United States Patent [19]

Leight

[11] **3,895,627**

[45] ***July 22, 1975**

[54] **EAR PROTECTOR**

[76] Inventor: **Howard S. Leight,** 16027 Northfield St., Pacific Palisades, Calif. 90272

[*] Notice: The portion of the term of this patent subsequent to Oct. 30, 1990, has been disclaimed.

[22] Filed: **June 21, 1973**

[21] Appl. No.: **372,168**

Related U.S. Application Data

[62] Division of Ser. No. 164,609, July 21, 1971, Pat. No. 3,768,470.

[52] **U.S. Cl.** **128/152**

[51] **Int. Cl.** **A61f 11/02**

[58] **Field of Search** ..... 128/151, 152; 181/23, 33 R

[56] **References Cited**

UNITED STATES PATENTS

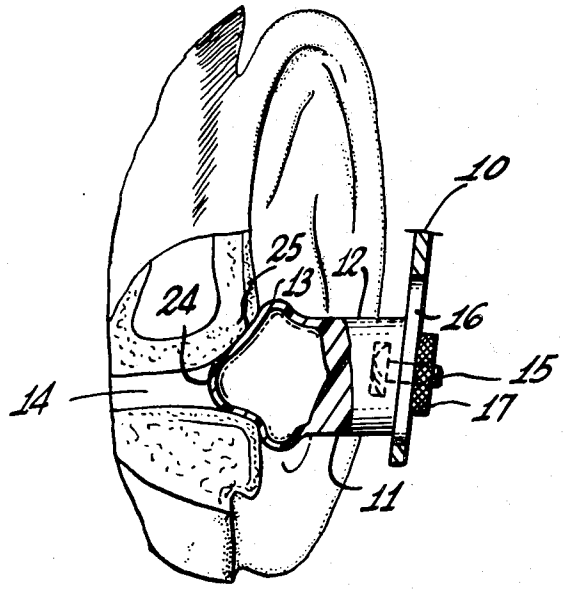
2,246,736	6/1941	Knudsen	128/152
2,441,866	5/1948	Cantor	128/152
2,670,737	3/1954	Cantor	128/152
2,785,675	3/1957	Berkman	128/152
2,803,247	8/1957	Zwislocki	128/152
2,824,558	2/1958	Michael	128/152
3,768,470	10/1973	Leight	128/152

Primary Examiner—Richard A. Gaudet
Assistant Examiner—Henry J. Recla
Attorney, Agent, or Firm—Lindenberg, Freilich, Wasserman, Rosen & Fernandez

[57] **ABSTRACT**

An ear protector to reduce the effect of high intensity sound upon the human ear. The protector includes a band or other resilient means extending over, under, or around the head and provided with a soft resilient pod at each end. Each pod is formed of a soft resilient material and has an air cushion portion adapted to fit into and over the opening to the ear canal.

2 Claims, 10 Drawing Figures



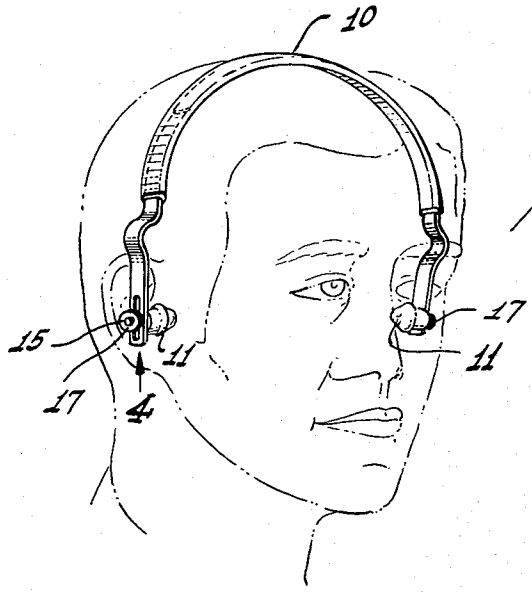


Fig. 1

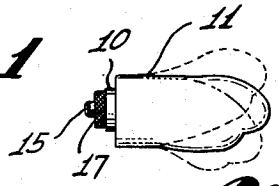


Fig. 4

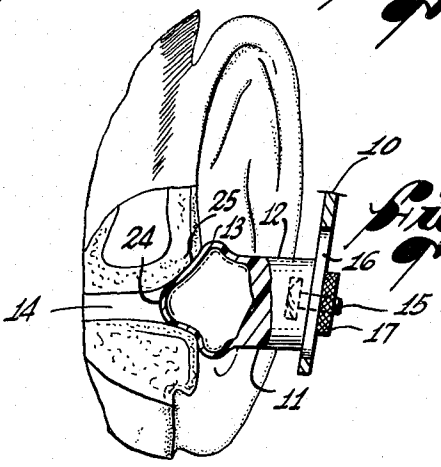


Fig. 2

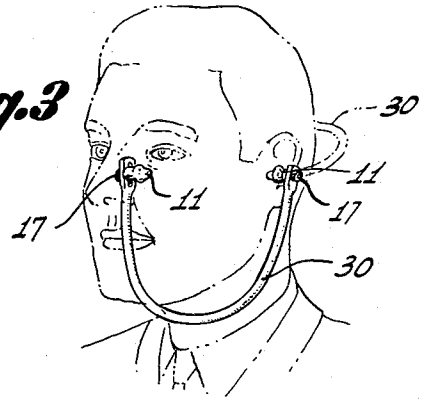


Fig. 3

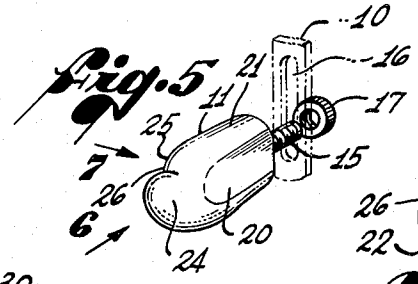


Fig. 5

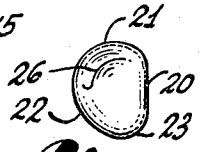


Fig. 6

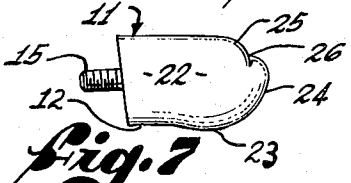


Fig. 7

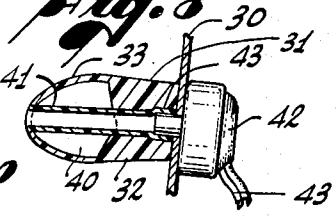


Fig. 8

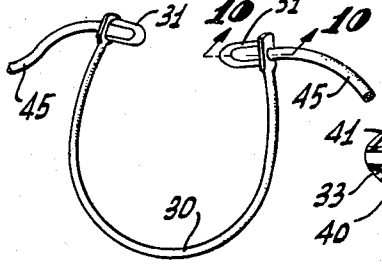


Fig. 9

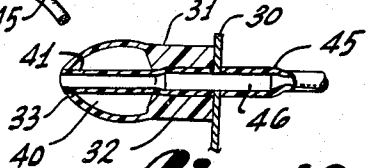


Fig. 10

EAR PROTECTOR

CROSS-REFERENCE TO RELATED APPLICATION

This application is a division of patent application Ser. No. 164,609, filed July 21, 1971 and now U.S. Pat. No. 3,768,470.

BACKGROUND OF THE INVENTION

This invention relates generally to devices for protecting the ear from sound or noise of great intensity, such as may be encountered when working in the neighborhood of jet aircraft engines, certain portions of factories, etc. In its simplest form, such an ear protector may consist of a wad of cotton that is stuffed into the ear, but the efficiency of such a cotton wad leaves much to be desired.

In general, the more effective prior art devices have each comprised a resilient band that passes over the head, with a plug of one form or another to be inserted into the ear canal. For example, the patent to Cantor, U.S. Pat. No. 2,670,737, has a plug consisting of a hollow, flexible envelope that is filled with a finely-divided material, such as flaked graphite. The patent to Rosenblatt, U.S. Pat. No. 3,016,054, has a central ball-shaped nipple surrounded by a soft cup that fits over the ear, while the patent to Glorig, U.S. Pat. No. 3,301,253, shows a cone-shaped member that is intended to extend into the ear canal. In each of these prior art devices, the attempt has been to plug the ear canal so that sound does not enter it. However, in doing this, the canal has been stretched, the seal has been inadequate, or the pressure exerted on the area of the ear surrounding the canal has been excessive. Consequently, less than satisfactory results have been obtained.

SUMMARY OF THE INVENTION

The present invention comprises an ear protector including a pair of soft, resilient pods, each shaped to fit at least part way into the ear canal and to extend over the entrance to the canal, so that effective blocking of sound is achieved. This is done by making the pod of a thin-walled, rubber-like material that encloses air trapped within the pod so that a soft, resilient plug is provided, preferably shaped to conform to the ear. In modified forms, the plug is provided with a small tube extending from the outside of the plug to the inner end to transmit sound, such as might be provided by head phones or the equivalent.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a complete ear protector including the head band and pod, indicating how these are placed on the head of the wearer;

FIG. 2 is an elevational view, partly broken away, showing the construction of the pod and its cooperation with the ear;

FIG. 3 is a perspective view, generally similar to FIG. 1, and showing a simplified, light-weight form of the device, in which the resilient head band may be either worn under the chin or around the back of the head;

FIG. 4 is a bottom view of a pod for the left ear, indicating the way the pod may swivel to fit into the ear canal;

FIG. 5 is a perspective view of the pod and its method of attachment to the head band;

FIG. 6 is an end elevation view, taken in the direction of the arrow 6 of FIG. 5;

FIG. 7 is a side elevational view of the pod, taken in the direction of the arrow 7 of FIG. 5;

FIG. 8 is a cross-sectional view of an alternate form of device showing a sound-reproducer attached to the outer end of the pod;

FIG. 9 is an elevational view of another alternate form of the type which may be used in airplanes, for example, where passengers are provided with flexible rubber tubes connecting the ear pieces to stereo-sound-reproducing equipment; and

FIG. 10 is a cross-sectional view of the form of pod shown in FIG. 9.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

As seen in FIG. 1, the preferred form of my invention contemplates the provision of an ear protector that will normally be worn for a considerable period of time, is intended to block out all sounds, and has no provision for the transmission of sound, as might be the case if an ear phone, or head phones were incorporated. Such a device, as indicated in my preferred form, would normally be worn for an extended period of time, such as an hour or more, as a workman around continuously noisy machinery might do. In this form of device, a resiliently yieldable head band 10 extends over the top of the head of the wearer, and at each end holds a resilient ear plug or pod 11. Each pod 11 is individually adjustable vertically on the head band 10 so that the head band may rest upon the top of the head, and the pods may be adjusted to fit properly into each ear of the wearer.

As indicated in FIG. 2, the pod 11 consists of a solid portion or base 12 and a hollow tip portion 13 enclosing a cavity 18 having air or other gas trapped therein. The whole pod is preferably made of a single material, such as a rubber-like composition that is light-weight, flexible, and feels comfortable in the ear. As seen in FIG. 2, the hollow tip 13 of the pod 11 extends part way into the ear canal 14, while the rear portion of the tip is pressed to spread around the opening of the canal so that a seal is provided, not only within the canal, but around the opening to the canal. The base 12 of the pod 11 is solid to confine the spreading to the tip 13, and also to provide a firm support for the pod. Preferably, a screw 15 is embedded in the outer end of the base 12, so that the shank of the screw may project through a slot 16 in the head band 10, while a nut 17 holds the pod in adjusted position on the head band. By making the head band 10 relatively narrow, as compared with the base of the pod 11, the pod may pivot backwards and forwards, as indicated in FIG. 4, to adjust to the best position within the ear.

The configuration of the preferred form of pod is shown in some detail in FIGS. 5, 6 and 7. The pod shown in these figures is intended for the left ear, and a similar pod for the right ear will be a mirror image of the one shown. As best seen in FIGS. 5 and 6, the forward surface 20 of the pod 11 is flattened throughout substantially its entire length, both along the base 12 and the tip 13, to provide a flattened surface 20 which bears against the tragus of the ear. The flattened surface 20 conforms closely to the shape of the tragus of the ear, so there is a minimum possibility of air gaps between them through which sound could pass. Since the tragus of the ear is at the forward side, the pod 11 is held with the flattened surface facing to the front.

In cross-section, the pod **11** is generally cylindrical, with the front side **20** joining an upper curved surface **21** that merges into the rear surface **22** of greater radius, and in turn merging into a lower surface **23** of smaller radius that in turn joins the front surface **20.** The general appearance is that of an ovoid cylinder whose upper surface is tipped slightly rearwardly.

The inner end of the pod **11** is generally rounded, with the extreme end of the tip having a generally hemispherical surface **24** of relatively small diameter, displaced toward the bottom of the pod and joining with a surface **25** of greater radius of curvature to form a groove **26.** The protuberance **24** is thus of a size adapted to project into and close the ear canal **14,** while the area **25** is larger and bears against the area surrounding the entrance to the canal.

At the entrance to the ear canal of the human ear, the ear is gradually rounded at the bottom of the ear canal entrance and more sharply cornered at the top part of the ear canal entrance. As illustrated in FIGS. **6** and **7,** the pod is formed to conform to the ear canal entrance, and to this end has a groove or concave junction region at **26,** where the portion entering the ear canal meets the portion that lies near the top of the entrance to the ear canal, but the pod is convex at its diametrically opposite region which lies near the bottom of the entrance to the ear canal. The bottom side **23** bulges so that it extends below the level of the solid base portion **12,** or in other words, beyond the boundaries of the base portion **12.** The bulging side **23** conforms closely to the shape of the bottom of the ear, and the fact that it is soft and hollow means that it can readily deform against the ear to provide a very good fit. Also, inward pressing of the pod results in deformation of the hollow tip part, and the outward bulging at **23** encourages further outward bulging against the ear.

At this point, it becomes clear that the material forming the tip **13** must be quite soft so that it conforms to the shape of the ear, instead of forcing the ear to conform to the shape of the tip. Certain prior devices have had a stiffness or hardness such that instead of the tip of the ear protector conforming to the ear, the ear was required to conform to the shape of the ear protector, and this caused discomfort and pain, and prevented the ear protector from being worn over any extended period of time.

It is also apparent that in addition to having a soft portion **13,** the ear protector must have a sufficient stiffness to insure that the tip seats firmly within the canal **14** and around the area surrounding the canal. By first conforming to the shape of the ear and by then applying a sufficient, but not excessive, pressure to hold the pod firmly against the ear, a comfortable ear protector is provided that effectively reduces the intensity of sound.

It is sometimes desirable to wear the ear protectors for only relatively short periods of time, with the protectors being removed the remainder of the time for ease of communication. Thus, an employee working in the vicinity of the passenger terminal of an airport may wish to be able to converse with other employees, passengers and crew members in a normal manner, but still needs the protection of the ear protectors when jet engines are operated in his immediate vicinity. Under these conditions, the form of protector shown in FIG. **3** is very convenient.

In this form, the pods are identical to those previously described, but the head band **30** is different from the head band **10** previously described.

Instead of resting upon the top of the head as the head band **10** does, the head band **30** is arranged to go under the chin or around the back of the head, as indicated in FIG. **3.** As in the case of the head band **10,** the head band **30** urges the pods **11** inwardly into the ears to effect the necessary seal, and the pods then support the light-weight head band **30.** Since the head band does not rest upon the head, but is spaced from it, there is no need for adjustment of the pods **11** with respect to the head band **30.**

To provide this light-weight head band **30,** I prefer to use a light-weight tube or rod, such as a light-weight plastic tube having a wire stiffener therein.

With this form of construction, it is a simple matter to remove the pods **11** from the ears and to allow the ear protector to drop around the neck when the sound or noise level drops to a value where the ear protectors are no longer needed. When the need again arises, they may be easily reinserted in the ears, and the protector is thus immediately available at all times without any danger of harming the ears or tiring the head of the wearer.

The form shown in FIG. **3** can also be easily adjusted for wearing with the head band **30** extending around the rear of the head instead of below the chin, since the pod **11** is attached to the head band by means of the shank **15** of the retaining screw, and the pod can be rotated about the shank to the desired position. In each case, of course, whether the head band **30** goes under the chin or behind the head, or even above the head, it is important that the pods **11** be positioned, as previously described, so that the flat surface **20** is located on the forward side to bear against the tragus.

In some instances, it is important that extraneous sound be kept out, but that certain sounds be transmitted to the ear. Thus, in some instances it is important that external sounds, such as the noise of an aircraft engine, be kept from the ears of the pilot so that he can hear and understand the words that are coming to him over the airplane radio or intercommunicating system. The pod **31** has been designed to meet these requirements, while retaining the advantages of the preferred forms. The pod **31** is basically similar to the pod **11,** having a solid portion or base **32** with a hollow resilient tip **33,** both the base and the tip being formed of a soft resilient material, such as rubber or other rubber-like products, and with a sealed chamber or cavity **40** within the tip having a quantity of air sealed therein to provide the desired resilience.

A light-weight flexible tube **41** is generally axially located in the pod **31,** extending along the length of the pod from the outer end of the base **32** to the inner end of the tip **33.** The cavity **40** within the tip **33** is thus of a generally annular shape surrounding the tube **41.** A transducer **42,** such as a crystal or dynamic sound reproducing means, is provided with a hollow boss **43** that projects through the head band **10** and fits into the outer end of the pod **31.** A similar combination of pod **31** and transducer **42** may be provided for the other ear, or if desired, the other ear may be provided with the previously described pod **11.**

While the head band **30** could be used in connection with the pod **31** and transducer **42,** it is generally preferable to use the head band **10.** While the pod **31** will

be approximately the same weight as the pod **11**, the transducer **42** adds additional weight to the assembly, and greater comfort is generally achieved if the weight of the assembly is supported by the head band **10**.

The alternate form of pod just described is adaptable for use with the ear-phone sets furnished passengers in airplanes to permit them to listen to music, sound motion pictures, etc. Such a head-phone set, illustrated in FIG. **9**, includes a pair of pods **31** supported by a head band **30** and connected by the presently used flexible tubes **45** that extend to the sound transducers usually located in the seats of the aircraft. The pods **31** are generally similar to the pods previously described, including the base **32** and the flexible tip portion **33**. The annular cavity **40** surrounds the tubular member **41**, and the whole device may be attached to the head band **30** by a small piece of relatively stiff tubing **46** that is inserted into the outer end of the tubular member **41** and extends through the head band **30** to receive the flexible tube **45**.

When using the pod **31** in conjunction with either the transducer **42** or the flexible tubes **45** and associated transducers, the result is that the ambient noise surrounding the person is prevented from entering the ear canal **14**, while the desired sound from the transducer is directed down the tubular member **41** and into the ear canal. The soft and yieldable tip **33** is comfortable and does not cause pain to the wearer, even after being worn for several hours.

It will be realized that various types of supporting means may be used to hold the pods **11** and **31** in place, and the forms **10** and **30** that have been shown are merely illustrative of various elements that may be used to hold the pods in the proper manner. Additionally, the pod **11** has been shown and described as having a particular form, but this form may be varied, so long as the major considerations of general size, approximate shape, and resilient cushioning are provided.

What is claimed is:

1. An ear protector comprising:

a pair of sound-attenuating pods and means for holding said pods against the ears of a wearer;

each pod being of generally cylindrical shape and having a base portion attached to said holding means and a tip portion adapted to enter the ear canal, at least one side of said tip portion bulging so that it extends radially beyond the boundaries of the base portion and said tip portion forming a smooth continuous curve along the bulging portion and up to the extreme tip of the pod, said pod being solid up to a region near the beginning of said bulging tip portion and said tip portion being hollow and of soft resilient material so that said bulging portion can readily deform against the region of the ear surrounding the ear canal to thereby form a good sound-tight seal therewith.

2. The ear protector described in claim **1** wherein:

each of said pods is of non-circular cross-section at said bulging tip portion, and said pod holding means is constructed to hold the pods in a predetermined orientation in which said bulging side of each pod faces primarily downwardly.

* * * * *