

[72] Inventor **Rubein V. Johnson**
 2432 Court St., Muskogee, Okla. 74401
 [21] Appl. No. **41,812**
 [22] Filed **June 1, 1970**
 [45] Patented **Aug. 31, 1971**

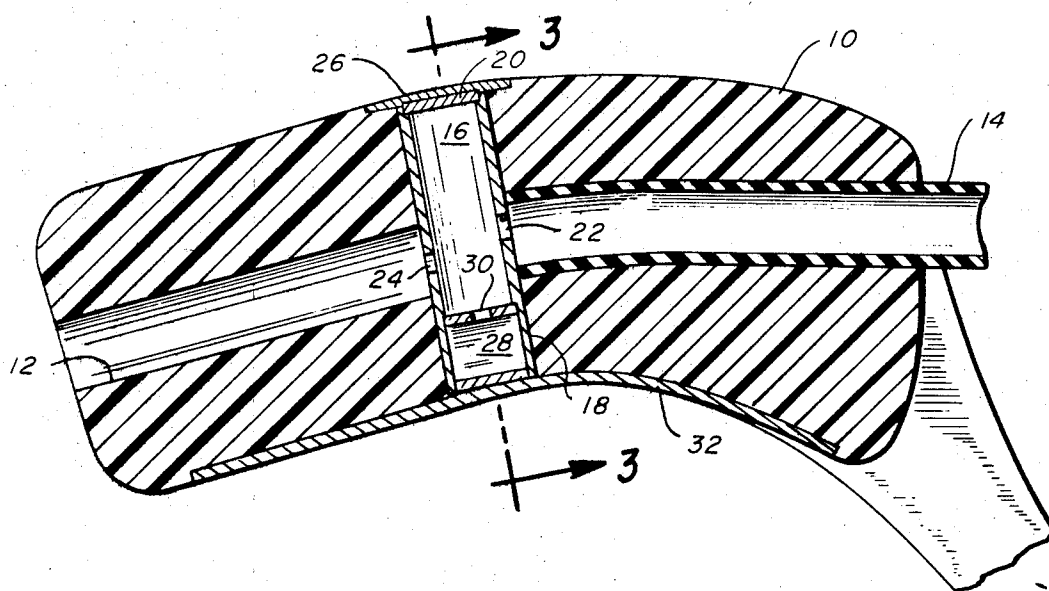
[56] **References Cited**
UNITED STATES PATENTS
 1,969,559 8/1934 Kelly 181/23
 2,148,477 2/1939 Koch 179/107 BC
 2,874,231 2/1959 Wallace 179/107

Primary Examiner—Stephen J. Tomsky
Attorney—Head & Johnson

[54] **ACOUSTIC EAR MOLD FOR HEARING AID**
3 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** **181/23,**
 179/107 BC
 [51] **Int. Cl.** **G02k 13/00,**
 H04r 25/00
 [50] **Field of Search** **181/23/;**
 179/107 BC, 107 E

ABSTRACT: An acoustic ear mold insertable into the ear of an individual with impaired hearing and used in conjunction with a hearing aid amplifier incorporates therein reflection chambers. Amplified sound wave energy conducted to the ear mold proceeds to the hearing part of the brain over two separate routes, one route being by way of the tympanic membrane and the second route being by bone conduction through the mastoid process.



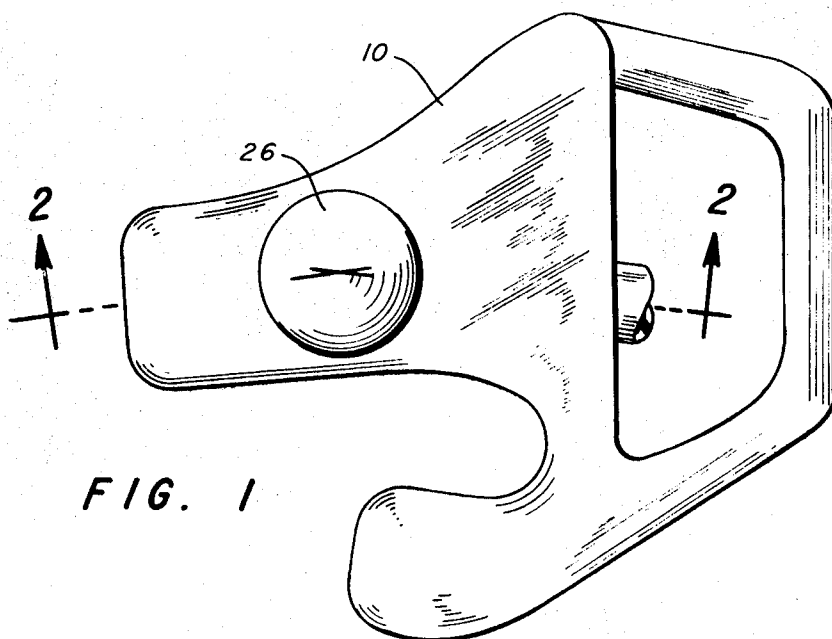


FIG. 1

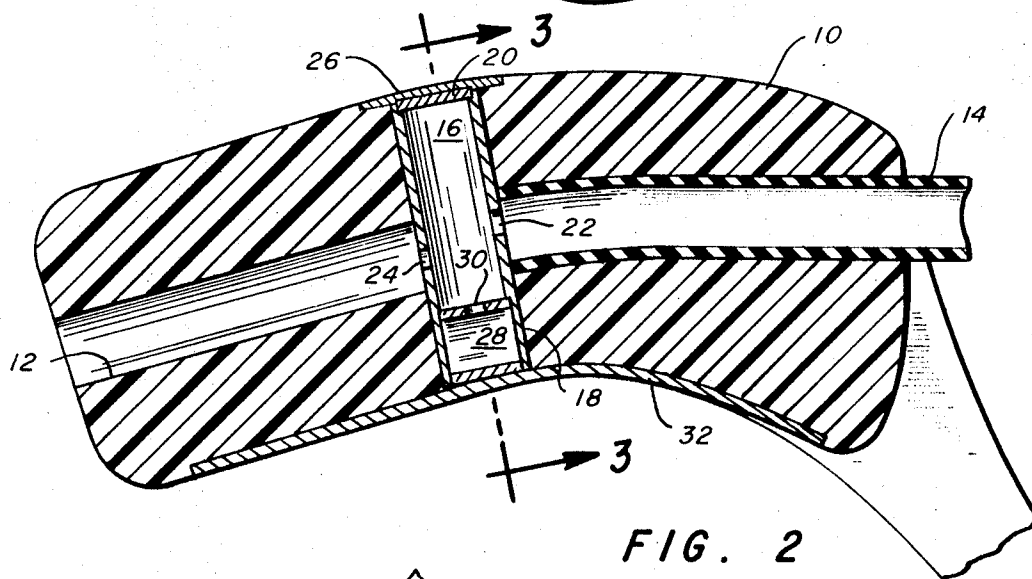


FIG. 2

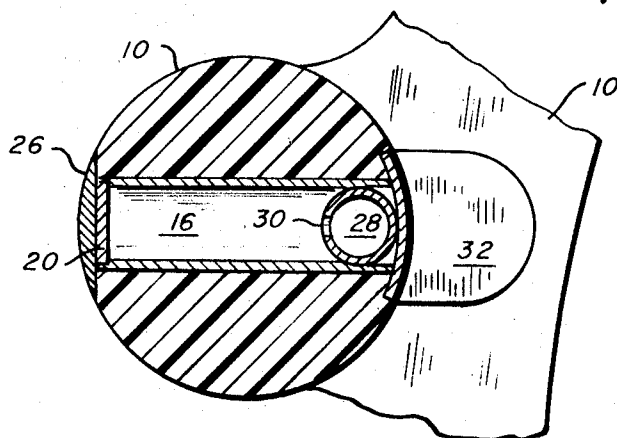


FIG. 3

INVENTOR,
RUBEIN V. JOHNSON

BY
Head & Johnson
ATTORNEYS

ACOUSTIC EAR MOLD FOR HEARING AID

BACKGROUND OF THE INVENTION

This invention relates to hearing aids and more particularly to an ear mold for a hearing aid.

Heretofore hearing aids have been developed for amplifying sound waves and to conduct the amplified waves to the tympanic membrane of the ear in order to improve the hearing of an individual. Presently manufactured hearing aid apparatus includes an amplifier and an ear mold which are insertable in the ear. Amplified sound wave energy created by the amplifier is usually air conducted to the ear mold wherein a longitudinal canal conveys the amplified sound wave energy to the tympanic membrane of the ear where the normal hearing process is commenced; that is, the sound wave energy strikes the tympanic membrane, and then travels on to the malleus, the incus, the stapes to the oval window and on through the fluid of the sacs of the internal ear where the cochlea contains the organ of the corti with associated nerve endings of the auditory nerve from the brain.

A disadvantage of the presently manufactured ear molds is that improved hearing is contingent solely upon sound wave amplification. If for example otosclerosis has rendered immovable or partially immovable the stapes due to ankylosis in the oval window, the effectiveness of a hearing aid is lost. Also in many instances where a high level amplification is necessary, sound saturation results, whereby the normal process of hearing becomes traumatized and the degree of hearing is not aided insofar as intelligibility is concerned.

In addition to the normal air conduction process of hearing by way of the tympanic membrane, sound wave energy can also be conducted to the hearing part of the brain by means of bone conduction. In bone conduction hearing, vibratory sound wave energy is transmitted to the brain over a separate and distinct route from the normal hearing process. Sound wave energy directly enters the mastoid process and travels by bone conduction to the hearing part of the brain for discrimination and interpretation. Thus bone conduction hearing can be beneficial in reinforcing sound wave energy transmitted to the brain by the normal air conduction process.

It is therefore an object of this invention to present an improved acoustic ear mold for bone conduction of sound wave energy.

It is another object of this invention to present an improved ear mold wherein amplified sound waves are conducted to the tympanic membrane of the ear and simultaneously therewith to the bones of the mastoid process such that sound wave energy is conveyed by two separate routes to the hearing understanding part of the brain for speech and sound discrimination, interpretation and understanding.

SUMMARY OF THE INVENTION

Generally the improved acoustic ear mold of this invention contains as an integral part thereof reflection chambers which divert and convert air conduction sound waves into bone conduction sound waves while yet allowing air conduction sound waves to pass to the tympanic membrane for entrance into the normal hearing process. The reflection chambers pass sound wave energy into the bones of the mastoid process for conduction to the hearing part of the brain. The bone conducted sound wave energy reinforces the air conducted sound wave energy and increases the sound discrimination, interpretation and understanding of the amplified sound waves entering the ear mold.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side view of an ear mold for use in conjunction with an amplifier of a hearing aid and incorporating the improvements of this invention.

FIG. 2 is a cross-sectional view of the ear mold taken along lines 2—2 of FIG. 1.

FIG. 3 is a cross-sectional view of the ear mold of this invention taken along lines 3—3 of FIG. 2.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Turning now to the drawings, there is shown an ear mold incorporating the improvements of this invention. The design of the ear mold, generally noted as the numeral 10, is merely one of the many types commercially available to the industry, and the exact configuration thereof in no way limits the application of the improvement of this invention. Ear mold 10, insertable over the external auditory meatus portion of the ear, includes a longitudinal canal 12 in which is received a pliant plastic tube 14 which conducts amplified sound waves from the amplifier of the hearing aid (not shown). The amplifier of the hearing aid may be of any of the various types commercially available. By way of example, the amplifier may be contained in the template of a pair of glasses or, in other instances, may be a solid state device carried by the ear mold itself. Canal 12 conducts amplified sound waves received from the amplifier through the ear mold and presents the same to the tympanic membrane of the ear where the normal hearing process is initiated.

Turning now to the specific improvement of this invention and to the apparatus for improving the hearing ability of a person having impaired hearing, snugly fitted in a hole transversal to the canal 12, at a slight oblique angle thereto, is a first reflection chamber 16 composed of a cylindrical tube 18 capped on the upper end by a reflection plate 20. Tube 18 may be fabricated from various materials of various sizes, for example, such could be a 14-Kt. gold tube having a size 8 outer diameter. Chamber 16 communicates with canal 12 through opposed apertures 22 and 24 in the wall of the tube 18. Due to the curvature of the canal 12, aperture 24 is slightly vertically offset from aperture 22 and is also of smaller diameter. Apertures 22 and 24 enable air sound wave energy emanating from the amplifier of the hearing aid within plastic tube 14 to pass into and exit from chamber 16.

Referring now to reflection plate 20, the upper end of tube 18 is beveled outwardly to form a receiving service therefor. Reflection plate 20 is retained on the upper end of tube 18 by means of gold solder 26 which is sanded to conform to the shape of the ear mold 10, as can be seen in the drawings. Reflection plate 20 is constructed of a hard metallic surface such as 18-Kt. gold and includes a solid smooth undersurface perpendicular to the longitudinal axis of tube 16 and which totally reflects sound wave energy impinging thereon without any diffusion thereof. In other words, the undersurface of reflection plate 20 serves as a sounding board for sound wave energy, as will become evident in the subsequent discussion.

Turning now to the lower end of tube 18, there is received therein a second reflection chamber 28 having a longitudinal axis normal to the axis of the chamber 16 and comprised of a circular cylinder. In order to insure a tight fit of chamber 28 in the lower end of tube 18, tube 18 is routed to accept the ends of chamber 28. When received within tube 18, chamber 28 is flush with the lower end thereof and contains an upward transverse aperture 30 coaxial with the longitudinal axis of chamber 18.

Embedded in mold 10 is a bone contactor bar 32 contiguous with the lower end of chamber 16 and the outer wall of chamber 28. Bone contactor bar 32 is also made of a metallic substance such as 18-Kt. gold and is shaped to conform to the curvature of the bony structure of the auditory meatus and when the ear mold 10 is inserted in the ear, the contactor bar is contingent with the skin covering the bony structure so as to cause a transference of sound wave energy from the bone contactor bar into the bony structure for bone conduction of the energy to the brain.

In operation, amplified sound wave energy provided by the amplifier of the hearing aid, enters the acoustic ear mold through the plastic tube 14 and passes into the first reflection chamber 16 through aperture 22. The sound wave energy en-

tering chamber 16 impinges upon the inner wall thereof, is reflected upwardly against the reflection plate 20 and then is reflected downwardly without diffusion to the second reflection chamber 28 through aperture 30. Sound wave energy then passes into the contactor bar 32 and thence into the bony structure of the auditory meatus for conduction to the hearing part of the brain through the mastoid process.

Simultaneously with the bone conduction, sound wave energy also exits from first reflection chamber 16 and is conducted through canal 12 on to the tympanic membrane where the normal hearing process is initiated.

Thus the acoustic ear mold of this invention provides for both conduction of sound wave energy of the same intensity and frequency to simultaneously travel over two separate routes to the hearing understanding part of the brain; thereby enabling the person to have a greater speech and sound discrimination, interpretation and understanding of that which has been transmitted. As can be seen from the aforementioned discussion, this bidirectional conduction of sound waves to the hearing part of the brain enables a person to improve his hearing and does not involve any moving physical members.

While gold has been referred to herein as the metal of which certain elements of the invention may be formed, it is understood that this is by way of example only and that other metals may be used with effectiveness.

During the detailed description of the preferred embodiment, specific language has been used for the sake of clarity. However, it is to be understood that the language used is for the sake of clarity only, and are not words of limitation, but in-

clude all equivalents which operate in a similar manner to accomplish similar purposes.

What is claimed:

1. An improved hearing aid ear mold insertable into the external auditory meatus of the ear and having a longitudinal canal for the conduction of sound waves to the tympanic membrane of the ear; said improvement comprising;

a first reflection chamber disposed in said ear mold transversally to and communicating with said canal at opposed points; said first reflection chamber having an upper closed end and an open lower end;

a second reflection chamber received in the lower end of said first reflection chamber and communicating therewith;

a bone contactor bar carried by said ear mold and abutting said first and second reflection chambers and adapted for engagement with the epidermis overlying the bony structure of the auditory meatus whereby sound wave energy conducted through said canal is reflected by said chambers into the mastoid bone process of the ear through said bone contactor bar for bone conduction to the hearing part of the brain.

2. An improved hearing aid ear mold as in claim 1 wherein said first and second reflection chambers are cylindrical and said second chamber is normal to said first chamber.

3. An improved hearing aid ear mold as in claim 1 wherein said chambers and bar are made of gold.

30

35

40

45

50

55

60

65

70

75