(No Model.)

J. H. CHEEVER.

TELEPHONE TRANSMITTER.

No. 281,240. Patented July 17, 1883.

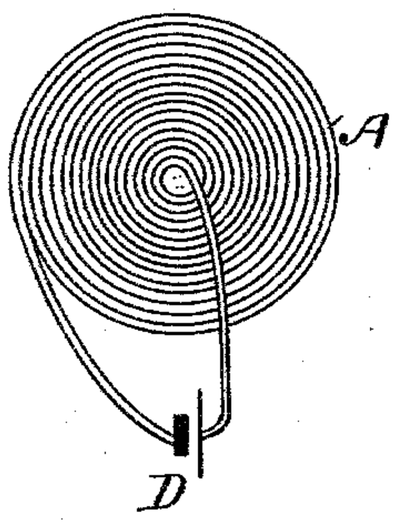

Fig. 1.

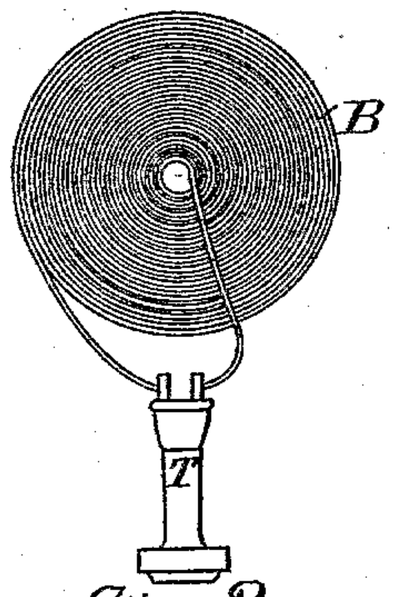

Fig. 2.

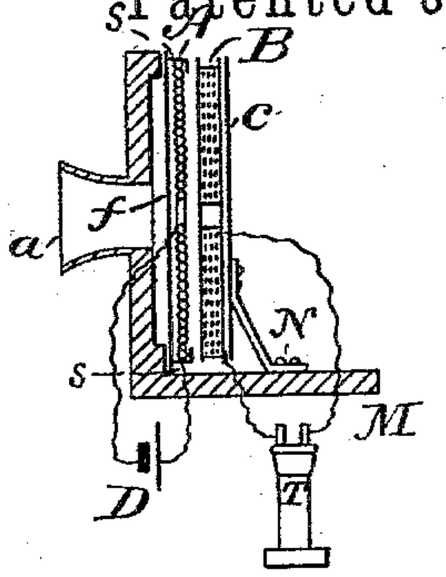

Fig. 3.

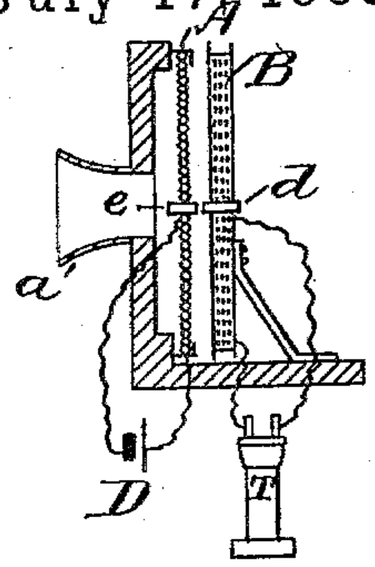

Fig. 4.

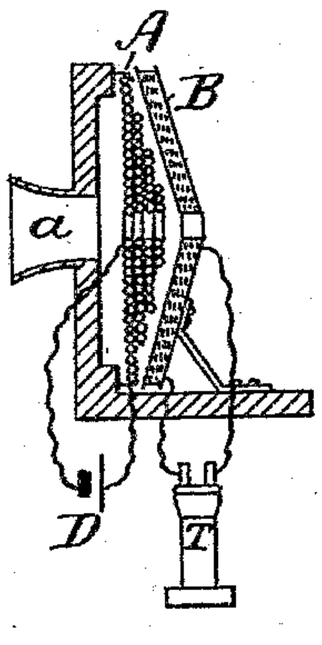

Fig. 5.

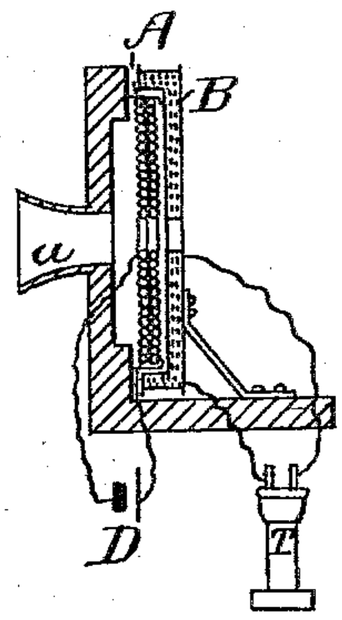

Fig. 6.

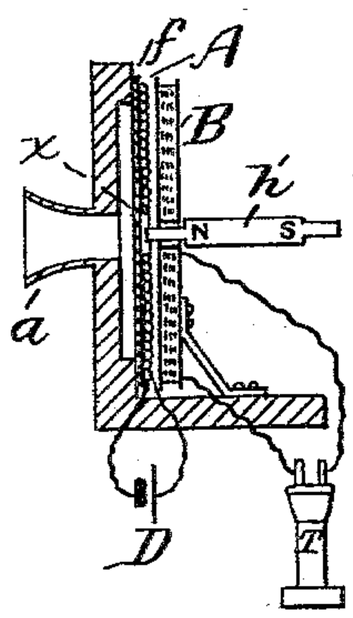

Fig. 7.

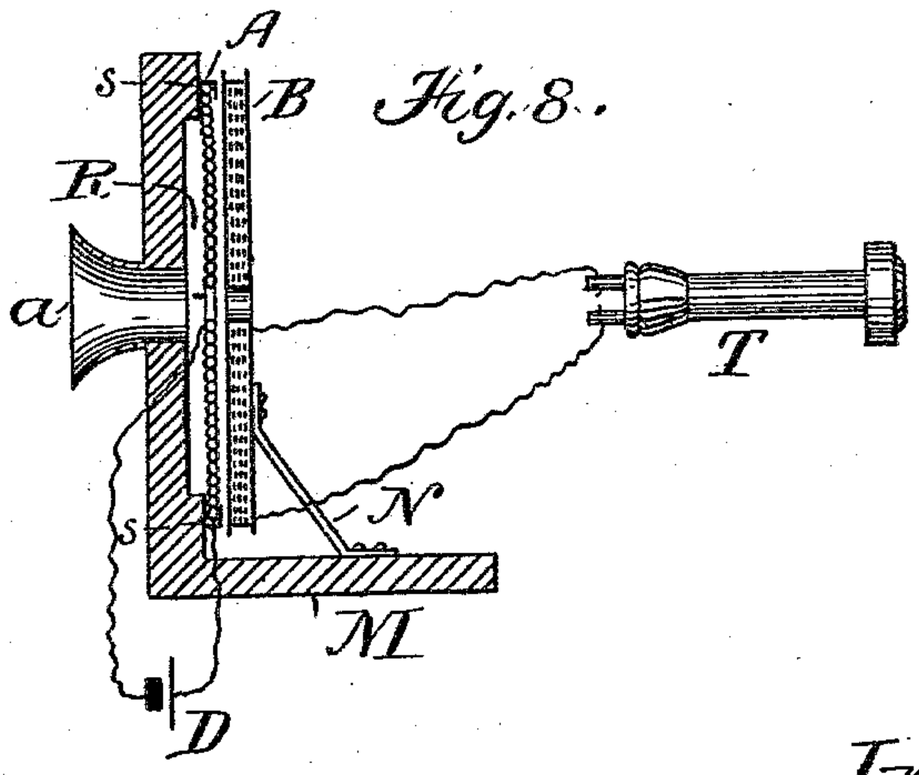

Fig. 8.

Witnesses.

Thos. D. Lockwood

Geo. Willis Pierce

Inventor.

Joseph H. Cheever.

UNITED STATES PATENT OFFICE.

JOSEPH H. CHEEVER, OF SOMERVILLE, MASSACHUSETTS.

TELEPHONE-TRANSMITTER.

SPECIFICATION forming part of Letters Patent No. 281,240, dated July 17, 1883.

Application filed February 5, 1883. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH H. CHEEVER, of Somerville, in the county of Middlesex and State of Massachusetts, have invented certain Improvements in Telephone-Transmitters, of which the following is a specification.

My invention relates to the art of transmitting and reproducing articulate speech at a distance; and it consists in an improvement in the said art.

It further consists, generally speaking, in a novel method of producing the undulating pulsations or currents of electricity which are essential to the successful transmission of articulate vocal sounds.

It further consists in certain instrumentalities and forms of apparatus in which the said improved method may be embodied, and by means of which I am enabled to transmit speech with great clearness and facility.

The aim of my invention is to secure such results, and, furthermore, to provide instruments of an extremely simple and economical construction.

Heretofore all transmitting-telephones, so far as I am aware, have been based upon certain principles in electrical and magnetical science, which, as a recognition of the present state of the art, I will now briefly describe. The first type is that which is now almost exclusively used as a receiver—*i. e.*, the ordinary Bell magneto-telephone, in which, when used as a transmitter, the undulating currents are developed by the vibration of a diaphragm of thin sheet-iron under the influence of the voice in front of a magnet, the core of which is surrounded by a helix of fine insulated wire, forming part of the main-line circuit, in which is also included the helix of the receiving-telephone. The said vibrations alternately re-enforce and weaken the strength of the magnet, and the magnetic variations produce brief magneto-currents in the transmitting-helix of a character corresponding to the sound-waves resulting from the spoken words, and these vibrations, passing over the main line and through the helix of the distant receiving-telephone, vary the magnetism of the same, causing its diaphragm to vibrate synchronously with the transmitting-diaphragm, throwing the air into vibrations, thus reproducing the sound. Transmitters of the second type are those in which the action of the voice on the diaphragm, instead of producing electric currents by creating and varying an electro-motive force, varies the resistance of a voltaic-battery circuit. Undulations of a much greater magnitude are thus developed with a corresponding strength in the reproduced tones. The best example of an instrument of this class is the well-known Blake transmitter, in which the diaphragm, when vibrated, effects a variation of resistance by varying the degree of contact-pressure existing between two electrodes in the battery-circuit, the said electrodes being normally in slight contact one with another. Other instruments of this class have been constructed in which a conductor forming a part of the battery-circuit dips to a greater or less extent in a conducting-fluid, which also forms part of the circuit, thus producing the necessary variation in the current strength. My invention, however, is based upon a principle in electro-dynamics, which, though well known, *per se*, has not heretofore been directly utilized in the transmission and reproduction of articulate speech. The principle may thus be stated: When a conductor or coil of insulated wire through which an electric current is passing is caused to approach or recede from another conductor, currents of electricity are induced in the latter or secondary conductor of a strength depending partly on the strength of current flowing in the primary conductor, partly upon the distance between the two coils, and partly upon the rate of speed which characterizes the approach and recession of the moving coil. This principle I have embodied in a transmitting-telephone consisting of two coils of insulated wire, one of which conveys a constant electric current, while the other is included in a main circuit of any desired length, having one or more telephones inserted therein as receivers. One of the said coils is adapted by suitable devices to vibrate by the sound-waves consequent upon spoken words, while the other coil is stationary. The movement or vibration of the freely-held coil in front of its fixed counterpart induces alternating currents of an undulatory character in the secondary coil independent of any variation in the strength of the electric current flowing through the pri-

mary coil. Although for convenience I prefer to vibrate the primary coil through which the current is flowing and to hold the secondary or main-line coil stationary, such a condition is not essential to the success of my invention, and I may, without materially affecting the results, reverse that arrangement, should it be desirable so to do. Moreover, the presence of an iron, paper, or other diaphragm is not necessary, although in practice it will be found preferable.

In the usual construction of my transmitter I employ with or for a transmitting-diaphragm a volute or a coil of insulated wire made up of several rows. This volute or coil is glued, so as to form a stiff surface of sufficient extent which will respond readily to the air-vibrations produced by the voice. This coil is fastened firmly at its edge to a suitable standard. A secondary coil, similar in form but composed of finer wire, and consisting of a much greater number of convolutions than the first coil, is placed near to but not quite touching the latter. The ends of the second coil are, when the instrument is to be operated, connected in the circuit of a telephone-line which includes the receiving-telephone. An electric current constant in strength is passed through the first coil. On speaking near the latter, it is caused to vibrate bodily, inducing in the secondary coil alternating electric currents of an undulatory character, which, passing over the main line and through the helix of the receiving-telephone, cause the diaphragm thereof to vibrate synchronously with the vibrations of the primary or diaphragm coil of the transmitter, thus reproducing the words uttered near the said transmitter.

In the drawings I have shown several forms in which my invention may be embodied, and also some of the essential parts of the same.

Figure 1 shows the primary or inducing coil detached and connected in the circuit of a battery; Fig. 2, the secondary coil, with its circuit closed, through a magneto-telephone; Fig. 3, a sectional view of the instrument in its simplest form; Fig. 4, a sectional view showing the coils as having iron cores in their centers; Fig. 5, a sectional view showing the coils as being pyramidal in form; Fig. 6, a sectional view showing the primary coil fitted loosely within the secondary coil; Fig. 7, a sectional view showing a combination of the instrument with a magneto-telephone. Fig. 8 is an enlarged view of the transmitter, similar to Fig. 3.

In Fig. 3, A is the primary coil, supported in clamps *s*, attached to the front of a suitable frame or standard, M, which is fitted with a mouth-piece, *a*. The ends of this coil are united with the poles of a battery, D. In close proximity to the primary coil I place a secondary coil, B. This is of high resistance, being composed of a great number of turns of insulated wire. Connected with its ends, which may be extended to any desired length by being connected with a main-line circuit, is a telephone, T. In front of the primary coil is an iron diaphragm, *f*, to which the coil is cemented, or fastened otherwise. A plate of iron, *c*, is placed behind and close to the secondary coil B. The presence of these iron plates augments the inductive effect of the coil A upon the secondary coil B.

Fig. 8 is nearly the same as Fig. 3, and is shown on a larger scale. It represents the instrument in its simplest form. The iron diaphragm and plate *f* and *c*, respectively, are dispensed with. The primary coil A is clamped at its edge (shown at *s*) to the front board of the standard M. The secondary coil is held by the brace N. An air-space, R, is left between the front board and the coil A. The volute or diaphragm coil may consist simply of one row of insulated copper or iron wire; or a coil consisting of several rows may be employed, as in Figs. 5 and 6. Fig. 5 shows the primary helix, consisting of several rows wound in a pyramidal form. The secondary coil B is pressed in a form corresponding therewith. In Fig. 6 the primary coil loosely fits within the secondary coil B, thus enabling the primary coil to exert an inductive effect on the edges or flanges of the secondary coil, as well as on the surface thereof. In Fig. 4 both coils are represented as being fitted with iron cores *e* and *d*, which aid in the inductive effects.

Fig. 7 shows a magneto-telephone combined with my charged coil-diaphragm transmitter. *f* is an iron diaphragm, to which is fastened the inducing-coil A, and which is clamped, as in the foregoing figures, to the standard. The secondary coil B surrounds the core of a magnet, *h'*. The iron diaphragm forms a part of the primary circuit, the primary coil being attached thereto at the point *x*. In this form of instrument the effect of the vibration of the iron plate in the magnetic field surrounding the end of the magnet, being inductive, is added to the inductive action of the coil A on the coil B, causing an increase of volume in the transmitted speech. Where iron wire is used for a primary coil, the coil as a whole is rendered quite magnetic.

In the ordinary microphonic transmitter the largest amount of current that can be used to advantage is about one ampere per second. This is because of the heating of the electrodes at their point of contact. Frying and hissing noises ensue when the contacts become heated, these interfering with conversation. What is gained in loudness by an increase of current above the amount stated is lost in distinctness of articulation. One great advantage of my invention is that the amount of inducing-current employed is limited only by the burning of the insulating substance surrounding the wire of the coil-diaphragm. With a coil made of moderately-large wire very intense currents may be used, and consequently strong inductive effects may be produced. According to

the laws of electro-dynamic induction, an induced current is proportional to the square of the inducing current, and as the limit of available current is large, very satisfactory results are obtained.

I am aware that heretofore induction-coils have been employed in connection with transmitting-telephones; but such use has been entirely subordinate to the variations of the strength of current passing in the primary coil, caused by varying the pressure at a point of contact. My invention is distinct from any such use, since in the primary coil which I employ the current of electricity is of a constant strength, and the currents in the secondary coil, instead of being induced by the increase and decrease of an electric current, are induced by the approach and recession of a charged primary coil.

I have spoken of the primary coil as being made of iron wire. The secondary coil may be made of iron wire also.

I claim—

1. A telephone-transmitter consisting of a coil or volute in a battery-circuit, a suitable frame or support therefor, a secondary coil adapted to be included in a main-line circuit, and a mouth-piece by which the sound-waves of the human voice may be directed to the primary coil, whereby the said primary coil may be vibrated in the presence and vicinity of the secondary coil, as described.

2. In a telephone-transmitter, a primary coil in a battery-circuit, a diaphragm attached thereto, and a mouth-piece in front of the said diaphragm, combined with a secondary helix included in the circuit of a receiving-telephone and supported in inductive proximity to the primary helix, substantially as and for the purposes described.

3. The combination, in a telephone-transmitter, of a helix in a battery-circuit and a second helix in a main-line circuit, including a receiving-telephone, whereby when either helix is vibrated by vocal utterances in the vicinity of the other undulatory currents are produced in the secondary helix and the vocal utterances reproduced in the receiver.

4. The combination of a helix in a closed battery-circuit with a secondary helix, a closed circuit in which the said secondary helix is included, and one or more receiving-telephones, also included with the secondary helix in the closed circuit, so that the vibrations of the primary helix shall induce electrical undulations in the secondary helix, substantially as described.

5. In a telephone-transmitter, a primary helix or volute in the circuit of a battery, a diaphragm attached thereto, a supporting-frame therefor, and a mouth-piece inserted in the said frame in front of the diaphragm, combined with a bar-magnet placed in inductive proximity to the said diaphragm, and a secondary coil or helix surrounding the core of the said magnet in inductive proximity to the primary coil, whereby the magneto-electric currents induced by the action of the diaphragm on the magnet are superadded to the electro-dynamic currents induced in the secondary coil by the vibration of the primary helix, substantially as described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 3d day of February, 1883.

JOSEPH H. CHEEVER.

Witnesses:
THOS. D. LOCKWOOD,
GEO. WILLIS PIERCE.