on wires already existing in 1884 between New York and Boston. Later a special line was built between the same cities, which gave fairly good service. The next line was established between New York and Philadelphia, heavier wire being used, which gave results so superior to any previous line that it led the company to enlarge in the same direction. Other lines then followed from New York to Troy, Troy to Buffalo, Philadelphia to Pittsburg, Philadelphia to Washington, and from Pittsburg to Erie, Pa.

By a certain combination of several of these lines, a continuous circuit of 800 miles or more was effected and experimental tests made. The trials gave the engineers an insight as to the practical possibilities of the construction of an efficient line between New York and Chicago, and by further calculations they were able to determine what the size of the wire should be. Hard drawn copper wire, weighing 435 lb. to the mile, was finally adopted, and its use on the line to Chicago has fully verified the calculations. It operated perfectly in all kinds of weather, and would work well with an additional 250 miles added on to either end. A new special line had just been opened between New York and Boston, of the heaviest wire, which enabled conversation to be carried on perfectly between Boston and Chicago. In transmitting sound by electrical pulsations over these great distances, it was somewhat diminished in volume, but was very distinct and perfectly understood. In remarking upon the instantaneous nature of the transmission, he gave two comparative illustrations. Taking the hawk for example, if it could fly at its fastest speed it would take six hours to go from New York to Chicago; or, if a rifle was fired at its highest velocity from New York to a target in Chicago, it would take one hour's time. But in the telephone the element of time was eliminated, the impulse traversed the distance instantaneously, and the reply returned as quickly. Its rapidity is inconceivable.

Lantern illustrations were given of the interior of the New York Long Distance office, also of the Chicago office, and of the terminus at Jersey City, the subway pipes, the different pole lines passing out of the city, plans for putting up poles, the old and new system of fixtures for house top lines, and views in the country showing the lines of poles and cross arms.

Everything about the long distance lines is constructed in a solid, permanent character, provision being made for further enlargement when demanded.

At the end of his interesting talk he invited the audience to listen through the forty telephones in circuit to the music of a cornet and banjo that would be played in Chicago, and to any conversation that might be carried on.

The companies had connected the wires temporarily with the lecture room for this purpose. The experiment was most successful, every note and fluctuation in the notes of the Chicago cornet were heard with a volume and distinctness that was quite remarkable, while the intervals between the notes were absolutely quiet, not the slightest interference of the usual telephone induction sound being observed.

It should be mentioned that the views thrown upon the screen were made by Mr. Edward H. Lyon, the gentleman who officiated at the Chicago end of the line when its inauguration took place last October.

Votes of thanks were passed to the lecturers and the telephone companies, and everybody seemed to be satisfied that long distance telephony was to be the coming method of communication. The officers of the society—Mr. Joseph Wetzler, president, and Mr. George H. Guy, secretary—are to be congratulated in bringing about such an instructive and unusual entertainment, and the enterprise of the telephone companies in aiding them also merits favorable mention.

THE EQUITABLE PRINTING TELEGRAPH.

The defects of the telephonic transmission of intelligence sometimes become unpleasantly obvious. When a conflict ensues as to some message that may have been sent at a previous time, there is no way of verification afforded. There is no record of the case. This want has been seriously felt in many instances. In this respect the telephone is inferior to the old time printing telegraphs.

In the Equitable Printing Telegraph, a new and ingenious invention, the difficulty is overcome. In it is presented a printing instrument worked by a keyboard like a typewriter and printing from rubber type its message upon paper tapes. The connection and operation are the acme of simplicity. As an example a pair of instruments were recently set up and connected and put to work in this office in a few minutes.

The transmitting and receiving instruments are identical in all respects, resembling to a certain extent a pair of typewriters. When a message is sent both print it, so that the sender and receiver both have copies of the message.

The great feature of the machines are their automatic unison. The trouble with printing and index machines has been in securing unison of the two instruments, so that both should print the same letters. In the present system this unison is automatically established. If unison is disturbed, the machines at once stop until by touching a lever they are again started in unison. The entire operation of the machines is so simple that it can be learned in ten minutes. Up to distances of fifty miles the system can be used on direct circuit, for greater distances a relay connection with local battery is employed. A pair of instruments can be connected in a telephone circuit and would form a valuable auxiliary to that service. A speed of forty-five words a minute can be obtained.

In practice, a button or key with the desired letter on it is pressed down. When the click announces the printing of the letter, the key bearing the next letter is pressed down, and so on.

There is no need to call any one at the distant end when a message is to be sent. The message is simply

THE EQUITABLE PRINTING TELEGRAPH.

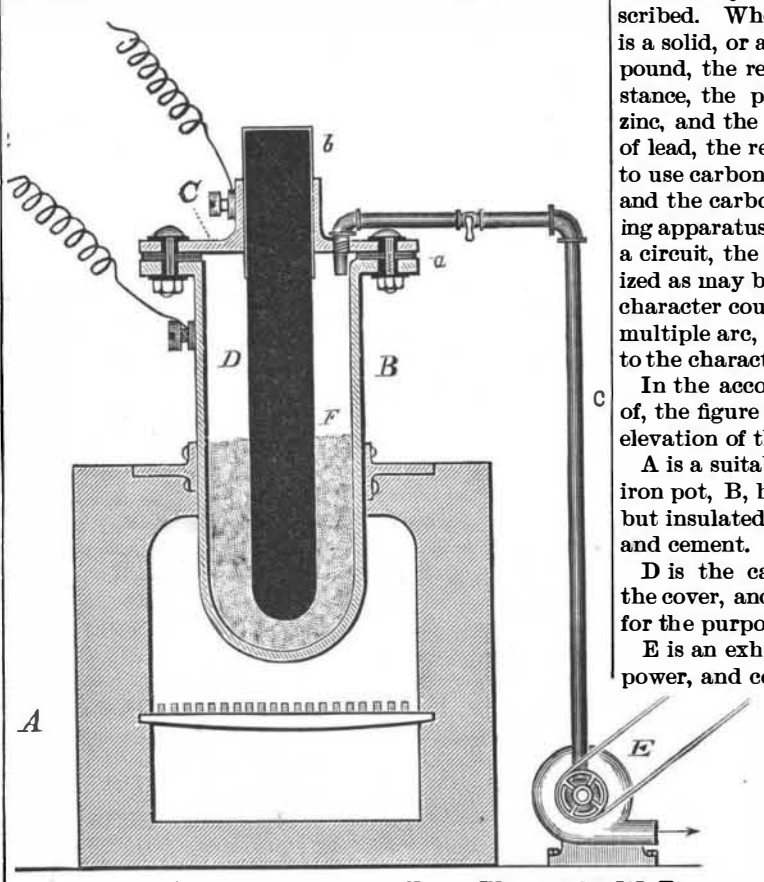
transmitted, and is on the tape when the recipient goes to the instrument.

The system is controlled by the Equitable Manufacturing and Electric Company, 44 Broadway, New York. It presents an admirable simplification of telegraphic service. The expense of these instruments is small.

Edison's New Art of Generating Electricity.

Ten years ago Mr. Thomas A. Edison applied for a patent for this invention, but in some way the Patent Office has managed to withhold the issue of the patent until the present time. The following is an abstract of Mr. Edison's description as contained in the patent issued on the 31st ult.:

The object I have in view is to generate powerful continuous currents of electricity from the elements, and salts or compounds thereof, by dry chemical reaction in a simple and efficient manner. This I accomplish by the use of positive and negative electrodes, placed in a chamber exhausted to the point where the gases generated by the reaction become good conductors of electricity, and subjecting such chamber to the action of heat, to assist the chemical reaction and increase the electrical conductivity of the gases, the positive and negative electrodes being surrounded by a decomposable dry chemical compound, which under the conditions of heat and rarefaction attacks the positive electrode and is decomposed, the reaction generating powerful continuous currents of electricity, which are utilized in a circuit in which the electrodes are located. For the positive electrode may be used any of the metals or metalloids, or carbon, the surrounding decomposable compound being an oxide, chloride, or other salt or compound of an element which will attack the positive electrode under the conditions imposed of heat and rarefaction, while the negative electrode can be any conducting element not attacked by the active compound used. If the result of the action of the compound on the positive electrode is a gas (as would be the case with a carbon electrode attacked by an oxide), the action may be cumulative, or reciprocal as will be presently explained, and a gas being generated, the exhausting apparatus will have to be kept in operation continuously to maintain the desired degree of rarefaction; but, if the result of the action is a solid (as with a metal attacked by an oxide), the action would not be cumulative, and no gas being generated, only sufficient action of the exhausting apparatus would have to be maintained to overcome the leakage, and this might be done by a continuous or intermittent operation of the exhausting apparatus.



EDISON'S NEW ART OF GENERATING ELECTRICITY.

In carrying out my invention, I employ a suitable pot or vessel, for instance one of iron, having a tight cover, and connected with suitable exhausting apparatus for producing the proper degree of rarefaction therein. The iron pot may form the negative electrode of the apparatus. By the cover is supported the positive electrode of carbon, which makes good contact therewith and hangs down into the pot. This carbon electrode may be a cylinder made by compressing powdered bituminous coal and then coking the same slightly, the compression being continued during the coking, or a piece of wood may be carbonized under pressure to produce the electrode. The upper end of the electrode is copper-plated, to make a close fit with the sides of the opening in the cover through which it passes, and to make good electrical contact with such cover, or the cover may be solid and the carbon electrode be hung from the under side of the same.

The vessel is provided with a metallic oxide partly filling the same and surrounding the carbon electrode. Oxide of iron is suitable for the purpose. This vessel is mounted in a suitable furnace for giving the necessary heat to produce rapid chemical reaction. The temperature being raised to the point where the carbon will be attacked by oxygen, carbonic oxide will be formed, which being a powerful reducing agent will reduce the oxide of iron, producing metallic iron and carbonic acid. The carbonic acid will attack the carbon, consuming a portion thereof, forming carbonic oxide and changing the carbonic acid to carbonic oxide. The increased volume of carbonic oxide will act on the oxide of iron, reducing the oxide of iron and forming carbonic acid, which again attacks the carbon, and so on, this cumulative or reciprocal action continuing until the oxide of iron is all reduced or the carbon all consumed. While the cumulative action is taking place, the exhausting apparatus is kept in action, maintaining nearly or quite a definite degree of rarefaction in the vessel, which, with the heat, gives the gases high electrical conductivity, making possible the generation of powerful electrical currents by the cumulative dry chemical reaction described. When the result of the dry chemical reaction is a solid, or a gas which does not decompose the compound, the reaction will not be cumulative. For instance, the positive electrode might be a metal, as zinc, and the compound a metallic oxide, such as oxide of lead, the resulting oxide being a solid, but I prefer to use carbon and an oxide. The body of the vessel and the carbon form the two electrodes of the generating apparatus, and these being properly connected in a circuit, the powerful currents generated can be utilized as may be desired. A number of vessels of this character could be connected with the same circuit, in multiple arc, in series or in multiple series, according to the character of current it is desired to furnish.

In the accompanying drawing, forming a part hereof, the figure represents a vertical section and partial elevation of the apparatus.

A is a suitable furnace, upon which is mounted the iron pot, B, having cover, C, secured tightly thereto, but insulated therefrom by the packing (*a*) of asbestos and cement.

D is the carbon cylinder, passing tightly through the cover, and having its upper end (*b*) copper-plated for the purposes already stated.

E is an exhaust fan driven by any suitable source of power, and connected by a pipe (*c*) with the interior of the vessel, B.

F is the metallic oxide placed within the vessel around the carbon.

1 and 2 are the circuit connections.

Nine claims are made, of which the first is as follows:

1. The improvement in the art of generating electricity, consisting in causing the dry decomposition of a chemical compound, in a rarefied atmosphere and in the presence of a positive element which is attacked by such compound and is electrically charged thereby, and a negative element which is electrically charged by the dry chemical reaction, substantially as set forth.

ROEBLING'S railway bridge at Niagara has a span of 821 feet.