May 18, 1954 W. E. NEWMAN 2,678,973

MOUNTING FOR HEARING AID RECEIVERS

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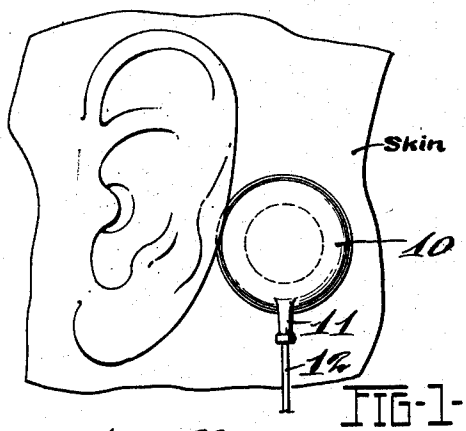


FIG-1-

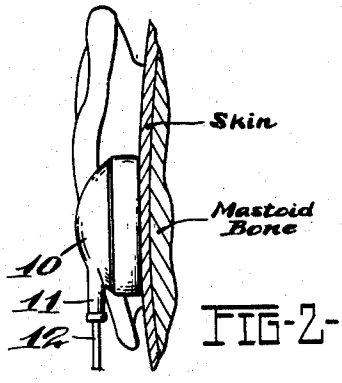


FIG-2-

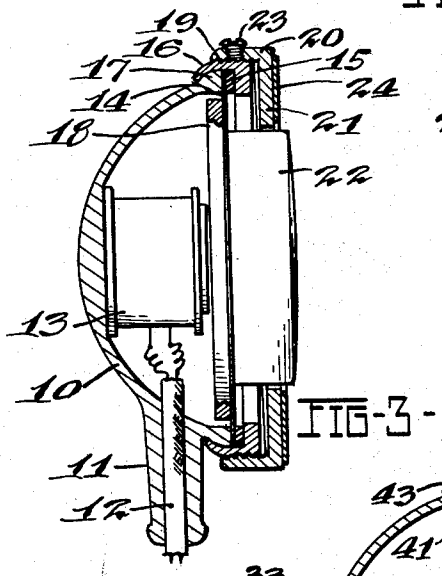


FIG-3-

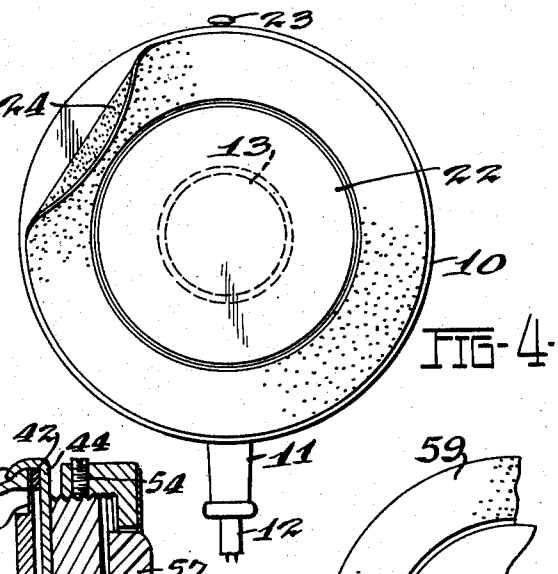


FIG-4-

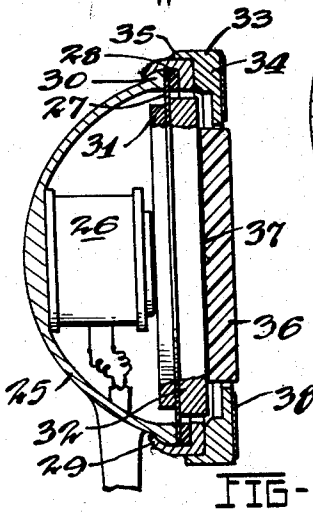


FIG-5-

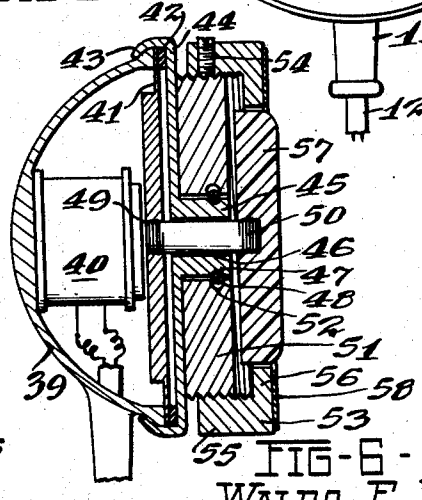


FIG-6-

FIG-7-

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MOUNTING FOR HEARING AID RECEIVERS

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2 Claims. (Cl. 179—107)

1

This invention relates to hearing aid receivers and, more particularly, to means for securing a bone conduction type receiver to the head of the user.

Hearing aid receivers, in general, may be divided into two classes. These classes are (1), the air conduction type which usually is secured to a molded insert that fits the interior of the outer ear and in which sound is conducted through the air from the receiver unit into the ear passageways and (2), the bone conduction type in which the hearing aid receiver is mounted back of the ear and over the mastoid bone, the sound being conducted directly from a vibratory part of the receiver through the skin to the mastoid bone and thus to the audile nerves of the user.

One way of securing a bone conduction receiver in place on the head of a user is by mounting it on the end of a resilient clamp which is stretched over the top of the head; but this method of mounting is less than desirable because not only does it disturb the hair of the user, but it focuses other persons attention on the fact that he is wearing a hearing aid. Furthermore, it is difficult to adjust the pressure of the clamp so that the hearing aid receiver is held tightly enough against the head of the user to transmit the sound and not tight enough to become painful.

A relatively recent improvement in hearing aid receivers of the bone conduction type, has been the use of a thickened receiver diaphragm which projects out of the receiver housing and which is directly adhered to the skin of the wearer by the use of an adhesive disc or other adhesive material. This type of bone conduction receiver usually has a small, molded, generally hemispherical, housing with a generally flat disc-like, magnetically actuated diaphragm projecting far enough out of the housing so that the diaphragm can be adhered to the user's skin, without placing the housing itself in contact with the skin.

This type of bone conduction receiver has advantages over the clamp-on type in that it is less obvious and thus more flattering to the wearer and it is not as uncomfortable to wear because the only pressure on the head is created by the relatively little weight of the receiver itself. This type of receiver, however, has one serious drawback. With the receiver diaphragm adhered to the skin of the wearer, approximately half of the effective vibratory sound transmitting force of the receiver is dissipated by vibrating the receiver housing in the air.

It is an object of this invention to provide an improvement in bone conduction type receivers

2

for hearing aids in which the efficiency of transmission from the receiver diaphragm to the skin of the wearer is greatly increased over that of the present forms.

It is another object of this invention to provide an improvement in adhesively attached bone conduction hearing aid receivers, which effectively holds the receiver housings substantially motionless, so that much higher efficiency of transmission of sound from the vibratory diaphragm to the mastoid bone, is achieved.

It is a further object of this invention to provide adaptors for standard types of hearing aid receivers, i. e., both air conduction and bone conduction receivers, which will impart to such receivers the improved operation of bone conduction receivers embodying the instant invention.

Other and more specific objects will be apparent from the drawings, in which:

Fig. 1 is a fragmentary view in elevation showing a hearing aid receiver embodying the invention in place on the skin of a wearer over the mastoid bone immediately to the rear of the wearer's ear.

Fig. 2 is a fragmentary view partly in section taken from the right side of Fig. 1 and showing a side elevation of a hearing aid receiver embodying the invention.

Fig. 3 is an enlarged vertical sectional view of a bone conduction hearing aid receiver embodying the instant invention.

Fig. 4 is a view in elevation taken from the right side of Fig. 3.

Fig. 5 is a vertical sectional view similar to Fig. 3 but of an adhesive type bone conduction hearing aid receiver equipped with an adaptor through the use of which the benefits deriving from the instant invention may be achieved.

Fig. 6 is a view similar to Figs. 3 and 5 but of a standard air conduction hearing aid receiver equipped with a second modification of adaptor from which the benefits and improved results of the instant invention are derived.

Fig. 7 is a fragmentary view in elevation of a portion of the hearing aid receivers shown in Fig. 6.

Modern hearing aid receivers, regardless of the general type in which they are classified, usually each consist in a molded, generally hemispherical housing 10 having a neck 11 through which an electrical conductor 12 leading from the amplifier is introduced. A bone conduction hearing aid receiver is affixed to the skin of a user immediately behind one of the user's ears, as is shown in Figs. 1 and 2, so that the vibrations

transmitted by the receiver pass with little interference or loss through the skin and to the mastoid bone and thus to the audile nerve of the user. The electrical conductors 12 are connected to the sound receiving and amplifying components of the hearing aid and to an electromagnet 13 mounted in the interior of the housing 10.

In Fig. 3, which illustrates a bone conduction receiver constructed in accordance with the instant invention, a diaphragm 14 is placed across the open equatorial end of the housing 10 and retained in place thereon by a gasket ring 15 and a spun over metal bezel 16, which is formed around an annular bead 17 at the rim of the housing 10. The diaphragm 14 may be equipped with a metal disc 18 acting as the armature for the electromagnet 13. The peripheral edge of the ring 19 is provided with a series of threads 19 for the reception of an interiorly threaded annular metal ring 20 having an inwardly directed, radial flange 21. A thick disc-like plunger 22 is secured to the exterior side of the diaphrgam 14 and projects through the opening in the annular ring 20. The outer surface of the plunger 22 may be slightly convex to conform itself to the slight depression in the skin of the wearer which results when the unit is mounted in place. A set screw 23 is threaded through the peripheral flange of the annular ring 20 and engageable with the threads 19 on the bezel 16.

A hearing aid receiver embodying the invention as disclosed in Fig. 3 is mounted in place on the skin of a wearer by the use of an annular, double surface adhesive ring or washer 24 which adheres to the radially extending flange 21 of the ring 20 and also to the skin of a wearer. In placing the hearing aid receiver on the skin of the wearer a technician first adheres a fresh adhesive ring 24 to the flange 21 and then after loosening the set screw 23 rotates the ring 20 relative to the housing 10 until the plunger 22 protrudes through the opening in the ring 20 and slightly beyond the plane of the skin-side surface of the adhesive ring 24. The hearing aid receiver is then pressed in position on the skin of the user and, depending upon the elasticity of the user's skin, the amount of pressure against the user's skin exerted by the protruding surface of the plunger 22 can be adjusted by rotating the ring 20 until the most nearly perfect sound transmission between the plunger 22 and the mastoid bone is achieved. The set screw 23 is then tightened and the hearing aid receiver is in position for use.

Because the adhesive ring 24 adheres the housing 10 to the skin of the wearer, the inertia of this heavier portion of the hearing aid receiver serves as a substantially motionless base against which the diaphragm 14 and its plunger 22 vibrate to transmit force and sound to the skin and the mastoid bone. It has been found that by thus adhering the housing rather than the diaphragm to the skin of the wearer the efficiency of the transmission of sound is more than doubled and less interfering receiver noise is transmitted with a lower power output.

Fig. 5 illustrates an adaptor means for accomplishing the object of the instant invention by modification of a prior art bone conduction, adhesive type receiver originally designed for adhering the diaphragm to the skin of the wearer. A bone conduction, diaphrgam adherence, receiver unit consists in a molded, generally hemispherical housing 25 in which is located the conventional electromagnet 26 and which has a diaphragm 27 retained in place by a washer 28 and metal bezel 29 spun around a molded shoulder 30 at the edge of the housing. A metal plate 31 is attached to the inner side of the diaphragm 27, serving as an armature for the magnet 26. A diaphragm plunger 32 is secured to the outer surface of the diaphragm 27 and designed to protrude a slight distance through the opening formed by the inner edge of the bezel 29. In the normal use of this prior art adhesive bone conduction receiver, an adhesive disc would be adhered to the surface of the plunger 31 and this disc in turn adhered to the skin of the wearer. As already explained, adhering the diaphragm plunger itself to the skin of the wearer has the disadvantage that the housing is free to vibrate and a large percentage of the sound is lost by its vibration, being dissipated in the air.

An adaptor to accomplish the objects of the instant invention by modifying a diaphragm adherence, bone conduction receiver unit may consist in a metal bezel or adaptor ring 33 which has an inwardly directed radial flange 34 and a rearwardly directed peripheral flange 35 that fits over the original receiver bezel 29 and can be quickly and easily placed thereon, for example, by cementing it in place. A second adaptor plunger 36 is adhered by means of an adhesive disc 37 to the original diaphragm plunger 32. An adhesive annulus 38, similar to the adhesive annulus 24 in the receiver illustrated in Figs. 3 and 4, is provided for adhering the unit to the skin of the user. Adaptor plungers 36 having various thicknesses may be provided so that, after appropriate testing, an adaptor plunger of a thickness correct to compensate for the elasticity of the particular user's skin and thus to provide for the most efficient transmission of sound, may be given to the user. The adaptor equipped bone conduction receiver is implaced on the user's head in the same manner as the embodiment of the invention disclosed in Figs. 3 and 4.

In Fig. 6 there is illustrated an air conduction hearing aid receiver showing how it can be provided with an adaptor by the use of which the benefits of the instant invention can be achieved. In common with other hearing aid receivers, an air conduction hearing aid receiver comprises a hemispherical housing 39 containing an electromagnet 40 and having a diaphragm 41 which is retained in the housing by a gasket 42 and a peripheral flange 43. In an air conduction type receiver unit the flange 43 is a part of a cover 44 which substantially closes the flat face of the housing 39, being provided with an axially extending projection 45 through which an axial hole 46 is formed. An annular depression 47 is cut or molded in the periphery of the projection 45 and a snap ring 48 fits in the depression 47.

The elements of the device shown in Fig. 6 which have so far been described are conventional in air conduction receivers. In their normal use a molded ear plug is secured on the projection 45 by the snap ring 48 and the ear plug is inserted into the outer ear of the wearer.

Fig. 6 illustrates how an air conduction hearing aid receiver can be modified to accomplish the objectives of the instant invention and derive the benefits procurable therefrom. A hole 49 is drilled and threaded at the center of the diaphragm 41 for the reception of an axially extending plunger pin 50. The pin 50 extends through the hole 46 in the projection 45, extending beyond the end of the projection 45. An adaptor plate 51 having an inner annular groove

52 is snapped over and held in place by the split ring 48. The peripheral edge of the plate 51 is threaded to receive an annular, flanged ring 53 having inner threads. A set screw 54 extends through a peripheral flange 55 of the ring 53 and is engaged with the threaded surface of the adaptor disc 51. The ring 53 has an inwardly directed radial flange 56 leaving a central opening in which is located a plunger disc 57 that is cemented or otherwise secured on the outer end of the plunger pin 50. An adaptor ring 58 may be adhered to the radial flange 53 in the manner already described with respect to the receivers shown in Figs. 3, 4 and 5 and the entire unit is mounted on the skin of the wearer and adjusted for the maximum efficiency in sound transmission.

In Fig. 7 there is shown a fragmentary view in elevation, particularly illustrating a fragment of the radial flange 56 of the ring 53 and showing how instead of the annular double surface adhesive disc 58, a liquid adhesive 59 may be spread on the flange 56 to adhere the receiver in place on the skin of a user.

Having described an entire hearing aid receiver embodying my invention and modifications of adaptor means by which standard hearing aid receivers can be modified to constitute modifications of my invention, I claim.

1. In a hearing aid having a housing and a vibratory diaphragm, in combination, a plunger affixed to the outer side of said diaphragm for

contacting the skin of the user and transmitting vibrations thereto, a member mounted on said housing and extending peripherally around said plunger, adhesive means for adhering said member and thus said housing to the skin of a user, and plunger mounting means whereby the skin contacting end of said plunger protrudes beyond the plane of the skin contacting side of said adhesive means, whereby the skin contacting end of said plunger is pressed tightly against the skin of the wearer and sound transmitting vibrations are transferred directly to the skin.

2. A hearing aid according to claim 1 in which the plunger mounting means is adjustable to vary the distance which the skin contacting end of the plunger protrudes beyond the plane of the skin contacting side of the adhesive means, whereby the degree of pressure exerted against the skin of the wearer may be varied to accommodate conditions encountered in different wearers.

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