

July 20, 1926.

1,593,377

A. P. YOUNG

TELEPHONE RECEIVER AND SIMILAR SOUND PRODUCING DEVICE

Filed May 19, 1923.

2 Sheets-Sheet 1

Fig. 1.

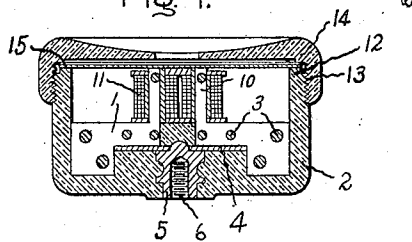


Fig. 2.

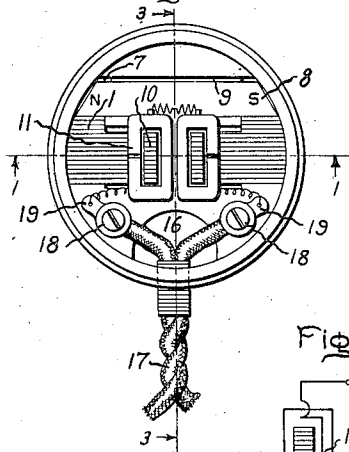


Fig. 3.

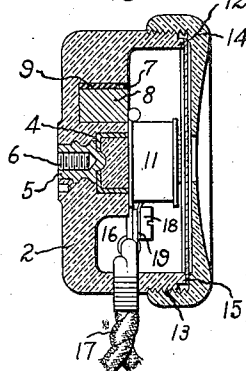


Fig. 4.

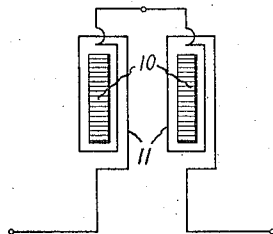
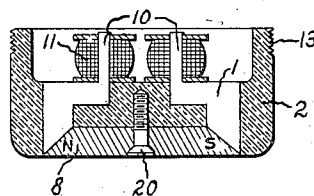


Fig. 5.



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Fig. 6.

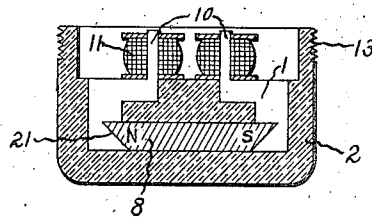


Fig. 7.

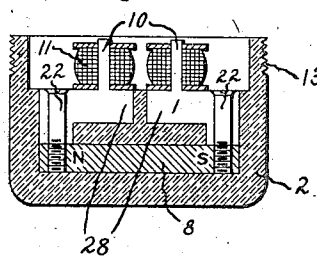


Fig. 8.

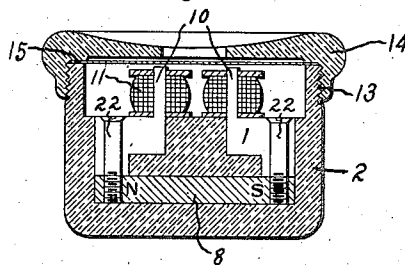


Fig. 9.

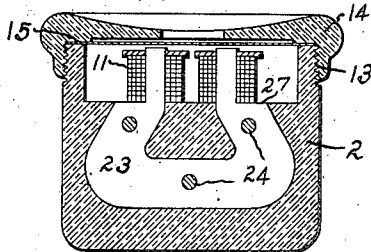
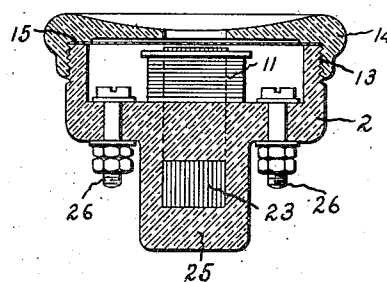


Fig. 10.



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UNITED STATES PATENT OFFICE.

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TELEPHONE RECEIVER AND SIMILAR SOUND-PRODUCING DEVICE.

Application filed May 19, 1923, Serial No. 640,060, and in England May 20, 1922.

My present invention relates to telephone receivers and similar sound producing devices of the type in which a coil or coils mounted upon the pole pieces of a magnetic circuit, actuate a diaphragm and vibrate it according to the fluctuations of current through the coil or coils to produce sound waves.

The object of my invention is to provide an improved construction for a device of this character.

In carrying out my invention I mould a portion or the whole of the magnetic material constituting the magnetic circuit of the instrument in a moulded composite insulating material, such as plastic india rubber or synthetic resin. Metal inserts, such as the terminal posts where the ends of the exciting coils are united to the leading-in conductors and the stud where connection is made between the telephone receiver and the head band or other supporting member, may also be moulded into the insulating material at the same time as the parts of the magnetic circuit. Preferably the moulded material is formed so as to retain some or all of the above-mentioned parts and also constitute the casing of the instrument.

The magnetic circuit preferably comprises laminated or solid pole pieces moulded in the moulded composite insulating material and a permanent magnet preferably of cobalt steel is either moulded into the material in the same plane as the pole pieces with its poles adjacent to pole pieces or is moulded laterally of the pole pieces. In some cases two permanent magnets may be employed, one on each side of the plane of the pole pieces, and arranged so that their polar extremities are adjacent the sides of the pole pieces. Instead of moulding the magnet or magnets into the material a recess or recesses may be moulded in the material and the magnet or magnets may be wedged in the recess or recesses.

In the preferred construction of a telephone receiver according to my invention I mould the pole pieces and metal inserts into the moulded composite insulating material so as also to form a casing, and at the same time I mould a straight slot or recess at one side of the pole pieces slightly larger than the straight bar magnet which, after moulding and hardening by means of heat, is inserted in the recess, and a wedge is

driven in between the magnet and the outer wall of the recess so as to force the poles of the magnet into good contact with the pole pieces. The coils are then mounted on the pole pieces and the coil terminals are secured to the terminal screws and the leading-in conductors on the side of the pole pieces opposite to the magnet. A diaphragm, of stallo, for example, is then placed over the casing and held in position by the usual screwed cover with an opening in the center.

Other forms of magnetic circuit and arrangement of pole pieces and magnets falling within the scope of my invention are hereinafter set forth.

My invention will be more fully described in connection with the accompanying drawings, in which Figs. 1, 2 and 3 represent the preferred form of construction embodying my invention. Fig. 2 is a plan view of a telephone receiver with the cover plate and diaphragm removed. Fig. 1 is a sectional elevation about the line 1—1 of Fig. 2, and Fig. 3 is a sectional elevation about the line 3—3 of Fig. 2. Fig. 4 is a diagram of the electrical connections. Figs. 5 to 10, inclusive, represent modifications of my invention in which Figs. 5 to 9 illustrate different methods of forming and mounting the magnetic structure; Fig. 10 being a transverse sectional elevation of Fig. 9.

Similar reference numerals are used throughout to denote like parts.

Referring now to Figs. 1, 2 and 3, laminated sections of soft iron 1 constituting pole pieces are moulded into a moulded composite insulating material 2 such as plastic india rubber or bakelite. These laminations may be held together by rivets 3 or they may simply be drilled transversely in order that the insulating material may flow into the drilled holes so as firmly to retain the laminations in position. In this case a suitable spacing piece 4 may be clamped to the pole pieces 1 to hold them in position while the insulating material is being cast around them. The pole pieces may in some cases be solid instead of laminated. At the same time a metal plug 5 is preferably moulded into the bottom of the casing or it may be formed integrally with the spacing member 4. This plug is provided with a threaded hole 6 which is adapted to receive the corresponding threaded stem of the ear-

piece support. On one side of the pole piece and adjacent the base limb there is left a substantially rectilinear slot or recess 7 adapted to take a short bar magnet 8, preferably a cobalt steel magnet. The side of the slot away from the pole piece may be filled with moulded insulating material, but preferably a fiber or similar wedge 9 is driven in to press the ends of the bar magnet firmly against the base of the pole pieces 1. The free ends of the pole pieces 10 are narrowed as shown in order to take the standard size coils 11 and are of a height slightly less than that of the side 12 of the casing. The upper rim of the casing is screw-threaded externally as shown at 13 to engage with an apertured cap or cover 14 made preferably of similar material, and the diaphragm 15 has its rim secured between these two members. In order to adjust the distance of the diaphragm from the tips of the pole pieces suitable packing rings may be inserted between the edges of the diaphragm and the upper rim of the casing 2.

On the opposite side of the pole pieces from that on which the magnet is located, a cavity 16 is provided to take the conducting leads 17; the ends of which are held by terminal screws 18 engaging with a corresponding metal insert which is moulded into the composite material. The ends of the coils 11 are secured by solder or the like to metal washers 19 which are held in electrical connection with the ends of the conducting leads 17 by the screws 18. In the diagram of electrical connections shown in Fig. 4, it will be seen that the coils are so arranged that when the current flows in a given direction one pole piece will be of north polarity while the other pole piece is of south polarity. Combining this polarity with the polarity due to the permanent magnet 8, it will be seen that the fluctuations of current through the coils 12 will serve alternately to weaken and strengthen the flux passing from one pole piece to the other pole piece through a portion of the diaphragm, causing the latter to vibrate.

The design of telephone receiver shown in Figs. 1, 2 and 3 manufactured as above described has been found to give very sensitive operation when used with radio receiving sets. This may be partly due to the rigidity of the mounting of the pole pieces and partly to the provision of the chamber between the diaphragm and the flat surface from which the pole pieces project. As will be seen from Fig. 3 this surface is uniform except for the polar projections and the semi-circular recess where the leading-in conductors enter the casing.

It will be obvious that in cases where a stronger exciting force is required a slot may be provided for holding a second magnet adjacent the base limbs of the pole

pieces instead of the cavity 16 previously described; in which case the conducting leads 17 would be secured by the screws 18 engaging with metal plugs moulded into the bakelite between one of the slots 7 and the side of the casing 2.

In the construction shown in Figs. 5 to 8, a single bar magnet 8 is provided and mounted upon the ends thereof are the pole pieces 1, the pole pieces and the magnet now being in the same plane. In Fig. 5 the magnet is retained in position by means of a screw 20 securing it to the insulating material between the pole pieces, and the ends of the bar magnet and pole pieces are sloped off at an angle so as to fit together like a window frame. In Figs. 6 to 8, an insulating material such as plastic india rubber, bakelite, etc. is moulded around the outside of the bar magnet. In Fig. 6 the lower ends of the polar laminations 1 are provided with a recess 21 which engages with the correspondingly shaped end of the bar magnet 8. In Fig. 7 I have indicated an arrangement whereby any of the constructions illustrated may be combined with projecting pieces 28 formed in the magnetic circuit to provide a shunt path for the flux, in a manner that is well known per se, and in both Figs 7 and 8 mild steel screws 22 are employed for securing the pole pieces to the magnet. In Figs. 9 and 10, a U-shaped magnet is used, the limbs thereof being preferably offset towards each other near the yoke and parallel at their free ends. Holes 24 are provided transversely through this magnet and the composite material penetrates these holes during the moulding operations and thereby rigidly holds the magnet in position. The free ends of the magnet are preferably cut, leaving rectangular pole pieces of uniform cross-section adapted to take the standard coils 11. These pole pieces may also be slotted to reduce eddy currents. In Fig. 10 it will be noticed that a considerable portion of the insulating material has been omitted and instead of the watch type telephone receiver shown in Fig. 1, we have a flat circular form with a diametrically projecting portion 25 moulded around the yoke of the magnet 23.

While in all the figures the free ends of the pole pieces are indicated as consisting of a cut away rectangular portion cylindrical pole pieces, either straight or slightly tapering may be used if preferred to take similarly arranged coils. In all cases, by providing the flat surface 27 on the pole pieces a suitable bed will be provided upon which the coils may rest.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. The combination in a telephone receiver of a body of moulded composite insulating material, a pair of pole pieces having

coil holding portions which extend upwardly above said body of insulating material and offset portions extending parallel to said coil holding portions and downwardly into said body of insulating material, and a permanent magnet which is held in intimate contact with said pole pieces by said body of insulating material.

2. In a telephone receiver, a pair of pole pieces, a casing moulded about the pole pieces and adapted to hold them in position, said casing being provided with a substantially rectilinear recess adjacent one side of said pole pieces, a permanent magnet mounted in said recess, and means for holding the permanent magnet in intimate contact with said pole pieces.

3. The combination in a telephone receiver of a body of moulded composite insulating material, a pair of pole pieces having coil holding portions which extend upwardly above said body of insulating material, horizontally extending portions which are embedded in said body and downwardly extending portions which are also embedded therein, and a permanent magnet which is held in intimate contact with said pole pieces by said body of insulating material.

4. The combination in a telephone receiver of a pair of laminated pole pieces which are moulded in a body of moulded composite insulating material, the laminations of said pole pieces being held in desired space relation by means of the insulating material, and a permanent magnet which is held with its poles in intimate contact with said pole pieces.

5. In a telephone receiver, a pair of pole pieces, a casing moulded about the pole pieces and adapted to hold them in position, said casing being provided with a substantially rectilinear groove adjacent one side of said pole pieces, a permanent magnet mounted in said groove and adapted to contact with said pole pieces, and means for adjusting the contact between the pole pieces and permanent magnet.

6. In a telephone receiver, a pair of pole pieces, a casing mounted about said pole pieces and adapted to hold them in position, said casing being provided with a rectilinear groove adjacent one side of said pole pieces, a permanent magnet loosely mounted in said groove and adapted to contact with said pole pieces, and means for holding the permanent magnet in intimate contact with said pole pieces.

7. The combination in a telephone receiver of a pair of pole pieces which are moulded in a body of moulded composite insulating material and a permanent magnet which is adjustably mounted adjacent said pole pieces and held in its desired position by means of the body of moulded material.

8. The combination in a telephone receiver of a pair of laminated pole pieces having holes through the individual laminations and a body of moulded composite insulating material which fills the holes in the laminations and holds the laminations and pole pieces in a desired space relation.

In witness whereof I have hereunto set my hand this 17th day of May, 1923.

ARTHUR P. YOUNG.