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SCIENTIFIC AMERICAN SUPPLEMENT

No. 894.

For the Week Ending February 18, 1893.

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THE CROWNING ACHIEVEMENTS OF THE TELEPHONE.

Two exhibitions of recent achievement in the line of telephony have recently taken place in this city. The first one signalized the opening of the telephone line from New York to Chicago. The next one was a public exhibition of the capacity of that line given by the transmission of music over the thousand miles intervening between here and the City of the Lakes. The music was so perfectly reproduced as to be heard by members of a large audience. To day New York is in telephonic communication with Chicago, and the oral transmission of intelligence has become an everyday affair. When the telephone was first introduced, it was believed that it would never have a very extensive application. It seemed impossible that all the leading business offices in such a city as New York should be put in communication with each other in any practical way by the almost impracticable invention of seventeen years ago. After the development of the telephone with microphonic transmitters for short distance work had become an acknowledged fact, the troubles offered by induction and the static capacity of long lines caused many to believe that the telephone could never be a long range instrument. As in the case of many other things in this world, it was found that the best appliances secured the desired results. The construction of an absolutely first-class copper line of large caliber wire and of the most perfect details of mounting has removed the thousand miles intervening between here and Chicago effectually, and now conversation can be held with Chicago even better than ordinarily with New York City connections. The success of long distance telephoning in the present case is merely one of the additional triumphs of the best.

On February 7 of the present year, a still greater achievement was commemorated. On that day was witnessed the opening of the telephone line from Boston to Chicago. Telephoning is successfully carried on over 1,250 miles of wire, owing to a somewhat circuitous route followed by the line. All distances hitherto covered are insignificant compared to this. The possibilities it holds for the future cannot well be overestimated. A step beyond Chicago and the banks of the Missouri will be reached, and we may yet see Omaha and San Francisco connected by a line which will form the final link in a chain bringing San Francisco and New York within speaking range of each other. When conversation is carried on perfectly as it now is over 1,250 miles of wire, the extension of distance becomes a matter of detail.

A few days after this reaches our readers, the original Bell telephone patent, to which the courts have awarded an unprecedentedly wide scope, will have expired. The expiration of the patent and opening of the field of telephony to the nation is, under the circumstances, a signal epoch in the history of invention. Seventeen years ago the patent was granted. Under energetic business management the industry based on this patent attained an enormous development, and it is interesting to note that these monumental achievements have only been accomplished during the last days of the life of the patent. The invention has not lived out a short life of usefulness to be relegated to obscurity. It has increased continually in importance and it is only at the end of its monopoly that its greatest developments have taken place. The connection of the two metropolises is a fitting work for the year of the Columbian Exposition. The American invention of the telephone will have in these commercial lines erected for everyday use its most impressive exposition—an exhibit which will far surpass anything that can be shown in the great halls of the electrical building of Chicago. It is an exhibit requiring the area of six or more States for its display.

The value of this invention in a money-making sense has been enormous. The price paid by the inventor of the telephone for his protection, technically speaking, becomes payable in a few days. The price paid for a patent is its surrender in statutory time to the public. The patent fee is merely designed to cover the expense of the office, and is no part of the consideration given by the inventor. But if we take an enlightened view of the matter, we will see that during its existence the Bell patent, by the convenience it has afforded the public in the transaction of business, has awarded the public a rich return for the monopoly granted. The convenience alone is invaluable, and the money return to business men in the transaction of important matters cannot be overestimated.

The completion of these great long distance lines marks the beginning of a epoch when telephony will acquire a new importance. Were the patent awarded a further existence, every year would witness for it an increase in value. The returns received for the patent hitherto have been in great part based upon what it did during its struggling years of business, and during a period of great uncertainty when it was quite problematical what its results were to be. Now that it has obtained a firm lease of life, now that the telephone itself is in the full strength of a matured existence, the patent lapses. It is the old story; the inventor obtains the least reward for his exertions; the true beneficiary is the public. Estimating the benefit which the public has received from the invention, had the return been one hundred fold to the owners of the invention, the reward even then for what has altered the whole face of business and commercial life would have been not a particle too much. The spirit of our patent system is admirably illustrated in the whole matter. An invention is made; the incitement for making the invention is the award by government of a short monopoly conditional on its being patented; that is, disclosed to the public. Thus incited, the inventor works to achieve his result, achieves it, and obtains what return he can in the seventeen years of its life. Then, in the full vigor of an assured success, with the most brilliant prospects before it, after having revolutionized the business world, the invention becomes public property and the inventor loses all claim upon it.

The moral in the history of the telephone applies well in the case of the would-be minimizers of patent rights. For just as the invention is in its most advanced state of development and has the most brilliant future before it, when the returns from it should be of unprecedented and of growing largeness, it becomes public property and part of the capital of the American nation at large.

THE ANNUAL REPORT OF THE COMMISSIONER OF PATENTS.

The annual report of Commissioner Simonds, dated January 31, has been issued. It is contained in the Patent Office *Gazette* of February 7. The general report deals with the old questions which unfortunately are very live questions—questions which we have repeatedly dilated on in these columns. Want of room, want of facilities and want of help are the crying needs of the office. The delay in disposing of patent cases is very great, but no relief is granted by Congress.

From the report we learn that there are now 605 officials and employes, with salaries varying from $5,000 to $360 per annum. The three superior officers are appointed by the President, 464 are under civil service rules, the remainder in the unclassified service are appointed.

For the World's Fair an exhibit including some 2,500 models, nearly all working models, is in preparation. It will include many loans from inventors in addition to original models in possession of the office, and will form an exhibition of interest quite unique. One of the models goes as far back as 150 B. C.; another illustrates a harvester used in the first century of our era.

The net receipts of the office were $1,286,331.83. The expenditures were $1,110,739.24. The balance in the United States Treasury to the credit of the office reached on January 1, 1893, the sum of $4,179,910.26. During the year 1892, 39,514 applications for patents for inventions were received, 104 for reissues and 1,130 for design patents; 23,478 patents were issued and 81 reissues were granted; 13,291 patents expired during the year. Among the grantees of patents next to America comes England with 653 United States patents granted. Germany presses close to her with 507 patents. New York heads the list of States and Territories with 3,781 patents; Oklahoma is at the foot with 3. Connecticut is the most inventive State, with one patent to every 955 inhabitants; Mississippi is the least, with one patent to every 23,447 inhabitants.

The report is of unusual interest throughout, and in our brief summary we have left much of it untouched.

PROGRESS OF LONG DISTANCE TELEPHONY.

"The Telephone and How We Talk from New York to Chicago" was the title of an interesting experimental lecture given before the New York Electrical Society, at Columbia College, New York, on the 8th inst. Mr. J. J. Carty, the electrician of the Metropolitan Telegraph and Telephone Company, explained the nature of sound and the mechanism of speech, its propagation and reception by the ear, the physiology of the ear, the evolution from the speaking tube and string telephone to the electric, telephone, a description of the construction and principle of the latter, and the construction of the transmitter, induction coil and the battery. By means of an electric arc lantern, diagram lantern slides were projected on the screen, illustrating very fully the points Mr. Carty made.

Following him, Mr. F. A. Pickernell, the accomplished chief engineer of the American Telegraph and Telephone Company (the Long Distance Company), gave an entertaining account of the growth and extent of long distance telephony. As telephone lines began to be extended, it was found a wire weighing sixty-five pounds to the mile would answer. But with the introduction of metallic circuits, which gave results free from the induction, experience demonstrated heavier wires with less resistance were the most satisfactory. In learning these things they had found it necessary to lay aside the empirical rules certain noted electricians had made and establish a standard of their own, as it appeared to be a special science, requiring special conditions. The early experiments were tried

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.

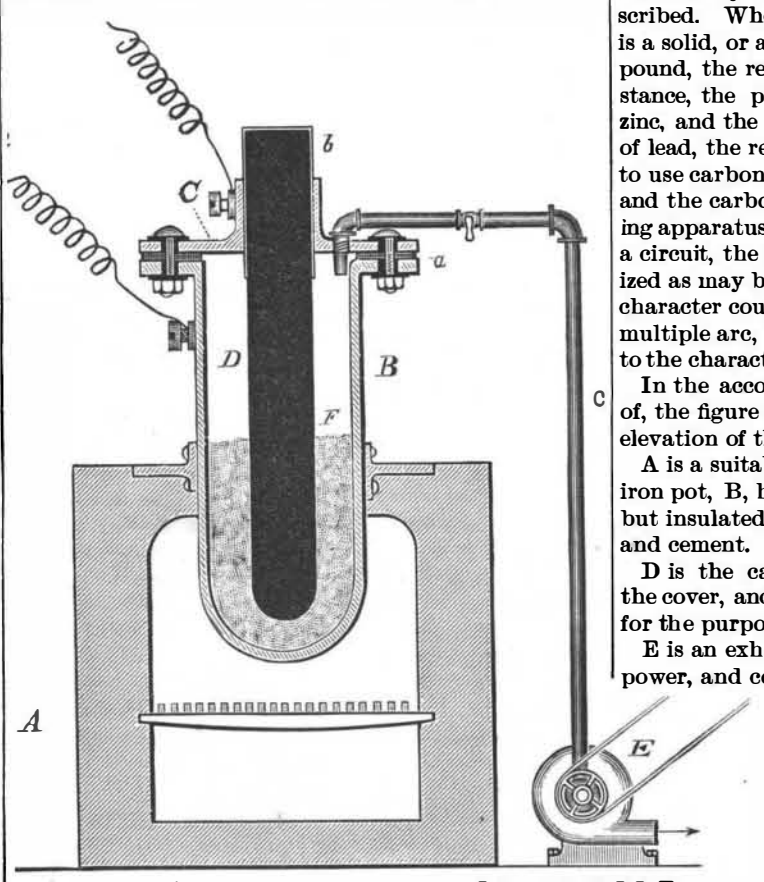
transmitted, and is on the tape when the recipient goes to the instrument.

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.