

Dec. 10, 1968

G. M. HILL
EAR FITTINGS

3,415,246

Filed Sept. 25, 1967

2 Sheets-Sheet 1

FIG. 1.

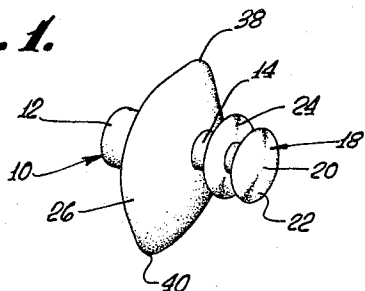


FIG. 3.

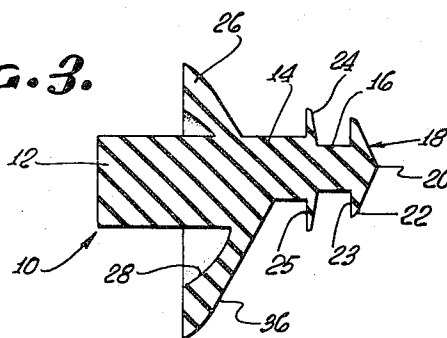


FIG. 2.

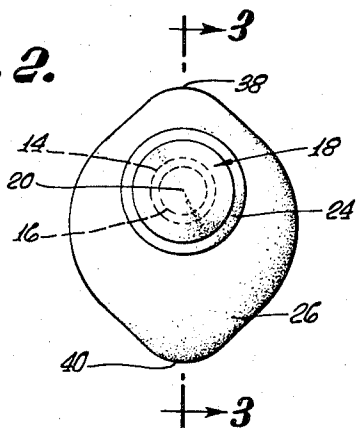


FIG. 4.

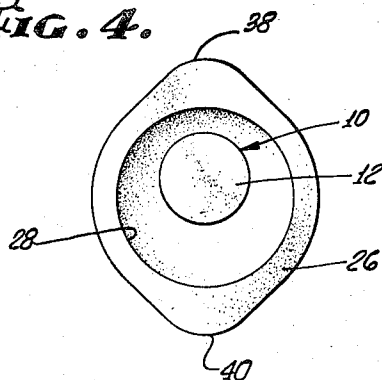


FIG. 5.

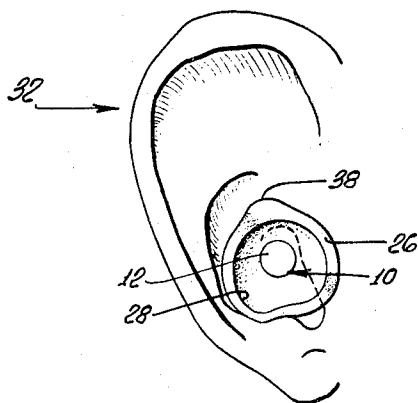
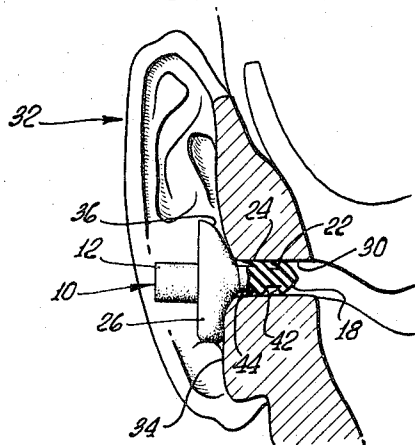


FIG. 6.



INVENTOR.
GEORGE M. HILL
By *Huebner & Worrel*
ATTORNEYS.

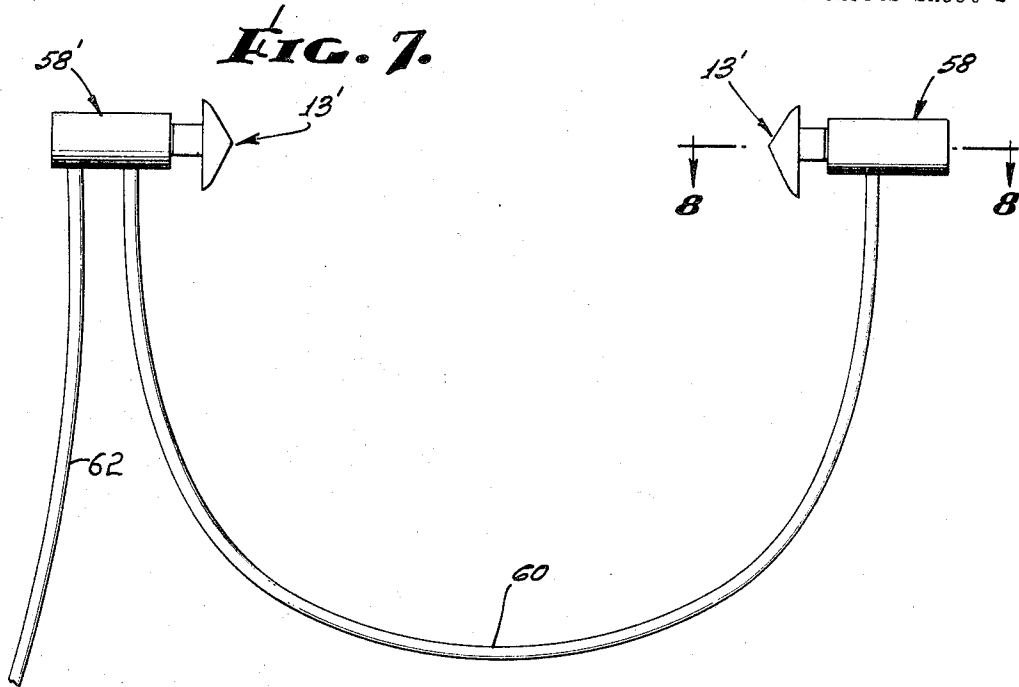
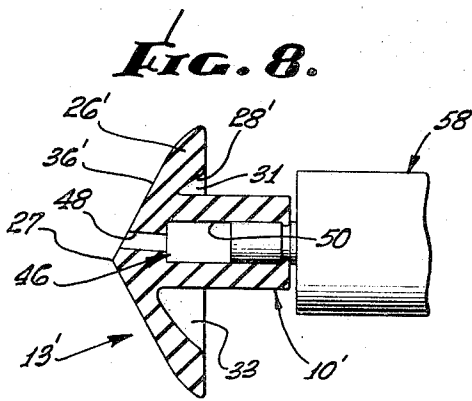
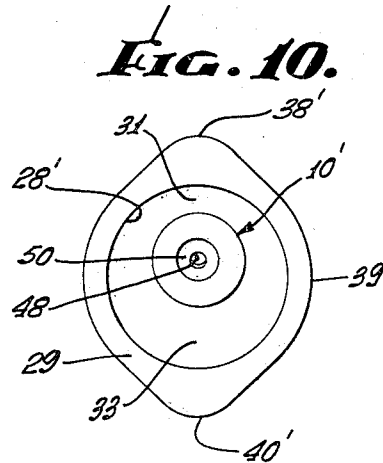
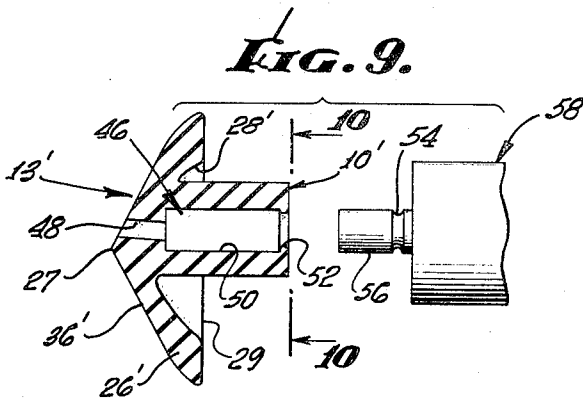
Dec. 10, 1968

G. M. HILL
EAR FITTINGS

3,415,246

Filed Sept. 25, 1967

2 Sheets-Sheet 2



INVENTOR.
GEORGE M. HILL
By *Huebner & Worrel*
ATTORNEYS.

1

3,415,246

EAR FITTINGS

George M. Hill, Van Nuys, Calif., assignor to Sigma Sales Corporation, North Hollywood, Calif., a corporation of California

Continuation-in-part of application Ser. No. 550,743, May 17, 1966. This application Sept. 25, 1967, Ser. No. 677,822

9 Claims. (Cl. 128—152)

ABSTRACT OF THE DISCLOSURE

An ear fitting adapted to be used to restrict the entry of sound to the human ear and also adapted to be used to filter out the entry of undesired sound to the human ear when said fitting is utilized as an earphone fitting or extension.

The fitting includes a central stem portion and an enlarged flange portion which bears against the concha of a human ear. The enlarged flange limits the entry of the fitting into the ear. This is a continuation-in-part of my application Ser. No. 550,743, filed May 17, 1966, now abandoned.

Background of the invention

This invention relates to ear fittings adaptable for use as ear plugs which comfortably and securely fit within an ear so as to block the ear passageway and earphone extensions for use with headsets and earphones used with recorders, portable radios, airline movies and music systems and similar devices.

The problems of industrial noise continue to grow despite efforts to control the sources of noise and to develop protective devices. Such problems range from simple annoyance with low volume sounds to potentially detrimental physical and psychological effects with high volume noise and particularly high frequency sounds.

Many of the protective devices now available are not adequate since the simple devices are often of little more effect than cotton wadding and the more effective devices are so complex that they become too expensive as a practical matter.

Summary of the invention

Therefore, a primary objective of this invention is to provide an ear plug which is highly effective in blocking sound, yet simple enough that it is inexpensive to produce.

Another object of this invention is to provide an ear plug having a burr-type seating operation which will securely hold the ear plug in position.

Still another object of this invention is to provide an ear plug which is comfortable to the wearer thereof.

A further object of this invention is to provide an ear plug having a central stem from which project spaced inner flanges adapted to resiliently seat the plug within an ear and an outside flange adapted to fit in and fill up the concha or outer portion of the ear.

The modification of this invention is intended to solve two problems inherent in the use of the small earphones now commonly used with portable radios, recorders, television, movie, and stereo music systems found on may airlines, and similar devices.

The first problem has always been present when such devices are used by more than one person and this relates to the questionable hygiene of such multiple use. A primary object of the earphone extension disclosed herein is to provide an extension which may be easily removed from the earphone itself, either to be sterilized for reuse or for disposal.

The second problem arises with physical discomfort to the wearer of the present commercially available plastic

2

earphones. Loosening the earphone within the ear, while lessening the pressure upon the ear and therefore lessening the pain, also decreases the effectiveness of the earphone. Therefore, another object of this invention is to provide an earphone extension which is comfortable to wear for long periods of time.

Other objects and advantages will be apparent from the following description and drawings wherein:

Brief description of the drawings

FIGURE 1 is a perspective view of the subject ear plug; FIGURE 2 is an elevational view of the ear plug taken from the forward end thereof;

FIGURE 3 is a longitudinally sectioned view taken through 3—3 of FIGURE 2;

FIGURE 4 is an elevational view taken from the rearward end of the plug and opposite from the end shown in FIGURE 2;

FIGURE 5 is an elevational view of an external human ear looking toward the head with the subject ear plug inserted in the exterior ear passageway;

FIGURE 6 is a cross sectional view of an external human ear with the subject ear plug inserted therein;

FIGURE 7 is an elevational view of an earphone headset with modified ear fittings attached thereto;

FIGURE 8 is an enlarged, fragmentary, side elevational view of the headset and ear fitting combination, partly in section;

FIGURE 9 is an exploded view of the earphone and ear fitting combination shown in FIGURE 8; and

FIGURE 10 is a rear elevational view of the ear fitting taken along line 10—10 of FIGURE 9.

Description of the preferred embodiment

An ear fitting generally designated as 13 in the drawings in accordance with this invention is preferably made of soft, flexible, resilient, non-toxic, non-allergenic silicone-type rubber and generally includes a cylindrical central stem 10 having a large rear portion 12, a reduced diameter middle portion 14 and a forward portion 16 further reduced in diameter.

The end of forward portion 16 is formed as a flattened cone 18 which annularly tapers from a pointed front end 20 outwardly to form annular forward flange 22, the rear surface 23 being substantially flat and normal to stem 10. Between forward portion 16 and middle portion 14 is an annular dish-shaped middle flange 24 extending concentrically out from stem 10 and inclined slightly back toward rear portion 12. The rear portion 25 is substantially flat and normal to stem 10. An irregular shaped rear flange 26 extends out annularly from stem 10 between middle portion 14 and rear portion 12 thereof. Rear flange 26 slopes away from middle portion 14 and includes an annular rear recess 28 on its side adjacent to rear portion 12 of stem 10.

The forward portion 16 and middle portion 14 of stem 10 are adapted to be inserted in the external auditory meatus 30 (which is a roughly cylindrical passageway) of a human external ear 32 as shown in FIGURES 5 and 6. Thus, the diameter of the forward portion 16 and the middle portion 14 of stem 10 are constructed so as to be less than the diameter of external auditory meatus 30.

The diameters of forward flange 22 and middle flange 24 are greater than the diameter of external auditory meatus 30. However, these flanges are constructed so as to be resiliently flexible. Therefore, they will bend back toward stem 10, as shown in FIGURE 6, when the plug is inserted in external auditory meatus 30.

Flanges 22 and 24 are of sufficient thickness that they will resiliently bear against the internal walls of external auditory meatus 30 and small enough in diameter that they can be bent back within the auditory meatus 30

though flange 24 is slightly larger in diameter than flange 22. With the flanges 22 and 24 of differing diameter a complete seating within the meatus 30 is possible even if the diameter of the meatus 30 may vary. Thus, when the ear plug is inserted in auditory meatus 30 flanges 22 and 24 fold back toward rear portion 10 so that a burr-type fit firmly lodges the plug against the walls of auditory meatus 30 and resists withdrawal therefrom. In fact, the end of the jaw bone (not shown) near external ear 32 has a lateral component of movement which tends to further seat the plug. That is movement of the ear plug into auditory meatus 30 is facilitated and movement from auditory meatus 30 resisted by this lateral movement of the adjacent jaw bone in conjunction with the flanges 22 and 24.

The inward movement of the ear plug is limited by rear flange 26 bearing against the concha 34 of external ear 32 (the pit or funnel in ear 32 surrounding the opening into external auditory meatus 30). Moreover, flange 26 has a seating face 36 extending from the middle portion 14 of stem 10 which is shaped to be somewhat complementary with the shape of concha 34. An annular recess 28 extends into the surface of rear flange 26 opposite from face 36 so that the thickness of flange 26 is reduced enough to be a resiliently flexible structure. Thus, when pressed against concha 34 face surface 36 will tend to conform thereto.

Also, in order to facilitate comfortable secure seating of the ear plug within any human ear the outside periphery of flange 26 is irregular including tear drop tips 38 and 40 and is offset somewhat from the axis of stem 10. As best seen in FIGURE 3 part of face surface 36 is further forward than the other portions thereof and the axis of middle portion 14 is offset from the axis of rear portion 12. Hence, when the ear plug is inserted into an ear 32 it can be rotated until the particular portion of face surface 36 which best conforms to concha 34 is in abutting, sealing relationship therewith. As can be seen from FIGURE 5 the flange 26 may be deformed when properly and completely inserted within the human ear. Moreover, rear portion 12 of stem 10 is enlarged so that it is relatively rigid compared to middle and forward portions 14 and 16, whereby rear flange 26 is securely braced and a good finger grip is provided thereby.

The structure of this ear plug facilitates its firm resilient burr-type seating in nearly all shapes and sizes of human ears. And because of its flexible flanges the bearing pressure against abutting surfaces of an ear is light enough not to cause discomfort.

It will thus be seen that when the ear plug is properly inserted within the ear two air pockets 42 and 44 are created between the flanges 22 and 24 and flanges 24 and 26 respectively. Such air pockets will act to trap auditory sounds and together with the baffles created by the flanges 22, 24 and 26 will effectively attenuate sounds.

The effectiveness of the ear plug has been demonstrated by a test program conforming with the American Standards Association requirements for the measurement of the real-ear attenuation of ear protectors at threshold, specified in ASA Z24-22-1957. The comparative test, utilizing the number of subjects provided for in the ASA specification, and using the subject ear plug and two prior art structures, tested with a noise range from 125 to 8,000 cycles per second (frequency in Hertz). Damaging high frequency noise is usually considered to be above 500 cycles per second.

The test results showed that the subjects tested with the present invention had an average attenuation of between 24 and 45 decibels within the above noise range at threshold or when the noise was first heard. As an illustration when the noise frequency was 125 cycles per second, the average attenuation with the present invention was 24 decibels, while the average attenuation with two prior art structures was 14 and 18 decibels respectively. At a higher noise level tested, namely 4,000 cycles

per second, the average attenuation with the present invention was 45 decibels, while the average attenuation with the two prior art structures was 30 and 43 decibels respectively.

The modification of the ear fitting 13, adapted for use as an earphone extension for headsets, is illustrated in FIGURES 7-10. Generally, the modified fitting on earphone extension 13' consists of a cylindrical stem 10' and an enlarged, conical flange 26' extending annularly outward from the stem 10'.

The flange 26a is comparable to the rear flange 26 of the ear fitting illustrated in FIGURES 1-7. Both flanges bear against the concha of a human ear and serve to limit the penetration of the ear fittings into the ear as well as restricting entry of undesired sounds. The flange 26' tapers outwardly and rearwardly from a point 27 and forms a flange face 36' which bears against the concha of the ear. The flange generally resembles a flattened cone, in which the altitude of the cone is less than the diameter of its base. Due to annular rear recess 28' the flange 26' is resiliently flexible and will tend to conform to the concha of an ear when pressed there against.

The irregular shape of the flange base 29, which is generally circular with opposed protrusions 38' and 40' projecting from the circumference 39 of said flange base, further facilitates the adaptation of the earphone extension to variously shaped ear conchas. Furthermore, and for the same purpose, the flange 26' is axially offset from the stem portion 10'. This feature is best illustrated in FIGURE 8.

It will be readily observed that the axis of flange 26', taken as a line from forward point 27 normal to the flange base 29, is parallel to the central axis of the stem portion 10a, but as viewed in FIGURE 8, the axis of the portion 26' is slightly above the axis of the stem portion 10'. This axial offsetting of the two major portions of the earphone extensions results in the annular rear recess 28' being irregularly shaped. Again referring to FIGURE 8, the portion 31 of the recess above the stem 10' is smaller than the recess portion 33 below the stem. As a result, the lower portion of the flange 26' is more flexible than the upper portion thereof. Thus, when brought to bear against the concha of an ear, the earphone extension may be rotated until it best conforms to said ear concha, the varying flexibility of different portions of the flange serving to aid in the attainment of a comfortable, yet close and effective fit.

Running lengthwise through the earphone extension 13' is a cylindrical bore 46, having a relatively wide rear portion 50 concentric with the axis of stem portion 10a, and a narrower forward portion 48. The forward portion 48 of the bore 46 is angled slightly away from the axis of conical flange 26'. This is to facilitate the entry of sounds into the external auditory meatus of the human ear, since most ear canals are slightly angled. At the rear opening of bore portion 50 is a raised, annular rib 52. This rib 52 seats in a corresponding annular groove 54 about the narrowed forward stem 56 of an earphone 58. Due to its flexibility the earphone extension may be slipped on and off the earphone fixture 58 for sterilization or disposal.

The earphone fittings or extensions are adaptable for use with any earphone-headset system and no particular system is claimed herein. A flexible, resilient headband 60 serves in all cases to hold the earphone and earphone extensions in place bearing against the conchas of a wearer's ears, and a sound input conduit 62 conveys the sound to the earphone fixture 58 or 58'.

While the particular ear plug herein shown and described in detail is fully capable of attaining the objects and providing the advantages herein before mentioned, it is to be understood that it is merely illustrative of the presently preferred embodiments of the invention and that no limitations are intended to the details of construction or design herein shown other than as defined in the appended claims.

I claim:

1. An ear plug made of resilient material comprising a central stem including a thick, relatively stiff rear portion, a middle portion offset axially from said outer portion and reduced in diameter therefrom, and a forward portion reduced in diameter from said middle portion wherein said forward and middle portion are smaller in diameter than the diameter of the external auditory meatus of the human ear in which said plug is to be used, an annular cone-shaped forward surface protruding from the end of the forward portion of said stem wherein said annular cone-shaped forward surface slopes toward the rear portion of said stem, said forward member including a resiliently flexible annular flange which is larger in diameter than the diameter of the external auditory meatus of the human ear in which said plug is to be inserted but bendable so as to resiliently fit within said external auditory meatus, a resiliently flexible middle flange projecting annularly from said stem between the forward and middle portions thereof, said middle flange being diametrically larger than the diameter of the external auditory meatus of the human ear in which said plug is to be inserted but bendable so as to resiliently fit within said external auditory meatus, and a flexible external rear flange projecting from said stem between the rear portion and the middle portion thereof which is diametrically larger than the diameter of the external auditory meatus of the human ear in which said plug is to be inserted wherein said rear flange is not bendable so as to fit within said external auditory meatus but shaped generally complementary to the concha of the human ear on its surface that is adjacent to the middle portion of said stem.

2. An ear plug as defined in claim 1 which is made of a single piece of flexible resilient material.

3. An ear plug as defined in claim 1 wherein the rear flange is centrally offset from said stem and includes an annular recess in its surface opposite from its concha conforming surface, said recess being deep enough that said rear flange is thin enough to be flexible.

4. An ear plug as defined in claim 1 wherein the forward and middle flanges are circular.

5. An ear plug adapted to fit a human ear and having a portion adapted to seat itself within the external auditory meatus of a human ear comprising an elongated resilient stem, said stem including a rear portion of relatively large diameter and an offset forward portion of a diameter less than said rear portion, said forward portion terminating in a resilient first annular flange, a resilient second flange on said forward portion of said stem in spaced relation from said first annular flange and of greater diameter, said first and second flanges adapted to be inserted within said external auditory meatus, a resilient third annular flange on said rear portion of said stem in spaced relation from said second annular flange having a rearwardly tapered forward face adapted to engage and seal the concha of a human ear, said flanges forming baffles within said external auditory meatus and air traps between said first and second flanges and said second and third flanges whereby said baffles and said traps will attenuate sound waves.

6. A unitary ear fitting adapted to conform to and fit against the concha of a human ear to restrict the entry of undesired sound therein comprising: a relatively thick and stiff cylindrical stem portion including a central elongated axis parallel to its length, an enlarged, flexibly deformable flange portion shaped to complement the concha of a human ear and limit the depth of insertion of said fitting into the external auditory meatus of said ear; said flange being generally conical in shape, the altitude of said conical flange being less than the slant height thereof, the circumference of the base of said conical flange being generally circular with opposed protrusions projecting therefrom, said conical flange including an annular recess in its base opposite said concha conforming surface and said flange being axially offset from said stem portion.

7. In a sound receiving head set comprising a sound input conduit, an earphone fixture receiving said conduit, the combination with an ear fitting mounted on said earphone fixture and adapted to seat in the human ear, said ear fitting including a relatively thick and stiff cylindrical stem portion including a central elongated axis parallel to its length, an enlarged, flexibly deformable flange portion shaped to complement the concha of a human ear and limit the depth of insertion of said fitting into the external auditory meatus of said ear; said flange being generally conical in shape, the altitude of said conical flange being less than the slant height thereof, the circumference of the base of said conical flange being generally circular with opposed protrusions projecting therefrom, said conical flange including an annular recess in its base opposite said concha conforming surface, said flange being axially offset from said stem portion, and a cylindrical bore running lengthwise through said ear fitting whereby sound from said input conduit and said earphone fixture will pass through said ear fitting into said ear and said flexibly deformable flange will restrict the entry of undesired external sound.

8. An ear fitting as defined in claim 7, wherein said fitting is rotatably mounted on said earphone fixture, whereby said fitting may be rotated to achieve complete complement between said flange and the concha of a human ear.

9. An ear fitting as defined in claim 7, wherein the cylindrical bore includes a portion adjacent the flange which is inclined relative to the axis of the remaining portion of said bore.

References Cited

UNITED STATES PATENTS

2,246,737	6/1941	Knudsen	128—152
2,487,038	11/1949	Baum	128—152
3,259,128	7/1966	Leight	128—152
3,301,253	1/1967	Glorig	128—150

ADELE M. EAGER, *Primary Examiner.*

U.S. Cl. X.R.

128—132; 179—182; 181—23; 2—209