Nov. 7, 1972 J. T. MACKEN ET AL 3,702,123

VENTED HEARING AID EAR MOLD

Filed Sept. 9, 1971 2 Sheets-Sheet 1

Fig. 1

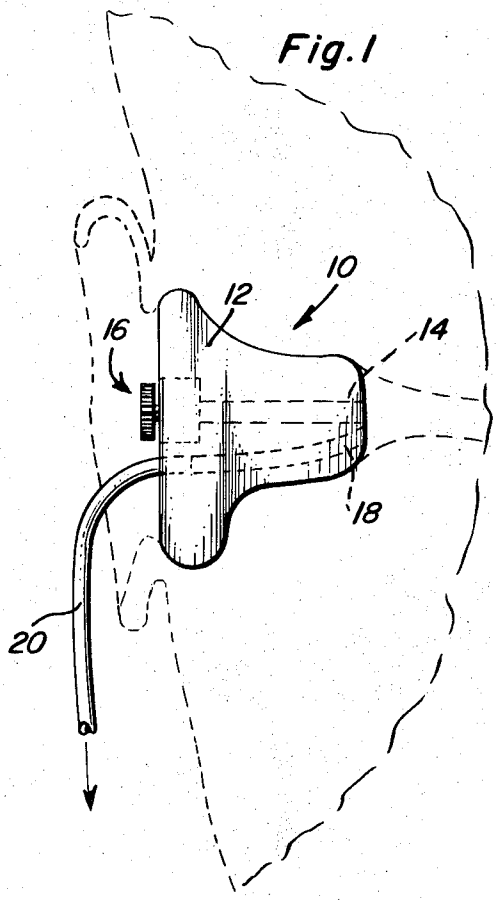


Fig. 2

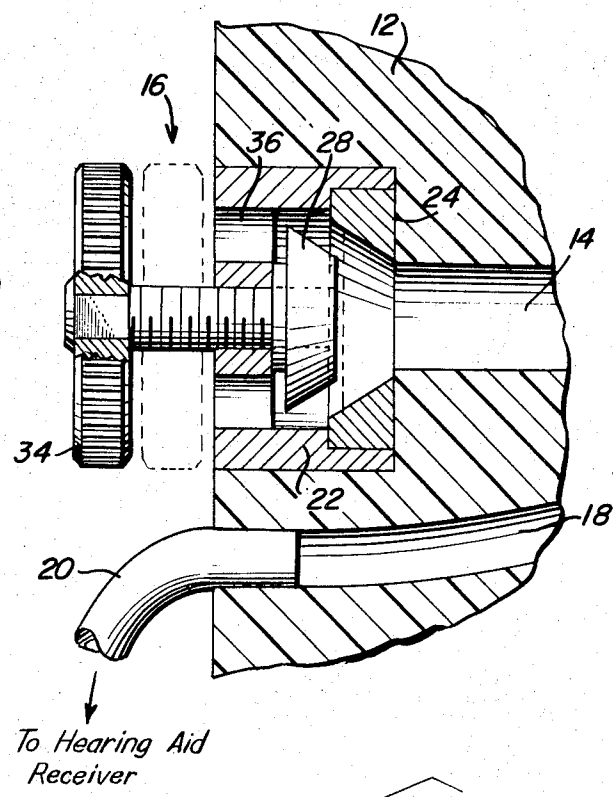
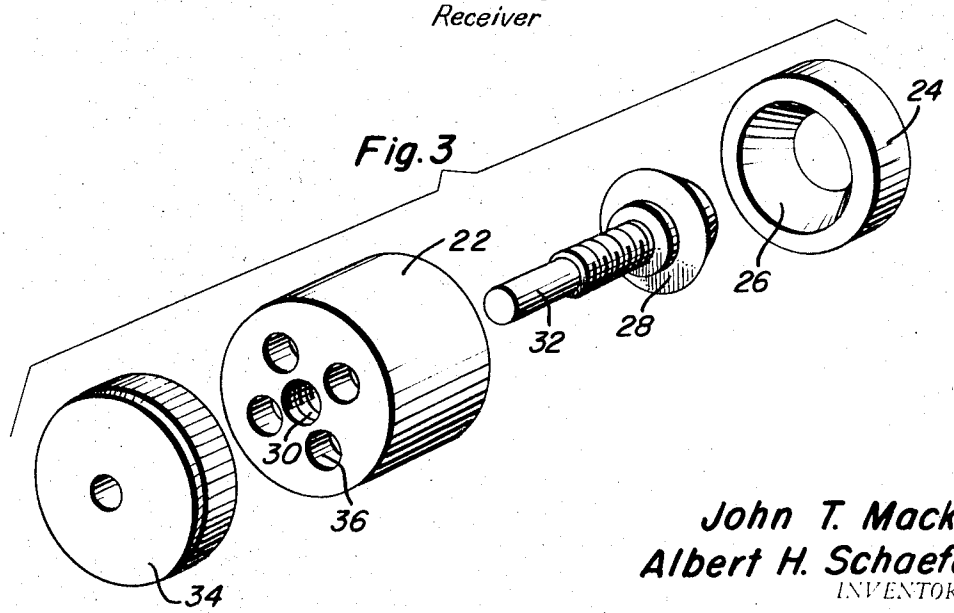


Fig. 3



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Filed Sept. 9, 1971 2 Sheets-Sheet 2

Fig. 4

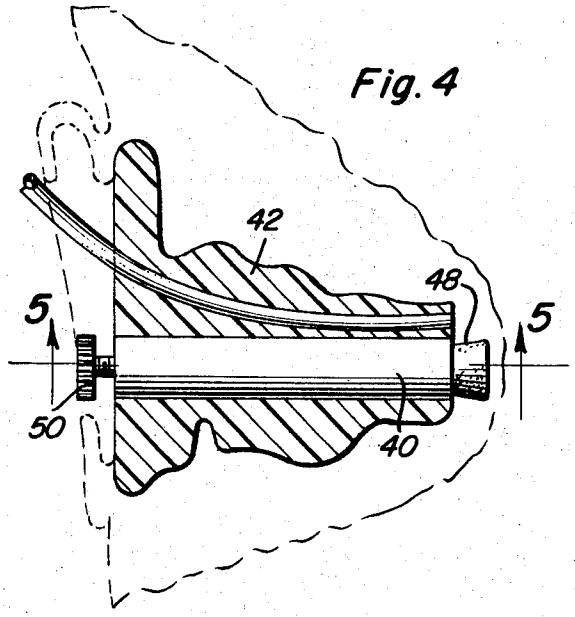


Fig. 6

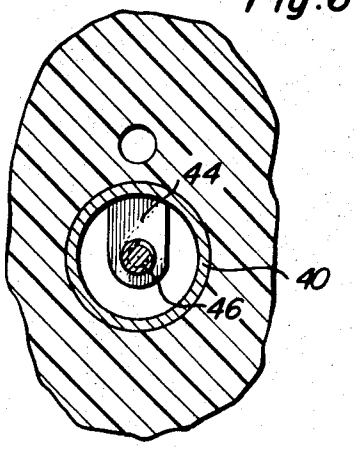


Fig. 5

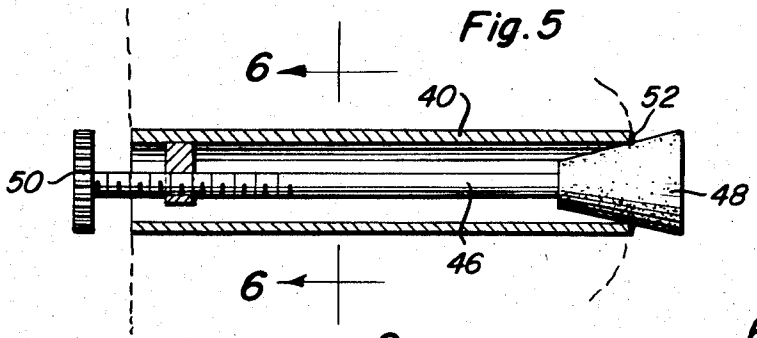


Fig. 9

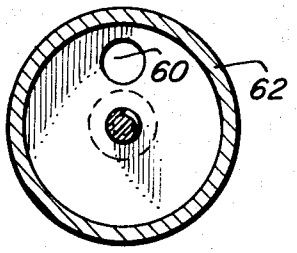


Fig. 8

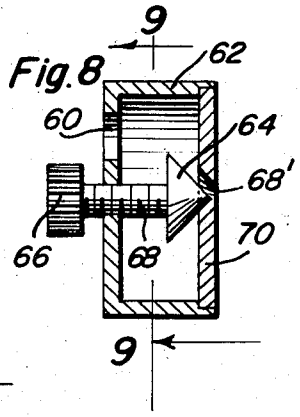
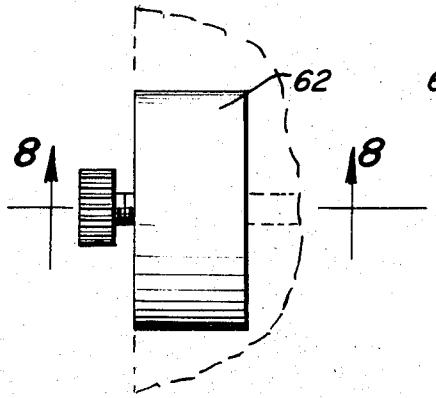


Fig. 7



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VENTED HEARING AID EAR MOLD

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ABSTRACT OF THE DISCLOSURE

An adjustable vented ear mold assembly for use with hearing aids, and the like said ear mold assembly including an acoustical valve with means providing an infinite number of adjustments or tuning settings by a wearer to achieve the most desirable acoustic results.

The present invention is generally related to ear molds and, more particularly, to vented hearing aid ear molds.

In the past, various vented ear mold constructions have been provided which included some type of venting arrangement for presetting the tone or acoustical quality of sound heard by the wearer. While such conventional constructions have greatly improved the hearing and comfort of the wearer, they were permanently preset either at the factory or at the time of purchase, such that subsequent adjustments or tuning by the wearer was either impractical or impossible. This often resulted in subsequent hearing discomfort due to the fact that the wearer was unaccustomed to the hearing aid at the time the tone adjustment was made. For example, ceramic microphone hearing aids have a wider frequency range than most magnetic microphone hearing aids. As such, a person who purchased a ceramic hearing aid to replace one of the magnetic type would be unaccustomed to the low frequency tone of the ceramic type. While initial vent adjustment often provided comfort to the wearer subsequent adjustment is necessary to provide the best results after the wearer has become accustomed to the low frequeuncy tone.

It is an object of the present invention to provide a novel vented ear mold which may be conveniently adjusted by the wearer after insertion, thereby providing the most desirable acoustic setting from the standpoints of comfort and hearing improvement.

Another object of the present invention is to provide a versatile ear mold construction with a readily adjustable acoustical valve which permits a wearer to make an acoustical setting to achieve the most desirable results after insertion of the mold into his ear.

It is a further object of the present invention to provide a unique acoustic valve which is readily adjustable by the wearer, extremely compact, yet, durable, long lasting and relatively inexpensive to manufacture.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

FIG. 1 is an elevational view of a first embodiment of the ear mold assembly of the present invention.

FIG. 2 is a partial sectional view of the valve mechanism associated with the present invention.

FIG. 3 is an exploded perspective view of the valve mechanism shown in FIG. 2.

FIG. 4 is an elevational view of a second embodiment of the ear mold assembly of the present invention.

FIG. 5 is a sectional view taken along section 5—5 of FIG. 4.

FIG. 6 is a sectional view taken along section 6—6 of FIG. 5.

FIG. 7 is an elevational view of a third embodiment of the valve mechanism associated with the present invention.

FIG. 8 is a sectional view taken along section 8—8 of FIG. 7.

FIG. 9 is a sectional view taken along section 9—9 of FIG. 8.

Referring now, more particularly, to FIGS. 1-3, the ear mold assembly of the present invention is generally indicated by the numeral 10 and includes an ear mold mounting member 12 made of rubber, plastic, or similar materials. Preferably, mounting member 12 is of the conventional type and is shaped to conform to the contours of the regions of the ear canal and outer ear regions immediately adjacent to the canal opening. This provides a snug, comfortable fit in the wearer's ear and provides a substantial acoustical seal with the abutting surfaces of the ear. The mounting member is provided with an elongated acoustic passage 14 adapted to communicate with the ear canal at one end and with a valve mechanism 16 at the opposite end thereof. Mounting member 12 is further provided with an elongated sound passageway 18 also adapted to communicate with the ear canal and adapted to receive a sound tube 20 which extends from the exterior of the ear mold assembly for connection to a conventional hearing aid receiver.

Valve mechanism 16 is comprised of a housing including a generally cylindrical shell 22 which is cemented or press-fitted to mounting member 12 and a cylindrical valve seat member 24 mounted at the inner end of shell 22. Valve seat member 24 includes an internal frusto-conical surface 26 defining a valve seat. A valve member 28 is threadedly received through a threaded mounting aperture 30 formed in shell 22. Valve member 28 is frusto-conical in shape at one end, such that it is adapted to snugly engage frusto-conical valve seat 26 when adjusted to such a position. The opposite end of valve member 28 is provided with an elongated stem portion 32 of reduced diameter and which is adapted for mounting of an acoustic adjustment knob 34 thereon. Preferably, adjustment knob 34 is rigidly affixed to the stem portion 32 by the flattening of one end thereof during the manufacture. The adjustment knob, however, may be held in position by way of a setscrew, or other conventional fastening means. Also, it should be noted that the adjustment knob, shell, valve member, and valve seat member are made of relatively rigid materials to assure proper positioning therebetween. Preferably, these components are made of brass with nickel plate to assure long life and resistance to corrosion, and the like.

As mentioned above, the purpose of the ear mold assembly is to permit a wearer to acoustically adjust or tune the ear mold by way of acoustical venting to achieve maximum comfort and hearing improvement. This adjust-

ment or acoustical tuning is achieved by way of an air vent defined by acoustical passage **14**, the valve opening, and four acoustical vents **36** formed in cylindrical shell **22** and communicating with the surrounding atmosphere. As such, the effective cross-sectional area of the air vent may be adjusted by movement of valve member **28**. Rotation of adjustment knob **34** transfers movement to the valve member such that an infinite number of positions are available between the fully closed and fully opened positions. When adjusting the ear mold assembly, the wearer rotates adjustment knob **34** while listening carefully until he achieves the most desirable setting. This permits the wearer to adjust the ear mold assembly to attenuate the lower frequencies which are generally more pronounced with ceramic hearing aids. This could not be done with conventional vented ear molds, since the vent opening was preset at the factory or at the time of sale after performing a single hearing test. The ear mold assembly of the present invention permits the wearer to make adjustments whenever he so desires in order to compensate for changes in tonal quality of the hearing aid, positioning of the ear mold, or for attenuation of surrounding noise levels.

Referring to FIGS. 4–6, a second embodiment of the present invention may be seen. The function and purpose of the second embodiment is identical to that of the first embodiment, shown in FIGS. 1–3. However, the second embodiment is provided with a single-piece elongated cylindrical housing **40** which extends through the entire thickness of an ear mold mounting member **42** to define an air vent therethrough. Thus, the entire cross-sectional area of housing **40** may be utilized as an acoustical vent with the exception of the restriction presented by an inwardly extending mounting tab **44** which threadedly receives threaded shaft **46**. A resilient valve member **48** is affixed to one end of shaft **46**, with an adjustment knob **50** rigidly affixed to the opposite end. The valve seat is defined by a circumferential end edge **52** of housing **40**. As such, the acoustical adjustment is achieved by rotating adjustment knob **50** to vary the spacing between valve seat **52** and valve member **48**. In the fully closed position valve member **48** forms a substantial seal with valve seat **52** due to the resiliency of the valve member. It will be appreciated that when operating the second embodiment ear mold assembly, the valve member is moved inwardly to increase venting, while increased venting of the first embodiment required that the valve member move in the outward direction.

Referring to FIGS. 7–9, a third embodiment of the present invention may be seen in detail. This valve mechanism is quite similar to the first embodiment but provides only a single acoustical vent **60** formed in valve housing **62**, and the valve member **64** is conical in shape, rather than frusto-conical as the valve of the first embodiment. Movement of valve member **64** is also achieved by way of an adjustment knob **66** rigidly affixed to a threaded valve shaft **68** threadedly received by housing **62**. The valve seat **68** is formed in a relatively flat disk-shaped member **70** which is press-fitted to housing **62**. The operation and purpose of the third embodiment of the ear mold assembly is identical to those of the first two embodiments. However, the acoustical differences achieved by adjustment vary somewhat from those achieved with the first two embodiments, due primarily to the relatively short length of the valve housing.

From the foregoing descriptions, it will be appreciated that the ear mold assembly of the present invention provides a unique and novel means of acoustically tuning a hearing aid ear mold after it has been inserted into the ear of a wearer. This permits the wearer to compensate for changes in frequency, ear mold fitting, or surrounding noise levels. In addition, the wearer may adjust the ear mold assembly to the exact setting, an infinite number of settings being available between the fully opened and fully closed positions. It will be appreciated that minor changes in shape and materials for the valve movement mechanism are deemed to fall within the scope of the present invention.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention.

What is claimed as new is as follows:

1. In combination with a hearing aid, an ear mold assembly comprising an ear mold mounting member adapted to engage the canal regions of a wearer's ear, an adjustable acoustic valve mechanism mounted in said mounting member, said acoustic valve mechanism including a housing with a valve seat formed therein and a valve element adjustably connected to said housing, means for selectively adjusting the position of said valve element relative to said valve seat to change the spacing therebetween for acoustically tuning said ear mold assembly.

2. The structure set forth in claim **1** wherein said housing includes at least one acoustical vent therein communicating at one end with the exterior of said housing and said mounting member and at the opposite end with the area surrounding said valve element to define an acoustic path.

3. The structure set forth in claim **2** wherein said selective adjustment means includes an adjustment knob affixed to said valve element and located on the exterior of said housing and ear mold mounting member for convenient adjustment by the wearer when said assembly is mounted in his ear.

4. The structure set forth in claim **3** wherein said selective adjustment means further includes a threaded stem portion on said valve element threadedly received by said housing.

5. The structure set forth in claim **4** wherein said valve seat is defined by a frusto-conical valve surface formed in said housing adapted to engage said valve element.

6. The structure set forth in claim **5** wherein said valve element includes a valve surface adapted to snugly engage said valve seat when in the fully closed position.

7. The structure set forth in claim **6** wherein said ear mold mounting member includes an acoustic passageway extending therethrough and having one end adapted to communicate with a wearer's ear canal and an opposite end terminating adjacent to said acoustic valve mechanism.

8 The structure set forth in claim **7** wherein said valve seat is located immediately adjacent to said opposite end of said acoustic passageway in said ear mold mounting member.

9. The structure set forth in claim **8** wherein said valve element includes a valve surface which is frusto-conical in shape and adapted to snugly engage said valve seat when in the fully closed position.

10. The structure set forth in claim **6** wherein said housing is comprised of an elongated hollow cylindrical member with one end adapted to communicate with a wearer's ear canal and the opposite end communicating with the exterior of said housing and said ear mold mounting member.

11. The structure set forth in claim **10** wherein said valve seat is defined by a circumferential edge portion at said one end of said housing.

12. The structure set forth in claim **11** wherein said valve element includes tapered valve surfaces adapted to engage said circumferential edge portions when said valve mechanism is in closed position.

13. The structure set forth in claim **12** wherein said valve element is of resilient material and frusto-conical in shape.

14. An ear mold assembly comprising an ear mounting adapted to engage the canal regions of a wearer's ear, an

adjustable acoustic valve mechanism mounted in said ear mold mounting, said acoustic valve mechanism including a valve seat formed therein and an adjustable valve element oppositely disposed of said valve seat, and means for selectively adjusting the position of said valve element relative to said valve seat to change the spacing therebetween for acoustically tuning said ear mold assembly.

15. The structure set forth in claim **14** wherein said acoustic valve assembly includes at least one acoustical vent therein communicating at one end thereof with the exterior of said ear mold assembly and at the opposite end thereof with the area surrounding said valve seat to define an acoustic path.

16. The structure set forth in claim **15** wherein said selective adjustment means includes an adjustment knob affixed to said valve element and located on the exterior of said ear mold assembly for convenient adjustment by a wearer when said assembly is mounted in his ear canal.

17. The structure set forth in claim **16** wherein said selective adjustment means further includes a threaded stem portion on said valve element.

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U.S. Cl. X.R.

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