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638,001, May 12, 1967.

[50] Field of Search..... 179/182,
 156, 179

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[54] **EARPHONE ASSEMBLY WITH RESILIENTLY**
RETAINED TRANSDUCER
8 Claims, 3 Drawing Figs.

[52] U.S. Cl. 179/182 R
 [51] Int. Cl. H04r 1/10

ABSTRACT: An earpiece consists of a molding of elastomeric material and has a central recess. An electroacoustic transducer capsule is captively held in said recess by resiliently interengaging with said molding. The molding includes a pluglike projection defining a passage therethrough for receiving a guide rod of a headset strap. The walls bounding the passage frictionally engage the guide rod to mount the earpiece thereon for adjustable displaceable movement.

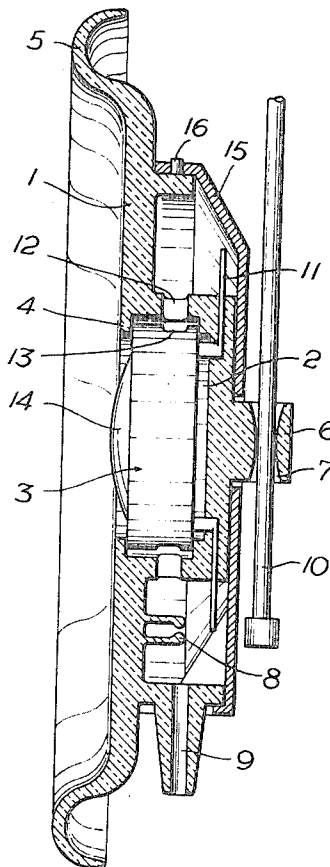


FIG. 1

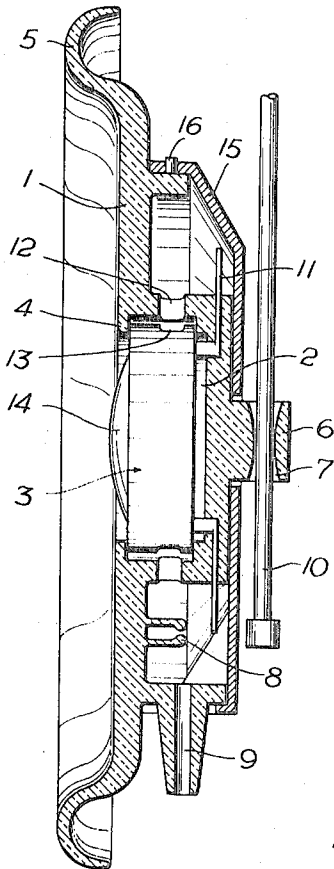


FIG. 2

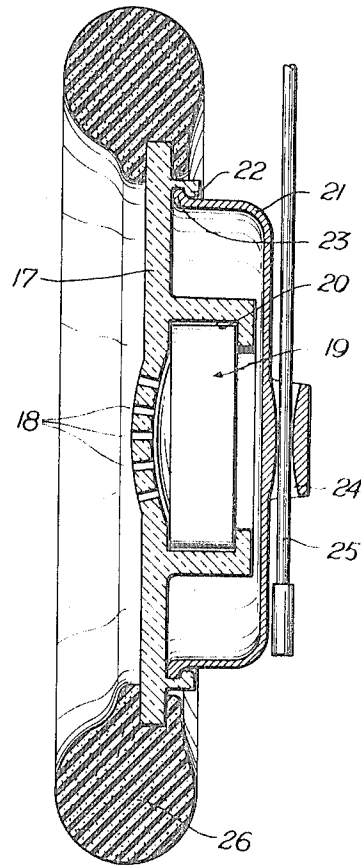
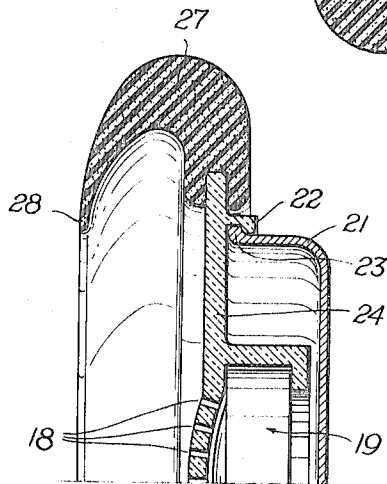


FIG. 3



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EARPHONE ASSEMBLY WITH RESILIENTLY RETAINED TRANSDUCER

This application is a continuation of application Ser. No. 638,001, filed May 12, 1967, now abandoned.

SUMMARY OF THE INVENTION

This invention relates in general to earphones and in particular to a new and useful earphone having a molded ear-forming outer housing with a central recess for receiving an electroacoustic transducer, the housing resiliently holding the transducer therein, and with a cover interlocking the parts in resilient engagement.

Earphone sets consist essentially of two sound generators, which are held on the head and urged against the ears (auricles) by a resilient strap. Each sound generator comprises a disc-shaped part of hard plastics material, which in operative position engages the ear and effects a seal from the outside. This part is described in most cases as an earpiece. A housing containing an electroacoustic transducer is attached to said earpiece. Holding means provided on the housing permit of a connection to the resilient head strap. This connection is adjustable within limits. The costs of manufacturing such earphone set are considerable because a relatively high structure expenditure is required. These costs impede the widespread use of the earphone set whereas such widespread use should be promoted in view of the molestation caused by the sound emitted from loudspeakers. The known earphone sets have further disadvantages, which are due to the fact that the flexible cable is subjected to high mechanical stresses and must often be replaced. Such replacement of the cable can be performed only in very rare cases by an unskilled person because the connections must be carefully soldered.

It is an object of the invention to provide an earphone assembly with new elements of construction which ensure that the earphone assembly resists rough handling. According to the invention this is accomplished in that the earpiece consists of soft plastics material or soft rubber and represents a molding, which has a central, cylindrical recess, into which an electroacoustic transducer in the form of a capsule is adapted to be simply snapped.

To enable an insertion of the transducer into the molding, the cylindrical recess for receiving the electroacoustic transducer may either be open towards the ear, or the opening may be on the side remote from the ear, provided that the sound can reach the ear of the wearer through the bottom of the recess. For this purpose, a plurality of ducts or apertures may be provided. Alternatively, the bottom of the recess may be so thin, at least in the middle, that it forms a substantially sound-transmitting diaphragm.

To hold the electroacoustic transducer in position in the recess, the latter has at least one groove or rib or at least one flangelike ring, which bears on the rim of the inserted transducer and holds the same in a defined position.

To establish the electrical connections, radial holes may be provided, in accordance of the invention, in the wall of the central recess, and the required electrical connecting leads may extend through these holes, or, according to another feature of the invention, metallic elements may be embedded or inserted in the molding and these elements may be formed at one side to match the terminals of the electroacoustic transducer whereas they are adapted at the other end to be connected to a cable, a lead or the like. It will be understood that the metallic elements are arranged to terminate in the cylindrical recess of the molding at the terminals of the electroacoustic transducer which has been inserted.

According to a further feature of the invention the molding is formed on its rear side, which is remote from ear, with lugs or projections, which suitably form clamps for holding and/or guiding the flexible connecting cable and for relieving the terminals from tension. The molding may be integrally formed with a cable sleeve.

According to the invention, the molding may be provided at its rim with a bead, which establishes a seal between the ear

and the sound transducer, or the molding may terminate in an inturned rim so that the sound generator can be hung on the auricle without need for other fixing means. Such a mode of carrying an earphone is known from the Benaudi earphone.

According to a special feature of the invention the molding terminates in a flat disc, which is adapted to have a bead of particularly soft material mounted on its rim, which bead may consist of a sealing ring if the earphone set is carried on the head by a resilient strap, or such bead may constitute an inturned rim if the sound generator is to be hung on the ear or auricle.

For the connection of a head strap, the molding is provided on its side remote from the ear with a protruding pin or the like, which has a preferably double-conical or prismatic aperture, which guides the guide rod or another fixing element of a resilient head strap. The aperture should be double-conical or prismatic to improve the movability of the earphone on its guiding or holding rod.

For covering the rear side of the molding and to protect the terminals from damage, the invention teaches to close the molding with an integral cap, which consists preferably of metal. To fix this cap, the pin for the guide rod of the strap may extend from the cap so that the rod extending through the pin prevents a falling down of the cap. In another embodiment of the invention the cap is held on its out-turned rim (flange) by an inturned annular flange of the molding and the guide rod for the strap is guided in a suitable lug of the cap.

Accordingly, it is an object of the invention to provide an earphone with a resiliently deformable housing and having a recess, in which a transducer is located, constructed so that the transducer is resiliently held therein, and including cover means for interlocking the housing with the transducer and for mounting the earphone to a head set.

A further object of the invention is to provide an earphone which is simple in design, rugged in construction and economical to manufacture.

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, its operating advantages and specific objects attained by its use, reference should be had to the accompanying drawings and descriptive matter in which there are illustrated and described preferred embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a transverse sectional view of an earphone construction in accordance with the invention;

FIG. 2 is a similar view showing a second embodiment of the invention; and

FIG. 3 shows a modification of the example shown in FIG. 2.

DETAILED DESCRIPTION

As is apparent from the introductory part of the specification, the crux of the invention resides in that a molding of soft plastics material or soft rubber is used in an earphone and has a central cylindrical recess, into which an electroacoustic transducer in the form of a capsule can simply be snapped. The drawing shows a molding 1, a recess 2, and an electroacoustic transducer capsule 3.

The capsule 3 is captively and resiliently held by the nose 4, which in accordance with the invention, consists of an inturned annular flange. To insert or remove the transducer 2 the molding may be bent to increase the resilient force of the recess 2. After the transducer 3 is in position the molding may be released to cause it to resiliently engage around the transducer.

In the embodiment shown in FIG. 1, the molding 1 terminates in a thin bead 5, which ensures a sealing contact of the earphone with the ear. On that side which is remote from the

ear, the molding 1 has a pluglike projection or pin 6, which is formed with a transverse passage 7, having opposite inwardly curved walls forming a central portion of narrowest cross section and ends of wider cross sections. A guide rod 10 of a head strap or another fixing element (not shown) is directed through passage 7 and resiliently held therein.

The molding 1 is further provided on its rear side with projections 8 for fixing the connecting cable and for relieving the terminals from tension. The molding 1 may be provided with a cable sleeve 9, which may be formed integrally with the molding or may be subsequently inserted into the molding 1 as a separate part. The cylindrical wall of the recess 2 is formed with openings 12, through which the electrical connections to the capsule 3 may be established at 13 by plugging, clamping or soldering. As is also shown in FIG. 1, metallic elements 11 may be embedded or inserted in the molding 1 and these elements may terminate in the recess 2 and contact the terminals of the inserted capsule 3 so that the electrical connections are established. The elements 11 may be provided at their other end with eyes, screw terminals or soldering tags, to which the ends of the cable are connected.

According to the invention, the rear side of the molding 1 is covered towards the outside by an integral cap 15, which consists preferably of a light alloy. This cap 15 may be held, for example, by noses 16, which protrude from the molding 1 and engage suitable openings in the cap. A dropping of the cover 15 is prevented in that the pin 6 extends through the bottom of the cap so that the guiding rod 10 of the strap, which rod is guided in the pin 6, acts like a cotter pin.

FIG. 2 illustrates a different embodiment of the invention. The embodiment differs from the one shown in FIG. 1 in that the molding 17 in FIG. 2 has a cylindrical recess 20, which corresponds to the recess 2 in FIG. 1 but is accessible from that side of the molding 17 which is remote from the ear. In this embodiment, the electroacoustical transducer capsule 19 must be inserted so that its sound-emitting opening faces the bottom of the recess so that this bottom must be permeable to sound, either by the provision of apertures or openings 18 or in that the bottom of the diaphragm 20 is so thin that it acts as a sound-permeable protective diaphragm. Whereas the cap 21 might be fixed like the cap 15 in FIG. 1, it is recommendable to provide a fixation which can be released only with more difficulty. For instance, the molding 17 may be formed with an annular projection, which has an inwardly protruding nose 22, and an annular flange 23 of the cap 21 interengages with the annular projection. A firmer mounting is required in the embodiment of FIG. 2 because a head strap 25 which is employed must be held on the cap 21 in a projection 24 of the latter. This is necessary because the recess 20 differs from the recess 2 in the other embodiment so that the molding 17 cannot be provided with a portion which corresponds to the projection 6 of FIG. 1.

A further difference from the embodiment shown in FIG. 1 resides in that the molding 17 terminates in a smooth rim of rectangular cross-sectional shape and this rim is adapted to have a bead 26 of particularly soft material mounted thereon. This soft bead 26 results in a particularly good seal against disturbing sound from the outside and may also facilitate the wearing of the earphone set.

The molding 17 may be approximately circular similar to the embodiment of FIG. 1. As is apparent from FIG. 3, the sealing bead 26 may be replaced by a different bead 27, which has a strongly inturred rim 28. This results in the formation of a cap, which can accommodate the entire earphone of the user. This design is similar to a Benaudi earphone and enables a wearing of the sound generator on the ear without need for a head strap. Such a mode of wearing the earphone may be considered more convenient by some users.

It has been found that the moldings 1, 17 are preferably made from materials having a Shore hardness of 40-80. The use of such a material will result in a molding which has the required strength and compliance. The earphone according to the invention will resist very rough usage, particularly because it comprises a molding of soft material, which absorbs even

hard shocks to a large extent and renders them harmless for the electroacoustic transducer. Besides, this material will not break.

As the earphone according to the invention comprises only few parts, which are held together only by plug connections, without need for screws or rivets, the assembling and any repairs will be facilitated and the costs of manufacturing and repairing the earphone will be reduced. The repair is so simple in virtually all cases that it can be carried out by an unskilled person.

While specific embodiments of the invention have been shown and described in detail to illustrate the application of the inventive principles, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. An earphone assembly comprising a molding of elastomeric material having an inner surface formed with a portion configured to conform to the user's ear, said molding including a portion projecting from its opposite surface and forming a central, relatively small diameter cylindrical recess, said recess having an open end; a substantially cylindrical electroacoustic transducer capsule, having a diameter slightly larger than that of the open end of said recess, inserted into said recess through said open end, said molding resiliently retaining said capsule in said recess; means, including said opposite surface of said molding and said recess forming portion, defining an annular enclosure for the connections to said capsule; and a plug projecting substantially centrally from the outer surface of said earphone and formed to displaceably receive a head strap guide rod.

2. An earphone assembly, as claimed in claim 1, wherein said plug defines a passage for the guide rod; said molding including shaped metallic elements formed therein and which are adapted to the terminals of said electroacoustic transducer and provide means for connecting an electrical cable thereto; said molding being one-piece and being formed with a cable bushing.

3. An earphone assembly, as claimed in claim 1, wherein said plug defines a passage for the guide rod; said molding including an outer rim formed with a raised edge for enclosing the ear of the user; a cover connected to said molding and having an opening through which said plug extends; and a guide rod extending through said passage for supporting the earphone on a head strap and providing means preventing withdrawal of said cover.

4. An earphone assembly, as claimed in claim 1, in which said annular enclosure-forming means includes a cover enclosing the said opposite surface of said molding, and having a central opening; said plug projecting through said central opening and defining a passage bounded by convergent walls; and a rod for a head strap extending through said passage and resiliently engaged by said walls but displaceable along said passage.

5. An earphone assembly, as claimed in claim 1, in which said annular enclosure-defining means includes a relatively rigid cover member engaging around said molding over said opposite surface formed with said recess, said cover being connected to said molding to hold said molding.

6. An earphone assembly, as claimed in claim 5, wherein said molding includes an annular flange extending from said opposite surface thereof; and a plurality of projections extending outwardly from said flange; said cover having a flange portion engaged around said annular flange and having openings through which said projections extend.

7. An earphone assembly, as claimed in claim 1, wherein said plug has a bore extending therethrough; and a guide rod for a head strap extending through said bore.

8. An earphone assembly, as claimed in claim 5, wherein said molding includes an annular flange on said opposite surface thereof, said flange forming with said molding an annular depression; said cover having a projecting flange portion projecting into said annular depression and resiliently engaging said flange.