(No Model.)

S. L. WIEGAND

TELEPHONE.

No. 436,513. Patented Sept. 16, 1890.

Fig. 1

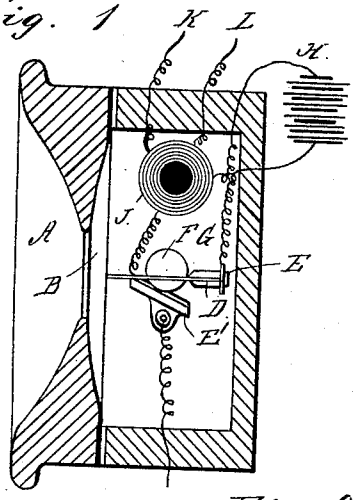


Fig. 1a

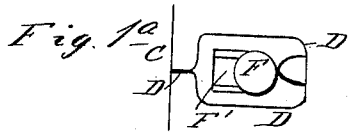


Fig. 5.

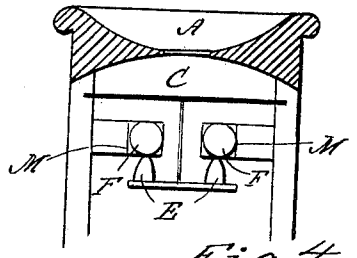


Fig. 2.

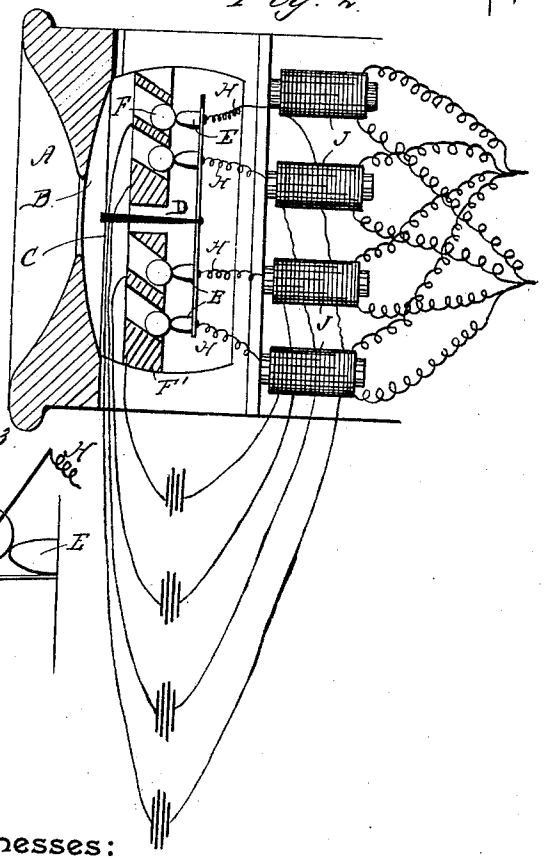


Fig. 4

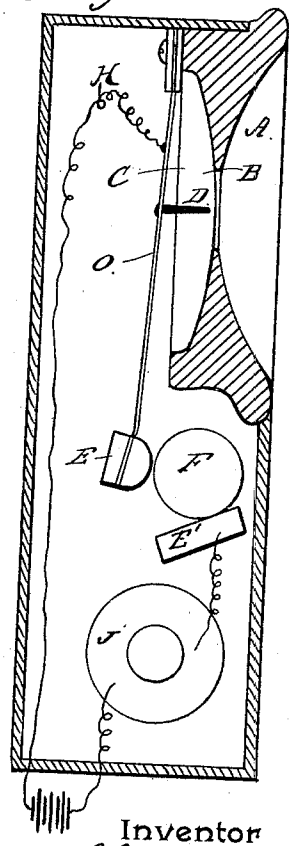
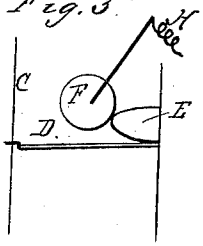


Fig. 3.



Witnesses:
Hans A. Hielm
Daniel Eby

Inventor
S. L. Wiegand

UNITED STATES PATENT OFFICE.

S. LLOYD WIEGAND, OF PHILADELPHIA, PENNSYLVANIA.

TELEPHONE.

SPECIFICATION forming part of Letters Patent No. 436,513, dated September 16, 1890.

Application filed May 28, 1889. Serial No. 312,455. (No model.)

To all whom it may concern:

Be it known that I, S. LLOYD WIEGAND, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Telephone-Transmitters; and I do hereby declare the following to be a sufficiently full, clear, and exact description thereof to enable others skilled in the art to make and use the said invention.

This invention relates to the transmitting portion of telephones and microphones, and is designed to produce from the vibrations of articulate speech and vocal sounds interruptions and changes in the tension of a connected electric circuit capable of transmission through longer distances, and greater resistances than is practicable with electro-magnetic telephones, and of development by connected electro-magnets, and mechanism thereby operated or controlled, of reciprocating surfaces generating sound waves or pulsations in the atmosphere corresponding with those vibrating the transmitting-diaphragm.

Heretofore in the method of operating and in the construction of instruments for this purpose an electrode or electrodes (usually of carbon) have been secured to the back of the transmitting-diaphragm, against which electrodes another loose or free electrode rested, being pressed into contact with each other by gravitation or by a spring, which free electrode was propelled by the impulse of the sound vibration imparted to the diaphragm and the attached electrode, and separated from the contact with the first electrode by the returning motion of the loose electrode. The motion of the electrode in such instruments is dependent upon and governed by the same laws of action and reaction by which the first of a series of equal pendulous elastic balls hung in contact with each other stops its own motion, but imparts it to the next ball, so that the last ball of the series describes an ascending arc corresponding to the descending arc described by the first ball. The varying of the contact between the electrodes in such telephonic and microphonic transmitters depends upon the reaction of the diaphragm and the electrode thereto attached and occurs after the electrode fastened to the diaphragm has impinged on the free electrode. In this invention the varying of the contact between the electrodes is effected directly by propelling or driving the electrode or electrodes attached to the diaphragm, as the case may be, away from the free electrode. The electric current in the circuit, alternately strengthened and weakened, operates to generate an induced current in a secondary and line circuit, the tension of which will vary with the varying resistance produced by the motion of the electrodes, and thereby reproduce vibrations of the diaphragm of a receiving-instrument which will correspond to those imparted to the diaphragm of the transmitter. The form of apparatus used in operating by this method is shown in the annexed drawings, in which—

Figure 1 shows a section of the telephone-transmitter. Fig. 1^{A} is a plan of the electrodes and parts connecting them to the diaphragm. Fig 2 is a section of a transmitter provided with multiplex electrodes, batteries, and induction-coils. Figs. 3, 4, and 5 show modifications in the manner of connecting and operating the electrodes.

A represents the receiving-funnel; B, the sound-collecting cavity, (made preferably in the form of a flat paraboloid;) C, the diaphragm secured to the rim of the collecting-cavity B.

D is the stem or rod attached to the diaphragm C and projecting rearwardly therefrom. Attached to the stem D is an electrode E, having its conducting point or surface toward the diaphragm C. In the transmitter shown in Fig. 1 there is but one such electrode E connected with the stem D. In the microphone shown in Fig. 2 there are several. When two or more electrodes E are employed, they should be insulated so that they may be operative in strengthening and weakening the electric circuit, as hereinafter explained.

Between the diaphragm C and the electrode or electrodes E, thereto attached, are placed other electrically-insulated electrodes F, of carbon or equivalent material, resting against the electrodes E, so as to be in contact therewith. Each pair of electrodes E and F is connected electrically with wires G and H, through the primary circuit of the induction-coil J and a battery R, or equivalent means of producing or exciting electric tension.

The secondary wires of the induction-coil J are connected with line-wires K and L, leading to a receiving-instrument, which may be of any of the usual constructions. The electrodes F are supported so as to rest against and be susceptible of motion in a similar or the same direction as the electrodes E, as shown in Figs. 1 and 2. The electrodes F are in the form of balls resting upon inclined guides F′, in or on which they roll against their opposing electrodes E, the wire G being attached to the inclined guides, which are formed of conducting material and insulated electrically from each other. As shown in Fig. 3, the electrode F is suspended as a pendulum in the rear of the diaphragm, so as to swing against the electrode E. As shown in Fig. 4, the electrode E is suspended by a spring O, forming an electric connection with the wire G, and, as shown in Fig. 5, the electrodes F are placed vertically over the electrodes E and are held in position laterally by a guide H, consisting of a plate having perforations corresponding in form to the electrodes F, and in which the latter fit loosely. Guide H is either insulated or made of insulating material and connected by flexible wires to the wires H. The vibration of the electrodes E in this instance is in a vertical direction.

The method of operation by the mechanism above described is as follows: Articulate speech being addressed to the funnel A passes into the cavity B, impinges upon the diaphragm C, and propels it and the connected electrodes away from the speaker, retracting the electrodes E from the electrode F, the action of gravitation or of the suspending springs being slower than that of the vibrating movement of the diaphragm and connected electrode. The contact of the electrodes E and F will thereby be varied from the direct impulse of the voice on the diaphragm and such variation be repeated during the succeeding vibrations of the diaphragm. The pulsatory current produced in the primary coil of the induction apparatus by the opening and closing of the primary circuit and by the variable resistance produced by the varying pressure exerted by the electrodes upon each other operates to generate an induced current in the secondary coil of the induction apparatus, which latter current is transmitted to the line-wire and actuates the receiving-instrument. The secondary current so produced presses the intermittent and pulsatory characteristics of the primary current and serves to transmit articulate speech or other sounds or signals.

Without attempting to produce graphic illustrations of the form of vibrations, as has been done in announcing the theory or explaining the supposed action of other telephones, the following facts have been demonstrated and are here stated: That in this method the first impulse of sound on the diaphragm diminishes the primary current; that the extent of diminution varies with the force of the sound-wave; that the force of the ensuing reaction produces an increase of this current; that the extent of surfaces brought into contact at each variation is dependent upon the force of the movement of the diaphragm and varies with the extent of the previous movement; that the secondary or induced circuit conveys, with corresponding variations of electric tension and magnetic effect, the varying impulses produced by the vibrations of the articulate speech and other sounds on the diaphragm C, and that corresponding sounds occur at the diaphragm connected with the electro-magnets in the line-wire. In the multiplex electrode transmitter shown in Fig. 2 the operation is similar to that shown in Fig. 1, the difference being that a number of primary circuit and induction coils are used in conjunction with one transmitting-instrument, the secondary being connected to line-wires for the purpose of increased acoustic effect or to overcome resistances from length of line-wire impracticable for use with single similar telephone-transmitters.

I am aware that microphones have been constructed with one electrode attached to the diaphragm and arranged to impinge against a movable electrode, the construction being such that when the diaphragm is forced away from the speaker the electrode connected with the diaphragm impinges upon the loose electrode, forcing it forward also, and the immediately-ensuing reaction of the diaphragm and the momentum of the loose electrode producing a severance and an opening of the circuit. Such constructions of microphones have been found defective in operation, owing to the fact that the loose electrode being forced away from the diaphragm by a constantly-varying force its momentum is constantly varied, and in consequence of which the force with which it returns and the time during which it is returning, so as to again impinge upon the other electrode, so retards and interferes with the operation of the instrument as to materially impair its utility in transmitting articulate speech.

In my improved transmitter I avoid the evils resulting from the varying momentum of the loose electrode in the instrument above referred to by so combining the electrode with the diaphragm that when the latter is forced away from the speaker it will cause the two electrodes to impinge against each other only as the diaphragm is retracted, so that during the interval of retraction the loose diaphragm is subject to the exceedingly-slight movement and momentum which is due to its very slight descent by gravity. By this arrangement of parts I am enabled to secure a most sensitive and reliable transmitter.

I make no claim in this application to the method herein described, as it forms the subject-matter of a separate application filed by me, the serial number of which is 312,472.

Having fully described my invention, what

I claim as new, and desire to secure by Letters Patent, is—

1. In a telephone-transmitter, the combination, with a diaphragm having an electrode permanently connected so as to vibrate therewith, of a loosely-mounted electrode resting normally against the first electrode and arranged to be propelled by vibrations of the diaphragm and its connected electrode toward the speaker and make variable contact during ensuing reaction, substantially as set forth.

2. In a telephone-transmitter, the combination, with a diaphragm and an electrode connected therewith so as to vibrate with the diaphragm, of an electrode loosely mounted on an inclined supporting-guide, said electrodes being constructed and arranged to diminish the contact by the movement of the diaphragm in a direction away from the speaker, substantially as set forth.

3. In a telephone-transmitter, the combination, with a diaphragm and an electrode connected therewith so as to vibrate with the diaphragm, of a spherical electrode loosely mounted and located between the diaphragm and the electrode connected therewith, substantially as set forth.

4. In a telephone, the combination, with a diaphragm and an induction-coil, of two electrodes, one connected with the diaphragm and the other loosely mounted and acted upon by gravity, said electrodes being included in the primary circuit of the induction-coil and arranged to be diminished in contact by the direct action of the diaphragm and increased in contact after the reaction of the diaphragm, substantially as set forth.

S. LLOYD WIEGAND.

Witnesses:
J. DANIEL EBY,
ALEX H. SIEGEL.