

F. K. FITCH.  
Electric-Telephone.

No. 214,767.

Patented April 29, 1879.

Fig 1.

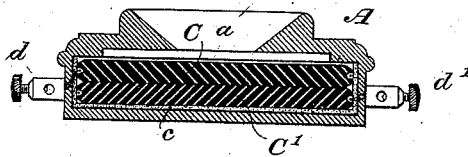


Fig 2.

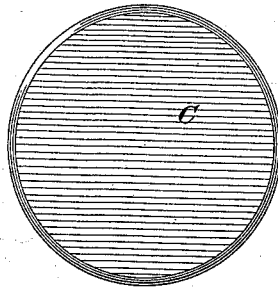
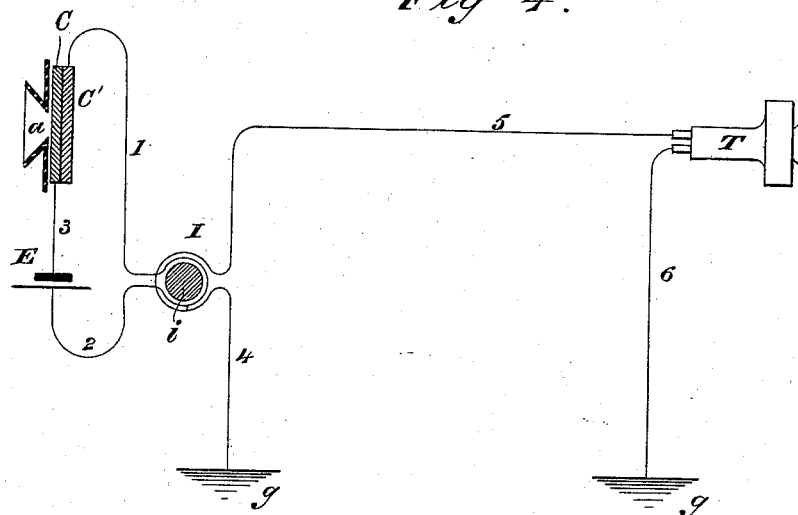


Fig 3.



Fig 4.



WITNESSES

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# UNITED STATES PATENT OFFICE.

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## IMPROVEMENT IN ELECTRIC TELEPHONES.

Specification forming part of Letters Patent No. **214,767**, dated April 29, 1879; application filed December 11, 1878.

*To all whom it may concern:*

Be it known that I, FREDERICK K. FITCH, of Jersey City, in the county of Hudson and State of New Jersey, have invented certain new and useful Improvements in Transmitters for Speaking-Telephones, of which the following is a specification.

My invention has for its object the more perfect transmission of articulate sounds or speech over telegraphic circuits by means of an improved transmitting apparatus, the diaphragm of which is acted upon directly by the sonorous vibrations traversing the atmosphere in such manner as to produce the necessary corresponding variations of strength or undulations in the electric circuit, which variations are reproduced at the receiving-station in usual well-known ways.

It has long been known that sounds of all kinds are produced by vibration, and that when these vibrations are communicated to an elastic medium, such as the atmosphere, they alternately cause expansions and contractions of its particles, which may be in turn communicated to other elastic bodies upon which the vibrations impinge. It has also long been known that when an electric current traverses two conducting bodies in contact with each other the resistance at the points of contact of the two bodies varies in an inverse ratio to their area of surface-contact.

My invention, which is based on these well-known facts, consists in a novel apparatus for transmitting articulate sounds or speech through an electric circuit embracing two carbon plates in constant contact, one of said plates being of proper form to be thrown into vibration by the direct impingement of the atmospheric sound-waves upon it, and, by its vibration, in constant but variable contact with the other plate, causing variations in the resistance of the electric circuit by correspondingly varying the area of the points of the faces of the two plates in contact.

My invention secures an apparatus for the telephonic transmission of articulate speech of extreme simplicity and efficiency, well adapted for use in connection with any of the well-known forms of receiving-telephones, and

has been practically demonstrated to be specially useful on lines which are subject to inductive interference from adjacent telegraphic conductors upon the same supports or in the same cable.

In the accompanying drawings, which represent so much of my improved apparatus as is necessary to illustrate the subject-matter herein claimed in the best form now known to me, Figure 1 represents a transverse section therethrough; Fig. 2, a face view of the transmitting-plate, and Fig. 3 an edge view of the same. Fig. 4 represents a preferred and well-known method of arranging the circuits for operating long lines.

The transmitting-plates C C' are preferably circular in form, and composed of hard gas-carbon, for reasons hereinafter set forth. These transmitting bodies or plates are preferably made alike in shape and size, and are placed with their adjacent surfaces in immediate contact with each other in a chamber formed within a box or case, A, the bottom and sides of which chamber are lined with a layer of woolen cloth, felt, or some similar semi-elastic or yielding material, c. The transmitting-plates fit somewhat loosely in the chamber, but not so much so but that the lining serves to retain them securely therein with their adjacent faces in constant contact with each other.

The usual conical mouth-piece *a* on the top of the case concentrates the atmospheric vibrations directly upon the upper transmitting or impinging plate, C, which latter is connected by a wire with the binding-screw *d*, the other plate, C', in like manner, being connected with the binding-screw, *d'*, the circuits running as usual. The wires and carbon plates are preferably connected in the manner shown in Fig. 3. A groove is turned in the edge of each plate, and the wire is wrapped one or more times around the groove in the plate and twisted on itself, as shown at *b*, a considerable surface of wire thus being brought into contact with the carbon, and the connection thus offers comparatively little resistance to the passage of the current.

My improved transmitter may be placed in circuit with any of the known forms of receiv-

ing-telephones, consisting preferably of an electro-magnet, a plate or diaphragm, and a battery, say, of three or four elements.

When the apparatus is at rest, a constant current will traverse the circuit, passing through the transmitting-plates C C'. When, now, one speaks into the mouth-piece *a*, sonorous vibrations are set up in the atmosphere, which are communicated to and impinge directly upon the impinging transmitting-plate C, causing corresponding vibrations in the area of the points of the faces in contact between the vibrating or impinging transmitting-plate C and the secondary transmitting-plate C', thus correspondingly varying the resistance between the contact-surfaces of the two plates.

The strength of the constant current traversing the circuit is varied in like ratio, and a corresponding effect is produced in the action of the electro-magnet of the receiving-telephone upon its armature, whence it results that the vibrations of the transmitting apparatus caused by the direct impingement of the air-waves on the carbon-plate are reproduced by the diaphragm of the receiving-telephone.

The ordinary well-known arrangement on circuit heretofore described is well adapted for short lines. For greater distances the proportion of the variable resistance between the transmitting-plates to that of the total resistance of the circuit becomes too small to produce the desired result. In such cases it will be preferable to arrange the circuit in the well-known manner shown in Fig. 4, in which the transmitting-plates are placed in a local circuit, 1 2 3, including a battery, E, and the primary wire of an electro-magnetic induction-coil, I, of well-known construction. The secondary wire of the said induction-coil is included in a circuit, 4 5 6, which extends to the distant station, and that point passes through an ordinary receiving-telephone, T, in the usual way.

The length of wire and number of convolutions in the secondary coil of the induction apparatus I should be increased in proportion to the length of the wire 5, in order to produce the best results.

It will readily be understood from the foregoing description that the action of my improved apparatus does not depend in the slightest degree upon variations in the specific resistance of the mass of carbon under pressure, but solely upon the application of the well-known fact, hereinbefore recited, that the resistance encountered by the electric current in passing from one conducting body to another depends wholly upon the extent of the faces in contact.

It is by no means essential that the transmitting-plates should be of the precise form shown in the drawings, although I have found that the best effect is produced by constructing the transmitting bodies in that manner.

I prefer carbon transmitting-plates, as I have obtained the best results with them practically, and for the reason that a carbon plate is not easily oxidized by the passage of a current, while, on the contrary, the surfaces of most metals, when exposed to similar conditions, soon become coated at the place of contact with a non-conducting oxide, which increases the resistance to an extent which soon renders the apparatus inoperative.

I disclaim, broadly, a diaphragm-transmitter such as shown in Bell's patent of January 30, 1877, or varying the specific resistance of carbon by variations in pressure, as claimed by Edison.

I also disclaim the use of carbon pencils or contact-points, or a make-and break contact in an electric circuit, such as shown by Edison and by Berliner.

I also disclaim, broadly, the combination, in an electric circuit, of two or more solid conducting bodies in constant contact with each other, one of said bodies being of proper form to be thrown into vibration by the impingement of atmospheric sound-waves upon it, and by its vibrations producing variations in the area of surface-contact between said bodies, and consequently corresponding variations in the resistance offered to an electric circuit at the place of such contact, as this constitutes a portion of the subject-matter shown in a prior application of mine, of which this is a division.

I am also aware that it has been proposed to use a carbon-plate transmitter with a metal plate and a damper of vibrations, such as a rubber block, between the carbon plate and mouth-piece, and disclaim such device; but,

Having thus fully described the operation of my improved apparatus, what I claim therein as of my own invention, and desire to secure by Letters Patent, is—

1. The telephonic transmitting apparatus hereinbefore set forth, consisting of the combination, in a telegraphic circuit, of two carbon plates with their respective adjacent faces in constant contact, one of said plates being of proper form to be thrown into vibration by the direct impingement of atmospheric sound-waves thereon, and by its vibrations in constant contact with the other plate, causing variations in the area of the points of the faces in contact, and consequently causing corresponding variations in the resistance of the circuit.

2. The combination, substantially as hereinbefore set forth, of the casing or chamber, its yielding or semi-elastic lining, and the carbon plates secured therein with their adjacent faces in contact with each other.

FREDERICK K. FITCH.

Witnesses:

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WM. ARNOUX.