March 5, 1963 J. D. HENDERSON 3,080,011

EAR CANAL INSERT

Filed July 16, 1956

Fig. 1

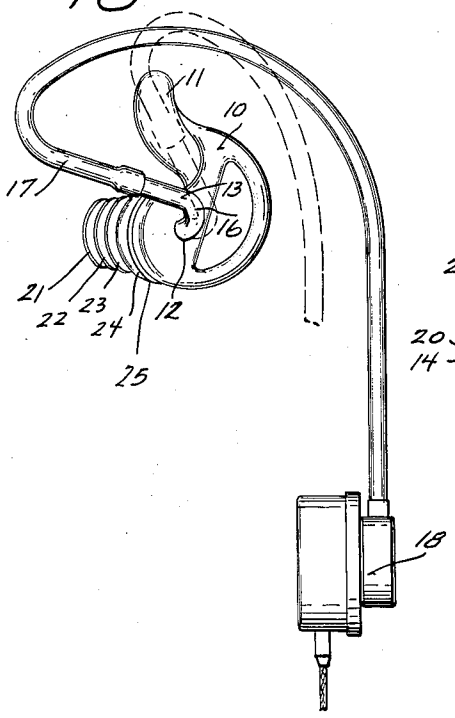


Fig. 2

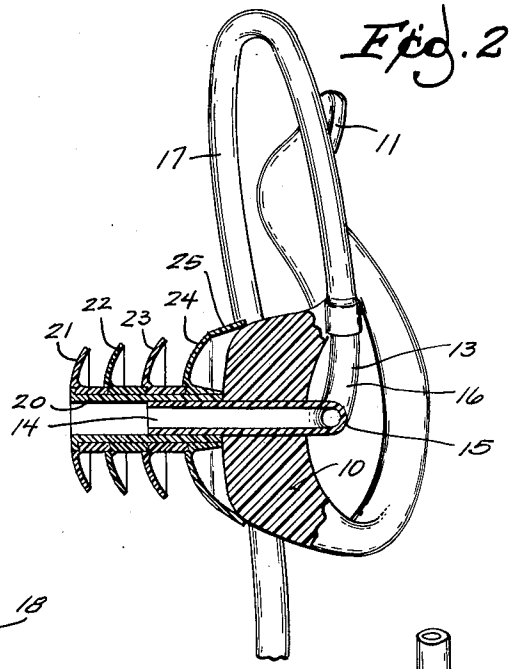
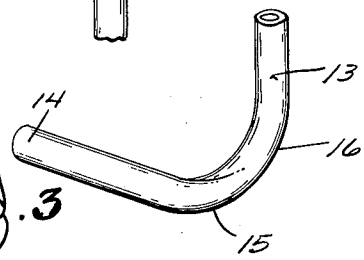


Fig. 3



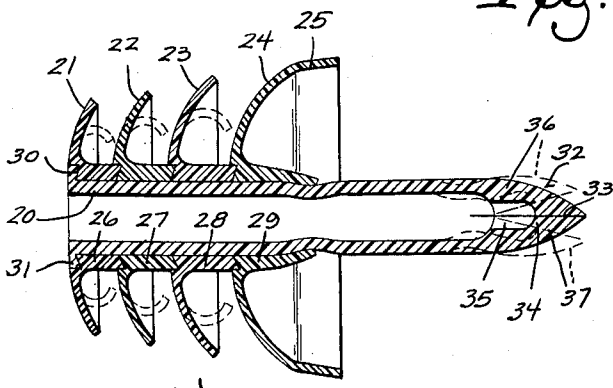


Fig. 4

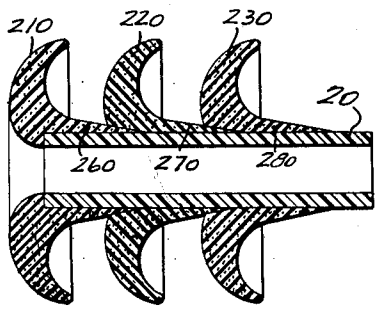


Fig. 5

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EAR CANAL INSERT

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This invention relates to an ear canal insert. The insert may be used as a part of a hearing aid device. In another embodiment, it is adapted to serve as a stopper to exclude sound or water from the ear canal. This latter embodiment may be converted for use as a hearing aid device by simply severing unneeded portions thereof.

The major feature of the invention consists in the provision of a very soft tip comprising one or more units having head portions comprising mushroom-shaped flanges desirably made of natural or synthetic rubber or plastic. These flanges are desirably so soft that if they were made integral with the tube upon which they are mounted, the tube would not have sufficient stiffness to enable the tip to be inserted into the auditory canal. Accordingly, while the mounting tube is quite flexible, so that it will follow all irregularities of the auditory canal, it nevertheless is considerably stiffer than the material of which the mushroom-shaped head portion flanges are formed. These flanges desirably have tubular hub portions telescopically sleeved onto the mounting tube and desirably interlock with each other and with the tube.

Another feature of the invention consists in the manner in which the tip is mounted on a sound tube which is swiveled in the ear mold, the latter being adapted to be anchored in the concha of the outer ear and having a portion normally lying behind the tragus. The sound tube desirably has a compound curve which may, for example, comprise two right angle bends in different planes, the tube passing from one directly into the next. The end of the tube passes through the mold and has telescopically sleeved onto it the mounting tube of the tip. External formation of the sound tube is such that when it is swiveled to the position of use, a portion of the tube extends upwardly behind the tragus of the wearer's ear, locking the mold in the ear. This position of the parts would not permit the mold to be inserted or removed but for the fact that the sound tube is swiveled in the mold and can readily be moved pivotally to and from this locking position.

It will be understood that the insert comprising the mounting tube and the mushroom-shaped flanges can be used independently of any mold both for hearing aid purposes and for purposes of an ear stopper.

In fact, the mounting tube may be extended beyond the outermost flange and provided with a substantially closed end so slit that it may readily open when manipulated by the wearer's hand, but will normally be closed to exclude both water and sound. The opening of the slit end by manipulation is desirable because it precludes the trapping of air during manipulation of the insert into and from the auditory canal.

In the drawings:

FIG. 1 is a view in perspective showing a hearing aid device embodying the invention.

FIG. 2 is a view in axial section through the device of FIG. 1.

FIG. 3 is a detail view of the portion of the sound tube which is swiveled in the ear mold in the device of FIG. 1 and FIG. 2.

FIG. 4 is an enlarged detail view in axial section of a modified type of ear insert suitable for use as a stopper.

FIG. 5 is a view in axial section of a further modified ear insert embodiment.

The mold 10 may be of any conventional design. As shown, it includes an extension 11 formed to extend behind

the tragus of the wearer's ear. Extending through the mold is a hole at 12 in which there is mounted a sound tube 13 having a portion 14 projecting beyond the mold to mount the tip hereinafter described. The sound tube can be swiveled in the mold to oscillate between the full and dotted line positions in which it is illustrated in FIG. 1. As it issues from the mold, it is bent at 15 to extend laterally toward a point beneath the tragus anchor 11 of the mold. Upon reaching a point beneath mold portion 11, the sound tube is bent upwardly at 16 to receive sound tube extension 17 which leads to it from the speaker 18, wherever that be located. As the art well knows, there are various other potential arrangements for the speaker, including direct connection with the straight portion of tube 13 immediately adjacent the mold, thereby dispensing with the curves 15 and 16 above described. The arrangement disclosed, however, is the more usual one and it has the advantage that in the use of the device, with the mold 10 in the wearer's ear, the extension 17 of the sound tube passes directly in front of the mold extension 11 to lock the mold into the ear. For manipulation of the mold to or from position of use, the sound tube 13 is swung to the position illustrated in full lines in FIG. 1. Only after the mold is in place is the sound tube swung to the dotted line position and passed behind the ear.

The invention contemplates the use of materials of three different and distinct degrees of stiffness. The sound tube 13, 14, 15, 16 and 17 is flexible but offers considerable resistance to bending. It is relatively stiff. The insert mounting tube 20 has only sufficient stiffness so that it can be used to force the insert portion of the device into the ear canal. It should be sufficiently flexible to follow readily the bends in the ear canal, no two canals being alike. The annular flanges 21, 22, 23 and 24 which comprise the head portions of successive mushroom-shaped units are very soft indeed, being readily foldable inwardly in the manner indicated in dotted lines in FIG. 4. These are desirably made of plastic material of progressively increasing radius. They also may be natural or synthetic rubber of any adequately soft synthetic resin or sponge. The largest flange 24 desirably has a generally cylindrical skirt portion 25 which, under water pressure, would completely seal access to the ear canal.

The several flanges 21, 22, 23 and 24 desirably have hub sleeve portions 26, 27, 28, 29. Each is provided with an annular seat for the end of the next. The seat 30 of hub portion 26 receives an annular stop desirably in the form of a flange or ring 31 which is desirably molded integrally with the inner end of mounting tube 20. The tubular hub sleeve portion 29 of the outer flange 24 may taper as shown, since it does not have any interlocking connection with any other part. The other hub sleeve portions are simply beveled at their ends to engage in the successive seats provided by the hub sleeve portions of successive flanges.

In the device shown in FIG. 4, the mounting tube 20 extends outwardly well beyond the external ear and is provided with a normally closed tip 32 which may taper to a blunt point. This tip is divided into two parts by a normally closed transverse slit at 33 which extends beyond the relatively heavy portion 34 wherein the internal passage 35 is greatly reduced as compared with the normal cross section of the mounting tube 20.

The device as shown in adapted for use as an ear stopper to be worn by divers to exclude water or to be worn by any person during sleeping periods to exclude sound. The arrangement is such that the projecting portion of the mounting tube may be used as a handle to manipulate the stopper into and from the ear. In the course of such manipulation, pressure on the mounting tube will spring the parts 36 and 37 open as indicated in

dotted lines in FIG. 4, thereby placing the interior of the mounting tube in communication with the external atmosphere so that air cannot be trapped to increase or decrease pressure in the wearer's ear during insertion or removal of the plug. Such trapping would inevitably occur by reason of the engagement of the soft flanges 21, 22, 23 with the auditory canal of the wearer's ear but for this venting feature.

The identical device can be adapted for hearing aid use simply by cutting off unneeded portions of the mounting tube 20 where these project outwardly beyond hub 29. FIG. 2 shows the identical device remaining after the unneeded portions of the mounting tube have been removed. The retained portion of the mounting tube is then sleeved onto the inwardly projecting end 14 of sound tube 13 to seal the wearer's auditory canal against sound other than such as is supplied through the sound tube.

In the alternative arrangement of FIG. 5, the head portion flanges 210, 220 and 230 correspond to flanges 21, 22 and 23 of the device heretofore described except that they comprise synthetic sponge rubber. Their hub sleeve portions 260, 270 and 280 are all tapered so that each successively applied head portion flange slides up onto the tapered hub sleeve portion of the flanged unit which precedes it.

It will be understood that in any of these devices it is perfectly practicable to use only one head portion flange if desired, it being intended that as many auxiliary units will be supported on the mounting tube as may be required for the particular installation. The illustration of three flanges in FIG. 5 and four in FIGS. 1, 2 and 4 merely represents normal conventional practice and is merely by way of exemplification. The head portion flanges may also be of any appropriate radius, being freely selectively applicable to the mounting tube.

The fact that these head portion flanges are made of ultra soft material as described not only enables them to conform to any ear canal without undue pressure, but also enables them to change their form to accommodate changes in the ear canal such as occur constantly as the wearer chews or speaks or otherwise moves the muscles affecting the shape of his ear canal. Moreover, the very softness of these flanges so completely eliminates "feedback" that this is not a problem at any normal speaker volume. In many hearing aids, sound waves communicated to the ear canal through the sound tube are mechanically transmitted from the wall of the auditory canal back through the ear plug to the speaker, causing whistle. In actual tests, it has been found that whistle is almost completely absent in the use of the insert here described and occurs only when the volume of sound delivered from the speaker is so excessive as to be abnormal.

I claim:

1. An auditory canal insert comprising a mounting tube portion and an annular peripherally flanged head portion mounted thereon, the said head portion comprising material too soft to maintain its form when pushed into the ear and the mounting tube portion constituting a flexible tubular support of sufficient stiffness to be used as a means of inserting the head portion and to maintain an open passage therethrough, the mounting tube portion having a terminal stop and the head portion comprises a tubular hub sleeve seated against said stop.

2. The device of claim 1 in further combination with at least one additional head portion comprising an annular flange and a tubular hub sleeve through which the mounting tube extends, the tubular hub sleeve engaging the hub sleeve of the first mentioned head portion.

3. An auditory canal insert comprising a mounting tube portion and an annular peripherally flanged head portion mounted thereon, the said head portion comprising material too soft to maintain its form when pushed into the ear and the mounting tube portion constituting a flexible tubular support of sufficient stiffness to be used as a means of inserting the head portion and to maintain an open passage therethrough, the head portion comprising a tubular hub sleeve through which the mounting tube portion extends and in further combination with a plurality of additional head portions each comprising a soft annular flange and a hub sleeve through which the mounting tube portion extends, the several hub sleeves being in end to end engagement.

4. The device of claim 3 in which each hub sleeve has a terminal annular seat adapted to receive the hub sleeve of a preceding head, the mounting tube portion having a seating flange engaging the seat of the hub sleeve of the innermost head.

5. An auditory canal insert comprising a mounting tube portion and an annular peripherally flanged head portion mounted thereon, the said head portion comprising material too soft to maintain its form when pushed into the ear and the mounting tube portion constituting a flexible tubular support of sufficient stiffness to be used as a means of inserting the head portion and to maintain an open passage therethrough, and a concha mold having a sound communicating tube extending therethrough and with which the said mounting tube portion is in telescopic connection.

6. The device of claim 5 in which the mold has an extension adapted to lie behind the tragus of the wearer's ear, the sound tube being swiveled in the mold and having an extension upwardly in proximity to the mold extension and movable upon the swiveled connection of the sound tube with the mold to and from tragus-embracing position.

7. In a device of the character described, the combination with a concha mold having an extension adapted to project behind the tragus of the wearer's ear, of a sound tube with which the mold has a swiveled connection, said tube communicating therethrough with the auditory canal of the wearer, said sound tube including a portion movable upon said swiveled connection to and from a position opposite said mold extension.

8. The device of claim 7 in further combination with an auditory canal insert mounted on the sound tube, the sound tube having a portion extending through the mold for the support of the insert.

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