(No Model.) 2 Sheets—Sheet 1.

A. C. BROWN.

TELEPHONE RECEIVER.

No. 551,347. Patented Dec. 10, 1895.

Fig. 1.

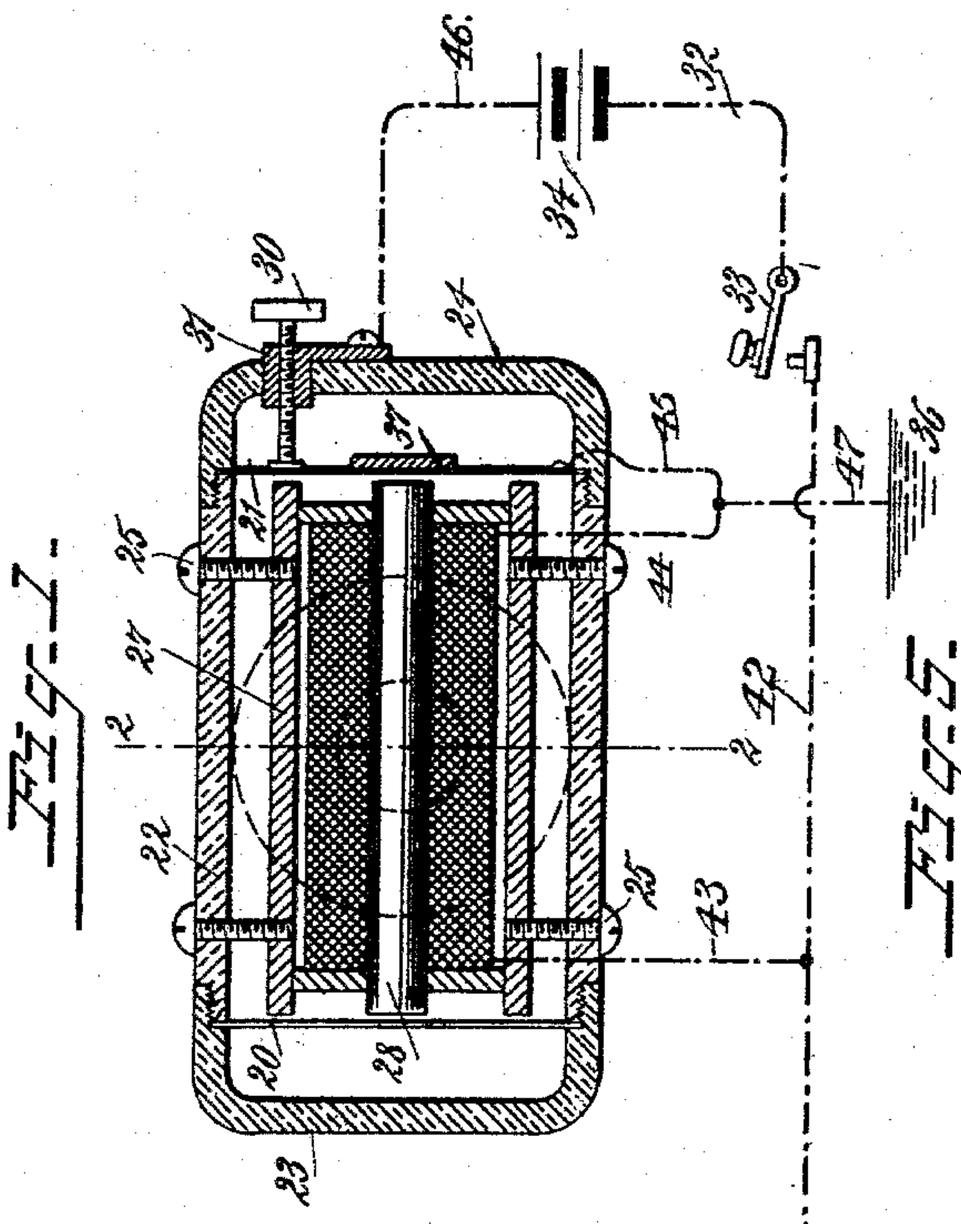


Fig. 2.

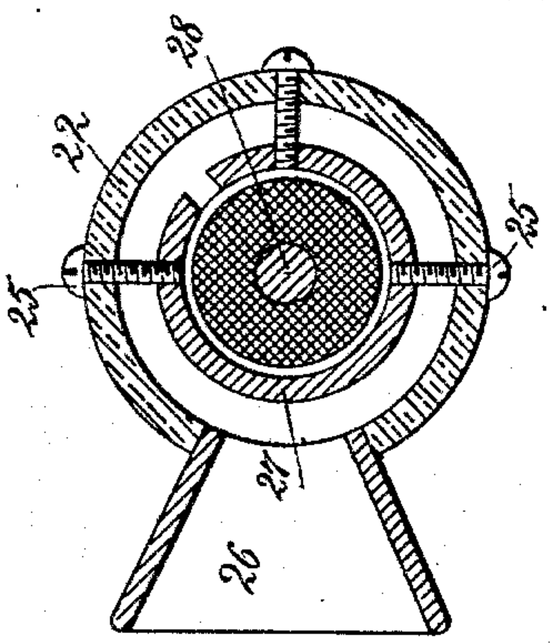


Fig. 3.

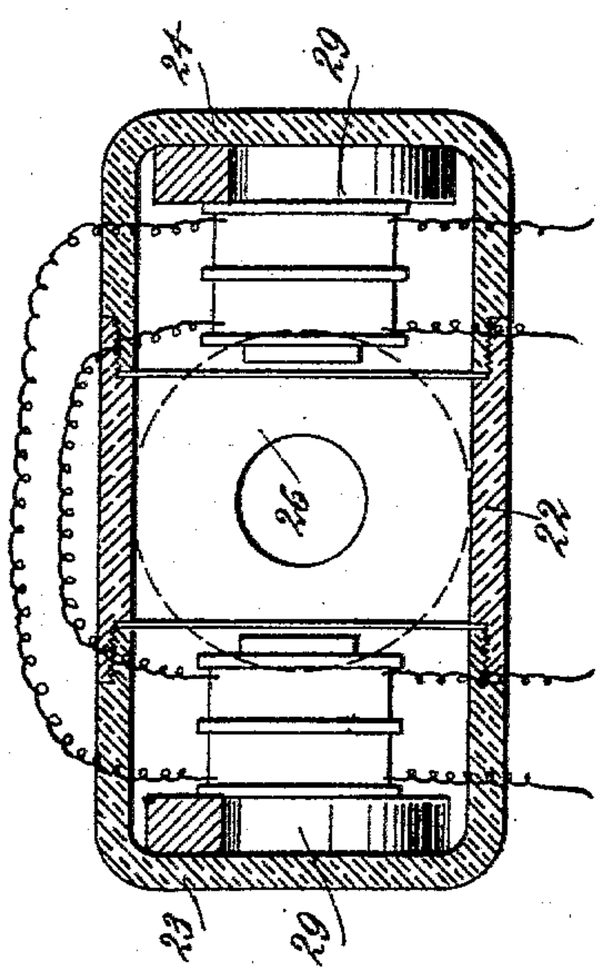
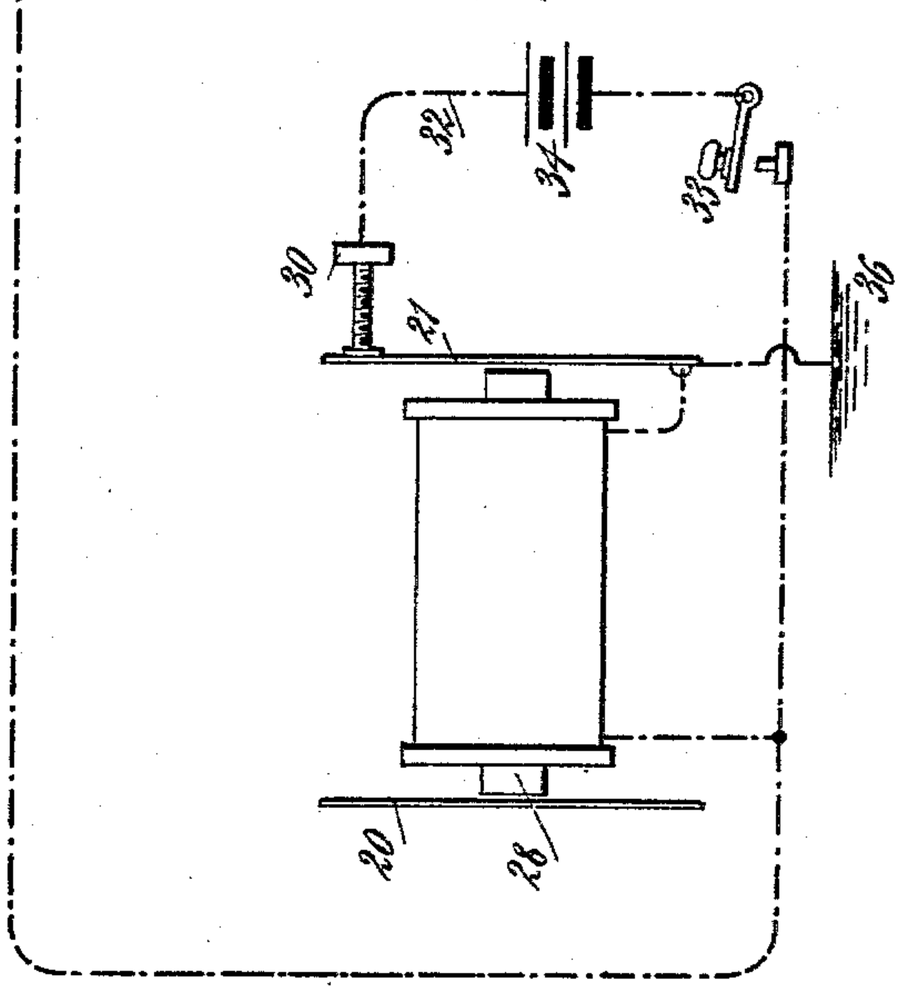


Fig. 4.



WITNESSES:
Henry T. Hirsch.
Wm. H. Capel.

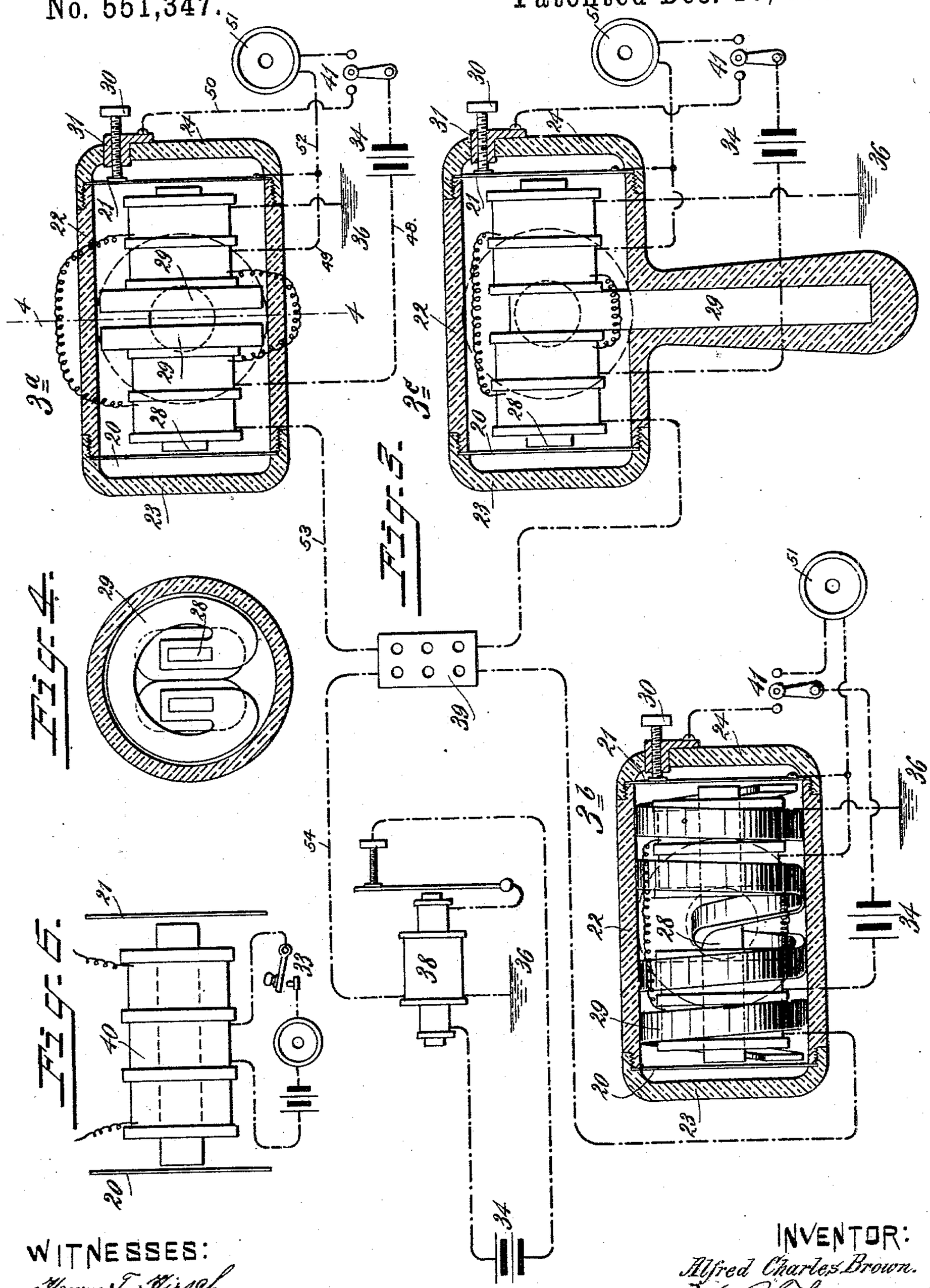
INVENTOR:
Alfred Charles Brown.
by H. C. Townsend
ATTORNEY.

(No Model.) 2 Sheets—Sheet 2.

A. C. BROWN.

TELEPHONE RECEIVER.

No. 551,347. Patented Dec. 10, 1895.



WITNESSES:
Henry T. Hirsch.
Wm. A. Capel.

INVENTOR:
Alfred Charles Brown.
by H. C. Townsend
ATTORNEY.

UNITED STATES PATENT OFFICE.

ALFRED CHARLES BROWN, OF LONDON, ENGLAND.

TELEPHONE-RECEIVER.

SPECIFICATION forming part of Letters Patent No. 551,347, dated December 10, 1895.

Application filed July 11, 1895. Serial No. 555,672. (No model.)

To all whom it may concern:

Be it known that I, ALFRED CHARLES BROWN, a subject of the Queen of Great Britain, and a resident of Lewisham, (London,) in the county of Kent, England, have invented a certain new and useful Telephone-Receiver, of which the following is a specification.

This invention relates to electric telephone-receivers and has for its object the construction of a receiver capable of giving a very clear and loud reproduction of articulate and other sounds while retaining a small and compact form, also to a means of signaling thereon and to a means for causing the receiver-coils to fulfill the functions of the separate induction-coils heretofore used in conjunction with the transmitters at both ends of the line, thereby cutting out the waste resistance and self-induction of the secondaries of the induction-coils and so increasing the current energy available to operate the distant receivers.

With these ends in view the invention consists in a telephone-receiver provided with a central ring-seating having a mouthpiece, diaphragms mounted in said seating, and polarizing-magnets for said diaphragms mounted in proximity thereto and designed in a manner to cause the diaphragms to simultaneously vibrate to and from each other.

It also consists in combining with a receiver having a diaphragm polarized by an electromagnet, a local circuit including a coil of said magnet, the diaphragm, a battery and a contact adapted to engage with said diaphragm to produce a buzzing sound when the local is closed.

It further consists in the construction, combination and arrangement of parts hereinafter fully described and set forth in the claims.

In the accompanying drawings, forming a part of this specification, Figure 1 represents an individual system constructed for the improved receiver. Fig. 2 is a vertical transverse section of the receiver, taken in the plane indicated by line 2 2. Fig. 3 represents an exchange system constructed on the improved plan. Fig. 4 is a vertical transverse section of the modified form of receiver shown at 3^a. Fig. 5 represents in longitudinal central section a modification of the particular form of receiver shown at 3^a. Fig. 6 represents the preferred arrangement of the coils of the receiver.

The receiver is so constructed that its coils shall fulfill the functions of the separate induction-coils heretofore used in conjunction with the transmitters at both ends of the line, thereby cutting out the waste resistance and self-induction of the secondaries of the induction-coils, and so increasing the current energy available to operate the distant receivers.

With this end in view the receiver is preferably constructed with two diaphragms 20 21, opposed to each other and having a ring or similar seating 22 between them, onto which they are clamped by two end pieces 23 24, which may be screwed over or into or otherwise affixed to the central ring-seating, and have recesses turned out so as to clamp the diaphragms round near their edges but leaving a shallow chamber over the larger part of the surface of the diaphragms on their outsides, which chambers are practically air-tight. The diaphragms are then actuated by an electromagnet or electromagnets placed preferably between them and affixed to the central ring-seating in any suitable manner, as by screws 25, which seating also carries on one side a mouthpiece 26, communicating with the inside air-space contained between the two diaphragms; or, in some cases, the electromagnets may be placed on the outer side of the diaphragms instead of between them. (See Fig. 5.) If one electromagnet is used it may consist of a single coil and straight core, each end or pole of which acts on one diaphragm. (See Fig. 1.) If more than one coil is used, however, care must be taken that they are joined in such way that each diaphragm is attracted toward the center or released away by the same direction-current as respectively attracts or releases the other diaphragm. I then polarize the core of the electromagnet, when a single straight one is used as above described, by placing around the outside of the coil or coils of the electromagnet a tube of steel, as 27, preferably slit down one side, and magnetized as nearly to saturation as possible, so that one of its ends which faces a diaphragm is north-seeking and the other south-seeking, and the magnetic circuit is then completed, less the small necessary air-gaps, through the

diaphragms themselves and the central core 28 of the electromagnet, which together with the diaphragms is thereby strongly polarized by induction. The steel tubular magnet may also, if desired, itself form the central case or ring seating for the diaphragms; or if a separate case be used, an equivalent of the tubular magnet may of course be made by arranging a number of separate bar-magnets round inside the case but outside the coil of the electromagnet, with their similar poles all at the same end, and so that they together practically form a laminated tube round the electromagnet. The polarizing-magnets may also be bowed outward in the middle to increase their lengths projecting, if desired, through the central casing; or I may polarize the core of the electromagnet by connecting its central portion between the two diaphragms to the pole of a steel magnet 29, as at 3^c, which may either extend straight away at right angles to the core and project through the central ring-seating so as to form a handle for the instrument, or may be curved away round the outside of the coils but inside the casing, as at 3^b, so as to get as great as possible a length and have its outer end preferably but not necessarily thickened so as to connect it more closely with both the diaphragms at some point near their edges; or I may use a horseshoe-magnet opposed to one diaphragm, in which case the polarizing magnet or magnets may as before extend out at right angles through the case so as to form a handle, or may be circular or approximately similarly curved, so as to lie around the outside of the coils but inside the space contained within the central ring-seating, or they may themselves form the ring-seating, and with their poles extended inside toward the cross-cores and about midway between the diaphragms by pole-pieces so as to oppositely polarize each limb of the cross-cores which extend thence toward the diaphragms so as to form two horseshoe-magnets, one opposed to each diphragm, four small coils being then used, (see 3^a, Figs. 4 and 5,) and all joined in circuit so as to fulfill the above-mentioned condition as to attracting both diaphragms together; or in the case of the horseshoe and similar polarizing magnets they together with their cores may be placed one on the outside of each diaphragm instead of between the diaphragms, Fig. 5, the central air-space and ring-seating being then preferably made narrower but communicating with the mouth or ear piece as before.

The part of the invention relating to signaling consists in causing the receiver (which for this purpose may be either as above described or any ordinary previously used form) to emit a loud buzzing sound, capable of attracting attention from a distance and useful for a variety of other signaling purposes, by one of the following means: Where the instruments are used on "private lines," as in Fig. 1, or circuits which do not communicate with an exchange, I screw through or otherwise affix to some part of the case of the receiver opposite to the outside (or side farthest from the electromagnet) of the diaphragm (or one of the diaphragms, as 21, if the receiver has more than one) a metal contact-screw 30, taking care that the body of the same is by an ordinary means insulated from the diaphragm itself. This contact-screw through its nut 31 is then connected in series with the coils of the receiver, the circuit being completed through the diaphragm. When a direct battery or generator current is then passed through such a receiver the diaphragm is vibrated electromagnetically and so produces a loud buzzing sound, the circuit being as traced below. If another receiver be joined in circuit therewith, the latter will be likewise caused to sound, and for this purpose it is not necessary to include the contact of the first receiver in series with the second, but only the coils, so that the contact and coils of the first are used to operate the second or any number of other receivers, which arrangement gives the maximum of sound with the minimum current. The local stands normally closed between the diaphragm and screw 30, and open as at the key or switch 33, which in calling is closed, sending the current from the battery 34 over the circuit 32 42 43 44 45, the diaphragm, screws 30 and 46, back to battery, causing the diaphragm to move rapidly back and forth like a buzzer-armature between the core 28 and the screw 30, and a flow of the extra currents over the line to operate the buzzer at the other station or stations. The speaking-circuit is simply from the ground 36 at one station through the coil of the receiver (here acting as a magnet) and over the line-wire to ground 36 at the other station. It is preferable also to load the central portion of the diaphragm of the receiver carrying the contact with a heavier piece of iron, as indicated at 37, which greatly increases the loudness of the buzzing sound and eases the adjustment, without appreciably affecting or decreasing the loudness and clearness of the articulation of the receiver for vocal telephonic sounds. For "exchange-circuits," Fig. 3, however, or lines communicating with a central station, I prefer to produce the buzzing sounds in the receivers at the subscribers' or out stations for signaling from the exchange or central station to the out-stations (or similar purposes) by means of a powerful induction-coil 38, placed at or in connection with the exchange, and having a rapidly-interrupted battery or generator current passed continually through its primary, while the exchange is operating (or capable of being switched on or off at will). Arrangements are then made by which the secondary of the induction-coil is connected to the out-station circuits, as by the operator's signaling-keys or any suitable switch-board, as indicated at 39; or instead of an induction-coil, an ordinary electromagnet

and make and break may be used, kept going by a local current at the exchange, and the extra currents from the coils of this electro-magnet put to the out-station lines by the operator's signaling-keys in a manner similar to that shown in connection with the magnets in the individual system above described.

The user, say at station 3ª, in calling moves key 41 to the left, thereby closing the circuit from battery 34 through conductor 48, the coils of the magnet, conductor 49, and key 41 back to battery, the secondary currents induced in the other coils of the receiver traversing line 53 to the central station. After calling, said key is moved to the right, thereby breaking the calling-circuit and closing the circuit of transmitter 51 from battery 34, over conductor 48, central coils of receiver-magnet, conductors 49 and 52, through transmitter and key back to the battery. This is the primary induction-circuit, the secondary being from ground 36 through the end coils of the receiver-magnet and over the line 53 to central.

In order to cause a telephone-receiver to act as its counterpart's induction-coil I may sometimes wind them with two different circuits, one having a low resistance and being arranged to be connected with the local battery-circuit together with the transmitter when the instrument is in action, and the other having a high resistance and being connected to line and to the distant receiver, so that the low-resistance circuit forms the primary and the high-resistance circuit the secondary, (as in ordinary induction-coils,) as well as actuating the receiver's own diaphragm or diaphragms.

The two coils or circuits may be variously disposed on their respective cores—as, for instance, wound one underneath the other in the ordinary way, but are better wound as separate coils and placed upon different parts of the length of the same core, so that while the primary of low-resistance circuit can act inductively on the secondary or high-resistance circuit, the latter occupies the position of closer proximity to the diaphragm or diaphragms, and is therefore more efficient in vibrating it or them in response to currents received from the line.

The form of receiver which it is especially preferred to use for this purpose is that illustrated in Fig. 6. It consists of a single straight electromagnet, each end of whose core acts on one of the two opposed diaphragms, which as in Fig. 1 are clamped onto a central ring-seating containing the electromagnet, and which core is preferably polarized by a permanent magnet in one of the forms described. It is then preferable to place the low-resistance circuit or primary on a coil 40 in the center of the length of the core of the electromagnet (which core is preferably made of a bundle of iron wires or similar laminations) and the high-resistance or secondary circuit on two short coils occupying the outer ends of the core, and which are thus immediately opposed to the diaphragms.

In consequence of the magnetic polarization of the core produced by the flow of the battery-current in the primary circuit, this form of telephone may also be used without a permanent polarizing-magnet, but where such is used care must be taken to connect the primary coils in such direction that the battery-current magnetization increases, and not diminishes, that produced by the permanent magnets.

Where such combined receiver and induction coil is used in conjunction with the diaphragm contact described above for signaling purposes, I prefer to join the make-and-break contact on the diaphragm (by means of a key, as 41, capable of being operated at will) in series with the battery and primary coil, instead of the high-resistance or secondary coil, while being used for signaling purposes, keeping the secondary in the line circuit, as by so doing a much smaller battery is enabled to more powerfully operate the receiver or receivers at the distant station or stations.

What I claim as my invention is—

1. In a telephone receiver, the combination with a casing, two diaphragms mounted therein, a soft iron core presenting its ends directly to said diaphragms, a coil upon said core connected to line, and a permanent magnet exterior to the coil and presenting its ends to the diaphragms upon the same side as the core and in such relation to the core that the diaphragms form parts of the magnetic circuit between the core and said magnet, substantially as set forth.

2. The combination substantially as described, of a battery transmitter, a telephone receiver having a diaphragm and buzzer contact to be operated by said diaphragm, a battery, and a switch for closing the connection of the battery through the transmitter or through the buzzer contacts and a coil of said receiver at will.

3. In a telephone instrument, the combination of the diaphragm and electro-magnet of the receiver, with a local circuit containing a battery, the diaphragm and a coil of said magnet, and a contact in said circuit arranged to engage with the diaphragm on the side thereof opposite to the magnet and to act as a buzzer contact in connection with the diaphragm when said circuit is closed.

4. In a telephone instrument, a magneto receiver having its coil in the main line, another coil mounted upon the same core as the receiver coil and included in the local circuit with the battery and the transmitter, the receiver diaphragm in a branch of the local circuit, a contact point normally engaging the diaphragm and also included in said branch, and means for switching the current of the battery from the local circuit through said branch, as and for the purpose set forth.

5. In a telephone system, the combination

with the primary and secondary coils of an inductorium, of a soft iron core therefor, a permanent magnet connected thereto, the diaphragm, a contact point normally in connection therewith, a local battery including in its circuit the transmitter and primary coil of the inductorium which coil in connection with the diaphragm and contact point constitute a buzzer, and the main line circuit passing through said secondary coils which serve as the coils of the magneto electric receiver.

6. In a telephone instrument, the combination with the main and local circuits, of an electro-magnet having a coil in the main circuit and another in the local circuit, a receiver diaphragm operated by one of said coils as the moving part of a buzzer and by the other coil as the speech transmitting medium of the receiver, and a fixed buzzer contact in circuit with the diaphragm and with which the diaphragm repeatedly breaks and makes circuit upon the closure of this circuit and said coils acting in conjunction as the coils of the inductorium.

Signed at the city of London, in the county of Middlesex, in England, this 24th day of June, A. D. 1895.

ALFRED CHARLES BROWN.

Witnesses:

GEO. R. NELSON,

N. R. JAURALDE.