

(No Model.)

H. V. HAYES.

TELEPHONE.

No. 370,477.

Patented Sept. 27, 1887.

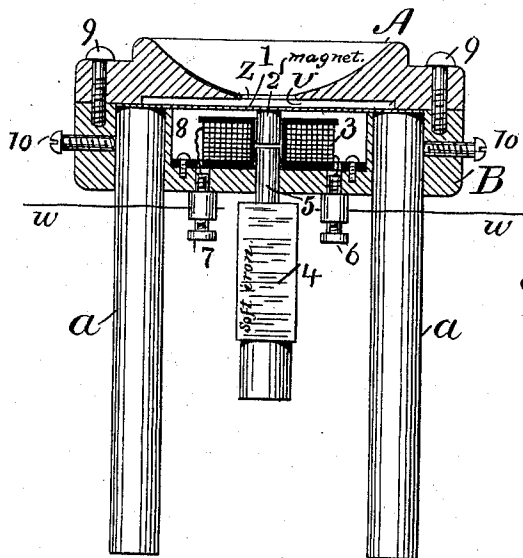


Fig. 1.

Fig. 2.

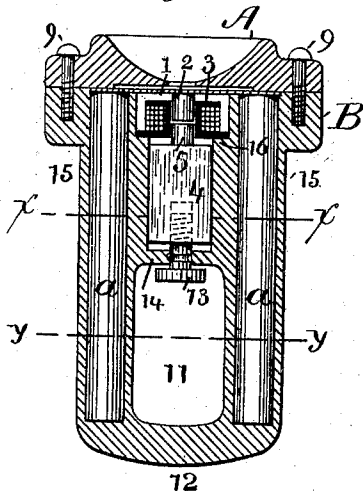
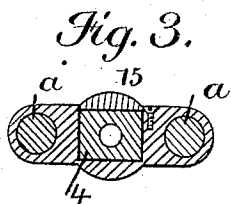


Fig. 4.

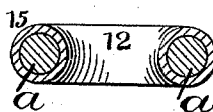
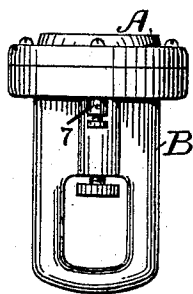


Fig. 5.



Witnesses.
Geo. Willis Pierce,
Wm. Bertholdy.

Inventor:
Hammond V. Hayes.

UNITED STATES PATENT OFFICE.

HAMMOND V. HAYES, OF CAMBRIDGE, MASSACHUSETTS.

TELEPHONE.

SPECIFICATION forming part of Letters Patent No. 370,477, dated September 27, 1887.

Application filed March 23, 1887. Serial No. 232,110. (No model.)

To all whom it may concern:

Be it known that I, HAMMOND V. HAYES, of Cambridge, in the county of Middlesex and State of Massachusetts, have invented certain
5 Improvements in Telephones, of which the following is a specification.

This invention has reference to that class of articulating-telephones commonly employed as receivers, but capable, also, of use as trans-
10 mitters, which comprise a vibratory magnetic diaphragm, or vibratory diaphragm and armature, and a permanent magnet with a spool or bobbin of insulated wire, this being adapted for inclusion in an electric circuit.

15 It consists in dispensing with the usual central magnet and in suspending or attaching a light permanent magnet to the inner center of the diaphragm in the presence of a comparatively large body of soft iron and in the center of an electro-magnetic helix forming part
20 of an electric circuit.

It consists, also, in re-enforcing the magnetism of the said light permanent magnetic core by mounting strong magnets in such a way
25 that one of the poles of each of the said magnets is in contact with the edges of the diaphragm. I have found that such a construction affords an efficient and extremely satisfactory telephone.

30 In the accompanying drawings, Figure 1 is a sectional view of a skeleton telephone embodying my invention. Fig. 2 shows a vertical section of a similar telephone constructed in a form suitable for use, with the working
35 parts inclosed in a convenient case. Fig. 3 is a cross-section on the line *x x*, and Fig. 4 a cross-section on the line *y y* of Fig. 2. Fig. 5 is a side elevation of the instrument shown in section in Fig. 2.

40 In the drawings, B is a telephone-case, and A the usual surmounting cap, provided with a central aperture, *z*, and vocalizing-chamber *v*, and serving, also, as a mouth or ear piece and adapted to clamp the diaphragm in place by
45 means of the screws 9.

The vibratory diaphragm 1 is mounted in a suitable seat in the case B, and to the center of its inner surface I suspend a small and light permanent magnet, 2. Upon the floor
50 of an inclosed chamber, 8, in the casing B is placed an electro-magnetic helix, 3, of any usual size and form, the terminals of which

are united to binding-screws 6 and 7 for the more convenient connection with the wires *w*
55 *w* of an electric circuit.

The light magnet or core 2 projects some distance into the hollow helix 3 and works loosely therein. Below the chamber 8, I mount a bar
60 or mass of soft iron, the upper end of which, 5, is properly formed, also, as a core and extends through the floor of the chamber 8 and into the center of the helix, where its end is closely approximated to the end of the light
65 magnet 2. The best results are attained when the end 5 of the soft-iron bar or mass is brought as close as possible to the end of the light magnet 2.

I find that the operation of this telephone is greatly improved by the presence of the bar-magnets *a a*, which are arranged with their
70 like poles projecting through the case and in contact with the surface of the diaphragm near its edge. These magnets may, if desired, be fixed in position by set-screws 10. Although, as stated, the presence of these re-enforcing
75 magnets emphatically improves the operation of the telephone, the instrument works in a very satisfactory manner even when they are not employed.

Figs. 2, 3, 4, and 5 show the instrument as
80 arranged for commercial use. The working parts are substantially identical with those described in connection with Fig. 1. They are, however, completely inclosed in the case B, which is provided with side walls, 15, and
85 the end wall, 12.

Channels may be provided within the casing for the reception of the re-enforcing magnets *a*, and their front ends are, as described above,
90 in contact with the edge of the vibratory diaphragm 1.

The helix 3 rests upon a shoulder, 16, of the casing, and the soft-iron mass 4 occupies a recessed chamber, also in the said case, while its
95 core-extension projects into the hollow of the helix 3. The position of the mass of iron 4, and consequently of the core projection thereof, with respect to the end of the light diaphragm-magnet can be regulated by the adjusting-screw 13, which works in the fixed
100 bearing 14. The opening 11 through the casing provides a convenient and accessible position for the head of the adjusting-screw, for the insertion of the fingers in holding while in

use, and means for hanging the telephone up when not in use. When this instrument is to be used, the soft-iron core 5 is brought quite close to the magnet 2, and magnetism is induced therein by the said magnet.

If it is operated as a transmitter, the impingement of the sound-waves produced by the voice upon the diaphragm 1 causes it to vibrate, and such vibrations necessarily effect a reciprocatory motion of the light magnet 2, attached to the said diaphragm within the hollow helix 3 and in front of the soft-iron projection 5. The magnetic field in which the helix is placed is thus varied by the said reciprocatory motion of the magnet, and also by the variation of the induced magnetic condition of the soft-iron projection 5, and electric currents corresponding to and representing the said waves are thus developed in the circuit of the said helix, and, circulating in the said circuit, are adapted to excite a like magnetic variation in any receiving-telephone in the same circuit, and thereby to reproduce the transmitted sounds in a manner well understood. Furthermore, when used as a receiving-telephone the voice-currents developed by any transmitter in the circuit circulate through the convolutions of the helix 3 and vary the induced magnetism of the soft-iron projection 5, and likewise the direct magnetism of the magnet 2. These variations combine to produce a mechanical vibration of the diaphragm 1, which vibration is a fac-simile of the original vibration experienced by the transmitting diaphragm, and the transmitted sounds are thus reproduced.

It will of course be understood that I may, without departing from the spirit of my invention, vary the proportions and dispositions of the several parts of the instrument considerably.

Having now fully described my invention and its operation, I claim—

1. The combination, in a telephone, of a diaphragm or vibratory plate, a hollow helix mounted near the said diaphragm and adapted for inclusion in an electric circuit, a magnet affixed to the center of the said diaphragm and projecting into the said helix, and a soft-iron mass projecting into or mounted in close approximation to the reverse side of the said helix, substantially as described.

2. An electric telephone comprising, in combination, a vibratory diaphragm and a small bar-magnet suspended therefrom or attached thereto in the immediate presence or proximity of a mass of soft iron and in the center of an electro-magnetic helix, forming, or adapted to form, part of an electric circuit.

3. In an electric telephone, the combination of a vibrating diaphragm, a small bar-magnet suspended therefrom, a hollow helix adapted for connection in an electric circuit surrounding loosely the said bar-magnet, a soft-iron bar or mass mounted in close proximity to the said helix and to the end of the suspended magnet, and one or more magnets having their ends in contact with the edges of the diaphragm and adapted to re-enforce the magnetism of the suspended magnet, substantially as described.

4. In an electric telephone, the combination of a vibratory diaphragm, a hollow helix adapted for connection in an electric circuit and mounted in close proximity to the inner surface of said diaphragm, a light bar-magnet suspended from the center of the diaphragm and adapted to reciprocate within the said helix, and a soft-iron bar or mass adjustably mounted in close proximity or partly within the said helix, substantially as specified.

5. In an electric telephone, the combination of a vibrating diaphragm, a light bar-magnet suspended from the center thereof, a hollow helix adapted for connection in an electric circuit surrounding loosely the said bar-magnet, a soft-iron bar or mass mounted in close proximity to the said helix and to the end of the suspended magnet, an adjusting-screw therefor, one or more magnets having their ends in contact with the edges of the diaphragm and adapted to re-enforce the magnetism of the suspended magnet, and an inclosing-case having longitudinal channels for the reception of the said re-enforcing magnets, substantially as described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 17th day of March, 1887.

HAMMOND V. HAYES.

Witnesses:

GEO. WILLIS PIERCE,
V. M. BERTHOLDE.