April 4, 1944. J. E. VALENTINE 2,345,842

NOISE ELIMINATOR

Filed Oct. 14, 1943

Fig. 1.

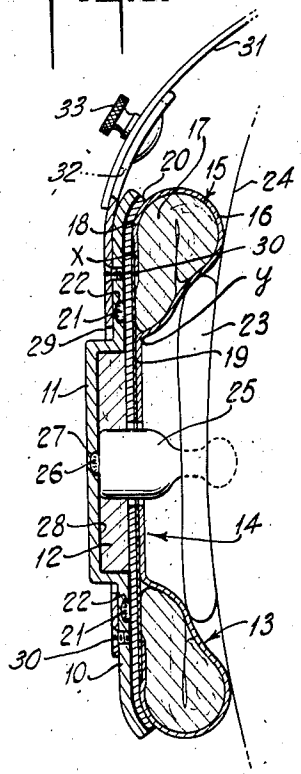


Fig. 2.

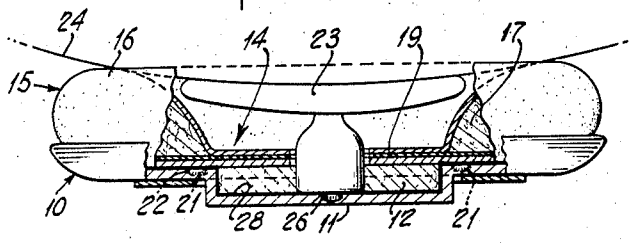


Fig. 3.

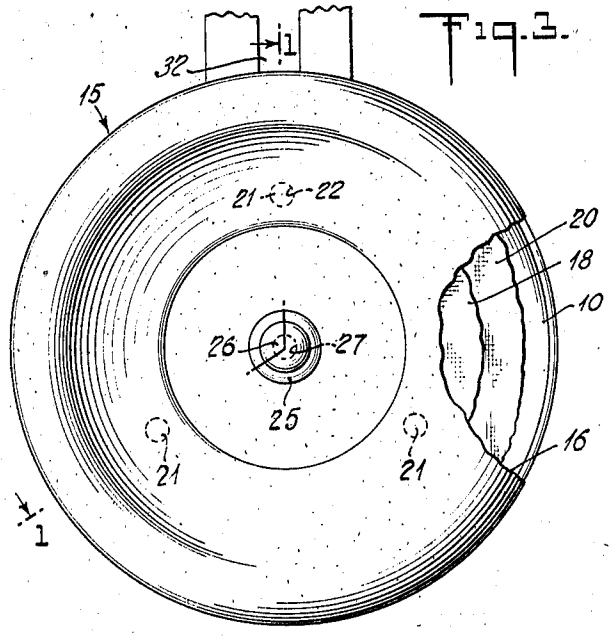


Fig. 4.

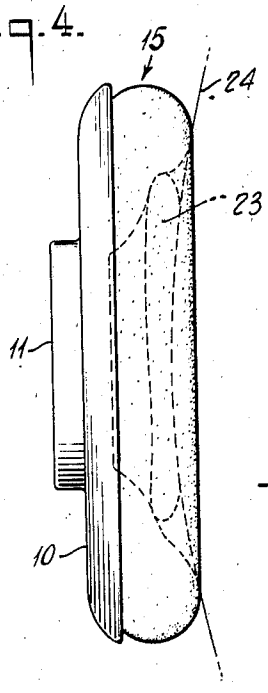


Fig. 5.

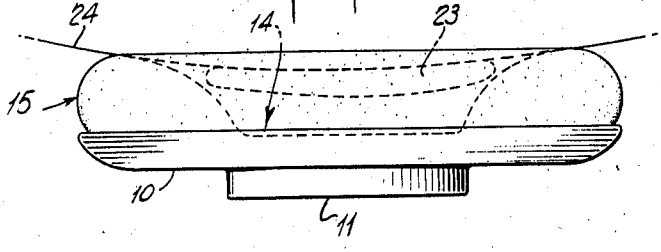
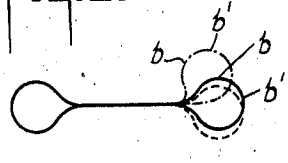


Fig. 6.



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BY

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NOISE ELIMINATOR

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Application October 14, 1943, Serial No. 506,234

4 Claims. (Cl. 128—151)

This invention relates to a device for use in the prevention and treatment of traumatic deafness, and more particularly to a device to protect the user from noise and the effects of noise.

Traumatic deafness is impairment or loss of hearing arising from injury to the structure of the ear due to the impact thereon of violent sound vibrations and particularly of steady pounding on the eardrums and ear structure, such, for example, as that to which many workers in industrial operations involving the use of heavy machinery, are exposed. I understand that the frequency of the occurrence of this malady, particularly among factory workers, presents a problem which is acute enough so that compensation insurance companies are interesting themselves in it.

An object of the invention is to provide a simple and effective device to protect the user from noise and the effects of noise.

Another object of the invention is to provide a device of the said kind which is well adapted to conform itself to the user's ear and the portion of the user's head surrounding the ear, and to provide an effective closure for the ear without damaging, or uncomfortable pressure on the cartilages of the ear.

Another object is to protect the auditory system of a person subjected to the shock of violent or frequently recurring sound vibrations by means coacting to both close the auditory canal and to form a noise insulated space around the outer ear leading to the auditory canal.

Another object is to provide a device of the above mentioned nature having a concavity permitting the ready expansion and contraction therein of a member adapted to exert a yielding pressure on the ear.

Another object is to provide a hygienic article of the above mentioned nature the head contacting portion of which may be effectively aseptic-ized, and which may be so efficiently made and at such low cost that, as a practical matter, the head contacting portion may be frequently discarded and a new one substituted therefor.

Another object is to provide a device which will be comfortable to the user, light in weight, air and moisture permeable, and pleasing in appearance.

Another object is to provide an ear closure the depth of which may be varied without substantially changing the width of the closure.

Another object of the invention is to provide a device of the kind described which will itself be substantially unresponsive to external sound waves and free from vibration.

Another object is in general to provide an improved device of the above mentioned nature and a simple and efficient method of constructing the same. Other objects will be in part obvious or in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements, arrangements of parts, and in the several steps and relation and order of each of said steps to one or more of the others thereof, all as will be pointed out in the following description, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawing:

Figure 1 is a vertical cross sectional view, partly in elevation, of one embodiment of my invention and its relation in use to the ear of the user;

Figure 2 is a similar horizontal cross sectional view;

Figure 3 is a front elevation of the embodiment of the invention shown in Figures 1 and 2;

Figure 4 is a view similar to Figure 1 without the central ear closure member;

Figure 5 is a view similar to Figure 4 without the central ear closure member; and

Figure 6 is a diagrammatic view illustrating the hinged or swinging action of the annular envelope relative to the web portion of the device.

Similar reference characters refer to similar parts throughout the drawing.

I have provided a carrier or backing 10, preferably circular, and of a diameter on the order of the maximum diameter of the ear. The backing is provided with an outwardly extending offset portion 11, preferably cylindrical, and within the recess or chamber thus formed a filling of a soft resilient sound damping material, such, for example, as a disk 12 of cotton or wool padding, may be inserted. In the embodiment of the invention shown in Figures 1, 2 and 3, the sound damping material or disk is distributed, or cut away centrally, to permit the member 25 to be detachably secured to the backing 10, preferably in the center of offset portion 11, as is described herein.

Fixed to the carrier 10, preferably by detachable means, is a disk-like member 13 having a central, preferably circular, web-like portion 14, shown cut away centrally in Figures 1, 2 and 3, from the outer periphery of which is suspended an annular portion 15 of considerably greater thickness than the web-like portion 14 and hav-

ing a rounded surface adapted for use as a bearing surface against the user's head and of a size to wholly encompass the user's ear along its minor axis and to contact only the soft extremities of the ear along its major axis and to conform itself to the shape of the ear. The annular portion 15 also constitutes means for spacing the web portion 14, and with it the carrier 10, laterally from the user's head so that a sound insulated space is provided over the user's ear and in front of the entrance to the auditory canal thereof.

The annular portion 15 preferably comprises a container or envelope 16 having therein a filling of soft resilient sound excluding material 17, which is preferably in the form of an annular disk of padding of suitable thickness and pliability, such, for example, as cotton or wool padding, bent peripherally upon itself, so that it is substantially U-shaped in cross section. The arms of the bent-over filling member 17 tend to expand within the envelope 16 and press outwardly upon the inner surface of the envelope and thus give it a rounded bearing surface.

As illustrated herein the web portion 14 and the envelope 16 are formed by a plurality of superimposed disk-like members joined together at two different radial distances. These members are the facing 18, which may be made, for example, of velour or other pile fabric, or other material suitable as a bearing surface against the user's head, and the backing 19, which may be of any strong, durable and preferably inexpensive material. The facing member 18 has its peripheral portion carried across the face of the annular disk of padding 17 and around its peripherally bent-over surface to a point such as "x" on its rear surface where the facing 18 is engaged by the backing 19, the peripheral portion of which overlaps the inwardly extending peripheral portion of the facing and is secured thereto, preferably adhesively, as by thermoplastic adhesive but sewing or any other suitable means may be employed. The facing members 18 and 19 are also secured together as at "y" thus forming the web portion 14 and closing the envelope 16.

As illustrated herein the attachment means between the member 13 and carrier 10 is provided by superimposing on backing member 19 the annular disk-like member 20 which may be of any suitable fabric, preferably a strong, inexpensive cloth, and providing coacting male and female snap fastener members on the rear of member 20 and the front surface of carrier 10, respectively. The male snap-fastener members 21 are shown disposed at substantial and equal radial distances from the center of member 20 and arranged in an isosceles triangle. The female fastener members 22 are shown similarly disposed in carrier 10 so that as a first step in assembling members 13 and 10 any male fastener member may be seated in any female fastener member and it is not necessary to relate one member to another in a single, predetermined way.

The member 13 may thus be readily attached to or detached from carrier 10.

It will be noted, as illustrated in Figures 1 and 2, and 4 and 5, that the annular portion 15 of member 13 fully encloses the user's ear 23 both in a vertical plane and in a horizontal plane and forms a bearing surface around the user's head, indicated generally by a line 24, and over the upper and lower extremities of the ear, such pressure as there is being distributed widely around the user's ear and over the soft portions thereof.

The means of interengaging member 13 and carrier 10 is preferably spaced inwardly from the outer periphery of the annular portion 15 of member 13 sufficiently so that a part of portion 15 extends radially beyond said interengaging means and is thus free to swing inwardly, thereby moving the line of contact between annular portion 15 and the user's head toward the outer periphery of said annular portion. This action is illustrated diagrammatically in Figure 6 wherein annular portion 15 is indicated both in the plane of web portion 14, and substantially normal thereto. It will be seen from reference to Figure 6, that as annular portion 15 swings away from the plane of web portion 14, the line of contact between portion 15 and a surface against which it is presented shifts from "b" to "b'," and that b' tends to move into the same plane, normal to web portion 14, which contains the former line of contact "b," although "b'" is further removed laterally from web 14 than "b." This swingability of envelope 16, in conjunction with the conformability and resiliency of annular portion 15 as a whole, makes possible a wide variation in spacing of the web portion 14 of member 13 from the user's head, thereby increasing the depth of the space defined by member 13 to accommodate variations in the size of the ear and the shape of the head of persons who may use the device, without substantially changing the perimeter of the bearing surface of the device.

As illustrated in Figure 1, an ear closure member 25 is provided, detachably secured to carrier 10 at its center, in the offset portion 11, and projecting inwardly through the center cut-outs in member 20 and the web portion 14 of facing member 18. The detachable securing means may be provided by male snap fastener member 26, at the rear end of member 25, and corresponding female snap fastener member 27, on the inner face of portion 11 of carrier 10.

The member 25 is preferably made of a resilient material, such, for example, as rubber or a rubber-like material, covered, for example, with the same material forming the facing member 18 of member 13. The member 25 may be shaped more or less like the conventional ear-plugs used for swimming, and should project inwardly through and beyond the plane of the web somewhat further than the bearing surface of envelope 16 of annular portion 15, to close the opening to the auditory canal of the ear.

The size of member 25 is related to the size of the space, in front of the auditory canal of the ear, defined by the device, so that member 25 will at all times be able to change its form, as by becoming thicker and shorter to accommodate the size and shape of the ear of the user. Thus the member 25 may at all times exert a yielding pressure against the central portion of the ear without undue or uncomfortable pressure upon the cartilages of the ear.

There is thus provided a self-adjusting, sound insulated space around the user's ear and means in said space adapted to close the entrance to the auditory canal of the user's ear.

To minimize and prevent variations from being set up in the device itself I provide a thin layer 27, indicated by the heavy line defining the inner surface of carrier 10, of a vibration damping material, such as a known plastic material, and which may be applied by spraying it, prefer-

ably on the inside face of carrier 10, before the device is assembled.

The members 13 and 25, may be asepticized to protect the user against infection. I have found that a device of the kind disclosed herein having a facing of textile material has many advantages over one made of rubber since such material will readily absorb a disinfectant, and it has the further advantages that it is less susceptible to extremes of temperature and it is freer from condensation of moisture on its surface and is thus more comfortable to the wearer.

The embodiment of the invention shown in Figures 4 and 5 is the same as that shown in Figures 1, 2, and 3, except that the ear contacting member 25 is omitted and the member 20 and the web portion 14 of facing 18 are not cut out centrally.

The noise eliminating device described herein may be positioned on the head by any suitable means, such, for example, as head band 31 having at its end annular portion 29 adapted to fit around offset portion 11 of carrier 10 to which it may be detachably secured as by screws 30. The head band 31 may be slotted at 32 to receive an adjusting screw 33.

It will thus be seen that there has been provided by this invention an article in which the various objects hereinabove set forth, together with many thoroughly practical advantages, are successfully achieved. As various possible embodiments might be made of the mechanical features of the above invention and as the art herein described might be varied in various parts, all without departing from the scope of the invention, it is to be understood that all matter hereinbefore set forth or shown in the accompanying drawing is to be interpreted as illustrative and not in a limiting sense.

What I claim is:

1. A device for protecting the user from noise and the effects of noise which comprise a disk-like carrier having a centrally disposed offset portion forming a cup-like recess, and a member, having a circular web-like portion and an annular envelope of yieldable material, the maximum diameter of which is substantially the same as the maximum diameter of said carrier, extending radially from the outer periphery of said web-like portion, and having a filling of soft resilient material adapted to expand said envelope into a bearing surface extending laterally from the plane of said web-like portion, and disposed relatively to the carrier so that said web-like portion is substantially concentric with and overlying the cup-like recess of said carrier, and means for attaching said member to said carrier positioned a substantial distance from the outer periphery of the envelope portion of said member to permit the outer portion of said envelope to have a substantially swinging action in a plane normal to the plane of the carrier.

2. A device for protecting the user from noise and the effects of noise which comprises a disk-like backing member having a centrally disposed offset portion providing a chamber, sound damping material in said chamber, a member secured to said backing and adapted to form a closure around the user's ear, and including a relatively thin web portion of sound excluding material disposed across the recessed portion of said backing member, having around its periphery a relatively thick annular portion, rounded in cross section, said annular portion serving as a bearing surface against the user's head and adapted to change the position of its line of contact with the surface of the user's head to vary the spacing of said backing and said web portion from the user's head.

3. A device for protecting the user from noise and the effects of noise which comprises a backing having a cylindrical outwardly extending offset portion, soft resilient sound excluding material in said recess, and a member having a diameter on the order of the diameter of said backing and having an outer portion comprising a soft yieldable envelope contoured to provide a bearing surface fitting over and around the user's ear by inclusion in said envelope of a blank of soft resilient sound excluding material compacted in said envelope so that said blank is substantially U-shaped in cross section, with one of the arms thereof pressing outwardly on the bearing face of said envelope and serving to space the body portion of said member and said backing from the side of the user's head.

4. A device for protecting the user from noise and the effects of noise which comprises, a disk-like backing, and a disk-like member secured to said backing at a distance from the periphery thereof and having a portion of rounded cross section extending radially beyond the interconnection between said backing and said member and capable of a swinging action in a plane normal to said backing, said portion rounded in cross section comprising a soft yieldable annular envelope having therein as a filling an annular blank of padding peripherally bent over upon itself, said envelope being suspended around the periphery of a relatively thin web-like portion, substantially concentric with said backing and cut away centrally, and a resilient finger, projecting inwardly from said backing through the cut away center of said web-like portion, and adapted to yieldably contact the ear, the resiliency of said finger being increased by the swinging action of said outer portion of rounded cross section of said disk-like member.

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