have given a current of 12 amperes with an electromotive force of 95 volts; or, in other words, two have given a sufficient current for one small arc lamp or 25 incandescent lamps. Upon the occasion of our visit to the laboratory at No. 38 Holborn viaduct, this battery supplied seven Edison incandescent lamps with a current. The inventors claim that they have produced a secondary battery or accumulator of power of any other. So far as the laboratory experiments have gone, their results appear to be sufficient to encourage the inventors in proceeding with the work of practical development.

Electric Lighting in Mills.

BY C. J. H. WOODBURY.

Although the cruder forms of electric light were made early in this century, preceding the locomotive, the telegraph and illuminating gas, yet the mechanical refinements devised within a few years have been necessary to master many of the practical and economic difficulties, and render it feasible to bring electric lighting from the laboratory to the commercial world, creating an element in manufacturing affairs.

Although our object is to consider electric lighting solely in regard to its employment for industrial purposes, a better understanding may be reached by examining some of the principles involved in its production.

The accumulation of electricity by means of a dynamo machine is based upon two principles: First, that when a wire is moved across a magnet through the field of force, the power exerted against the attraction of the magnet is converted into electricity. Second, when an electric current is passed through insulated wires coiled around a piece of iron, the iron is magnetized.

In a dynamo machine the magnets are very feebly magnetized; but when the armature is revolved it generates an electric current, which passes through the wires around the magnets, increasing their strength and enabling them to produce a stronger current in the armature, and this in turn adds to the strength of the magnets, the armature and the magnets reacting on each other until the limit of the capacity of the magnets is reached, after several hundred revolutions of the armature. When the motion of the armature is stopped the magnets lose nearly all their magnetism, as soft iron will not retain magnetism like steel.

Permanent steel magnets were originally used for this purpose; but electro magnets are capable of holding twenty times as much magnetism as permanent magnets.

This is the rough outline of dynamo machines. Their construction is not so simple a matter, involving numerous problems upon matters which cannot be considered here.

Electricity for lighting might be furnished by galvanic batteries, but the cost would amount to twenty-five times as much as when generated by a dynamo.

There are two methods of converting electricity into light. The arc light is chiefly due to the glowing of produced by the current overcoming the resistance offered by the space between the carbon poles, whereby the energy of the electricity is converted into heat.

The carbons are slowly volatilized and partially burned. The intensely heated vapor adds to the illumination, but the combustion of the burning carbon interferes with the light, as the arc light is more brilliant when enclosed in a glass receiver and removing the air. The incandescent light is produced by the current overcoming the resistance offered by a filament of carbon and raising it to a temperature sufficient to render it luminous.

The immediate destruction of the carbon is prevented by regulating the quantity of the current and enclosing the carbon in a glass bulb and exhausting the air, so that it cannot burn.

Both the arc and the incandescent light is due to the glowing of intensely heated carbon. In the arc light the incandescence is destructive to the carbon; and in the incandescent lamp the object is to make the carbon as enduring as possible under the conditions of brilliancy, which are essential for satisfactory results. The arc lamps are placed at openings in the conducting wires, and the carbons form a portion of the circuit. The electricity passes through the lamps in order, and the tension is reduced a certain amount at each lamp.

In the incandescent system the lamps are hung in wires swung down from the main conductors, so that the current is divided, an equal portion passing through each lamp. The comparison is sometimes made that the main conductors could be represented by the sides of a ladder, while the position of incandescent lamps would be in the middle of the rounds of the ladder.

In the arc light, where the carbon is heated to destruction, the total quantity of light for a given expenditure of electricity is about nine times what it is in an incandescent light working at a commercial rate. In an incandescent lamp the question of endurance of the carbon is the second factor in determining the most advisable brilliancy for the light.

According to Howell's experiments on the Edison light, if the electricity supplied to a 16-candle power Edison lamp be increased one-fourth, the candle power is doubled, but the endurance of the lamp would be reduced.

The golden mean of the true economy between expense of renewals of lamps and that of power can be reached only by long experience.

I presume that the present intensity of brilliancy which has been adopted is at about the minimum cost for the present construction of carbons.

The unit of measurement of light is expressed in candle power, which is the light furnished by a standard wax candle burning 120 grains per hour.

by an argand burner consuming five cubic feet of gas per hour.

With the incandescent lamp the light is nearly uniform in all directions.

In the arc light the terminals of the carbons are different, the lower carbon consuming to a sharp point, and the upper one is blunt and the end concave. The light emitted from these ends is not alike; the upper carbon having the most heated surface, about nine-tenths of the light is thrown downward below a horizontal plane. The power of arc lights, as generally stated, is that of the strongest rays which are thrown down at an angle of 45 degrees, which is about twice the brilliancy of the average light. Nearly half of the light is held back by the white glass tubes, and the arc lights being further apart an excess of light is necessary to secure sufficient diffusion at extreme points, because the intensity of light diminishes as the square of the distance.

The value of electricity for lighting mills is based upon the character of the illumination desired, each mill being, to some extent, a law unto itself.

One of the first items of consideration is the influence of electric light upon the operative, considered as a machine to be kept in good condition, in order to obtain the best results. As the electric light does not require any air to support combustion, it does not injure the air in a mill.

On the other hand, Dr. William A. Hammond states: "A gas burner consuming four cubic feet per hour produces more carbonic acid gas in a given time than is evolved from the respiration of eight adult human beings."

This is an important matter in night work, when the air becomes so impure that it prevents the operatives from doing the amount of work which they do if the air was pure.

Gas lights increase the temperature excessively. In the basement story of a mill 400 by 65 feet, and 15 feet high, were 456 looms on heavy colored cotton goods. The room was lighted by 457 4-foot gas burners. When these were used it was stated that the temperature increased 25 degrees in an hour. Now the room is lighted by 35 electric lights, and the increase in temperature, if any, is not enough to be indicated by an ordinary thermometer. In two other mills the rise in temperature, after lighting the gas, varied from 11 to 13 degrees.

The economy of any light increases much more rapidly than the temperature. A large gas light furnishes more light for a given quantity of gas than a small one.

Nine years ago I made some experiments upon the efficiency of kerosene burners, and obtained similar results.

The temperature of the upper carbon in an electric arc light is estimated at 6,000 degrees Fahrenheit, and the lower one at 4,500 degrees, but this estimate refers only to the special light experimented with which were used small carbons, and the general result to-day is probably greater than the one given above.

This high temperature furnishes much more light rays from a given amount of heat than a lower temperature would give.

Dr. Chas. W. Siemens, in an address delivered before the British Association in York, England, last August, stated that in a gas burner only one per cent. of the calorific energy of combustion produced light; while in the incandescent light it was three and seven-tenths per cent., and in the arc light it amounted to thirty-three per cent. Whether subsequent investigation may not modify these results is an open question, but the general statement that the electric light contains a much smaller proportion of the heat rays than the gas will be questioned.

It is stated by Mr. W. Pickering that the injurious effects of artificial light upon the eyesight are due to heat from lights, and not to the light itself.

Another matter of value in electric lights is the ability to distinguish tints. The light from the tips of the carbons is white, and the light of the arc between them is a bluish-purple, so that the general tint of the arc is that bluish-white, which has a very white appearance.

Where the use of shades of color is involved, electricity furnishes the only artificial light which can be feasibly used; and in such cases where the operation of a certain department would otherwise be limited to the duration of sunlight, the economy from the use of the electric light is, to a certain extent, proportionate to extra profits accruing from this extension of the time of labor.

In other departments of manufacturing, the aid to the production of perfect work, by this improved illumination, is a source of additional revenue, because the proportion of damaged goods usually made when the mill is badly lighted, is thereby diminished.

EXPENSE.

The cost of maintenance of a system of lighting bears little relation to its intrinsic worth. The item of cost of lighting is a small fraction of the whole operating expense, and what is desired is to light a mill so well that there will be no difference in the character of day and night work, either in quantity or quality. Any expenditure beyond that is unwarrantable.

The question of the cost of lighting by electricity is subject to many legitimate variations, of which the question of power is most variable. In a steam mill, where the dynamo is driven by the same engine that runs the mill, it should only be charged with its share of fuel, but not with any other expense of power, wherever it does not introduce any new expenditures in the way of plant, repairs, or labor in the engine room.

Some mills have departments which are only run by daylight, where work is thrown off at sundown, and so compensates for the steam requiried by the dynamo. For example, in one mill using electric lights, the power used in the nepping room is slightly more than is required for the dynamo, so when the machinery in that room is stopped, the dynamo can be started without bringing any extra load on the engine. Most factories are driven by water power, with supplementary steam power during the low water in the summer months; the electric lights would be required during the shorter days of the year, at a time when there is usually an abundance of water, and the extra power can be used by the dynamo by the use of more water, without requiring any additional expense.

It is difficult to make comparison between various methods of illumination, because a change of light is always made an excuse for more light.

The majority of mills are lighted with gas made by the destructive distillation of petroleum, and of about 80 candle power, which is generally reduced to 60 candle power by mixing air with it, and burned through one foot (nominal) burners, which consume about 1¼ feet per hour.

The annual cost of oil gas per burner is from seventy-five cents to one dollar. In all these estimates, interest at six per cent. forms one item in cost. One large corporation, with exceptional privileges, makes its coal gas at an annual cost of 69 cents per burner. Another corporation, inland, makes its coal gas as $1.25 per thousand feet, at an annual cost of $1.79 per burner, each burner consuming 1,433 cubic feet annually.

Of two large mills in the same city, manufacturing similar goods, the more modern one makes oil gas at an annual cost of 79 cents per burner, while the older one buys coal gas at $2.65 per burner.

Sometimes, when the gas-making apparatus is not managed with skill, the goods are damaged from soot which settles on them.

The longer time light is required, the average cost is lessened, because with the addition of operating expenses, the interest on plant, being a fixed amount, becomes a smaller proportion of the whole cost. In electric lighting, the cost of plant is so much that interest is an important item, and when the mill is run nights, the relative cost of electric lighting is materially diminished. A white cotton mill, running 60 hours a week, generally uses light 300 to 350 hours a year; where they run 66 hours a week, lights are required 400 to 450 hours a year. A dark mill requires about twice the number of lights that is sufficient in a white mill, and uses light about 100 hours a year more than a white mill.

An arc light, as generally used in mills, requires about one horse-power. Mr. James Renfrew, Jr., at Adams, Mass., has found, by test, that the 40 light Brush dynamos in his mills each require 36.6 horse power. The lights were running in a satisfactory manner, but no photometric tests were made.

The cost of arc lights in several steam mills running 400 hours per year, is 6½ cents per hour, of which 1½ cents are for carbons, and 5 cents for attendance, coal, depreciation and interest. When a mill runs nights, the hourly cost is diminished.

The ratio of substituting electric lights for gas is quite variable, being one arc light to from ten to twenty gas burners. In one mill lighted by kerosene the ratio was one arc lamp to eight kerosene lamps.

In a colored mill, one arc light will light the looms on 700 to 1,400 square feet of floor, but in a white mill the same light will be sufficient for looms on 1,000 to 2,000 square feet of floor. The reflected light from white walls and ceilings adds very materially to the diffusion.

A card room 48 by 100 feet, containing 64 cards, was satisfactorily lighted by one arc light. The end of the room was extended about 40 feet, and the light was not satisfactory toward that end of the room, because there was no end wall to serve as a reflector.

It is convenient to compare the cost of electric lighting with the expense of gas in the same place, although it must be remembered that gas does not furnish as much or as good light, and is therefore not so valuable where quality of light is of importance.

In a weave room, on very fine work, 24 arc lights replaced 292 six foot burners, which consume (292 × 6) 1752 feet per hour, so one arc light represents the consumption of (1752 ÷ 24) 73 feet of gas per hour. A careful estimate shows these arc lights to be costing 6½ cents an hour, so this arc lighting system represents gas at 89 cents per thousand. A similar estimate in another mill gives the annual cost of gas $2,188 and electricity at $1,125, or equal to gas at 90 cents a thousand. The annual saving to that mill in lighting expenses by the use of electricity makes a profit of $1,603, which represents 6 per cent. on $17,716, without making mention of any improvement in work or production due to that light. In both of these establishments the lights were used about 450 hours per year. Other estimates give the cost of arc lighting equal to gas at from 65 cents upward per thousand. In the case of incandescent lighting the cost is more difficult to estimate, because they are run at all degrees of brilliancy, affecting both the power and the life of the lamp.

Both the Edison and the Maxim lamps are guaranteed to average 600 hours; yet in the New York Post-office the average record of the Maxim lamps is stated to be 1,850 hours up to September first, and 15 lamps had already burned 3,456 hours.

The ferry boat Jersey City, belonging to the Pennsylvania Railroad, is lighted by the Maxim lights, and their record has been given to me as averging 1,645 hours, and the lamps still burning.

The data for the above was taken with lamps in use, and does not represent their ultimate endurance.

Mr. Timothy Merrick, of Holyoke, authorizes me to ve the facts respecting his experience with the Edi- n system in the Merrick Thread Company's mill, umber 3. This mill runs all night five nights in e week for fifty-one weeks per year, using light 869 hours per annum. It was lighted by 95 burners city gas, costing $2.13 net, which amounted to 5 per month. 95 Edison B burners (8 candle ower) were substituted for the gas. In the first 000 hours five lamp carbons had broken, and Octo- er 20th they had been in use 1,278 hours, and 11 had roken.

Allowing that the lamps average six months' use, he cost of lighting is made up as follows:

190 lamps, at $1	$190 00
Interest and depreciation	153 50
6 H. P., at $10	60 00
Annual cost Edison light	$403 50
Monthly " "	33 62
Monthly cost gas	225 00

The results from these lamps are very satisfactory, and certainly in excess of what would have been obtained if the lamps had been forced beyond their normal capacity.

The Holyoke Water Power Company furnish water power very cheaply; and the result may be interesting if we hold the Edison Company to their minimum guarantee; and also charge the dynamo with four pounds of coal per hourly horse power.

4.78-100 renewals of 95 lamps equals 454 lamps, at $1.00	$454 00
Interest and depreciation	153 50
30.74 tons coal at $5.75	176 81
Annual cost Edison light	$784 31
Monthly " " "	65 36

...ich is equal to gas at 65 cents per thousand.

...he mill is situated at the base of a high bank, and is only eleven feet six inches between floors, so it is very hot in summer, and Mr. Merrick informed me that it would have been impossible to run the mill nights during the extremely hot season last summer, if the help had been subjected to the heat and vitiated air from the burning gas.

It must be kept in mind that an instance of a mill running day and night is an extreme one in favor of the electric lights; but the data are given and the matter can be estimated to suit other times of operation.

The Electrical Exhibition, Royal Aquarium.

This exhibition, which is rapidly approaching completion, seems likely to surpass, in electric light appliances at all events, anything which has gone before. The chief novelty in machines will probably be the exhibit of Messrs. Ferranti, Thompson and Ince. We have on more than one occasion spoken of the Royal Aquarium as being, perhaps, the most accessible place, from all parts of London, for the purpose it is now being devoted to. As far as we are able to judge, success must be assured.—*London Electrical Review.*

The *Pall Mall Gazette* says that the making of the electrical railway between Portrush and the Giant's Causeway marks an era in the history of locomotion. If the sanguine hopes of its projectors are ...lized, it will be not less remarkable in the history of Ireland. Nature has left her destitute of those stores of force in the shape of coal mines, with which England and Scotland have been so plentifully favored, but she has dowered her with an inexhaustible supply of force in the shape of waterfalls, which have run to waste from before the days of Finn McCool until now. "The costless drainage of a wilderness," which, on Canadian rivers, Mr. Hussey Vivian found busy converting, almost without the intervention of a human hand, beams of rough-hewn timber into finished doors and windows and all manner of woodwork, has never been harnessed to the service of man in Ireland. The advent of an electrical age promises to change all that, and the Portrush Railway may be the forerunner of the great things which are yet to come, when the Irish have learned to employ the drainage of their hills in driving the machinery of their mills. Turbines planted on the River Bush are to generate the electricity which is to drive the tram-cars from Portrush to the Giant's Causeway.

At the last meeting of the Royal Society a communication was made by Professor D. E. Hughes, F.R.S., on the nature of magnetism. The author propounded a theory of magnetic action which he has been led to by numerous experiments, some of which he showed to the Society. The conclusions of Professor Hughes are in his own words: "1. That each molecule of a piece of iron, steel, or other magnetic metal, is a separate and independent magnet, having its two poles and distribution of magnetic polarity, exactly the same as its total evident magnetism when noticed upon a steel bar-magnet. 2. That each molecule or its polarity can be rotated in either direction upon its axis by torsional stress, or by physical forces such as magnetism and electricity. 3. That the inherent polarity or magnetism of each molecule is a constant quantity like gravity; that it can neither be augmented nor destroyed. 4. That when we have external neutrality, or no apparent magnetism, the molecules, or their polarities, arrange themselves so as to satisfy their mutual attraction by the shortest path, and thus form a complete closed circuit of attraction. 5. That when magnetism becomes evident, the molecules or their polarities have all rotated symmetrically in a given direction, producing a north pole if rotated in this direction as regards the piece of steel, or a south pole if rotated in the opposite direction. Also, that in evident magnetism, we have still a symmetrical arrangement, but one whose circles of attraction are not completed except through an external armature joining both poles."

Electric Lights for the Bridge.

The contract for lighting the Brooklyn bridge has been awarded to the United States Illuminating Company, which is the local organization of the United States Electric Lighting Company. Seventy powerful arc lights will be distributed on both sides of the bridge, and these will all be run from machines situated on the Brooklyn side and driven by special engines. The contract includes not only the dynamo machines and lamps, wires, and lamposts, but also the engines used for driving the machines Two separate circuits are to be used which will feed alternate lamps on both sides of the bridge, so that if any accident should befall one of the engines only the alternate lamps will be extinguished. The contract calls for the completion of the work within sixty days.

A New Electric Light Company.

An application has been filed at Harrisburg, Pa., for a charter for a new electric light company, to be located at Pittsburgh. The incorporators are prominent business men of Pittsburgh, and the company is to develop the patents of the Rev. J. J. and Thomas J. McTighe, the well-known inventors, whose new form of dynamo machines are said to possess considerable merit, a description of which we shall give in next edition.

New Model of Callaud's Sulphate of Copper Battery.

Callaud's Sulphate of Copper Battery (Dumoulin-Froment Model).—In this battery, made by Messrs. Dumoulin and Froment, the sulphate of copper is placed in a glass jar, in the bottom of which there are two holes. By this arrangement the sulphate of copper can easily be removed, and the liquid be more or less stirred up, without bringing the solution in immediate contact with the zinc. The piercing of the two holes can be easily done, and at very little cost.

The positive pole is formed by a copper wire, rolled in the shape of a spiral at its lower end, and consequently is without weld, solder, or any possible break in its continuity. A protection of rubber, sufficiently thick, formed by a simple tube slipped over the end of the copper wire, covers it from the bottom to outside the outer jar. The zinc is suspended by two hooks, which are simply passed through two holes made in the top of the jar, and which rest on the edge of the outer jar.

This battery has one peculiarity which can be of a certain use as regards attending to it—namely, the difference generally noticed between the level of the liquid inside and outside of the glass jar. If the battery is in good condition, the liquid in the jar is lower than that with the zinc, thus showing that the solution of sulphate of copper is concentrated, or nearly so, and that of zinc sulphate is not so; this case proves the battery to be in good working condition. If, on the contrary, the heights of the liquids are equal, or even if the sulphate of copper should be higher than the other, it is because the copper solution is not concentrated enough, or that the sulphate of zinc solution is overcharged with salt.

The constants of the battery thus made do not differ at all from those of the ordinary callaud (E = about 1 volt, R = 6 to 8 ohms), because the positive pole is always kept in the solution of sulphate of copper, which escapes from the jar through the two holes.

Atlantic Cables.

For some time past there has been a new Atlantic Cable Company rumored, but no definite steps have apparently been taken to proceed with the manufacture and laying of more cables. This threatened opposition was based on the supposed control by one company in America (the Western Union Company) of the existing cables. In order to do away as far as possible with this notion, an independent marine telegraph office is about to be opened in New York. The Direct United States and the French Atlantic cables will be worked from this office, quite independently of the existing land lines in America, and at the same time will be open to receive messages from any of the land telegraph companies of the United States. As the existing cables, thanks to the duplex system of working, are sufficient for a much larger traffic than there is at present, it is probable that the new office will obviate the necessity of laying more Atlantic cables for a considerable time to come. While upon this subject, we may mention that Dr. Muirhead has just successfully "duplexed" the Jay Gould Cable across the Atlantic.

A Throat Electric Lamp.

At the last meeting of the Leeds and West Riding Medico-Chirurgical Society, Mr. Margetson, of Dewsbury, England, exhibited an incandescent lamp, designed by himself, and used by him since October last in examining the mouth and throat. The globe was about half the size of a walnut. It can be held in the mouth for two minutes without discomfort from the heat.

REVIEW
OF THE
Telegraph and Telephone,
(AN ELECTRICAL JOURNAL)

PUBLISHED SEMI-MONTHLY AT 23 PARK ROW.

P. O. BOX, 3329.

O. WORTHINGTON, - - *Editor and Proprietor.*

SUBSCRIPTION.

United States and Canada, $2 00 per annum, in advance.

Great Britain and other foreign countries, $2.50 = s. = 13 francs, in advance. Postage free.

ADVERTISING.

Transient rate, 35c. per line each insertion.

"Business specials," 50c. a line.

EDITORIAL ANNOUNCEMENT.

We invite correspondence from Electricians, Inventors and the Telegraph and Telephone fraternity on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

Those desiring to recommend their goods can do so to any extent in our advertising columns, but we will not publish for pay anything of that nature in our reading columns.

Subscribers can at any time have the mailing address of their paper changed by sending both old and new address. Wm. Dawson & Sons, 121 Cannon Street, London, England, are our accredited representatives for Great Britain.

The Editor does not hold himself responsible for opinions expressed by his correspondents.

No notice is taken of anonymous communications.

DEALERS SUPPLIED WITH THIS PAPER BY

The American News Company, New York.
The American News Company, Denver, Col.
The American News Company, Kansas City, Mo.
The American News Company, St. Paul, Minn.
The New York News Company, New York.
The New England News Company, Boston, Mass.
The Central News Company, Philadelphia, Pa.
The Western News Company, Chicago, Ill.
The St. Louis News Co., St. Louis, Mo.
The Cincinnati News Company, Cincinnati, Ohio.
The Pittsburgh News Co., Pittsburgh, Pa.
The Baltimore News Company, Baltimore, Md.
The San Francisco News Co., San Francisco, Cal.
The Montreal News Company, Montreal, Canada.
The Toronto News Company, Toronto, Ontario, Canada.
Wm. Dawson & Sons, London, England.
J. N. Duquet, Quebec, Canada.
H. A. Kramers & Son, Rotterdam, Holland.
Berthold Mendel, Berlin, Germany.
F. D. Osborne, Calcutta, East India.
F. Knauff, Moscow, Russia.

NEW YORK, MARCH 1, 1883.

CONTENTS.

The Patents of Augustus Hahl and Elisha Gray Upon Elevator Annunciators.

The Hahl patent was issued March 10, 1874, while Gray's application was pending in the Patent Office. Interference was afterwards instituted between Hahl's patent and Gray's application, which resulted in favor of Gray as to the broad principle of an electric annunciator traveling upon an elevator car, and means for signalling from the different floors while the car is in motion.

Gray, however, conceded priority of invention to Hahl upon the specific device of a flexible or folding cable, which has been adopted generally.

These patents are both owned by the Western Electric Company, and several suits have been brought upon them in St. Louis, Chicago, and New York. In these suits the defendants have settled or ceased to contest the matter before the final hearing.

In May, 1881, the Western Electric Company brought suit against the Chicago Electric Manufacturing Company. This suit was contested vigorously to the end in the Circuit Court for the Northern district of Illinois, and was decided in favor of the validity of both parties by Judge Blodgett.

The opinion rendered December 26, 1882, is published in full in the Federal *Reporter* of February 6, 1883. The Court, after defining the inventions and reviewing the interference proceeding which were had in the Patent Office, continues as follows:

"These concessions and disclaimer left the Gray patent covering only the general principle of connecting the annunciator in the moving car of an elevator with signal keys on the respective floors of the building and the battery by the means shown, but conceded priority of the flexible cable method to Hahl.

"The defense of want of novelty rests mainly on the patents of Holmes and Corey for similar devices, and the analogous devices of Foster and the gas tube, by which gas is carried by means of a flexible tube to burners in an elevator car.

"As to the Holmes and Corey patents, it is sufficient to say that they were put in interference with the Hahl patent before the Patent Office, and the commissioner on proof decided that the invention of Hahl was prior to that of either Holmes or Corey. This decision of the commissioner may not be so wholly conclusive upon all the world as to prevent the citation of the devices of Holmes and Corey as anticipating the Hahl patent, but no proof is introduced on this trial which was not before the commissioner, on this interference, and it seems to me there can be no doubt that the decision of the commissioner was correct upon the testimony in the matter then before him, and that his award of priority to Hahl sufficiently disposes of the Holmes and Corey devices for the purposes of this case.

"The Foster patents are for devices for transmitting signals by means of pneumatic tubes.

"Neither of them show the application of the device to an annunciator in the car of an elevator while in motion, and even if they had shown such application to the Foster device I do not think a person could, without invention, from any hint or suggestion in the Foster device, by mere mechanical skill, adapt the system of electric calls used in Hahl's device to an elevated car. The same may be said of the flexible gas pipe.

"Neither air, working through a flexible pneumatic tube, nor gas, passing through it for the purpose of illumination, is the electric fluid, and it required something more than was done, either by Foster with his pneumatic tube, or whoever applied the gas tube, to apply electricity to the operation of an annunciator in a car in motion.

"The proof shows that since the Hahl and Gray patents, this device has been generally adopted for use in elevator cars, and its adoption, and the fact that almost simultaneously quite a number of inventors, two of them at least, Gray and Holmes, well known to the public for valuable inventions in the field of electric science, had given their attention to the subject matter, covered by the devices now before us, is evidence that it required something more than mere mechanical skill to accomplish the result attained by this patent.

"As to the second point, that this device shows only a mere aggregation of parts and produces no new result, it is sufficient to say the result produced is the transmission of signals to a car, *when in motion*, which was new and had never been produced until this combination, and that some of the parts in this combination perform a new function, and the whole combination produces a new result.

"As to the objection that the Gray patent was irregularly issued, it is, perhaps, not material to the purposes of this case to consider that point seriously, because the defendant in this case is shown by the proof to only use the flexible cable method, covered by the Hahl patent; but I have no doubt that under Section 4,904 of the Revised Statutes the Commissioner of Patents had the right to declare an interference between Gray's application and the Hahl patent, as the statute expressly gives him the power to declare an interference between 'any pending application and any unexpired patent.'

"So, too, it seems to me that both patents are sufficiently definite in their statements to describe and cover the inventions claimed.

"There is no controversy in this case on the question of infringements.

"The proof shows that the defendants have used, and are using, the flexible cable method shown and described in the Hahl patent.

"I can, therefore, see no reason why the complainant is not entitled to a decree and to an accounting."

Electrical Energy.

[*Continued from page 4.*]

Numerous attempts were made, after the announcement of Volta's invention, to improve the form and action of the apparatus. These endeavors have continued, with more or less success, to the present day, of which the storage of electical energy is an instance.

Two months after the announcement by Volta of his invention, Messrs. Nicholson and Carlisle decomposed water its constituent gases by means of Volta's pile.

In 1801, Dr. Wollaston pronounced that the oxidation of the metals in a voltaic pile is the cause of its electrical effects; later in the same year, he turned the power of an electrical machine into a continuous current while decomposing water by frictional electricity.

In 1801, Gautherot observed the action due to polarization on which electrical storage is supposed to depend.

In 1802, in the very infancy of voltaic electricity, an *artificial magnet* was employed to decompose water in place of the direct galvanic or voltaic current. This is of interest in connection with the employment of magneto-electricity in charging accumulators.

In 1803, Ritter, of Jena, devised a secondary battery making use of the currents due to polarization. When an electric current is sent through acidulated water, with platinum plates as electrodes, a film of oxygen covers the positive electrode, and a film of hydrogen covers the negative electrode. One of these two substances being electro-positive and the other electro-negative, they act in the liquid like two different metals; the hydrogen plays the part of zinc, and the oxygen plays the part of platinum.

Withdrawing the charging battery and connecting two plates thus covered with films of gas, by a nducting wire, an electric current is obtained. e direction of this current is from the hydrogen n to the oxygen film through the conducting re.

o electrodes thus covered with condensed gas-films are said to be polarized.

When a cell with platinum plates is introduced o a voltaic circuit it is found that the battery-cur-t, though strong at first, gradually weakens. is is due to the opposed current of polarization.

The electro-motive force of the film-covered plates in the opposite direction from the current charging em, and may be far greater than that of the battery arging them. It may give a more brilliant spark d overcome resistances insuperable to the charging ttery.

This form of battery was discovered by Ritter. me writers accredit the invention to Gautherot in 01, as consisting of a phial containing salt and ter, with a stopper through which passed two ver wires. Gautherot was followed by Erman, a rman, who was in turn followed by Ritter of na.

In 1805, Brugnatelli deposited gold on silver edals by voltaic action by immersing them in am-onurate of gold.

In 1812, Zamboni constructed a pile of alternate yers of tin foil, paper and peroxide of manga-se.

In 1826, Nobili, by the electrolysis of a solution of e acetate of lead, deposited peroxide of lead on ates of metal.

In 1833, Faraday set the whole theory of storage electrical energy on a firm basis in a series of pers communicated to the Royal Society. He said at "the decomposing action of a current is con- r a constant quantity of electricity, notwith- g great variations in its sources, in its intensi-s or in other circumstances." He showed by merous experiments that electricity and chemical inity are the same force differently modified ; by owing that the amount of decomposing effects in l substances agrees with their chemical equivalents. o those not acquainted with the nature of chemical mbinations it may be desirable to state that the ements of bodies always unite in definite propor-ons. For instance, eight atoms of oxygen unite with e of hydrogen to form water, and one atom of ygen unites with five of potassium to form potass.

The eight parts of oxygen which combine with one hydrogen to form water combine in the proportions 32 with copper, 58 with tin and 103 with lead ; d the same amount of electric force that is re-ired to separate 8 parts of oxygen from water will, secondary action, separate copper, tin and lead om their combinations with oxygen in the propor-on of 32 with copper, 58 with tin and 103 with ad.

Faraday carefully collected the results of the tion of a zinc plate and a plate of platinum in lute acid.

The quantity of oxygen and hydrogen evolved owed the amount of water decomposed. The eight of the zinc plate was diminished, and the eight of water decomposed, as 9 is to 32.31 ; these umbers correspond with the equivalents of water d zinc.

In 1837, Schonbien, of Basle, announced the fact at plates coated with peroxide of lead possessed motive qualities.

840, Murray deposited various metals on arbon surfaces by galvanic action.

In 1841, Alfred Smee enunciated the laws regulat-ng the character of metallic deposits by galvanic ction.

In 1842, Grove invented his gas battery. This rrangement consisted of platinized plates enclosed in tubes, and arranged in pairs. One plate of each pair being surrounded with oxygen gas and the other with hydrogen gas, the lower extremities of the plates being in acidulated water.

[*To be Continued.*]

It is stated that the Swan United Electric Light Company, of London, have sold to the Russian Government, for £100,000 in cash, the exclusive right to use their invention throughout the Empire, and to sell their lamps. There can be but little doubt that the employment of the electric light in the larger cities and towns of Russia could be made a most lucrative State monopoly. The company's paid-up capital is £160,000 in 80,000 shares.

The Bell telephone appears to be rapidly triumphing over its competitors. A suit which has attracted much attention has just been decided in its favor in England in the Court of Appeals after a hard fought legal battle. The trial in the lower court before Mr. Justice Fry occupied sixteen days, and in the Court of Appeals before the master of the rolls, Lord Justice Lindley and Lord Justice Bowen, it occupied nine days.

The United Telephone Company, owning the Bell and Edison patents sued to restrain an infringement of their patents. The defendants maintained that Bell was not the inventor of the telephone ; that a German, Herr Reis, in 1862 published in a German scientific journal an illustrated description of an instrument invented by him for the reproduction of musical sounds by electro-magnetism, a copy of which journal found its way to the library of the Institute of Civil Engineers in England. Second, that the invention of Mr. Bell had been exhibited, and so published, in England, by Sir William Thomson, of Glasgow, shortly before the date of the patent ; and, third, that the specifications of Mr. Edison's patent for a transmitter, involving the principal of the microphone, were improperly drafted, claiming the phonograph also, which was not comprised in the provisional specifications,—a fatal fault under English law. The decision in the inferior court was for the plaintiffs on all points except that regarding the Edison patent, and both parties appealed. There is, however, a provision of English law enabling an inventor to enter a disclaimer of a part of the title or specification so as to save a patent. This was done in the present case, and the sole question before the Court of Appeals was the validity of the Bell patent.

The result of the trial was, as stated above, a triumph for the Bell telephone and its owners. It was held that the invention of the Reis instrument, or toy, had been published in England, but that it was so different from the Bell instrument that such publication could not be considered an anticipation of the latter. The instrument exhibited at Glasgow was made by Mr. Bell. In 1876, when Sir William Thomson was in attendance at the Centennial Exhibition in this country, Mr. Bell exhibited his tele phone to him, and gave him an instrument to take home. At the next meeting of the British Association, Sir William Thomson spoke enthusiastically of the invention, and exhibited the instrument given him by Professor Bell, although he could not make it work, nor could anybody else. This was before the English patent was secured. The court held that this was nevertheless a publication, and the decision would have gone against the owners of the Bell patent but for the fact that the instrument actually patented contained improvements upon the instrument then exhibited of such importance as justified holding the patent good.

Thus the Bell telephone holds its own in England as in this country. There have been some big fights over it in both countries, and there will be more, for it is well worth fighting for.

We extract from the Brooklyn *Eagle* some exceedingly interesting remarks upon electric light matters by the able contributor who signs himself "F. H. N.:"

Dr. Siemens, speaking of the cost of electric light, (incandescent principle), says: "From the experience of large installations, I consider that electricity can, roughly speaking, be produced in London at a cost of about one shilling per 10,000 Ampere volts or Watts (746 Watts being equal to one horse power) for an hour. Hence, assuming that each set of four incandescent lamps in series required 200 volts electromotive force and 60 Watts for their efficient working, the total current required for 64,000 such lights is 19,200 amperes, and the cost of the electric energy lost by this current in passing through 1-100th of an ohm resistance is £16 ($80) per hour."

"At Brunn, in Lower Austria, a theater has been lighted with fifteen hundred lamps, each having an intensity of sixteen candles. At Holborn three machines, each capable of furnishing one thousand incandescent lamps, have been placed in position, and unusual success is being had. The lamps in use, however, which, it is claimed, have a minimum life of one thousand hours, are said to cost three shillings. From this a high authority calculates that the cost of lamps alone will amount to one-half that of gas, which, it is said, will give a like intensity of light at three shillings the thousand cubic feet. There is a very important point, however, in this incandescent system of electric lighting as developed by Edison that many are apt to overlook. That is the transmission of power over the same wire or through the same electric main whence comes the current for lighting purposes. In the district whose boundaries have already been given, innumerable small steam engines are used for running elevators and working shafts. Now, it has been demonstrated that an electrical force equal to, say, ten horse power, may be economically transmitted a short distance—say a mile's length, perhaps more. Each of these small engines, beside its first cost and interest on the money expended, etc., requires the employment of an engineer. For a tithe of this expenditure, if Mr. Edison's expectations are not too sanguine, the required power may be transmitted through an electric main. To be sure, this power must first be generated by means of the combustion of coal at the central station, but there it is generated in immense boilers and through engines of large dimensions. But these engines are required to work the dynamo-electric machines that supply the light at night, and would lie unemployed through the day-time if power was not also needed. Now, even admitting that electric lights are more expensive than gas jets of the same intensity—and that this is true when electricity is generated on a grand scale has not yet been proved beyond peradventure—even admitting this, the amount received for the auxiliary supply of power over the same wires during the day-time that supplied the light by night would go far, if it did not entirely eliminate this extra cost, and enable the light company to reduce the charge for light below actual cost.

The continuous and often unnecessary use of technical terms by those who essay to describe electrical discoveries and improvements, even in popular publications, prevents many who would otherwise be interested in the subject, but have not the time at their disposal to master the technicalities, from keeping themselves abreast of the times.

In an article recently published in a popular periodical, which had substantially for its theme the question as to whether or not carburetted hydrogen gas, such as is generally used, was to be preferred to the electric light, the author—no doubt an able man in his specialty—produced a perfect labyrinth of inextricable mazes of technical explanations. Such expressions as molecular tensions, molecular disturbances, photo metric tests, and so forth, seemed to ep out from every line; but when he said "You ll readily perceive that the Nth power of" so d so is equal to so and so, no doubt most readers laid wn the publication in despair, and, as the author, as they could see, came to no conclusion as to ch, gas or the electric light, was to be preferred, ew no more of the subject in question than they l before.

Such an explanation reminds one of a case said to ve been tried recently in a Georgia court. A negro, ving discovered a lost coon in the possession of other negro, had him arrested for petit larceny. ter hearing the evidence on both sides, the learned dge rose majestically, and thus decided the point law: "At common law this yer animile was per nal property; but, inasmuch as the law conceives at everything attaches to the land, it would not be ceny, independently of the statutes, to sever and rry away, with felonious intent, a animile from a e or from a barn. But, if this yer animile were vered at one time and carried away at another, er an interval of time, a larceny would be com- tted; for the property would become by the sever- ce the personal property of the owner of the realty, d rest as such in his possession before the asporta- on."

"Dat's all wery well," said the plaintiff, after he d patiently listened to the learned dissertation, but what we wants to fin' out is, who gets de coon!"

There are, however, some terms whose significance is absolutely necessary to understand in order to lly comprehend descriptions of mechanical appli- ces of the electric current. The most important of ese are the terms work, energy and potential. ork, in its physical sense, might not inappro iately, perhaps, be described as that capacity for something that can be measured. We will e that a laboring man has been employed to t a trench through a field. In a certain time, and der certain conditions, he will have performed a rtain amount of labor that can be measured, and will exhibit a certain amount of exhaustion. Or t us suppose a stout-bodied lad to set himself to the sk of throwing a given number of cricket balls just far as he can. The first he throws, we will say xty yards, the second less, and so on, until he aches the last, and is so fatigued with his previous forts as to be unable to throw it but a short distance. The great tidal streams throughout the country, or at generated at the coal mines, where fuel is cheap, ould be transmitted hundreds of miles and sold for mere song. In an address delivered in Glasgow me years since, Professor Siemens, the eminent ectrician, said that in England a means of trans- itting power by electricity must soon be the all- portant question of the day. "What are the Eng- sh to do," he inquired, "when their coal is ex- austed?" Of Niagara Falls, he said, "the amount water falling over Niagara is equal to 100,000,000 ns an hour, falling 150 feet. The amount of coal equired to raise such a weight up to the point from hich it fell, which is a measure of the amount of ower yielded by that water in falling, would re- uire the consumption of 260,000,000 tons of coal, hich is the amount of coal now consumed by the ntire world. Now, if fifty per cent. of the power sed to drive the first dynamo machine could be re overed from the second, and hence if the whole ower of Niagara could be utilized, it might be dis- over the United States so as to give from aterfall alone a power equal to the present en- re mechanical force of the world, estimating that ne-half the coal used is solely for mechanical pur- oses. The means by which Professor Siemens ould draw the power from the falls would consist f a series of flumes from the edge of the descent of e American Falls to the level of the water below f a size large enough to carry the waters of the

At the present state of efficiency of the transmitting machines, such an enterprise would, of course, be out of the question; but such a consummation would not be more extraordinary in the future than the transmitting of a mechanical movement by elec- tricity, as is accomplished in the telegraph, was in the past.

But the dynamo electric machine, in its present state of efficiency, is capable, as has already been said, of utilizing the power of a running stream toward lighting with electricity the towns that lie adjacent to it. Already the town of Godalming, on the River Wey, in Great Britain, is thus being lighted. Coal is here very expensive, since it must be brought from a great distance. Mr. Alexander Siemens, referring to this scheme in a letter, says that they had some difficulty with the stream driving their water wheel at first, owing to floods, but that with the assistance of a small steam engine, working as an auxiliary, they have succeeded in working the light very satis- factorily, having seven large voltaic arc lights and 300 small incandescent lights in use, the water power doing the major portion of the work. The only dif- ficulty experienced in this instance was irregularity in the light, owing to irregularities in speed. Doubt- less, when they get their turbine wheels in position, with adjustable sluices for regulating the quantity of water flowing in, all this will be rectified, and they will be enabled to dispense with the services of the auxiliary engine altogether. In a country like Ire- land, for instance, where coal for the most part must be imported, the power transmitting machine must in the future prove of inestimable value. Her water power, which, as estimated by Sir Robert Kane, amounts to one million and a quarter horse power, may, through the agency of this machine, be dis- tributed through the country in the shape of elec- tricity, and supply her mills with power and her cities and villages with light and even heat, instead of being as now permitted to run uselessly to waste.

Take, for instance, the case of Dublin, which has canals on both the north and south sides. Low press- ure turbines could, and no doubt will, in the near future, be established so that they will drive dynamo electric machines, through the instrumentality of which the whole city will be lighted. In the mag neto electric machine the field is produced by the presence of a powerful permanent magnet consisting of several pieces of steel that have been magnetized. In the dynamo machine the magnetic field is produced by an electro magnet which itself is excited by the currents it generates. These are produced by what might be called an accumulative action. One current sus- tains and increases another, and when all act simul- taneously on the electro magnet they serve to increase the total effects until the iron is saturated with mag- netism. These generators as has already been said, may be worked by a steam engine, in which the en- ergy of the coal, or at least a small part of it, is turned into steam and the steam is turned into electricity, or the generator may be worked by water power. At Craigside, near Newcastle-on-Tyne, where Sir Wil- liam Armstrong lives, the power of a stream near by is turned into electricity by the interposition of an electric generator and the house is lighted, as its owner says, "by the river running through the grounds."

The storage batteries of Plante, Brush and Faure, though their present efficiency has, perhaps, been greatly exaggerated, will doubtless in the future play a very important part as adjunct to the electric gen- erators, if not as an independent electric distribu- tors.

The idea, however, that the storage and secondary batteries or electric accumulators hold the currents with which they are charged until such time as they are needed, is a mistaken one. Electricity, as every one knows, is one result of chemical action. When tion results until the incoming current ceases, at which time a reverse chemical action takes place which pro- duces electricity.

The future possibilities of these secondary batteries seem to be almost unlimited. Practically speaking, it might be described as the missing link that was needed to insure the dynamo against accident, even if it served no other purpose. For wherever machinery is used, and it is necessary both where the dynamo is worked by steam and water power, there are likely to be oc- casional breaks, and the secondary battery is kept charged and in juxtaposition to the dynamo may, for a time, at least, take its place in distributing the elec- tric current, thus giving time for necessary repairs. The value of such service, especially where light is being supplied, may readily be seen. In the City of New York, for instance, we have seen the arc lamps which supply certain streets with light, suddenly grow dim and the section they essayed to light, re- main in darkness for a portion of the night. Such ac- cidents rarely happen in the use of carburetted hydro- gen gas, and the advantages of the latter as a constant illuminant, would be greatly increased in com- parison, were it not for the fact that the secondary battery is expected in the future to make the utter extinguishment of these lights a rare occurrence.

Western Union Plans for the Transmission of Messages Over the City.

The lease recently made by the Western Union Tel- egraph Company of the large building on the south- west corner of Fifth avenue and Twenty-third street is the first step in the material improvement of the company's service in this city. The large building at Broadway and Dey street, which contains the head offices of the company, is the great center of tele- graphic communication. Hundreds of wires stretch out from it to all parts of the country and to the thirty branch offices in this city. The operating room, which extends over the entire seventh story of the building, is a great receiving and distributing reservoir of messages. Despatches from out of town are received there and telegraphed again to the branch offices nearest to the street numbers to which they are addressed. The branch offices in turn pour all their contributions into this room for transmission. The city system includes hundreds of miles of wire, the use of which is at times interrupted by storms and by contact with other wires, and by fires. Frequently the local business is too great for the wires. The ex- pense of operating also, is a considerable item.

A few years ago Gen. T. T. Eckert, the Vice-Pres- ident and General Manager of the company, made a study of the pneumatic tube system of London, and became convinced that it was practicable in this city. The first experiment was made by connecting the Stock and Cotton Exchanges with the main offices by pneumatic tubes. The result was exceedingly satis- factory to both the company and its patrons. The service was performed more quickly, greater accu- racy was secured by avoiding retransmissions, and expenses were diminished. The next step was to con- nect the main office of the company with the offices of the newspapers belonging to the Associated Press. The company now proposes to increase its pneumatic tube service, and partly to that end has leased the building mentioned.

To be Consolidated.

The Mutual District Telegraph Company and the District Telegraph Company, of Boston, are to be consolidated at an early day. Mr. D. J. Hearn, of the former company, has been offered the position of superintendent for New England, of the new

Telephonic.

Electric Eccentricities.

ometimes a vague conviction of uncertainty, ed chiefly in the unsatisfactory outcome of ured theories, will steal over the wisest minds l set them a wool gathering, and so it cannot be rtling that colts in the wide pasture of matters ctric should occasionally lose their bearings and pe around for a little light.

Possibly the feature of intensest interest surround- g the science is the delightful "go-as-you-please" nner in which many of its teachers treat the same bject; and, whilst scores of instances could be ed to prove this position, it will probably suffice to ntion the failure of a recent electric congress to termine the value of an ohm, a value that seems ed and immutable in the primer of electric engi- ering.

However, this is not intended as a philosophical sertation, and the sooner we come to the core the ppier for all concerned.

It is generally supposed that trees, branches and en leaves, when they come in contact with a charged re, will inveigle and convey away a certain por- n of the current, and so far as heavily saturated egraph wires are concerned, a very small limb has en known to demoralize a very long circuit.

A sane electrician would hardly be so careless as to low many limbs to touch his wire and expect it to ork, certainly not unless they were exceedingly in- cessible, and in that case he would not by any eans effect ignorance of the cause when he found necessary to double his battery, at least not to him- lf.

But when we come to a telephone wire the condi- seem to be changed, or at least not thoroughly tood.

It has been suspected that the use of induced or agneto currents might have something to do with ese peculiar conditions, and doubtless, as evidence comes more available, some of the preconceived otions upon the subject will have to be materially odified.

The disuse of insulators upon many telephone lines as already become a phenomena of progression in e art, and there may be much to be learned upon e same subject in the near future.

These items may help a little.

A line six miles long was recently constructed in uth-west Texas connecting the two ranches of a rge cattle farm.

A route had been surveyed through the dense live ak, mesquite and hackberry (all are bad for tele- raph lines), which it is intended to cut out in the ourse of time freeing the line, but at present the en- ire line lies and cuts into the tops of these trees in housands of places, and they were all green when he wire was placed.

Now these bells ring out at either end clear and oud, and as for talking, if the subscriber who "never ets no connections no how," could stand and listen, is ears would tingle with unsuppressed delight.

Another case.

A line runs from the central office in San Antonio o the Government depot, two and one-half miles dis- ant, and is grounded to the common supply water- ipe of that suburb with a number eight copper wire oldered securely of course.

wire is of number 14 steel. About one hun- rds from the depot the wire forks and runs, ay, one hundred and fifty yards further to the quar- ers and is grounded to the same water pipe by a omewhat smaller copper wire.

We will call the exchange *A*, the depot *B*, and the quarters *C*.

Now according to the theories upon this subject, when *C* rings he will get *B* of course, and it should seem that *A* would not get enough current to simu- late a taste, but the fact exists that he rings up *A* at the same time, that no switch is necessary and the talking facilities between all three are in no wise re- duced.

That the theory is correct in the main, can hardly be doubted, else the exchange would ring up many subscribers when only one is wanted.

Careful investigation in this case furnishes no rea- son for calling into question the perfection of all de- tails.

One more instance may not be amiss.

A wire was run some three hundred yards from the exchange and properly grounded at the subscrib- er's place of business, the bells rung all right at either end and through to each other, but whilst the subscriber had no difficulty in hearing the exchange the latter could not get a syllable from the subscriber.

Of course there are many ways of accounting for this, but in view of the consideration that the sub- scriber's battery was in good condition, and that the resonant rumble in the transmitter was on time, ex- cept when the main line was disconnected, the limit of possibilities, the average inspector will suspect, was somewhat circumscribed, and in truth it resolved itself into contact with a tin gutter somewhat nearer the exchange than the subscriber.

This latter fact, however, adds nothing to the lucid- ity of the topic.

Referring to the first instance, the conclusion is in- evitable that a line could be strung upon trees for possibly fifty miles or more and would still be avail- able for telephonic purposes, and it can hardly be questioned that as experiment brings confidence, the mind of the military electric engineer of the future, to say nothing of others who may find themselves in an urgent strait for rapid communication, will not be perturbed by the absence of insulators, provided his carpet-trunk is well supplied with plenty of light wire and a pair of gutta-percha tubes. J. K. D.

San Antonio, Texas, Feb. 15, 1883.

Telephonic Progress in Canada.

A Montreal contemporary states that the Bell Tele- phone Company has at the present, telephone offices in about 100 towns and places in Canada, and em- ploys a staff of more than 250 men, the number of subscribers amounting to 4,250. The company pos- sesses at Montreal a large factory, where all the in- struments and apparatus used in Canada, are manu- factured. The number of subscribers in the princi- pal towns is as follows: Montreal, 866; Toronto, 525; Hamilton, 320; Ottawa, 250; St. John, N. B., 275; Winnipeg, 250; Quebec, 240; London, 230; Halifax, 170; Victoria, B. C., 130. During the last year the company laid nearly 1,000 miles of telephone lines.

The Telephone in Italy.—On the 31st ult., there were in use in Rome, 651 Telephones; in Turin, 454; Naples, 413, and in Milan 390.

The annual meeting of the New York Electrical Society will be held in the rooms of the society in the Metropolitan T. and T. Building, corner of Green- wich and Liberty streets, on Friday evening, March 2. Among the business to be transacted will be the elec- tion of officers and standing committees for the en- suing year.

The Problem of the Telephone.

That the American Bell Telephone Company is master of the telephone field must be acknowledged. Every telephone user knows it. Every would-be user knows it. Every telephone inventor knows it. The recent consolidation of telephone interests, the massing of capital, the successes in court, have made this company a tower of strength. With a capital of $10,000,000, swelled by premiums to $18,000,000, with legal advisers, and experts schooled in the art of telephony from the beginning, and with judicial prejudice in its favor, it appears futile for a rival to attempt a contest with so powerful an opponent. If the claims of the Bell patent are to be construed by every court as covering any and all methods of trans- mitting speech electrically, then telephone inventors must be content with the bare possibility of disposing of their inventions to the controlling power; but if, on the other hand, the Bell patents are found to cover only a specific method and apparatus for transmitting speech, then there is a field in which inventors may work with prospects of a reward.

It is held by some that the Bell patent covers only the method of and apparatus for transmitting speech electrically by means of undulatory currents of elec- tricity. It is held by the Bell counsel and experts that there can be no other method, while it is claimed by others that another method and other apparatus may be employed to accomplish the same end. In all these phases of the telephone problem there arise questions for which there is now no answer. The most intricate points of law as well as the most sub- tile physical principles are involved; and now the question is, as to the advisability of pursuing tele- phone investigations for purely monetary considera- tions. Any one familiar with the present status of telephonic apparatus can readily see that there is no greater field for study, and none that has greater promise of profit in it, than that of telephone inven- tion.

Let the legal aspect of the matter be as it may, it is positive that the accomplishment of certain improve- ments in the telephone would yield a far richer har- vest than has been reaped by any inventor in this line. It should be no source of discouragement to the determined and intelligent inventor that hundreds, and probably thousands, have reached toward the prize with a grasp too short, for it is only a faithful index of the great value of the prize that so many have striven for it.

The results to be attained are continuity, uniform- ity, and reliability of action, increased volume of sound, freedom from external disturbances, increased distances, and better service for less money. How all this is to be accomplished we shall not attempt to suggest, but a few of the obvious things to be done are to reduce the delicacy of the apparatus, to in- crease the current used on the line wire and to use a current of lower potential, and to isolate the telephone wires from other line wires carrying heavy currents.

Why should not the telephone speak out in the ordinary conversational tone, and why should it not be spoken to in the same tone, without the necessity of being near the instrument? Why should not the distance over which conversation is carried on equal telegraph distances? Of course, we know that elec- tricians and physicists have struggled with these problems, but what are the results?

If we are to have a long distance telephone, the in- duction coil must be discarded, because the secondary current avails itself of every avenue of escape from its conductor, and everything with which it comes into contact—the insulators, the air, even contiguous wires—rob it of some of its strength, so that in at- tempting to communicate by telephone over long lines the current is lost, little by little, at every insu- lator, and all along the line until it is finally insuffi- cient to affect the receiver.

If a battery current of the strength used in teleg- raphy be employed, evidently something besides carbon must be used for electrodes in the transmitter, or the instrument under some conditions might yield an electric light instead of transmitting speech.

Some are of the opinion that speech can be transmitted by means of an interrupted current on a broken circuit. If this is possible, a proper apportionment of the periods of contact and periods of separation of the electrodes of the transmitter should give increased volume of sound, and permit of the use of a battery current on the line.

The fact that more than five hundred patents have been issued for telephonic improvements will naturally discourage inventors, but let the student of telephony consider that there is a great similarity between many of the telephone inventions; that the variations are mostly structural, and not in principle; that the majority of inventors are wedded to certain accepted theories; and finally, that most if not all of them are in the same groove, and that to obtain new results there must be a radical departure from the reigning idea; then he will look for means and methods differing from those of his predecessors.

In what the telephone of the future will consist we cannot predict; but it should be capable of talking and being talked to, as one person talks to another; and a man in New York should be able to transact business orally with another in Chicago or San Francisco.—*Scientific American.*

The annual meeting of the National Bell Telephone Company of Maine was held at Lowell, Mass., last week. The report of the Treasurer showed that the company had connected January 1, 1883, 3,708 subscribers, a net increase of 803 made during the year 1882.

The subscribers are distributed as follows:

Augusta	172
Bath	103
Bangor	220
Biddeford	67
Boothbay	20
Calais	54
Fitchburg	260
Lewiston	230
Lowell	950
Portland	710
Rockland	42
Waterville	40
Worcester	826

The company has a total of 2,243 miles of wire. The net earnings for the year were $86,931.96, of which $59,298 has been paid out in dividends, leaving a surplus of $27,633.96, which, added to surplus on hand January 1, 1882, $9,710, makes a surplus to date of $37,343.96. It is predicted that the increase of 1883 will exceed that of 1882. The following officers were elected for the ensuing year: W. A. Ingham, President; Charles J. Glidden, Treasurer and Secretary; Loren N. Downs, General Manager, Lowell; Franklin J. Rollins, Clerk, Portland, Me.

During the month of January the telephone companies handled 21,158 extra-territorial messages, as follows: Union, 1,144; National Bell of Maine, 1,850; Bay State, 7,333; Boston and Northern, 10,831.

Telephoning by a Beam of Light.

Prof. Alexander Melville Bell, father of Mr. Alexander Graham Bell, the inventor of the Bell telephone, and his brother, Mr. Charles James Bell, of Toronto, Canada, have been in the city since Monday. In the course of a half-hour talk yesterday Prof. Bell was asked:

"If the question may be allowed, Prof. Bell, is it true that Mrs. A. Graham Bell is a deaf mute?"

"She is, and yet she talks almost perfectly. You would never know she were deaf if you met her. Deaf mutes are dumb only because they are deaf. There is no local defect to prevent utterance. When they know how to control their vocal organs they engaged in teaching the visible speech to 2,000 pupils in Boston, my son made the experiments which led him finally to the sending of audible words through the electric wire."

"The popular impression is that the sound is in some way conveyed over the wire, just what is the fact?"

"The fact is, that it is a beautiful example of the convertibility of forces from one form to another. Thus, you give the first vibratory mechanical motion of the air which is imparted to the membrane carrying the iron. This motion is converted into electricity in the coil of wire surrounding the electro magnet, and at the receiving end is first effective as magnetism, which is again converted into vibratory motion at the iron armature, which motion is imparted to the air, and so receives again a sound wave in the air like the original one."

"I have heard sounds conveyed by a beam of light," said the Professor.

"Articulate sounds?"

"Yes, words. No practical application has yet been made of this, but there will be."

We do not have sunshine enough for this to be any special value in Cincinnati, but the reportorial instinct was aroused, and the question, "How did you manage it?" followed.

"It was in Boston. The wires were stretched from the top of the Institute of Technology to some other high building, the name of which escapes me. The sun's rays were received in a parabolic reflector. My son spoke against the back of a diaphragm, the front of which was silvered. The vibration of the voice created vibrations in the diaphragm, and consequently in the rays of light reflected from the mirror, and these shaped themselves into articulate sounds."

The Thomson-Houston System of Electric Lighting in Boston.

The Boston *Advertiser* celebrated its removal to new and enlarged quarters on Monday by issuing a twenty-page paper, containing a review of the principal business enterprises of Boston. From this we learn that the American Electric and Illuminating Company of that city, which uses the Thomson and Houston arc-light system, is making rapid progress. The company was incorporated last May, and began operations in September. It has now 200 lights in use in Boston, with contracts for 100 more. The central lighting station is situated in the basement of the Massachusetts Charitable Mechanic Institute, on Huntington avenue. The motive power is communicated to the dynamos by means of a one hundred and fifty horse power Wheelock engine, two fifty horse power Lawrence engines, two rotary Wing engines, one of thirty and one of one hundred horse power. The last named engines are the first of the kind ever made or used for this purpose, which will work with a direct attachment to the dynamo. The total lighting capacity of the present central station of the company is about 1,000 lamps, of 2,000 candle power each. There are about ninety towns and cities in New England now dependent entirely upon gas, for which the company has already procured a number of charters, and it is intended to establish sub-companies throughout the New England States as rapidly as possible. The total number of arc lights in use in the United States is said by the *Advertiser* to be over 75,000.

Frictional Electricity in the Press Room.

We looked into the press room of one of Boston's large printing establishments this week. The foreman was furious and the proprietor sorrowful. Frictional electricity in the printed sheets of paper as trouble. It is an interesting and not uncommon phenomenon, and is not easily explained nor easily controlled. It has puzzled Profs. Bell and Wadman, and the best electricians we have about here. The packing upon the press cylinder seems to act as an inductor, and the paper leaves the press thoroughly electrofied. We watched a press running of 1,700 per hour. Suddenly the printed sheet clung about the cylinder as though pasted upon it, and had to be torn off in strips. Again, we lifted a few freshly printed leaves, and they ripped and crackled like the stitches in an old coat. Then we saw a lot of cardboard being printed. The sheets stuck together as solid as a brick, and could not be separated until the electricity had partly passed off. A piece of printers' brass rule placed in this pile of cardboard, with an end projecting, threw off sparks when approached within an inch by another piece of rule. Two sheets sucked together when held fourteen inches apart. Wet rags placed around the delivery table and led into a bucket of water charged the water with electricity in forty minutes so that a positive shock was felt upon a hand being immersed in the pail. Electrical currents were felt in the hands and arms upon handling a pile of paper eight minutes after being printed. The bother to the printer is a considerable one. It entails inconvenience and a serious loss. Valuable work is frequently spoiled by the electricity packing the leaves so closely as to offset the fresh ink. Then the presses have to be slow-speeded with frequent stoppages. Nothing so demoralizes the pressman as the mystery of frictional electricity when under full headway.

Electric Bicycles.

Electricity has long been threatening to displace gas as an illuminant. It is now entering the field against the horse as a means of traction. Two eminent electricians claim to be able to bottle up twelve horse power in a storage battery weighing three hundred weight, and they promise to produce in a few months a perfectly practical electric tricycle, capable of running fifteen or twenty miles without recharging the accumulators, and able to ascend all such hills as are now possible for the foot tricycle, and even steeper gradients if auxiliary foot gearing be used to help the electro-motor when the incline is great.

The weight of batteries will not exceed the weight of a second rider, and it will run at the rate of seven miles an hour. As the new motor will never go lame, or shy, or break its knees, or eat its head off when not employed, it is likely to prove a dangerous rival to the horse. The quadruped, however, which has survived steam need not fear extinction by electricity.—*Pall Mall Gazette.*

Mr. William Baxter, inventor of the celebrated Baxter engine, who has lately completed a contract for lighting certain streets in Jersey City, N. J., states:

"We are running 56 lights (one 20 and two 18-light dynamos). These are driven by a Baxter automatic cut-off vertical engine, 12 x 12 cylinder, 240 revolutions per minute, 70 lbs. steam, cutting off at one-fourth stroke. The consumption of coal is less than two lbs. per hour per light, the latter being the Fuller electrical company's standard lights of 2,000 candle power each. We are using ordinary anthracite coal, costing $4.60 per ton delivered in Jersey City. The above consumption of fuel includes also the heating by steam of the building (26 x 100 feet) in which the apparatus is placed. The building is constructed of

NEW PATENTS—ELECTRICAL—1883.

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING FEBRUARY 23d, 1883.

271,169 Electric induction machine; Addison G. Waterhouse, New York.

271,172 Electric light; Edward Weston, Newark, N. J.

271,042 Electric locomotive; Charles G. Curtis and Francis B. Crocker, New York.

271,175 Electromotor; Schuyler S. Wheeler, Charles G. Curtis and Francis B. Crocker, New York.

271,171 Incandescent electric lamp; Edward Weston, Newark, N. J.

271,029 Lightning conductor; Willian Brown, Duncannon, Pa.

271,059 Magazine electric lamp; Alenza T. Gifford, Providence, R. I.

270,990 Multiplex telegraphy; Charles Seldon, Toledo, O,

270,907 Optical attachment for printing telegraphs; Wm. J. McCausland, Philadelphia, Pa.

271,188 Receiver for telephones; Samuel H. Bartlett and Henry E. Waite, New York.

WEEK ENDING FEB. 2, 1883.

271,598 Automatic testing apparatus for telegraphic fire-alarm stations, George F. Bulen, Jersey City, N. J.

271,783 Automatic fire-extinguishing and alarm system, Charles E. Buell, New Haven, Conn.

271,999 Automatic switch-stand, Oliver J. True, Port Clinton, and Henry H. Houghton, Elyria, O.

271,610 Circuit closer for telephone receivers, Edward C. Dean, Washington, D. C.

271,947 Commutator for dynamo-electric machines, Elihu Thomson, New Britain, Conn.

271,928 Dynamo and magneto-electric machine, Chas A. Seeley, New York, N. Y.

271,972 Dynamo-electric machine, William Baxter, Jr., Jersey City, N. J.

271,979 Dynamo-electric machine, Ebenezer Gordon, New York, N. Y.

271,991 Electric regulator and alarm for incubators, F. Roosebrook, Elmira, N. Y.

271,991 Electrical insulator, Demetrius M. Steward, Cincinnati, O.

271,004 Electric gas-lighting burner, Henry J. Warren, West Bridgewater, Mass.

271,707 Electric hotel annunciator and fire alarm, Albert T. Hess, Des Moines, Ia.

271,918 Electric current regulator, Elihu Thomson, New Britain, Conn.

271,832 Electrical conductor, Perry G. Gardner, Jr., J. W. Leroy and Giles K. Tinker, North Adams, Mass.

271,721 Electric brake-setting apparatus, Jesse B. Low, Pulaski, N. Y.

271,805 Electric gas-lighting burner, Charles H. Crockett, Boston, Mass.

271,816 Electric arc lamp, William L. Dudley, Covington, Ky.

271,882 Electro-magnetic car signal, John W. Marley, Chicago, Ill.

271,904 Electric mail conveyer, Eberhart Nicolaisen, New York, N. Y.

271,913 Electric switch-board, Thomas J. Perrin, Brooklyn, N. Y.

271,914 Electrical switch-board, Thomas J. Perrin, Brooklyn, N. Y.

271,825 Fastening for electric circuit wires, Henry G. Fiske, Springfield, Mass.

271,615 Governor for dynamo-electric machines, Thomas A. Edison, Menlo Park, N. Y.

271,992 Galvanic battery, Abner M. Rosebrugh, Toronto, Ontario, Can.

271,613 Manufacture of incandescent electric lamps Thomas A. Edison, Menlo Park, N. J.

271,750 Manufacture of covered or insulated wire, Joseph D. Thomas, New York, N. Y.

271,903 Mouth-piece for telephone transmitters, Aaron S. Nichols, New Haven, Conn.

271,958 Railroad train telegraph, William T. Waters, Atlanta, Ga.

271,616 Regulator for dynamo-electric machine, Thomas A. Edison, Menlo Park, N. J.

271,654 Regulator for dynamo-electric machines, John F. Ott, Newark, N. J.

271,597 Station switch for fire telegraphs, George F. Bulen, Jersey City, N. J.

271,628 Secondary battery, Alfred Haid, Rahway, N. J.

271,732 Secondary battery, Charles Placide, Nezeraux, Paris, France.

271,880 Secondary battery, James A. Maloney, Washington, D. C.

271,733 Tripod standard for lighting rods, T. H. Pattee and T. D. Ridge, Greencastle, Ind.

271,878 Telephone, Charles T. Loring and G. W. Pierce, Boston, Mass.

271,924 Telephone transmitter, Edward A. Shoettel, Brooklyn, N. Y.

The American Iron and Steel Association officially announces that the quantity of pig iron made in the United States, in 1882, was 4,623,000 tons, which is most 500,000 tons more than was ever before made in one year in this country.

The Pennsylvania Railroad Company has tried the Brush arc light for illuminating its yard near the Union Depot, in Pittsburgh. The experiment proving successful, the company has recently added to the number of lamps.

Compared with 1874, Philadelphia shows an increase of 150,000 in population, and has 280 miles of paved streets more than it had at that time. There are also 55,000 more dwellings than there were then.

Business Notices.

The attention of persons interested in local telegraph and telephone organizations is respectfully called to the electric lighting system of The Fuller Electrical Company; and the practicability of making arrangements with that company for the introduction of its apparatus, either in isolated plants, or through the formation of local companies desiring to engage in the business of electric lighting. The specially valuable feature of this company's system may be seen by examination of its apparatus in Boston, Worcester, Providence, Hartford, New York City, Brooklyn, Jersey City, Paterson, Philadelphia, Lancaster, Scranton, Syracuse, Rochester, Buffalo, Pittsburgh, Wheeling, Steubenville, Xenia, Dayton, Grand Rapids, Chicago, Springfield, Belleville, St. Louis, St. Paul, and many other smaller places throughout the country. Correspondence is invited.

THE FULLER ELECTRICAL COMPANY.
44 East 14th Street, New York City.

A Dictionary of Electricity, by Henry Greer, N. Y., Agent College of Electrical Engineering, 122 East 26th street, New York. Octavo, $2.00. Professor Edison says of it: "It is exceedingly valuable to all interested in electrical science. Leaving out the old glass machine, sealing-wax, amber experiments, &c., &c., and inserting cuts and descriptions of the recent wonderful inventions, makes it exceptionally interesting to electricians and telegraphers. Nearly every electrical inventor and manufacturer in the world will find a description of their invention or apparatus in it."

Storage of Electrical Energy, by Henry Greer, N. Y., Agent College of Electrical Engineering. Paper binding, 50 cents. One of the latest and best publications on this interesting subject.

JOHN TURNER, President. JOHN P. LORING, Sec. and Treas.

THE

CENTRAL AMERICAN

Telegraph & Telephone Co.

CAPITAL STOCK, - $100,000.

SHARES $10 EACH.

FULL PAID AND NON-ASSESSABLE.

This Company has acquired and owns *all* the telephonic rights formerly the property of the American Bell Telephone Company, Continental Telephone Company, and the Tropical American Telephone Company, Limited, in **Central America** and **Panama.**

The Company **BUYS** its telephones and transmitters, and thereby avoids paying royalties.

A limited number of the shares of the stock is offered for sale at $5 per share.

Address,

JOHN P. LORING, Treasurer,

Sears' Building, BOSTON, Mass.

PAINE & LADD,

HALBERT E. PAINE, Late Commissioner of Patents.
STORY B. LADD.

Attorneys in Patent Causes
And Solicitors,
WASHINGTON, D. C.

BANNING & BANNING,

PATENT ATTORNEYS

AND

SOLICITORS,

21 Park Row, NEW YORK. Honore Building, CHICAGO.

CONNOLLY BROS. & McTIGHE,

PATENT ATTORNEYS

AND

SOLICITORS.

Electrical Cases a Specialty.

1 GRANT ST., PITTSBURGH, PA

914 F STREET, WASHINGTON, D. C.

—AND—

1001 CHESTNUT STREET, PHILADELPHIA, PA.

PARTRICK & CARTER,

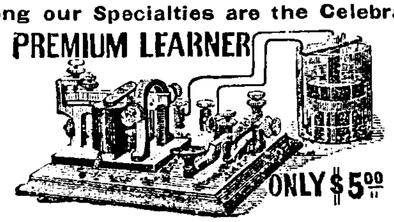
Philadelphia, Pa.,

MANUFACTURERS OF

Telephone, Telegraph & Electrical

INSTRUMENTS and SUPPLIES.

Among our Specialties are the Celebrated



Not the Cheapest, but guaranteed the Best.

COMPLETE OUTFIT ONLY $5.00.

The Fitch Chlorine Battery, patented Sept 16, 1879, acknowledged the **Best** Battery in use for Telephones, Annunciators, Call Bells, etc. Price, $1.50 per cell. Liberal discount to the trade.

The Acme Steel Lever Key, best and most perfect Key ever placed before the telegraphic profession; endorsed by hundreds of the most expert telegraphers in the country. Price by mail, $3.00.

The **Original Giant Sounder,** price $4.00 by mail.

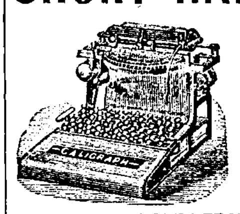
Send for our catalogues and price lists. Correspondence solicited.

PARTRICK & CARTER,

Telephone, Telegraph and Electrical Instruments and Supplies of every description.

No. 114 SOUTH 2d STREET, PHILADELPHIA, PA.

SHORT-HAND WRITING



thoroughly taught by mail. Good situations procured all pupils when thoroughly competent. First-class stenographers furnished railroad officials without charge for my services Correspondence solicited.

CALIGRAPHS SOLD.

Special inducements offered business men, lawyers, stenographers and railroad officers.

Send for COLLEGE REPORTER and caligraph circulars to

W. G. CHAFFEE, Oswego, N. Y.

THE WEST INDIA

Telegraph & Telephone Company,

LIMITED.

CAPITAL STOCK, - - $150,000.

SHARES, $10 EACH. FULL PAID ARE NON-ASSESSIBLE.

Transfer Office, LONG BRANCH, NEW JERSEY.

T. C. MORFORD,

Register of Transfers.

This company has acquired and owns all the telephonic rights formerly the property of the Continental Telephone Co. and Tropical American Telephone Co., Limited, including the *exclusive right*, for a term of years, of selling, leasing, and using in the islands of Hayti, San Domingo, Jamaica, Porto Rico, St. Croix, Vieque, Culebra and St. Thomas, Bell Telephones, Blake Transmitters and all other telephonic apparatus manufactured by the **AMERICAN BELL TELEPHONE CO.**, under patents owned or controlled by it in the United States and Canada, has been granted concessions from the Governments of the Islands for exclusive right to the exchange systems for telephones. This Company **Buys** their **Telophonas and Transmitters**, thereby avoid paying royalties.

A PORTION OF THE STOCK FOR SALE.

Address

The West India Telegraph and Telephone Co.

CHILLICOTHE, OHIO.

DELANO & HAINES,

PROMOTERS and BROKERS,

Formerly of 55 Broadway, have removed to new and commodious quarters in

TEMPLE COURT, 5 BEEKMAN STREET.

We make a specialty of the organization of companies the development of enterprises of unquestionable merit, and obtaining capital for the same. Sole agency for the *American Diamond Rock Drill* and the *Miner's Hand Drill* for the Republic of Mexico.

EXECUTIVE OFFICES OF

"THE MEXICAN TELEPHONE CO."

AND

The Tropical American Telephone Co.,

(LIMITED.)

These companies have acquired and own, in their respective territories, all the telephone rights formerly the property of the Continental Telephone Co., including the *exclusive right* for a term of years, of selling, leasing and using Bell Telepeones, Blake Transmitters, and all other telephonic apparatus manufactured by the **American Bell Telephone Co.,** under patents owned or controlled by it in the United States and Canada.

Valuable Telephone Territory

can be had by parties who can furnish the money requisite to develop it, in the Republic of **Mexico,** the **West India Islands,** and **South America.**

BOOKS FOR ELECTRICIANS!

Crompton, R. E.—Electric Light, 40c.
Thompson, S. P.—Storage of Electricity, 20c.
Ayrton, W. E.—Storage of Energy, 20c.
Bell, A. G.—Lecture on the Telephone, 60c.
Sprague, J. T.—Electric Light, 40c.
Ayrton, W. E.—Electric Railways, 20c.

E. & F. N. SPON, 44 Murray St., N. Y.

GEO. H. WHIPPLE,

56 Wall St., N. Y.

ELECTRIC LIGHT,

TELEPHONE,

TELEGRAPH,

—AND—

Miscellaneous Stocks.

This paper will be devoted to the sole purpose of keeping you conversant and thoroughly posted on all topics of an electrical nature, which may be brought out from time to time, in this country and Europe.

L. G. TILLOTSON & CO.

Manufacturers, Importers and Dealers in

RAILWAY

TELEGRAPH & TELEPHONE

SUPPLIES

OF EVERY DESCRIPTION,

Nos. 5 & 7 Dey Street,

NEW YORK.

Portable Electric Lighter.

PRICE, $5.00.

A scientific and economical apparatus for lighting; patented in the United States, May 27, 1879, and May 26, 1882; complete in itself; requiring no extra power, the electric current being generated by chemical action.

Portable Electric Lighter with

BURGLAR ALARM

Price $10. We make attachments by means of which our Electric Lighter can be converted into a reliable Burglar Alarm, confronting the trespasser with light and alarm bell at the same instant.

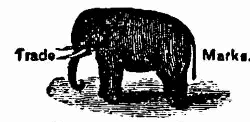
Agents wanted all over the country. Liberal discounts. Enclose stamp for circular.

PORTABLE ELECTRIC LIGHT CO.

22 Water Street, Boston, Mass.

Incorporated under the laws of Massachusetts, Dec. 1882.

Phosphor-Bronze Telephone Wire,



"Phosphor-Bronze."

COMBINES HIGH ELECTRICAL CONDUCTIVITY AND RESISTANCE TO CORROSION WITH LIGHTNESS AND TENACITY.

Standard Sizes, 16, 17 and 18, Stubs' Gauge.

ADDRESS:

THE PHOSPHOR-BRONZE SMELTING CO., Limited,

512 ARCH STREET, PHILADELPHIA, PA.

Owners of the United States Phosphor-Bronze Patents,

Sole Manufacturers of Phosphor-Bronze in the United States.

J. H. LONGSTREET,

MANUFACTURER OF

Telegraph and Telephone Supplies

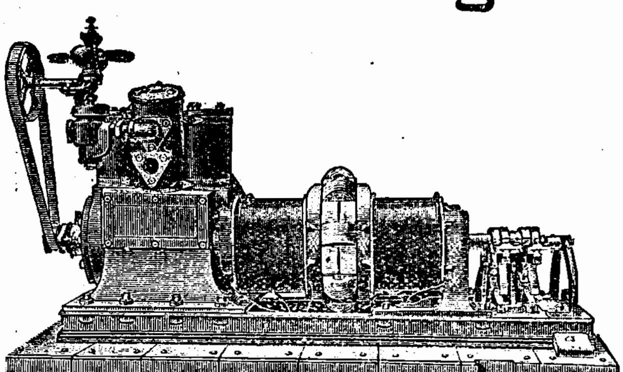
OF EVERY DESCRIPTION.

9 Barclay Street,

NEW YORK.

GEORGE WESTINGHOUSE, Jr. President. RALPH BAGALEY, Secretary and Treasurer. H. H. WESTINGHOUSE, Superintendent.

The Westinghouse Engine



AS CONNECTED DIRECT

— TO —

Dynamo Electric Machines

OF ANY MAKE

For Electric Lighting.

ALSO

INDEPENDENT ENGINES

For driving by Belt *without Counter-Shafting.*

Send for Illustrated Circular.

THE WESTINGHOUSE MACHINE COMPANY,

Works at Pittsburgh, Pa. 92 and 94 LIBERTY STREET, NEW YORK.

Western Office, 14 South Canal St., Chicago, Ill.

CARBON POINTS

FOR

Electric Lamps,

AND

PLATES FOR BATTERIES.

We make a superior carbon for electric lamps; straight, burning with a clear white light, and of the greatest possible durability.

Our Battery Plates are the best in the market.

Send for samples and price list.

Boulton Carbon Co.

CLEVELAND, OHIO.

The Works of the Jno. A. Roebling's Sons Co., at Trenton, N. J., have facilities for producing large quantities of Telegraph Wire on short notice. The Belgian system of rolling long lengths of wire rods, and improved methods of galvanizing, were first introduced in the United States at these works. It insures the production of wire with few joints, and with a thick coating of zinc.