March 23, 1954 C. LEIGHT 2,672,863

EAR PLUG AND SOUND ABSORBING MATERIAL CONSTRUCTION

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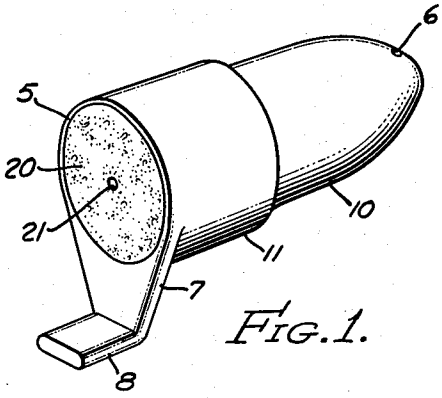


FIG. 1.

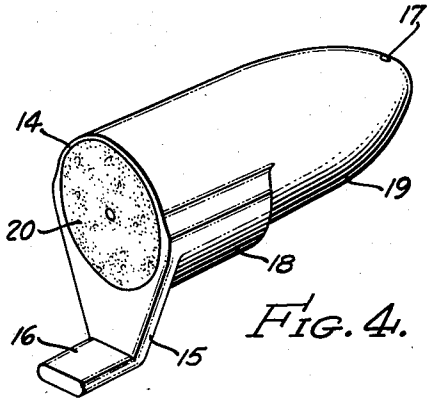


FIG. 4.

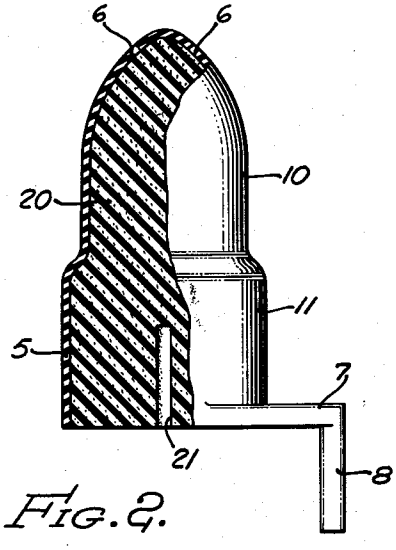


FIG. 2.

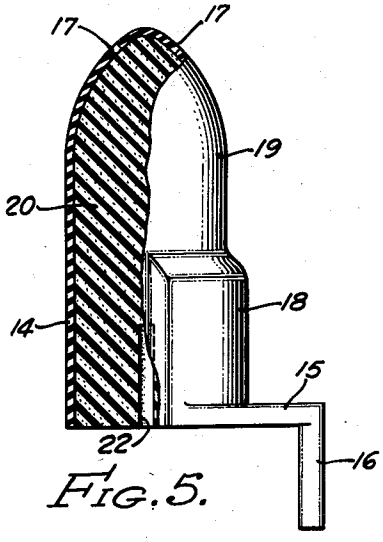


FIG. 5.

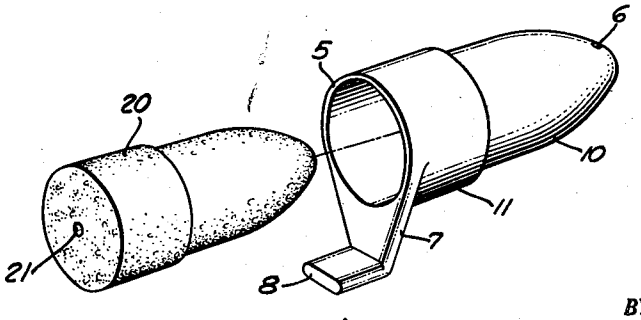


FIG. 3.

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EAR PLUG AND SOUND ABSORBING MATERIAL CONSTRUCTION

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2 Claims. (Cl. 128—152)

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This invention relates to sound absorbing devices, and particularly to an ear plug adapted to decrease or attenuate the amplitude of sound waves reaching the ear drum of a person.

The use of ear plugs to prevent auditory injury and noise fatigue are well-known, and plugs for attenuating the amplitude of sound waves reaching the ear have been used in different occupations. Ear plugs are also worn by aviators, in which case the plugs should be of a type which are comfortable when worn under headphones.

The construction of the present plug is of the general type disclosed and claimed in my U. S. Patent No. 2,446,707 of August 10, 1948. This prior plug is in the form of a cylindrical body tapered at one end and having a right-angle handle section to facilitate the insertion and removal of the plug from the ear canal. The present plug has two general over-all shapes. One is of the type shown in the above mentioned patent, and the other is one whereby the external form is modified for improving the fit of the plug in the ear.

The primary feature of the present plug is a filler insert made of a special formula spongy sound absorbing material to improve the selective absorptivity of the sound waves. The insert may be in two sections, as shown in the patent, or may be a single unit. The plug is provided with pressure equalizing vents and an opening which aids the transmission of the lower frequencies to permit almost normal conversation while protecting the ear from harmful noise amplitudes and frequencies.

The principal object of the invention, therefore, is to facilitate the selective attenuation of sound amplitudes and frequencies to the ear.

Another object of the invention is to facilitate the fit of a sound absorbing ear plug in the ear.

A further object of the invention is to provide an improved ear plug which absorbs the harmful noise while permitting the plug to be worn under earphones.

A still further object of the invention is to provide an improved method of constructing an ear plug which is comfortable in the ear at all times and which is particularly efficient in the absorption of harmful sound waves while permitting almost normal conversation.

A still further object of the invention is to provide an improved method of producing a selective sound absorber for ear plugs.

A still further object of the invention is to provide an improved sound absorber for ear plugs.

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Although the novel features which are believed to be characteristic of this invention will be pointed out with particularity in the appended claims, the manner of its organization and the mode of its operation will be better understood by referring to the following description, read in conjunction with the accompanying drawings, forming a part hereof, in which:

Fig. 1 is a perspective view of one form of ear plug embodying the invention.

Fig. 2 is a sectional view, partly in cross-section, of the plug shown in Fig. 1.

Fig. 3 is an expanded view of the plug shown in Figs. 1 and 2 showing the selective sound absorbing insert.

Fig. 4 is a perspective view of a second modification of an ear plug embodying the invention, and

Fig. 5 is a sectional view, partly in cross-section, of the ear plug of Fig. 4.

Referring now to the drawings, in which the same numerals identify like elements, the plug is formed of a thin outer shell or skin 5 of flexible material, such as sheet rubber, obtained by molding, the tip of the plug having pressure equalizing vents 6. Molded to the skin section 5 and as an integral part thereof is a handle formed with a section 7 at right angles to the longitudinal axis of the plug, and a section 8 at right angles to section 7 and parallel to the longitudinal axis of the plug. The section 7 is tapered from opposite points on the circumference of the larger diameter section of the skin section 5 to the width of the rectangular tab section 8.

As shown in Figs. 1, 2, and 3, one end of the plug is pointed in an oval or bullet shape, while the skin section is of two diameters, the section 10 having the point formed at one end thereof. Section 10 is of a smaller diameter than the section 11, the variation in diameters being approximately one-sixteenth of an inch. That is, the smaller section 10 for a medium sized plug is approximately six-sixteenths of an inch in diameter, and the diameter of the larger section 11 is approximately seven-sixteenths of an inch. For other sizes of plugs, these dimensions are proportional. The length of the tab section 7 for a plug having the above dimensions is one-eighth of an inch, and the length of the section 8 is three-sixteenths of an inch. A two-sectioned plug of this type has been found to be easily insertable and removable from the ear, while providing a snug fit to prevent the passage of sound waves around the plug.

Referring now to the plug shown in Figs. 4 and

5, this plug has a skin section 14 of the same type as the skin section 5 of the first modification, and also, has the same form of integral tab with sections 15 and 16. It also has equalizing vents 17. The difference between the plugs in Fig. 1 and in Fig. 4 is in the shape of the skin section 14. It has been found that the ear canal is such that a better fit for many ear canals is generally accomplished if the larger diameter section 18, similar to section 11 in Fig. 1, extends only one-half way around the circumference of the plug. That is, one-half of the plug divided lengthwise is cylindrical from the open end of the skin 14 to the point, while the other half varies in diameter similarly to the plug of Fig. 1. That is, section 19 divided transversely is the same as section 10 of the plug in Fig. 1, while section 18 is only one-half of section 11. This provides an improved wedging action, inasmuch as the tab is always placed toward the back of the ear.

The primary improvement of the plugs above described is provided by the use of a new form of absorbent filler insert shown at 20 in both plugs. This material is molded to fit the internal form of either skin 5 or 14, the form for Fig. 1 being shown in perspective in Fig. 3. The insert 20 has a hole 21 therein extending axially of the plug for a short distance therein. This opening has been found to aid the passage of the lower frequencies to the ear drum, and thus, permit almost normal conversation while the plugs are being worn, the plugs attenuating the higher amplitude levels and frequencies of the sound waves. This opening, along with vents 6, aids in pressure equalization as well as permitting "breathing" of the plug for ventilation.

The plug 20 is made from latex foam rubber impregnated with flocculated cellulose. To produce the sound absorbing insert 20, the latex foam may be made in accordance with several standard formulas. The formula used herein consists of approximately sixty-five percent of dry latex by weight to approximately thirty-five percent of other ingredients. These other ingredients are a soap solution to produce emulsification and frothing, accelerators and sulfur for curing or vulcanization, a protective colloid for stabilization, an anti-oxidant for optimum aging, a metallic salt to activate curing, a color carrier to provide the desired opacity, a color pigment, and a gellation material to control coagulation of the foam.

This solution is mechanically mixed with the flocculated cellulose at the ratio of one hundred parts of the dry latex rubber component to three to twenty parts of cellulose by weight. After the liquid latex foam and cellulose are thoroughly mixed, the mixture is poured into a die of the proper shape to form an insert such as shown at

20, and then baked at a temperature of substantially 250 degrees Fahrenheit for approximately eighteen minutes. This time has been varied between fifteen and twenty-five minutes with satisfactory results. After the inserts are cured, they are punched from the mold. Although cellulose is preferred, finely ground cork has been used with satisfactory results.

The above ear plugs, therefore, are particularly efficient in absorbing an adequate proportion of harmful noise to reduce the noise level to a safe value. The ear plugs are safe, comfortable, and invisible, and may be worn with comfort at work or during sleep. Ventilation is provided to the inner ear to avoid dizziness, and the plugs are shaped to provide a beveled wedging action, insuring one hundred percent efficiency at all times. The special type of insert material has been found to have the ability to absorb the higher frequencies of sound waves, while permitting the lower frequencies of conversation to penetrate to the ear. Therefore, it is unnecessary to remove the plugs for normal conversation.

The inserts are molded in a form to fit the particular internal shape of the skin or shell portion of the plug. The inserts generally remain fixed in their shells after insertion, but a spot of glue may be applied at the time of insertion to insure their remaining in position.

I claim:

1. In an ear device having a shell, an insert plug comprising a solid integral member formed of a vulcanized mixture of liquid latex foam and cellulose, said member being shaped to fit the interior of the shell.

2. In a plug for an ear device, a solid integral member having latex foam and cellulose mixed so as to absorb sound waves of relatively high frequencies while permitting the passage of sound waves of lower frequencies, said member being provided with an axially extending hole for ventilating the plug.

CHARLES LEIGHT.

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