April 3, 1928. 1,665,045

S. R. SWENSON

TELEPHONE RECEIVER

Filed Jan. 23, 1925

Fig. 1

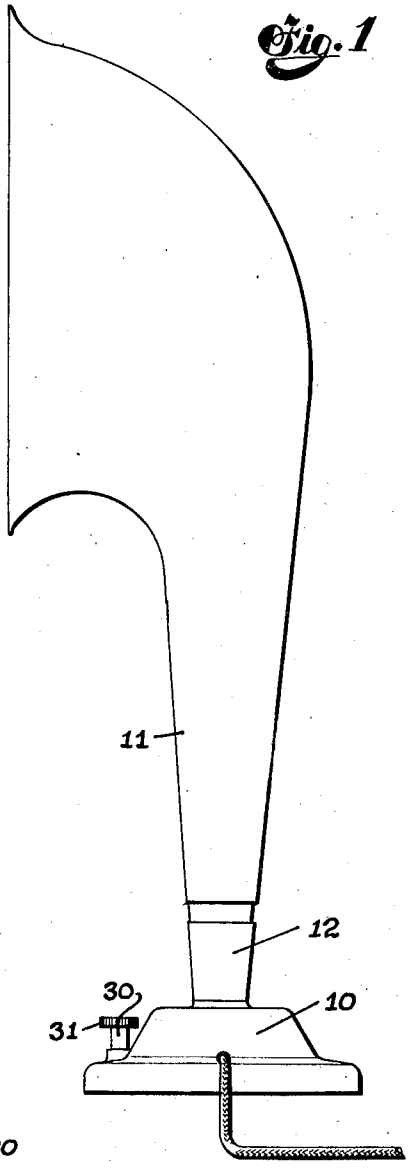


Fig. 3

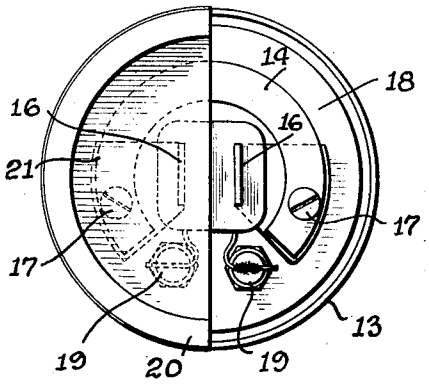
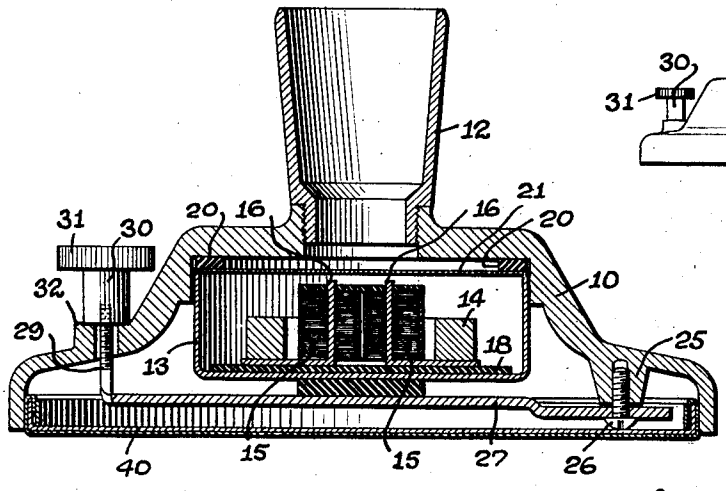


Fig. 2



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UNITED STATES PATENT OFFICE.

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TELEPHONE RECEIVER.

Application filed January 23, 1925. Serial No. 4,139.

This invention relates to devices for receiving undulating electric currents and translating them into sound vibrations. More specifically, the invention relates to telephone receivers. By "telephone receivers" I mean to include both receivers adapted to be placed in contact with the ear of the user as well as devices known in the radio art as "loud speakers," although the invention is directed principally toward the latter.

The invention has for certain of its objects to provide a device of the class described which is efficient in operation and capable of ready adjustment, while comparatively simple and inexpensive to construct. Other objects and advantages will appear as the invention is hereinafter disclosed.

Referring to the drawings which illustrate what I now consider a preferred form of the invention:

Fig. 1 is a side elevation of a complete loud speaker embodying the invention.

Fig. 2 is an enlarged sectional elevation of the lower portion of the device shown in Fig. 1, the horn being omitted in this view.

Fig. 3 is a detail plan view of the magnet case or unit with one-half of the diaphragm and one-half of the gasket or ring cut-away.

The form of the invention illustrated comprises a hollow base 10, constructed of metal, preferably non-magnetic, or other suitable material, and a horn 11, the horn being of usual construction and secured to the base by means of a hollow sleeve or ferrule 12 which is screw-threaded at its lower end to screw into a tapped hole in the upper central part of the base 10.

Within the base is mounted a cup-shaped member 13 conveniently constructed by punching it out of a sheet of metal in the manner that the casings of cartridges, shells and the like, are constructed. If the member 13 is constructed of metal which may rust or corrode, it is preferably coated with a metal or other material to resist such action. Within the cup 13 and secured to the base thereof are a permanent magnet 14 and two electromagnets 15, 15. The cores 16, 16, of the electromagnets are made of silicon steel or soft iron and are each secured to a corresponding one of the poles of the permanent magnet. Bolts 17, 17, which pass through suitable openings in the permanent magnet 14, cores 16, 16, and the bottom of the cup 13 serve to secure these parts together, it being noted that the bolts 17, 17, pass through a disc 18 of micarta or the like interposed between the cores 16, 16 and the base of the cup. The electromagnets are wound and serially connected with each other in the usual way, and the free terminals of the windings are each electrically connected to corresponding one of two terminals or posts 19, 19, which pass through and are secured to the bottom of the cup 13, but are insulated therefrom and from each other by means of the disc 18 and suitable insulating bushings. The usual current-conducting leads are electrically connected to the bottoms of the posts 19, 19, to transmit to the windings of the electromagnets 15, 15, the electric undulations to be translated into sound vibrations.

The base 10 is adapted to receive a ring or gasket 20 of rubber or other suitable compressible material. It will be noted that the outside diameter of the gasket 20 is substantially the same as, or slightly less than, the outside diameter of the cup 13, and that the inside diameter of the gasket is considerably less than the inside diameter of the cup 13. In the normal or operative position of the parts, a diaphragm 21 is clamped at its periphery between the gasket 20 and the upper edge or rim of the cup 13. I provide means for holding the parts in the position above described and illustrated and whereby the distance between the diaphragm and the poles of the electromagnets (i. e., the air gap) may be varied at will, and I shall now proceed to describe the now preferred form of such means.

The base 10 is provided at one side with a downwardly projecting tapped boss 25 adapted to receive a screw 26 which passes through an opening in a metallic strap or bridge-piece 27. At or about its middle portion, this bridge piece engages the bottom of the cup 13 or, preferably, a rubber or other compressible disc 28 interposed between the bridge-piece and bottom of the cup 13. This disc may be secured to the bottom of the cup 13, substantially at its center, by means of shellac, cement or the like. It will be noted that the bridge-piece 27 is provided with openings through which

the lower ends of the bolts 17, 17, are adapted to extend. The other end of the bridge-piece 27 is provided with an integral screw-threaded stud 29 which is adapted to extend upwardly through an upwardly extending boss 32 provided on the base 10. A nut 30 having a milled head 31 is adapted to screw onto the stud 29 and to engage, at its lower end, the upper end of the boss 32.

The diaphragm 21 performs a double function or serves in a two-fold capacity. It acts as an armature of the electromagnets, and to this end is constructed of silicon steel, or other suitable ferrous metal, and also operates as a sound-producing diaphragm, i. e., it produces sounds in accordance with undulations of the current passing through the coils of the electromagnets. It will be noted that the diameter of the diaphragm 21 is substantially the same as, or slightly greater than the outside diameter of the cup 13.

Assuming that the parts are in the assembled position, the operation is substantially as follows. The undulating current, for example that in the B circuit of a radio receiver, supplied to the windings of the electromagnets 15, 15, causes the diaphragm 21 to vibrate and set up sound vibrations in accordance with the undulations. These sound vibrations are transmitted up through the horn or resonator 11. If the amplitude of the undulations in the electric current is too great for the particular air gap adjustment, the diaphragm may strike the pole-pieces of the electromagnets and "blasting" would result. If, on the other hand, the air gap is too great, the sound vibrations will be comparatively feeble because the pull of the electromagnets or the diaphragm varies substantially inversely as the square of the length of the air gap. Therefore, for any particular amplitude of undulating current supplied to the electromagnets, there is a corresponding length of air gap which will cause the intensity of faithful sound vibrations to be a maximum. The average value of the current through the electromagnets and the amplitude of undulation of this current vary according to the particular instrumentality, or combination of instrumentalities, with which the loud speaker is employed, and vary also with different adjustments and conditions of operation of any given instrument, or combination of instrumentalities, with which the loud speaker is employed. Therefore, it is highly desirable, if not absolutely necessary, that provision be made for conveniently adjusting the length of the air gap. This is effected in my improved device as follows.

By turning the nut 30 in the proper direction the strap or bridge-piece 27 presses the cup 13 upwardly toward the base 10. This compresses the outer portion or rim of the gasket 20 but leaves the inner portion of the gasket free to press relatively downwardly upon the diaphragm 21 at an annular region or zone of contact inside the rim thereof. This causes the air gap distance to be shortened to an extent in accordance with the extent of rotation of the nut 30. Conversely, if and when the nut 30 is turned in the opposite direction, the compression upon the outer portion or rim of the gasket is relieved and the central portion of the diaphragm moves relatively away from the pole pieces of the electromagnets, i. e., the air gap is shortened. As will be seen the adjustment to lengthen or shorten the air gap is effected by manipulation of the nut 30 wholly outside of the base 10. The base 10 may therefore not only be closed at its bottom, as by means of a cloth covered plate 40 frictionally or otherwise held in the base, but the base 10 may be sealed at the factory, after inspection and test of the instrument.

Aside from the matter of facility of adjustment of the air gap, which is one of the features of the invention, the arrangement of parts disclosed has been found to lead to highly efficient operation from the standpoint of intensity and faithfulness of the sound reproduction. During all conditions of operation, the outer portion or rim of the gasket 20 is under some degree of compression so that, under normal conditions of operation, the diaphragm 21 is somewhat cupped or convexed downwardly toward the poles of the electromagnet in opposition to its tendency to assume a plane position by virtue of its inherent resiliency.

In accordance with the provisions of the patent statutes, I have herein described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiments thereof, but I desire to have it understood that the apparatus disclosed is only illustrative and that the invention can be carried out by other means. Also, while it is designed to use the various features and elements in the combinations and relations described, some of these may be altered and others omitted and some of the features of each modification may be embodied in the others without interfering with the more general results outlined, and the invention extends to such use.

What I claim is:

1. A telephone receiver comprising in combination, a diaphragm, means comprising an electromagnet for vibrating said diaphragm, an elastic compressible annulus in engagement with the periphery of said diaphragm on the side thereof opposite said electromagnet, and means for compressing the outer portion of said annulus to move the central portion of said diaphragm toward said electromagnet.

2. The combination set forth in claim 1 in which mechanism set forth is enclosed in a casing and in which the last mentioned means is adjustable from the exterior of the casing.

3. A telephone receiver comprising in combination, a cup-shaped casing, a hollow base surrounding said casing and substantially closing the top thereof, an annulus of compressible elastic material interposed between the rim of said casing and said base, a diaphragm interposed between the rim of said casing and said annulus, a bridge-piece within said base and extending across and below said casing, and means operable from the exterior of said base for moving said bridge-piece upwardly.

In testimony whereof I hereto affix my signature.

SWEN R. SWENSON.