(Model.)

M. MARTIN.

TELEPHONE.

No. 539,068. Patented May 14, 1895.

Fig. 3.

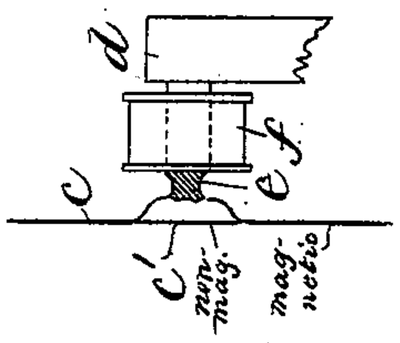

Fig. 4.

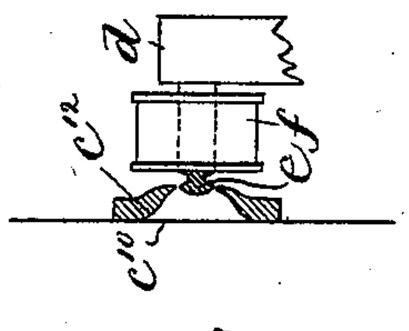

Fig. 5.

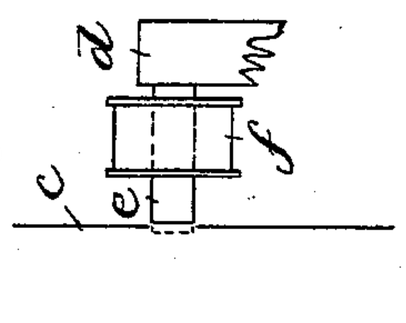

Fig. 2.

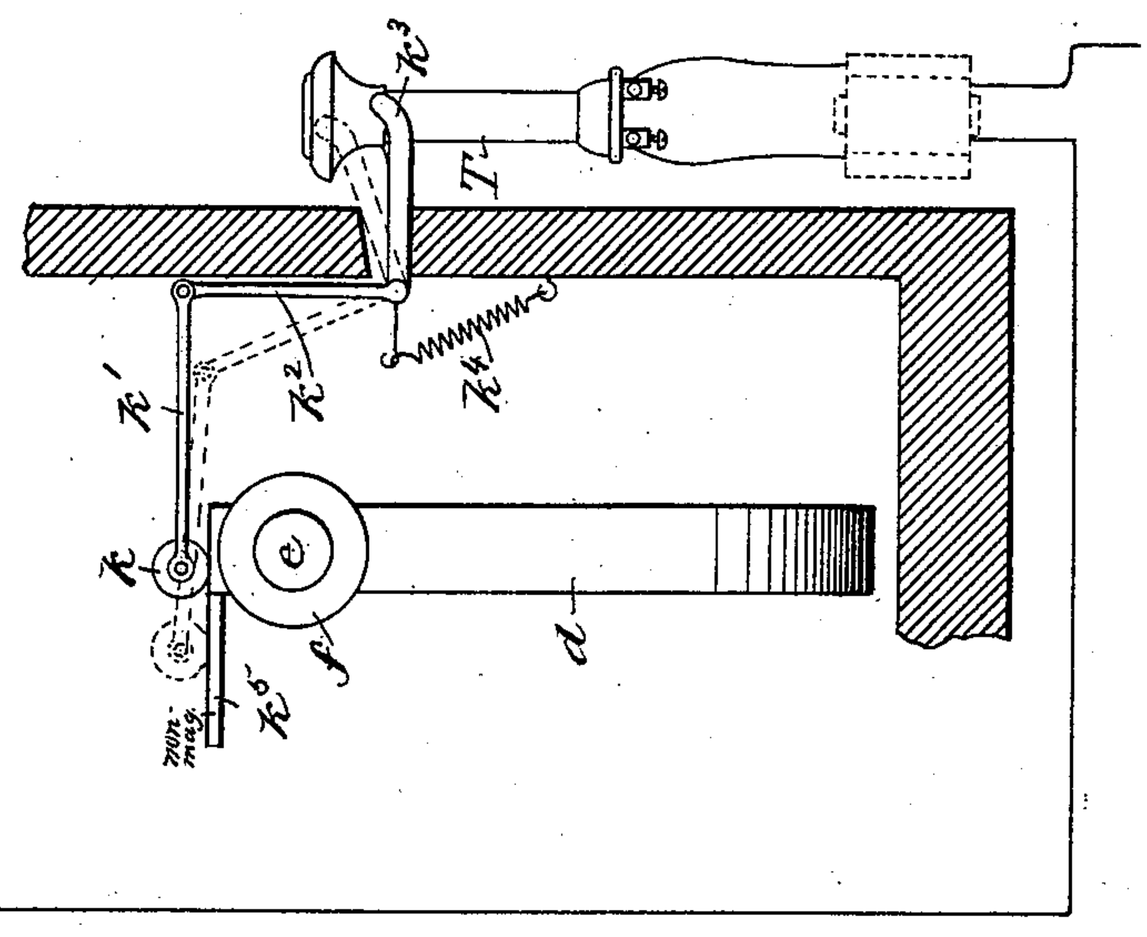

Fig. 1.

Witnesses.
Jas. J. Maloney.
R. E. Hill.

Inventor,
Morris Martin
by Jos. P. Livermore
Att'y.

UNITED STATES PATENT OFFICE.

MORRIS MARTIN, OF MALDEN, MASSACHUSETTS.

TELEPHONE.

SPECIFICATION forming part of Letters Patent No. 539,068, dated May 14, 1895.

Application filed November 10, 1886. Serial No. 218,475. (Model.)

To all whom it may concern:

Be it known that I, MORRIS MARTIN, of Malden, in the county of Middlesex, in the State of Massachusetts, have invented an Improvement in Telephones, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

The main object of my invention is to produce an effective magneto telephone transmitter that may be substituted for the battery telephones in general use, thereby avoiding the expense and inconvenience of maintaining local batteries in connection with the telephonic instrument.

Figure 1 is a section at right angles to the plane of the diaphragm of a telephone-transmitter embodying this invention, showing the magnet and its inducing-coil in elevation. Fig. 2 is a partial section on a plane at right angles to that of Fig. 1, showing the means for operating the magnet-keeper; and Figs. 3 to 5, inclusive, modifications to be referred to.

The invention is shown as embodied in a telephone having a sound chamber *a* with a mouth piece *b*, a diaphragm *c* and inducing magnet *d*, having a pole piece *e*, and inducing coils thereon, all of which with the exception of the diaphragm and co-operating part of the pole piece may be of substantially the same nature as in telephones of usual construction, and operate in the usual manner to produce electric undulations in the circuit of the coil, that correspond in form to the vibrations of the diaphragm *c* produced by sound waves or impulses entering the sound chamber *a*. Instead, however, of having the pole piece terminate opposite the middle of the diaphragm so that the strain derived from the magnetic attraction is at right angles to the plane of the diaphragm and tends to bend it inward as in telephones of usual construction, the diaphragm, is, in accordance with this invention, made non-magnetic opposite the end of the pole piece *e* being as shown in Fig. 1, provided with an opening of slightly greater diameter than the end of the pole piece which is preferably hollowed out at its end as shown and also provided with an annular groove near its end, so that it terminates in a laterally projecting edge, around which the magnetic field is of greatest strength, as will be readily recognized by those familiar with the laws of magnetism. This edge is preferably placed as nearly as possible in the plane of the diaphragm *c*, so that the strain on the diaphragm from the magnetic attraction is in the plane of the diaphragm instead of being as is usually the case, at right angles to the diaphragm and merely resisted by the stiffness of the diaphragm against a force tending to bend it. By thus relieving the diaphragm of the lateral or bending strain, which is normally or constantly applied, in telephones heretofore made, it is left perfectly free to respond to the minutest lateral or bending strain produced by the air waves acting against it, thus rendering the diaphragm far more sensitive than when it is already acted upon by lateral straining forces, and further than this the movement of the diaphragm back and forth in the magnetic field produced around the edge of the pole piece is far more effective in generating currents than the movement of magnetic material toward and from the end of the pole piece, as in the usual mode of operation.

I have found in practice that the removal of a portion of the diaphragm as represented in Fig. 1, does not materially diminish the effect of the sound waves upon it, but it is not necessary to leave the center of the diaphragm open and if found desirable it might be made as shown in Fig. 3, that is, with the middle part of the magnetic diaphragm offset and provided with an opening to receive the pole piece of the magnet, while the face of the diaphragm that is acted upon by the sound waves is made intact by a non-magnetic plate *c'* fastened in the depressed or recessed portion.

Another modification is represented in Fig. 4, in which the entire diaphragm c^{10} that is acted upon by the sound waves is non-magnetic, being composed, for instance, of sheet brass, and has attached to it a magnetic armature c^{12} terminating in an edge opposite the edge of the pole piece which thus has no tendency to draw the diaphragm c^{10} aside or strain it, as is the case in telephones heretofore devised in which a magnetic armature is attached to and vibrated by a non-magnetic diaphragm.

It would be within the invention if the dia-

phragm c^{10} of Fig. 4, were of thin iron, as its mass would be so small relative to that of the armature c^{12} as to produce no appreciable effect and the effective pull of the magnet would still be in a direction parallel with the plane of the diaphragm which would be substantially non-magnetic opposite the end of the pole piece.

Figs. 3 and 4 also represent modifications in the shape of the pole piece which does not, however, differ essentially from that shown in Fig. 1, and I have found, by experiments that excellent results are attained even without changing the shape of the pole piece from that commonly used as shown in Fig. 5, merely by cutting an opening in the diaphragm opposite the end of the pole piece and preferably of slightly larger diameter than the pole piece, and it also is not essential that the edge of the pole piece should be exactly in the plane of the diaphragm as I have obtained excellent results with the pole piece both in the positions shown in full, and in dotted lines in Fig. 5; for although the pole piece when placed in the full line position would undoubtedly exert some lateral strain on the diaphragm, it is far less than when acting directly on the middle portion of the diaphragm, and the character of the transmission of an ordinary receiving telephone is vastly improved merely by cutting away the middle of the diaphragm without any further change in adjustment and either leaving said middle portion or closing or covering the opening with non-magnetic material.

A telephone constructed as shown in full lines, Fig. 5, as just described will operate to a certain extent as a receiver but the instrument embodying this invention will not, as a general thing be efficient as receivers for the reason that the magnetic attraction acting wholly or mainly in the plane of the diaphragm has but little, if any, tendency to vibrate the same. The quality of the transmission is still further improved by the employment, in combination with a diaphragm acted upon by the magnetic force as described, of a microphonic contact *g*, *h*, operated by the diaphragm and controlling the currents generated in substantially the manner described in my former application, heretofore referred to.

It will be understood that the strength of the magnetic field may be increased indefinitely without impairing the sensitiveness of the diaphragm when constructed and arranged in relation to the said field as herein described and that consequently a battery current of any desired strength may be applied to the main line which current will be partially controlled by the microphonic contact and will tend rather to improve the telephonic transmission than to injure it, as is the case when a battery current is applied to a telephone line as commonly used, but the mode of operation of the transmitters will even then be widely different from that of the ordinary battery telephones which require a local battery with each transmitting instrument. In this case it might be desirable to remove the receiving instrument from the effect of the battery current on the main line which might be done by interposing an induction coil between the main line and each receiving telephone leaving the latter affected only by the changes in current, and unaffected by the steady current.

Various other arrangements in circuit will be readily suggested to those familiar with the art of telephonic communication all of which are within the scope of the present invention so long as they involve the use of a diaphragm acted upon by an attractive force mainly parallel with its plane (in contra-distinction to a force or forces mainly at right angles to its plane), and its magnet, either being used alone or in combination with a microphonic contact affected by the same sound waves and itself affecting the current generated by the magnet and diaphragm.

Another part of the invention consists in providing means for maintaining the charge of a permanent magnetism in the inducing magnet *d* which is shown as of usual horseshoe form.

This is effected by providing the magnet with an armature or keeper *k* shown as an iron cylinder connected by a link *k'* with an arm k^2 connected with the arm or hook k^3 that supports the receiving telephone T in the usual manner. The connected arms k^2 k^3 are acted upon by a spring k^4, or it might be a weight, which is insufficient to balance the weight of the telephone T, but which, when the telephone is removed, can move the arms k^2, k^3 and the connected keeper *k* to the position shown in dotted lines Fig. 2 where it rests on a non-magnetic shell or support k^5 and thus leaves the magnet in the condition to act with full effect on the pole piece *e*.

I am aware that instruments have been devised in which the magnet used for generating the currents for telephonic transmission is also used to generate currents for signaling and is provided with an armature or keeper that is forced off from the magnet when the instrument is used for telephonic communication but I do not know of any instrument in which the keeper is automatically thrown off, or on the magnet when the instruments are to be in or out of use, the keeper being solely for the purpose of maintaining the strength of the magnet and being operated by placing the telephone on its support and removing it therefrom.

I claim—

1. The combination of the magnet having a pole piece terminating in a laterally projecting flange or edge with a diaphragm composed of magnetic material having a portion of said magnetic material removed opposite the end of the magnet-pole substantially as and for the purpose described.

2. The combination of the diaphragm or vibrating piece of magnetic material, having

a central opening with a magnet having a pole piece terminating opposite the said opening whereby the attractive force of the said magnet acts mainly in the direction of the plane of the diaphragm substantially as described.

3. The combination of an inducing magnet and coil and diaphragm constituting the telephonic instrument with a movable armature or keeper for the said magnet and actuating mechanism operated by the removal of the telephone from its support and its replacement thereon whereby the said keeper is retained on the magnet when the instrument is not in use and is removed therefrom when the instrument is in use for telephonic communication substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

MORRIS MARTIN.

Witnesses:

JOS. P. LIVERMORE,

JAS. J. MALONEY.