Nov. 5, 1968 F. P. BEGUIN ET AL 3,408,658

HEARING PROTECTOR

Filed Aug. 25, 1966 3 Sheets-Sheet 1

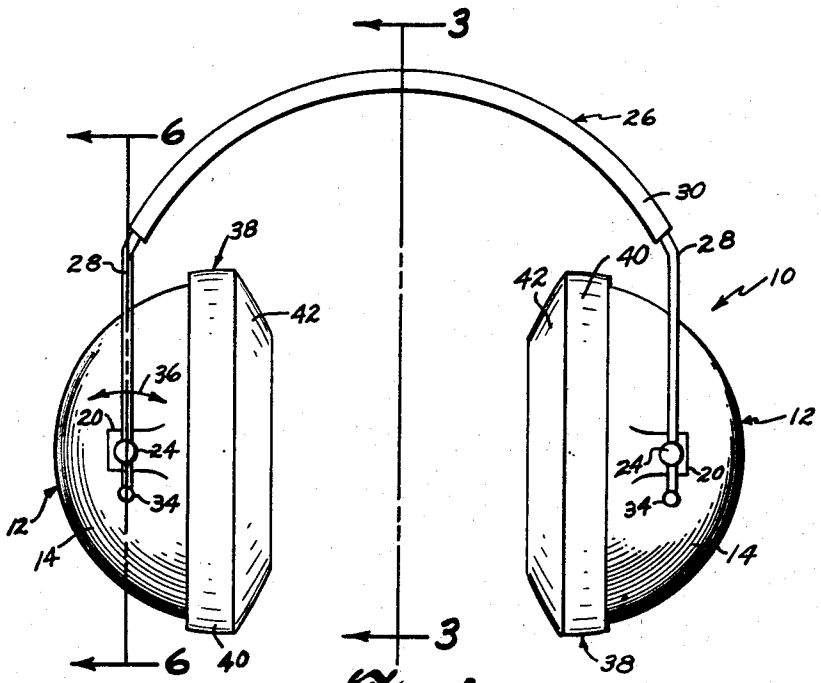


Fig. 1

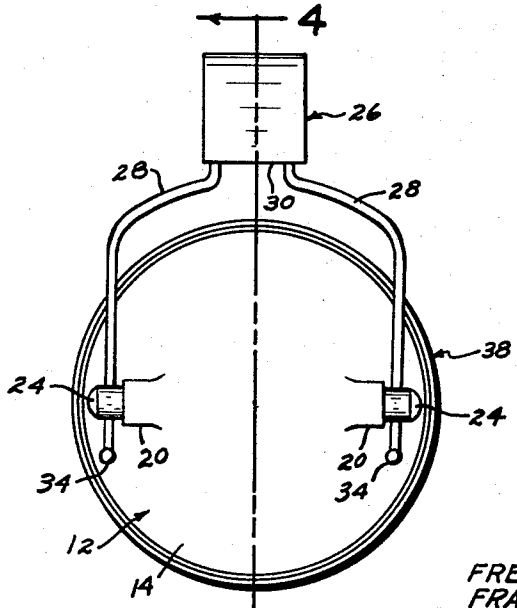


Fig. 2

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Nov. 5, 1968 F. P. BEGUIN ET AL 3,408,658

HEARING PROTECTOR

Filed Aug. 25, 1966 3 Sheets-Sheet 2

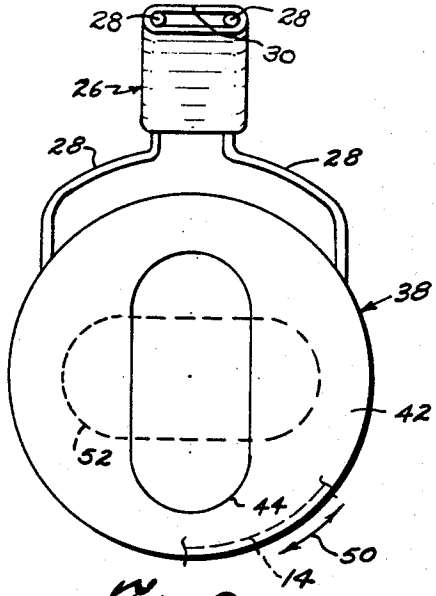


Fig 3

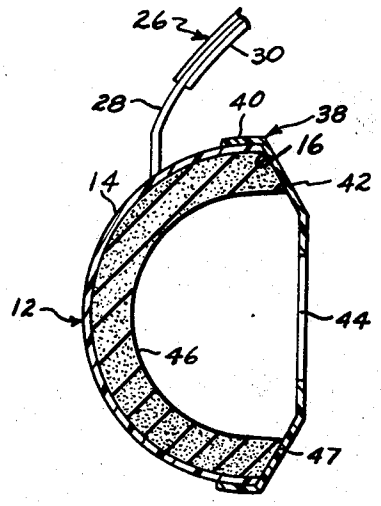


Fig 4

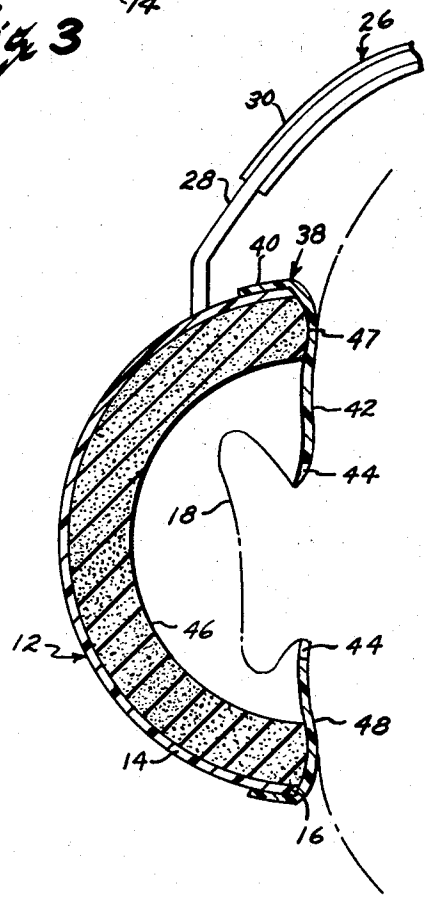


Fig 5

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Nov. 5, 1968 F. P. BEGUIN ET AL 3,408,658

HEARING PROTECTOR

Filed Aug. 25, 1966 3 Sheets-Sheet 3

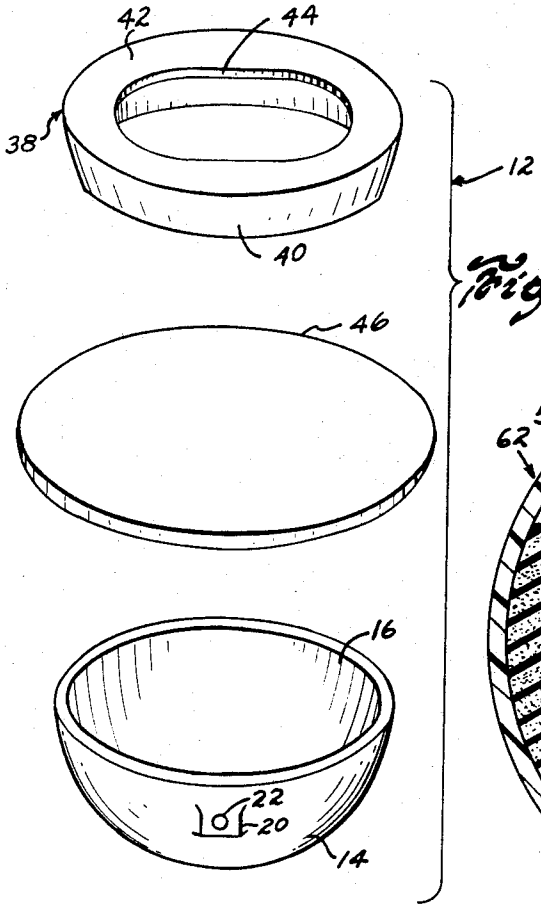


Fig. 7

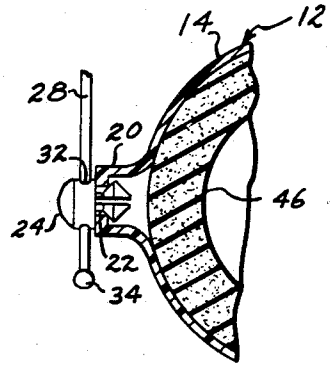


Fig. 6

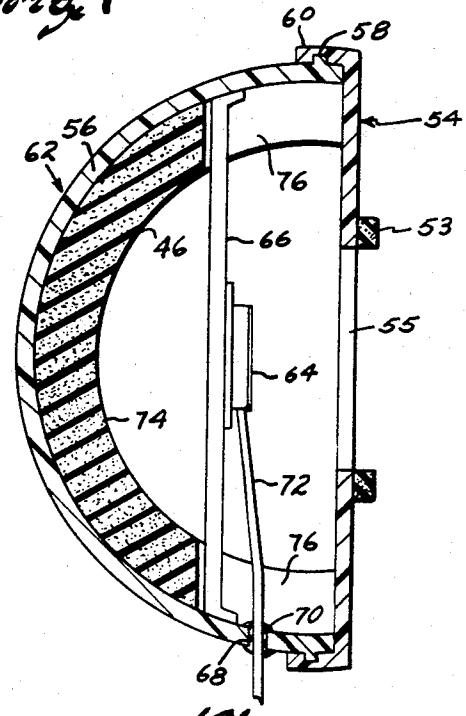


Fig. 8

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3,408,658

HEARING PROTECTOR

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2 Claims. (Cl. 2—209)

ABSTRACT OF THE DISCLOSURE

A low-cost hearing protector comprising an open ended rigid ear cup lined with a relatively thick layer of soft and readily compressible sound dampening material. The thick edge of the lining is extended outwardly beyond the open end of the cup as means for cushioning the cup against the head of a wearer. A thin highly flexible cover having a centrally disposed elongated opening therein extends over the open end of the cup. The edge of the cover is flanged over the outer side of the cup wherewith the cover may be gripped and rotated on the cup for preselected orientation of the elongated opening.

This invention relates to hearing protectors and, more particularly, to a novel and improved hearing protector adapted for use in general industrial environments where only limited noise attenuation is required.

Muff-type hearing protectors are usually recommended for use in high noise environments. These hearing protectors have rigid noise-shielding cups for enclosing the ears and have rigid flanges secured to the rims of the cups for supporting cushions which are intended to conform to the wearer's head to form acoustical seals between the cups and the head. These rigid cup flanges and the cushions required thereon add considerably to the cost of muff-type hearing protectors making the widespread use of such protectors in general industrial environments quite expensive. The rigid cup flanges also make it difficult for the flange cushions to conform to heads of various sizes and configurations with any suitable degree of comfort. The flanges interfere especially with conforming of the flange cushions around the temple pieces of eyeglasses worn with the hearing protector. This lack of comfort makes it difficult to induce workmen to wear muff-type protectors even where noise attenuation is absolutely required.

In lower noise environments where less noise attenuation is required, the use of ear plugs is frequently recommended. However, various ear plug sizes are required to fit different people so that the proper size of ear plug is not always available for each workman; ear plugs are small and are easily lost or misplaced; and supervisory personnel cannot readily observe whether workmen are actually wearing ear plugs in recommended areas. Because of these disadvantages, hearing protection programs based on the use of ear plugs in general industrial environments are frequently unsuccessful.

It is an object of this invention to provide novel and improved muff-type hearing protectors which are particularly adapted for widespread use in industrial environments where noise attenuation is desirable but is not absolutely required; to provide muff-type hearing protectors having novel and improved noise-shielding cups; to provide muff-type hearing protectors which are so comfortable to wear that they will be readily worn by workmen in general industrial environments; to provide such hearing protectors which are of such inexpensive construction that they are adapted for widespread use in general industrial environments; to provide such hearing protector cups which fit comfortably on heads of various sizes and configurations and which even fit comfortably over the temple pieces of eyeglasses worn with the hearing protector cups; and to provide such improved hearing protector cups which effect significant noise attenuation.

Briefly described, the novel and improved muff-type hearing protector of this invention includes a pair of noise-shielding cups, each embodying a rigid cup having an open end which is large enough to fit over the auricle of an ear for accommodating the auricle within the cup. A flexible member or cover is secured to the cup and preferably has a pliable sheet-shaped portion which extends over and substantially covers the open end of the rigid cup. The flexible cover preferably has an elongated opening adapted to fit closely around the juncture of the ear auricle with the head and is mounted on the rigid cup to permit flexing of the cover throughout its entire extent over the open cup end. In a preferred embodiment of this invention, a lining of resilient, compressible, sound-deadening cellular material such as open cell polyurethane foam sponge is disposed within the rigid cup to bear against the flexible cover for normally holding the pliable sheet-shaped portion of the flexible cover distended outwardly from the open end of the rigid cup. The hearing protector also preferably includes head band means or the like for supporting the noise-shielding cups on a wearer's head.

In this construction, the flexible cup cover is capable of flexing to a substantial extent to conform comfortably to a head of any size or configuration. The resilient compressible lining of the rigid cup comfortably conforms the pliable sheet-shaped portion of the cup cover to a wearer's head to provide a comfortable and effective acoustical seal between the cup and head, even when temple pieces of eyeglasses worn with the hearing protector are disposed between the flexible cup cover and the wearer's head. The bearing of the resilient cup lining on the pliable cup cover also tends to damp vibrational flexing of the cup cover.

In a preferred embodiment of this invention, each rigid noise-shielding cup is round adjacent its open end and the flexible cover is attached to the open end of the cup in such a way that it can be rotated on the cup. This construction permits accurate and comfortable orientation of the elongated cover opening around the auricle of an ear regardless of the position of the hearing protector head band with respect to the wearer's head.

Other objects, advantages and details of the hearing protector provided by this invention appear in the following detailed description of preferred embodiments of this invention, the detailed description referring to the drawings in which:

FIG. 1 is a front elevation view of the muff-type hearing protector of this invention embodying the improved hearing protector cups of this invention;

FIG. 2 is a side elevation view of the hearing protector of FIG. 1;

FIG. 3 is a section view along line **3—3** of FIG. 1;

FIG. 4 is a section view along line **4—4** of FIG. 2;

FIG. 5 is a section view similar to FIG. 4 illustrating the function of the hearing protector of this invention;

FIG. 6 is a section view along line **6—6** of FIG. 1;

FIG. 7 is a perspective view illustrating the simple assembly of the components of the hearing protector provided by this invention; and

FIG. 8 is a section view similar to FIG. 4 illustrating an alternative embodiment of this invention.

Referring to the drawings, **10** in FIGS. 1 and 2 indicates the novel and improved muff-type hearing protector of this invention which is shown to include a pair of novel and improved noise-shielding cups **12**. As illustrated par-

ticularly in FIG. 4, each of the hearing protector cups **12** embodies a rigid cup **14** having an open end **16**, the rigid cup preferably being formed of a suitable plastic material such as polyoxymethylene. The cup **14** preferably has its largest diameter adjacent the open end of the cup and the open cup end is preferably large enough to fit easily over the auricle of an ear for accommodating the auricle within the cup. An ear auricle accommodated within the cup **14** is indicated at **18** in FIG. 5.

For use in mounting the hearing protector cups **12** in the hearing protector **10**, each of the rigid plastic cups **14** preferably has a pair of integrally molded bosses **20** apertured as at **22** to detachably receive rotatable cup mounting studs **24** as shown particularly in FIG. 6. The hearing protector **10** then preferably includes head band means **26** for supporting the hearing protector cups **12**. For example, the head band **26** preferably includes a pair of suitably shaped, resilient wire arms **28** which are held and are partially enclosed by a flat plastic or rubber tube **30**. The opposite ends of the wire head band arms fit through apertures **32** in the mounting studs **24** with friction fits and small caps **34** of plastic or metal are cemented or otherwise fixed on the ends of the wire arms. In this construction, the rigid noise-shielding cups **14** are of inexpensive design and the mounting studs **24** acoustically seal the cup apertures **22**. The hearing protector cups **12** are easily adjusted up and down on the wire head band arms and remain in any position of adjustment on the arms by reason of the friction fit between the arms and the mounting studs **24**. Of course, the caps **34** prevent sliding of the protector cups off the head band arms **28**. As indicated by the arrow **36** in FIG. 1, the hearing protector cups **12** are free to pivot on the mounting studs **24**.

In accordance with this invention, a flexible member or cover **38** is mounted on each rigid cup **14**. For this purpose, the flexible cover **38** is preferably provided with a flange **40** which fits closely around the rigid cup **14** at the open cup end, the increasingly diameter of the cup adjacent its open end providing a surface to be gripped by the cover flange **40**. See FIG. 4. The flexible cover **38** also includes a portion **42** which extends over and substantially covers the open end **16** of the rigid cup, the portion **42** being permitted to flex throughout its extent over the open cup end. The portion **42** of the flexible cover member has an elongated opening **44** which is adapted to fit closely around the juncture of an ear auricle with the head as will be understood. See FIG. 5. In a preferred embodiment of this invention, the flexible cover member **38** is formed of a pliable material such as polyvinyl chloride, the cover portion **42** comprising a simple sheet-shaped element of such material. A preferred material for the cover **38** is a commercially available polyvinyl chloride containing a metallic ingredient for increasing the weight of the material.

In accordance with this invention, a lining **46** of a resilient, compressible, sound-deadening cellular material is disposed within each rigid cup **14** to bear against the flexible cover **38** entirely around the cover opening **44** at a location spaced from the cover opening, as indicated at **47**. The lining **46** preferably comprises a normally disc-shaped element which is relatively large with respect to the cup **14**, the lining being partially compressed in being disposed within the rigid cup **14** so that the lining resiliently bears or presses against the cup and the flexible cover **38** for normally distending the portion **42** of the cover outwardly from the open end **16** of the rigid cup to assume the somewhat conical shape shown in FIG. 4. A preferred lining material is open cell, polyurethane foam sponge but any other suitably resilient sound-deadening material can also be used within the scope of this invention.

It will be understood that the hearing protector cup **12** of this invention embodies inexpensive elements which are very easily assembled. As shown in FIG. 7, the cup **12** essentially embodies only the rigid cup **14**, the disc-shaped sponge lining **46**, and the flexible cover **38**. These elements are easily assembled by slightly stretching the cover member flange **40** over the open end of the cup **14** to enclose the lining **46** within the cup. Alternately, the cover can be attached to the cup and the lining can be inserted into the cup through the cover opening **44**.

It will also be understood by reference to FIGS. 1 and 5 that the hearing protector **10** is easily and comfortably mounted on a wearer's head. That is, the protector cups **12** may be grasped and spread apart for inserting the auricles of the wearer's ears inside the cups, the resilience of the head band arms **28** then serving to hold the cups against the wearer's head indicated at **48** in FIG. 5. The sliding and pivotal adjustment of the cups **12** on the head band assures a comfortable positioning of the cups over the ears. As shown in FIG. 5, the flexible cover of the hearing protector cups readily conforms to a large surface area of the wearer's head to assure a comfortable and effective acoustical seal between the cup and head. The resilient lining of the hearing protector cups not only serves to deaden sound vibrations set up by modal vibrations within the rigid cup **14** but also serves to resiliently conform and cushion the flexible cup cover against the wearer's head. As the flexible cup cover is adapted to flex throughout its entire extent over the open end of the rigid cup, the cover conforms readily to any head size or configuration or even over the temple pieces of eyeglasses (not shown) which may be worn with the hearing protector. The bearing of the resilient lining against the flexible cup cover also serves to damp any resonance vibrations of the cup to prevent any pumping or piston-like movement of the cup with respect to the head and to assure that the cup **12** provides significant sound attenuation. As illustrated in FIG. 3, the flexible cover **38** is rotatable on the rigid cup **14**, as indicated by the arrow **50**, so that the elongated cup opening **44** can be oriented at different positions with respect to the head band **18**, as indicated by the broken lines **52**. In this arrangement, the head band **18** can be worn over the top or behind the rear of the wearer's head as preferred while the cover opening **44** can be oriented with the longest cups of the opening aligned with the longest dimension of the auricle of the wearer's ear to fit comfortably around the auricle.

Many variations of the hearing protector **10** are possible within the scope of this invention and it should be understood that this invention includes all modifications and equivalents thereof falling within the scope of the appended claims. For example, as illustrated in FIG. 8, the flexible cover **38** formed of a pliable material such as polyvinyl chloride may be replaced with a flexible cover **54** formed of a shape-retaining flexible material such as polyethylene. An additional cushion means **53** such as a ring of closed cell polyurethane foam sponge may also be cemented or otherwise attached to the cover **54** around the cover opening **55** as will be understood. The rigid cup **14** may be replaced with a cup **56** having a bead **58** around the open end **60** of the cup, the cover **54** then having a flange **61** which is adapted to snap over and grip the cup bead **58**, as shown in FIG 8. Of course, the head band means **18** may be replaced with any other conventional means such as a helmet or hat for supporting the hearing protector cups **12** upon a wearer's head. Further, any conventional means may be employed other than the mounting studs **24** for attaching the hearing protector cups to cup-supporting means such as the head band.

It should also be understood that the novel noise-shielding cup **12** of this invention can also be employed in connection with microphone means to provide a mouthpiece microphone unit. For example, as shown in FIG. 8, a mouthpiece unit **62** provided by this invention embodies a rigid cup **56** having a flexible cover **54** and mounts a microphone **64** on a support **66** fixed within

the cup **56**. The cup **56** is apertured at **68** to receive a grommet **70** through which microphone leads **72** can extend from within the cup **56** and a resilient compressible lining **74** disposed within the cup to bear against the flexible cover is notched as at **76** to fit around the microphone support **66**, as shown in FIG. 8. As will be understood, the flexible cover **54** readily conforms to the user's head around his mouth permitting the user to speak directly into the microphone while shielding the microphone from the effects of ambient noise. Any conventional means (not shown) can be employed for venting the mouthpiece microphone unit, if desired.

We claim:

1. A noise shielding device comprising a rigid cup havin ga circular open end of an inner diametral dimension adapted to be substantially greater than the maximum normal size of a human ear auricle, a thick soft and readily compressible member lining the inside surface of said cup and having an annular edge extended outwardly substantially beyond said end of said rigid cup, a thin annular highly flexible cup cover extending completely over said edge of said lining and having a centrally disposed diametrically aligned elongated opening adapted to fit about the ear auricle relatively closely around the root thereof, said cover further having a circular peripheral flange fitted externally intimately over said circular open end of said cup in frictional engagement therewith whereby said cover may be gripped and rotated on said cup for preselected orientation of said elongated opening whereby, when fitted over said ear auricle against a head, said flexible cover forms an acoustical seal between said head and cup with cushioning between said seal and end of said rigid cup being effected by said extended edge of said lining to damp vibrational flexing of the cover and resonant pumping of the cup with respect to the head.

2. A noise shielding device as set forth in claim **1** further including a portion of increasing diameter extending circumferentially about said rigid cup adjacent said open end thereof over which said peripheral flange of said cup cover is rotatably fitted whereby said portion avoids accidental withdrawal of said cover from said cup during rotation of said cup and during occurrances of removal of the device from the head.

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