United States Patent [19]

Leight

[11] **3,768,470**

[45] **Oct. 30, 1973**

[54] **EAR PROTECTOR**

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

[22] Filed: **July 21, 1971**

[21] Appl. No.: **164,609**

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

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

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

[56] **References Cited**

UNITED STATES PATENTS

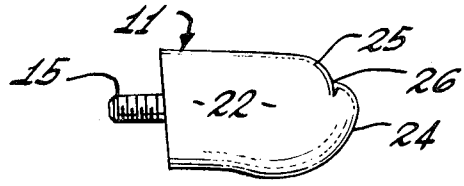
2,670,737	3/1954	Cantor	128/152
2,824,558	2/1958	Michael	128/152
3,259,128	7/1966	Leight	128/152
3,301,253	1/1967	Glorig	128/152
3,415,246	12/1968	Hill	128/152
2,785,676	3/1957	Berkman	128/152

Primary Examiner—Richard A. Gaudet
Assistant Examiner—G. F. Dunne
Attorney—Arthur Freilich et al.

[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



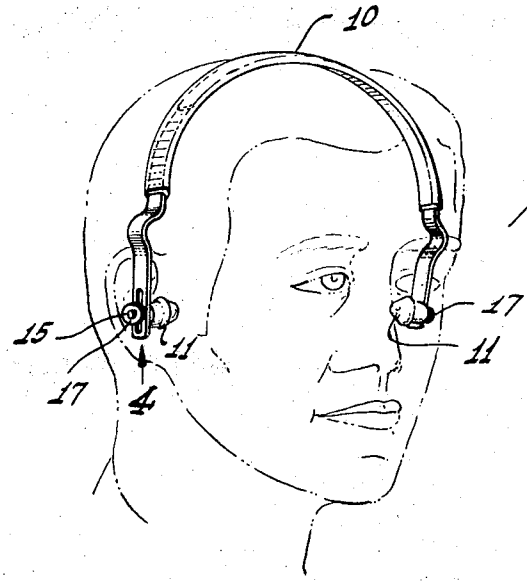


Fig. 1

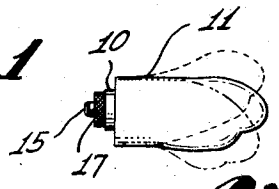


Fig. 4

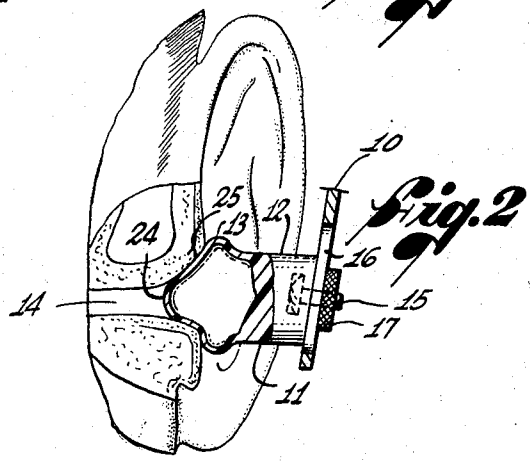


Fig. 2

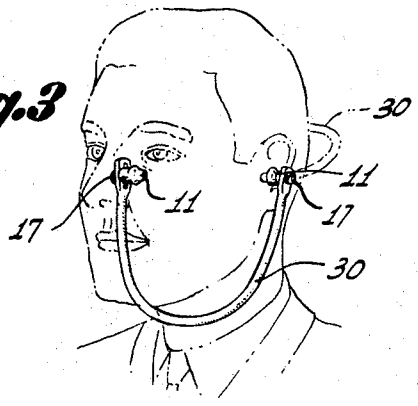


Fig. 3

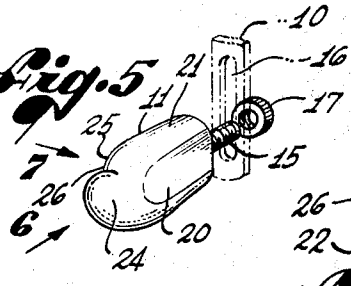


Fig. 5

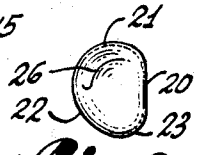


Fig. 6



Fig. 7

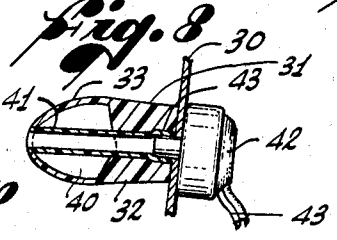


Fig. 8

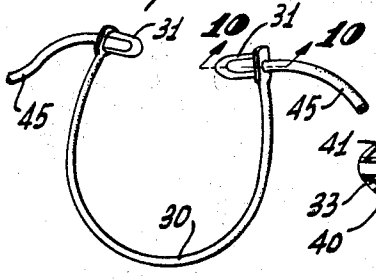


Fig. 9

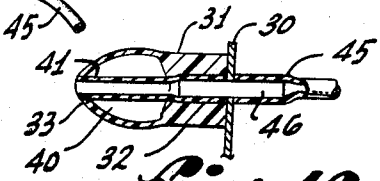


Fig. 10

INVENTOR.
HOWARD S. LEIGHT
BY Fulwider, Patton, Rieber
Lee, and Utecht
ATTORNEYS

EAR PROTECTOR

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 simples 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 U.S. Pat. to Cantor, 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 U.S. Pat. to Rosenblatt, No. 3,016,054, has a central ball-shaped nipple surrounded by a soft cup that fits over the ear, while the U.S. Pat. to Glorig, 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 inadeuqate, 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

In 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 elevational 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 PREFERRED FORM

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 he 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.

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.

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 conditons, 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 re-inserted 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.

DESCRIPTION OF ALTERNATE FORMS

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 addtional 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 an-

nular 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.

I claim:

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 having a base and tip, said tip including a convexly rounded outer portion for entering the ear canal and an inner portion larger in cross-section than said outer portion for engaging the ear region around the entrance to the ear canal, said inner and outer portions forming a concave junction region along only one side of the tip, the region diametrically opposite said concave junction region being convex.

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

said pod holding means is constructed to fit in a predetermined orientation on the head of the wearer, and said pods are mounted on said holding means with each concave junction region thereof facing in an upward and rearward direction.

* * * * *