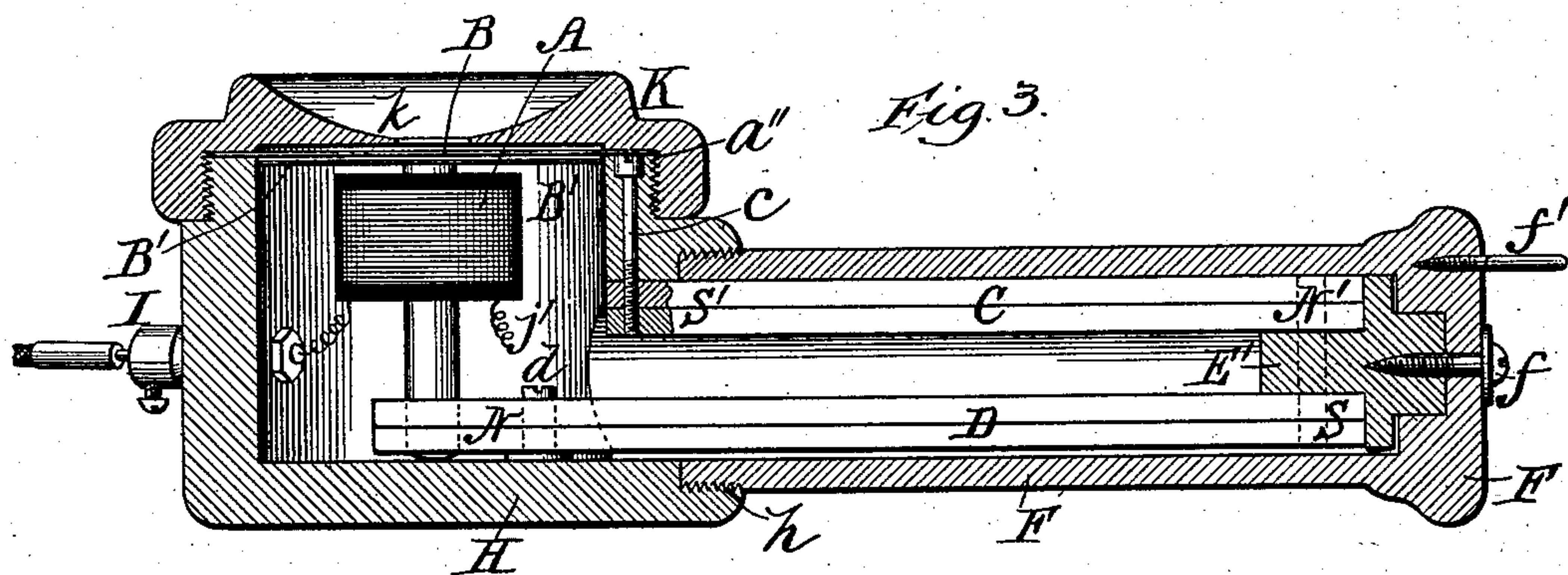
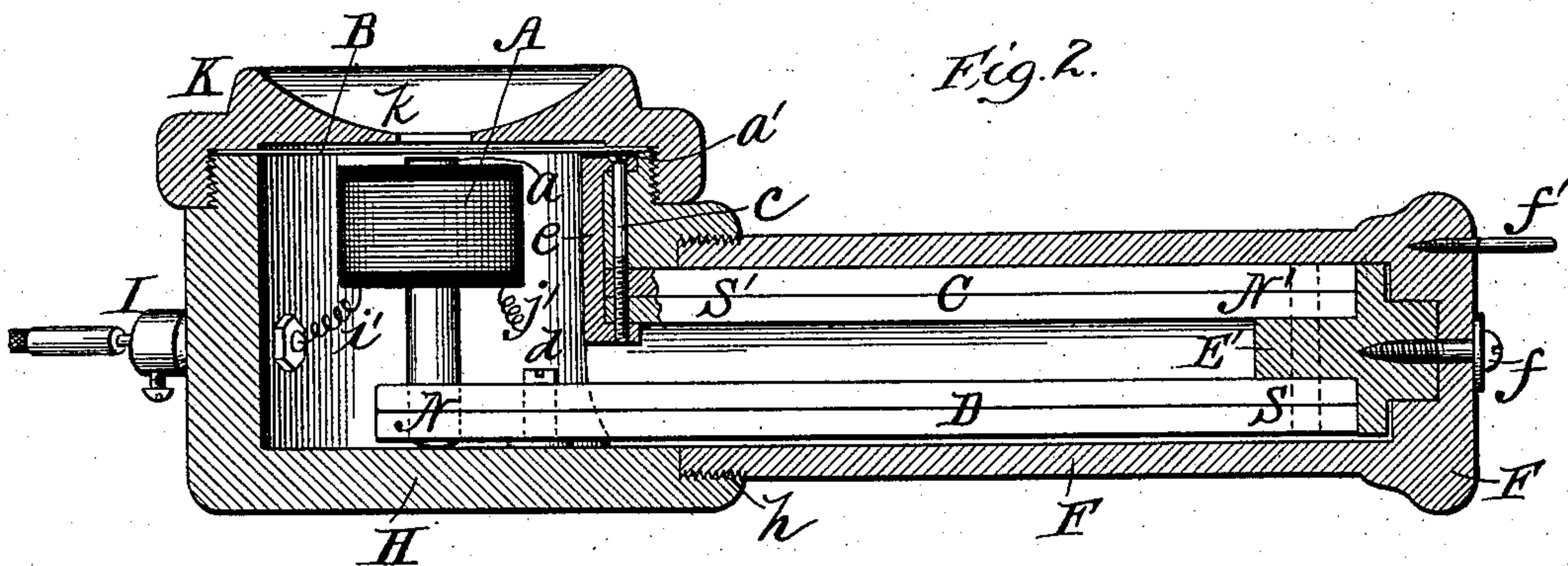
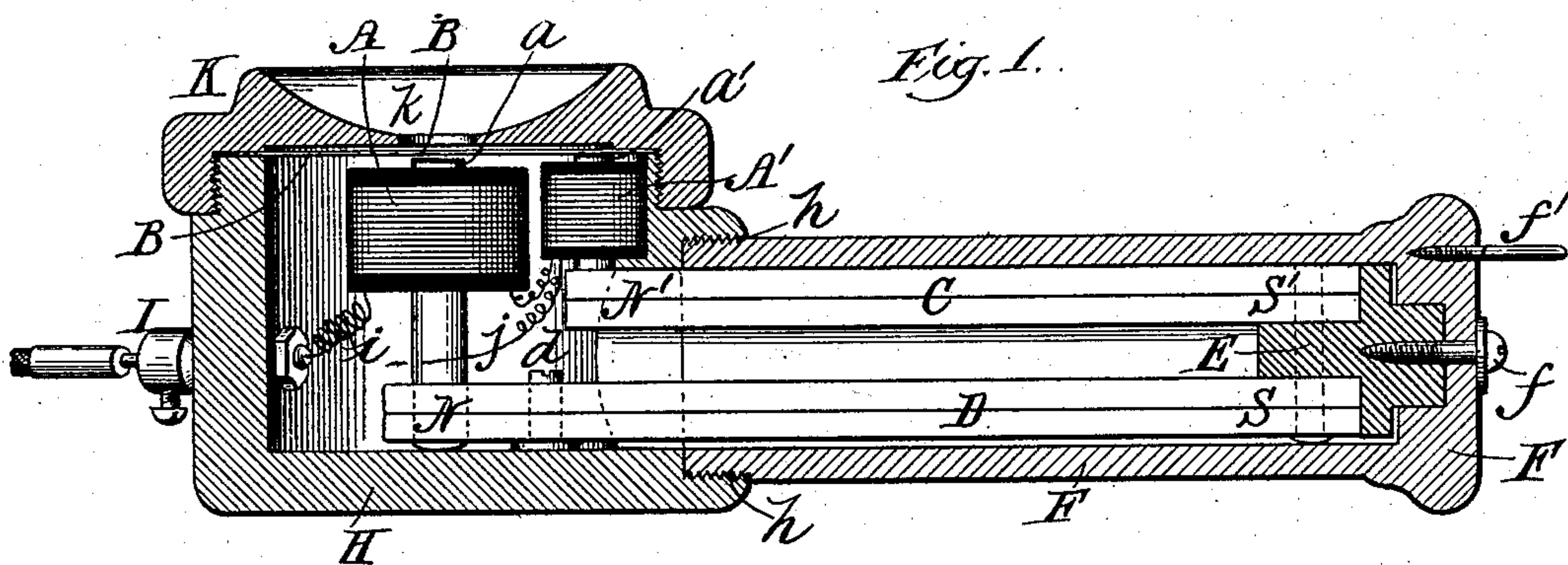


(No Model.)

E. M. & W. S. HARRISON.  
MAGNETO TELEPHONE.

No. 571,190.

Patented Nov. 10, 1896.



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# UNITED STATES PATENT OFFICE.

EDWARD M. HARRISON AND WILLIAM S. HARRISON, OF CHICAGO,  
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## MAGNETO-TELEPHONE.

SPECIFICATION forming part of Letters Patent No. 571,190, dated November 10, 1896.

Application filed November 21, 1894. Serial No. 529,477. (No model.)

*To all whom it may concern:*

Be it known that we, EDWARD M. HARRISON and WILLIAM S. HARRISON, citizens of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Magneto-Telephones; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to magnetic telephones comprising a transmitting and receiving instrument, each of modified or varied construction and arrangement of parts, as will be clearly pointed out in connection with the drawings.

The object of our invention is to provide a magneto-transmitter in which the metal diaphragm is of the same polarity as the pole carrying the electromagnet, and arrange the permanent magnets with the adjacent ends of the same polarity, thereby causing a push on the diaphragm-plate and keeping it in a concave position with relation to the electromagnets, so that the least force or forward movement of said plate causes instantaneous disturbances of the magnetic lines of force, which will produce their consequent currents on the line-wires.

Another object of our invention is to bring the magnetic lines of force of the opposite poles of a permanent magnet in a magneto-receiver to such a position as to almost close the magnetic circuit, or, in other words, to reduce the length of the lines of force to the minimum. This arrangement brings the magnetic plane to a very narrow limit, and thus produces the strongest pull on the diaphragm-plate and keeps it in a constant convex position with reference to the electromagnet, so that the slightest movement on the induced alternating currents from the inductorium will cause a release of the diaphragm and the consequent reproduction of the tones or sounds producing said currents. This arrangement also brings the opposite poles of a permanent magnet as near together in a neat compact case as possible, and at the same time thoroughly saturates the dia-

phragm-plate with their magnetic influence, which is absolutely necessary, if it is desired to produce one of the most sensitive and loudest reproducing magnetic receivers heretofore known.

One of the special objects in our new magneto-receiver is to cause the magnetic stress on the diaphragm to constantly pull said diaphragm toward the pole carrying the electromagnet by having the outer edge of the diaphragm separated from the outer edge of the pole-piece by only a thin piece of cloth or paper, which, although producing quite a magnetic leakage from the pole-piece to the diaphragm, yet thoroughly saturates the diaphragm with magnetism, thereby carrying a strong opposite polarity to the center of the diaphragm. Yet there is sufficient retardation in the leakage in the outer pole-piece to the diaphragm to allow instantaneous variations in the magnetic vibrations of the diaphragm.

Another object of our invention is to provide a compact and convenient case for the instrument and to make the whole instrument of such simple construction as to reduce it to the minimum cost.

The matter constituting our invention will be defined in the claims.

Our magnetic telephone is illustrated in the accompanying drawings, in which—

Figure 1 represents a vertical longitudinal section of the instrument, adapted to serve as a transmitter. Fig. 2 represents a similar section of the instrument, constructed particularly to serve as a receiver. Fig. 3 represents a similar section illustrating a modification of the receiver shown in Fig. 2.

The case of the instrument is constructed of insulating material, such as wood or hard rubber, and consists of the cylindrical handle F, having a slightly-enlarged outer end and a screw-threaded inner end, a cylindrical cup or receptacle H, having a lateral opening provided with an internal screw-thread *h*, and also a screw-threaded upper edge or rim, and the cover or ear-piece K, having a downwardly-extending flange by which it is screwed to the case H and serving to hold the diaphragm B in position between it and the end of the case H. The handle F is screwed



into the lateral opening of the case at *h*. The ear or mouth piece *K* is provided with the usual concavity and central opening *k*.

The transmitter instrument, Fig. 1, is constructed with double electromagnetic coils *A* and *A'*, the cores of which are compound diamagnetic wires of even length and are connected to the ends of the magnets having similar polarity, as *N* and *N'*. The permanent steel magnets *C* and *D* have their like poles, as *N* and *N'*, in contact with the cores of the electromagnets *A* and *A'*, as shown, and their south poles or ends *S* and *S'* are riveted to the brass heel-piece *E*, which is bolted to the lower or outer end of the handle *F* by the screw *f*. The two upper permanent magnets *C* are made much shorter than the lower permanent magnet, and have connecting with their inner ends or north pole *N'* the core of the electromagnet *A'*. The upper end of the core of the coils *A'* has a cushion *a'*, made of some soft material, such as thin felt or paper, and the diaphragm *B* rests at its outer edge lightly in contact with said cushion *a'*, while the center of the diaphragm is brought as near as possible to the cushion *a* at the upper end of the core of coil *A* without being actually in contact therewith. The two permanent magnets *D* are made longer than the magnets *C*, and have connected to their inner end or north pole *N* the core of the electromagnet *A*, and the upper end of said core is provided with a thin cushion *a*, of felt or paper. A blind adjusting-screw *d* serves for raising or lowering the magnetic coil *A*. This screw *d* is made of brass, so as to contract when the magnets expand and expand when the magnets contract.

The upper ends of the permanent magnets *C* and *D* being of the same polarity and the outer edge of the diaphragm-plate *B* being nearer in contact with the core of the electromagnetic coil *A'*, such core causes a push, as it were, between the center of the diaphragm and the upper end of the core of the electromagnet *A*, thus causing the diaphragm to be concave with reference to the electromagnet. The object of this is that when any tones or sounds are projected against the center of the diaphragm, driving it toward the electromagnet *A*, there will be no drumming sound, as in the ordinary magneto-transmitter. A notable difference between this transmitter instrument and the receiver is that the heel-piece *E* is made of a non-magnetic material, such as brass or copper, while in the receiver the heel-piece *E* is made of soft iron, and the transmitter permanent magnets are of the same polarity at their upper ends, while in the receiver they are of the opposite polarity at their upper ends, as will be hereinafter more fully described.

The two coils *A* and *A'* are of different resistance, the coil *A'* having from twenty to twenty-five per cent. less resistance than the coil *A*. They are connected in series, and their outer wires *i* and *j* are connected at the

upper part of the case to a binding-post, such as *I*, only one of which is shown.

In our magneto-receiver instrument, Fig. 2, the electromagnet *A* connects by its core with the north pole of the permanent magnet *D*, and the upper end of said core is provided with a soft cushion *a*, of felt or paper. The longer permanent steel magnet *D* and the shorter steel magnet *C* are riveted at their outer or lower ends to the soft-iron heel-piece *E'*. It will be noted that the magnet *D* has its south pole *S* and the magnet *C* its north pole *N'* riveted to the heel-piece *E'*. The magnet *C* is made shorter than magnet *D*, as shown, and at its inner or upper end is made fast to the receiver-case by a soft-iron shoe or clamp *e*, which fits over the magnet at *S'* and over the upper edge of the receiver-case and is bolted in position by the long screw *c*, which passes through the inwardly-turned ends of the shoe *e*, through the receiver-case, and through the magnet *C* at *S'*. The cushion of felt or paper, *a'*, is placed on top of the soft-iron clamp *e*, upon which lightly rests the diaphragm *B*. It is to be noted that the adjacent or upper ends of the magnet *C* and *D* are of opposite polarity; that is, their north and south ends or poles are pointed in the same direction as indicated by *N* and *S'*. This produces a pull on the diaphragm *B*, making it concave with reference to the electromagnet and bring it just slightly in contact with the soft cushion *a* of the electromagnet *A*. This arrangement prevents any drumming or metallic overtones in the receiver, as the diaphragm *B* is allowed the full amplitude of its vibrations.

The end of the handle *F* is provided with a metal ring or eye *f* for hanging up the instrument.

The construction of the receiver in Fig. 3 is slightly modified as follows: A small interior diaphragm *B'* is placed just under the large outer diaphragm *B* and in contact with the core of the electromagnet *A*. The diaphragm *B* is in contact at its outer edge with the bolt or screw *c*. These two diaphragms are separated by a thin piece or disk of felt *a''*.

The transmitter magneto-telephone, Fig. 1, may be connected with the receiver magneto-telephone, Fig. 2, by a line-wire connecting with binding-post *I*, and the wire *j'*, Fig. 2, is connected by a wire to the ground, and a return-wire from the ground is also connected with the binding-post for the wire *j'*, which makes a complete circuit. One may now speak into the transmitter instrument, Fig. 1, when the sound may be heard in the distant receiving instrument, Fig. 2.

Having described our invention, what we claim, and desire to secure by Letters Patent, is—

1. In an electromagnetic telephone the combination with a diaphragm of permanent steel magnets, of unequal length, their like poles being separated at their lower ends by a diamagnetic heel-piece and electromagnetic coils



on the pole-pieces at the opposite ends, substantially as shown and described.

2. In an electromagnetic telephone the combination with a diaphragm, of permanent steel magnets, of unequal length, and having their like poles separated at their lower ends by a diamagnetic heel-piece, the upper ends of the magnets being attached to the two electromagnetic coils of unequal resistance, substantially as shown and described.

3. In an electromagneto-telephone, the combination with the diaphragm of permanent steel magnets of unequal length and having their like poles separated at their lower ends, and riveted to a diamagnetic heel-piece, the upper ends of the magnets being attached to two electromagnetic coils of unequal resistance, a cushion of felt or equivalent material attached to the upper ends of the cores of the electromagnetic coil, the edge of the diaphragm-plate resting lightly in contact with the cushion of the electromagnetic coil A', and the center of the diaphragm-plate barely out of contact with the cushion of the electromagnetic coil, A, substantially as described.

4. In an electromagnetic telephone-receiver, the combination with a diaphragm-plate of a long and a short permanent steel magnet, having their north and south ends separated at their lower ends by a paramagnetic heel-piece, to which they are riveted, said heel-piece forming a nut or tap to bolt the magnets to the lower ends of the receiver-case and a connecting-screw, the upper ends of the short permanent steel magnet having a soft-iron shoe fitting over the ends of the magnets and to the top of the inside of the receiver-case, substantially as described.

5. In an electromagneto-telephone, the combination with a diaphragm and compound magnets in pairs of uneven length, having their north and south ends separated at their lower ends by a paramagnetic heel-piece, a screw connecting said heel-piece to the handle of an insulating-case, a bolt connecting the upper end of the short permanent magnet to the receiver-case and having one end adjacent to the diaphragm, and the long permanent magnet carrying an electromagnetic coil with its core adjacent to the diaphragm-plate, substantially as described.

6. In an electromagnetic telephone, the combination with a diaphragm and compound permanent magnets of uneven length, made fast in the handle of a case composed of insulating material, the upper end of the short permanent magnet being bolted to the receiver-case, and the long permanent magnet carrying an electromagnetic coil, having a core composed of numerous soft-iron wires and its outer end adjacent to the diaphragm-plate, of a blind binding-screw composed of brass, or equivalent metal, whose expansion is opposite to that of iron under the influence of heat or cold, for the purpose of uniformly maintaining the same position of the outer end of the core with relation to the diaphragm under varying temperatures, substantially as described.

In testimony whereof we affix our signatures in presence of two witnesses.

EDWARD M. HARRISON.

W. S. HARRISON.

Witnesses:

FLORENCE SAUNDERS,  
J. E. HOLYOKE.