(No Model.)

C. A. RANDALL.

TELEPHONE RECEIVER.

No. 312,162. Patented Feb. 10, 1885.

Fig. 1.

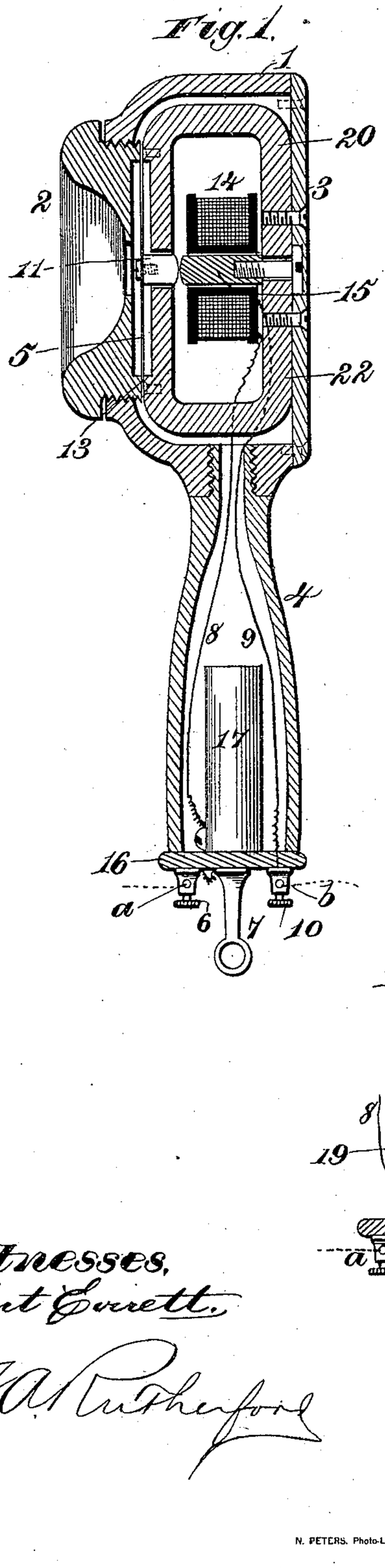


Fig. 2.

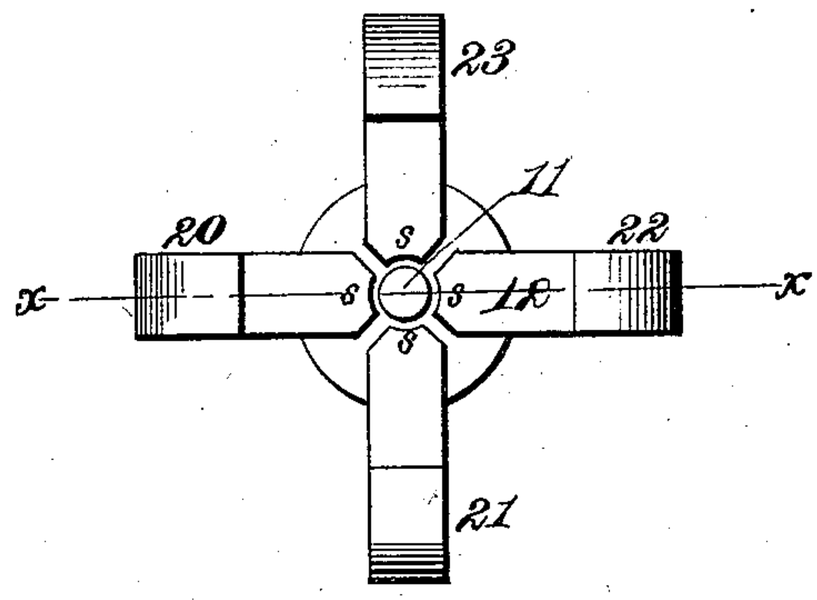


Fig. 3.

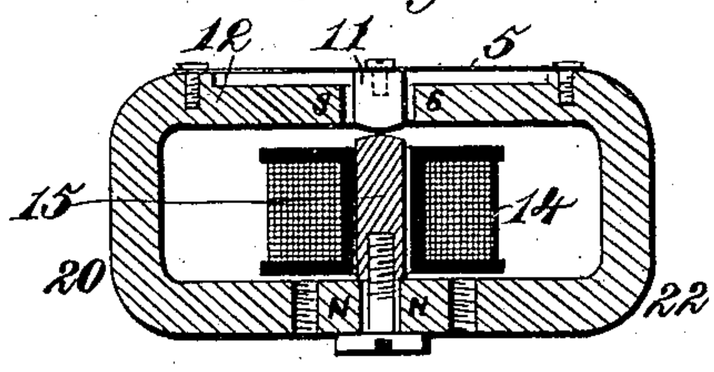
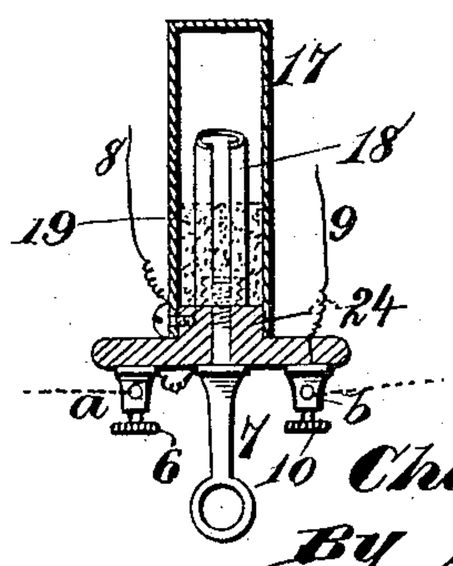


Fig. 4.



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UNITED STATES PATENT OFFICE.

CHARLES A. RANDALL, OF NEW YORK, N. Y.

TELEPHONE-RECEIVER.

SPECIFICATION forming part of Letters Patent No. 312,162, dated February 10, 1885.

Application filed February 25, 1884. (No model.)

To all whom it may concern:

Be it known that I, CHARLES A. RANDALL, a citizen of the United States, residing at New York, in the county and State of New York, have invented new and useful Improvements in Telephone-Receivers, of which the following is a specification.

My invention relates to what are technically known as "telephone-receivers"—that is, sound-reproducers, devices in which electrical undulations or pulsations affect a diaphragm or vibrator, so as to throw it into vibration corresponding to the electrical undulations or pulsations, it thereby reproducing the sound which caused such undulations or pulsations. The object thereof is to furnish such a receiver of increased or amplified power in operation, simple in construction, capable of ready dismemberment for any needed repairs, and yet of neat and convenient shape. In accomplishing these results a case is used made of three parts—a body encircling and inclosing the magnets, a base to which the magnets are attached, and which is then fastened to the body, and an ear-piece screwing into the front of the body. Into this case screws a hollow handle containing a reliable switch mechanism, so that when in normal position for use the operative parts shall be thrown into circuit, but when not in use and hung upon the proper hook the operative parts shall be cut out of circuit. Four horseshoe-magnets are used, united at their ends upon the base, while upon the top their free ends nearly meet, an opening being there left, forming a magnetic field of great intensity. They are united together upon the base, so as to form four radial arms. Their tops or free ends are slightly cut away, so as together to form a recess or chamber slightly smaller than the vibrator or diaphragm, the under side of the ear-piece being similarly recessed. The diaphragm or vibrator is secured to the magnets, and when they are in position the ear-piece is screwed down firmly upon them. Within the magnets is secured a helix, whose core is attached to their center, and is therefore of their polarity. The core is in a line with and approaches nearly to the opening left between the free ends of the magnets, in which opening plays another core attached to the diaphragm or vibrator, the latter core being then by induction of the same polarity as the free ends of the magnets.

The automatic switch referred to as in the hollow handle consists of two concentric metal tubes, secured together but insulated from each other, the inner one being, say, about half the length of the exterior one, and slotted. In these tubes is placed a quantity of mercury, fine shot, or other mobile conductor, filling half or not quite half the exterior tube, and most, if not all, the inner tube. The metal arm carrying the hook by which the receiver is to be hung up passes up through the cap of the handle, and is electrically connected to the inner tube. The two ordinary terminals are provided, one connected to the hook-arm, whence connection may be made by the mobile conductor from the inner to the outer tube, thence to the helix, while the other connects directly to the helix. When the receiver is held upright, there is a circuit then from one terminal, hook-arm, inner tube, mobile conductor, outer tube, helix, to the other terminal. When the receiver is hung up in inactive position, the circuit between the two tubes is broken by the mobile conductor flowing away from the inner tube, the circuit through the telephone and around its helix being thereby broken. The details of this construction and the principles may be better understood by reference to the drawings, in which—

Figure 1 is a sectional view of a receiver embodying my invention; Fig. 2, a top view of the magnets used; Fig. 3, a sectional view on the line *x x*, Fig. 2; Fig. 4, a detailed sectional view of the automatic switch.

1 is the body of the case, 2 the ear-piece, and 3 the base thereof, while 4 is the handle, secured to 1 in any suitable manner, say by a screw attachment, as shown.

Upon the base 3 are secured the four permanent horseshoe-magnets 20 21 22 23. These magnets are arranged upon the base to about touch, an aperture being left between their ends, through which may pass the screw which secures them to the base and the core 15 of the helix 14 to them. This core is somewhat larger than the aperture or space, so as to rest on each magnet and be polarized by contact. When the screw is passed up through the base

and space or aperture into the core 15 it binds them all firmly together, forming a compound magnet, of which 15 forms one pole. In this construction these magnets are placed so as to form four right angles, as shown in Fig. 2, similar poles being contiguous to each other. Their free ends nearly approach each other, leaving a space or field of great magnetic intensity, in which may play a core, 11, attached to an armature or vibrator, 5. In the top or free ends of these magnets are formed recesses 12, the recesses of the four magnets forming a chamber slightly less in diameter than the diameter of 5, which is fastened at its edges to the body of the magnets. A chamber of the same size is made in the under side of the ear-piece 2, shoulders 13 being left thereon. As before stated, these magnets are fastened to the base 3, and when the base 3 is secured, with the attached magnets, to the body 1, the ear-piece 2 is screwed down so as to bear firmly upon the edge of the diaphragm or vibrator secured to the magnets, aiding in firmly holding it in place, the recesses in the magnets and in the ear-piece forming a chamber in which the diaphragm or vibrator may readily vibrate.

Within the space formed by the four magnets is placed a helix, 14, whose core 15 is attached to the union of the magnets, and is therefore normally of similar polarity. This core is in line with and approaches closely to the supplementary core 11, before referred to, which is attached to 5, and plays in the space formed by the free ends of the magnets. This core 11 is of course of polarity normally similar to that of these free ends. It will be seen that therefore 11 and 15 are in a field of very great magnetic intensity, wherein they are affected inductively in addition to the magnetic effects by contact before referred to, and that as the polarity of 15 is varied either in degree or kind by the currents passing through helix 14, the attraction and repulsion between 11 and 15 will be varied and a large amplification of vibration of 5 results. The handle 4 is hollow, its free or lower end being closed by a cap, 16, to which is secured the automatic switch, consisting of a metal tube, 17, an interior tube, 18, concentric therewith and of about or a little less than half the length of 17, and a quantity of mercury, fine shot, or other mobile conductor, 19. The interior tube, 18, is slotted, as shown, to permit the free passage of the conductor to its interior. The two tubes are insulated from each other by the shoulder or hub 24 of the cap 16, the cap and its shoulder or hub being of insulating material, a hook-arm, 7, passing up through the cap 16 and the shoulder or hub 24, then screwing into the base of 18 and uniting them firmly together, and to the cap 16, which is secured to the handle 4 in any suitable manner. This cap 16 also carries the line-terminals, which may be ordinary binding-screws, 6 10.

In dotted lines *a b* are shown the line-connections secured in the posts 6 10. Connections are made from 6 to 7 from the outer tube, 17, by wire 8 to the helix, from the helix by wire 9 direct to terminal or binding-post 10 to line *b*. Hence, when the receiver is held in upright position for use, it is evident that the mobile conductor flows to the bottom of the tubes and connects 17 and 18, the circuit then being *a*, 6, 7, 18, 17, 8, 14, 9, 10, *b*. If its position be reversed, however, the mobile conductor will flow away from 18, breaking the connection between 17 and 18, and thereby breaking the circuit around the helix 14. Thus constructed, a receiver is furnished simple and economical in construction, yet easy of dismemberment for repairs, the entire organization of the sound-reproducing parts, the permanent magnets, electro-magnet, and diaphragm or vibrator being attached to the base and readily detachable therewith from the body for inspection or repair.

It will be noticed that as the supplementary core 11 is secured to the diaphragm or vibrator and the latter to the magnets themselves, the diaphragm or vibrator and core are magnetized by contact to a considerable degree, as well as by the inductive effects of the free ends upon the core itself. At the same time the diaphragm-controlling portions, the additional core 11, and the core 15, are in magnetic fields of great intensity, readily and largely varied by the helix 14, so that there is a considerable and desirable amplification of effect upon the diaphragm or vibrator 5 in its vibrations.

In the switch the use of the two concentric tubes and a mobile conductor insures a larger area of contact, making such contact certain and firm and of little resistance. All these features combine to render it a desirable, neat, and reliable receiver.

While four permanent magnets, 20 21 22 23, have been shown and described herein, it is of course to be understood that a greater number may be used without departure from the spirit of my invention, and that four is only typical of any number united at one end having their free ends forming a magnetic field in which the core 11, attached to the vibrator or diaphragm, may play.

Having thus described my invention, what I claim is—

1. In a telephone-receiver, the combination of four or more permanent magnets united at one end of each, the other ends being free and forming a magnetic field, the magnets being arranged longitudinally beneath the diaphragm, and having their similar poles facing each other, substantially as set forth.

2. In a telephone-receiver, the combination of four or more permanent magnets, the inclosed helix, its core united to the attached ends of the magnet, a vibrator or diaphragm, and an additional core attached to the vibrator or diaphragm and playing within the field formed by the free ends of the permanent magnets, substantially as described.

3. In a telephone-receiver, the combination of a series or number of permanent magnets united together at one end and to the core of an electro-magnet placed within them, a diaphragm, and an additional core attached thereto and placed within the field formed by the free ends of the permanent magnets, substantially as described.

4. In a telephone-receiver, the combination, with the operative and controlling magnets and diaphragm, of a containing-case made in three parts—a body, an ear-piece, and a detachable base—the magnets and diaphragm being attached to the latter, substantially as described.

5. In a telephone-receiver, the combination, with the case, of a hollow handle containing a switch consisting of two concentric metallic tubes, a mobile conductor, and circuit-connections, substantially as described.

6. In a telephone-receiver, the combination of the permanent magnets, the helix for affecting their polarity, the case and attached hollow handle, the switch within the latter consisting of the two concentric metallic tubes, and a mobile conductor and circuit-connections, substantially as described.

7. An automatic switch consisting of an exterior tube, an interior slotted tube concentric thereto, and a mobile conductor for electrically connecting the two tubes in one position and disconnecting them in the reverse position, substantially as described.

8. In a telephone-receiver, the combination, with the diaphragm, of the series of radial permanent magnets recessed upon their tops to form a chamber over which the diaphragm or vibrator extends, substantially as described.

9. In a telephone-receiver, the combination of the permanent magnets, arranged as described, an interior electro-magnet having its core attached to the united ends of the permanent magnets, a diaphragm or vibrator attached to the permanent magnets, and an additional core attached to the diaphragm and playing in the field formed by the free ends of such permanent magnets, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

CHAS. A. RANDALL.

Witnesses:
JAMES L. NORRIS,
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