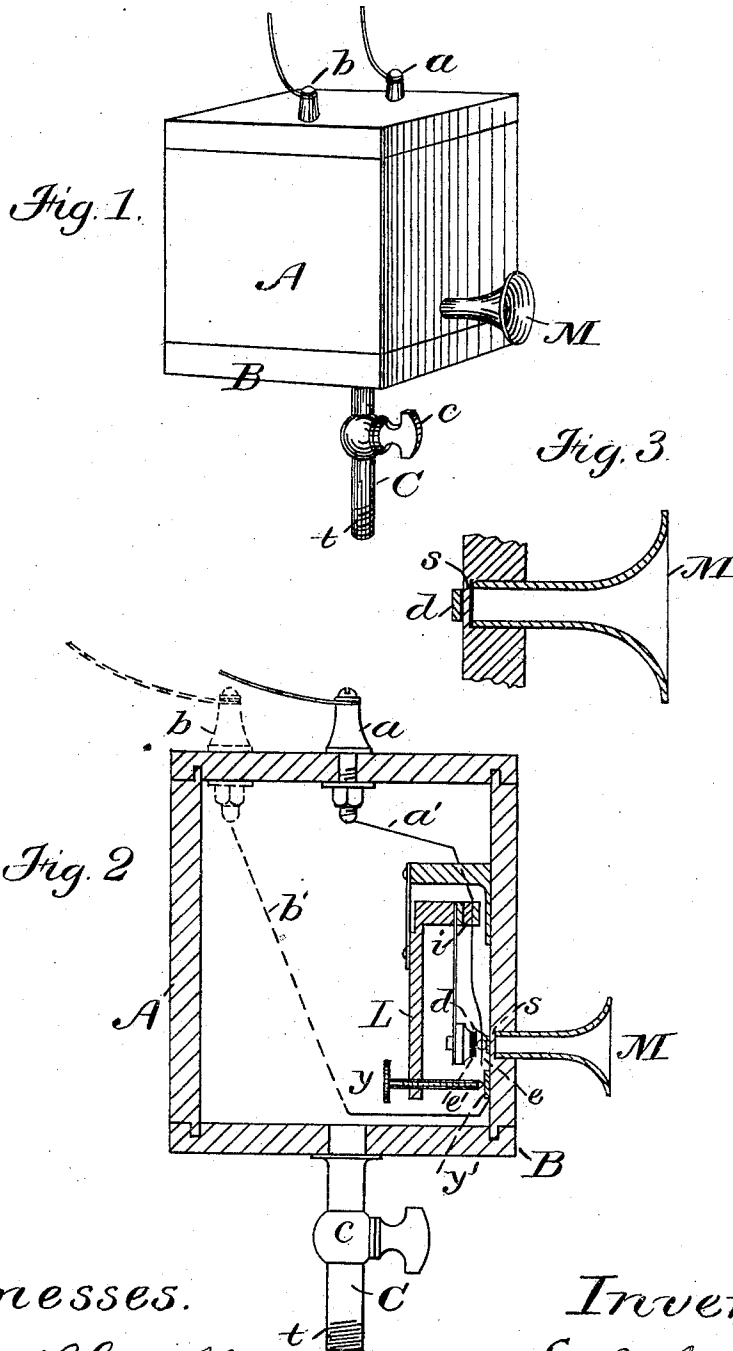


(No Model.)

E. BERLINER.
TELEPHONE.

No. 248,839.

Patented Nov. 1, 1881.



Witnesses.
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Geo. W. Purce—

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UNITED STATES PATENT OFFICE.

EMILE BERLINER, OF BOSTON, MASSACHUSETTS.

TELEPHONE.

SPECIFICATION forming part of Letters Patent No. 243,839, dated November 1, 1881.

Application filed July 30, 1881. (No model.)

To all whom it may concern:

Be it known that I, EMILE BERLINER, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain Improvements in Telephones, of which the following is a specification.

My invention relates to that class of instruments known as "microphonic" or "contact" telephones, in which the vibrations resulting from the impact of the sound-waves on a resonant plate or surface so act upon a variable resistance included in the voltaic circuit of such telephones as to cause the said resistance alternately to increase and diminish. It is well known that in such instruments the variable resistance point is produced by the adjustable contact of two electrodes, and that its alternate increment and decrement are due to the varying degree of pressure between them, resulting from the said vibrations of the diaphragm resonant surface or sounding-board. By such variation of the resistance at the point of contact the continuous current of a galvanic battery flowing in the circuit is thus thrown into electrical undulations corresponding in form to the superinducing sound-waves. The original sound-waves being thus, so to speak, converted into undulatory currents of electricity, these in turn are made to produce corresponding mechanical movements at the receiving-station, whereby at that point the air is thrown into vibrations and the original sounds reproduced in suitable receivers.

Experience has demonstrated that the electrical resistance of the point of contact in its normal state, or at all times when it is quiescent or unoperated upon, should be extremely low, and that any appliance by which said resistance can be practically lessened is of positive gain, because under such a condition the amount of variation, when the instrument is being operated upon, is definitely increased.

It is also evident that if the mechanical resistance to the motion of the movable parts of a microphonic telephone can in any way be reduced there is also an advantage, because the parts are thus rendered more amenable to operation by the disturbing or operating influences of the sound-waves.

The object of my invention is therefore, first, to reduce the normal electrical resistance of

the point of contact between the two electrodes of the voltaic circuit in the telephone; and, second, to lessen the mechanical resistance or opposition to the free and unrestricted motion of the working parts by the withdrawal of the pressure of the atmosphere.

I have discovered that instruments of the class hereinbefore described—such, for example, as the well-known Blake or Berliner transmitters—give much better results when their contact-electrodes are maintained *in vacuo*, and that when so disposed their sensitiveness is greatly increased. This is due to the causes which I have in this specification indicated—viz., that there is a substantial decrease in the normal resistance at the contact-point of the electrodes, and that there is no air-pressure to interfere with and impede the motion of the working parts attached to and supporting the electrodes.

My invention, then, is a contact or microphonic telephone, wherein the electrodes constituting the variable resistance are inclosed *in vacuo*, and it is illustrated by the accompanying drawings.

Figure 1 is a perspective view of an apparatus in which I have embodied my invention. Fig. 2 is a vertical section of the same, illustrating the position and connection of the working parts; and Fig. 3 is a detail of the mouth-piece and a portion of the front of the apparatus on a larger scale.

The working parts of my vacuum-telephone are inclosed in an air-tight box, A, which may be constructed of any suitable material. I have made it of wood, and have fastened the base-board or bottom B of the box with screws to the frame A, inserting between the respective edges a packing or pad of rubber cloth, or some similar substance, so as to make the joint perfectly tight. Into a hole extending through the bottom of the box is inserted a pipe, C, furnished with a stop-cock, c. The pipe C is fitted at its extreme end with a screw-thread, *t*, by which it, and consequently the entire box, is attached to the plate or pipe leading from the plate of an air-pump, by which the air is exhausted from the box A. In the front of the box A is bored a hole, which is tapped with a screw-thread, by which is secured the mouth-piece M. This hole is not bored completely through

the box, but to within an eighth of an inch of its interior surface, thus leaving a layer of wood, *s*, about an eighth of an inch thick, against which the sound-waves are directed through the mouth-piece, and which is found to give a sufficient vibration to the electrodes. Before inserting the mouth-piece *M*, I cover the cut surface of the wood at the bottom of the hole with a thin layer of shellac, in order to prevent air from leaking through the thin layer of wood, *s*, into the box. On the interior surface of the front of the box, at the point opposite the hole in which the mouth-piece is inserted, is secured also by means of shellac or any other suitable cement, a metallic button, *d*, on which rests the platinum electrode *e*, while pressing on the platinum point is the carbon button *e'*, the platinum and carbon forming together the point of variable resistance in the circuit. The small spring carrying the platinum electrode is fixed to an insulating-block, *i*, held by the adjusting-lever *L*, and is electrically connected by means of the wire *a'* to the binding-screw *a*; and the carbon button is connected by its spring through the spring-lever *L* and adjusting-screw *y* to the metal button *y'*, and from thence by wire *b'* to the binding-screw *b*.

From the binding-screws wires lead, as usual, to the local battery and to the primary circuit of the induction-coil, if one is used, or directly to the two circuit-wires, if a coil is not employed.

It will be observed that the electrodes and springs herein shown and described are substantially identical with those employed in the Blake transmitter. Any other form of contact-electrode, however, answers the purpose equally well.

In order that the connections may be clearly seen, I have shown the binding-screw *b* somewhat out of its true position.

The instrument is arranged for operation in the following manner: A perfect adjustment is obtained before closing the box by means of the screw *y*. The bottom *B* is then firmly screwed on, and the pipe *C*, attached thereto, is connected to an air-pump with the stop-cock *c*

open. The pump is then operated until the air is exhausted from the box *A*. It is not essential that the vacuum shall be perfect. The stop-cock *c* is then closed and the box unscrewed from the air-pump and set up in any desired position. The thin layer of atmospheric air which is normally between the electrodes is thus extracted, reducing the ordinary or normal resistance of the transmitter-contact; and the electrode-springs, being unresisted by atmospheric pressure, have much greater freedom and delicacy of movement, and are enabled to transmit a greater volume of sound with a much clearer articulation than has heretofore been possible, and the sensitiveness of the instrument is generally increased.

While I may, if I so elect, use a vacuum-box fitted with a diaphragm or vibrating plate as the medium whereby I communicate motion to the electrodes, I prefer the construction hereinbefore described, as by it I obtain sufficient vibration through the relative movement of the particles of which the structure of the wood is composed, while I diminish the tendency to leakage round the edges of the diaphragm, which would tend to deteriorate or detract from the degree of rarefaction obtained.

I claim as my invention—

1. A telephone-transmitter comprising, in combination, an air-tight box in which a vacuum or partial vacuum is maintained, and electrodes supported within said box in contact with each other, substantially as described.

2. An apparatus for transmitting sound by electricity, consisting of a variable resistance in a vacuum and means, substantially as described, of varying the said resistance in accordance with the vibrations of sound-waves, as set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 20th day of May, A. D. 1881.

EMILE BERLINER.

Witnesses:

T. D. LOCKWOOD,
C. T. LORING.