March 20, 1956 K. O. TOOKER 2,738,850

ARTIFICIAL HEARING AID

Filed Aug. 30, 1951

Fig. 1.

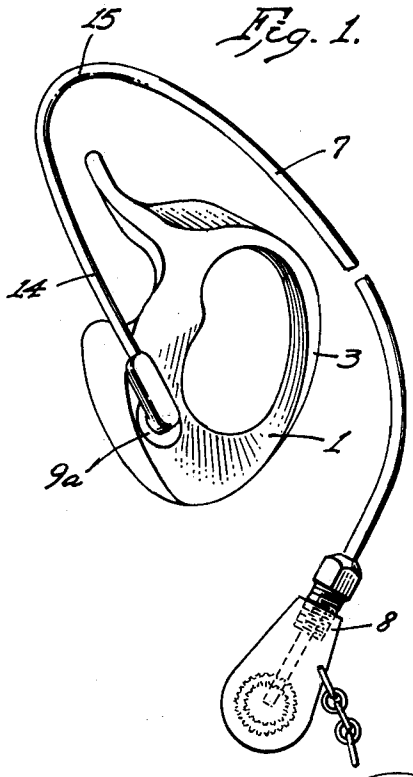
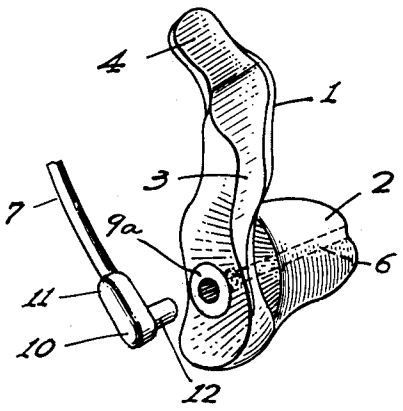


Fig. 2.



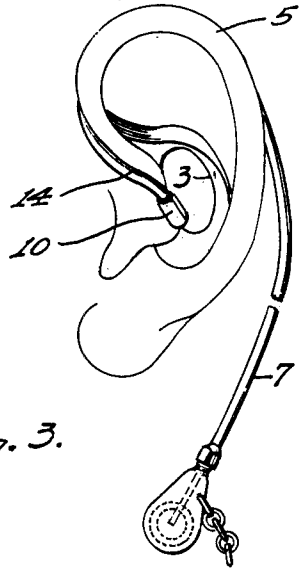


Fig. 3.

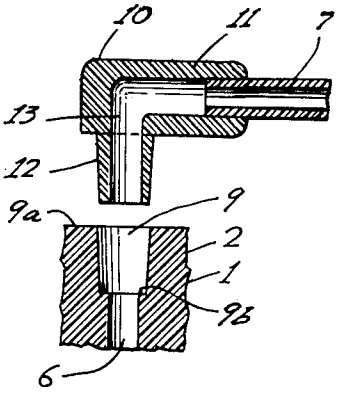


Fig. 4.

INVENTOR.
Kenneth O. Tooker.
BY
Christy, Parmelee & Strickland
ATTORNEYS.

United States Patent Office 2,738,850 Patented Mar. 20, 1956

2,738,850

ARTIFICIAL HEARING AID

Kenneth O. Tooker, Pittsburgh, Pa.

Application August 30, 1951, Serial No. 244,327

3 Claims. (Cl. 181—23)

This invention relates to artificial hearing aids and, more particularly, to improvements which increase the life and improve the operation of certain attachments which are connected to the ear of the person using the apparatus.

More specifically, this invention is concerned with artificial hearing aids of the type in which a transparent plastic mold is inserted in the wearer's ear. This ear mold has an entry portion which is inserted in the auditory canal of the wearer's ear and a mounting portion which is engaged with the helix of the ear to secure it in position. The entry portion receivable in the auditory canal is provided with a drilled opening which has its inner end terminating adjacent the ear drum or auditory nerve and a flexible tube of transparent plastic permanently connected with the outer end thereof. The flexible tube is hooked over the upper edge of the ear so as to form an additional support for the ear mold and so that the plastic tube may be partially concealed by the ear. This tube is connected with sound amplifying apparatus, and in conjunction with the drilled opening of the ear mold forms an artificial extension of the auditory canal.

In conventional forms of apparatus of the character just referred to, the transparent flexible tube is provided with a short section which has a fused or otherwise permanent attachment to the ear mold at the outer end of its drilled opening. This short section of tubing is a source of trouble in conventional apparatus, in that kinks or bends formed therein reduce the size of the opening or auditory canal extension provided by the tube. If the bends or kinks formed in the tube are sufficiently sharp, the passageway in the tube will be completely shut off, and this will require replacement of the tube. Manipulation, even though carefully done, of the ear mold when it is inserted in the wearer's ear, results in severe flexing and twisting of the tube section particularly at its point of connection thereto, and this enhances the possibility of forming damaging kinks in such tube section. This short section of tubing extends directly outwardly from the drilled opening and thereby forms a direct axial extension of the drilled opening and the auditory canal. This necessitates a sharp bend in the portion of the tube which extends upwardly and hooks over the wearer's ear, and increases the likelihood of formation of damaging kinks or bends of a type which will close the opening in the tube and render the apparatus inoperative. Failure of the tube in this manner, as well as failure due to hardening and discoloration resulting from body contact, necessitates return of the ear mold to the maker for replacement of the flexible tube attached thereto.

One of the principal objects of this invention is to provide an improved connection of the flexible tube to the drilled opening in the ear mold which will eliminate the necessity of sharp bends in the flexible tubing and thereby reduce the possibility of kink formations which will render the tube inoperative. This improved connection comprises an L-shaped fitting at the outer end of the drilled opening in the ear mold which provides

a connecting passage-way at a sharp or right angle to the drilled opening in the ear mold. Due to the fitting providing this L-shaped passage-way being constructed of relatively hard and rigid material, there is little possibility of damage to the auditory canal extension formed by its L-shaped passage-way. The provision of the L-shaped passage-way further enables the flexible tubing connected thereto to be trained directly upwardly over the upper edge of the wearer's ear without any kinks or sharp bends therein, and thereby reducing the possibility of failure.

A further object is to provide a removable connection between the mold and tubing which will enable the drilled opening in the mold to be cleaned of wax.

Another object of this invention is to provide a removable connection for the flexible tubing at the point at which it joins with the drilled opening in the ear mold.

A further object of the invention is to provide a removable connection of the character referred to which has an L-shape with one arm of the connection being receivable in an enlarged opening formed at the outer end of the drilled opening, the enlarged opening and portion of the L-shaped fitting receivable therein having a taper of a character to be described.

Other objects and advantages of the invention will be apparent from the following description. In the drawings there is shown a preferred embodiment of the invention. In this showing:

Fig. 1 is a perspective view illustrating the improved connection of the flexible tube with the ear mold;

Fig. 2 is a perspective view of the apparatus shown in Fig. 1 taken from a different angle;

Fig. 3 is a perspective view similar to Fig. 1 showing the apparatus in position on a person's ear; and

Fig. 4 is an enlarged fragmentary sectional view of the ear mold and the detachable fitting connection.

In the drawings, the numeral **1** designates as a whole an ear mold which is insertable in the ear of a wearer in a manner to be described. The ear mold **1** is preferably molded from a hard and transparent plastic material which is sufficiently rigid to hold its shape in use. Suitable molding materials for this purpose are methyl methacrylate, polystyrene, cellulose acetate, vinyl acetate, or other suitable plastic materials having similar characteristics. The ear mold **1** is provided with a protruding portion **2** which is insertable or receivable in the auditory canal of the wearer. The protruding portion **2** has connected thereto a band **3** which is engageable in the helix of the ear and has a hook **4** receivable in the fossa of the anti-helix to maintain the mold **1** in position in the wearer's ear. In Fig. 3, the numeral **5** designates a human ear and shows the mold **1** therein in its mounted position. The part **2** has a drilled opening **6** formed therein for connection with a flexible tube **7**, which has a connector at its terminal **8** for connection to sound amplifying apparatus (not shown). The tube **7** conducts sound from the amplifying apparatus to the opening **6** and thereby to the ear.

In accordance with the principles of this invention, the ear mold has an enlarged opening **9** formed at the outer end of the drilled opening **6**. A flat area **9***a* is formed about the outer end of the opening **9** for a purpose to be described. The opening **9** terminates in an annular ledge **9***b* spaced inwardly from the area **9***a*. The flexible tube **7**, at the end thereof connectible to the ear mold **1**, is provided with a rigid transparent plastic fitting **10** of L-shape having an arm **11** permanently connected to the end of the tube **7** as shown in Fig. 4, and an arm **12** for detachable engagement with the ear mold **1**. The fitting **10** is molded of the same type of plastic material as the mold **1**. The arms **11** and **12** have drilled openings at right angles to each other for connecting the tube

7 to the drilled opening 6. The arm 12 has an axial taper converging downwardly as viewed in Fig. 4, and the opening 9 has a similar taper diverging in an upward direction away from the ledge 9b as viewed in Fig. 4. The taper of the arm 12 and the opening 9 need be only very slight, forming an angle with their axes in the nature of about 1° to 1½°, but is essential in the provision of an airtight seal when the part 12 is inserted in the opening 9. When the part 12 is inserted in the opening 9, there is provided an air-tight seal between the outer surface of the part 12 and the inner surface of the part 9, and the passage-way 13 in the fitting 10 will form an extension of the opening 6 connecting it with the flexible tube 7. The axial tapers of the parts 12 and 9 greatly facilitate the formation of an air-tight seal when fitted together. In addition, the provision of the flat area 9a about the opening 9 provides a surface against which the under side of the arm 11 may abut to limit movement of the part 12 into the opening 9 and thereby prevent its wedging in the opening 9 so tightly that it cannot be removed. The arm 12 has an axial length substantially the same as the length of the opening 9, so that its outer end will engage with the ledge 9b when fitted in position in the opening 9.

By reason of the shape of the fitting 10, and its L-shape particularly, it will be noted that, referring to Figs. 1 and 3, the end portion 14 of the tube 7 extends directly upwardly from the ear mold 1 without any kinks or bends therein so that its upper loop 15 may be hooked over the upper edge of the wearer's ear as shown in Fig. 3 without any hooks or sharp bends in the tube 7.

Another desirable advantage is provided by the fitting 10 in that the tube 7 may be replaced by the wearer in the event of damage thereto without returning the mold to the maker as is necessary with present conventional constructions. A further advantage is provided by the detachable fitting in that, upon removal, wax may be cleaned from the drilled opening in the ear mold.

Attention is also directed to the fact that the taper of the fitting part 12 and the opening 9 enables a friction grip for securing connection parts together, which moreover provides an effective air seal. This air seal isolates the column of air in the passage-way formed by the openings in the tube 7, fitting 10, and the drilled opening 6 which, it will be noted, are of the same size. Since the passage-way 13 through the fitting 10 is the same size as the opening 6, and since the arm 12 has a length about the same as the length of the opening 9, the opening in the arm 12 will be a smooth continuation of the opening 6, thereby offering a minimum of disturbance to the transmission of sound through the opening 6.

As apparent from the drawings, the end of the tube 7 is connected to the fitting 10 by insertion in the opening 13 extending through the arm 11. Before insertion, the end of the tube 7 is softened by dipping in a solvent therefor, such as liquid cellulose acetate or other suitable material, so that it will adhere tightly in the fitting 10 after insertion.

While I have illustrated and described certain specific embodiments of my invention, it will be understood that this is merely by way of illustration, and that various changes and modifications may be made therein within the contemplation of my invention and under the scope of the following claims.

I claim:

1. In artificial hearing apparatus of the type comprising a molded plastic ear piece of integral construction having an entry portion for insertion in the auditory canal of an ear and a mounting portion for mounting engagement in the helix of the ear and a sound conducting opening extending through said entry portion, and a flexible tube for conducting sound to said sound conducting opening, the invention which comprises a detachable friction conection between the ear piece and tube, said connection comprising a part in the form of a plug secured to the end of said tube and a part integral with said ear piece having an opening enlarged with respect to and aligned with said sound conducting opening in which said plug part is received, said plug part and ear piece part having surfaces frictionally engaged when said plug part is inserted in said enlarged ear piece opening and providing a frictional-holding and air-sealing connection between said parts and at least one of said surfaces having a taper in a direction axially of said sound conducting opening to facilitate insertion of the plug in said enlarged opening and the formation of said connection.

2. In artificial hearing apparatus of the type comprising a molded plastic ear piece of integral construction having an entry portion for insertion in the auditory canal of an ear and a mounting portion for mounting engagement in the helix of the ear and a sound conducting opening extending through said entry portion, and a flexible tube for conducting sound to said sound conducting opening, the invention which comprises a detachable friction connection between the ear piece and tube, said connection comprising a part of molded rigid plastic material in the shape of an L having one arm connected with said tube and its other arm in the form of a plug, said arms respectively having axially extending openings which intersect at their point of connection to each other, and a part integral with said ear piece having an opening enlarged with respect to and aligned with said sound conducting opening in which said plug arm is received, said plug arm and ear piece part having surfaces frictionally engaged when said plug arm is inserted in said enlarged ear piece opening and providing a frictional-holding and air-sealing connection between said parts and at least one of said surfaces having a taper in a direction axially of said sound conducting opening to facilitate insertion of the plug arm in said enlarged opening and the formation of said connection.

3. An apparatus as defined in claim 2 characterized by said one arm and ear piece part having surfaces in abutting engagement when said plug arm is inserted in said enlarged opening, and in which said one arm extends in an upward direction with respect to the ear in which said ear piece is inserted.

References Cited in the file of this patent

UNITED STATES PATENTS

1,581,700	Summer	Apr. 20, 1926
1,753,817	Aber	Apr. 8, 1930
1,755,775	Dunn	Apr. 22, 1930
1,824,427	Fensky	Sept. 22, 1931
2,169,194	Geyer	Aug. 8, 1939
2,535,258	Bland	Dec. 26, 1950
2,545,731	French	Mar. 20, 1951
2,573,132	French	Oct. 30, 1951
2,584,402	Volkmann	Feb. 5, 1952