HEARING AID COUPLING

Arthur O. Crosby, Minneapolis, Minn., assignor to The Telex Corporation, Tulsa, Okla., a corporation of Delaware

Filed Nov. 29, 1965, Ser. No. 510,186
U.S. Cl. 179—442
Int. Cl. H04r 1/10, 25/00, 25/02
6 Claims

ABSTRACT OF THE DISCLOSURE

A hearing aid ear mold coupling having a relatively soft socket for removably receiving the end of a sound tube that is connected to a source of compressional wave energy. The remainder of the body of the ear mold is comprised of material exhibiting a relatively higher or lower durometer characteristic. The relatively soft and resilient socket connects with a sound duct extending through the ear mold and is provided with an enlarged chamber intermediate its ends and the end of the sound tube that is removably insertable into the soft and resilient socket is of complementary shape with respect to the enlarged chamber and is comprised of material exhibiting a relatively higher durometer characteristic with respect to the relatively soft and resilient socket.

This invention relates generally to hearing aids and is more particularly directed to a device and apparatus for coupling compressional wave energy from an external source to an ear mold disposed in the ear of a user of hearing aid apparatus.

In prior art apparatus of the type with which my invention is concerned, a source of compressional wave energy, such as a microphone-amplifier-receiver contained in an eyeglass temple member, is and has been coupled to a device adapted to be inserted and retained in the ear canal of a user through a means for conveying compressional wave energy, for example, a sound tube comprised of flexible plastic material. Under many normal conditions, experience has shown that the user of such apparatus will desire to remove the source of compressional wave energy from his body but still retain the ear canal enganging device in his body. One such experience might involve the removal of an eyeglass type of hearing aid for substituting an amplified source of compressional wave energy, a telephone with suitable amplifying means or a listener's headset which may provide compressional wave energy at a sufficient volume, or power output, to enable the user to hear without the use of his hearing aid device. In the most commonly accepted and used device of this nature, the ear mold, or device inserted in the ear canal of a user, is customarily permanently attached to the hearing aid device through a sound tube and must, of necessity, be completely removed from the ear canal of a user before the hearing aid device may be removed from the body of a user. Under such normal conditions, it may easily be seen that removal of the eyeglasses for cleaning or replacement of a battery will require the removal, also, of the ear mold, which, as will be set forth below, is undesirable and unnecessary when my invention is utilized.

It may further be noted that the known prior art devices have incorporated a rigid connection between the flexible sound tube and the ear mold and this has resulted in stresses and strains being applied to the sound tube itself whereby breakage which is considered to be premature has occurred. The premature breakage and inconvenience to the user has resulted in the development of various forms of coupling devices which are intended to be operable to provide a situation wherein the ear canal engaging device may be left in place and the hearing aid device removed from the body of the wearer. One known example of such apparatus is comprised of a ferromagnetic annular insert provided around a sound canal in an ear mold and a registering cooperating magnetic device disposed around the sound outlet end of a sound tube. The magnetic coupling resulting from the force of attraction between the magnet and the ferromagnetic insert may, under suitable conditions, provide the desired degree of coupling between the sound tube and the ear mold while allowing successive and repetitive connections and disconnections.

However, this type of connector does not appear to have solved the problem of premature breakage of the sound tube because it does not provide for a satisfactory freedom of motion of the separable connector under normal operating conditions. It is therefore an object of my invention to provide an improved connector for coupling a sound tube connected to a source of compressional wave energy to an ear mold device.

A further object of my invention is to provide an improved ear mold device for use in combination with a separable sound tube connector.

Another object of my invention is to provide an improved separable coupling for a sound tube and an ear mold which comprises a ball member and a socket member, one of which is comprised of material exhibiting a higher durometer scale characteristic than the other.

A still further object of my invention is to provide an improved ball and socket separable coupling in which one of the members of the coupling is comprised of an insert to be disposed within an ear mold.

Another object of my invention is to provide an improved connector for connecting a sound tube to an ear mold which provides a three degree freedom of motion to eliminate undue stresses and strains on the sound tube under normal conditions of operation.

With these and other objects of my invention in mind, it may be seen that my invention is comprised of a separable coupling having two sections, one of which is attached to a sound tube and the other attached to an ear mold. One of the sections is comprised of a resilient socket that is adapted to receive the other section which is complementary shaped and of a rigid nature. The shape of the sections is such as to provide an effective seal for the compressional wave energy and to allow a sufficient three degree freedom of motion while maintaining a readily separable connection and effective seal to prevent loss or leakage of compressional wave energy that is being conveyed from the sound tube to the interior of the ear canal of a user through the ear mold.

Other objects and advantages of my invention may become apparent from a consideration of the appended specification, claims and drawings, in which—

FIG. 1 is a side elevation view of an eyeglass type of hearing aid apparatus disposed in operative relationship with respect to the ear of a user and embodying the principles of my invention;
FIG. 2 is a partial, enlarged, sectional view of a portion of the apparatus shown in FIG. 1 taken along section lines 2—2;

FIG. 3 is an enlarged partial sectional view of a common prior art apparatus; and

FIG. 4 is an enlarged fragmentary sectional view of a further embodiment of my invention.

Referring now to the drawings in which like elements have been identified by like reference characters, there is shown in FIG. 1 a representation of the well known, eye-glass type of hearing aid, indicated by reference 10, which includes at least one temple member 11 containing suitable hearing aid apparatus that is adapted to provide an output of compressional wave energy to a suitable flexible sound tube, 12, that is in turn connected to an ear mold 13 configured and adapted to be inserted into the ear canal of a user and which includes a sound canal disposed intermediate its inner end and its outer surface.

In FIGS. 1, 2 and 4 an ear mold 13 is shown having a sound canal 24 extending therethrough from the portion of the ear mold that is normally disposed in the external portion of the ear through the end of the ear mold that is disposed in the ear canal of a user. Ear mold 13 may be of the well known custom molded devices that are constructed of hard or soft plastic material from impressions taken, by suitable means, of the individual ears of a user. It may also be noted on FIGS. 1, 2 and 4 that the end of sound tube 12 is provided with a ball coupling 15 which, in the embodiments shown, includes a hollow right angled tube that is adapted to be connected at one end to the end of sound tube 12 and is provided with a spherical ball portion at its end extremities which includes a flared aperture in fluid communication with right angled tube 19. In one operative embodiment of my invention, ball coupling 15 was comprised of plastic material having substantial rigidity.

The embodiment of FIG. 2, a socket insert member 14 is shown disposed in a suitable recess formed in ear mold 13 at the outer end of ear canal 12. Socket member 14 includes a lower end 21 adapted to be suitably connected and held within the recess in ear mold 13, a centrally disposed aperture 25 that extends upwardly from the bottom to an enlarged spherical chamber 23 and to a conically shaped upper end 22. Socket 14 is shown dimensioned, with respect to the recess in ear mold 13, so as to provide an annular relief 20, intermediate its outer periphery and the recess in ear mold 13 so as to allow for outward expansion upon insertion and removal of a ball connector 15. Enlarged chamber 23 is shown having a shape that is complementary to the end of ball coupling 15 and is configured to provide a degree freedom of motion while maintaining an effective seal with respect to the sound energy to be transmitted therethrough.

In the embodiment of FIG. 4, an ear mold 16 is shown comprised of substantially two volumes of material, 17 and 18. The volume surrounding the outer end of sound canal 24 extending through ear mold 16, is comprised of material having a suitable durometer scale characteristic to allow for insertion and removal of ball coupling 15. In a sense, the column indicated by reference character 17 may be considered to be the same as or similar to a socket 14 and for this reason, the same reference has been applied thereto. An enlarged chamber of complementary configuration with respect to ball coupling 15 and an outwardly flaring conical portion is provided in a manner similar to that described above in connection with FIG. 2.

The embodiment shown in FIG. 3 is comprised of a right angle, preferably rigid, plastic tubing member 19 that is screw threaded at its lower end to be threadably inserted into the outer end of a sound canal 24 in an ear mold 23. Sound tube 12 is shown disposed over the outer end of angle tube 19 to provide the necessary coupling to the source of compressional wave energy contained in suitable remotely disposed hearing aid apparatus.

Referring to FIG. 3, it should be apparent to those familiar with the art with which my invention is concerned that the ear mold 13 which is threadably attached to the end of angle tube 19, must be completely removed from the ear canal of a user when the hearing aid apparatus is removed from the body of a user because it is physically attached thereto.

In the present invention, the separable connector comprised of ball coupling 15 and, in FIG. 2, socket member 14, is merely pulled apart and under slight outward pressure, the coupling will separate and the sound tube, including ball coupling 15, may be disposed in the position indicated in dotted outline on FIG. 1 of the drawings by reference character 12A. Following the separation of the connector, the eye-glass hearing aid may easily be removed from the head of the wearer and the ear mold 13 remains in place.

It should likewise follow that the same operation obtains in connection with the second embodiment of my invention shown in FIG. 4 of the drawing.

Among the salient features of my invention are the provision of the annular relief 20 in FIG. 2 which allows for ease of operation in the separation and connection of my device, and the improved durometer scale shown in FIG. 4 in which the material of which the ear mold is comprised includes at least two volumes of material having different durometer scale characteristics.

In connection with the construction of the embodiment of FIG. 2, socket 14 may preferably be comprised of material having a low durometer scale rating so that it is resilient. A suitable material for the socket 14 is the commercially available plastic material known as Geon. In the embodiment of FIG. 2, the ear mold is customarily comprised of a plastic material having a relatively high durometer scale rating.

In the embodiment of FIG. 4, one operative device was constructed in which the ear mold was comprised of soft silicone surgical rubber which, it was discovered, is particularly useful in overcoming problems arising from allergies and the like. The volume indicated by reference character 17 was comprised of a material having a higher durometer rating but in the range providing sufficient resilience characteristics to allow for easy insertion and removal of ball coupling 15.

It may be noted that the spherical configuration of chamber 23 in socket 14 and ball coupling 15 provides for a substantial and sufficient amount of freedom of motion about the three axis to permit to eliminate stresses and strains applied to the end of sound tube 12 in, for example, the illustrated prior art apparatus.

It is understood that suitable modifications may be made in the structure as disclosed, provided such modifications come within the spirit and scope of the appended claims. Having now therefore fully illustrated and described my invention, what I claim to be new and desire to protect by Letters Patent is:

1. Sound tube coupling apparatus comprising in combination;

(a) an ear mold adapted to be disposed in the ear canal of a user, said ear mold including a sound canal for conveying sound energy therethrough and a relatively soft, resilient insert having a longitudinal aperture disposed in registration with the sound canal and an enlarged spherical chamber intermediate its ends, said insert being disposed on the outer end of the ear canal; and

(b) a flexible sound tube adapted to be connected at one end to a source of compressional wave energy and including a connecting means at the other end, said connecting means including an enlarged spherical portion of complementary dimension with respect to the spherical chamber in said resilient insert and of relatively hard rigid material, said enlarged spherical
portion being operative to rotatably, removably engage the insert in the outer end of the ear canal in said ear mold.

2. The apparatus of claim 1 in which an annular relief is provided around the outer periphery of the insert over the portion of the insert surrounding the spherical chamber.

3. The apparatus of claim 1 in which the outer end of the insert is flared radially outwardly.

4. The apparatus of claim 2 in which the outer end of the insert is flared radially outwardly.

5. The apparatus of claim 1 in which the insert is comprised of material having a lower durometer characteristic than the remainder of the ear mold.

6. The apparatus of claim 1 in which the insert is comprised of material having a higher durometer characteristic than the remainder of the ear mold.