

(No Model.)

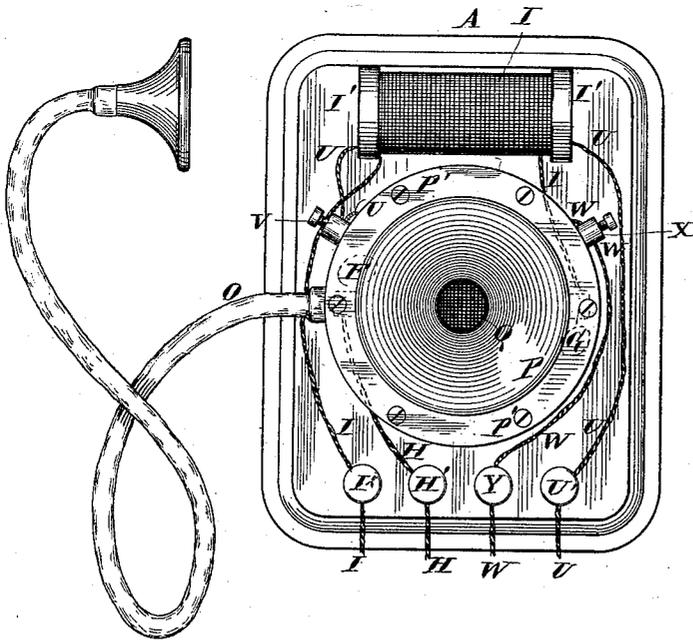
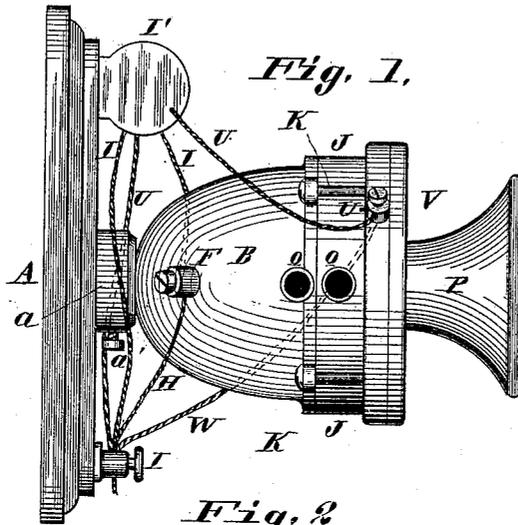
4 Sheets—Sheet 1.

L. EHRLICH, B. DUBINSKI & G. REIN.

TELEPHONE.

No. 378,780.

Patented Feb. 28, 1888.



Witnesses.

F. A. Hopkins.

Geo. Wheelock.

Inventors.

Leo Ehrlich.

Benjamin Dubinski.

Gustavus Rein.

By their Attorneys

Knights Bros.

(No Model.)

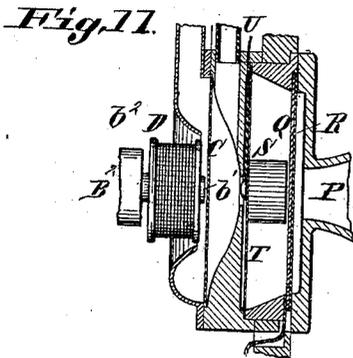
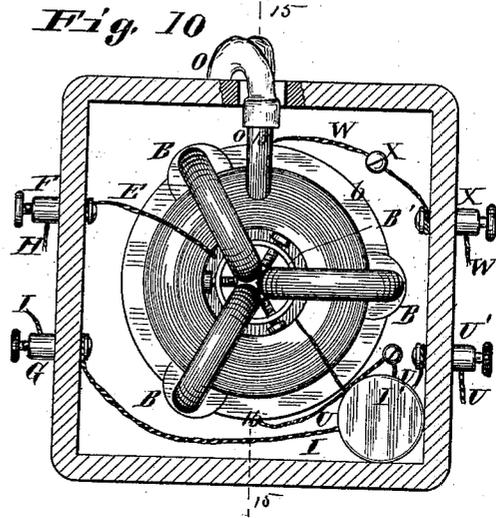
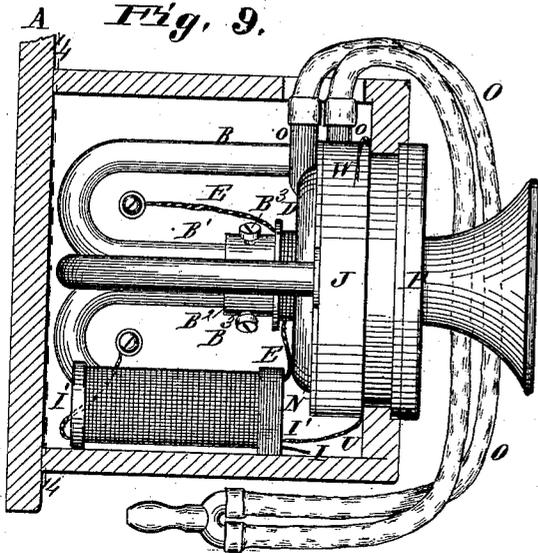
4 Sheets—Sheet 3.

L. EHRLICH, B. DUBINSKI & G. REIN.

TELEPHONE.

No. 378,780.

Patented Feb. 28, 1888.



Witnesses.

F. A. Hopkins,

Geo. L. Wheelock.

Inventors.

*Leo Ehrlich,
Benjamin Dubinski,
Gustavus Rein.*

By their Attorneys

Knigh Bros.

(No Model.)

4 Sheets—Sheet 4.

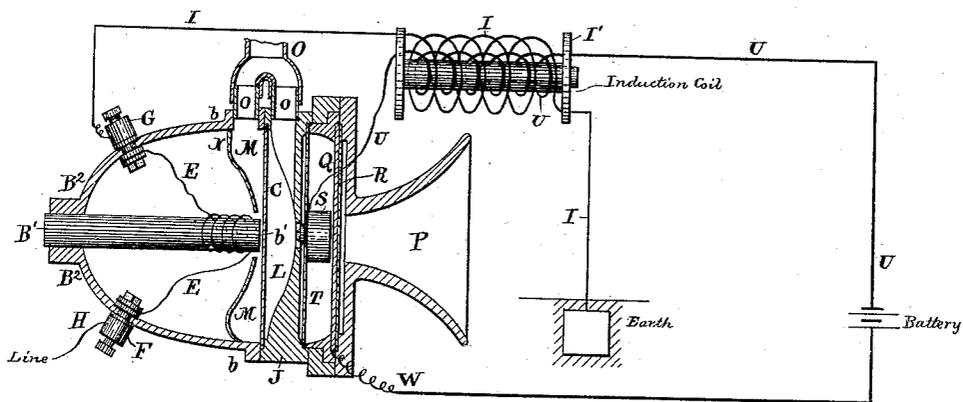
L. EHRLICH, B. DUBINSKI & G. REIN.

TELEPHONE.

No. 378,780.

Patented Feb. 28, 1888.

Fig. 12.



Attest:
Geo. H. McArthur
f. A. Hopkins

Inventors:
Leo Ehrlich.
Benjamin Dubinski
Gustavus Rein.
By Smith Bros. Attys.

UNITED STATES PATENT OFFICE.

LEO EHRLICH, BENJAMIN DUBINSKI, AND GUSTAVUS REIN, OF ST. LOUIS, MISSOURI; SAID DUBINSKI AND REIN ASSIGNORS TO SAID EHRLICH.

TELEPHONE.

SPECIFICATION forming part of Letters Patent No. 378,780, dated February 28, 1888.

Application filed June 5, 1886. Serial No. 204,238. (No model.)

To all whom it may concern:

Be it known that we, LEO EHRLICH, BENJAMIN DUBINSKI, and GUSTAVUS REIN, all of the city of St. Louis, in the State of Missouri, have invented a certain new and useful Improvement in Telephones, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, and in which—

Figure 1 is a side elevation of the apparatus. Fig. 2 is a front elevation of same. Fig. 3 is a detail side elevation of the bell-formed magnet and the mouth-piece, and Fig. 4 is a front view of same. Fig. 5 is a longitudinal horizontal section at 5 5, Fig. 4, showing in addition substantially where the connections are made with the battery and coil. Fig. 6 is a vertical transverse section at 6 6, Fig. 5. Fig. 7 is vertical transverse section at 7 7, Fig. 5. Fig. 8 is a vertical transverse section at 9 9, Fig. 5. Fig. 9 is a side elevation showing a permanent magnet of different construction, the inclosing box or case being in longitudinal section. Fig. 10 is a vertical transverse section at 14 14, Fig. 9. Fig. 11 is a detail vertical longitudinal section at 15 15, Fig. 10. Fig. 12 is a diagrammatic view showing the circuit and circuit-connections.

We will describe the modifications in the order in which the figures occur.

A is a board to which the other parts are attached, and which may be secured to any suitable support.

The permanent magnet consists of a steel or iron bell-formed or cup-formed part, B, with an iron core-bar, B', extending axially from the apex. The rim *b* of the part B forms one pole of the magnet and the end *b'* of the bar B' forms the other pole. The part B has a projection, B², at the apex, which is inserted in the socket of the knob *a* and held in by a set-screw, *a'*.

C is a vibrating metal diaphragm that will be thrown into vibration by electric currents in the core B'.

D is a spool surrounding the core B', upon which is wound a wire, E, whose ends are secured to the binding-posts F and G, and to these parts are respectively secured the line-wire H and ground-wire I, the former leading

to another telephone and constituting the receiving-wire therefrom.

The ground-wire I forms the secondary of the induction-coil on the spool I', around which is also wound a primary coil and within which is a core to increase the inductive influence of the primary coil. The ground-wire extends to a binding-post, I², and the line-wire H connects with a binding-post, H', beside the post I², and with the ground.

The diaphragm C is held at its periphery between the rim or pole *b* and a circular piece, J, these parts being secured together by screws K. There is an air-chamber each side of the diaphragm C, one chamber, L, being formed in the piece or block J and the other chamber, M, being formed between the diaphragm and a plate, N, having the form of a pot-lid. From these chambers extend passages *o*, which are in communication with a tube or tubes, O, fitted for application to the ear or ears.

It will be understood that currents of electricity in the coil on spool D will cause the vibration of the diaphragm C and the vibration of the air in the chambers L and M, which vibration is carried to the ear or ears by tube or tubes O.

P is the mouth-piece, which is attached to the body or part J by screws P' or by other means. Between the mouth-piece and the part J is held the edge of the carbon diaphragm Q and a sheet-metal or mica protecting-diaphragm, R, which covers the outer side of the carbon diaphragm to protect it from the breath of the speaker. The protecting-diaphragm R is not essential, as its office is not to increase the efficiency of the carbon diaphragm at the time it is in use, but merely to protect it from deterioration.

S is a carbon button which is held in contact with the carbon diaphragm. This button is secured to a disk, T, of mica, said disk being parallel with the diaphragm Q and the proper distance therefrom to hold the button S in the position described. The mica forms a flexible support for the button, which is not influenced by change of temperature or moisture. The button may be of any desired size and thickness, even up to a diameter equaling that of the carbon diaphragm. Any suitable support may be used for the button.

U is a wire in connection with a binding-post, U'. Said wire is in communication with one pole of an electric battery and is carried to the spool I', around which it is coiled, (beneath the wire coil I,) and from the spool the wire U goes to a binding-post, V, and from that to the carbon button S.

W is an electric wire extending from the carbon diaphragm Q to a binding-post, X, and from that to a binding-post, Y, and from the post Y to the other pole of the galvanic battery. The wires have, for convenience, in most cases been spoken of as continuous through the binding-posts; but though there is electric connection through the posts, the wires are, of course, not continuous.

Now it will be seen that when the circuit U W is closed there is a continuous current of electricity passing through the primary coil. When, in the vibration of the diaphragm Q, the pressure between the button S and diaphragm Q is increased or decreased, the current is likewise increased or decreased, thus inducing electricity in the induction-coil I by the variations in the strength of the current, and which current induced in the secondary wire I passes along the line and through a helix around a core similar to B' in the telephone of the distant station, and thus causes similar vibrations of the receiving-diaphragm at that station, which are communicated to the ear by the air in the chambers and tube.

The above description applies to the device as shown in Figs. 1 to 8, inclusive.

In the modification shown in Figs. 9, 10, and 11 a galvanic battery, primary and induction coils, and separated diaphragms for receiving and transmitting are used; but the permanent magnet is modified in form. It has the same rim or flange, *b*, forming one pole, and a core, *b'*, forming the other pole, upon which is a similar spool, D; but in place of the bell B are three bars attached to the pole-ring *b* at one end and curve in a horseshoe form, with the inner ends, B', inserted in a cap, B³, from which the core-bar *b'* extends axially. The ends of these horseshoe-magnets are held in the cap B³ by set-screws B⁴. The operation of this device is precisely like that described in connection with

the first eight figures of the drawings, and it will be sufficiently plain, as the same letters of reference are used for like parts.

We claim as our invention—

1. The combination, in a telephone, of two vibrating diaphragms parallel with each other, with two closed chambers, one each side of the inner or receiving diaphragm, and having a tube leading from the chambers to the outside of the case, all substantially as shown and described.

2. In a telephone receiving and transmitting instrument, the combination, with two vibrating diaphragms parallel with each other, two closed chambers, one on each side of the inner or receiving diaphragm, and a tube leading from each of said chambers to the outside of the case, of a plate, T, arranged between said diaphragms, and a button, S, secured to plate T, and thereby held in contact with the outer or transmitting diaphragm, substantially as set forth.

3. The combination, with the vibrating diaphragm of a telephone having electrical connection with one pole of a battery, of a button electrically connected with the other pole of a battery, and a plate formed of mica, to which plate the button is secured and by which the button is cushioned, substantially as set forth.

4. In a telephone, the combination of a permanent magnet having one pole in the form of a bell or cup and the other pole consisting of a core-bar extending axially from the apex, a wire, E, coiled helically around said core-bar and having its ends electrically connected to the binding-screws F and G, inserted in the bell-formed pole of the magnet, a secondary wire, I, of an induction-coil making connection between binding-screw G and the earth, a line-wire, H, connected to binding-screw F, a chamber of which said bell-formed pole forms part of the wall, and a conducting ear-tube extending from said chamber, as set forth.

LEO EHRlich.

BENJAMIN DUBINSKI.

GUSTAVUS REIN.

Witnesses:

SAML. KNIGHT,
EDW. S. KNIGHT.